# APPENDIX C

# TECHNICAL SPECIFICATIONS

# DIVISION 1 WEST MARY STREET

# DIVISION 2 WEST MOORE STREET

# West Mary Street Road & Drainage Improvements
# FY2024 Community Development Block Grant
# Division 1: West Mary Street Road & Drainage Improvements
# Division 2: West Moore Street Drainage Improvements

**Prepared for:**

**City of Dublin**

**February 27, 2026**

## Technical Specifications

**Note: All correspondence and coordination including submittals, testing results, pay requests, etc. referenced in the technical specifications shall be sent to the City of Dublin Engineering Department. This is a City of Dublin Georgia project, and all correspondence shall be with the City of Dublin.**

## Index of Technical Specifications



The City of Dublin is committed to Affirmatively Further Fair Housing. This project is covered under the requirements of Section 3 of the HUD Act of 1968. This contract opportunity is a Section 3 Covered Contract Section 3 Business Concerns are encouraged to apply. The City of Dublin is committed to providing all persons with equal access to its services, programs, activities, education and employment regardless of race, color, national origin, religion, sex, familial status, disability or age. Section 3 documents are required prior to Notice of Award.

Build America, Buy America (BABA) Contract Clause
All requirements of the Build America, Buy America (BABA) Act, 41 USC 8301 note, and all applicable rules and notices, as may be amended, shall be complied with if applicable to the infrastructure project. Pursuant to HUD's Notice, "Public Interest Phased Implementation Waiver for FY 2022 and 2023 of Build America, Buy America Provisions as Applied to
Recipients of HUD Federal Financial Assistance" (88 FR 17001), any funds obligated by HUD on or after the applicable listed effective dates, are subject to BABA requirements, unless excepted by a waiver.

# Section 636—Highway Signs

## 636.1 General Description

This work includes fabricating and installing highway signs according to the details on the Plans and the Manual on Uniform Traffic Control Devices.

### 636.1.01 Definitions

General Provisions 101 through 150.

### 636.1.02 Related References

**A. Standard Specifications**

**B. Referenced Documents**

Manual on Uniform Traffic Control Devices

### 636.1.03 Submittals

Before fabricating overhead panel type signs, submit to the Engineer the Shop Drawings to approve the sign bracing and method of attaching to sign supports.

Before driving piles, furnish a list of proposed pile lengths to the Engineer.

## 636.2 Materials

Ensure that materials meet the requirements of the following Specifications:

| Material | Section |
|---|---|
| Sign Fabrication and Accessories | 910 |
| Steel Sign Posts and Bolts (Drive Type) | 911.2.01 |
| Galvanized Steel Structural Shape Posts | 911.2.02 |
| Delineator Posts | |
| Galvanized Steel | 911.2.04.A.4 |

| Material | Section |
|---|---|
| Aluminum "U" Flange | 911.2.04.A.5 |
| Wood | 911.2.04.A.6 |
| Flexible | 911.2.04.A.7 |
| Aluminum Sign Blanks | 912.2.01 |
| Extruded Aluminum Sign Panels | 912.2.02 |
| Reflective Sheeting | 913.2.01 |
| Silk Screen Lettering Paint | 914.2.01 |
| Steel Posts and Arms for Mast Arm Assembly | 915.2.01 |
| Guy Wires for Mast Arm Assembly | 915.2.02 |
| Center Mount Reflector | 916.2.01 |
| Demountable Characters with Reflective Sheeting | 917.2.01 |
| Fittings, bolts, nuts, washers, clips, molding, etc., for panel signs shall conform to the requirements shown on the Plans. | |
| Class A Concrete Footings for Signs | 500 |
| Piling | 855.2.03 |
| Portland Cement | 830.2.01 |
| Sign Paint, Enamel | 870.2.03 |

### 636.2.01 Delivery, Storage, and Handling

General Provisions 101 through 150.

## 636.3 Construction Requirements

### 636.3.01 Personnel

General Provisions 101 through 150.

### 636.3.02 Equipment

General Provisions 101 through 150.

### 636.3.03 Preparation

General Provisions 101 through 150.

### 636.3.04 Fabrication

General Provisions 101 through 150.

### 636.3.05 Construction

**A. Finished Signs**

Ensure that the finished signs are clear cut and that the lines of letters and details are true, regular, and free of waviness, unevenness, furry edges or lines, scaling, cracking, blistering, pitting, dents, or blemishes.

Only one type of demountable characters (letters, numerals, symbols, and borders) is permitted on special roadside signs on each Project.

**B. Erecting the Signs**

1. Drive Type Posts

   Drive type posts may be driven in place or placed in prepared holes.

   a. Use driven posts only in firm and stable soil. If the soil is sandy or unstable, place each drive type post in a prepared dry hole of at least a 4 in (100 mm) diameter.

   b. When placing posts in prepared holes:

      1) Backfill the holes with a mixture of damp, clean friable soil and 8 percent by volume Portland cement.

      2) Thoroughly tamp the mixture in place around the posts.

   c. Erect posts vertically as deep and at an angle to the roadway as shown on the Plans or as directed.

   d. Do not penetrate posts in the coastal plain region less than 4 ft (1.2 m) or 3 ft (1 m) for posts in the Piedmont and the Valley and Ridge Regions when no guard rail is present.

      When erecting signs behind a guard rail, penetrate at least 3 ft (1 m) for posts 14 ft (4.2 m) or less long, or 4 ft (1.2 m) for posts over 14 ft (4.2 m) long.

2. Single-Plate Signs

   Erect single-plate signs 9 ft² (0.84 m²) or less on one drive-type post unless otherwise specified on the Plans. Erect single-plate signs greater than 9 ft² (0.84 m²) on two drive-type posts.

   Leave enough distance between the two posts to fit the mounting holes in the sign plate.

3. Steel Posts for Mast Arm Assemblies

   a. Erect steel posts for mast arm assemblies in a concrete foundation according to the Plans. Erect at the place, height, and angle to the roadway specified.

   b. After curing the concrete foundation for at least 24 hours, securely fasten the specified signs into place on the mast arm.

4. Ground-Mounted Panel-Type Signs

   a. Erect the supporting members of ground-mounted panel-type signs where shown on the Plans or as directed by the Engineer at the specified angle to the roadway.

   b. Securely fasten the panels into place.

5. Milepost Signs

   Erect milepost signs including posts as specified on the Plans.

6. Delineator Posts

   Use delineator posts made of galvanized steel, aluminum, or an alloy that conforms to the requirements of Subsection 911.2.04.A.4 or 911.2.04.A.5.

   a. Erect the posts where shown on the Plans.

   b. Mount reflectors for galvanized steel or aluminum posts on the flange side of the post.

   c. When signs are attached to supports, torque the bolts to at least 20 ft-lbs (27 N•m).

7. Overhead Panel-Type Signs

   Erect overhead panel type signs on sign supports where shown on the Plans or as directed by the Engineer.

   a. Ensure that the bottom of the sign is 18 in (450 mm) above the top of the lighting fixture.

   b. Ensure that the sign has ample bracing for mounting the sign support so that each sign can withstand 1 in (25 mm) of ice accumulated on the entire sign and wind pressures shown on the Plans.

   c. Ensure that the top of each sign is three degrees off perpendicular from the bottom of the sign. Use the three-degree slant to lean the sign toward the approaching traffic

**C. Foundations (for Special Roadside Signs)**

Do not disturb the natural ground adjacent to a foundation more than necessary to construct the footing.

1. Excavate for the footings to the lines and elevations shown on the Plans or established by the Engineer. Do not disturb or loosen the foundation below these elevations.
2. Use forms of the necessary shape and dimensions to construct the footings to the lines and elevations shown on the Plans.
3. Cure the concrete foundations, constructed in conformance with Section 500 and the Plan details, at least 7 days before erecting the sign.
4. Ensure that the minimum lengths of steel H piling used in the foundations of ground-mounting signs are accepted and meet the Plan penetration requirements.

   The Plan quantity of steel H piling is shown for estimating purposes only; determine and provide the necessary lengths of piles.
5. Before driving the piles, furnish a list of proposed pile lengths to the Engineer.
   a. Use full-length piles or built-up piles with a maximum of two splices that are made in the presence of the Engineer.
   b. Furnish satisfactory identification for all piles or portions thereof.
6. When rock prevents the penetration required on the Plans, construct according to the notes and details shown on the Plans.
7. The minimum energy ratings required by Section 520 for pile hammers will be waived for constructing ground-mounted sign supports. Jetting is not permitted.
8. Place required backfilling in layers no greater than 6 in (150 mm) thick and thoroughly compact it to the approximate density of the undisturbed soil in the area.

**D. Sign Panels**

Use extruded, panel-type aluminum. Ensure that the sign type used meets the requirements of Subsection 912.2.02.

**E. Legends and Borders**

Place legends and borders according to Subsection 917.2.01, "Demountable Characters", with Type VI reflective sheeting.

### 636.3.06 Quality Acceptance

General Provisions 101 through 150.

### 636.3.07 Contractor Warranty and Maintenance

General Provisions 101 through 150.

## 636.4 Measurement

**A. Type-1 or Type-2 Highway Signs**

Type 1 or Type 2 highway signs with reflective sheeting of Type III, IV, or VI as specified on the Plans to be paid for lump sum. Completion includes providing the message and furnishing and placing signs complete and accepted.

**B. Portland Cement**

Portland cement stabilized material used for backfilling holes is not measured for payment.

### 636.4.01 Limits

General Provisions 101 through 150.

## 636.5 Payment

Highway signs, galvanized steel posts, I-beam posts, delineators, mast arm assemblies, Class A concrete, and piling for signs are paid for at the lump sum for the various items. Payment is full compensation for furnishing and erecting the Item complete in place according to this Specification.

Separate payment will not be made for piling splices, the cost of cutting, or the cutoff portions. Pile cutoffs remain the Contractor's property.

Payment will be made under:

| | | |
|---|---|---|
| Item No. 636 | Highway signs, type 1 material, reflective sheeting type__3_, | Lump Sum |

# Section 653—Thermoplastic Traffic Stripe

**653.1 General Description**
This work includes furnishing and applying thermoplastic reflectorized pavement marking compound. Ensure that markings conform to Plan details and locations, these Specifications, and the Manual on Uniform Traffic Control Devices. Thermoplastic traffic stripe consists of solid or broken (skip) lines, words, and symbols according to Plan color, type, and location.

**653.1.01 Definitions**
Thermoplastic Marking Compound: A compound extruded or mechanically sprayed on the pavement that cools to pavement temperature. When combined with glass spheres it produces a reflectorized pavement marking. Short Lines: Crosswalks, stop bars, arrows, symbols, and crosshatching. Extrude short lines rather than spraying them on. Unless otherwise specified, spray all other lines.

**653.1.02 Related References**
**A. Referenced Documents**
QPL 46 Federal Test Method Standard 141, Method 4252 ASTM D 1155 ASTM D 620 ASTM D 570 ASTM D 256 ASTM D 2240 ASTM E 28 ASTM 121

**653.1.03 Submittals** Ensure that the producers of the thermoplastic compound and glass spheres furnish to the Department copies of certified test reports showing results of all tests specified in this Section. Also ensure that producers certify that the materials meet the other requirements of this Section by submitting copies of certification at the time of sampling. Final Acceptance, however, will be based on satisfactory test results from samples obtained before delivery.

**653.2 Materials**
**A. General Characteristics of Thermoplastic**
1. Deterioration
Use thermoplastic material with the following characteristics:
a. Does not deteriorate upon contact with:
□ Pavement materials
□ Petroleum droppings from traffic
□ Chemicals, such as sodium chloride or calcium chloride, used to prevent formation of ice on roadways or streets
b. Does not scorch, discolor, or deteriorate if kept at the manufacturer's recommended application temperature, or at least 375 °F (190 °C), for up to 4 hours.
c. Has a temperature versus viscosity characteristic that remains constant from batch to batch through four re-heatings.

2. Fumes
Use material that in the plastic state does not give off fumes that are toxic or harmful to

persons or property.

**B. Detailed Characteristics of Thermoplastic**

1. Material Composition

Use material binder with the following characteristics:

□ A mixture of synthetic resins, with at least one resin that is solid at room temperature, and high boiling point plasticizers

□ A total binder content of 18 percent to 35 percent by weight

□ A pigmented binder that is well-dispersed and free of dirt, foreign objects, or ingredients that cause bleeding, staining, or discoloration

The binder shall be Type A—alkyd. Ensure that at least 33% of the binder composition or at least 8% by weight of the entire material formulation is a maleic-modified glycerol ester of resin. Ensure that the finished thermoplastic pavement marking material is not adversely altered by contact with oily pavement materials or by contact from oil dropping onto the pavement surface from traffic. Ensure that the filler has the following characteristics:

□ White calcium carbonate or equivalent

□ Compressive strength of 5,000 psi (34.5 MPa)

2. Suitability for Markings

Use thermoplastic material that is especially compounded for traffic markings and has the following characteristics:

□ Prevents markings from smearing or spreading under normal traffic conditions at temperatures below 120 °F (49 °C)

□ Gives a uniform cross section, with pigment evenly dispersed throughout the material

□ Has a uniform material density and character throughout its thickness

□ Allows the stripe to maintain its original dimensions and placement

□ Ensures that the exposed surface is free from tack and is not slippery when wet

□ Does not lift from the pavement in freezing weather

□ Has cold ductility properties that permit normal movement with the road surface without chipping or cracking

3. Drying Time

When applied at a temperature range of 400 °F to 425 °F (204 oC – 218 oC) and a thickness of 1/8 in. to 3/16 in. (3 mm to 5 mm), the material shall set to bear traffic in a maximum of 2 minutes when the air temperature is 50 °F ± 3 °F (10 oC ± 2 oC) and shall set to bear traffic in a maximum of 10 minutes when the air temperature is 90 °F ± 3 °F (32 oC ± 2 oC).

4. Reflectorization

Ensure that during manufacturing, reflectorizing glass spheres were mixed into the compound to the following specifications:

□ At least 16 percent by weight using glass spheres with a minimum refractive index of 1.65

□ At least 25 percent by weight using glass spheres with a minimum refractive index of 1.50

**C. Physical Requirements of Thermoplastic**

1. Color

Confirm the color of thermoplastic as follows:

a. White thermoplastic material contains at least 8 percent by weight titanium dioxide that meets the requirements of ASTM D 476, Type II, Rutile. The white thermoplastic material shall be pure white and free from dirt or tint. Compare yellow material to match Federal Test Standard Number 595, Color 13538.

2. Color Retention

a. Test specimens prepared from samples submitted according to ASTM D 620 by the Department Inspector.

b. Use an ultraviolet light source as specified in the test procedure, or use a 275 watt sunlamp with a built-in reflector.

c. Ensure that after 100 hours of exposure to the light source, the test specimens show no color change when compared to an unexposed specimen.

3. Water Absorption

Ensure that materials have no more than 0.5 percent by weight of retained water when tested by ASTM D 570, procedure (a).

4. Softening Point

Ensure that materials have a softening point of at least 175 °F (79 °C) as determined by ASTM E 28.

5. Specific Gravity

Ensure that the specific gravity of the thermoplastic compound at 77 °F (25 °C) is between 1.9 to 2.5.

6. Impact Resistance

Use material with an impact resistance of at least 10 in-lbs at 77 °F (1.13 N·m at 25 °C), tested as follows:

a. Heat for 4 hours at 400 °F (204 °C).

b. Cast into bars of 1 $in^2$ (625 $mm^2$) cross sectional area, 3 in (75 mm) long.

c. Place with 1 in (25 mm) extending above the vise in a cantilever beam (Izod type) tester using the 25 in-lbs (2.82 N·m) scale. This instrument is described in ASTM D 256.

7. Indentation Resistance

Measure the hardness by a Shore Durometer, Type A2, as described in ASTM D 2240. Maintain the temperature of the Durometer, 4.4 lb. (2 kg) load and the specimen at 115 °F (45 oC). Apply the Durometer and 4.4 lb. (2 kg) load to the specimen and the reading shall be between 50 to 75 units, after 15 seconds.

8. Low Temperature Stress Resistance

a. Furnish sample test blocks as follows:

1) Coat the samples using the same method as the planned installation of the compound.

2) Coat the samples with at least 32 in² (206 mm2) of the compound.

b. Have the samples tested as follows:

1) Immerse a sample in cold water for one hour.

2) Immediately place the sample in a freezer chest or other insulated cold compartment and maintain at a temperature of –20 °F (–29 °C) for 24 hours.

3) After 24 hours, remove the sample and bring it to normal room temperature. Following the test, confirm that the sample does not crack, flake, or fail to adhere to the substrate.

9. Reheating

Ensure that the compound does not break down, deteriorate, scorch, or discolor if held for 6 hours at the plastic temperature of 425 °F (218 °C); or if reheated up to the plastic temperature 4 times.

10. Abrasion Resistance

Have the material tested for abrasion resistance as follows:

a. Ensure that the maximum loss of the material does not exceed 0.4 grams when subjected to 200 revolutions on a Taber Abraser at 77 °F (25 °C), using H-22 Calibrade wheels that are weighted to 500 grams.

b. Keep the wearing surface wet with distilled water throughout the test.

c. Prepare the panel by forming a representative lot of material at a thickness of 0.125 in. (3.18 mm) on a 4 in (100 mm) square steel plate with a thickness of 0.050 ± 0.001 in (1.27 mm ± 0.03 mm), on which a primer has been previously applied.

11. Yellowness Index

The white thermoplastic material shall not exceed a yellowness index of 0.12 according to AASHTO T 250.

12. Flowability

After heating the thermoplastic material for 240 ± 5 minutes at 425 °F ± 3 °F (218 oC ± 2 oC) and testing the flowability, ensure that the white thermoplastic has a maximum of 21 percent residue according to AASHTO T 250.

13. Flowability-Extended Heating

After heating the thermoplastic material for 8.0 ± 0.5 hours at 425 °F ± 3 °F (218 oC ± 2 oC), while stirring the last 6 hours and testing for flowability, ensure that the thermoplastic has a maximum percent residue of 28 according to AASHTO T 250.

14. Storage Life

The material shall meet the requirements of this specification for 1 year. Ensure that the

thermoplastic melts uniformly with no evidence of skins or unmelted particles during the 1-year period.

**D. Physical Requirements of Glass Spheres**

1. Premixed Glass Spheres

The glass spheres contained in the material shall meet the following requirements:

**Percent of Premixed Glass Spheres That are True Spheres (when tested according to ASTM D 1155)**

| Minimum Index of Refraction | Percent of Overall Beads | Percent of Beads Retained on any Sieve |
|---|---|---|
| 1.65 | At least 75% | At least 70% |

a. Index of Refraction. Determine the index of refraction of the premixed glass spheres by the liquid immersion method at 77 °F (25 °C).

b. Roundness. Ensure that the minimum percentages of premixed glass spheres are true spheres according to the following table:

| U.S. Sieve Standard Sieve Size | Percent Passing |
|---|---|
| No. 16 (1.18 mm) | 100 |
| No. 30 (600 µm*) | 60 to 90 |
| No. 50 (300 µm) | 15 to 40 |
| No. 80 (180 µm) | 0 to 10 |
| No. 100 (150 µm) | 0 to 5 |

*µ = micro meter

c. Imperfections. Ensure that no more than 5 percent of the spheres show air inclusions, bubbles, lap lines, chill wrinkles, or other imperfections when viewed through a 60-power microscope in the refractive index liquid.

d. Foreign Matter. Ensure that the quantity of foreign matter does not exceed 1 percent.

e. Gradation. Have the beads tested using ASTM: D 1214 to ensure they have the following gradations:

f. Chemical Resistance. Use material manufactured with glass spheres that withstand immersion in water and acids without corroding or etching, and withstand sulfides without darkening or decomposing. Have the chemical resistance tested by placing a 3 g to 5 g

sample in each of three glass beakers or porcelain dishes and immersing as follows:
□ Cover the first with distilled water.
□ Cover the second with a 3N solution of sulfuric acid.
□ Cover the third with a solution of 50 percent sodium sulfide, 48 percent distilled water, and 2 percent Aerosol 1B or similar wetting agent.
Ensure that after one hour no darkening, hazing, or other evidence of instability is evident when examined microscopically.

2. Drop-On Glass Spheres

**E. Requirements of Sealing Primer**
Place the particular type of two-part epoxy binder-sealer at the application rate as recommended in writing by the thermoplastic material manufacturer.

**653.2.01 Delivery, Storage, and Handling**
Use material delivered in 50 lb (22.7 kg) unit cardboard containers or bags strong enough for normal handling during shipment and on-the-job transportation without loss of material. Ensure that each unit container is clearly marked to indicate the following:
□ Color of the material
□ Process batch number or similar manufacturer's identification
□ Manufacturer's name
□ Address of the plant
□ Date of manufacture

**653.3.02 Equipment**
Depending on the marking required, use hand equipment or truck-mounted application units on roadway installations.

**A. Spray Application Machine** Ensure that each spray application machine is equipped with the following features:
□ Parts continuously mix and agitate the material.
□ Truck-mounted units for lane, edge, and center lines can operate at a minimum of 5 mph (8 kph) while installing striping.
□ Conveying parts between the main material reservoir and the shaping die or gun prevent accumulation and clogging.
□ Parts that contact the material are easily accessible and exposable for cleaning and maintenance.
□ Mixing and conveying parts, including the shaping die or gun, maintain the material at the plastic temperature with heat transfer oil or electrical element controlled heat. Do not use an external source of direct heat.
□ Parts provide continuously uniform stripe dimensions.
□ Applicator cleanly and squarely cuts off stripe ends and applies skip lines. Do not use pans, aprons, or similar appliances that the die overruns.
□ Parts produce varying widths of traffic markings.
□ Applicator is mobile and maneuverable enough to follow straight lines and make

normal curves in a true arc.

**B. Automatic Bead Dispenser**
Apply glass spheres to the surface of the completed stripe using a dispenser attached to the striping machine to automatically dispense the beads instantaneously upon the installed line. Synchronize the glass sphere dispenser cutoff with the automatic cutoff of the thermoplastic material.

**C. Special Kettles**
Use special kettles for melting and heating the thermoplastic material. Kettles equipped with automatic thermostatic control devices provide positive temperature control and prevent overheating. Ensure that the applicator and kettles are equipped and arranged according to the requirements of the National Fire Underwriters.

**D. Hand Equipment**
Use hand equipment for projects with small quantities of lane lines, edge lines, and center lines, or for conditions that require the equipment. Use hand equipment approved by the Engineer. Ensure that hand equipment can hold 150 lbs (68 kg) of molten material and is maneuverable to install crosswalks, arrows, legends, lane, edge, and center lines.

**E. Auxiliary Vehicles** Supply the necessary auxiliary vehicles for the operation.

**653.3.05 Construction A. General Application**
Thoroughly clean pavement areas to be striped. Use hand brooms, rotary brooms, air blasts, scrapers, or other approved methods that leave the pavement surface clean and undamaged. Take care to remove all vegetation and road film from the striping area. All new Portland Cement Concrete pavement surfaces shall be mechanically wire brushed or abrasive cleaned to remove all laitance and curing compound before being striped. Lay stripe with continuous uniform dimensions. Apply the type of stripe at each location according to the Plans, using one of the following methods:
□ Spray techniques
□ Extrusion methods wherein one side of the shaping die is the pavement, and the other three sides are contained by or are part of the suitable equipment to heat and control the flow of material.

1. Temperature
Apply thermoplastic traffic stripe only when the pavement temperature in the shade is above 40 °F (4 °C). To ensure optimum adhesion, install the thermoplastic material in a melted state at the manufacturer's recommended temperature but not at less than 375 °F (190 °C).

2. Moisture
Do not apply when the surface is moist. When directed by the Engineer, perform a moisture test on the Portland cement concrete pavement surface. Perform the test as

follows:

a. Place approximately 1 yd2 (1m2) of roofing felt on the pavement surface.

b. Pour approximately 1/2 gallon (2 L)of molten thermoplastic onto the roofing felt.

c. After 2 minutes, lift the roofing felt and inspect to see if moisture is present on the pavement surface or underside of the roofing felt.

d. If moisture is present, do not proceed with the striping operation until the surface has dried sufficiently to be moisture free.

3. Binder-Sealer

To ensure optimum adhesion, apply a binder-sealer material before installing the thermoplastic in each of the following cases:

- Extruded thermoplastic
- Where directed by the Engineer for sprayed thermoplastic
- Old asphaltic concrete pavements with exposed aggregates
- Portland cement concrete pavements as directed by the Engineer

Ensure that the binder-sealer material forms a continuous film that mechanically adheres to the pavement and dries rapidly. Use a binder-sealer currently in use and recommended by the thermoplastic material manufacturer according to QPL 46. To ensure optimum adhesion, apply a two-part epoxy binder-sealer on all Portland cement concrete pavements for either sprayed or extruded thermoplastic material. Apply the epoxy binder-sealer immediately in advance of, but concurrent with, the application of the thermoplastic material. Apply in a continuous film over the pavement surface.

4. Bonding to Old Stripe

The old stripe may be renewed by overlaying with new material. Ensure the new material bonds to the old line without splitting or cracking.

5. Offset from Construction Joints

Off-set longitudinal lines at least 2 in (50 mm) from construction joints of Portland cement concrete pavements.

6. Crosswalks, Stop Bars, and Symbols

Make crosswalks, stop bars, and symbols at least 3/32 in (2.4 mm) thick at the edges and no more than 3/16 in (4.8 mm) thick at the center.

7. Film Thickness

a. Maintain the following minimum average film thicknesses on all open graded asphalt concrete friction courses:

- 0.120 in (3.0 mm)* for lane lines
- 0.090 in (2.3 mm)* for edge lines
- 0.150 in (3.8 mm)* for gore area lines

b. Maintain the following minimum average film thicknesses on all other pavement types:
- 0.090 in (2.3 mm)* for lane lines
- 0.060 in (1.5 mm)* for edge lines
- 0.120 in (3.0 mm)* for gore area lines

8. Glass Spheres

a. Apply glass spheres to installed stripe surface at a minimum rate of 14 lbs of spheres to each 100 square feet ((700 g/m2) of thermoplastic material.

b. Apply the glass sphere top-coating with a pressure-type gun specifically designed for applying glass spheres that will embed at least one-half of the sphere's diameter into the thermoplastic immediately after the material has been applied to the pavement.

**B. Removing Existing Stripe**

Remove existing stripe according to Section 656. Remove 100 percent of existing traffic stripe from:
- Portland cement concrete pavement where the new stripe will be placed at the same location as the existing marking
- Pavement where the new stripe will be placed at a different location from the existing markings

**C. Tolerance and Appearance**

No traffic stripe shall be less than the specified width and shall not exceed the specified width by more than 1/2 in (13mm). The length of the 10 ft (3 m) segment for skip stripe and the 30 ft (9 m) gap between segments may vary plus or minus 1 ft (300 mm). The alignment of the stripe shall not deviate from the intended alignment by more than 1 in (25 mm) on tangents and on curves up to and including 1 degree (radius of 1745 m or greater). On curves exceeding 1 degree (radius less than 1745 m), the alignment of the stripe shall not deviate from the intended alignment by more than 2 in (50 mm). Stop work when deviation exceeds the above dimensions, and remove the nonconforming stripe.

**653.3.06 Quality Acceptance**

Segments of the thermoplastic traffic stripe that have been placed according to the Plans and Specifications may be accepted 30 days after the required work is complete in that segment. If thermoplastic traffic stripe fails to meet Plan details or Specifications or deviates from stated dimensions, correct it at no additional cost to the Department. If removal of pavement markings is necessary, perform it according to Section 656 and

place it according to this Specification. No additional payment will be made for removal and replacement of unsatisfactory striping.

**653.3.07 Contractor Warranty and Maintenance** After segments are accepted, the Contractor will be relieved of maintenance on those segments.

**653.4 Measurement**
Measurement will be made per linear foot for each specified width and lump sum for arrows and symbols.

**A. Solid Traffic Stripe**
Stripe is measured by the linear foot (meter), linear mile (kilometer), or square yard (meter). Breaks or omissions in solid lines or stripes at street or road intersections are not measured for payment.

**B. Skip Traffic Stripe** Skip stripe is measured by the gross linear mile (kilometer) as specified. The unpainted space between the painted stripes is included in the overall measurement if the Plan ratio of one to three (10 ft [3 m] segment and 30 ft [9 m] gap or other patterns as designated on the Plans) remains uninterrupted. Measurement begins and ends on a stripe.

**C. Words and Symbols**
Each word or symbol complete according to Plan dimensions is measured by the Unit.

**653.5 Payment**
Payment is full compensation for the Work under this section, including:
- Cleaning and preparing surfaces
- Furnishing all materials
- Applying, curing, and protecting stripe
- Protecting traffic, including providing necessary warning signs
- Furnishing tools, machines, and other equipment necessary to complete the Item

Payment will be made lump sum for striping and lump sum for arrows and symbols.

# 708 — Mobilization and Demobilization

## 1. Scope

The work consists of the mobilization and demobilization of the contractor's forces and equipment necessary for performing the work required under the contract. It does not include mobilization and demobilization for specific items of work for which payment is provided elsewhere in the contract. Mobilization will not be considered as work in fulfilling the contract requirements for commencement of work.

## 2. Equipment and material

Mobilization shall include all activities and associated costs for transportation of contractor's personnel, equipment, and operating supplies to the site; establishment of offices, buildings, and other necessary general facilities for the contractor's operations at the site; premiums paid for performance and payment bonds including coinsurance and reinsurance agreements as applicable; and other items specified in section 4 of this specification.

Demobilization shall include all activities and costs for transportation of personnel, equipment, and supplies not required or included in the contract from the site; including the disassembly, removal, and site cleanup of offices, buildings, and other facilities assembled on the site specifically for this contract.

This work includes mobilization and demobilization required by the contract at the time of award. If additional mobilization and demobilization activities and costs are required during the performance of the contract as a result of changed, deleted, or added items of work for which the contractor is entitled to an adjustment in contract price, compensation for such costs will be included in the price adjustment for the item or items of work changed or added.

## 3. Payment

Payment will be made as the work proceeds, after presentation of paid invoices or documentation of direct costs by the contractor showing specific mobilization and demobilization costs and supporting evidence of the charges of suppliers, subcontractors, and others. When the total of such payments is less than the lump sum contract price, the balance remaining will be included in the final contract payment. Payment of the lump sum contract price for mobilization and demobilization will constitute full compensation for completion of the work.

Payment will not be made under this item for the purchase costs of materials having a residual value, the purchase costs of materials to be incorporated in the project, or the purchase costs of operating supplies.

**4. Items of work and construction details**

Items of work to be performed in conformance with this specification and the construction details therefore are:

Mobilization and Demobilization

(1) This item shall consist of mobilizing and demobilizing personnel and equipment in preparation to perform the work within the scope of this contract.

(2) Any work that is necessary to provide access to the site including, but not limited to, grading, temporary culverts, and clearing will be included in this item.

(3) Any fence removed for access and/or to provide work area shall be replaced with same or like materials as approved by the engineer.

(4) The Contractor shall exercise caution to minimize the amount of damage caused by the grading and clearing operations.

(5) This item shall not include transportation of personnel, equipment and operating supplies between and within work limit areas of this contract.

# INDEX TO

# SECTION 02204 – GRADING COMPLETE

# SECTION 02204

# GRADING COMPLETE

## PART 1 - GENERAL

### 1.1 SECTION INCLUDES

A. Grading.

B. Excavation and Sawcutting.

C. Backfilling.

D. Compaction.

E. Remove and Replace Topsoil.

F. Dressing of Shoulders and Banks.

G. Stone Drainage Filter

H. Water Control

I. Testing

### 1.2 OMITTED

### 1.3 MEASUREMENT AND PAYMENT

A. Grading to subgrades, construction of ditches, dressing of disturbed areas, removing and replacing topsoil, excavating, sawcutting, backfilling and compacting to required elevations, testing, staking, and construction supervision shall be included in the contract lump sum price for "Grading Complete."

B. Unsuitable Material - Payment will include excavation, sawcutting, and disposal of unsuitable material.

C. Borrow - Payment will include furnishing materials required in excess of suitable materials available on site.

D. Earthwork - All earthwork associated with the installation of bulkheads, headwalls, wingwalls, weir structures, drainage filters, rip-rap, etc. shall not be measured for

direct payment. Payment for the earthwork shall be included in the item to which it pertains.

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

F. Proof Rolling - Payment will be made at the contract unit price. Payment will include furnishing a loaded truck, truck driver, fuel and rolling the designated areas.

G. Grading complete shall include all demolition of concrete and asphalt pavements, curb and gutter, rocks, etc.

## 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 1557-00 – 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. Materials Source: Submit names of materials source.

## 1.6 QUALITY ASSURANCE

A. Perform work in accordance with State of Georgia, County of Laurens, and City of Dublin standards.

## 1.7 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 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 6 inches of 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 6" 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.

G. Removing and disposing of miscellaneous roadway items, including but not limited to pavements, curbs, and drainage structures including all necessary saw cutting required for removal.

## 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 98% 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.

F. The contractor shall pay for all costs associated with compaction testing.

**3.11 OMITTED**

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.

B. Reporting

### 1.2 RELATED SECTIONS

A. Section 02204 – Grading Complete

B. Section 02720 – Storm Drainage

### 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 on the 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.

# 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.

## 3.2 ON-SITE OBSERVATION

A. The Contractor shall notify Engineer within 24 hours of control measures installation for site visit. Engineer 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 underlayed 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 | 10 |

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. .

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).

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 hall 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.

## 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 SCOPE

A. The majority of grading placement will be accomplished by others. The contactor will be responsible for providing a cost per ton to place ABC in order for the final pavement grades to match those shown on the plans. The contactor is responsible for determining the amount of ABC required to meet plan grades. The total tonnage will be submitted to the City of Dublin and approved before any ABC is purchased or placed.

### 1.2 RELATED SECTIONS

A. Section 02204 – Grading Complete

B. Section 02512GA - Asphaltic Concrete Binder/Surface Courses:

### 1.3 MEASUREMENT AND PAYMENT

A. Payment will be made at the lump sum price. Payment will include supplying all material, labor, and equipment, placing where required, and performing all operations necessary to complete the work in accordance with drawings and specifications.

### 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 1557-00 – 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 1557, (Modified 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

### 1.1 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. Level and contour surfaces to elevations and gradients indicated.

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

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

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

E. 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 98% 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. Density and moisture testing will be performed in accordance with ASTM D 1556.

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

C. Frequency of Tests:

1. Base Density - One (1) test per 5,000 square feet.

END OF SECTION

## INDEX TO

## SECTION 02512GA - ASPHALTIC CONCRETE BINDER/SURFACE COURSES

# SECTION 02512GA

# ASPHALTIC CONCRETE BINDER/SURFACE COURSES

## PART 1 - GENERAL

### 1.1 SECTION INCLUDES

A. Surface Course

B. Binder Course

### 1.2 RELATED SECTIONS

A. Section 02204 – Grading Complete

B. Section 02231 - Aggregate Base Course

### 1.3 MEASUREMENT AND PAYMENT

A. Asphaltic Concrete Surface Course: Will be paid for at the contract unit price of completed and accepted surface course for the thickness specified.

B. Prime: Will not be paid for separately. The cost involved in cleaning and preparing the surface, furnishing and applying all materials including sand and water, for repairs and maintenance shall all be included in the contract unit price for the Base Item bid.

C. Tack Coat: Will not be paid for separately.

D. Payment for pavement and tack coat will be in full for preparing and cleaning, providing all materials, labor and equipment including placing, compacting and testing.

### 1.4 REFERENCES

A. ASTM D 946-82 (Reapproved 1999) – Penetration-Graded Asphalt-Cement for Use in Pavement Construction.

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

C. 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.

D. ASTM D 2726-00 – Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures.

E. ASTM D 2950-91 (Reapproved 1997) – Density of Bituminous Concrete in Place by Nuclear Methods.

F. ASTM D 1754-97 - Effect of Heat and Air on Asphalt Materials (Thin-film Oven Test).

G. ASTM D-1188-96e1 - Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Paraffin-Coated Specimens.

## 1.5 QUALITY ASSURANCE

A. Perform work in accordance with Georgia Department of Transportation Standard Specifications for Construction of Roads and Bridges - 1993 Edition.

B. Mixing Plant: Conform to Georgia Department of Transportation Standard Specifications for Construction of Roads and Bridges – 1993 Edition.

## 1.6 ENVIRONMENTAL REQUIREMENTS

A. Do not place asphalt mixture when ambient air temperature is less than that indicated in the Table nor when the surface is wet or frozen.

| Lift Thickness | Min. Air Temperature, Degrees F. |
|---|---|
| 1" or Less | 55 |
| 1.1" to 2" | 45 |
| 2.1" to 3" | 35 |
| 3.1" to 4" | 30 |
| 4.1" to 8" | Contractor's Discretion |

B. Mixture shall be delivered to the spreader at a temperature between 250 degrees F and 325 degrees F.

## 1.7 TESTING

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

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

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

D. Test results shall be furnished to the Engineer.

## PART 2 - PRODUCTS

### 2.1 TACK COAT

A. Material: Shall be AC-20 or AC-30, asphalt cement, conforming to Sections 413 and 820 of the Georgia Department of Transportation Standard Specifications for Construction of Roads and Bridges. When the temperature in the shade exceeds 70 degrees F, an emulsion such as CRS - 2h or CRS - 3 may be used.

### 2.2 ASPHALT CEMENT AND ADDITIVES

A. Asphalt Cement: Shall conform to the requirements of Section 820.01 of the Georgia Department of Transportation Standard Specifications for Construction of Roads and Bridges. The material shall be AC-20 or AC-30. The loss on heating from the Thin-Film Oven Test shall not exceed 0.75 percent.

B. Anti-Stripping: Shall conform to requirements of Section 831.04 of the Georgia Department of Transportation Standard Specifications for Construction of Roads and Bridges.

### 2.3 AGGREGATES

A. General: Mineral aggregate shall be composed of fine aggregate or a combination of fine and coarse aggregate. Coarse aggregate shall be that portion of the material retained on a No. 8 sieve.

B. Fine aggregate shall be considered that portion passing the No. 8 sieve. Fine aggregate, coarse aggregate, and any additives in combination with the specified percentage of asphalt cement shall meet the requirements of tests specified, before approval may be given for their individual use.

C. Fine Aggregate: Shall conform to the requirements of Section 802.01 of the Georgia Department of Transportation Standard Specifications for Construction of Roads and Bridges.

D. Coarse Aggregate: Shall conform to the requirements of Section 802.02 of the Georgia Department of Transportation Standard Specifications for Construction of Roads and Bridges.

E. Surface Course: The surface course shall consist of fine and coarse aggregate and mineral filler uniformly mixed with hot asphalt cement in an approved mixing plant. The gradations, asphalt content and stabilities shall be the following:

| TYPE "E" | |
|---|---|
| Square Sieve | % Passing |
| 3/4" | 100 |
| 1/2" | 85 – 100 |
| 3/8" | 70 – 85 |
| No. 8 | 44 – 48 |
| No. 50 | 13 – 22 |
| No. 200 | 4 – 7 |
| % Asphalt Cement | 5.0 – 7.0 |
| Marshall Stability @ 50 Blows (Design) | 1,500 |
| Air Voids, % (Design) | 4.0 – 5.0 |

E. Intermediate or Binder Course: The mineral aggregates and asphalt cement shall be combined in such proportions that the composition by weight of the finished mixture shall be within the following range limits:

| TYPE "B" | |
|---|---|
| Sieve Designation | Percentage by Weight Passing |
| 1 inch | 100 |
| 3/4 inch | 85 - 100 |
| 3/8 inch | 55 - 75 |
| No. 8 | 30 - 36 |
| No. 50 | 11 - 19 |
| No. 200 | 4 - 7 |
| % Asphalt Cement | 4.0 - 5.5 |
| Marshall Stability, lbs. @ 50 Blows (Design) | 1,500 |
| Air Voids, % (Design) | 4.0 – 5.0 |

## 2.4 SOURCE QUALITY CONTROL AND TESTS

A. Submit proposed mix design for review prior to beginning of work.

B. Test samples in accordance with the requirements of these specifications.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. ON-SITE OBSERVATIONS: 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.

B. Contractor shall verify base has been inspected, is dry, and gradients and elevations are correct.

## 3.2 PREPARATION

A. Apply tack coat in accordance with Section 413 of the Georgia Department of Transportation Standard Specifications for Construction of Roads and Bridges. Rate of application shall be 0.04 to 0.06 gallons per square yard of surface.

B. Work shall be planned so no more tack coat than is necessary for the day's operation is placed on the surface. All traffic not essential to the work should be kept off the tack coat.

C. Apply tack coat to contact surfaces of curbs and gutters. Apply in manner so exposed curb or gutter surfaces are not stained.

D. Coat surfaces of manhole frames and inlet frames with oil to prevent bond with asphalt pavement. Do not tack coat these surfaces.

## 3.3 PLACEMENT

A. Construction shall be in accordance with Sections 400 of the Georgia Department of Transportation Standard Specifications for Construction of Roads and Bridges, 1993 edition.

B. Asphaltic concrete shall not be placed on a wet or frozen surface.

C. Compaction shall commence as soon as possible after the mixture has been spread to the desired thickness. Compaction shall be continuous and uniform over the entire surface. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment. Perform rolling with consecutive passes to achieve even and smooth finish without roller marks. Compaction rolling shall be complete before material temperature drops below 185° F.

D. Areas of pavement with deficient thickness or density shall be removed and replaced at no additional cost to the Owner.

## 3.4 TOLERANCES

A. General: All paving shall be subject to visual and straightedge inspection during construction operations and thereafter prior to final acceptance. A 10-foot straightedge shall be maintained in the vicinity of the paving operation at all times for the purpose of measuring surface irregularities on all paving courses. The straightedge and labor for its use shall be provided by the Contractor. The surface of all courses shall be inspected with the straightedge as necessary to detect surface irregularities. Irregularities such as rippling, tearing or pulling, which in the judgment of the Engineer indicate a continuing problem in equipment, mixture or operating technique, will not be permitted to recur. The paving operation shall be stopped until appropriate steps are taken by the Contractor to correct the problem.

B. Flatness: All irregularities in excess of 1/8 inch in 10 feet for surface courses and 3/16 inch in 10 feet for intermediate and base courses shall be corrected.

C. Variation from Design Elevation: Less than 1/4 inch.

D. Scheduled Compacted Thickness: Less than 1/4 inch under tolerance.

E. Pavement Deficient in Thickness: When measurement of any core indicates that the pavement is deficient in thickness, additional cores will be drilled 10 feet either side of the deficient core along the centerline of the lane until the cores indicate that the thickness conforms to the above specified requirements. A core indicating thickness deficiencies is considered a failed test. Pavement deficient in thickness shall be removed and replaced with the appropriate thickness of materials. If the Contractor believes that the cores and measurements taken are not sufficient to indicate fairly the actual thickness of the pavement, additional cores and measurements will be taken, provided the Contractor will bear the extra cost of drilling the cores and filling the holes in the roadway as directed.

## 3.5 FIELD QUALITY CONTROL

A. Quality acceptance of the in-place density of the surface course shall be in accordance with the Georgia Department of Transportation Standard Specifications for Construction of Roads and Bridges, Section 400.05 subparagraphs F and G.

B. Density Testing: Performed in accordance with ASTM D-2726 and ASTM D-2950. Core samples for each day's operation shall be taken, tested and results reported to the Engineer the following day. The areas sampled shall be properly restored by the Contractor at no additional cost to the Owner. Nuclear gauge tests shall be taken during the asphaltic concrete placement.

1. The average pavement core density for a project shall be at least 96% of the maximum laboratory density as determined by the Marshall Method of test. Individual core densities shall not be less than 95% of the maximum laboratory density.

2. The average pavement nuclear gauge density for a project shall be at least 100% of the target density obtained from a control strip. Individual nuclear tests should not be less than 98% of the target density.

C. Temperature:

1. Asphaltic concrete shall not exceed 325 degrees F at any time.

2. Asphaltic concrete shall not be placed once the temperature of the mix falls below 250 degrees F or the delivered temperature is more than 15 degrees F below the batch plant's delivery ticket.

3. Temperature at time of loading shall be recorded on the truck delivery ticket.

D. Frequency of Tests:

1. Asphaltic Concrete - One (1) test for each 250 tons placed.

   a) Asphalt extraction and gradation test.

   b) Marshall Stability Test

   c) Core Sample

2. Field determination of density by nuclear method every 5,000 square feet during construction of the asphaltic concrete binder/surface course.

END OF SECTION.

# INDEX TO

# SECTION 02560 - FLOWABLE FILL

# SECTION 02560

# FLOWABLE FILL

## PART 1 - GENERAL

### 1.1 SCOPE

A. The work covered by this section consists of furnishing all material, equipment, and performing all labor for the manufacturing, transporting, and placing of flowable fill in backfilling for remove and replace asphalt pavement. The material shall be placed as shown on the contract drawings.

### 1.2 RELATED SECTIONS

A. Section 02512SC – Asphaltic Concrete Binder/Surface Course

### 1.3 AVAILABILITY

A. Most of the major ready-mix concrete plants are familiar with this material. It is supplied as a finished product by means of ready-mix trucks and is handled the same as concrete except it is flowable and does not require consolidation by vibrating.

### 1.4 REFERENCES

A. ASTM C 33-93 – Concrete Aggregates

B. ASTM C 94-94 – Ready-Mixed Concrete

C. ASTM C 150-95 – Portland Cement

D. ASTM C 618-94 – Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete

### 1.5 MEASUREMENT AND PAYMENT

A. The payment will be per contract unit price.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

A. General - Flowable fill shall be composed of fine aggregate (sand), cementitious materials (portland cement plus fly ash), and water.

B. Fine Aggregate - Fine aggregate shall conform to the quality and gradation requirements of ASTM C 33 for fine aggregate.

C. Portland Cement - Portland cement shall conform to the requirements of ASTM C 150, Type I.

D. Fly Ash - Fly ash shall conform to the requirements of ASTM C 618, Class F.

E. Mixing Water - Mixing water shall conform to the requirements of ASTM C 94.

## 2.2 PROPORTIONING

A. The intended proportioning of materials for flowable fill per cubic yard shall be as follows:

| | |
|---|---|
| Portland Cement | 100 pounds |
| Fly Ash | 600 pounds |
| Fine Aggregate (SSD)* | 2,435 pounds |
| Water | 458 pounds (55 gallons) |

*Saturated Surface Dry

The amount of water may be adjusted to provide for a workable mix during placement.

The Contractor may direct minor modification of the mix proportioning to suit local conditions and materials.

# PART 3 - EXECUTION

## 3.1 PLACEMENT

A. The flowable fill may be placed by direct discharge from the truck, by pumping or by other approved methods. It shall be placed as shown on the contract drawings.

CAUTION: Fluidized flowable fill is a heavy material and during placement (prior to seating) will exert a high fluid pressure against the pipe and any forms or wall used to contain the fill. Unless the pipe is anchored down or held in place in some manner, the placement of the flowable fill will cause the pipe to float or shift. The Contractor shall be responsible for anchoring or securing the pipe so the line and grade is maintained during placement and setting of the flowable fill.

To avoid displacing the pipe, placements have been made by placing the flowable fill in small incremental depths with the time interval between placements sufficient in length to allow initial "setting" of the prior placement. However, the engineer in no way endorses or recommends this method. Should this method be utilized, the Contractor shall be responsible for developing a procedure which will ensure maintenance during placement and setting.

The ends of the flowable fill will require blocking with wood or metal forms, bags of soil, or other means.

The flowable fill will tend to bleed water to the surface. The blocking of the ends of the flowable fill shall be accomplished in such manner so as not to prevent the runoff of the bleeding water.

Placement of flowable fill shall start only when weather conditions are favorable. The temperature shall be at least 35 degrees F and rising. Mixing and placing shall stop when the temperature is 38 degrees F and falling. Placement shall be performed when it is not raining, and shall be as continuous an operation as is practicable.

The completed flowable fill shall not be subjected to any load and shall remain undisturbed by construction activities for at least 24 hours after placement.

**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 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.

### 1.4 MEASUREMENT AND PAYMENT

A. There will be no measurement for this item. Payment shall be at lump sum price.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

A. All barricades signs, and traffic control signal devices shall conform to the requirements of the current South Carolina 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 - 10 AM and 4 PM - 10 PM. Between the hours of 10 AM and 4 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.

B. 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 02667 - WATER DISTRIBUTION SYSTEM

# SECTION 02667

# WATER DISTRIBUTION SYSTEM

## PART 1 - GENERAL

### 1.1 SECTION INCLUDES

A. Piping

B. Valves

C. Fittings

D. Connect to Existing System

E. All necessary appurtenances to convey potable water from the existing system to the location shown on the plans.

### 1.2 RELATED SECTIONS

A. Section 02110 - Site Clearing

B. Section 02204 - Earthwork

C. Section 02902 - Grassing

### 1.3 OPTIONS

A. The bid form and specifications describe several pipe materials. The Owner will select the one to be used. Where manufacturers of material or equipment are named in the specifications, the Contractor may use equipment or materials of other manufacturers provided they are reviewed and accepted by the Engineer as meeting the specifications prior to ordering such equipment or materials.

### 1.4 REFERENCES

A. 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.

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

C. ANSI/AWWA C 153/A-21.53-00 - Ductile Iron Compact Fittings, 3 in. through 2.4 in. and 54 in. through 64 in., for Water Service.

D. ANSI/AWWA C 110/A21.10-98 - Ductile Iron and Gray Iron Fittings, 3 in. through 48 in. for Water and Other Liquids.

E. ANSI/AWWA C 150/A-21.50-96 - Thickness Design of Ductile Iron Pipe.

F. ANSI/AWWA C 151/A-21.51-96 - Ductile Iron Pipe, Centrifugally Cast, for Water or other liquids.

G. ANSI/AWWA C 104/A-21.4-95 - Cement-Mortar Lining for Ductile Iron Pipe and Fittings for Water.

H. ASTM D 1784-99a - Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride)(CPVC) Compounds.

I. ASTM D 2241-00 - Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR - Series).

J. ANSI/AWWA C 901-96 - Polyethylene Pressure Pipe and Tubing, ½ in. through 3 in., for Water Service.

K. ASTM D 2737-99 - Polyethylene (PE) Plastic Tubing.

L. ANSI/AWWA C 115/A21.15-99 - Flanged Ductile Iron Pipe with Ductile Iron or Gray Iron Threaded Flanges.

M. ANSI/AWWA C 111/A21.11-00 - Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings.

N. ASTM D 3139-98 - Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.

O. ANSI/AWWA C 900-97 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 in through 12 in., for Water Distribution.

P. ANSI/AWWA C 500-93 - Metal-Seated Gate Valves for Water Supply Service.

Q. ANSI/AWWA C 509-94 - Resilient-Seated Gate Valves for Water Supply Service.

R. ANSI/AWWA C 502-94 - Dry-Barrel Fire Hydrants.

S. ANSI/AWWA C 800-89 - Underground Service Line Valves and Fittings.

T. ANSI/AWWA C 600-99 - Installation of Ductile Iron Water Mains and Their Appurtenances.

U. ANSI/AWWA C 605-94 - Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water.

V. ASTM D 2774-01 - Underground Installation of Thermoplastic Pressure Piping.

W. UNI-Bell UNI-B-3 - Recommended Standard for the Installation of Polyvinyl Chloride (PVC) Pressure Pipe.

X. ASTM D 1556-00 - Density and Unit Weight of Soil In Place By The Sand-Cone Method.

Y. ASTM D 2922-96e1 - Density Of Soil and Soil Aggregate In Place By Nuclear Methods (Shallow Depth).

Z. ANSI/AWWA C 651-99 - Disinfecting Water Mains.

AA. ASTM D 1557-00 - Laboratory Compaction Characteristics of Soil Using Modified Effort.

BB. ASTM D 2672-96a - Joints for IPS PVC Pipe Using Solvent Cement.

CC. ANSI B-18.2.2 - Square and Hex Bolts and Screws.

DD. ANSI B-18.2.2 - Square and Hex Nuts.

EE. ANSI/AWWA C905-97 – Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 in. through 48 in. (350 mm through 1,200 mm), for Water Transmission and Distribution.

FF. ASTM A 139-00 – Electric-Fusion (Arc) – Welded Steel Pipe (NPS 4 or over).

## 1.5 QUALITY ASSURANCE

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

B. Manufacturer - Material and equipment shall be the standard products of a manufacturer who has manufactured them for a minimum of 2 years and who provides published data on the quality and performance of the products.

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

D. Design - Devices, equipment, structures, and systems not designed by the Engineer that the Contractor wishes to furnish shall be designed by either a registered professional engineer or by someone the Engineer accepts as qualified. If required, complete design calculations and assumptions shall be furnished to the Engineer or Owner before acceptance.

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

F. Hydrostatic tests on pipe shall be made by the Contractor with equipment qualified by the Engineer. The Engineer or his representative reserves the right to accept or reject testing equipment. Hydrostatic testing shall be conducted in the presence of the Engineer or his representative and a representative of the City of Dublin Engineering Department.

## 1.6 REQUIREMENTS OF REGULATORY AGENCIES

A. Water mains shall be sterilized to meet the requirements of the appropriate Health Department. Sterilization shall be in accordance with AWWA Standards C-651, latest revision.

## 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. Contractor 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 SEQUENCING AND SCHEDULING

A. Contractor shall arrange the work so sections of mains between valves are tested, sterilized, pavement replaced, and the section placed in service as soon as reasonable after installation.

## 1.9 ALTERNATIVES

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

## 1.10 GUARANTEE

A. Contractor shall guarantee the quality of materials, equipment, and workmanship for a period of 12 months after acceptance. Defects discovered during this period

shall be repaired by the Contractor at no cost to the Owner. The Performance Bond shall reflect this guarantee.

## 1.11 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 his 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 the drawings.

B. Contractor shall call for underground utility locations before starting work. Underground utilities location service can be contacted at 1-800-282-7411.

## 1.12 CONNECT NEW MAIN TO EXISTING SYSTEM

A. The Contractor shall furnish the necessary pipe and perform all excavation, dewatering, shoring, backfilling, etc., necessary to make the connection of a new main to the existing water system. The Contractor shall contact the Superintendent of the Water Utility a minimum of 48 hours in advance of construction. The Contractor shall be responsible for coordinating his construction with the utility operator.

## 1.13 DAMAGE TO EXISTING WATER SYSTEM

A. Damage to any part of the existing water system by the Contractor or Subcontractors, that is repaired by the Utility Owner's forces, shall be charged to the Contractor on the basis of time and material, plus 30% for overhead and administration.

## 1.14 MEASUREMENT AND PAYMENT

A. Measurement - The length of mains, and branch lines to be paid for will be determined by measurement along the centerline of the various sizes and types of pipe actually furnished and installed, from the center of fitting, and from the center of the main to the end of the branch connection. No deduction will be made for the space occupied by valves and fittings.

B. Payment -

1. Pipe - Payment for pipe will be made per the linear foot for pipes which are actually placed, as shown on the plans, or as directed by the Engineer. Excavation, dewatering, installation, backfill, compaction, testing, metal detector tape, tracing wire, and all other incidentals to installation of the mains shall be considered as subsidiary obligations of the Contractor for completion of the line in place.

2. Fittings – No separate payment will be made for fittings.

3. Valves - Valves in the distribution system will be paid for at the lump sum price. Payment will include furnishing and installing the valve, valve boxes or manholes.

4. Fire Hydrants - Payment for new fire hydrants will be made at the lump sum price for fire hydrants. Payment will include the cost of furnishing, installing and connecting the hydrant, gravel sump, restrained joints, backfilling, and painting.

5. Cleaning and Disinfecting - No separate payment will be made for cleaning and disinfecting. Cleaning and disinfecting piping in the distribution system will be included in the lump sum and unit prices for the appropriate items.

6. Grassing - There will be no separate measurement or payment. Grassing shall be considered as a subsidiary obligation of the Contractor in the restoration of disturbed areas.

7. Metal Detector Tape - No separate payment will be made for tape. The cost of furnishing and placing metal detector tape shall be included in the contract unit price for installing pipe.

8. Connections to Existing Mains - Payment for connections of the new mains with existing mains will be made at the lump sum price for each type connection and will include all labor and materials required to locate, excavate, cut, connect and backfill in an approved and workmanlike manner.

9. Tapping Sleeves and Crosses - Payment will be made at the lump sum price Payment will include all labor, materials, and equipment necessary to locate, excavate, furnish and install the sleeve or cross, valve, valve boxes or manholes, tap the existing main, backfilling and compaction.

10. Flush Valves - Payment for flush valves will be made at the lump sum price. Payment will include furnishing and installing the ball valve, riser pipe and cap, valve or meter box and the concrete collar.

11. Tracing Wire - No separate payment will be made for wire. The cost of furnishing and placing tracing wire shall be included in the contract unit price for installing pipe.

12. Restrained Joints - Payment for restrained joints will be made at the lump sum price for each size installed. Payment will include all labor, materials and equipment necessary to furnish and install each restrained joint.

13. Backflow Preventor Assembly – Payment will be made at the lump sum price for each size. Payment will include furnishing and installing the backflow preventor assembly, vault, cover, testing and certification.

## 1.15 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 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 shall be 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

Products and materials used in the work shall conform to the following:

## 2.1 PIPE

A. Ductile Iron Pipe - Shall conform to ANSI A-21.50 (AWWA C-150) and ANSI A-21.51 (AWWA C-151). All pipe shall be Pressure Class 350 unless otherwise noted. It shall be cement lined in accordance with ANSI A-21.4 (AWWA C-104).

B. P.V.C. - Pipe 4-inches through 12-inches shall conform to all requirements of AWWA C-900, DR 18, pressure rating of 150 p.s.i. and shall have the following minimum wall thickness:

| | |
|---|---|
| 4" | .267 inches |
| 6" | .383 inches |
| 8" | .503 inches |
| 10" | .617 inches |
| 12" | .733 inches |

PVC pipe 14-inches through 48-inches shall conform to all requirements of AWWA C905 with CI outside diameter, DR 25, with a pressure rating of 165 PSI.

PVC pipe for fire lines shall have a pressure rating of 200 PSI.

Pipe with diameter less than 4-inches shall conform to all requirements of ASTM D-1784 and D-2241 (SDR 21). The pipe shall have a minimum pressure rating of 200 p.s.i. Certificates of conformance with the foregoing specifications shall be furnished with each lot of pipe supplied. All P.V.C. pipe shall bear the National Sanitation Foundation Seal of Approval.

## 2.2 JOINTS

A. Flanged Joints - Shall conform to ANSI A-21.15 (AWWA C-115). Bolts shall conform to ANSI B-18.2.1 and nuts shall conform to ANSI B-18.2.2. Gaskets shall be rubber, either ring or full face, and shall be 1/8 inch thick. Gaskets shall conform to the dimensions recommended by AWWA C-115 latest revision.

B. Mechanical Joints -In ductile iron pipe shall conform to ANSI A-21.11 (AWWA C-111).

B. Push-On-Joints - In ductile iron pipes shall conform to ANSI A-21.11 (AWWA C-111).

D. Plastic Pipe - Joints in plastic pipe 4-inches through 12-inches shall meet all requirements of AWWA C-900. Joints in plastic pipe 14-inches through 48-inches shall meet all requirements of AWWA C905. Joints in plastic pipe with a diameter less than 4-inches shall conform to ASTM D-3139.

E. 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. The joints shall be in accordance with the applicable portions of AWWA C-111. The manufacturer of the joints shall furnish certification, witnessed by an independent laboratory, that the joints furnished have been tested without signs of leakage or failure. Restrained joints shall be capable of being deflected after assembly.

## 2.3 FITTINGS

A. Fittings for Ductile Iron or Plastic Pipe - Shall be ductile iron, manufactured in accordance with ANSI A-21.53 (AWWA C-153). They shall be cement lined in accordance with ANSI A-21.4 (AWWA C-104). Fittings shall be designed to accommodate the type of pipe used.

B. Fittings for Flanged Pipe - Shall be manufactured in accordance with ANSI A-21.10 (AWWA C-110), Class 125 flanges.

C. Fittings for Plastic Pipe - Less than 4" shall be PVC with ring tite rubber joints conforming to ASTM D-3139 or solvent weld joints conforming to ASTM D-2672.

## 2.4 GATE VALVES

A. Two (2) Inches and Larger Valves - 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 or C-509. They 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 psi and be tested at 400 psi.

Valves shall be furnished with "O" ring packing. Two (2) "O" ring shall be located above the thrust collar and one (1) "O" ring below. The thrust collar shall be permanently lubricated and have an anti-friction washer on top of the thrust collar.

Valves installed in pits or above ground shall be furnished with hand wheels. Buried valves shall be furnished with square operating nuts.

B. Smaller Than Two (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 approved valve boxes. The valve boxes shall have a suitable base that does not damage the pipe, and shaft extension sections to cover and protect the valve and permit easy access and operation. The cover shall be cast iron. The box and any extensions needed shall be cast iron having a crushing strength of 1,500 pounds per linear foot. Valve boxes shall conform to the detail shown.

D. Valve Manholes - Manholes shall be constructed of new whole brick of good quality laid in mortar made of 1 part portland cement and 2 parts clean sharp sand. Every brick or block shall be carefully and fully bedded in mortar. The outside shall be completely plastered with 1/2 inch of 1:2 mortar. Approved precast concrete manholes may be substituted for brick manholes.

E. Flush valves - Shall conform to the details shown.

## 2.5 FIRE HYDRANTS

A. General - Hydrants shall be manufacturer's current model design and construction. All units to be complete including joint assemblies. Physical characteristics and compositions of various metal used in the hydrant components shall meet the requirements as specified in AWWA C-502 latest revision. Hydrants shall be suitable for working pressure of 150 p.s.i.

B. Bonnet - Bonnet may have oil filled or dry reservoir. If oil filled, bonnet must have "O" ring packing so that all operating parts are enclosed in a sealed oil bath. Oil filler plug shall be provided in bonnet to permit checking of oil level and adding oil when required. If dry type, hydrant top must have lubricating hole or nut for ease

of lubrication. All parts must be removed through top of hydrant without moving entire barrel section from safety flange.

C. Nozzles and Caps - The hydrant shall have two (2) 2 -1/2 inch connections and one (1) 4-1/2" steamer connection, National standard threads. Nozzles shall be bronze and have interlocking lugs to prevent blowout. Nozzle caps shall be secured to fire hydrant with non-kinking type chain with chain loop on cap ends to permit free turning of caps.

D. Seat Ring - Seat ring shall be bronze.

E. Drain Valves and Openings - Positive operating drain valves shall be provided to assure drainage of fire hydrant when the main valve is closed. Drain openings shall have bronze bushings.

F. Main Valve - Valve shall be designed to close with the pressure and remain closed. Valve shall be made from material that will resist rocks or other foreign matter.

G. Barrel and Safety Flanges - Hydrants shall have a safety-type vertical barrel and be designed with safety flanges and/or bolts to protect the barrel and stem from damage and to eliminate flooding when hydrant is struck. Bury depth shall be cast on barrel of hydrant.

H. Operating Stop and Nut - Hydrant shall have a positive stop feature to permit opening of hydrant without over travel of stem. Operating nut shall be bronze, 1-1/2", point to flat, pentagon.

I. Bolts and Nuts - Bolts, washers and nuts shall be corrosion resistant.

J. Inlet - Bottom inlet of hydrant shall be provided with mechanical joint connection as specified and shall be 6-inch nominal diameter.

K. Direction of Opening - Hydrant shall be designed to close "right" or clockwise and open "left" or counter-clockwise.

L. Coatings - All inside and outside portions of hydrant shall be coated in accordance with AWWA C-502. The exterior portion of hydrant above ground level shall be painted with two (2) coats of best grade zinc chromate primer paint and with two (2) coats of approved hydrant enamel. Color shall be Federal Safety Yellow unless otherwise designated by Owner.

M. Joint Assemblies - Complete joint assemblies consisting of gland, gasket, bolts, and nut shall be furnished for mechanical joint inlets.

## 2.6 SERVICE CONNECTIONS

A. Taps in pipe larger than 3-inches shall be made with a tapping machine. A corporation stop shall be installed at the connection to the main. The corporation stop shall be brass manufactured in conformance with AWWA C-800. Inlet and outlet threads shall conform to AWWA C-800.

The key and body seating surfaces shall be accurately machined and fit to a taper of 1-3/4-inches per foot. The stem and retaining nut shall be so designed that failure from overtightening of the retaining nut results in thread stripping rather than stem fracture. Corporation stops shall be 1-inch equivalent to Mueller H-15008 or Ford F-1000 with a stainless steel stiffener. Service saddles shall have 1-inch AWWA taps, equivalent to Ford Styles 202B or S70. Contractor shall adhere to pipe manufacturer's recommendations on maximum tap sizes for each main size.

B. Where connections to larger service pipes are required, multiple taps shall be made and connected by branch. Taps for house services in PVC pipe 2-inches and smaller shall be equivalent to a Dresser Style 294 "Qwik Tap" or made with a PVC Tee. The connection shall be capable of withstanding internal water pressure continuously at 150 p.s.i. House service lines will be 1-inch polyethylene tubing with a curb stop at the property line. The end of the service lateral at the property line shall be marked with a 2 x 4 stake, 36-inches long with the top 6-inches above the ground and painted blue. The depth of the pipe shall be marked on the back of the stake. Location of service line must appear on the "as-built" information and record drawings.

## 2.7 TAPPING SLEEVES/CROSSES

A. Cast Iron - Shall be Mechanical Joint Type sized to fit the intercepted pipe. They shall have duck-tipped end gaskets and shall be equivalent to Mueller H-615/715 with a tapping valve attached. Outlet end of valve shall have a joint suitable for type of pipe installed in the new branch. Sleeve/Cross shall be sized to fit the intercepted pipe without leaking.

B. Stainless Steel – Shall be all stainless steel construction with full circumferential gasket equivalent to JCM 432 with a tapping valve attached. Outlet end of valve shall have a joint suitable for type of pipe installed in the new branch. Sleeve shall be sized to fit the intercepted pipe without leaking.

## 2.8 CURB STOPS

A. At the end of the service line, where the meter is to be installed, a 1-inch brass ball valve with padlock wing shall be installed. The unconnected end shall be closed inside I.P. thread. The curb stop shall be closed bottom design and sealed against external leakage at the top by means of a non-adjustable resilient pressure actuated seal, and shall be provided with a secondary resilient seal disposed above the pressure seal for added protection of the bearing surfaces against ground water infiltration. Shut off shall be effected by a resilient pressure actuated seal so disposed in the key as to completely enclose the inlet body port in the closed position. All ball valves shall be 1/4 turn and the full open and closed

position shall be controlled by check lugs which are integral parts of the key and body. The pressure rating shall be 175 p.s.i. The ball valves shall be equivalent to Ford Ball Valve No. B61-444W.

## 2.9 METAL DETECTOR TAPE

A. Will be used over all pipe. The tape shall consist of 0.35 mils thick solid foil core encased in a protective plastic jacket that is resistant to alkalis, acids, and other destructive elements found in the soil. The lamination bond shall be strong enough that the layers cannot be separated by hand. Total composite thickness to be 5.0 mils. Foil core to be visible from unprinted side to ensure continuity. The tape shall have a minimum 3" width and a tensile strength of 84 lbs. per three inch wide strip.

A continuous warning message indicating "potable water" repeated every 16" to 36" shall be imprinted on the tape surface. The tape shall contain an opaque color concentrate designating the color code appropriate to the line being buried (Water Systems - Safety Precaution Blue).

## 2.10 BACKFLOW PREVENTOR ASSEMBLY

A. Reduced Pressure – Shall consist of two (2) independently operating check valves, one (1) differential relief valve located between the two (2) check valves, two (2) resilient seat gate valves, and four (4) properly placed resilient seated test cocks. Backflow preventor two (2) inches and smaller shall have a bronze valve body. Backflow preventor greater than two (2) inches shall be ductile iron or stainless steel. All internal parts in the check and relief valves shall be made of series 300 stainless steel or polymer materials suitable for potable water and rated for 175 PSI working pressure. The assembly shall be constructed so all internal parts can be serviced or removed while in line. Assembly must be factory assembled and tested. Backflow preventor shall be equivalent to Febco Model 825 or Ames Model 4000 SS.

B. Double Check – Shall consist of two (2) independently operating check valves, two (2) resilient seat gate valves and four (4) properly placed resilient seated test cocks. Backflow preventor two (2) inches and smaller shall have a bronze valve body. Backflow preventor greater than two (2) inches shall be ductile iron or stainless steel. All internal parts in the check valves shall be made of Series 300 stainless steel or polymer materials suitable for potable water and rated for 175 PSI working pressure. The assembly shall be constructed so all internal parts can be serviced or removed while in line. Assembly must be factory assembled and tested. Backflow preventor shall be equivalent to Febco Model 805 or Ames Model 2000 SS.

## 2.11 TRACING WIRE

A. Tracing wire shall be # 12 gauge insulated single strand copper wire.

## 2.12 CASING

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

## 2.13 CASING SPACERS

A. Casing spacers shall be bolt on style with a shell made in two (2) 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" from casing pipe at all times. Casing Spacers shall be as manufactured by Cascade Waterworks Manufacturing Company, or approved equivalent.

## 2.14 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

A. The Engineer shall have the right to require any portion of the work be completed in his presence and if any work is covered up after such instruction, it shall be exposed by the Contractor for observation. However, if the Contractor notifies the Engineer such work is scheduled and the Engineer 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 Engineer or Project Representative. All 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 Project Engineer or Project Representative a minimum of 48 hours notice for all required observations or tests.

It will also be required of the Contractor to keep accurate, legible records of the location of all water lines, service laterals, valves, fittings, and appurtenances. These records will be prepared in accordance with the paragraph on "Record Data

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

## 3.2 INSTALLATION

A. Ductile iron pipe shall be laid in accordance with AWWA C-600; Plastic pipe shall be laid in accordance with AWWA C 605, ASTM D 2774, UNI-Bell UNI-B 3 and the pipe manufacturer's recommendations. The standards are supplemented as follows:

1. Depth of Pipe - 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.

2. Alignment and Grade - The water mains shall be laid and maintained to lines and grades established by the plans and specifications, with fittings, valves, and hydrants at the required locations unless otherwise accepted by the Owner. Valve-operating stems shall be oriented in a manner to allow proper operation. Hydrants shall be installed plumb.

   a) Prior Investigation - Prior to excavation, investigation shall be made to the extent necessary to determine the location of existing underground structures and conflicts. Care shall be exercised by the contractor during excavation to avoid damage to existing structures. The pipe manufacturer's recommendations shall be used when the watermain being installed is adjacent to a facility that is cathodically protected.

   b) Unforeseen Obstructions - When obstructions not shown on the plans are encountered during progress of work, and interfere so a change of the plans is required, the Engineer will revise the plans, or order a deviation in line and grade, or arrange for removal, relocation, or reconstruction of the obstructions.

   c) Clearance - When crossing existing pipelines or other structures, alignment and grade shall be adjusted as necessary, with the acceptance of the Owner, to provide clearance as required by federal, state, and local regulations or as deemed necessary by the Owner to prevent future damage or contamination of either structure.

3. Trench Construction - The trench shall be excavated to the alignment, depth, and width specified or shown on the plans and shall be in conformance with all federal, state, and local regulations for the protection of the workers.

4. Joint Restraint - All bends, plugs, valves, caps and tees on 2" pipe and larger, shall be provided with stainless steel tie rods or joint restraints

equivalent to Megalugs. Additional restraint shall be as indicated on the drawings.

5. Anchorage for Hydrants - A concrete block 1' x 1' x 2' shall be poured between the back of the hydrant and undisturbed earth of the trench side without covering weep holes and bolts. Joint restraints equivalent to Megalugs manufactured by EBAA Iron may be used in lieu of concrete blocking.

6. Hydrostatic and Leakage Tests – Ductile iron pipe shall be tested in accordance with AWWA Standard C 600, Section 4 - Hydrostatic Testing. Allowable leakage shall not exceed that determined by the formula $L = SDP^{1/2}/133,200$, in which L is the allowable leakage in gallons per hour; S is the length of pipe in feet tested; D is the nominal diameter of the pipe in inches; and P is the average test pressure during the leakage test in pounds per square inch gauge. The test shall be conducted for at least two (2) hours and a pressure of 150 psi shall be maintained during the test. Fire lines shall be tested at 200 PSI for the same duration.

   P.V.C. pipe shall be tested in accordance with AWWA Standard C 605, Section 7.3 – Hydrostatic Testing. Allowable leakage shall not exceed that determined by the formula $L = NDP^{1/2}/7,400$, in which L is the allowable leakage in gallons per hour; N is the number of joints in the length of pipeline tested; D is the nominal diameter of the pipe in inches; and P is the average test pressure during the leakage test in pounds per square inch gauge. The test shall be conducted for at least two (2) hours and a pressure of 150 PSI shall be maintained during the test. Fire lines shall be tested at 200 PSI for the same duration.

   Should any test of the pipe laid disclose leakage greater than the above specified, the Contractor shall at his own expense, locate and repair the defective joints until leakage is within the specified allowance. The Contractor is responsible for notifying the Engineer 48 hours (minimum) prior to applying pressure for testing. Pressure test will be witnessed by the Engineer or his authorized representative. All visible leaks shall be repaired regardless of the leakage amount.

7. Backfilling and Compaction - All trenches and excavation shall be backfilled immediately after the pipes are laid therein, unless other protection of the pipe line is directed. The backfilling material shall be selected and deposited with special reference to the future safety of the pipes. The material shall be completely void of rocks, stones, bricks, roots, sticks, or any other debris that might cause damage to the pipe and tubing or might prevent proper compaction of the backfill. Except where special methods of bedding and tamping are provided for, clean earth or sand shall be solidly tamped about the pipe up to a level at least 2' above the top of the pipes, and shall be carefully deposited to uniform layers, each layer solidly

tamped or rammed with proper tools so not to injure or disturb the pipeline. The remainder of trench backfilling shall be carried on simultaneously on both sides of the pipe in such manner preventing injurious side pressure. The material used shall be selected from excavated material anywhere on the work if any of the material is suitable.

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 as determined by ASTM D 1556 or D 2922. Below the 24-inch line to, and including the area around the pipe, the density shall not be less than 95% of maximum laboratory density, at optimum moisture. In areas other than traffic areas, the backfill shall be compacted to 90% of maximum laboratory density at optimum moisture.

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 the Engineer immediately after installation.

Where thermoplastic (PVC) pipe is installed, the Contractor shall take precautions, in accordance with ASTM D-2774, during backfilling operations so not to create excessive side pressures, or horizontal or vertical deflection of the pipe, nor impair flow capacity.

8. New Service Connections - Contractor shall tap the main and install a service connection to each lot or as directed by the Engineer in accordance with details shown on the plans for Water Service Connections. Plastic tubing for service lines shall be installed in a manner preventing abrupt changes or bends in any direction. Contractor shall exercise extreme caution to prevent crimping of the tubing during handling, storage and installation. Tubing shall have an absolute positive connection to the water main to prevent leakage. Taps shall be made perpendicular to the main. A water service connection shall be marked on the curb with a "W." The mark shall be made with a branding iron on the vertical face of the curb and shall be a minimum of 1/4-inch in depth.

9. Detection Tape - Detection tape will be used over all pipe and tubing. The tape shall be laid 18" below finished grade.

10. Tracing Wire - Tracing wire will be installed on all water mains and water service laterals directly on top of the water line. The wire shall be secured to the pipe with tape or other acceptable methods at spacings of no more than 36" apart. Where water service laterals connect to water mains, the wire insulation shall be stripped so the bare wires can and shall be jointed securely together and wrapped with a rubberized insulation tape. The insulated wire must maintain electrical continuity. The tracing wire shall also be stubbed up into each valve box and at each fire hydrant. Stub up

connections shall be stripped, joined and wrapped as previously described for water service laterals. This tracing wire system shall be checked and tested by the Contractor, in the presence of the Engineer or water department, prior to acceptance of the water main installation. All equipment, meters, detectors, etc., needed for testing shall be furnished by the Contractor.

11. Jacking and Boring – Steel casing of diameter shown on the plans shall be jacked and bored in location indicated. Joints between sections of the steel casing shall be of a continuous weld made by a certified welder. Jacking and boring shall be in accordance with the State Department of Transportation Standard Specifications. Carrier pipe shall be installed as shown on the detail. After carrier pipe has been installed, ends of the casing shall be sealed using a rubber enclosure and stainless steel straps or brick and mortar.

    Where work involves a highway, the Resident Engineer of the State Department of Transportation shall be notified three (3) days before crossing is started. Where the work involves a railroad, the work shall conform to requirements of AREA specifications. Division Superintendent of the Railroad shall be notified three (3) days prior to beginning work. Before commencing work within the right-of-way of railroads or highways, Contractor shall verify the Owner has obtained required permits.

## 3.3 CONNECTIONS OF WATER MAINS

A. Any physical connection of untested water mains with existing water mains is prohibited except when acceptable backflow prevention devices have been installed and checked by Engineer or Engineer's Representative.

1. Any new water main to be tested must be capped and restrained with retaining glands or thrust blocks to prevent blow out or leakage during the pressure testing.

2. Water for filling or flushing the new water main will be obtained through a Temporary Jumper Connection to the existing main. Appropriate taps of sufficient size must be made at the end of the new system to allow air to escape during the filling sequence.

3. This physical tie-in with the existing system must be physically disconnected after sufficient water for hydrostatic testing and disinfection has been obtained.

4. Once the new water system has demonstrated adequate hydrostatic testing and has been flushed and chlorinated in accordance with paragraph 3.4, the new system or main will then be subjected to bacteriological testing.

5. The permanent connection to the new system must be made with clean materials. The connection may be made with either solid or split ductile iron sleeves. Any connection with stainless steel or similar metal full circle clamps is prohibited. Once the connection has been made, the new system must be flushed using water from the existing system to insure adequate flow and velocity into the new water system.

## 3.4 DISINFECTION

A. After the hydrostatic and leakage tests have been completed, water pipes shall be disinfected and tested in accordance with AWWA C 651 and the Regulations of the local Health Department.

All new mains and repaired portions of, or existing mains shall be thoroughly flushed then chlorinated with not less than fifty parts per million (50 ppm) of available chlorine. Chlorine gas or seventy percent high-test calcium hypochlorite can be used. Water from the existing distribution system or other source of supply should be controlled so as to flow slowly into the newly laid pipeline during application of chlorine. The solution shall be retained in the pipeline for not less than twenty-four (24) hours and a chlorine residual of 25 ppm shall be available at this time. Then the system shall be flushed with potable water and the sampling program started. The chlorine residual during sampling shall be between 0.5 and 1.5 PPM.

After final flushing and before the new water main is connected to the distribution system, two consecutive sets of bacteriologically acceptable samples, taken at least 24 hours apart, shall be collected from the new main. One set of samples shall be collected from every 1,200 feet of new water main, plus one set from the end of the line and at least one set from each branch. All samples shall be tested for bacteriological (chemical and physical) quality in accordance with standard methods for the examination of water and wastewater; and shall show the absence of coliform organisms. The results shall be submitted to the Engineer by the Contractor.

## 3.5 PARTIAL ACCEPTANCE OF THE WORK

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

## 3.6 GRASSING

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

## 3.7 SEPARATION BETWEEN WATER AND 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, the 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 the bottom of the water main is at least 18 inches above the top of the 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 the water main and the top of the sewer. At the 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 the bottom of the sewer and the top of the water main;

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

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

d. both the 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.

## 3.8 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 the

latest specifications of the State Department of Transportation. Traffic shall be maintained and controlled by means of flagmen.

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

## 3.9 FIELD QUALITY CONTROL

A. Soil and density tests shall be made by a testing laboratory approved by the Engineer and shall be made at the Contractor's expense. 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 1556 or ASTM D 2922. Results of the tests shall be furnished to the Engineer.

The minimum number of tests required shall be:

Backfill over pipe
in traffic areas. . . . . .1 per 100 lf or less for each 4 feet of depth or portion thereof.

Backfill over pipe
in non-traffic areas. . . . .1 per 500 lf or less for each 4 feet of depth or portion thereof.

The minimum percent of compaction of the backfill material (in accordance to ASTM D1557) shall be the following:

In traffic Areas..... 98% of maximum laboratory density.

In non-traffic Areas.....90% of maximum laboratory density, unless otherwise approved by the Engineer.

END OF SECTION

# INDEX TO

# SECTION 02720 - STORM DRAINAGE

# SECTION 02720

# STORM DRAINAGE

## PART 1 - GENERAL

### 1.1 SECTION INCLUDES

A. Construction of pipes, drainage inlets, manholes, headwalls, and various drainage structures.

### 1.2 RELATED SECTIONS

A. Section 03310 – Cast in Place Concrete

### 1.3 OPTIONS

A. Where manufacturers of material or equipment are named in the specifications the Contractor may use equipment or materials of other manufacturers provided they are reviewed and accepted by the Engineer as equivalent to those specified.

### 1.4 REFERENCES

A. 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.

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

C. ASTM C 76-00 – Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.

D. ASTM C 443-98 – Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.

E. ASTM B 745/B 745M-97 – Corrugated Aluminum Pipe for Sewers and Drains

F. ASTM D 1056-00 – Flexible Cellular Materials - Sponge or Expanded Rubber

G. ASTM F 894-98a – Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe.

H. ASTM D 3350-00 – Polyethylene Plastics Pipe and Fittings Materials.

I. ASTM D 1751-99 – Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).

J. ASTM D 1752-84 (1996) e1 – Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

K. ASTM D 2321-00 – Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications.

L. ASTM C 150-00 – Portland Cement.

M. ASTM C 144-99 – Aggregate for Masonry Mortar.

N. ASTM C 207-91 (1997) – Hydrated Lime for Masonry Purposes.

O. ASTM C 62-01 – Building Brick (Solid Masonry Units Made From Clay or Shale).

P. ASTM C 55-01 – Concrete Brick.

Q. ASTM C 478-97 – Precast Reinforced Concrete Manhole Sections.

R. ASTM C 1433-00a – Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers.

S. ASTM D 1557-00 – Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.

T. ASTM D 1556-00 – Test Method For Density and Unit Weight of Soil In Place By The Sand-Cone Method.

U. ASTM D 2922-96e1 – Test Methods For Density Of Soil and Soil Aggregate In Place By Nuclear Methods (Shallow Depth).

V. ASTM F 405-97 – Corrugated Polyethylene (PE) Tubing and Fittings.

W. ASTM F 667-97 – Large Diameter Corrugated Polyethylene Pipe and Fittings.

X. ASTM c 913-98 – Precast water and wastewater structures.

## 1.5 QUALITY ASSURANCE

A. Material Review - 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. Manufacturer - Material and equipment shall be standard products of a manufacturer who has manufactured them for a minimum of 2 years and provides published data on their quality and performance.

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

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

E. Testing Agencies - Soil tests shall be taken by a testing laboratory operating in accordance to ASTM D-3740 and E-329 and be acceptable to the 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.

## 1.6 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. Contractor 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.

## 1.7 SEQUENCING AND SCHEDULING

A. Contractor shall arrange the work so sections of pipes between structures are backfilled, checked, pavement replaced and the section placed in service as soon as reasonable after installation.

## 1.8 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 the results at no additional cost, the Engineer and Owner will examine the 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 the Contractor's convenience.

## 1.9 GUARANTEE

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

## 1.10 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 his 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 the drawings.

B. The Contractor shall call for underground utility locations before starting work. Underground utilities location service can be contacted at 811.

## 1.11 MEASUREMENT AND PAYMENT

A. Pipe Culverts and Storm Drains - The pipe will be paid for on the per linear foot basis. Payment of which will constitute full payment for all pipe, joints, filter fabric and bedding, including trenching, dewatering, excavation, backfill and compaction, surface clean-up, and all incidental labor and material necessary to complete the construction of pipe as required by this section of the specifications.

B. Drainage Structures - Payment will be made at the lump sum price. Payment will constitute full payment for all dewatering, excavation, formwork, precast concrete, backfill, compaction, frames, gratings or covers, concrete, brick and all miscellaneous materials, surface clean-up and labor necessary to complete the construction.

C. Headwalls – No separate payment will be made for headwalls. Payment will constitute full compensation for the dewatering, excavation, formwork, all materials, and incidentals necessary to complete the construction.

D. Sheeting and Bracing - Will not be measured for direct payment. All costs and charges in connection therewith shall be reflected and included in the item of work to which it pertains.

E. Subgrade Drain – No separate payment will be made for subgrade drainage. Payment will constitute full payment for trenching, furnishing and installing the perforated drain pipe with sock, furnishing and placing the fine aggregate, proper backfilling, surface cleanup, acceptable connection to structures, and all work necessary to make the installation complete.

F. Stone Backfill – No separate payment will be made for stone backfill. Payment will include the cost of removing and disposing of the unsuitable material and furnishing and placing the stone.

G. Sand Backfill – No separate payment will be made for sand backfill. Payment will include the cost of removing and disposing of the unsuitable material and furnishing and placing the sand.

H. Borrow - Borrow material will be paid according to Section 02204. Payment will include furnishing, hauling, placing and compacting the "borrow" material. Payment will also include disposing of the unsuitable material in an area furnished by the Contractor.

I. Ditch and Swale Excavation - Excavations required for the construction of new ditches or swales and regrading of existing ditches or swales will be paid according to Section 02204.

J. Connect Pipe to Existing Structures – No separate payment will be made for connecting pipe to existing structures. For precast structures, payment shall include the cost of dewatering, excavation, coring, installing and grouting in the pipe, backfilling, compaction and all work necessary to complete the connection. For brick structures, payment shall include the cost of dewatering, excavation, cutting a hole, installing and grouting in the pipe, backfilling, compaction and all work necessary to complete the connection.

K. Tracing Wire – No separate payment will be made for wire. The cost of furnishing and placing tracing wire shall be included in the contract unit price for installing pipe.

## 1.12 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 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 the Contractor's responsibility and shall be 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 PIPE

A. Concrete Pipe - Shall be reinforced Class III and shall conform to ASTM Specification C-76.

1. Joints - Shall be water tight flexible rubber gasket and shall meet ASTM Specification C-443.

B. Corrugated Aluminum Alloy Pipe - Shall conform to ASTM B745. Pipe may be annular or helical.

1. Joints - Coupling bands shall be one piece lap-type, having a width conforming to the pipe manufacturer's recommendations. They shall be of the angle lug, rod and lug, or U-bolt type. The type, size and gauge of the bands and size of angles, bolts and rods shall be as specified in the applicable standards or specifications for the pipe. The exterior rivet heads in the longitudinal seam under the coupling band shall be countersunk or the rivets shall be omitted and the seam welded.

2. Gaskets - Gaskets shall be made of 3/8-inch thick by 6-1/2-inch minimum width closed cell expanded synthetic rubber, fabricated in the form of a cylinder with a diameter approximately 10 percent less than the nominal pipe size. The gasket material shall conform to the requirements of ASTM D1056, Grade Number SBE-43.

3. Bends - Where specified, shall be shop fabricated to the angles and dimensions shown on the construction drawings.

C. Polyethylene - Shall be high density polyethylene corrugated pipe having an integrally formed smooth interior, equivalent to Advanced Drainage Systems N-12 or Hancor Hi-Q Sure-Lok. Pipe shall conform to ASTM D-3350, F667 and F894.

1. Joints - Shall be polyethylene split couplings, corrugated to engage a minimum of two (2) pipe corrugations on each side of the joint and fastened according to manufacturer's recommendations or bell-and-spigot joints, with the bell being an integral part of the pipe. Joints shall be soil-tight.

D. Subgrade Drain - Shall be heavy duty corrugated polyethylene perforated pipe manufactured by Advanced Drainage Systems (ADS) or equivalent and shall conform to ASTM F-405.

## 2.2 DRAINAGE STRUCTURES

A. Details - See plans.

B. Concrete - Reinforced and non-reinforced.

1. Class "A" - Minimum compressive strength = 3,000 psi at 28 days.

2. Reinforcing shall be covered by a minimum 1" of concrete for top slabs and 1-1/2" for walls and bases and 3" where concrete is deposited directly against the ground.

3. Expansion joint filler materials shall conform to ASTM Specification D 1751 or D 1752.

C. Mortar:

1. At connection of pipe and drainage structures 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 approved gradation. Hydrated lime may be added to the 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. The 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 the time the ingredients are mixed with water.

D. Brick Masonry - Brick shall conform to ASTM Specification C-62, Grade SW or C-55, Grade S. Mortar for jointing and plastering shall consist of one part portland cement and two parts fine sand. Lime may be added to the mortar in the amount not more than 25% of the volume of cement. The joints shall be completely filled and shall be smooth and free from surplus mortar on the inside of the structure. Brick structures shall be plastered with 1/2-inch of mortar over the entire outside surface of the walls. For square or rectangular structures, brick shall be laid in stretcher courses with a header course every sixth course, and for round structures, brick shall be laid radially with every sixth course a stretcher course.

E. Precast - Shall be constructed in accordance with ASTM C-478, C-913, or C-1433 and conform to the details on the project drawings.

1. Joints - Shall be tongue and groove sealed with flexible gaskets or mastic sealant. Gaskets shall be O-Ring or Type A or B "Tylox" conforming to ASTM C443 and mastic shall be "Ram-nek" or equivalent with primer. The primer shall be applied to all contact surfaces of the manhole joint at the factory in accordance with the manufacturer's instructions.

2. Steps - Shall be polypropylene equivalent to M.A. Industries, Type PS-1 or PS-1-PF. The steps shall be installed at the manhole factory and in accordance with the recommendations of the step manufacturer. Manholes will not be acceptable if steps are not installed accordingly.

3. Leaks - No leaks in the 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."

F. Frame, cover & grating shall conform to the details shown on the project drawings. Grates in pavement and in other flush-mounted type surfaces shall be of a "bicycle-safe" configuration consisting of 45 degree diagonal bars or slotted grates with a maximum clear opening of 1" and a maximum length of 9". In any case, the long dimension of the openings should be located transverse to the direction of traffic when possible.

## 2.3 FILTER FABRIC

A. Shall be a non-woven heat-bonded fiber of polypropylene and nylon filaments equivalent to Mirafi 140 N. The fabric shall be finished so the filaments will retain their relative position with respect to each other. The fabric shall contain stabilizers and/or inhibitors added to the base plastic to make the filaments resistant to deterioration due to ultraviolet and/or heat exposure. The product shall be free of flaws, rips, holes, or defects.

## 2.4 TRACING WIRE

A. Tracing wire shall be #12 gauge insulated single strand copper wire.

## 2.5 PRODUCT REVIEW

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

# PART 3 - EXECUTION

## 3.1 ON SITE OBSERVATIONS OF WORK

A. The line, grade, deflection, and infiltration of storm sewers shall be tested by the Contractor under the direction of the Engineer. The 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. However, if the Contractor notifies the Engineer such work is scheduled and the Engineer fails to appear within 48 hours, the Contractor may proceed without him. All work completed and material furnished shall be subject to review by the Engineer or Project Representative, and all 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 Project Engineer or Project Representative a minimum of 48 hours notice for all required observations or tests. Storm sewers shall be dry for observation by the Engineer. Lines under water shall be pumped out by the Contractor prior to observation, at no additional cost to the Owner.

It will also be required of the Contractor to keep accurate, legible records of the location of all storm sewer lines and appurtenances. These records will be prepared in accordance with the paragraph on "Record Data and Drawings" in the Special Conditions. Final payment to the Contractor will be withheld until all such information is received and accepted.

## 3.2 EXCAVATION FOR PIPE AND STRUCTURES

A. Excavated material shall be piled a sufficient distance from the trench banks to avoid overloading to prevent slides or cave-ins.

B. Remove from site all material not required or suitable for backfill.

C. Grade as necessary to prevent water from flowing into excavations.

D. Remove all water accumulating in the excavation, from surface flow, seepage, or otherwise, by pumping or other approved method.

E. Sheeting, bracing or shoring shall be used as necessary for the protection of the work and safety of personnel.

## 3.3 TRENCHING FOR PIPE

A. Trenching for Pipe - The width of trenches at any point below the top of pipe shall be not greater than the outside diameter of the pipe plus 2' -0" for pipes measuring through 30-inches, and 3'-0" for pipes greater than 30-inches, to permit satisfactory jointing and thoroughly tamping of bedding material under and around pipes. Sheeting and bracing where required shall be placed within the trench width as specified. Care shall be taken not to over-excavate. Where trench widths are exceeded, redesign with a resultant increase in cost of stronger pipe or special installation procedures shall be necessary. Cost of this re-design and increased cost of pipe or installation shall be borne by the Contractor without additional cost to the Owner.

B. Removal of Unsuitable Material - Where wet or otherwise unstable soil, incapable of supporting the pipe, as determined by the Engineer, is encountered in the bottom of the trench, such material shall be removed to the depth required and replaced to the proper grade with select material, compacted as provided in the paragraph "BACKFILLING PIPE," hereinafter.

## 3.4 BEDDING

A. The bedding surface for the pipe shall provide a firm foundation of uniform density throughout the entire length of pipe. Before laying pipe, the trench bottom shall be de-watered by the use of well points. Where well points will not remove the water, the Contractor shall construct sumps and use pumps to remove all water from the bedding surface. The pipe shall be carefully bedded in a soil foundation accurately shaped and rounded to conform to the lowest one-fourth (1/4) of the outside portion of circular pipe, or to the lower curved portion of arch pipe for the entire length of the pipe. When necessary, the bedding shall be compacted to 98% of optimum

density. Bell holes and depressions for joints shall be only of such length, depth, and width as required for properly making the particular type joint.

B. Stone Backfill - Where, in the Engineer's opinion, the subgrade of the pipe is unsuitable material, the Contractor shall remove the unsuitable material six (6") deep and furnish and place stone backfill in the trench to stabilize the subgrade. The stone shall be 3/4-inch graded, but variations in the gradation will be permitted upon approval of the Engineer. Presence of water does not necessarily mean stone backfill is required. If well points or other types of de-watering will remove the water, the Contractor shall be required to completely dewater the trench in lieu of stone backfill. Stone backfill will be limited to areas where well pointing and other conventional methods of dewatering will not produce a dry bottom. Pipe shall be carefully bedded in the stone as specified above.

C. Sand Backfill – Where, in the Engineer's opinion, the character of the soil is unsuitable for pipe bedding, even though dewatered, an additional foot of excavation shall be made and replaced with clean sand furnished by the Contractor.

## 3.5 PROTECTION OF UTILITY LINES

A. Existing utility lines shown on the drawings or the locations of which are made known to the Contractor prior to excavation, and are to be retained, as well as utility lines constructed during excavation operations, shall be protected from damage during excavation and backfilling, and if damaged, shall be repaired at the Contractor's expense. If the Contractor damages any existing utility lines not shown on the drawings or the locations of which are not known to the Contractor, report thereof shall be made immediately. If the Engineer determines repairs shall be made by the Contractor, such repairs will be ordered under the clause of the GENERAL CONDITIONS of the contract entitled "CHANGES." When utility lines to be removed are encountered within the area of operations, the Contractor shall notify the Engineer in ample time for the necessary measures to be taken to prevent interruption of service.

## 3.6 PLACING PIPE

A. Each pipe shall be carefully examined before being laid, and defective or damaged pipe shall not be used. Pipe lines shall be laid to the grades and alignment indicated. Proper facilities shall be provided for lowering sections of pipe into trenches. Under no circumstances shall pipe be laid in water, and no pipe shall be laid when trench conditions or weather are unsuitable for such work. Diversion of drainage or dewatering of trenches during construction shall be provided as necessary. All pipe in place shall have been checked before backfilling. When storm drain pipe terminates in a new ditch, the headwall or end section together with ditch pavement, if specified, shall be constructed immediately as called for on the plans. Ditch slopes and disturbed earth areas shall be grassed and mulched as required. The Contractor will be responsible for maintaining these newly constructed ditches and take immediate action subject to approval to keep erosion of the ditch bottom and slopes to a minimum during the life of the contract. No additional compensation will be given to the Contractor for the required diversion

of drainage and/or dewatering of trenches. Grassing of the completed earth surface of the trench backfill shall conform to the requirements of Section 02902 - "Grassing."

B. Concrete Pipe: Laying shall proceed upgrade with the spigot ends of bell and spigot pipe and the tongue ends of tongue and groove pipe pointing in the direction of the flow.

C. Corrugated Aluminum Pipe: Shall be laid with the separate sections joined firmly together, with the outside laps of circumferential joints pointing upstream and with longitudinal laps on the side. Lifting lugs, where used, shall be placed to facilitate moving the pipe without damage to the exterior or interior coatings.

D. Polyethylene Pipe - Shall be laid with the separate sections joined firmly together on a firm, stable and uniform bedding. Provide a minimum 4 inches of bedding. When rock or unyielding material is present in the trench bottom, install a 6 inch minimum thickness cushion of bedding below the bottom of the pipe. Place pipe in trench with the invert conforming to required elevations, slopes, and alignment. Provide coupling or bell holes in pipe bedding in order to ensure uniform pipe support. Fill all voids under the pipe by working in bedding material. Pipe shall be installed in accordance with ASTM D-2321.

E. Subgrade Drain Tubing - Shall be laid as detailed on the construction drawings with the invert conforming to required elevations and alignment.

F. Tracing Wire – Tracing wire will be installed on all storm sewers and subgrade drain directly on top of the pipe. The wire shall be secured to the pipe with tape or other acceptable methods at spacings of no more than 36" apart. Where subgrade drains branch off from main lines, the wire insulation shall be stripped so the bare wires can and shall be jointed securely together and wrapped with a rubberized insulation tape. The insulated wire must maintain electrical continuity. The tracing wire shall also be stubbed up into each drainage structure. This tracing wire system shall be checked and tested by the Contractor, in the presence of the Engineer, prior to acceptance of the installation. All equipment, meters, detectors, etc., needed for testing shall be furnished by the Contractor.

## 3.7 JOINTS IN PIPES

A. Concrete Pipe - Flexible watertight joints shall be made with rubber gaskets. Jointing materials shall have no more than one splice, except two splices of the rubber gasket will be permitted if the nominal diameter of the pipe exceeds 54-inches.

1. Installation of Filter Fabric at Joint - After each section is joined up, the Contractor shall place one (1) layer of filter fabric around the joint, a minimum of four feet wide, centered on the joint.

2. Reinforcing wire exposed by cutting of the pipe shall be covered with a non-shrink grout equivalent to Quikrete Non-shrink General Purpose Grout #1585-01.

B. Corrugated Aluminum Pipe - Maintain pipe alignment and prevent infiltration of fill material at joints during installation.

1. Installation of Gaskets - Shall be in accordance with the recommendations of the manufacturer in regard to the use of lubricants and cements and other special installation requirements. The gasket shall be placed over one end of a section of pipe for half the width of the gasket. The other half shall be doubled over the end of the same pipe. When the adjoining section of pipe is in place, the double-over half of the gasket shall then be rolled over the adjoining section. Any unevenness in overlap shall be corrected so the gasket covers the ends of the pipe sections equally. Connecting bands shall then be centered over the adjoining sections of pipe, and rods or bolts placed in position and nuts tightened. The band shall be tightened evenly. Tension shall be kept on the rods or bolts and the gasket shall be closely observed to see it is seating properly in the corrugations.

2. Installation of Filter Fabric at Joint - After the connecting band has been tightened, the Contractor shall place one (1) layer of filter fabric around the joint, a minimum of four feet wide, centered on the joint.

C. Polyethylene Pipe - Coupled joints shall be banded as per pipe manufacturer's recommendations. Spigot ends of bell and spigot pipe shall be inserted into the bell to the stop position mark. Push spigot into bell using methods recommended by the manufacturer, keeping pipe true to line and grade.

1. Installation of Filter Fabric at Joint - After each section is joined up, the contractor shall place one (1) layer of filter fabric around the joint, a minimum of four feet wide, centered on the joint.

D. Subgrade Drain Tubing - Joints shall be joined using snap couplings. When installing sock wrapped pipe, overlap sock ends over coupling and secure with polyethylene tape.

## 3.8 BACKFILLING PIPE

A. After the bedding has been prepared, the pipe installed, select material from excavation or borrow, at a moisture content facilitating compaction, shall be placed along both sides of the pipe in layers not exceeding six-inches (6") in compacted depth. The backfill shall be brought up evenly on both sides of the pipe for the full length of the pipe. Care shall be taken to insure thorough compaction of the fill under the haunches of the pipe. Each layer shall be thoroughly compacted with mechanical tampers or rammers. This method of filling and compaction shall continue until the fill has reached an elevation of at least 12-inches above the top of the pipe. The remainder of the trench shall be backfilled and compacted by spreading and rolling or compacted by mechanical tampers or rammers in layers not to exceed 12-inches. Deficiencies in compaction shall be corrected by the Contractor without additional cost to the Owner. Where it is necessary, in the opinion of the Engineer, to leave sheeting and/or portions of bracing used in place,

the contract will be adjusted accordingly. Untreated sheeting shall not be left in place beneath structures or pavements.

B. For pipe placed in fill sections, the backfill material and the placement and compaction procedures shall be as specified above. The fill material shall be uniformly spread in layers longitudinally on or both sides of the pipe, not exceeding six inches (6") in compacted depth, and shall be compacted by rolling parallel with pipe or by mechanical tamping or ramming. Prior to commencing normal filling operation, the crown width of the fill at a height of 12-inches above the top of the pipe shall extend a distance of not less than twice the outside diameter on each side of the pipe or 12 feet, whichever is less. After the backfill has reached at least 12-inches, above the top of the pipe, the remainder of the fill shall be placed and thoroughly compacted in layers not exceeding 12-inches.

C. In compacting by rolling or operating heavy equipment parallel with the pipe, displacement of or injury to the pipe shall be avoided. Movement of construction machinery over a culvert at any stage of the construction shall be at the Contractor's risk. Any pipe damaged thereby shall be repaired or replaced at the Contractor's expense.

## 3.9 FIELD QUALITY CONTROL

A. Soil and density tests shall be made by a testing laboratory approved by the Engineer and shall be made at the Contractor's expense. 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 1556 or ASTM D 2922. Results of the tests shall be furnished to the Engineer.

The minimum number of tests required shall be:

Backfill over pipe
in traffic areas. . . . . .1 per 100 lf or less for each 4 feet of depth or portion thereof.

Backfill over pipe
in non-traffic areas. . . . .1 per 500 lf or less for each 6 feet of depth or portion thereof.

The minimum percent of compaction of the backfill material (in accordance to ASTM D1557) shall be the following:

In traffic Areas..... 98% of maximum laboratory density.

In non-traffic Areas..... 90% of maximum laboratory density, unless otherwise approved by the Engineer.

## 3.10 DRAINAGE STRUCTURES

A. Drainage structures shall be constructed of the materials specified for each type and in accordance with the details shown on the drawings.

## 3.11 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 the latest specifications of the State Department of Transportation. Traffic shall be maintained and controlled by means of flagmen.

## 3.12 CONNECT PIPE TO EXISTING STRUCTURES

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

END OF SECTION

## INDEX TO

## SECTION 02731 - WASTEWATER COLLECTION SYSTEM

| Paragraph | Title | Page |
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**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. Pumping Station

F. Force Main

### 1.2 RELATED SECTIONS

A. Section 02204 - Earthwork.

B. Section 02667 - Water Distribution System.

### 1.3 OPTIONS

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

### 1.4 REFERENCES

A. 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.

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

C. ASTM D 3034-00 – Type PSM Poly (Vinyl Chloride) PVC Sewer Pipe and Fittings.

D. ASTM D 2321-00 – Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Installations.

E. ANSI/AWWA C 150/A 21.50-96 – Thickness Design of Ductile Iron Pipe.

F. ANSI/AWWA C 151/A 21.51-96 – Ductile Iron Pipe, Centrifugally Cast, for Water or Other Liquids.

G. ASTM A 746-99 – Ductile Iron Gravity Sewer Pipe.

H. ASTM D 3212-96a – Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.

I. ASTM F 477-99 – Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

J. ASTM D 2241-00 – Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).

K. ASTM D 3139-98 – Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.

L. ASTM A 139-00 – Electric-Fusion (Arc) Welded Steel Pipe (NPS 4 and Over).

M. ASTM C 478-97 – Precast Reinforced Concrete Manhole Sections.

N. ASTM C 443-98 – Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.

O. ACI 318 (latest revision) – Building Code Requirements for Reinforced Concrete.

P. ASTM C 39/C 39M-01 – Compressive Strength of Cylindrical Concrete Specimens

Q. ASTM C 890-91 (1999) e1 – Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures.

R. ASTM C 891-90 (1997) – Installation of Underground Precast Concrete Utility Structures.

S. ASTM C 913-98 – Precast Concrete Water and Wastewater Structures.

T. ASTM A 615/A 615 M-01a – Deformed and Plain Billet - Steel Bars for Concrete Reinforcement.

U. ANSI/AWWA C-500-93 – Metal-Seated Gate Valves for Water Supply Service.

V. ANSI/AWWA C-509-94 – Resilient-Seated Gate Valves for Water Supply Service.

W. ASTM D-2922-96e1 – Test Methods For Density Of Soil and Soil Aggregate In Place By Nuclear Methods (Shallow Depth).

X. ASTM D-1557-00 – Laboratory Compaction Characteristics of Soil Using Modified Effort.

Y. ASTM D 1556-00 – Density and Unit Weight of Soil In Place By The Sand-Cone Method.

Z. ASTM D 714-87 (2000) – Evaluating Degree of Blistering of Paints.

AA. ASTM D 2794-93 (1999) e1 – Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).

BB. ASTM E 96-00 – Water Vapor Transmission of Materials.

CC. ASTM G 154-00a – Operating Fluorescent Light Apparatus (for UV) Exposure of Nonmetallic Materials.

DD. ANSI/AWWA C 111/A 21.11-00 – Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings.

EE. ASTM A 377-99 – Index of Specifications for Ductile Iron Pressure Pipe.

FF. ANSI/AWWA C 600-99 – Installation of Ductile Iron Water Mains and their appurtenances.

GG. ANSI/AWWA C115/A21.15-99 – Flanged Ductile Iron Pipe with Ductile Iron or Gray Iron Threaded Flanges.

HH. ASTM C 828-98 – Low-Pressure Air Test of Vitrified Clay Pipe Lines.

II. ASTM C 924-89 (1997) – Practice for Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method.

JJ. ASTM F 1417-92 (1998) – Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air.

## 1.5 MEASUREMENT AND PAYMENT

A. Measurement - The items listed in the proposal shall be considered as sufficient to complete the work in accordance with the plans and specifications. Any portion of the work not listed in the bid form shall be deemed to be a part of the item which it is associated with and shall be included in the costs of the unit shown on the bid form. Payment for the unit shown on the bid form shall be considered satisfactory to cover the cost of all labor, material, equipment and performance of all operations necessary to complete the work in place. The unit of measurement shall be the

unit shown on the bid form. Payment shall be based upon the actual quantity multiplied by the 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 the work.

B. Payment

1. Sewer Pipe - Payment will be made at the lump sum price for each pipe size at various depths of cut. Payment will include cost of pipe, plugs, dewatering, excavating all material, testing, backfilling, compaction, cleaning, metal detector tape, and all work necessary to complete the sewer lines.

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

3. Manholes - Payment for manholes will be made at the lump sum price. Payment shall include the cost of excavating, dewatering, constructing the manholes in accordance with the plans, furnishing and installing a frame and cover, steps, and pipe connectors, backfilling and compacting the material around the manhole.

4. Stone Backfill - Stone backfill will be measured by using the length for which stone is ordered by the Engineer, times a depth of 6-inches, times a width of 2 feet wider than the barrel of the pipe. Payment will include the cost of removing the unsuitable material and furnishing and placing the stone.

5. Sand Backfill - Sand backfill will be measured by using the length for which sand is ordered by the Engineer, times a depth of 12-inches, times a width of 2 feet wider than the barrel of the pipe. Payment will include excavating the unsuitable material below the invert, furnishing and compacting the sand backfill.

6. Service Connection - Payment will be made at the lump sum 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. Tracing Wire – No separate payment will be made for wire. The cost of furnishing and placing location wire shall be included in the contract unit price for installing force main pipe, sanitary sewer and service laterals.

9. Laterals - Payment will include furnishing the pipe, backfilling, compaction, and all work and materials necessary to complete the laterals.

10. Grassing - There will be no separate measurement or payment. Grassing shall be a subsidiary obligation of the Contractor in the restoration of disturbed areas.

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

12. Pumping Stations - All work except the force main covered in this subsection will be paid for under the lump sum item for the Pumping Station. Work described in other sections necessary to make the Pumping Station complete will also be included in the lump sum payment. Such work will include dewatering, excavation, backfilling, compaction, site preparation, access road, fencing, grassing, potable water system, electrical, hoist system, and clean-up.

13. Force Mains - Shall be paid for at the lump sum price for the various sizes. Payment will include the pipe, fittings, thrust blocking, restrained joints, excavation, backfilling, compaction, testing, grassing, metal detector tape, and tracing wire. Satisfactory tests must be completed before payment is made.

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

15. Check & Gate Valves – No separate payment will be made.

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

## 1.6 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 the 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 2 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 the Engineer with a list of projects and the Owners or Engineers who are familiar with his competence.

E. Devices, equipment, structures, and systems not designed by the Engineer and the Contractor wishes to furnish, shall be designed by either a Registered Professional Engineer or by someone the Engineer approves 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 accepted by the 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 the name of the one making the test.

G. Infiltration, line and grade of sewer, pump performance, and hydrostatic tests on force mains shall be made by the Contractor with equipment qualified by the Engineer and in the presence of the Engineer. The Engineer or his 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, the Contractor shall obtain permission from the 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. The Contractor shall replace or repair any damaged pipe or structure.

## 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 the section 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 the results at no additional cost, the Engineer and Owner will examine the 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 the Contractor's convenience.

## 1.11 GUARANTEE

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

## 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 his 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 the drawings.

B. The Contractor shall call for underground utility locations before starting work. Underground utilities location service can be contacted at 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 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 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.

## PART 2 – PRODUCTS

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

### 2.1 SEWER PIPE

A. PVC Pipe - 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. PVC pipe shall be installed in accordance with ASTM D 2321. 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 ring. Pipe sizes and dimensions shall be as shown in the table shown in this specification. Standard lengths shall be 12.5 feet (±1-inch). Fittings shall meet the same specification requirements as the 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. 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 the inside.

1. Coating on the outside shall be an asphaltic coating approximately 1 mil thick. The finished coating shall be continuous, smooth, neither brittle when cold or sticky when exposed to the 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. The interior of

the pipe shall receive 40 mils nominal dry film thickness of the epoxy. Lining application, inspection, certification, handling and surface preparation of the area to receive the protective coating shall be in accordance with the 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. The joints shall conform to ASTM D 3212 and the gaskets shall conform to ASTM F 477.

## 2.3 FORCE MAIN

A. Plastic pipe shall be P.V.C. Class 160, SDR 26, conforming to ASTM D 2241 and installed in accordance with these specifications and with ASTM D 2321. 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. The joints shall be in accordance with the applicable portions of AWWA C-111. The manufacturer of the joints shall furnish certification, witnessed by an independent laboratory, that the joints furnished have been tested without signs of leakage or failure. Restrained joints shall be capable of being deflected after assembly.

## 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 the drawings at each crossing. The minimum wall thickness shall be 3/8 inches.

## 2.5 CASING SPACERS

A. Casing spacers shall be bolt on style with a shell made in two (2) 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" from casing pipe at all times. Casing Spacers shall be as manufactured by Cascade Waterworks Manufacturing Company, or approved equivalent.

## 2.6 MANHOLES

A. Masonry - Shall be new whole brick of good quality laid in masonry mortar or cement mortar made of 1 part portland cement and 2 parts clean sharp sand. Every brick shall be fully bedded in mortar. Manholes shall conform to the locations and details shown on the plans.

B. Precast Concrete - Shall be reinforced concrete constructed in accordance with ASTM C 478 and the details shown on the plans "Precast Concrete Manholes." 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. The primer shall be applied to all contact surfaces of the manhole joint at the factory in accordance with the 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 - Shall be equivalent to M.A. Industries, Type PS-1 or PS-2-PF or IMCO Reinforced Plastics, Inc. Model F.R.P. The steps shall be installed at the manhole factory and in accordance with the recommendations of the step manufacturer. Manholes will <u>not</u> be acceptable if steps are not installed accordingly.

E. Pipe Connections - Shall have flexible watertight joints at the point of entry of any sewer main into the manhole. The joint shall be wedged rubber shape equivalent to "Press Wedge II," or a rubber sleeve equivalent to "Kor-N-Seal" or "Lock Joint."

F. Coatings - New manholes requiring a force main tie-in shall have all interior surfaces coated with a factory applied coal tar epoxy. The coating shall be Ruff Stuff 2100 manufactured by Induron Protective Coatings, Bitumastic Super Service Black manufactured by Kop-Coat, Inc. or an accepted equivalent. The coating shall be applied in two coats to achieve a dry film thickness of at least 10 mils per coat in accordance with the manufacturer's recommendations. Surfaces shall be cleaned of all dust, form oils, curing compounds and other foreign matter prior to the coating application.

Existing manholes requiring a force main tie-in shall also be coated. The interior surfaces shall be cleaned and prepared according to the paint manufacturer's recommendations. Paint type, thickness and applications shall conform to the above mentioned specifications.

## 2.7 TEES

A. Tees shall be 4-inches and the same diameter as the run of the pipe. They shall be of the same material as the sewer main.

## 2.8 LATERALS

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

## 2.9 STONE BACKFILL

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

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

## 2.10 SAND 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 the pipe to at least 2 feet above the top of the pipe, the Contractor shall furnish suitable sandy borrow material to accomplish the requirements. The material shall not have more than 60% passing the No. 100 sieve, nor more than 20% passing the 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, stainless steel or bronze trim, 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 the detail shown on the drawings.

## 2.13 METAL DETECTOR TAPE

A. Will be used over all pipe lines. The tape will be electronically or magnetically detectable tape and shall be at least two (2") wide and boldly labeled every eighteen to thirty-two inches. Tape shall have a tensile strength of not less than 120 grams per 1.5 mils of thickness. Material of the tape shall last as long as the pipe it marks, even in adverse soils.

## 2.14 TRACING WIRE

A. Will be used over all force main, sanitary sewer and service lateral lines. The wire will be #12 gauge insulated single strand copper wire.

## 2.15 SUBMERSIBLE SEWAGE PUMPING STATION

A. Shall be dual submersible pumps installed in a concrete wet well. The pumps shall be equivalent to Flygt, ABS, or EMU conforming to the characteristics shown on the drawings.

B. Wet Well - Shall be precast reinforced concrete sections. The product design, performance, materials, manufacture, handling, and installation shall conform to the following references and the project specifications:

ACI 318 - Building Code Requirements for Reinforced Concrete

ASTM C 39 - Compressive Strength of Cylindrical Concrete Specimens

ASTM C-478 - Precast Reinforced Concrete Manhole Sections

ASTM C 890 - Minimal Structural Design Loading for Precast Concrete Water and Wastewater Structures

ASTM C 891 - Installation of Underground Precast Concrete Utility Structures

ASTM C 913 - Precast Concrete Water and Wastewater Structures

The Contractor or supplier shall provide for the design of the precast structure. Each section of the structure shall be designed and manufactured for its individual depth, loading conditions (lateral, surcharge and hydrostatic), and opening requirements. All concrete in the precast structure shall have a minimum

compressive strength of 4,500 psi after 28 days. Reinforcing steel shall comply with ASTM A 615 Grade 60 (min. fy = 60,000 psi). Bar bending and placement shall comply with the ACI latest standards.

The precast structure manufacturer shall have the necessary equipment and facilities for the proper manufacture of the sections and to perform compressive strength tests on concrete tests specimens. Test cylinders shall be made for each structure and test conducted in accordance with ASTM C 39, except the compressive strength shall be equal to or greater than the design of the concrete. Structure design computations, concrete mix design, and test reports certifying design strength has been achieved at the 28-day break shall be submitted to the Engineer. Design of the structure shall be performed by a Registered Professional Engineer at the Contractor's expense. The design parameters for the precast structure shall include:

Lateral load based on a water table at the surface using equivalent fluid pressure of 80 pcf from the surface grade down and a vehicle wheel load designation of HS20-44. Design live load for the top slab shall be 300 psf. The precast concrete sections shall have a minimum wall thickness of 6" and minimum top and bottom slab thicknesses of 8". Actual thicknesses greater than minimum shall be as required by the loading conditions.

The access hatches in the top slab of the wet-well structure shall be for the clear opening dimensions indicated and have a load capacity of 300 psf. The material shall be Aluminum Alloy 6063-T5 and T6, minimum 1/4" thick plate, flush-type lock with inside spoon handle. The frame shall be complete with hinged and hasp-equipped cover, upper guide holders, chain holders and cable holder. Chain and cable holders shall be stainless steel or aluminum. Frame shall be securely mounted above the pumps. The hatch covers shall be torsion-bar loaded for ease of lifting and shall have a safety-locking handle in open position.

The Contractor shall furnish and install guide bars for each pump to permit raising and lowering the pump. Guide bars shall be galvanized and of adequate length and strength to extend from the lower guide holders on the pump discharge connection to the upper guide holder mounted on the access frame.

The wet well shall be provided with sleeves, 24" below finished grade, for access of the power and control conduits. The sleeves shall be of proper size and number to accommodate all necessary power and control conduits.

All interior concrete surfaces shall have a factory applied coal tar epoxy coating. The coating shall be Ruff Stuff 2100 manufactured by Induron Protective Coatings, Bitumastic Super Service Black manufactured by Kop-Coat, Inc. or an accepted equivalent. The coating shall be applied in two coats to achieve a dry film thickness of at least 10 mils per coat in accordance with the manufacturers recommendations. Concrete surfaces shall be cleaned of all dust, form oils, curing compounds and other foreign matter prior to the coating application.

The structure manufacturer shall prepare and submit six (6) sets of shop drawings showing wall and slab thicknesses, structural reinforcing and opening locations. The manufacturer shall also provide the design analyses and calculations to show all sections have been designed for the burial depths shown on the construction drawings as well as stresses incurred during transport, handling and installation. Calculations and analyses must be performed and sealed by a Licensed Professional Engineer and submitted for review. All shop drawings and design calculations shall be submitted to the Contractor for review. Contractor shall forward these documents to the Engineer. Such documents shall bear the stamp or written statement of the Contractor indicating Contractor's review for completeness and receipt. Contractor shall be responsible for the accuracy of the shop drawings and for their conformity to the plans and specifications. Shop drawings with insufficient or incomplete data required to indicate compliance with these specifications are not acceptable and will be returned to the Contractor. Rejected shop drawings shall not relieve the Contractor from his completing the project within the time allowed by the Contract Documents.

C. Pump Design - Pumps shall be capable of handling raw, unscreened sewage with the capacity to pass 3-inch diameter spheres. Pumping units shall be automatically connected to the discharge piping when lowered into place on the discharge connection. The pumps shall be easily removable for inspection or service, requiring no bolts, nuts or other fastening to be removed for this purpose, and no need for personnel to enter wet well. Each pump shall be fitted with a galvanized chain of adequate strength and length to permit raising the pump for inspection and removal.

D. Pump Construction - The pump(s) shall be designed to pump sewage, storm water, heavy sludge and other fibrous materials without injurious damage during operation. The lifting cover, stator housing and volute casing shall be of gray iron construction with all nuts, bolts, washers and other fastening devices coming into contact with sewage, constructed of stainless steel and protected by primer coat and a coat of rubber-asphalt or epoxy paint. The impeller shall be hard alloy gray iron construction, dynamically balanced, double shrouded, non-clogging design with a long thoroughfare and no acute angles.

The pump motor shall be of Class F Insulation, NEMA B design, watertight and positively oil cooled, filled with a transformer oil, equivalent to BP Energol JSO or Shell Diala D or DX or housed in an air-filled watertight chamber. The pump motor shall be guaranteed to run in a totally, partially or non-submerged condition continuously for a period of 24 hours without injurious damages. Water cooled pumps shall not be considered equal. Before final acceptance, a field running test at the job site demonstrating the ability to operate continuously for 24 hours under a non-submerged condition, shall be performed for all pumps being supplied, if required. The pump shall be provided with a tandem double mechanical seal running in an oil bath. The seals shall be of lapped tungsten carbide and welded to stainless steel retainers and held in contact by separate springs. Conventional double mechanical seals with a spring assembly between the rotating faces, requiring constant differential pressure to effect sealing and subject to penetration

and opening by pumping forces shall not be considered equal to the tandem seal specified and required. The pump shaft shall be of stainless steel and supported by a double row inboard bearing for axial thrust and a single row outboard bearing for radial thrust. The impeller shall be connected to a short sturdy shaft in order to minimize shaft deflection. The shaft shall not extend more than 2-1/2 times its diameter below the nearest support bearing.

The pump cable shall be of proper length to reach from the pumps in the wet well to the control panel without any splices. The cable shall be the "SO" or hypalon jacketed SPC type and in compliance with industry standards for loads, resistance against sewage and of stranded construction. The cable shall enter the pump through a heavy duty entry assembly which shall be provided with an internal grommet assembly to protect against leakage once secured and must have a strain relief assembly as part of standard construction. The power cable shall connect to a terminal board which separates the incoming service from the pump motor, where if leakage occurs, the terminal board will short out and not cause damage to the motor.

Each pump shall be supplied with a universal coupling which bolts to the pump discharge flange and shall accept the discharge elbow provided by the pump manufacturer. Seal of the pump at the discharge flange shall be accomplished by a single downward linear motion of the pump with the entire weight of the pump guided to and pressing against the discharge connection. No part of the pump shall bear directly on the sump floor and no rotary motion of the pump shall be required for sealing. Sealing at the discharge shall be effected to insure a positive leakproof system and for ease of removal. The pump shall be guaranteed not to leak at the discharge flange.

E. Pump Test - The pump manufacturer shall perform the 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 be checked for correct rotation.

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

4) Pump shall be removed from test tank, meggered 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 the above information shall be supplied with each pump at the time of shipment.

6) All pump cable ends will then be fitted with a rubber shrink fit boot to protect cable prior to electrical installation.

F. Pump Controls - To synchronize the operation of the pumps with variations of sewage level in the wet well, the Contractor shall provide a liquid level sensor system consisting of a mercury switch 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 sensor in the wet well to the control panel without any splices. Four (4) such sensors shall be installed to determine pump-on, lag pump on, pump-off, and high-level alarm conditions. An alternator shall also be provided to change the sequence of operation of the pumps at the completion of each pumping cycle. Provisions shall also be made for the pumps to operate in parallel if the level in the wet well continues to rise above the "pump-on" cycle. The Contractor shall furnish and install one (1) automatic control center, equipped with individual disconnects, across-the-line magnetic starters, 3 phase, overload and phase protection, electrical alternator, automatic transfer to non-operating pump in event of overload in operating pump, overload reset, hand-off-automatic pump operation selector switch, 24 volt control circuit transformer, and terminal board with connections for high-level alarm. All components housed in NEMA 4X enclosure. The control center shall be installed on a treated timber rack next to the station. Cables provided for pump feeders and pump controls shall be installed in conduit from control center to entrance point in wet well. See detail sketch on construction drawings.

G. Alarm - A high water alarm shall be supplied. A red flashing light shall be supplied in separate NEMA 4X enclosure for mounting at the control box. An audible alarm consisting of a weatherproof bell with automatic reset silencer switch and signal light shall be installed in addition to the flashing red light alarm.

H. Submersible Pump Station Valve Pit - The valve pit shall be precast concrete of the dimensions shown on the construction drawings. Valve pit design shall meet the requirements for precast concrete specified in section 2.14, paragraph B. Each pit shall have a hatch cover. The covers shall be:

| | |
|---|---|
| Clear Opening | 3'-0" x 4'-0" |
| Capacity | 300 lbs/sq. ft. |
| Material | Aluminum Alloy 6063-T5 & T6 1/4" plate with a Neoprene gasket to make hatch watertight |

I. Gate Valves - Cast iron, bronze fitted, double disc, conforming to AWWA C 500, Class 125, NRS.

J. Check Valves - Cast iron, bronze fitted, spring and lever type with neoprene seat and O-ring seals on a stainless steel valve pin.

K. Hydrants - Shall be frost-proof with 36-inch bury, 1-inch male outlet, and 1-inch male inlet, with the outlet 36-inches above the ground. The water line from the

main to the hydrant shall be 1-inch diameter, rated for a minimum working pressure of 200 PSI.

L. Backflow Preventer - Shall be a 1-inch double check valve assembly mounted in a plastic meter box. Backflow preventer shall be equivalent to Watts Regulator Model No. 007M1QT.

M. Fencing - A new fence shall be installed at the pump station site where shown on the drawing and shall be in accordance with Section 02831 - "Chain Link Fences and Gates."

A 3" x 5", 7 gauge, stainless steel plate with an emergency phone number shall be furnished and installed at a conspicuous location on the fence or control panel.

N. Access Road - Access road to the station shall be as shown on the drawing. Stabilization shall be accomplished by constructing a base using granite crusher run stone aggregate composed of 50% screenings and 50% stone, compacted to 6-inch thickness.

O. Shop Drawings - 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, 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.

All shop drawings shall be completely checked and marked accordingly by the 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 "Make Corrections as Noted," the reviewer has noticed deficiencies in compliance with the contract specifications and drawings. It is understood the corrections indicated will be incorporated by the Contractor in the final product, operation and maintenance manuals and the shop drawings submitted at the completion of the project. Rejected shop drawings shall not relieve the Contractor from completing the project within the time allowed by the contract documents.

Upon completion of the project, the Contractor shall provide the Engineer with four (4) complete sets of the final reviewed shop drawings. These four copies shall be in bound form and submitted before final payment is made.

P. Pump Warranty - The pump manufacturer shall warrant the pumps being supplied to the Owner against defects in workmanship and materials for a period of five years under normal use, operation and service. In addition, the manufacturer shall replace certain parts which shall become defective through normal use and wear on a progressive schedule of cost for a period of five (5) years; parts included are

the mechanical seal, impeller pump housing, wear ring and ball bearings. The warranty shall be in published form and apply to all similar units.

Q. Operation and Maintenance Manual - The pump manufacturer shall furnish the Owner with a minimum of six (6) manuals for the pumps installed.

R. Electrical Service - Service to the pumping station shall be as required for pump. Service shall be underground originating in weatherhead on the service pole at the site and terminating in the main breaker.

Conduits below grade shall be Schedule 40 PVC and above grade shall be rigid galvanized. Conduits shall be sealed to prevent sewer gases entering the control panel. Sealing shall be accomplished by stuffing both ends of the conduit with duct-seal, or other approved material.

Conductor shall be copper.

The neutral conductor of each service shall be grounded to a ground rod system. Grounding conductor shall be sized in accordance with Article 250 of the N.E.C. and shall be installed in non-metallic conduit to points of ground connection.

Ground rod system shall consist of three-3/4" x 10' copper weld ground rods. Ground rods shall be installed three feet (3') apart with top of rods twelve inches (12") below grade and shall be interconnected with the bare copper grounding conductor. Connections to ground rods shall be with chemical weld connectors.

1) Running Time Meters - Shall be installed for measuring the elapsed running time for each pump. Meters shall be installed on the face of the control panel with the counter visible when the door or panel is opened. One meter shall be provided for each starter, and shall be connected to operate simultaneously with the starter it is monitoring. Meters shall be non-reset type, hermetically sealed, 115 volts, 60 hertz, with a five digit counter registering 1/10 hour and a total range of 99,999 hours.

## 2.16 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 psi rated ball check valve with a corrosion resistant phenolic base and a rubber seat. Check valve shall be of the full waterway design for quiet operation and with the flow area through the valve equal to or exceeding the flow area of the pipe to which it is installed.

## 2.17 GATE VALVES

A. Two (2) Inches and Larger Valves - 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 or C 509. 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 psi and be tested at 400 psi.

Valves shall be furnished with "O" ring packing. One (1) "O" ring shall be located above the thrust collar and one (1) below. The thrust collar shall be permanently lubricated and have an anti-friction washer on top of the thrust collar.

B. Smaller Than Two Inches (2") - Shall be all brass, ball valve type. The pressure rating shall be 175 psi.

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

## 2.18 PLUG VALVES

A. Shall be of the same diameter as the piping 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 or Dresser X-Centric Style 800. All valves 6" and larger shall be equipped with gear actuator and handwheel.

## 2.19 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 and pump station operation shall be tested by the Contractor under the direction of the Engineer. The 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. However, if the Contractor notifies the Engineer such work is scheduled and the Engineer 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 Engineer or Project Representative. All improper work shall be reconstructed. 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 Project Engineer or Project Representative a minimum of 48 hours notice for all required observations or tests.

It will also be required of the Contractor to keep accurate, legible records of the location of all sanitary lines, service laterals, manholes, and appurtenances. These records will be prepared in accordance with the "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. The line and grade of sewers and position of all manholes and other structures are shown on the drawings. The grade line as given on the profile or mentioned in these specifications means the invert or bottom of the pipe inside and the price for trenching shall include the trench for the depth below this line necessary to lay the sewer to this grade, but measurements for payment will be made only to the grade line. Master control lines and bench marks have been provided by the Engineer. The Contractor shall be responsible for the proper locations and grades of sewers.

## 3.3 SEWER EXCAVATION

A. The 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 the Engineer. Trenches shall be excavated in conformance with the Occupational and Safety Health Administration's (OSHA) Regulations.

Where the character of the soil is unsuitable for pipe bedding as determined by the Engineer or testing laboratory, an additional foot of excavation will be authorized and the trench backfilled with sand backfill. The unsuitable material shall be disposed of at the Contractor's expense in a proper manner. The bottom of all trenches shall be rounded to conform to the bottom of the pipe, to afford full bearing on the pipe barrel. Excavation in excess of the depths and widths required for sewers, manholes, and other structures shall be corrected by pouring subfoundations of 3,000 psi 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 the soil conditions encountered, to protect the adjoining property and for safety. Where shown on the drawings or where directed by the Engineer, the Contractor must

install solid sheeting to protect adjacent property and utilities. The sheeting shall be steel or timber and the Contractor shall submit design data, including the section modulus of the members and the arrangement for bracing at various depths, to the Engineer for review before installing the sheeting. It shall penetrate at least 3 ft. below the pipe invert. Contractor shall ensure support of the pipe and its embedment is maintained throughout installation and ensure sheeting is sufficiently tight to prevent washing out of the trench wall from behind the sheeting.

B. Sheeting Removal - Sheeting shall be removed in units and only removed when the backfilling elevation has reached the level necessary to protect the 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 the installed pipe and its embedment when using movable trench boxes and shields. Movable supports should not be used below the top of the pipe zone unless approved 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 the drawings or authorized by the Engineer.

## 3.5 LAYING PIPE

A. All sewer pipe shall be laid upgrade with spigots pointing downgrade. The pipe shall be laid in a ditch prepared in accordance with Paragraph 3.3 "Sewer Excavation." When the sewer is complete, the interior surface shall conform on the bottom accurately to the grades and alignment fixed or given by the Engineer. Special care shall be taken to provide a firm bedding in good material, select borrow, stone backfill or 3,000 PSI concrete, as authorized, for the 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 the 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 the haunching material in the area between the bedding and the underside of the pipe before

placing and compacting the remainder of the embedment in the 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 in. are encountered in the trench bottom, excavate a minimum depth of 6 in. below the 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 the main line before removing material from the sides of the pipe. Materials and density of service line embedment shall conform to specifications for the main line.

G. Manhole Connections - Use flexible water stops, resilient connectors, or other flexible systems approved by the Engineer to make watertight connections to manholes and other structures.

H. Jacking and Boring – Steel casing of diameter shown on the plans shall be jacked and bored in location indicated. Joints between sections of the steel casing shall be of a continuous weld made by a certified welder. Jacking and boring shall be in accordance with Georgia DOT Standard Specifications. Carrier pipe shall be installed as shown on the detail. After carrier pipe has been installed, ends of the casing shall be sealed using a rubber enclosure and stainless steel straps or brick and mortar.

Where work involves a highway, the Resident Engineer of the State Department of Transportation shall be notified three (3) days before crossing is started. Where the work involves a railroad, the work shall conform to requirements of AREA specifications. Division Superintendent of the Railroad shall be notified three (3) days prior to beginning work. Before commencing work within the right-of-way of railroads or highways, Contractor shall verify the Owner has obtained required permits.

## 3.6 SEPARATION BETWEEN WATER & SANITARY SEWER

A. Parallel Installation:

1. Water mains shall be laid at least ten (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, the 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 the bottom of the water main is at least 18 inches above the top of the 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 the water main and the top of the sewer. At the 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 the bottom of the sewer and the top of the water main;

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

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

d. both the 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 the pipes are laid therein, unless other protection of the pipe line is directed. The backfilling material shall be selected and deposited with special reference to the future safety of the

pipes. Except where special methods of bedding and tamping are provided for, clean earth or sand shall be solidly tamped about the pipe up to a level at least 2' above the top of the pipes, and shall be carefully deposited to uniform layers, each layer solidly tamped or rammed with proper tools so not to injure or disturb the pipeline. The remainder of the trench backfilling shall be carried on simultaneously on both sides of the pipe in such a manner preventing injurious side pressure. The material used shall be selected from excavated material anywhere on the work if any of this material 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 the area around the pipe the 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 approved by the Engineer. Compaction tests shall be conducted in accordance with ASTM D 1556 or ASTM D 2922 by an independent testing laboratory. Tests are to be taken at the direction of the 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 the Engineer immediately after installation.

Where thermoplastic (PVC) pipe is installed, the 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 the Engineer. The channel in the bottom of the 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 fifty (50) year flood elevation, unless watertight covers are provided. The tops of manholes outside of roads shall be built to grades 1" above the ground surface in developed areas and 6" above the 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 the 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 BACKFILL

A. Where, in the Engineer's opinion, the subgrade of the pipe trench is unsuitable material, the Contractor shall remove the unsuitable material 6" deep and furnish and place stone backfill in the trench to stabilize the subgrade. Presence of water does not necessarily mean stone backfill is required. If well points or other types of dewatering will remove the water, the Contractor shall be required to completely dewater the trench in lieu of stone backfill. Stone backfill will be limited to areas where well pointing and other conventional methods of dewatering will not produce a dry bottom. Stone shall be placed 6" deep and 2' wider than the pipe at the barrel. The pipe shall be carefully bedded in the stone as specified, or in accordance with the manufacturer's recommendations.

## 3.10 SAND BACKFILL

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

## 3.11 DEFLECTION

A. It is the Contractor's responsibility to assure backfill is sufficient to limit pipe deflection to no more than 7.5%. When flexible pipe is used, a deflection test shall be made by the Contractor on the entire length of installed pipeline, not less than 30 days after completion of all work including leakage test, backfill, and placement of any fill, grading, paving, concrete, or superimposed loads. 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. The ball, cylinder, or circular sections shall have a diameter, or minor diameter as applicable, of 92.5 percent of 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 psi 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 the opposite end of the shaft shall produce compression throughout the remote end of the ball, cylinder or circular section. Circular sections shall be spaced so the distance from the external faces of the front and back sections shall equal or exceed the diameter of the 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 that run. When a deflection device is used for the test in lieu of the ball, cylinder, or circular

sections described, such device shall be approved prior to use. The device shall be sensitive to 1.0 percent of the diameter of the pipe being measured and shall be accurate to 1.0 percent of the indicated dimension. Installed pipe showing deflections greater than 7.5 percent of the normal diameter of the pipe shall be retested by a run from the opposite direction. If the retest also fails, the suspect pipe shall be repaired or replaced at no cost to the Owner.

## 3.12 LEAKAGE

A. In no stretch of sewer between any two (2) 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 the 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. Low pressure air testing procedures for other pipe materials shall use the pressures and testing times prescribed in ASTM C 828 and ASTM C 924, after consultation with the pipe manufacturer. Prior to infiltration or exfiltration tests, the trench shall be backfilled up to at least the lower half of the 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 the water table is 2 feet or more above the top of the pipe at the upper end of the pipeline section to be tested, infiltration shall be measured using a suitable weir or other device acceptable to the Engineer and as per ASTM C109 or C969. When the 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 the water table and the top of the pipe at the upper end of the pipeline to be tested. The filled line shall be allowed to stand until the 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 the force mains to hydrostatic tests at 100 psi for a period of 2 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 the leakage during the pressure test is less than the number of gallons listed for each 1000 feet of pipe tested:

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

## 3.13 CLEANING AND ACCEPTANCE

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

## 3.14 CLOSING PIPE

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

## 3.15 PARTIAL ACCEPTANCE OF THE WORK

A. The Owner reserves the right to accept and use any part of the work. The Engineer shall have power to direct on what line the Contractor shall work and the 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 the Engineer before his 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 the latest specifications of the State Department of Transportation. Traffic shall be maintained and controlled by means of flagmen.

The edges of the pavement shall be cut to a neat straight line with a masonry saw. The backfill shall be compacted and tested and a concrete base course of 5,000 psi placed on the fill as shown on the details. The concrete base shall be placed within 24 hours after the pipeline is installed. A temporary wearing surface may be used provided it presents a smooth surface.

## 3.19 METALLIC DETECTOR TAPE

A. The 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 TRACING WIRE

A. Tracing wire will be installed on all force mains, sanitary sewer and service laterals directly on top of the pipe. The wire shall be secured to the pipe with tape or other acceptable methods at spacings of no more than 36" apart. Where sections of wire are jointed together, the wire insulation shall be stripped so the bare wires can be wrapped with a rubberized insulation tape. The insulated wire must maintain electrical continuity. This tracing wire system shall be checked and tested by the Contractor, in the presence of the Engineer or Owner prior to acceptance of the 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. The Contractor shall connect the system to the existing structure where indicated. For brick structures, a hole not more than 4-inches larger than the outside diameter of the new pipe shall be cut neatly in the structure, the new pipe laid so it is flush with the inside face of the structure, and the annular space around the 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 approved by the Engineer and shall be made at the Contractor's expense. 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 1556 or ASTM D 2922. 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 lf or less for each 4 feet of depth or portion thereof. |
| Backfill over sewer in non-traffic areas. . . . . | 1 per 500 lf or less for each 6 feet of depth or portion thereof. |

## 3.23 AIR RELEASE VALVE

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

## 3.24 SEWAGE PUMPING STATION

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 the Contractor on a prepared, evenly distributed and level, minimum 8-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 the sealant manufacturer's recommendation. Leakage through the joints or around the 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 the material in equal lifts (max. 2 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 1556 and ASTM D 2922. During the backfilling operation and until its completion, the wet well sections shall be maintained in an absolute plumb position. To prevent the structure from possibly becoming buoyant in hydrostatic or flooded conditions, the Contractor shall take necessary steps to avoid flotation of the structure.

The pumping station site shall be graded to drain to conform to the drawings. The fence, access road, and grassing shall be constructed after the site has been graded.

The Contractor shall connect to the water main with a saddle or tee and lay water line to the hydrant at the station. The hydrant shall be set in a gravel pocket with a 12" x 12" x 4" concrete collar at the ground level. Connection shall be disinfected and tested in accordance with AWWA C 651. Water shall not be used until favorable written test results have been furnished to the Engineer.

## 3.25 FORCE MAIN

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

## 3.26 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 approved by 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 – Grading Complete.

### 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. In areas where temporary grass cover is needed during the warm season, browntop millet shall be planted according to the seeding schedule in section 2.3.

## 1.5 MEASUREMENT AND PAYMENT

A. Payment for grassing will be made at the lump sum for the item "Grassing" 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. 33 percent centipede grass, 67 percent carpet 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 |
|---|---|---|
| Centipede | 25 lbs/acre | March 1 - September 30 |
| Carpet | 30 lbs/acre | March 1 - September 30 |
| Rye | 75 lbs/acre | October 1 - February 28 |
| Browntop Millet | 40 lbs/acre | April 1 - July 30 |

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 OMITTED**

**3.7 OMITTED**

**3.8 OMITTED**

**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 03305 – SITE CONCRETE

# SECTION 03305

# SITE CONCRETE

## PART 1 - GENERAL

### 1.1 SECTION INCLUDES

A. Concrete curbs and gutters, sidewalks, and parking areas.

### 1.2 RELATED SECTIONS

A. Section 02204 - Earthwork: Preparation of site for paving and base.

B. Section 02231 - Aggregate Base Course.

C. Section 02512GA - Asphaltic Concrete Binder /Surface Courses.

### 1.3 MEASUREMENT AND PAYMENT

A. Concrete pavement and sidewalk, regardless of thickness, will be measured by the square yard of finished surface complete in place and accepted.

B. Curb and Gutter - Payment for concrete curb and gutter sections will be made at the unit price per linear foot for the amount actually installed and accepted. Measurement will be along the centerline of the completed and accepted curb.

C. Payment shall constitute full compensation for furnishing all materials, plant, equipment, tools, forms, inserts, and for all labor and incidentals necessary to complete the work required by these specifications. No payment will be made for any material wasted, used for the convenience of the Contractor, unused or rejected.

### 1.4 REFERENCES (LATEST REVISION)

A. ACI 325.9R – Guide for Construction of Concrete Pavements and Bases.

B. ACI 304 – Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.

C. ASTM A 185 – Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.

D. ASTM A 497 – Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement.

E. ASTM A 615 – Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

F. ACI 330R – Guide for Design and Construction of Concrete Parking Lots.

G. ASTM C 33 – Concrete Aggregates.

H. ASTM C 39 – Compressive Strength of Cylindrical Concrete Specimens

I. ASTM C 94 – Ready-Mixed Concrete.

J. ASTM C 150 – Portland Cement

K. ASTM C 260 – Air-Entraining Admixtures for Concrete.

L. ASTM C 309 – Liquid Membrane-Forming Compounds for Curing Concrete.

M. ASTM C 494 – Chemical Admixtures for Concrete.

N. ASTM C 920 – Elastomeric Joint Sealants

O. ASTM C 1116 – Fiber-Reinforced Concrete and Shotcrete.

P. ASTM D 1751 – Preformed Expansion Joint Filler for Concrete Paving and Structural Construction. (Nonextruding and Resilient Bituminous Type).

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

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

**1.5 Omitted**

**1.6 SUBMITTALS FOR REVIEW**

A. Section 01300 - Submittals: Procedures for submittals.

B. Concrete Design Mix.

**1.7 QUALITY ASSURANCE**

A. Perform work in accordance with ACI 325 and ACI 330. State of Georgia.

B. Obtain cementitious materials from same source throughout.

**1.8 REGULATORY REQUIREMENTS**

A. Conform to applicable standards for paving work on public property.

**1.9 ENVIRONMENTAL REQUIREMENTS**

A. Do not place concrete when base surface temperature is less than 40 degrees F, or surface is wet or frozen.

### 1.10 TESTING

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

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

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

D. Test results shall be furnished to the Engineer.

## PART 2 - PRODUCTS

### 2.1 FORM MATERIALS

A. Wood or steel form material, profiled to suit conditions.

B. Joint Filler: ASTM D1751 type; 1/2 inch thick.

### 2.2 REINFORCEMENT

A. Reinforcing Steel: ASTM A 615, Grade 60 billet steel deformed bars; uncoated finish.

B. Welded Steel Wire Fabric: Plain type, ASTM A 185; uncoated finish.

C. Fiber reinforcement: Shall conform to ASTM C 1116 as manufactured by Fibermesh Company or equivalent. Concrete mix design shall utilize between 0.5% and 1.0% fiber content.

### 2.3 CONCRETE MATERIALS

A. Cement: ASTM C 150, Type I – Normal.

B. Fine and Coarse Mix Aggregates: ASTM C 33. Coarse aggregate shall consist of granite stone.

C. Water: Potable, not detrimental to concrete.

D. Air Entrainment: ASTM C 260.

E. Chemical Admixture: ASTM C 494, Type A - Water Reducing.

## 2.4 ACCESSORIES

A. Curing Compound: ASTM C309, clear with fugitive dye.

B. Sealant: Joints shall be sealed per detail on project drawings, conforming to ASTM C 920, Type S or M, Grade P or NS, Class 25.

## 2.5 CONCRETE MIX - BY PERFORMANCE CRITERIA

A. Provide concrete to the following criteria:

1. Flexible Strength: 700 psi.

2. Compressive Strength: 3,500 psi @ 28 days.

3. Slump: 4 to 5 inches.

B. Use accelerating admixtures in cold weather only when approved by Engineer. Use of admixtures will not relax cold weather placement requirements.

C. Use calcium chloride only when approved by Engineer.

D. Use set retarding admixtures during hot weather only when approved by Engineer.

## 2.6 SOURCE QUALITY CONTROL AND TESTS

A. All sampling and testing services shall be performed, at the Contractor's expense, by a testing agency which operates in accordance to ASTM D 3740 and E 329 latest edition and accepted by the Engineer.

B. Contractor shall submit a design mix on each class of concrete proposed for use. The mix shall be prepared by an approved testing laboratory. Compressive strength of at least four (4) specimens of the design mix shall indicate 15% higher than 28 days strengths specified. During the work, the Contractor shall make 3 test cylinders for each 30 cubic yards, or fraction thereof, of concrete placed each day. One cylinder shall be tested at 7 days and the other two at 28 days in accordance with ASTM C 39. Copies of all test reports shall be furnished to the Engineer.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Verify subgrade conditions under provisions of Section 02204 – Earthwork.

B. Verify compacted subgrade is acceptable and ready to support concrete and imposed loads.

C. Verify gradients and elevations of subgrade are correct.

## 3.2 CONSTRUCTION OBSERVATION

A. The 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. However, if the Contractor notifies the Engineer such work is scheduled, and the Engineer 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 Engineer or Project Representative. Improper work shall be reconstructed. 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.

## 3.3 SUBGRADE

A. Prepare subgrade in accordance with Section 02204 – Earthwork.

## 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 inside of mixing and conveying equipment. The reinforcement shall be made secure in position and shall be subject to examination and acceptance.

B. Moisten subgrade to minimize absorption of water from fresh concrete.

C. Coat surfaces of manhole, inlet, and catch basin frames with oil to prevent bond with concrete pavement.

D. Notify Engineer minimum 48 hours prior to commencement of concreting operations.

## 3.5 FORMING

A. Place and secure forms to correct location, dimension, profile, and gradient.

B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.

C. Place joint filler in position, in straight lines. Secure to formwork during concrete placement.

D. Forms shall be constructed to the shape, line, and grade required and shall be maintained sufficiently rigid to prevent deformation under load. Form work and details of construction shall conform to ACI-318, Chapter 6.

## 3.6 REINFORCEMENT

A. Place reinforcement as indicated.

B. Interrupt reinforcement at expansion joints.

## 3.7 PLACING CONCRETE

A. Placing of concrete shall conform to Chapter 5 of the American Concrete Institute Standard A.C.I. 318. Concrete having attained initial set or having contained water for more than 45 minutes shall not be used in the work. Concrete shall not be dropped freely more than 5 feet. Concrete shall be mixed and placed only when the temperature is at least 40 degrees F and rising. Concrete shall be placed only upon surfaces free from frost, ice, mud and other detrimental substances or conditions. When placed on dry soil or pervious material, water proof paper or polyethylene sheeting shall be laid over surfaces to receive the concrete.

B. Ensure reinforcement, inserts, embedded parts, formed joints and forms are not disturbed during concrete placement.

C. Place concrete continuously over the full width of the panel and between predetermined construction joints. Do not break or interrupt successive pours so cold joints will not occur.

D. Place concrete to elevations indicated on the contract drawings.

## 3.8 JOINTS

A. Place expansion joints at 50 foot intervals.

B. Place contraction joints at 10 foot intervals. Align curb, gutter, and sidewalk joints.

C. Place joint filler between paving components and building or other appurtenances. Recess top of filler 1/8 inch.

D. Provide sawn joints between curbs and pavement.

E. Saw cut contraction joints 3/16 inch wide at an optimum time after finishing. Cut 1/3 into depth of slab.

## 3.9 FINISHING

A. Curbs and Gutters: Light broom.

B. Direction of Texturing: Parallel to pavement direction.

## 3.10 JOINT SEALING

A. Separate pavement from vertical surfaces with 1/2 inch thick joint filler.

B. Place joint filler in pavement pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.

C. Extend joint filler from bottom of pavement to within 1/8 of finished surface.

## 3.11 TOLERANCES

A. Section 01400 - Quality Assurance: Tolerances.

B. Maximum Variation of Surface Flatness: 1/4inch in 10 ft.

C. Maximum Variation From True Position: 1/2 inch.

## 3.12 CURBS AND GUTTER SECTIONS

A. Shall be constructed as shown on the drawings and in accordance with applicable details. Subgrade below the curb and gutter sections shall be compacted to 98% density. Curb and gutter sections shall be constructed in sections of uniform length and shall not exceed 10 feet or be less than 5 feet in length. Straight edging along the edge of the gutter and top of curb shall conform to those requirements for the adjacent pavement but with no irregularities to exceed 1/4 inch in 10 feet.

B. If slip-form or extruded construction is used, contraction joints shall be located at intervals no greater than 10 feet by sawing the hardened concrete at the proper time. Joints shall be sawed between 4 to 8 hours after placing of concrete. The depth of the saw-cut shall be one-fourth thickness of the curb and gutter section. The maximum width of cut shall be 1/4". All joints shall be sawed in succession.

C. Half inch thick premolded expansion joints shall be installed completely through the joints at spaces not to exceed 50 feet and at all structures and walks.

D. When the curb forms are removed, backfill shall be immediately placed, tamped, and graded behind the new curb to help protect the line and grade. Machine methods of placing and forming may be used provided the finished product is satisfactory to the Engineer.

E. Contractor shall place a concrete depressed curb at all driveways shown on the drawings or where a driveway is in use.

F. Cracked curb and gutter will not be accepted.

## 3.13 CONCRETE CURING

A. Immediately after placement and finishing, concrete shall be protected from moisture loss for not less than 7 days. For surfaces not in contact with forms, white pigmented curing compound shall be uniformly applied after water sheen disappears from the concrete. Formed surfaces shall receive an application of

curing compound if forms are removed during the 7 day curing period. Curing compound shall not be applied during rainfall.

B. Curing compound shall be applied under pressure at the rate of 1 gallon per 150 square feet by mechanical sprayers. The spraying equipment shall be of the fully atomizing type. At the time of use, the compound shall be thoroughly mixed with white pigments uniformly dispersed throughout the sprayer. Care shall be taken to prevent application to joints where concrete bond is required, to reinforcement steel and to joints where joint sealer is to be placed. The compound shall form a uniform continuous coherent film that will not crack or peel and shall be free from pinholes and other imperfections. Concrete surfaces subjected to heavy rainfall within 3 hours after curing compound has been applied shall be resprayed by the above method and at the above coverage at no additional expense to the Owner.

C. No pedestrian or vehicular traffic shall be allowed over the surface for seven days unless the surface is protected by planks, plywood, or sand. The protection shall not be placed until at least 12 hours after the application of the curing compound.

D. Protect concrete by suitable methods to prevent damage by mechanical injury or excessively hot or cold temperatures.

## 3.14 FIELD QUALITY CONTROL

A. Section 01400 - Quality Assurance: Field inspection and testing.

B. Testing firm will take cylinders and perform slump tests in accordance with ACI 301.

## 3.15 PROTECTION

A. Immediately after placement, protect pavement from premature moisture loss, excessive hot or cold temperatures, and mechanical injury.

B. Do not permit vehicular traffic over pavement 7 days minimum after finishing.

END OF SECTION

# END PAGE APPENDIX C