

SECTION 02720
STORM DRAINAGE

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Trenching and other excavation.
- B. Ground water control.
- C. Pipe bedding.
- D. Installation of storm drains and appurtenances.
- E. Installation of underdrains and appurtenances.
- F. Backfill and compaction of backfill.
- G. Dust alleviation and control.
- H. Cleanup and restoration of surface in improved areas.
- I. Supplying all labor, materials, equipment and apparatus not specifically mentioned herein or noted on the plans, but which are incidental and necessary to complete the work specified.

1.02 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text only by the general designation.
- B. American Society for Testing and Materials (ASTM) Publications:
 - A - 34 Structural Steel.
 - A - 48 Gray Iron Castings.
 - A - 123 Zinc Coatings, Rolled, Pressed Forged Mat.
 - A - 386 Zinc Coating (Hot-Dip) on Assembled Steel Products.
 - C - 76 Reinforced Concrete Culvert.
 - C - 443 Joints for Circular Concrete Sewer and Culvert Pipe, using Rubber Gaskets.
 - C - 478 Precast Reinforced Concrete Manhole Sections.

C - 497	Method of Testing Concrete Pipe, Sections, or Tile.
D - 1784	Rigid Poly Vinyl Chloride (PVC) Compounds and Chlorinated Poly Vinyl Chloride Compounds
D - 1785	Pipe, Poly Vinyl Chloride (PVC) Schedules 40,80 and 120.
D - 2564	Solvent Cements for Poly Vinyl Chloride (PVC) Plastic Pipe and Fittings.
D - 3034	PVC Sewer Pipe and Fittings
F - 477	Elastomeric Seals (Gaskets) for joining Plastic Pipe.
F - 679	Standard Specifications for Poly Vinyl Chloride large Diameter Plastic gravity sewer pipe and fittings

1.03 QUALITY ASSURANCE

- A.** Submit manufacturer's data on pipe, drainage structure and castings to be used.
- B.** The Engineer may require manufacturer's or supplier's certificates showing conformance with this specification to be delivered with each shipment of material delivered to the job site.
- C.** D-Load or class of pipe requirements shown or called for on the plans shall be the minimum acceptable.
- D.** All pipes shall bear the manufacturer's label for the type, specification, and classification of the pipe.
- E.** All storm drains shall be subject to passing a ball test.

1.04 JOB CONDITIONS

- A.** Note and conform to conditions and requirements indicated and specified under Section 02202 of the Specifications.

PART 2 - PRODUCTS

2.01 REINFORCED CONCRETE PIPE

- A.** Pipe 12 inches and larger shall be reinforced concrete, bell and spigot-type pipe, conforming to the requirements of ASTM Designation C76 except that all pipe shall have been manufactured using Portland Cement Concrete conforming to the requirements of Section 02550 of these Specifications.
- B.** Pipe strength requirements shall be designated in terms of D-load as shown or called for on the plans. D-load as used herein is defined as the maximum load

the pipe will sustain per foot of length per foot of internal diameter under the standard three-edge bearing test without the appearance of any crack one one-hundredth (0.01) inch in width exceeding twelve (12) inches in length when tested in accordance with the procedure set forth in ASTM Designation C497.

- C. Pipe wall thickness and bell and spigot mating surfaces shall be the same for each size and class or D-load of pipe delivered to the job site. The concrete cover over any reinforcement shall not be less than 1" for 12" RCP and 1-1/2" for 18" RCP.
- D. Pipe shall be cured by water curing, steam curing, or a combination of both as required to produce the D-load strengths shown, noted or called for on the plans.
- E. All reinforced concrete pipe shall have rubber gasket joints that are self-centering and so designed that after the joint is made up, the rubber gasket shall not be required to support the weight of the pipe. Spigot grooves shall be provided in all joints, and the joint and gasket shall conform to the requirements of ASTM Designation C443. All joints shall be watertight.
- F. Pipe lengths shall not exceed twelve (12) feet for all pipe except that short lengths of pipe (two (2) feet nominal) shall be furnished and installed at all connections to structures and appurtenances.
- G. Each section of pipe shall be clearly and legibly marked with waterproof paint to show the date of manufacture, the D-load classification of the pipe, and the type of cement used in the manufacture of the pipe.

2.02 POLY VINYL CHLORIDE PIPE

- A. PVC pipe for minor storm drains less than twelve (12) inches in diameter shall conform to the requirements of ASTM 3034 or ASTM F-679 and shall have a DR rating of 26. All pipe and fittings shall be made of PVC plastic having a minimum cell classification of 12454-B or 13364-B as defined in ASTM D-1784. Pipe barrel shall have the words "STORM DRAIN" marked along the longitudinal axis of the outside in 1-5/8" high block letters with permanent ink. The words shall be repeated at 2-foot spacing along the pipe length.
- B. The Contractor may substitute pressure-sensitive tape in lieu of stenciling. Adhesive-backed Pipe Labeling Tape shall be PVC Plastic tape manufactured specifically for direct placement onto pipe, cable or conduit for warning and identification. Tape shall be a minimum of 2.2 mils, an adhesive strength of 26 psi, and with tensile strength of 32 lb. per inch of width. Tape shall be of the type provided in rolls, color coded for the utility involved with warning and identification imprinted in bold letters continuously and repeatedly over entire tape length. Code and letter coloring shall be permanent, unaffected by moisture or other substances contained in trench material.
- C. Couplings and fittings for use with PVC non-pressure pipe shall be of the same materials and in compliance with the requirements specified for the pipe. Couplings and fittings shall be equipped with rubber rings which fit into individual grooves formed in the inner wall to the requirement of ASTM Designation F-477.

2.03 PVC UNDERDRAINS

- A.** PVC underdrains shall consist of four (4) inch Schedule 40 perforated Poly Vinyl chloride (PVC) pipe conforming to the requirements of ASTM Designation D1785. B. Joints and fittings for PVC underdrains shall conform to the requirements of ASTM Designation D1785.
- B.** Solvent cement for joining PVC underdrain pipe, couplings and fittings shall conform to the requirements of ASTM Designation D2564.
- C.** Permeable material bedding and cover for subsurface drains shall be as specified in Section 02202 of these Specifications.
- D.** Filter Fabric for underdrains shall conform to Section 88 of the Standard Specifications.

2.04 STORM DRAIN MANHOLES

- A.** Barrel and cone sections for storm drain manholes shall be precast reinforced concrete of the form and dimensions shown and detailed on the plans and shall conform to the requirements of ASTM Designation C478. Concrete used for manhole barrel and cone sections shall conform to the requirements of Section 02550 of these Specifications.
- B.** Frames and covers for manholes shall be gray iron castings of the form and dimensions shown and detailed on the plans and shall conform to the requirements of ASTM Designation A48 for Class 30B castings. Frames and covers shall be match marked in sets which have been machined after fabrication to provide a firm and continuous seat. Each cover shall have cast into it the raised letters "STORM DRAIN". All castings shall be thoroughly cleaned and coated with commercial quality asphaltic varnish prior to delivery.
- C.** Steps for manholes and other storm structures shall be polypropylene to the form and dimensions shown and detailed on the plans.
- D.** Concrete for manhole bases shall be Class "A" conforming to the requirements of Section 02550 of these Specifications.
- E.** Reinforcement for manhole bases shall be deformed steel bars conforming to Section 02550 of these Specifications. Size and shape of reinforcement shall conform to the details shown on the plans.
- F.** Mortar for precast manhole section joints shall consist of one (1) part Portland Cement conforming to the requirements of Section 02550 of these Specifications, with two (2) parts of sand by volume. Sand shall be well graded and of such size that all will pass a No. 8 sieve.
- G.** Concrete for manhole frame anchor slabs shall be Class "A" conforming to the requirements of Section 02550 of these Specifications.

2.05 CONCRETE CURB INLETS

- A.** Concrete curb inlets for storm drains shall be cast in place, reinforced concrete of the form and dimensions shown and detailed on the plans.
- B.** Insert form for the curb inlet and other parts shall be as manufactured by Santa Rosa Cast Products, or approved equal. Concrete used in the construction of concrete curb inlets shall conform to the requirements for Class "A" concrete set forth in Section 02550 of these Specifications. Forming, placing and finishing shall conform to Section 02550 of these Specifications.
- C.** Reinforcement used in the construction of precast curb inlets shall be deformed steel bars conforming to Section 02550 of these Specifications.
- D.** Miscellaneous steel shapes used in construction of concrete curb inlets shall be structural quality carbon steel conforming to the requirements of ASTM
- E.** Designation A36 and shall be hot-dip galvanized after fabrication in conformance with the requirements of ASTM Designation A123.
- F.** Steps for curb inlets, where required, shall be polypropylene to the form and dimensions shown and detailed on the plans.

2.06 CAST-IN-PLACE DRAINAGE STRUCTURES

- A.** All concrete structures are to be cast in place except where specifically noted on the plans and specifications.
- B.** Concrete for cast-in-place drainage structures shall be Class "A" conforming to the requirements of Section 02550 of these Specifications.
- C.** Forming, placing and finishing concrete, and reinforcement for cast-in-place drainage structures shall conform to Section 02550.
- D.** Steel for frames and grates or covers for cast-in-place drainage structures shall be structural steel conforming to the requirements of ASTM Designation A36. Frames and grates or covers shall be fabricated to the form and dimensions shown and detailed on the plans and shall be hot-dip galvanized after complete fabrication in conformance with the requirements of ASTM Designation A386. Frames and grates or covers shall be match marked in sets which have been so constructed as to provide a firm and continuous seat.
- E.** Welding for frames and grates shall conform to the requirements of the American Welding Society for Arc and Gas Welding in Building Construction.

2.07 PIPE BEDDING AND COVER MATERIAL

- A.** Shall be as specified in Section 02202 of these Specifications.

PART 3 - EXECUTION

3.01 TRENCHING, BACKFILLING AND SHORING

- A. Shall conform to Section 02202 of these Specifications.

3.02 PIPE INSTALLATION

- A. Installation: Storm drain pipe , underdrains and appurtenances shall be installed in accordance with the best practice, and in conformance with the plans and these Specifications.
- B. Handling: Pipe shall be carefully handled during hauling, unloading, and placing operations, so as to avoid breakage or damage. Strap-type slings shall be used for lifting and placing; no chains or hooks will be permitted. Broken or damaged pipe including chipped bells of spigots, will be rejected, and shall be removed from the work site.
- C. Alignment: All pipe shall be accurately laid in conformity with the prescribed lines and grades as established by the Engineer. Each length shall be joined to the preceding section as specified, and after said jointing has been completed, there shall be no movement of the pipe in subsequent operations.
- D. Pipe Deflections: The laying of pipe on curved alignment will be permitted only when necessary to conform with the alignment shown or called for on the plans. Joint deflections called for on the plans shall be permitted up to one half of the deflection recommended by the pipe manufacturer.
- E. Cleaning: Before each new length of pipe is placed, the interior of the preceding pipe shall be carefully cleaned of all dirt and debris. When pipe laying is not in progress, all open pipe ends shall be closed with plugs in a satisfactory manner to the Engineer.
- F. Bearing: Pipe in the trench shall have continuous uniform bearing along its bottom, except all bell holes. Before lowering pipe into the trench, the Contractor shall remove all stakes, debris, loose rock and other hard material from the bottom of the trench.
- G. Positioning: After the final positioning, pipe shall be held in place in the trench with cover materials placed equally on both sides of the pipe at as many locations as required to hold the pipe section in place. Position plastic pipe with "STORM DRAIN" markings facing up. After joints are completed, the cover material shall be redistributed and compacted as herein required.
- H. Closure: At the end of each day and when work is not in progress, the open ends of pipe installed in the line shall be closed with plugs and openings for appurtenances shall be suitably covered.

3.03 CONNECTIONS

- A.** Unless separately listed on the bid schedule, make all required connections to existing facilities and improvements at no additional cost, and compensation for such work shall be deemed as included in the price bid for pipe installation.
- B.** All connections to manholes shall be constructed with concrete channels directed toward outlet pipe as shown and detailed on the plans.
- C.** Break-out holes in manholes for connecting new pipe shall be grouted all around to prevent ground water infiltration. Pipes shall be cut off flush with the inside surface of the manhole. Use PVC manhole adapters in break-out holes in manholes for connecting new PVC pipe and grout all around to prevent ground water infiltration. Pipes shall be cut off flush with the inside surface of the manhole.
- D.** A 2-foot nominal length of pipe shall be used when entering and leaving all manholes and structures.

3.04 STRUCTURES

- A.** Structures and appurtenances shall be installed at the location and to the lines and dimensions shown on the plans and detail drawings.
- B.** Structures shall be constructed and/or installed in conformance with the applicable requirements of Section 51 of the State Standard Specifications. Unless otherwise noted on the plans or detail drawings, all exposed surfaces of poured in place structures and appurtenances shall have a Class 1 surface finish.
- C.** Frames for manholes and tops of catch basins, inlets and other structures in paved areas shall be accurately placed flush with and in the plane of the finish pavement. All manhole frames in paved area shall be secured by means of concrete anchor slabs as shown and detailed on the plans and detail drawings.
- D.** All joints and pipe openings on manhole sections, risers, and grade adjustment rings shall be grouted smooth and flush with the interior of the structure in a workmanlike manner.

3.05 STORM DRAIN PLUGS & CLEANING

- A.** Where called for on the plans or directed, plugs shall be placed in open ends of storm drains. Plugs shall consist of a brick and mortar wall not less than eight (8) inches in thickness constructed in such a manner as to ensure a watertight seal. Mortar for plugs shall conform to the requirements of paragraph 2.04F hereof.
- B.** Storm drain pipe and structures shall be cleaned of all dirt, debris, and form work.

- C. Pipes shall be balled with an approved rubber ball to insure cleanliness prior to acceptance.

3.06 UNDERDRAINS

- A. Trenches for underdrains shall be excavated in the location shown.
- B. Place filter fabric in the trench to protect the permeable material and pipe prior to backfilling.
- C. The pipe installed and the trench backfilled with permeable material according to the dimensions and details shown on the plans.
- D. Perforated pipe, fabric, and permeable material shall be installed in accordance with Section 68-1.03 of the Standard Specifications.

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