

SPECIFICATIONS

WITHLACOOCHEE WPCP SECONDARY EQUALIZATION BASIN



CITY OF VALDOSTA UTILITIES DEPARTMENT



SEPTEMBER 2019

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SUBMITTALS

PART 1 - GENERAL

1.01 SCOPE

- A. This section outlines in general the items that the Contractor must prepare or assemble for submittal during the progress of the Work. Costs for the Work under this section shall be included in the appropriate items of the Contractor's bid prices. There is no attempt herein to state in detail all of the procedures and requirements for each submittal. The Contractor's attention is directed to the individual Specification Sections in these Contract Documents that may contain additional and special submittal requirements. The Owner reserves the right to direct and modify the procedures and requirements for submittals as necessary to accomplish the specific purpose of each submittal. Electronic PDFs shall be provided for each submittal.
- B. All manuals, drawings, photographs, videos and any other documentation that supports facility operations and maintenance (hereinafter referred to collectively as "documents" or "document") shall be delivered in electronic format, as specified in Paragraph 2.01. Additionally documents that are normally paper-based shall be submitted in Adobe Portable Document Format (PDF), and linked/bookmarked, as specified in Paragraph 2.01.

1.02 RELATED DOCUMENTS

- A. Drawings

1.03 ADMINISTRATIVE SUBMITTALS

- A. The Contractor shall provide all of the submittals required by the General Conditions, and as may be specifically required in other parts of these Documents. Submittals shall be addressed in accordance with paragraph 1.04.
- B. The Contractor is reminded of his obligation as required to make required submittals promptly to the applicable federal, state, or local agency. Failure to comply with this requirement may result in the withholding of progress payments and make the Contractor liable for other prescribed action and sanctions.
- C. The Contractor shall submit to the Owner a copy of all letters relative to the Contract, transmitting notifications, reports, certifications, payrolls, and the like, that he submits directly to a federal, state, or other governing agency.

1.04 TECHNICAL SUBMITTALS

- A. General:
 - 1. Requirements in this section are in addition to any specific requirements for submittals specified in other divisions and sections of these Contract Documents.
 - 2. Submittals to the Owner and Engineer shall be addressed to:

- a. LEA, PC.
 3. Submitted data shall be fully sufficient in detail for determination of compliance with the Contract Documents.
 4. Review, or acceptance of substitutions, schedules, shop drawings, lists of materials, and procedures submitted or requested by the Contractor shall not add to the Contract amount, and all additional costs that may result therefrom shall be solely the obligation of the Contractor.
 5. The Owner is not precluded by virtue of review, acceptance, or approval, from obtaining a credit for construction savings resulting from allowed concessions in the Work or materials therefore.
 6. It shall not be the responsibility of the Owner to provide engineering or other services to protect the Contractor from additional costs accruing from such acceptance or approvals.
 7. No equipment or material for which listings, drawings, or descriptive material is required shall be fabricated, purchased, or installed until the Engineer has on hand copies of such approved lists and the appropriately stamped final shop drawings.
 8. Submittals will be acted upon by the Engineer within a reasonable time and generally within 21 regular working days of receipt. Delays caused by the need for resubmittals shall not constitute reason for an extension of Contract time. The Contractor shall be responsible for all costs, including the Engineer's costs, associated with review of any information submitted and re-submitted more than two times.
- B. Product Data
1. Product Data includes standard printed information on materials, products and systems, not specifically prepared for this Project, other than the designation of selections from among available choices printed herein.
 2. Collect required data into one submittal for each unit of work or system, and mark each copy to show which choices and options are applicable to the Project. Include manufacturer's standard printed recommendations for application and use, compliance with standards, application of labels and seals, notation of field measurements which have been checked and special coordination requirements
- C. Samples
1. Samples include both fabricated and un-fabricated physical examples of materials, products and units of work, both as complete units and as smaller portions of units of work, either for limited visual inspection or, where indicated, for more detailed testing and analysis.
 2. Provide units identical with final condition of proposed materials or products for the Work. Include "range" samples, not less than three units, where unavoidable variations must be expected, and describe or identify variations between units of each set. Provide full set of optional samples where the Engineer's selection is required. Prepare samples to match the Engineer's sample where indicated. Include information with each sample to show generic description, source or product name and manufacturer, limitations and compliance with standards. Samples are submitted for review and confirmation of color, pattern, texture and "kind" by the Engineer. Engineer will note "test" samples, except as otherwise indicated, for other requirements, which are the exclusive responsibility of the Contractor.
- D. Miscellaneous submittals related directly to the Work (non-administrative) include warranties, maintenance agreements, workmanship bonds, project photographs, survey data and reports,

physical work records, statements of applicability, quality testing and certifying reports, copies of industry standards, record drawings, field measurement data, operating and maintenance materials, overrun stock, security/protection/safety keys and similar information, devices and materials applicable to the Work but not processed as shop drawings, product data or samples.

E. Shop Drawing Submittal Procedure:

1. The approved Drawings will be supplemented by such Shop Drawings as are needed to adequately control the Work. It is mutually agreed that all authorized alterations affecting the requirements and information given on the approved Drawings shall be in writing.
2. Shop Drawings to be furnished by the Contractor for any structure shall consist of such detailed Drawings as may be required for the prosecution of the Work.
3. Shop Drawings must be accepted by the Engineer before the Work in question is performed. Drawings for false work, centering and form work may also be required, and in such cases shall be likewise subjected to acceptance unless waived. It is expressly understood, however, that acceptance of the Contractor's Shop Drawings does not relieve the Contractor of any responsibility for accuracy of dimensions and details. It is mutually agreed that the Contractor shall be responsible for agreement and conformity of his Shop Drawings with the accepted Drawings and Specifications.
4. It is the responsibility of the Contractor to check all Shop Drawings before same are submitted to the Engineer. Shop Drawings which have not been checked and approved by the Contractor will not be accepted.
5. Shop Drawings shall be submitted only by the Contractor who shall indicate by a signed stamp on the drawings that he has checked and approved the Shop Drawings and that the Work shown on them is in accordance with Contract requirements and has been checked for dimensions and relationship with work of all other trades involved. Under no conditions shall Shop Drawings be accepted from anyone other than the Contractor.
6. The Contractor shall furnish the Engineer electronic copies of all Shop Drawings and submittals.
7. The Contract Price shall include the cost of furnishing all Shop Drawings and the Contractor will be allowed no extra compensation for such Drawings.
8. The acceptance of such Shop Drawings shall not relieve the Contractor from responsibility for deviations from Drawings or the Specifications unless he has, in writing, called attention to such deviations, and the Engineer has accepted the changes or deviations in writing at the time of submission, nor shall it relieve him from the responsibility for errors of any kind in Shop Drawings. When the Contractor does call such deviations to the attention of the Engineer, he shall state in his letter whether or not such deviations involve any extra cost. If this is not mentioned, it will be assumed that no extra cost is involved for making the change.

F. Shop Drawing Requirements: Shop drawings referred to herein shall include shop drawings and other submittals for both shop and field-fabricated items. The Contractor shall submit to the Engineer, as applicable, the following for all prefabricated or manufactured structural, mechanical, electrical, plumbing, process systems, and equipment:

1. General:
 - a. Shop drawings shall include technical data, drawings, diagrams, procedure and methodology, performance curves, schedules, templates, patterns, test reports,

calculations, instructions, measurements and similar information as applicable to the specific item for which the shop drawing is prepared.

- b. Provide newly-prepared information with graphic information at accurate scale (except as otherwise indicated) or appropriate number of prints hereof, with name or preparer (firm name) indicated. The Contract Drawings shall not be traced or reproduced by any method for use as or in lieu of detail shop drawings. Show dimension and note which are based on field measurement. Identify materials and products in the Work shown. Indicate compliance with standards and special coordination requirements. Do not allow shop drawing copies without appropriate final "Action" markings by the Engineer to be used in connection with the Work.
 - c. Drawings shall be presented in a clear and thorough manner. Details shall be identified by reference to sheet and detail, Specification section, schedule or room numbers shown on the Contract Drawings.
 - d. Minimum Scale:
 - i. Assembly Drawings Sheet, Scale: 1 inch = 30 feet.
 - ii. Detail Sheet, Scale: 1/4 inch = 1 foot.
 - e. Maximum assembly drawings sheet size shall be 24 x 36 inches.
 - f. Minimum detail sheet size shall be 8-1/2 x 11 inches.
 - g. Shop drawings or equipment drawings shall include dimensions, size and location of connections to other work, and weight of equipment.
 - h. Include catalog information and cuts.
 - i. Provide installation or placing drawings for equipment, drives and bases.
 - j. Supporting calculations for equipment and associated supports, or hangers required or specified to be designed by equipment manufacturers.
 - k. Complete manufacturer's specifications, including materials description and paint system.
 - l. Provide performance data and pump curves.
 - m. Suggested spare parts list with current price information and name of closest supplier.
 - n. List of special tools required for checking, testing, parts replacement, and maintenance. (Special tools are those which have been specially designed or adapted for use on parts of the equipment, and which are not customarily and routinely carried by maintenance mechanics.)
 - o. List of special tools furnished with the equipment.
 - p. List of materials and supplies required for the equipment prior to, and during startup.
 - q. List of materials and supplies furnished with the equipment.
 - r. Samples of finish colors for selection.
 - s. Special handling instructions.
 - t. Requirements for storage and protection prior to installation.
 - u. Requirements for routine maintenance required prior to plant startup.
 - v. List of all requested exceptions to the Contract Documents.
- G. Submittals required for foreign-manufactured items: In addition to the submittal requirements stated above, suppliers of foreign-manufactured items shall submit the names and addresses of companies within the United States that maintain technical service representatives and a complete

inventory of spare parts and accessories for each foreign-made item proposed for incorporation into the Work. Failure to prove the foregoing capabilities shall be just cause for rejection of the foreign-manufactured items.

- H. Final shop drawings to be submitted to Owner: Complete printed sets of final shop drawings and one electronic copy shall be submitted to the Owner before, or at the time of, delivery of equipment to the site.
- I. Record drawings: The Contractor will maintain, during construction, Record Drawings for the project which will include the changes made in materials, equipment, locations, and dimensions of the Work. The Contractor shall mark up a set of Drawings in Adobe Portable Document Format (PDF), and linked/bookmarked, as specified in Paragraph 2.01 with as-built information, RFI's, and notes of any other change. The marked set drawings shall reside on a server accessible to the Contractor, Engineer, Construction Manager and Owner. The marked drawings shall have active links directly to copies of RFI's or other documentation detailing the changes. A final copy of the Record Drawings shall be supplied to the Owner, Engineer and Construction Manager. The Contractor shall coordinate with the Engineer to develop final CADD drawings and files. The Engineer shall review the final drawings upon final acceptance at the job site. The final Record Drawings shall be turned over to the Owner on USB flash drive and a complete printed set.
- J. Submittal of interface information (connection and correlation with other work): Where called for on the Specifications and as determined necessary by the Engineer to provide proper correlation with other equipment, complete interface information shall be submitted. This interface information shall be accurate and contain all information necessary to allow the completion of detail design and construction of the interfacing or connecting work. The Contractor shall include in his negotiation for subcontract work, such agreements as may be necessary to ensure the accuracy of subcontractor's interface submittal information. In the event additional costs are incurred due to subsequent changes to information given in said interface information, such additional costs shall be borne by the Contractor.
- K. Operation and maintenance (O&M) manuals:
 - 1. The Contractor shall furnish electronic O&M manuals in accordance with paragraph 2.01. Hard-bound manuals shall also be required. Furnish six copies of a complete instruction manual for installation, calibration, operation, maintenance, and lubrication requirements for each component of mechanical and electrical equipment systems. All equipment manufacturers shall be made aware of these requirements, and all associated costs shall be included in the costs for furnishing the equipment or system. Each instruction manual furnished shall be fixed in hard-back cover which is clearly labeled to designate the system or equipment for which it is intended with reference to the building and equipment number, and the Specification section where the item is specified. The Contractor will assemble the instruction manuals for all vendor submittals into an Operation and Maintenance (O&M) Manual for the entire project.
 - 2. The manuals, both hard-bound and electronic, shall be furnished at least 100 calendar days prior to the scheduled completion of the Work. Any deficiencies found by the Engineer to exist in the manuals submitted shall be corrected by the Contractor within 30 calendar days following notification by the Engineer of the deficiencies.
 - 3. Each instruction manual shall include, but not be limited to, the following:
 - a. Diagrams and illustrations

- b. Detailed description of the function of each principal component of the system
 - c. Performance and nameplate data
 - d. Installation instructions
 - e. Procedure for starting
 - f. Proper adjustment
 - g. Test procedures
 - h. Procedure for operating
 - i. Shutdown instructions
 - j. Emergency operating instructions and troubleshooting guide
 - k. Safety precautions
 - l. Maintenance and overhaul instructions which shall include detailed assembly drawings with part numbers, parts list, instructions for ordering spare parts, and complete preventive maintenance instructions required to ensure satisfactory performance and longevity of the equipment
 - m. Lubrication instructions which shall list points to be greased or oiled, shall recommend type, grade, and temperature range of lubricants, and shall recommend frequency of lubrication
 - n. List of electrical relay settings and control and alarm contact settings
 - o. Electrical interconnection wiring diagram for equipment furnished, including all control and lighting systems
4. The manual shall be complete in all respects for all equipment, controls, accessories, and associated appurtenances.
 5. Each copy of the manual shall be assembled in one or more binders, each with title page, typed table of contents, and heavy section dividers with numbered plastic index tabs. Each manual shall be divided into sections paralleling the equipment Specifications. Binders shall be three-ring, hard-back type. All data shall be punched for binding and composition and printing shall be arranged so that punching does not obliterate any data. The project title, Division designation, and manual title printed thereon shall be as furnished by the Engineer.
 6. Where more than one binder is required, they shall be labeled "Vol. 1", Vol. 2," and so on. The table of contents for the entire set identified by volume number, shall appear in each binder. Submit manual organization and format to the Engineer for acceptance prior to manual preparation.
 7. Copies of O&M manuals for individual equipment shall be transmitted to the Engineer prior to installation of the equipment, and all equipment shall be serviced in accordance with the manufacturer's recommendations prior to operation. A service record shall be maintained on each item of equipment and shall be delivered to the Engineer prior to substantial completion. This requirement is in addition to the requirements of item 2 above.
 8. See Part 2 – Products Section of this Specification for additional specific O&M Manual requirements.

L. Maintenance summary forms:

1. In addition to the O&M Manuals, provide MAINTENANCE SUMMARIES in the format of the form bound at the end of this section and described below. The time for submittal of these forms shall be the same as prescribed above for the Operation and Maintenance Manuals.

2. An individual MAINTENANCE SUMMARY for each equipment item shall be compiled following the outline provided (bound at the end of this section); and six copies submitted for review by the Engineer. The manufacturer's standard form will not be acceptable as a substitute for the MAINTENANCE SUMMARY.
 3. The term "Maintenance Operation" as used in the MAINTENANCE SUMMARY bound at the end of this section is understood to mean any routine operation required to ensure the satisfactory performance and longevity of the equipment. Examples of some typical Maintenance Operations are lubrication, belt tensioning, adjustment of pump packing glands, routine adjustments, etc.
 4. The MAINTENANCE SUMMARY may take as many pages as required. However, the order and format shown must be adhered to. Only 8½ x 11 inch paper will be accepted.
- M. Manufacturer's certificates of proper installation: The Contractor shall submit manufacturers' certificates of proper installation for items of equipment.
- N. Samples and test specimens:
1. Where required in the Specifications, and as determined necessary by the Engineer, test specimens or samples of materials, appliances, and fittings to be used or offered for use in connection with the Work shall be submitted to the Engineer at the Contractor's expense, with information as to their sources, with all cartage charges prepaid, and in such quantities and sizes as may be required for proper examination and tests to establish the quality or equality thereof, as applicable.
 2. All samples and test specimens shall be submitted in ample time to enable the Engineer to make any tests or examinations necessary, without delay to the Work. The Contractor will be held responsible for any loss of time due to his neglect or failure to deliver the required samples to the Engineer as specified.
 3. The Contractor shall submit additional samples as required by the Engineer to ensure equality with the original accepted sample and/or for determination of Specification compliance.
 4. The Contractor shall provide for testing services for soils compaction and concrete cylinder breaks in accordance with the requirements described under Paragraph QUALITY ASSURANCE in Section 02222 – Excavation, Trenching and Backfill. All costs associated with initial tests shall be paid by the Contractor. If a sample fails to meet the specifications, any required retesting shall be paid for by the Contractor.
 5. All tests required by the Specifications to be performed by an independent laboratory shall be made by an approved laboratory. Certified test results of all specified tests shall be submitted in duplicate to the Engineer. The samples furnished and the cost for the laboratory services shall be paid by the Contractor.
 6. Laboratory tests and examinations that the Owner elects to make in its own laboratory will be made at no cost to the Contractor, except that, if a sample of any material or equipment proposed for use by the Contractor fails to meet the Specifications, the cost of testing subsequent samples shall be borne by the Contractor.
 7. Accepted sample items (fixtures, hardware, etc.) may be incorporated into the Work upon acceptance, and when no longer needed by the Engineer for reference.
- O. Construction Photographs:

1. The Contractor shall provide photographs in color showing the preconstruction treatment plant site, construction progress, and the post-construction treatment plant site. The photographer shall be equipped to take interior/exterior photographs with a digital camera. Indicated on the front of each hard copy print shall be the time and date. On the back of each print shall be the job title, and brief description of the photograph and location where the photograph was taken.
 - a. 25 – 50 exposures shall be taken of the preconstruction treatment plant site. Particular emphasis should be directed to structures on the site, or as directed by Engineer.
 - b. 25 – 50 exposures shall be taken monthly showing the progress of construction. The location of these photographs shall be determined by the Engineer.
 - c. 100 exposures shall be taken of the overall post-construction facilities.

P. Material and Equipment Colors:

1. The Engineer will provide a schedule of selected colors within 30 days after acceptance of materials and equipment, and after receiving samples of the manufacturers' standard colors for those items requiring Owner's selection.
2. See Section 02590.

Q. Certificates of Compliance:

1. A Certificate of Compliance shall be furnished for materials specified to a recognized standard or code prior to the use of any such materials in the Work. The Engineer may permit the use of certain materials or assemblies prior to sampling and testing if accompanied by a Certificate of Compliance. The certificate shall be signed by the manufacturer of the material or the manufacturer of assembled materials and shall state that the materials involved comply in all respects with the requirements of the Specifications. A Certificate of Compliance shall be furnished with each lot of material delivered to the Work and the lot so certified shall be clearly identified in the certificate.
2. All materials used on the basis of a Certificate of Compliance may be sampled and tested at any time. The fact that material is used on the basis of a Certificate of Compliance shall not relieve the Contractor of responsibility for incorporating material in the Work which conforms to the requirements of the Contract Documents, and any such material not conforming to such requirements will be subject to rejection whether in place or not.
3. The Engineer reserves the right to refuse permission for use of material on the basis of a Certificate of Compliance.
 - a. The form of the Certificate of Compliance and its disposition shall be as directed by the Engineer.

1.05 SPECIFIC CATEGORY REQUIREMENTS

- A. General: Except as otherwise indicated in the individual Work Sections, comply with general requirements specified herein for each indicated category of submittal.
1. Submittals shall contain:
 - a. The date of submittal and the dates of any previous submittals.
 - b. The Project title.
 - c. Submittals numbering shall be as follows: XXXXX.YY, where 'X' denotes the applicable Specification section and 'Y' denotes the individual submittal number for that particular Specification section, beginning with 01.

- d. Numerical submittal numbers, starting with 1.0, 2.0, etc. Revisions to be numbered 1.1, 1.2, etc.
- e. The names of:
 - i. Contractor.
 - ii. Supplier.
 - iii. Manufacturer.
- f. Identification of the product, with the Specification section number, permanent equipment tag numbers and applicable Drawing No.
- g. Field dimensions, clearly identified as such.
- h. Relation to adjacent or critical features of the Work or materials.
- i. Applicable standards, such as ASTM or Federal Specification numbers.
- j. Notification to the Engineer in writing, at time of submissions, of any deviations on the submittals from requirements of the Contract Documents.
- k. Identification of revisions on resubmittals.
- l. An 8 x 3 inch blank space for Contractor and Engineer stamps.
- m. Contractor's stamp identified by blue ink, initialed or signed, certifying review of submittal, verification of products, field measurements and field construction criteria and coordination of the information within the submittal with requirements of the Work and of Contract Documents.
- n. Submittal sheets or drawings showing more than the particular item under consideration shall have all but the pertinent description of the item for which review is requested crossed out.

1.06 ROUTING OF SUBMITTALS

- A. Submittals and routine correspondence shall be routed as directed at the Preconstruction Conference.

PART 2 - PRODUCTS

2.01 SUBMITTAL REQUIREMENTS

- A. Format and linking/bookmarking requirements are as defined in subsequent sub-paragraphs, for each document type.
 - 1. Operation & Maintenance Manual: The facility O&M manual shall be in PDF format, compliant with the Adobe PDF Specification Version 1.3 or latest version. They shall be PDF Formatted Text and Graphics (formerly Normal) or PDF Searchable Image (formerly Image+Text). If submitted in Searchable Image format, they shall be OCR'ed at a 95% confidence level, using Adobe Acrobat® Capture® 3.x or an equivalent product. This manual shall be linked and bookmarked as follows:
 - a. There shall be links from all Table of Contents, List of Tables, List of Figures, etc., entries to the actual occurrence in the body of the manual.
 - b. There shall be internal links from table, paragraph, or figure references within the body of the manual to the actual table, paragraph, or figure.

- c. There shall be external links from references to other documents within the body of the manual to the actual document (vendor manual, photograph, drawing, etc.).
 - d. Bookmarks shall be created for all linked TOC entries
 2. Vendor Manuals: Vendor provided equipment, sub-system or system manuals shall be in PDF format, compliant with the Adobe PDF Specification Version 1.3 or latest version if available. They shall be PDF Formatted Text and Graphics (formerly Normal) or PDF Searchable Image (formerly Image+Text). If submitted in Searchable Image format, they shall be OCR'ed at a 95% confidence level, using Adobe Acrobat Capture 3.x or an equivalent product. This manual, if it contains a Table of Contents, shall be linked and bookmarked as follows:
 - a. There shall be links from all Table of Contents, List of Tables, List of Figures, etc., entries to the actual occurrence in the body of the manual.
 - b. Bookmarks shall be created for all linked TOC entries
 - c. There shall be internal links from table, paragraph, or figure references within the body of the manual to the actual table, paragraph, or figure.
 3. Drawings: All facility drawings shall be in PDF format, compliant with the Adobe PDF Version 1.5 or latest version. They shall be PDF Searchable Image Exact (also known as PDF Image+Text). They shall be OCR'ed at a 95% confidence level, using Adobe Acrobat Capture 3.x or an equivalent product. Drawings shall contain links as follows:
 - a. External links from the Drawing Index (if it exists) to each drawing
 - b. External links from references within drawings to other drawings
 4. Drawings (CAD): All facility drawings available in native format (i.e. AutoCAD) shall be provided as electronic files in a native format supported by available viewers.
 5. Photographs: Any available digital photographs that support facility operations and maintenance shall be provided in JPEG or BMP format. JPEG is preferred due to its smaller file size.
 6. Videos: Any available videos that support facility operations and maintenance shall be provided in MPEG 1080 HD format.
 7. Other: Any other documents that support facility operations and maintenance shall be provided in PDF format, compliant with the Adobe PDF Specification Version 1.3 or latest version. They shall be PDF Formatted Text and Graphics (formerly Normal) or PDF Searchable Image (formerly Image+Text). If submitted in Searchable Image format, they shall be OCR'ed at a 95% confidence level, using Adobe Acrobat Capture 3.x or an equivalent product. If any document contains a Table of Contents, it shall be linked and bookmarked per paragraph 2.2.

2.02 SHOP DRAWINGS

- A. Unless otherwise specifically directed by the Engineer, make all shop drawings accurately to a scale sufficiently large enough to show all pertinent features of the item and its method of connection to the Work.

2.03 MANUFACTURER'S LITERATURE

- A. Where content of submitted literature from manufacturers includes data not pertinent to this submittal, clearly indicate which portion of the contents is being submitted for the Engineer's review.

- B. Submit the number of copies that are required to be returned (not to exceed three) plus three copies which will be retained by the Engineer.

2.04 SAMPLES

- A. Samples shall illustrate materials, equipment or workmanship and established standards by which completed work is judged.
- B. Unless otherwise specifically directed by the Engineer, all samples shall be of the precise article proposed to be furnished.
- C. Submit all samples in the quantity that is required to be returned plus one sample that will be retained by the Engineer.

2.05 COLORS

- A. Unless the precise color and pattern is specifically described in the Contract Documents, wherever a choice of color or pattern is available in a specified product, submit accurate color charts and pattern charts to the Engineer for review and selection.
- B. Unless all available colors and patterns have identical costs and identical wearing capabilities, and are identically suited to the installation, completely describe the relative costs and capabilities of each.

PART 3 - EXECUTION

3.01 CONTRACTOR'S COORDINATION OF SUBMITTALS

- A. Prior to submittal for the Engineer's review, the Contractor shall use all means necessary to fully coordinate all material, including the following procedures:
 - 1. Determine and verify all field dimensions and conditions, catalog numbers and similar data.
 - 2. Coordinate as required with all trades and all public agencies involved.
 - 3. Submit a written statement of review and compliance with the requirements of all applicable technical Specifications as well as the requirements of this Section.
 - 4. Clearly indicate in a letter or memorandum on the manufacturer or fabricator's letterhead, all deviations from the Contract Documents.
- B. Each and every copy of the shop drawings and data shall bear the Contractor's blue stamp showing that they have been so checked and approved. Shop drawings submittal to the Engineer without the Contractor's stamp will be returned to the Contractor for conformance with this requirement.
- C. The Owner will back charge the Contractor for costs associated with having to review a particular shop drawing, product data or sample more than two times to receive a "No Exceptions Taken" or "Make corrections noted" mark at a rate of \$150/hour.
- D. Grouping of Submittals

1. Unless otherwise specifically permitted by the Engineer, make all submittals in groups containing all associated items.
 2. No review will be given to partial submittals of shop drawings for items which interconnect and/or are interdependent. It is the Contractor's responsibility to assemble the shop drawings for all such interconnecting and/or interdependent items, check them and then make one submittal to the Engineer along with Contractor's comments as to compliance, non-compliance or features requiring special attention.
- E. Schedule of Submittals: Within 30 days of Contract award and prior to any shop drawing submittal, the Contractor shall submit a schedule showing the estimated date of submittal and the desired acceptance date for each shop drawing anticipated. A reasonable period shall be scheduled for review and comments. Time lost due to unacceptable submittals shall be the Contractor's responsibility and some time allowance for resubmittal shall be provided. The schedule shall provide for submittal of items which relate to one another to be submitted concurrently.

3.02 TIMING OF SUBMITTALS

- A. Make all submittals far enough in advance of scheduled dates for installation to provide all required time for reviews, for securing necessary reviews, for possible revision and resubmittal, and for placing orders and securing delivery.
- B. In scheduling, allow sufficient time for the Engineer's review following the receipt of the submittal.

3.03 REVIEWED SHOP DRAWINGS

- A. Engineer Review
 1. Allow a minimum of 21 days for the Engineer's initial processing of each submittal requiring review and response, except allow longer periods where processing must be delayed for coordination with subsequent submittals. The Engineer will advise the Contractor promptly when it is determined that a submittal being processed must be delayed for coordination. Allow a minimum of two weeks for reprocessing each submittal. Advise the Engineer on each submittal as to whether processing time is critical to progress of the Work, and therefore the Work would be expedited if processing time could be foreshortened.
 2. Acceptable submittals will be marked "No Exceptions Taken."
 3. Submittals requiring minor corrections before the product is acceptable will be marked "Make Corrections Noted." The Contractor may order, fabricate and ship the items included in the submittals, provided the indicated corrections are made. Drawings must be resubmitted for review and marked "No Exceptions Taken" prior to installation or use of products.
 4. Submittals marked "Amend and Resubmit" must be revised to reflect required changes and the initial review procedure repeated.
 5. The "Rejected - See Remarks" notation is used to indicate products which are not acceptable. Upon return of a submittal so marked, the Contractor shall repeat the initial review procedure utilizing acceptable products.

- B. No work or products shall be installed without a drawing or submittal bearing the "No Exceptions Taken" notation. The Contractor shall maintain at the job site a complete set of shop drawings bearing the Engineer's stamp.
- C. Substitutions: In the event the Contractor obtains the Engineer's acceptance for the use of products other than those which are listed first in the Contract Documents, the Contractor shall, at the Contractor's own expense and using methods accepted by the Engineer, make any changes to structures, piping and electrical work that may be necessary to accommodate these products.
- D. Use of the "No Exception Taken" notation on shop drawings or other submittals is general and shall not relieve the Contractor of the responsibility of furnishing products of the proper dimension, size, quality, quantity, materials and all performance characteristics, to efficiently perform the requirements and intent of the Contract Documents. The Engineer's review shall not relieve the Contractor of responsibility for errors of any kind on the shop drawings. Review is intended only to ensure conformance with the design concept of the Project and compliance with the information given in the Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site. The Contractor is also responsible for information that pertains solely to the fabrication processes or to the technique of construction and for the coordination of the Work of all trades.

3.04 RESUBMISSION REQUIREMENTS

- A. Shop Drawings
 - 1. Revise initial drawings as required and resubmit as specified for initial submittal, with the resubmittal number shown.
 - 2. Indicate on drawings all changes which have been made other than those requested by the Engineer.
- B. Project Data and Samples: Resubmit new data and samples as specified for initial submittal, with the resubmittal number shown.

TYPICAL MAINTENANCE SUMMARY FORM

1. EQUIPMENT ITEM
2. MANUFACTURER
3. EQUIPMENT IDENTIFICATION NUMBER(S)
4. WEIGHT OF INDIVIDUAL COMPONENTS (OVER 100 POUNDS)
5. NAMEPLATE DATA (hp voltage, speed, etc.)
6. MANUFACTURER'S LOCAL REPRESENTATIVE

Name _____ Telephone No. _____

Address _____

7. MAINTENANCE REQUIREMENTS

Maintenance Operation	Frequency	Lubricant (If Applicable)	Comments
List briefly each maintenance operation required & refer to specific information in mfr's std. maintenance manual, if applicable.	List required frequency of each maintenance operation.	Refer by symbol to lubricant list required.	
_____	_____	_____	_____
_____	_____	_____	_____

8. LUBRICANT LIST

Reference Symbol	Texaco	Std. Oil	Gulf	Mobile	Or Equal
List symbols used in Item 7. above.	List equivalent lubricants, as distributed by each manufacturer for the specific use recommended.				
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____

9. SPARE PARTS. Include your recommendations regarding what spare parts, if any, should be kept on the job.

END OF SECTION 01300

SECTION 01500

CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Layout of temporary facilities.
- B. Project identification.
- C. Temporary utilities.
- D. Barriers.
- E. Enclosures.
- F. Protection of installed work.
- G. Temporary Controls.
- H. Security.
- I. Access roads and parking.
- J. Field offices and sheds.
- K. Hazardous material identification and material safety.
- L. Removal of utilities, facilities and controls.

1.02 RELATED SECTIONS

- A. Drawings;
- B. Section 01300 – Submittals.

1.03 LAYOUT OF TEMPORARY FACILITIES

- A. Submit for approval, working drawings showing proposed locations and sizes of offices, shops, storage areas, fencing, temporary stationary equipment, and similar facilities. Where onsite space for temporary facilities is limited, allocation of available space will be made by the Construction Manager. Should the Contractor require space in addition to that allocated, the Contractor shall make his/her own arrangements for storage of material and equipment in a location off the construction site. For allocated space, submit to the Construction Manager for approval, proposed plan and layout for temporary offices, sanitary facilities, temporary construction roads, storage buildings, storage yards, and temporary power service and

distribution. Said facilities shall be located so as not to impede or prevent the principal function of existing facilities.

1.04 PROJECT IDENTIFICATION

- A. Provide 8-foot wide x 4-foot high project sign of exterior grade plywood and wood frame construction, painted, with exhibit lettering by professional sign painter, to the Construction Manager's design and colors.
- B. List title of project, names of Owner, Construction Manager, and Contractor.
- C. Erect on site at location established by the Construction Manager.
- D. No other signs are allowed without Owner permission except those required by law.

1.05 TEMPORARY UTILITIES

- A. General:
 - 1. Provide and maintain temporary and interim utility services necessary for performance of Work. Include costs associated with these services in lump sum price bid.
 - 2. Install and maintain utilities to comply with applicable code, safety, and utility company requirements.
 - 3. Connect to Owner's utility only on approval of the Construction Manager. Provide submeter for connections to Owner's utilities and pay for utility used.
 - 4. Use of permanent utilities or equipment during construction shall not constitute start of warranties or guaranties.
- B. Electricity:
 - 1. Provide connections, sized to provide service required for power and lighting. Feeder and branch wiring with area distribution boxes shall be located so that power is available through project site by use of power cords. Provide terminations for each voltage supply complete with circuit breakers, disconnect switches and other electrical devices required to protect power supply system.
 - 2. Provide and maintain lighting for construction operations.
 - 3. Temporary electrical power for use during construction shall not interfere with or adversely affect the normal operation of existing facilities.
- C. Temporary Heat:
 - 1. Provide as required to maintain specified conditions for construction operations to protect materials and finishes from damage due to temperature or humidity.
 - 2. Heat shall be warm air heat from oil or gas-fired portable unit heaters suitably vented to outside as required for protection of health and property. Heaters whose products of combustion are emitted within heated space shall be used only as approved by the Construction Manager. Open salamander type heaters will not be permitted.
 - 3. Any part of building or materials that become damaged because of lack of heat shall be repaired or replaced by the Contractor at no additional cost to the Owner.

4. Prior to operation of permanent facilities for temporary purposes, verify that installation is approved for operation, and that filters are in place. Provide and pay for operation, maintenance, utilities, and other associated items.
 5. Maintain minimum ambient temperature of 50 degrees F in areas where construction is in progress, unless indicated otherwise in specifications.
- D. Temporary Ventilation:
1. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
 2. Utilize existing ventilation equipment. Extend and supplement equipment with temporary fan units as required to maintain clean air for construction operations.
- E. Temporary Water Service:
1. Connect to existing water source for construction operations. Provide separate metering and reimburse Owner for cost of water used. Extend branch piping with outlets located so water is available by hoses with threaded connections.
- F. Sanitary Facilities:
1. Provide temporary sanitary facilities and service, and clean and maintain these facilities and enclosures. Remove temporary facilities from the site at completion of Work.
 2. Construction personnel shall not use existing sanitary facilities.
- G. Fire Protection:
1. Provide temporary fire protection equipment for protection of personnel and property during Work. Remove debris and flammable materials daily to minimize potential hazards.
 2. Report fires immediately to local fire service.

1.06 BARRIERS

- A. Provide barriers to prevent unauthorized entry to construction areas and to protect existing facilities and adjacent properties from damage from construction operations.
- B. Provide barricades and covered walkways required by governing authorities for public rights-of-way.
- C. Provide protection for plant life designated to remain. Replace damaged plant life.
- D. Protect non-owned vehicular traffic, stored materials, site and structures from damage.

1.07 ENCLOSURES

- A. Exterior Enclosures:
 1. Provide temporary weather-tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual

specification Sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

B. Interior Enclosures:

1. Provide temporary partitions as required to separate work areas from Owner occupied areas, to prevent penetration of dust and moisture into Owner occupied areas, and to prevent damage to existing materials and equipment.
2. Construction: Framing and sheet materials with closed joints and sealed edges at intersections with existing surfaces.
3. Paint surfaces exposed to view from Owner occupied areas.

1.08 PROTECTION OF INSTALLED WORK

- A. Protect installed Work and provide special protection where specified in individual specification Sections.
- B. Provide temporary and removable protection for installed Products. Control activity in immediate work area to minimize potential damage.
- C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- D. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- E. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- F. Prohibit traffic from landscaped areas.

1.09 TEMPORARY CONTROLS

A. Drainage and Erosion Control:

1. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.
2. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.
3. Plan and execute construction by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
4. Minimize amount of bare soil exposed at one time.
5. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.
6. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.
7. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.

B. Dust Control:

1. Execute Work by methods to minimize raising dust from construction operations.

2. Provide positive means to prevent airborne dust from dispersing into atmosphere.
- C. Construction Noise Control:
1. General: Conduct Work, use appropriate construction methods and equipment, and furnish and install acoustical barriers, as necessary to avoid exceeding legal noise levels.
 2. Nighttime Work: If Contractor desires to perform Work between the hours of 8 p.m. and 7 a.m., obtain necessary permits from appropriate agencies and make necessary arrangements prior to commencing.
 3. Mitigation of Construction Noise Impact: Submit to Construction Manager plans to mitigate construction noise impacts and to comply with noise criteria, including method of construction, equipment to be used, and acoustical treatment if necessary.
- D. Rodent and Pest Control:
1. Keep work area, including storage areas, free from rodents, noxious pests, and other vermin.
 2. The Construction Manager shall notify the Contractor of any noncompliance with this requirement and of the corrective action required. This notice, when delivered to the Contractor or the Contractor's representative at site of Work, shall be deemed sufficient notice of noncompliance and corrective action required. After receiving notice, immediately take corrective action. If the Contractor fails or refuses to eliminate rodents, pests or vermin and causes thereof promptly, the Owner may have necessary extermination work performed and charge costs to the Contractor.
- E. Pollution Control:
1. Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations.

1.10 SECURITY

- A. Security Program:
1. Protect Work existing premises and the Owner's operations from theft, vandalism, and unauthorized entry.
 2. Initiate program in coordination with the Owner's existing security system at job mobilization.
 3. Maintain program throughout construction period until Owner acceptance precludes the need for Contractor security.
- B. Entry Control:
1. Restrict entrance of persons and vehicles onto Project site.
 2. Allow entrance only to authorized persons with proper identification.
 3. Maintain log of workmen and visitors; make available to Owner on request.
 4. Owner will control entrance of persons and vehicles related to Owner's operations.
- C. Restrictions:

1. Do not allow cameras on site or photographs to be taken except by written approval of the Construction Manager, or as required by the Contract Documents.

1.11 ACCESS ROADS AND PARKING

A. Access Roads:

1. Construct and maintain temporary roads accessing public thoroughfares to serve construction area.
2. Extend and relocate as Work progress requires. Provide detours necessary for unimpeded traffic flow.
3. Provide and maintain access to fire hydrants free of obstructions.
4. Provide means of removing mud from vehicle wheels before entering streets.

B. Parking:

1. Construct temporary gravel surface parking areas to accommodate construction personnel.
2. When site space is not adequate, provide additional off-site parking.
3. Do not allow vehicle parking on existing pavement.

1.12 FIELD OFFICES AND SHEDS

- A. Contractor's field office: Provide and maintain temporary offices on the jobsite. Post a sign identifying Contractor and listing emergency telephone number(s) at, and outside of, Contractor's field office.
- B. Storage Sheds for Tools, Materials, and Equipment: Weather-tight, with heat and ventilation for Products requiring controlled conditions, with adequate space for organized storage and access, and lighting for inspection of stored materials.

1.13 HAZARDOUS MATERIAL IDENTIFICATION AND MATERIAL SAFETY DATA.

- A. Submit a Safety Data Sheet, as prescribed in 29 CFR 1910, Occupational Safety and Health Standards, for hazardous material 5 days before delivery of the material, whether or not listed in Appendix A of the Standard. This obligation applies to materials delivered under this contract which will involve exposure to hazardous materials or items containing these materials.
- B. "Hazardous material," as used in this clause, is as defined in 29 CFR 1910, in effect on the date of this contract.
- C. Comply with applicable Federal, State, and local laws, codes, ordinances, and regulations (including the obtaining of licenses and permits) in connection with hazardous materials.
- D. The Owner's rights in data furnished under this contract with respect to hazardous material are as follows:
 1. To use, duplicate, and disclose any data to which this clause is applicable. The purposes of this right are to:

- a. apprise personnel of the hazards to which they may be exposed in using, handling, packaging, transporting, or disposing of hazardous materials.
 - b. obtain medical treatment for those affected by the material.
 - c. have others use, duplicate, and disclose the data for the Owner for these purposes.
2. To use, duplicate, and disclose data furnished under this clause, in accordance with subparagraph D.1.a above, in precedence over any other clause of this contract providing for rights in data.
- E. There may be hazardous materials present at the facility. This notice is to warn and alert the Contractor of potentially hazardous materials even though materials may be located outside construction site area or in a restricted area not normally accessible to the Contractor or his/her employees. This does not relieve the Contractor of his/her responsibility for safety of his/her and his/her subcontractors' employees.
- F. Potentially hazardous materials may exist at the existing facility and may be supplied as part of this Work.
- G. Neither the requirements of this clause nor an act or failure to act by Owner, or Construction Manager shall relieve the Contractor of responsibility or liability for safety of the Construction Manager, Owner, Contractor, or subcontractor personnel or property.

1.14 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

- A. Remove temporary above grade or buried utilities, equipment, facilities, materials, prior to Final Application for Payment inspection.
- B. Remove underground installations to a minimum depth of 2ft. Grade site as indicated.
- C. Clean and repair damage caused by installation or use of temporary work.
- D. Restore existing facilities used during construction to original condition. Restore permanent facilities used during construction to specified condition.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01500

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SECTION 02222

EXCAVATION, TRENCHING, AND BACKFILL

PART 1 - GENERAL

1.01 SCOPE

- A. The Contractor shall perform all earthwork required for construction of the Work. Provide labor, equipment, tools, materials, and services needed to accomplish all earthwork including excavation, trenching and backfilling. The Work includes the loosening, removing, loading, transporting, depositing, and compacting in their final locations of all materials, wet and dry, compaction of fills and backfills, disposal of surplus and/or unsuitable materials, dust control, drainage control and cleanup. The Contractor shall comply with all federal, state and local safety and health standards, laws and regulations.
- B. Related Sections include but are not necessarily limited to:
 - 1. Section 02230 - Site Preparation.
 - 2. Section 02240 - Dewatering.
 - 3. Section 02920 - Lawns and Grasses.

1.02 DEFINITIONS

- A. Site: The property within the boundaries shown on the Drawings, easements and/or rights-of-way for roads, drainage facilities, and pipelines, and the Contractor's working and storage areas adjacent to the facilities.
- B. Controlled Fill: Compacted suitable fill material in all areas of the site requiring filling to grade as shown on the Drawings. Compacted select fill material shall be provided in all areas which will support pavement, a structure or some part of a structure.
- C. Structural Backfill: Compacted suitable fill material placed between the wall of a structure and construction excavation of slope up to finished grade.
- D. Suitable Fill Material: Shall be any material imported or excavated from cut areas which, in the opinion of the Engineer, is suitable for use in constructing fills.
- E. Select Fill Material: Clean granular material imported or excavated from the cut areas which, in the opinion of the Engineer, is suitable for use in constructing fills for foundations.
- F. Undercutting: The over-excavation or removal of existing fill, soft or unsuitable materials as determined by the Engineer, encountered below grades specified for excavation.
- G. Waste Excavation: Material from project excavations which is not suitable for use in backfill or compacted fills or is in excess of that required to be used for backfill or compacted fills.

- H. Trench Excavation: Excavation for trenches shall include the removal of all material of any nature, except rock, for the installation of the pipe and shall include the construction of trench shoring and stabilization measures, timbering and all necessary installation for dewatering.
- I. Backfill Material: Material used to refill an excavation. Backfill material is defined as starting 1 foot above the top of the pipe or conduit, or at the subgrade for cast-in-place structures such as vaults and valve boxes.
- J. Bedding Material: Material within the pipe zone that supports and surrounds the pipe or conduit.
- K. Pipe zone: Generally defined as the area that extends from 6 inches below the bottom of the pipe to 1 foot above the top of the pipe. For steel pipe, the pipe zone begins 4 inches below the bottom of the pipe.

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

- A. The Work of this Section shall comply with current versions, with revisions, of the following:
 - 1. International Building Code.
 - 2. Department of Transportation, State of Georgia, Standard Specifications, Construction of Roads and Bridges (GDOT Specifications).
 - 3. City of Valdosta Utilities Department Standard Specifications.
 - 4. City of Valdosta Land Development Regulations.
 - 5. American Society for Testing and Materials (ASTM).
 - a. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kn-m/m³)).
 - b. ASTM D854 - Standard Test Methods for Specific Gravity of Soil Solids by Water Pycnometer.
 - c. ASTM D2216 - Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.
 - d. ASTM D2487 - Standard Practice for Soil Classification of Soils for Engineering Purposes.
 - e. ASTM D6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil Aggregate by Nuclear Methods (Shallow Depth).
 - f. ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.04 CONTRACTOR SUBMITTALS

- A. The Contractor shall submit the following in compliance with Section 01300 - Submittals:
 - 1. The Contractor's detailed plan showing the design and calculations for all shoring, bracing, sloping of the sides of excavation, or other provisions for worker protection against the hazard of caving ground during the excavation of trenches or structure excavation. The Contractor's detailed plan shall include a description of the methods, schedule and equipment, including trench shields, to be used for earthwork operations. The Contractor's plan shall identify the locations of temporary soil stockpiles. The Contractor's detailed plan shall be submitted before starting any trench or structure excavation 5 feet deep or greater.

The Contractor shall be in possession of the Engineer's written acceptance of the detailed plan before starting any trench or structure excavation 5 feet deep or greater.

2. Samples of imported material.
3. Such other samples of materials as the Engineer may require.
4. An agricultural soil evaluation about the suitability of proposed topsoil.
5. Copies of approved permits, licenses and agreements.

1.05 SITE INVESTIGATION

- A. Contractor's Responsibility: The Contractor shall carefully examine the site and make all inspections necessary in order to determine the full extent of the Work required to make the completed Work conform to the drawings and specifications. The Contractor shall satisfy himself/herself as to the nature and location of the Work, conditions, the conformation and condition of the existing ground surface, and the character of equipment and facilities needed prior to and during prosecution of the Work. The Contractor shall satisfy himself/herself as to the character, quality, and quantity of surface and subsurface materials or obstacles to be encountered. Any inaccuracies or discrepancies between the actual field conditions and the Drawings, or between the Drawings and Specifications must be brought to Engineer's attention prior to bid submittal in order to clarify the exact nature of the Work to be performed.
- B. Existing utility lines shall be located on the project site. Excavation work shall not be authorized until inspection of underground utility lines has taken place.

1.06 SAFETY

- A. The Contractor shall familiarize himself/herself with, and shall at all times conform to the regulations of the "OSHA General Industry Occupational Safety and Health Standards", and "OSHA Safety and Health Regulations for Construction", and of applicable state and local standards and regulations.
- B. The Contractor shall familiarize himself/herself with, and shall at all times conform to all applicable regulations of the Subpart "P" entitled, "Excavations, Trenching, and Shoring" of OSHA Safety and Health Regulations for Construction "General Construction Safety Orders," the Owner's Site Rules and Regulations, and applicable federal, state, and municipal agencies.

1.07 ENVIRONMENTAL SAFEGUARDS AND REGULATIONS

- A. The Contractor shall comply with regulations in force at all times to prevent pollution of air and water.

1.08 QUALITY ASSURANCE

- A. By Contractor: An independent testing laboratory shall be retained by the Contractor and approved by the Owner, to perform inspection of the removal and replacement of unsuitable materials, all excavations, and the placement and compaction of all fills and backfills within the limits of earthwork on this Project. Costs for all such inspections and tests will be paid by the Contractor. The Contractor shall bear the cost of retest and reinspection of reworked faulty work, as well as any other testing done at the Contractor's discretion.

B. By Owner:

1. The Owner, through his/her project representative(s) will be the on-site arbiter and judge of the acceptability of the work done, based on such observations and tests he/she may require or perform.

C. Applicable Criteria, Tests and Standards:

1. Site Earthwork: Rough graded surface ready to receive rock surfacing shall be graded to ± 0.2 feet of the Plan elevation, except where meeting curbs, walks, or building entrances, grade to ± 0.1 feet of the Plan. However, the acceptance of such irregularities shall not be construed to reduce the thickness of rock or pavement. Permanent surface water courses shall be constructed to average plan grades and shall drain completely throughout their length. Finish surfaces shall be ± 0.1 feet of the Plan elevation, and all areas shall be finished so as to drain readily.
2. Earthwork for Structures: Tests as specified herein shall be taken on all prepared subgrade and compacted fill. Testing will be at the discretion of the Engineer.
3. Waste: Soil materials deemed unsuitable by the Engineer from tests or visual inspection, and all material delivered for fill or embankment, which cannot be satisfactorily compacted, shall be removed from the site and disposed of in a legal manner.
4. Clean-up: The Contractor shall remove all rubbish, debris, junk, and temporary materials, and dispose of in accordance with all applicable laws, regulations, permits and approvals from owners of property upon which the material will be disposed. The Contractor shall perform restoration of staging and storage areas and temporary roads to the satisfaction of the Engineer, as a condition for acceptance and final payment.
5. Standards for Soil Classification, Properties and Tests:
 - a. Earthwork and Embankment:
 - i. Classification – ASTM D2487.
 - ii. Physical Properties - ASTM D854, D2216.
 - iii. Compaction - Standard Proctor ASTM D698.
 - b. Controlled Fill and Backfill:
 - i. Classification - ASTM D2487.
 - ii. Atterberg Limits – ASTM D4318.
 - iii. Compaction – ASTM D698.
 - iv. Physical Properties – ASTM D854, D2216.
 - c. Borrow:
 - i. Classification - ASTM D2487.
 - ii. Other Properties - as determined by requirements at point of use.

1.09 COMPACTION

- A. The maximum dry density and optimum moisture content of each soil type used in the controlled compacted fill shall be determined in accordance with ASTM D698.
- B. Field density tests shall be determined in accordance with ASTM D698 or ASTM D6938.

1.10 INSPECTION

- A. Observation and compaction tests shall be as directed by the Engineer.
- B. Proof rolling in areas to receive pavement shall be accomplished with a loaded 10-ton dump truck with two (2) complete coverages in each of two perpendicular directions. Proof rolling shall be accomplished under the observation of the Engineer. Any areas which exhibit signs of instability or prior "pump" under the wheels of the loaded truck shall be undercut and replaced with clean, compacted fill, or crushed stone aggregate.
- C. All foundation subgrades shall be evaluated by the independent laboratory prior to covering the subgrade with fill, crushed stone or concrete. The Contractor shall provide access to the independent testing laboratory for testing purposes. The Engineer will verify that conditions are as anticipated and that required bearing capacity materials are available.
- D. The Engineer shall direct, as required, field density tests in the compacted materials below the surface where the surface is disturbed. When these tests indicate that the density of any layer of fill or portion thereof is below the specified density, the particular layer or portion shall be reworked until the specified density has been obtained.

PART 2 - PRODUCTS

2.01 FILL AND BACKFILL MATERIALS

- A. General: Fill and backfill material shall consist of select material obtained from the excavation, imported material, bedding material, or unclassified material. The Contractor shall import, at its expense, materials in excess of the approved material obtained from excavation as required to complete the fill, backfill, and grading Work as indicated.
- B. Controlled fill shall consist of any material imported or excavated from the cut areas that, in the opinion of the Engineer, is suitable for use in constructing fills. The material shall be free of debris and contain no rocks or hard lumps greater than 6 inches in size. Materials greater than 4 inches in size shall be placed by the Contractor so that they are surrounded by compacted fines; no nesting of rocks shall be permitted. No material of perishable, spongy, or otherwise improper nature shall be used in filling.
- C. Representative samples of material to be used for fill shall be tested by the independent testing laboratory in order to determine the maximum density, optimum moisture content and classification of the soil. In addition, the independent testing laboratory shall determine the approximate bearing value of a recompacted saturated sample by direct shear test or other test applicable to the particular soil.
- D. During grading operations, soil types other than those analyzed in the report of the soil investigation may be encountered by the Contractor. The independent testing laboratory shall be consulted to determine the suitability of these soils.
- E. No. 89 stone is required below all slabs and foundations to virgin soil or rock. Structural fill as defined herein is acceptable in lieu of No. 57 stone in all other structural fill applications.

- F. **Select Material:** Select material shall consist of primarily granular material obtained from the excavation which is free of vegetation, organic matter, rubbish, debris, rocks larger than 4 inches in diameter and other unsuitable material, has an expansion index less than 30 (less than 20 for footings and floor slabs) as determined by ASTM D4829, has a plasticity index of 10 or less, has a liquid limit of 30 or less, and is approved as select material by the Engineer.
- G. **Structural Fill and/or Backfill Materials** shall consist of select granular material approved by the Soils Engineer.
 - 1. The select granular material shall be import beach, dune or river sand, free of organic material, lumps, adherent films of clay or other unsuitable materials. The gradation for select granular material shall be well within the following limits:

Sieve Size	%Finer
3/4-inch	100
No. 4	30 – 85
No. 40	10 – 50
No. 200	0 – 8
- H. **Imported Material:** Imported material shall conform to the same specifications as select material defined above. Imported material placed in areas to be planted shall be able to support normal plant growth. The Contractor shall obtain approval by the Engineer before transporting imported material.
- I. **Bedding Material:** Bedding material shall be sand, gravel, crushed aggregate or free draining material.
- J. **Unclassified Material:** Unclassified excavation is defined as all excavation regardless of the type, nature, or condition of the materials encountered.

2.02 ROCK PRODUCTS

- A. Rock products, consisting of crushed rock, rock dust, gravel, sand, and stone for riprap shall be clean, hard, sound, durable, uniform in quality and free of disintegrated material, organic matter, oil, alkali, or other deleterious substance.

2.03 TOPSOIL

- A. Topsoil shall consist of friable clay or sandy loam, free from roots, stones, and other undesirable material and shall be capable of supporting a good growth of grass.

2.04 GEOTEXTILE FILTER FABRIC

- A. Geotextile filter fabric shall conform to the requirements of GDOT Section 881 - Fabrics

2.05 PIPELINE MARKING TAPE

- A. Plastic tape shall be provided and installed along the entire length of buried pipelines. Tape shall be minimum 4 mil thick polyethylene which is impervious to alkalis, acids, chemicals, and solvents which are likely in the soil. Tape shall be 12 inches wide and lettering shall be 1 inch tall permanent black on a blue background.

PART 3 - EXECUTION

3.01 GENERAL

- A. The Contractor shall perform earthwork as necessary to complete the Work as shown on the Contract Drawings and specified herein. The Contractor shall take the necessary precautionary measures to prevent dust or other nuisances which might be created by reason of his/her activities.
- B. All types of earthwork, including trench, structural and general excavation, fill, backfill and compaction, shall conform to applicable requirements of the City of Valdosta and to the requirements specified herein.
- C. Seventy-two (72) hours before the start of excavation, the Contractor shall notify the Utilities Protection Center and known owners of underground facilities in the area who are not members of the Utilities Protection Center of the proposed excavation.

3.02 DUST CONTROL

- A. The Contractor shall take all steps possible to prevent and reduce dust arising from the construction activity.
- B. The necessary precautionary measures shall include, but are not limited to the following:
 - 1. All unpaved construction areas shall be wetted at least twice daily during excavation and construction, and temporary dust covers shall be used to reduce dust emissions.
 - 2. The Contractor shall keep the construction area sufficiently dampened to control dust caused by construction and hauling, and at all times provide reasonable control of dust caused by wind.
 - 3. All loads shall be secured by trimming, watering, or other appropriate means to prevent spillage and dust.
 - 4. All materials transported off-site shall be either sufficiently watered or securely covered to prevent excessive amount of dust.
 - 5. All earth moving or excavation activities shall be discontinued during periods of high winds (i.e., greater than 15 mph), so as to prevent excessive amounts of dust.
 - 6. The Contractor shall maintain and operate construction equipment so as to minimize exhaust emissions.

3.03 CARE OF DRAINAGE WATER

- A. The Contractor shall take care of drainage water from the construction operations, and of stormwater and wastewater reaching the construction area from any source, so that no damage will be done to the excavation, piping or structures. The Contractor shall be responsible for any damages to persons or property on or off the construction site due to such drainage water or to the interruption or diversion of such stormwater or wastewater on account of the Contractor's operations.
- B. Such grading shall be done as may be necessary to prevent surface water from flowing into excavations, and any water accumulating therein shall be removed by pumping or by other

approved methods. Pumped water shall not be discharged directly to surface waters, but shall be directed to the nearest sedimentation basin available.

3.04 SITE PREPARATION

- A. Areas to be excavated, filled, graded, and to be occupied by permanent construction or embankments shall be prepared by clearing, grubbing and stripping. Clearing, grubbing and stripping shall conform to this Section. The Contractor shall provide for a Storm Water Pollution Prevention Plan in accordance with the requirements of the Georgia Stormwater Management Manual.

3.05 EXCAVATION

- A. General: The Contractor shall perform all excavation necessary or required as shown on the Drawings. Except when specifically provided to the contrary, excavation shall include the removal of all materials of whatever nature encountered, including all obstructions of any nature that would interfere with the proper execution and completion of the work. Unless otherwise directed, the removal of said materials shall conform to the lines and grades shown. Unless otherwise provided, the entire construction site shall be stripped of all vegetation and debris, and such material shall be removed from the site prior to performing any excavation or placing any fill. The Contractor shall furnish, place, and maintain all supports and shoring that may be required for the sides of the excavations, and all pumping, ditching, or other measures for the removal or exclusion of water as required by Section 02240 - Dewatering. Excavations shall be sloped or otherwise supported in a safe manner in accordance with the rules, orders, and regulations of OSHA.
- B. Equipment Foundations: The existing soil materials in the top two feet of those areas below the proposed structures shall be removed. The subgrade shall then be proof rolled in the presence of the Engineer prior to placement of controlled fill.
- C. Unclassified Excavation: Unclassified excavation shall consist of all excavation, including roadways, unless separately designated.
 - 1. Unsuitable material shall be excavated and disposed of as directed by the Engineer.
 - 2. Wet material, if unsatisfactory for the specified use on the project solely because of high moisture content, may be processed to reduce the moisture content, or may be required to be removed and replaced with suitable material.
 - 3. Excavation slopes shall be finished in conformance with the lines and grades shown.
 - 4. Surplus material shall be disposed of as directed by the Engineer.

3.06 TRENCH EXCAVATION, BEDDING AND BACKFILLING

- A. Excavation:
 - 1. General: Unless otherwise shown or ordered, excavation for pipelines and utilities shall be open-cut trenches. Trench widths shall be kept as narrow as is practical for the method of pipe zone densification selected by the Contractor.
 - 2. Sheeting, Shoring, and Bracing of Excavations: The manner of sheeting, shoring, and bracing excavations shall be as set forth in the rules, orders and regulations of OSHA, and in accordance with the requirements of the City of Valdosta. Sheeting, shoring and bracing shall be provided for the protection of life and limb, for the protection of existing

underground and above ground structures and improvements, and shall conform to applicable safety orders. Sheeting, shoring and bracing shall be provided to prevent trench sluffing, pavement separation and similar problems during construction, and shall include furnishing, installation, maintenance, and removal.

3. Bracing Trenches: The sides of the trenches shall be supported in such a manner as to prevent caving of the sides of the trench. Space left by withdrawal of sheeting or shoring shall be filled completely with dry granular material blown or rammed in place. All trenches deeper than 5 feet shall be shored unless cut to the angle of repose of the excavated soils.
4. Open Trench: The maximum length of open trench permitted in any one location shall be 300 feet or the length necessary to accommodate the amount of pipe installed in a single day, whichever is greater. All trenches shall be fully backfilled at the end of each day or, in lieu thereof, shall be covered by heavy steel plates adequately braced and capable of supporting vehicular traffic in those locations where it is impractical to backfill at the end of each day. The top of the steel plates shall be set flush with the top of the adjacent pavement, and the plates shall be surfaced for improved vehicular traction. The above requirements for backfilling or use of steel plate will be waived in cases where the trench is located further than 100 feet from any traveled roadway or occupied structure. In such cases, however, the Contractor shall provide and maintain barricades and warning lights conforming to requirements set forth in the GDOT Standards.
5. Minimum Width of Trench: For pipes 4 inches and larger, the minimum width of pipe trenches, measured at the crown of the pipe, shall not be less than 12 inches greater than the exterior diameter of the pipe, exclusive of bells and the minimum base width of such trench shall be not less than 12 inches greater than the exterior diameter of the pipe, exclusive of special structures or connections, and such minimum width shall be exclusive of all trench supports. For pipelines installed in common trenches, provide a 12 inch minimum clearance between lines unless otherwise shown on the Drawings.
6. Maximum Width of Trench: The maximum allowable width of trench for all pipelines 4 inches and greater, measured at the top of the pipe shall be the outside diameter of the pipe (exclusive of bells or collars) plus 24 inches, and such maximum shall be inclusive of all timbers. A trench wider than the outside diameter plus 24 inches may be used without special bedding if the Contractor, at his/her expense will furnish pipe of the required strength to carry the additional trench load. Such modifications shall be submitted to the Engineer and approved in writing. Whenever such maximum allowable width of trench is exceeded for any reason, except as provided for on the Plans or in the Specifications, or by the written direction of the Engineer, the Engineer shall, at his/her discretion, require that the Contractor, at his/her own expense for all labor and materials, cradle the pipe in Class B concrete, or other approved pipe bedding.
7. Maximum Length of Open Trench: Except by special permission by the Engineer, only that amount of pipe construction which can be completed in one day will be permitted. Maximum length of open trench shall never exceed 300 feet. This length includes open excavation, pipe laying and appurtenant construction and backfill which has not been temporarily resurfaced.
8. Where pipelines are to be installed in embankment fills, the fill shall be constructed to a level at least 1 foot above the top of the pipe before the trench is excavated.
9. Trench Side Slopes:
 - a. Temporary trench excavations shall, at all times, conform to the safety requirements herein before specified in Paragraph entitled "Safety."

- b. Loose cobbles or boulders shall be removed from the sides of the trenches before allowing workers into the excavation, or the trench slopes must be protected with screening or other methods. Trench side slopes shall be kept moist during construction if required to prevent local sloughing and raveling. A top of slope setback of at least 10 feet from any structure or 5 feet from outside edge of pavement shall be maintained. Surcharge loads due to construction equipment shall not be permitted within 5 feet of the top of any excavated slope.
 - c. If the Contractor elects to shore or otherwise stabilize the trench sides, they shall file with the Engineer for review, copies of drawings prepared and signed by a Civil Engineer duly registered in the State of Georgia before commencing excavation.
10. Excess Trench Excavation: If any trench, through the neglect of the Contractor, be excavated below the bottom grade required, it shall be refilled to the bottom grade, at the Contractor's expense for all labor and material, with specified bedding material compacted to a firm stable foundation.

B. Pipe Bedding:

1. Where indicated or as directed by the Engineer, the Contractor shall excavate below the bells or couplings for the full width of the trench and shall place bedding upon which the pipe is to be laid. Bedding shall be excavated native trench material for RCP and DIP and shall be select granular material for PVC and HDPE. Bedding for HDPE storm pipe shall be class I, II, or III material as defined in section 02630. In cases, as determined by the Engineer, where trench materials are suitable for use as bedding, the trench may be excavated to a point above the invert grade, and the trench bottom shaped so that the bottom segment of the pipe is firmly supported on undisturbed material.
2. At pipe subgrade, if moisture content of foundation soil exceeds the material's optimum moisture content by 2%, or if the trench is soft, wet, spongy, unstable or does not afford solid foundation for pipe, the Contractor shall excavate as directed by the Engineer and provide stable base for placement of pipe bedding.
3. Where rock, boulders or rubble is encountered in the trench, the Contractor shall excavate to a minimum 6 inch depth below subgrade or as the Engineer decides is necessary, and shall construct a base by placing crushed rock bedding upon which the pipe can be laid.
4. Before any pipe is lowered in place, the trench bottom or bedding shall be prepared so that each pipe will have a firm and uniform bearing over the entire length of the barrel and a width equal to one-half the outside diameter of the pipe. All adjustments in line and grade shall be made by scraping away or filling and tamping in under the barrel of the pipe. Wedging or blocking is not permitted.

C. Backfilling Pipe Trenches:

1. Backfilling Pipe Zone: Select backfill material for the pipe zone shall consist of herein before specified material or native or imported granular material as approved by the Engineer in advance of placement. Place material in the trench simultaneously on each side of the pipe for the full width of the trench and the depth of the pipe zone in layers 6 inches in depth. Each layer shall be thoroughly compacted by tamping. In all cases, backfilling of the pipe zone must be done by hand. Particular attention shall be given to underside of the pipe and fittings to provide a firm support along the full length of the pipe. The pipe zone shall be considered to extend 12 inches above the top of the pipe, and shall be compacted to a compaction of not less than 90% of maximum dry density at or slightly above optimum

moisture content by ASTM D698. Care shall be taken not to damage pipe or special coatings on the pipe.

- a. For PVC Pipe, use material and methods recommended in writing by pipe manufacturer for pipe bedding and for backfill material within pipe zone.
 - b. Use of Materials other than those specified shall be approved by the Engineer prior to use. The Contractor shall bear all cost of removal of rejected material, its hauling to an authorized disposal site, and cost of providing required material to complete the bedding and backfilling.
2. Backfilling Pipe Trench: After the pipe has been laid in the trench and has been inspected and approved, and backfilling in the pipe zone is complete and compacted, the remainder of the trench may be backfilled. The backfill material shall be suitable fill material or sand, free from all stones, clods or other deleterious material. Care shall be taken to ensure that no voids remain under, around or near the pipes.
3. Placement and Compaction of Trench Backfill:
- a. Unless otherwise shown or specified, Backfill shall be mechanically compacted by means of tamping rollers, sheepfoot rollers, pneumatic tire rollers, vibrating rollers, or other mechanical tampers to 90% of maximum density at optimum moisture.
 - b. Trench backfill under buildings or pavement shall be completed to a minimum of 95% of maximum dry density at optimum moisture.
 - c. The upper two feet of trench backfill which will subsequently support pavements or grade slabs should be further compacted to at least 98% of the soil's standard Proctor maximum dry density.
 - d. All compaction equipment shall be of size and type approved by the Engineer.
 - e. Impact-type pavement breakers (stompers) will not be permitted over any pipe.
 - f. Permission to use specific compaction equipment shall not be construed as guaranteeing or implying that the use of such equipment will not result in damage to adjacent ground, existing improvements, or improvements installed under the Contract.
 - g. Mechanically compacted backfill shall be placed in horizontal layers not exceeding 8 inches.
 - h. Each layer shall be evenly spread, the moisture content brought to near optimum condition and then tamped or rolled until the specified compaction has been attained.

D. General Pipeline Installation Requirements:

1. Depth of Pipe: Install pipelines at the depths shown on the Drawings. If elevations are not shown, piping shall be installed with cover adequate to resist construction loads.
2. Changes in Line and Grade:
 - a. In the event obstructions not shown on the plans are encountered during the progress of the work which will require alterations to the plans, the Engineer shall have the authority to change the plans and order the necessary deviation from the line or grade.
 - b. The Contractor shall not make any deviation from the specified line and grade without approval by the Engineer.
 - c. Should any deviations in line and grade be permitted by the Engineer in order to reduce the amount of rock excavation or for other similar convenience to the Contractor, any additional costs for extra pipe footage, pipe appurtenances, concrete, sewer structures, or other additional costs shall be borne by the Contractor.

3. Installing Pipe:
 - a. Contractor shall, after excavating the trench and preparing the proper bedding for the pipe, furnish all necessary facilities for properly lowering and placing sections of the pipe in the trench without damage and shall properly install the pipe. The section of pipe shall be fitted together correctly and shall be laid true to line and grade.
 - b. Pipe shall be laid up grade. Any pipe which is not in true alignment, both vertical and horizontal, or shows any undue settlement after laying shall be replaced when so ordered by the Engineer. No pipe shall be laid which is damaged, cracked, checked or spalled or has any other defect deemed by the Engineer to make it unacceptable, and all such sections shall be permanently removed from the Work.

3.07 PLACING, SPREADING, AND COMPACTING CONTROLLED FILL MATERIAL

- A. Fill material shall be placed in thin layers that shall not exceed 8 inches in loose measure.
 1. Each layer shall be spread evenly and shall be thoroughly mixed during the spreading to obtain uniformity of material in each layer.
 2. The moisture content of the fill material shall be within 2% of optimum as determined by ASTM D698.
 3. Some moisture adjustment will most likely be necessary to achieve the recommended compaction criteria, particularly where they are excavated from near or below the groundwater level.
- B. When the moisture content of the fill material is below that specified, water shall be added until the moisture content is as specified.
- C. When the moisture content of the fill material is above that specified, the fill material shall be aerated by blading, mixing, or other satisfactory methods until the moisture content is as specified. Fill material may be spread to dry in areas of site approved by the Owner.
- D. After each layer has been placed, mixed and spread evenly, it shall be thoroughly compacted to the specified density. Controlled fill shall be compacted to a density not less than 90% of the maximum dry density as determined by ASTM D698.
 1. Compaction shall be accomplished by sheepsfoot rollers, vibratory rollers, multiple-wheel pneumatic-tired rollers or other types of acceptable compacting equipment.
 2. Equipment shall be of such design that it will be able to compact the fill to the specified density.
 3. Compaction shall be continuous over the entire area and the equipment shall make sufficient passes over the material to ensure that the desired density has been obtained.
- E. Surface of fill slopes shall be compacted so that the slopes are stable and there shall be no excessive loose soil on the slopes. Finished slopes shall be no steeper than 3H:1V, unless otherwise shown or specified.

3.08 PLACEMENT AND COMPACTION OF STRUCTURAL FILL AND BACKFILL

- A. Before beginning filling or backfilling, all debris and foreign material, including water, shall be removed and the area shall be inspected and approved by the Engineer. Sloping sides of the excavations shall be stepped to prevent wedging action of the backfill against the structure.

- B. Structural fill should be placed in relatively thin lifts (8 inches maximum) and be uniformly compacted to at least 95% of the soil's standard Proctor maximum dry density as determined by ASTM D698. The upper foot of trench backfill which will subsequently support pavements or grade slabs should be further compacted to at least 98% of the soil's standard Proctor maximum dry density. During fill placement, a sufficient number of in-place density tests will be performed by the independent testing laboratory to verify the required compaction criteria has been met. Areas that do not comply with the compaction specification during the earthwork shall be recompacted until passing tests are achieved.
- C. Backfill shall be placed in uniform layers on opposite sides of structures and walls where applicable before compaction. Any damage to structures shall be repaired (or replaced) at no cost to the Owner. It shall be the sole responsibility of the Contractor to coordinate backfill placement techniques and methods with the Engineer. Permission to use specified compaction equipment shall not be construed as guaranteeing or implying that the use of such equipment will not result in damage to adjacent ground, existing improvements, or improvements installed under the Contract.
 - 1. Backfill shall not be placed around water bearing structures until leakage testing has been performed. Contractor shall be responsible for maintaining a dewatered excavation until backfilling is completed.
 - 2. Flooding, jetting or ponding will not be permitted for the compaction of any structure backfill.
 - 3. A minimum of one density test shall be performed for every 100 linear feet of wall or trench backfill for each 2-foot vertical increment.

3.09 CLEANUP

- A. Upon completion of work in this Section, all rubbish and debris shall be removed from the job site.
- B. All construction equipment and implements of service shall be removed and the entire area involved shall be left in a neat, clean and acceptable condition.

3.10 DISPOSAL OF SURPLUS AND/OR UNSUITABLE MATERIALS

- A. Excavated materials which are determined by the Engineer to be unsuitable for use in backfill or compacted fills or excavated material that is in excess of that required to be used for backfill or to construct fills shall be disposed of offsite at the Contractor's expense unless approved by the Owner to be wasted onsite.
- B. Over-Excavation Ordered by Engineer: Trenches shall be over-excavated beyond the depth shown when required by the Engineer. Such over-excavation shall be to the depth ordered by the Engineer. The over-excavation shall then be backfilled using $\frac{3}{4}$ inch crushed rock underlain by an approved woven geotextile. The Contractor shall then place bedding material over the crushed aggregate. All work specified in this Section shall be performed by the Contractor at no additional cost to the Owner when the over-excavation ordered by the Engineer is within 6 inches of the limit shown on the Drawings. When the over-excavation ordered by the Engineer is 6 inches more than the limit shown on the Drawings, additional payment will be made to the Contractor for the portion that exceeds the said 6-inch distance.

- C. Over-Excavation not Ordered or Indicated: Any over-excavation carried below the grade ordered or indicated shall be backfilled to the required grade with material designated by the Engineer and the material shall be compacted. Such work shall be performed by the Contractor at no additional cost to the Owner.
- D. Excavation in Vicinity of Trees: Except where trees are shown to be removed, trees shall be protected from injury during construction operations. No tree roots over 2 inches in diameter shall be cut without written permission of the Engineer. Trees shall be supported during excavation by means previously reviewed by the Engineer.

3.11 PREPARATION OF SUBGRADE

- A. The preparation of subgrade for pavement, curbs and gutters, driveways, sidewalks and other roadway structures shall be in accordance with GDOT Standards and Specifications.

3.12 TEMPORARY STOCKPILES

- A. Locations of temporary stockpiles shall be approved by the Engineer.
- B. Temporary stockpiles shall not surcharge buried pipe, conduits, or other structures.

END OF SECTION 02222

SECTION 02230
SITE PREPARATION

PART 1 - GENERAL

1.01 SCOPE

- A. The Contractor shall furnish all materials, equipment, and labor necessary to prepare the site including clearing, grubbing and stripping.
- B. Related Sections include but are not necessarily limited to:
 - 1. Section 01500 – Construction Facilities and Temporary Controls.
 - 2. Section 02222 – Excavation, Trenching, and Backfill.
 - 3. Section 02240 – Dewatering.

1.02 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

- A. Except as otherwise indicated in this Section, the Contractor shall comply with the City of Valdosta's Standard Specifications.

1.03 CONTRACTOR SUBMITTALS

- A. Before starting the Work, the Contractor shall have submitted a Storm Water Pollution Prevention Plan in accordance with the requirements of Section 01500 – Construction Facilities and Temporary Controls.
- B. Before completion of the Work, the Contractor shall submit an Affidavit of Legal Disposal attesting to the lawful disposal of all materials removed by clearing, grubbing, and stripping.

1.04 DEFINITIONS

- A. The following definitions apply to the Work of this Section:
 - 1. Clearing is defined as cutting trees, removing fences and posts, removing curbs and other improvements to prepare the site for grubbing and stripping.
 - 2. Grubbing is defined as the below grade part of clearing to remove roots, small piping, irrigation systems, etc., to prepare the site for stripping.
 - 3. Stripping is defined as removing a surface layer of soil and organic material, sod, topsoil, and other unsuitable material as defined in Section 02222 – Excavation, Trenching, and Backfill, to a depth that earthwork can proceed.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 GENERAL

- A. Existing Conditions: The site shall be examined and the Engineer notified of any conditions which affect the Work of this Section.
- B. Utility Interference: Where existing utilities interfere with the Work of this Section, the Engineer shall be notified of interferences, and notifications to the relevant departments and utilities shall be provided.

3.02 CLEARING, GRUBBING AND STRIPPING

- A. Clearing, grubbing and stripping shall comply with the following:
 - 1. All construction areas shall be cleared of grass and weeds to at least a depth of 6 inches and cleared of structures, concrete or masonry debris, trees, logs, upturned stumps, loose boulders, and any other objectionable material of any kind which would interfere with the performance or completion of the Work, create a hazard to safety, or impair the Work's subsequent usefulness or obstruct its operation. Loose boulders within 10 feet of the top of cut lines shall be incorporated in landscaping or removed from the site. Trees and other natural vegetation outside the actual lines of construction shall be protected from damage during construction, as directed by the Engineer.
 - 2. Within the limits of clearing, the areas below the natural ground surface shall be grubbed to a depth necessary to remove all stumps, roots, buried logs, and all other objectionable material. Septic tanks, drain fields, and connection lines and any other underground structures, debris or waste shall be completely removed if they are found on the site.
 - 3. The entire area to be affected by construction shall be stripped of topsoil to a depth to be determined by the Engineer during construction as successive 6 inch layers are removed to expose the underlying material. If the exposed material contains organic or other material not suitable for use as part of the earthwork in accordance with Section 02222 – Excavation, Trenching, and Backfill, additional layers of material shall be removed, down to as much as 2.5-feet below the existing ground contours, until all the topsoil is removed. The stripped materials shall be stockpiled and incorporated into landscaped areas or other nonstructural embankments.
 - 4. Unless otherwise indicated, native trees larger than 3-inches in diameter at the base shall not be removed without the Engineer's approval. The removal of any trees, shrubs, fences, or other improvements outside of rights-of-way as deemed necessary, shall be arranged with the property owner and be removed and replaced at no increased cost to the Owner.
 - 5. Except in areas to be excavated, stump holes and other holes resulting from the Work shall be backfilled with suitable material in accordance with Section 02222 – Excavation, Trenching, and Backfill.
 - 6. Low hanging branches and unsound or unsightly branches on trees or shrubs designated to remain, shall be removed as directed, but only after the Engineer has visited the site and provided written instructions.

END OF SECTION 02230

SECTION 02240

DEWATERING

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Requirements specified in Drawings.
- B. Provide all labor, equipment, materials and perform all work of design, construction, operation and maintenance of effective dewatering and recharging systems to ensure a safe and dewatered condition of all areas in which work will be performed.
- C. Continue operation and maintain dewatering systems as required to complete the Contract Work and to protect adjacent property or construction until there is no longer potential for damage resulting from rise or fall of groundwater or inflow of surface water.
- D. Remove or relocate equipment when no longer required, and as approved by the Engineer. Well-points shall be removed or closed in accordance with EPD procedures.
- E. Principal items of Work included in this Section:
 - 1. See Geotechnical Report for subsurface conditions in project area. Conduct additional subsurface investigations as required and provide dewatering system design.
 - 2. Furnish and install well-points, headers, sand or gravel packing and make necessary connections.
 - 3. Furnish, install and connect pumps and discharge lines.
 - 4. Drill wells and install pumps and discharge lines.
 - 5. Service and operate systems effectively.
 - 6. Install and operate surface pumping equipment in conjunction with surface channels and conduits to prevent the entry of surface water into the Work Area.
 - 7. Remove or relocate dewatering facilities when no longer required. As approved in each instance, well-points and like items may be abandoned in place.
- F. Related Sections include but are not necessarily limited to:
 - 1. Section 01300 – Submittals.
 - 2. Section 02222 – Excavation, Trenching, and Backfill.

1.02 QUALITY ASSURANCE

- A. Qualifications: Furnish the services of an experienced, qualified, and equipped dewatering subcontractor to design and operate the dewatering systems required for the Work. In lieu of the above, the Contractor may do the dewatering in accordance with a system approved by the Engineer and designed and sealed by a civil engineer who is registered in the State of Georgia and who has proven experience in this type of work.

- B. Water shall be kept out of all excavations.

1.03 SUBMITTALS

- A. The Contractor will provide submittals for dewatering in accordance with requirements of Section 01300 – Submittals.
- B. Prior to commencing work, prepare shop drawings showing the locations of the various dewatering systems with respect to the area to be dewatered and submit to the Engineer for review. Indicate thereon the outline of proposed permanent structures, depth to lowest point of excavation, well or well-point systems, and point of discharge.
- C. All designs submitted shall be signed by an engineer duly registered in the State of Georgia.

1.04 ALTERNATIVES

- A. Groundwater may be high and seasonally variable at excavations.
- B. Dewatering systems shall effectively intercept and remove water from the surrounding strata and thus prevent its entry into the excavation.
- C. The employment of alternatives to achieve this objective may be required, including measures to cause flow of the groundwater vertically by construction of pervious channels.
- D. Reliance shall not be placed solely on sheeting to protect work areas.

PART 2 - PRODUCTS

2.01 COMPONENTS OF THE DEWATERING SYSTEM

- A. Provide units of standard manufacture and in good working order.
- B. Unserviceable parts and equipment shall be removed from the jobsite.
- C. Major equipment for which repair parts are unavailable from local suppliers shall be considered obsolete and therefore not acceptable.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Coordination: Lay out and install dewatering installations beyond the limits of the permanent works. Avoid interference with access or other necessary activities.
- B. Barricades, Shelters, and Safety: Provide protections for vital parts from accidental damage or freezing, and erect signs and barricades to isolate hazardous areas.

3.02 PERFORMANCE

- A. Dewatering: Perform dewatering operations as required so all underground and below-grade Work is performed or installed in dry excavations, excepting only that Work specified for installation in wet excavations. Groundwater shall be maintained a minimum of 2 feet below the bottom of the lowest excavated grade. Maintain dewatering systems in continuous operation until the involved Work is completed, including the placing and compaction of backfill materials in the dry.
- B. Protection of Existing Facilities: Contractor shall provide standby equipment of sufficient size and capacity to ensure continuous operation of the dewatering systems. Where any sloped excavation infringes on or potentially endangers any existing facilities or structures, provide shoring, sheeting, and bracing according to shop drawings and calculations signed and sealed by a structural or civil engineer registered in the State of Georgia. File a copy of such plans and calculations with the Engineer for record purposes. At Contractor's expense and to the Engineer's satisfaction, the Contractor shall repair and make good all damage or settlement to the foundation or other portion of any new or any existing facilities or structures caused by permanent or temporary failure or operation of the dewatering system or by failure to maintain the existing groundwater level outside the dewatered areas.
- C. Drainage: During the life of this Contract, provide and maintain ample means to promptly and effectively remove water from all areas of Work, to prevent the entry of harmful quantities of water into the excavations and to dispose of the water removed. Avoid environmental damage and nuisance.
- D. Removal: Remove equipment when no longer required for dewatering or water controlling operations. Maintain operation of monitoring and settlement measurement systems until their removal is approved. To the extent approved, well-points and like items may be abandoned in place, otherwise all temporary works, dewatering and/or recharging facilities shall be removed in a manner satisfactory to the Engineer.
- E. Closure: Dewatering wells shall be closed when dewatering operations are no longer required and when approved by the Engineer. Dewatering wells and piezometers shall be closed in accordance with EPD procedures. Provide certification as required by EPD for well closure.

3.03 SURFACE DISCHARGE

- A. Protection of the environment: Adhere to all federal, state and local requirements and obtain all necessary permits for discharge of water to the Withlacoochee watershed.

END OF SECTION 02240

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SECTION 02440

SOIL EROSION, SEDIMENT, AND POLLUTION CONTROL

PART 1 - GENERAL

1.01 SCOPE

- A. The Work covered in this section consists of furnishing all labor, equipment, materials, tools, and other related items required to install slope protection, and sediment and erosion control devices. The Contractor is responsible for implementing best management practices (BMP) to prevent and minimize erosion and resultant sedimentation in all cleared and grubbed areas during and after construction. This Section covers the work necessary for the installation of structures and measures for the prevention and control of soil erosion. The Contractor shall furnish all material, labor and equipment necessary for the proper installation, maintenance, monitoring, reporting and removal (where applicable) of erosion prevention and control measures to cause compliance with the NPDES General Permit GAR 100001 for Storm Water Discharges Associated with Construction Activity for Infrastructure Construction Projects under this Section.
- B. Related Sections include but are not necessarily limited to:
1. Section 01300 – Submittals.
 2. Section 02222 – Excavation, Trenching and Backfill.
 3. Section 02920 – Lawns and Grasses.

1.02 REFERENCES

- A. Contractor shall be familiar with the following reference documents and keep those at the construction site at all times. These documents need to be complied with as applicable.
1. General NPDES Permit for Storm Water Discharges from Construction Activities (NPDES Permit GAR 100001);
 2. Manual for Erosion and Sediment Control In Georgia (Green Book), Latest Edition;
 3. Department of Transportation, State of Georgia Standard Specifications, Construction of Transportation Systems, (GDOT Specifications);
 4. National Stone, Sand and Gravel Association, Aggregate Classification (NSSGA Classification);
 5. City of Valdosta Stormwater Ordinance;
 6. Erosion, Sedimentation and Pollution Control Plan, (ESPCP) as required by the NPDES Permit;
 7. Comprehensive Monitoring Plan (CMP) as required by the NPDES Permit.
- B. All work and materials shall conform to the applicable federal, state and local requirements. In case of conflict between any requirements set forth in these Specifications and any provisions of said requirements, the more stringent requirements shall control.

1.03 DEFINITIONS

- A. Qualified Personnel. For purposes of this Section, the term Qualified Personnel means a person who has successfully completed an erosion and sediment control short course eligible for continuing education units, or an equivalent course approved by Environmental Protection Division of the Georgia Department of Natural Resources and the Georgia Soil and Water Conservation Commission.

1.04 REGULATORY COMPLIANCE

- A. Land disturbance activities are not authorized to begin until after all required erosion and sediment control submittals and/or permits are obtained from the United States, the State of Georgia, and/or the City. The Contractor shall become thoroughly familiar with GAR 100001 NPDES permit and all requirements. The Contractor is the Operator under the provisions of the NPDES Permit and shall be responsible for maintaining compliance with this permit. As Operator, the Contractor will be required to sign certain certifications as described in the NPDES Permit. The Contractor shall comply with requirements specified in the Contract Documents or by the Engineer. The Contractor shall also comply with all other laws, rules, regulations, ordinances and requirements concerning soil erosion and sediment control established in the United States, the State of Georgia, and/or the City. The following documents and the documents referenced therein define the regulatory requirements for this section.
 - 1. NPDES PERMIT: The Georgia National Pollutant Discharge Elimination System (NPDES) General Permit for Storm Water Discharges Associated with Construction Activity for Infrastructure Construction Projects governs land disturbance or construction activities of one (1) acre or more. On applicable sites, the Contractor is responsible for complying with terms and conditions of this permit.
 - 2. Manual for Erosion and Sediment Control in Georgia: The Contractor shall follow Practices and Standards of the Georgia Soil and Water Conservation Commission, Manual for Erosion and Sediment Control in Georgia.
 - 3. Erosion, Sedimentation and Pollution Control Plan: The Erosion, Sedimentation and Pollution Control Plan (ESPCP) is provided in the Contract Documents. The Contractor shall follow the practices described in the ESPCP, and provide/construct any other measures necessary for full compliance with the permit, whether specific structural erosion and sedimentation improvements are specifically shown on the drawings or not.

1.05 SUBMITTALS

- A. Submittals shall be made in accordance with the General Conditions of these Contract Documents, Section 01300 - Submittals, and the requirements of this Section.
- B. Provide product data for the following items:
 - 1. Graded stone;
 - 2. Filter fabric;
 - 3. Mulch;
 - 4. Silt fence fabric;

5. Rip-rap;
 6. Coarse aggregate;
 7. Fertilizer;
 8. Grass seed;
 9. Soil binders.
- C. Submit to the Engineer the proposed schedule for installation, maintenance, and removal of all temporary facilities and permanent erosion and sedimentation control measures. The schedule shall reflect the requirements of Paragraph 1.06 below (Sequence of Construction and Temporary Erosion Control Measures) and must show the anticipated starting and completion date for all land disturbance and development activities including:
1. Installation of temporary and permanent erosion and sedimentation control structures;
 2. Clearing operations;
 3. Grubbing operations;
 4. Grading operations;
 5. Pipeline installation;
 6. Wetwell construction and liner installation;
 7. Finish grading;
 8. Landscaping, including all seeding and sodding;
 9. Removal of temporary erosion and sedimentation control structures.

1.06 SEQUENCE OF CONSTRUCTION OF TEMPORARY EROSION CONTROL MEASURES

- A. Install all erosion and sedimentation control structures specified herein and shown in the Contract Documents, or as directed by the Engineer, as the first item of work within a given drainage area. Construction and installation of all erosion and sedimentation control structures shall begin down gradient of the area to be disturbed and proceed upgradient. The Contractor shall, at all times, maintain all soil erosion and sedimentation control structures and practices throughout construction and until permanent vegetation is established.

1.07 SPECIFIC REQUIREMENTS

- A. The requirements specified herein and shown in the Contract Documents are minimum requirements for the preventing or minimizing of soil erosion and sediment transport. The Contractor shall install and maintain soil erosion and sedimentation control measures in accordance with the following criteria. Requirements set forth in the Manual for Erosion and Sediment Control in Georgia shall govern in case of conflicting information, unless clearly identified as a deviation from the Manual.

PART 2 - PRODUCTS

2.01 SILT FENCE

- A. Filter Fabric. Install silt fence as shown on Drawings or as directed by the Engineer.

- B. Material Specifications: Silt Fence shall meet the requirements set forth in Section 171 – Silt Fence, of the Georgia Department of Transportation, (GDOT) Standard Specifications, Construction of Transportation Systems.
- C. Filter fabric must meet the requirements set forth in Section 881 – Fabrics, of the GDOT Standard Specifications, Construction of Transportation Systems. Silt fence fabric shall be from the GDOT Qualified Products List QPL-36. The Contractor shall submit to the Engineer copies of delivery invoices, certifications of other documentation that the filter fabric complies with these specifications, if requested by the Engineer.
- D. Posts. Posts shall be steel, meeting specifications in the Manual for Erosion and Sediment Control in Georgia.

2.02 STRAW BALES

- A. Bales shall be new, intact, and securely bound straw or hay capable of preventing the migration of sediment. Bales shall be wire or nylon bound and of a rectangular shape.
- B. Stakes capable of securing the bales in designated locations shall be wooden stakes a minimum of 4 feet long with nominal cross-sectional dimensions of 2 inches by 2 inches or minimum 4 feet long, No. 3 reinforcing bars. Provide a minimum two stakes per bale.

2.03 GRADED STONE

- A. Graded stone shall conform to requirements shown on the Drawings.
- B. Stone shall be used as listed.

Application	Stone Size	Specification
Construction Exit	1½ inches to 3½ inches	NSSGA R-2
Gravel Drop-type Inlet Sediment Traps	3 to 6 inches	NSSGA R-3
Check Dams	2 to 10 inches	NSSGA R-4
Stream Crossing	1½ inches to 3½ inches	NSSGA R-2
Storm Outlet (rip-rap)	--	Appendix C, Manual for Erosion and Sediment Control in Georgia

2.04 JUTE MESH

- A. A mesh matting fabricated of jute yarn. The yarn shall be unbleached, undyed and of loose twist. The unit weight of the yarn shall be at least 0.9 pounds per square yard but no more than 1.5 pounds per square yard. A 48-inch width shall show between 76 to 80 warpings and a one-yard length shall show between 39 and 43 weftings. The woven mesh shall be furnished in strips at least 45 inches wide.

- B. Anchoring staples shall be cold drawn wire not smaller than 14 gauge, formed into a “U” shape from a wire not less than 12 inches in length.

2.05 CONCRETE BLOCK

- A. Concrete block shall be 8-inch hollow block units of medium weight, grade N, conforming to ASTM C90 with an average compressive strength of 1900 psi.

2.06 CONSTRUCTION EXIT

- A. A geotextile underliner, conforming to Section 881.2.05, Plastic Filter Fabric, of the GDOT Standard Specifications, Construction of Transportation Systems, shall be used in all instances to stabilize and support the pad aggregate.
- B. Aggregate size will conform to the NSSGA R-2 classification for 1½ inch to 3½ inch stone.

2.07 SOIL BINDING AGENTS

- A. Soil binding agents shall consist of non-toxic, biodegradable materials that are environmentally safe. Application rates shall be as recommended by the manufacturer and shall meet the approval of the Engineer.

2.08 VEGETATIVE SOIL STABILIZATION

- A. Seed shall be clean, delivered in original unopened packages and bearing an analysis of the contents. Guaranteed 95% pure with minimum germination rate of 85% is required (see Contract Drawings for seed mix).
- B. Fertilizer shall be used as directed by the Engineer. Fertilizer shall be commercial, chemical type, uniform in composition, free-flowing, conforming to federal and state laws, and suitable for application with equipment designed for that purpose (see Contract Drawings for fertilizer composition).
- C. Straw mulch shall be threshed straw of oats, wheat, or rye, free from obnoxious weeds, or shall be clean hay. Average stalk length shall be 6 inches. Wood waste, asphaltic emulsion, or erosion control matting such as jute, or excelsior are also appropriate for temporary stabilization. Asphaltic emulsion shall be CSS-1 as manufactured by Chevron Asphalt Company, or an equal approved by the Engineer.
- D. Contractor shall submit to the Engineer, certificates of inspection of seed by federal or state authorities and copies of delivery invoices or other documentation of quantities of mulch and fertilizer.
- E. The Contractor shall give at least three days notice to the Engineer of the time and place of starting the following operations:
 - 1. Delivery of materials.
 - 2. Planting of grass.
- F. Contractor shall keep the Engineer advised of their schedule of operations.

- G. Unless otherwise specified or indicated, provide permanent vegetative stabilization with quantities and methods as recommended in the Manual for Erosion and Sedimentation Control in Georgia (Green Book) of fescue grass, topsoil, seed, and mulch. Plant and establish only during recommended planting seasons. Water, fertilize, and maintain vegetative cover until a thick and well established stand of grass has developed, but not less than 6 months.

2.09 LIME

- A. Pulverized dolomitic limestone with the following physical characteristics: minimum (by weight) of 70% passing a 200 mesh screen and 95% passing a 100 mesh screen. Chemical analysis: minimum 85% total calcium and magnesium carbonate content.

2.10 PROTECTIVE TREE FENCING

- A. Plastic safety fence made from UV stabilized high visibility orange polyethylene with 1¾ inches x 2 inches open diamond pattern, 48 inches high and 50 feet long.

2.11 MULCH

- A. Mulch straw from oats, wheat, rye, barley, or rice furnished in air-dry condition, free from weeds, mold, and other deleterious materials. Wood waste, asphaltic emulsion or erosion control matting such as jute or excelsior are also appropriate for temporary stabilization.

PART 3 - EXECUTION

3.01 SILT FENCE

- A. The silt fence shall be installed in accordance with the manufacturer's specifications.
- B. The approximate location of required erosion and sedimentation controls are shown on the Drawings.
- C. It shall be the responsibility of the Contractor to extend or upgrade erosion and sedimentation control devices or other protective measures whenever overland flow off-site is occurring in order to prevent the off-site migration of sediment.
- D. Installation: In general, silt fencing shall be installed on the downgradient side of all areas to be disturbed as well as the perimeter of the project site (Engineer may authorize an exception for a perimeter which is upgradient from all land disturbing activity). All posts (including penetration and spacing values) used to install silt fence shall comply with the specifications in the Manual for Erosion and Sediment Control in Georgia. Fence fabric must be inserted below ground and fence fabric must be fastened to posts according to the specifications in the Manual. Provide a minimum of two rows of fence adjacent to streams, rivers, or other water courses, whether shown on the drawings or not.
- E. Maintenance: Per Manual for Erosion and Sediment Control in Georgia and NPDES requirements.

3.02 STRAW BALES

- A. Installation: Place bales in a row with ends tightly abutting the adjacent bales. Corner abutment is not acceptable. Embed bales in the soil a minimum of 4 inches below grade. Build up backfilled soil a minimum of 4 inches above grade on the uphill side of the barrier and conform to grade on the downhill side of the barrier. Anchor each bale in place with wooden stakes or No. 3 reinforcing bars. The first stakes shall be driven toward the previously laid bale to force the bales together. Stakes shall reach a minimum of 18 inches into the ground.
- B. Maintenance: Per Manual for Erosion and Sediment Control in Georgia and NPDES requirements.

3.03 CONSTRUCTION EXIT

- A. Installation: Construction exits should be located at points where traffic will be leaving the construction site to a public or private right-of-way, street, alley, or parking area. All construction exits must be fully installed prior to the commencement of timber salvage, clearing, grubbing, grading or construction operations. Aggregate shall be applied on top of the geotextile underliner so that underliner is no longer visible.
- B. Maintenance: All construction exits shall be inspected once everyday for evidence of off-site sediment tracking. These inspections must be conducted until a Notice of Termination is submitted. Maintenance shall be performed by the Contractor, if needed, within 24 hours of the inspection. All construction exit pads shall be top dressed with aggregate at the earlier of (1) every 30 calendar days since the exit was maintained or installed, or (2) when geotextile underliner is visible or (3) is construction exit does not meet material or installation requirements outlined in this Section.

3.04 INLET SEDIMENT TRAPS

- A. Installation: Install inlet sediment traps where shown on the Drawings, as directed by the Engineer, and around all storm drain drop inlets that receive runoff from disturbed areas.
- B. Inlet Sediment Traps may be constructed of filter fabric as defined above, may be constructed as gravel drop inlet filters, or may be baffle box inlet filters. For gravel drop inlet filters, stone shall conform to NSSGA's R-3 specification (3-inch to 6-inch stone). Baffle box inlet filters shall be constructed of 2-inch x 4-inch or 4-inch x 4-inch posts and 2-inch x 4-inch boards. They shall be installed in accordance with the Manual for Erosion and Sediment Control in Georgia. Excavation may only be used in combination with a filtering device such as stone or silt fence. All sediment traps should provide a minimum of 1.5 feet of sediment storage. Sediment traps must be self draining.
- C. Maintenance: Per Manual for Erosion and Sediment Control in Georgia and NPDES requirements.

3.05 TEMPORARY AND EXISTING SEDIMENT BASINS

- A. Maintenance: Per Manual for Erosion and Sediment Control in Georgia and NPDES requirements.

3.06 VEGETATIVE SOIL STABILIZATION

- A. This Section covers work necessary for temporary stabilization of soil to prevent erosion following clearing, grubbing, grading or other construction activities in the areas identified in the Contract Documents or as directed by the Engineer, except wetlands. The right is reserved to modify the use, location, and quantities of the areas requiring stabilization as the Engineer considers what is in the best interest of the City. During construction, the Engineer will designate the extent of stabilization used in each location throughout the project.
- B. The stabilization measures specified herein shall be initiated on all disturbed areas including dikes and ditches within 24 hours of completion to minimize erosion and soil transport, providing however, that stabilization measures specified herein do not have to be initiated in the event that construction activities will resume on that portion of the site within fourteen (14) days from the date activities temporarily ceased. For cleared areas which may not receive permanent vegetative or other stabilization measures for six (6) months or less and a suitable growing season is not available for seedings to establish an erosion retardant cover, mulch may be applied according to the Specifications above and below.
- C. The Contractor shall keep the Engineer advised of their schedule of operations.
- D. Application: Planting and seeding shall be performed in accordance with the following schedule:
1. Summer seeding: No earlier than April 1 and no later than October 15.
 2. Winter seeding: October 16 until weather conditions prohibit further construction operations as determined by the Engineer.
 3. Soil Preparation: Prior to seeding operations, and after surface has been shaped, graded, and compacted, scarify surface to a minimum depth of 1 inch.
 4. Seeding: All seedbeds shall be a minimum depth of 1 inch. Seedbeds shall be reviewed by the Engineer prior to seeding. After soil has been scarified, apply required seed mix, as specified in this section, uniformly with a cyclone seeder, drill cultipacker seeder, or hydroseeder. When hydroseeding is the selected method of seeding, prepare and apply slurry at the rate and proportion shown on the Drawings.
 5. The required fertilizer mix shall be uniformly applied at the time of seeding. Upon completion of the seeding operations, apply straw mulch to a reasonably uniform thickness of 1½ inches to 2½ inches in depth. Mulch shall be loose enough to shade ground, reduce evaporation rate, and prevent or materially reduce erosion of underlying soil. Retain straw in place by applying asphaltic emulsion at a rate of 100 gallons per acre or mechanically tack the mulch into the soil to approximately 3 inches. Equipment used for tacking shall be designed for this use.
- E. Application of Mulch only: For areas receiving mulch only, apply at the following rates and to the following depths:
1. Dry straw or hay: Spread at a rate of two and one-half (2½) tons per acre. Apply to a depth of 6 inches to 10 inches. Apply uniformly and anchor as necessary.
 2. Wood waste: Spread at a rate of 6 to 9 tons per acre. Apply to a depth of 2 inches to 3 inches. Apply wood waste only on slopes that are 3:1 or flatter. Anchoring is not necessary.
 3. Jute Matting or Excelsior Netting: Apply in accordance with the manufacturer's recommendations.
 4. Asphaltic emulsion: Apply at a rate of 1200 gallons per acre. Apply uniformly.

- F. Maintenance: Per Manual for Erosion and Sediment Control in Georgia and NPDES requirements.

3.07 PROTECTIVE TREE FENCING

- A. The protective tree fencing shall be installed prior to commencement of land disturbance and maintained until final landscaping is complete.
- B. No construction activities, including the placement of topsoil, shall be permitted within the tree save area.
- C. Appropriate soil erosion and sedimentation control measures shall be installed outside the tree save area to prevent sediment from reaching the tree save area.
- D. Installation: Protective tree fencing shall be placed just outside of the Limits of Disturbance. Avoid driving stakes into major roots. Signs shall be posted that identify the fenced areas as a tree save area.
- E. Maintenance: Tree protection fencing shall be inspected daily and repaired or replaced as needed.

3.08 SEDIMENTATION CONTROL

- A. Sedimentation control shall be provided for all storm drain inlets and groundwater removed from the PSV vault or pipeline excavation.
- B. Sediment basins and/or check dams shall be provided as necessary in accordance with details shown on the Drawings.

3.09 INSPECTION, MONITORING, AND REPORTING

- A. The Owner shall be responsible for the implementation of the weekly erosion and sedimentation control inspections, monitoring, and reporting to comply with EPD guidelines as set forth in the NPDES Permit No. GAR 100001. The contractor shall provide a qualified person to perform daily inspection and to provide daily inspection reports to the owner.
- B. Erosion and sedimentation controls as described in these Specifications shall be maintained in good working condition throughout the life of the project. Any BMP found to be damaged or defective shall be promptly repaired or replaced.
- C. The Contractor will repair deficiencies within 24 hours of inspection, and will be responsible for any penalties or other costs associated with any permitting violations.

3.10 REMOVAL OF TEMPORARY EROSION AND SEDIMENTATION CONTROL STRUCTURES

- A. At such time that temporary erosion and sedimentation control structures are no longer required under this Specification, the Contractor shall notify the Engineer of its intent and schedule for the removal of the temporary structures, and obtain the Engineer's approval in writing prior to removal. Once the Contractor has received such written approval from the Engineer, the Contractor shall remove, as approved, the temporary structures and all sediment accumulated at the removed structure shall be returned upgradient. In areas where temporary

control structures are removed, the site shall be left in a condition that will restore original drainage. Such areas shall be evenly graded and seeded as specified in the paragraph titled Vegetative Soil Stabilization (refer to 3.06).

- B. The Contractor shall remove and dispose off-site all temporary silt fences, posts and straw bales.

3.11 NOTICE OF TERMINATION (NOT)

- A. When all construction activities have ceased, final stabilization has been implemented by the Contractor, and the site is in compliance with the NPDES permit, the Contractor together with the Owner shall submit a Notice of Termination.

END OF SECTION 02440

SECTION 02513

MANHOLES, DRAINAGE AND UTILITY STRUCTURES

PART 1 - GENERAL

1.01 SCOPE

- A. Fabricate, deliver, unload and install structures, manholes and fittings in a timely manner as indicated, specified and required.
- B. Principal items of Work included in this Section:
 - 1. Bases, rings, tops and cones for precast reinforced concrete manhole, utility and valve vaults, and other structures;
 - 2. Covers and frames;
 - 3. Manhole steps.
- C. Related Sections include but are not necessarily limited to:
 - 1. Requirements specified in Drawings;
 - 2. Section 01300 – Submittals;
 - 3. Section 02222 – Excavation, Trenching, and Backfill;

1.02 REFERENCES

- A. Publications listed below form a part of this Section to the extent referenced. The publications are referenced in the text by the basic designation only.
 - 1. American Society for Testing Materials (ASTM).
 - a. ASTM A48 – Specifications for Gray Iron Castings;
 - b. ASTM A74 – Specification for Cast Iron Soil Pipe and Fittings;
 - c. ASTM A536 – Specification for Ductile Iron Castings;
 - d. ASTM C443 – Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets;
 - e. ASTM C857 – Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures;
 - f. ASTM C858 – Specification for Underground Precast Concrete Utility Structures;
 - g. ASTM C891 – Standard Practice for Installation of Underground Precast Concrete Utility Structures;
 - h. ASTM C923 – Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals.
 - 2. American Concrete Institute (ACI).
 - a. ACI 318 – Building Code Requirements for Structural Concrete and Commentary;
 - b. ACI 350 – Code Requirements for Environmental Engineering Concrete Structures.
 - 3. American Society of Mechanical Engineers (ASME).

- a. ASME A112.3.1 – Stainless Steel Drainage Systems for Sanitary DWV, Storm and Vacuum Applications, Above and Below Ground;
- b. ASME A112.21.3M – Hydrants for Utility and Maintenance Use;
- c. ASME A112.36.2M – Cleanouts.
- d. ASME B16.1 – Gray iron Pipe Flanges and Flanged Fittings;
- e. ASME B31 – Standards of Pressure Piping.

1.03 SUBMITTALS

- A. Provide shop drawings for the work included in this Section in conformance with applicable requirements of Section 01300 - Submittals.
- B. Submit manufacturers' technical and test data with printed installation recommendations for gasket seals and watertight caulking.

PART 2 - PRODUCTS

2.01 MANHOLES AND UTILITY STRUCTURES

- A. All precast utility structures, vaults, manhole rings, tops, and cones shall be reinforced designed for AASHTO HB17 Standards for Highway Bridges, H20-44 highway loading, and shall conform to the Drawings and the requirements of ASTM C478. Cast-in-place reinforced concrete structures conforming to the requirements of ACI 318 and ACI 350 may be used in lieu of precast at Contractor's option. Precast structures shall conform to the following requirements:
 1. Rings: All structure rings shall be centrifugally spun or compactly vibrated in forms.
 2. Tops: All structure manhole tops and cones shall be compactly vibrated in forms.
 3. Gasket Seals: Watertight gasket or O-ring seals shall be provided at mating joints of precast concrete sections. Size gaskets to suit joint dimensions and surface conditions to ensure watertight completed installation. Use either compressible closed-cell neoprene rods with compatible bonding agent recommended by material manufacturer; or No. 95 extruded butyl rod and No. 2 Primer each produced by General Sealants, Inc., City of Industry, California, or approved equal, non-bituminous joint sealing compressible gaskets.
- B. All entries into existing manholes and structures shall be considered as confined space entries. Operations within new manholes shall be conducted in such a way to ensure an atmosphere where breathable air is maintained.

2.02 COVERS AND FRAMES

- A. All covers and frames shall conform to the requirements for Class 30 gray iron castings in ASTM A48. The castings shall be thoroughly cleaned and coated with commercial quality asphalt paint. Frames and covers shall be match marked in pairs before delivery to the Work, and the covers shall fit into their frames without rocking.
 1. Manholes: Heavy duty frame and lid, USF 655 CW-M or approved equal.
 2. Inlets: Refer to applicable GDOT detail.

3. Cover for sanitary sewer structures shall be lettered as detailed on Valdosta City Utilities standard detail A 498-1.2, covers for plant drain structures shall be lettered "Plant Drain", and covers for storm drainage structures shall be lettered "Storm Drain".

2.03 MANHOLE STEPS

- A. All manhole steps shall be Copolymer polypropylene coated drop step of 1 inch diameter steel bars as manufactured by M.A. Industries, Inc., Peachtree City, GA or approved equal.

2.04 FLEXIBLE PIPE TO MANHOLE CONNECTORS

1. The rubber for the connector shall comply with ASTM C443 and ASTM C923 and consist of EPDM and elastomers designed to be resistant to ozone, weather elements, chemicals, including acids, alkalis, animal and vegetable fats, oils and petroleum products. All stainless steel elements of the connector shall be 304 Stainless, excluding the worm screw for tightening the steel band around the pipe which shall be Series 305 Stainless. The worm screw for tightening the steel band shall be torqued by a breakaway torque wrench available from the precast manhole supplier, and set for 60 - 70 inch/lbs.
2. Connectors shall be NPC Kor-N-Seal as manufactured by Trelleborg Pipe Seals Milford Inc., Milford, NH or approved equal.

2.05 CATCH BASINS AND DROP INLETS

- A. Precast: ASTM C858, precast, reinforced concrete, designed according to ASTM C857 for structural loading. Include depth, shape, and dimensions indicated, with provision for rubber gasket joints.
 1. Gaskets: Rubber;
 2. Grade Rings: Include 2 or 3 reinforced-concrete rings, of 6-inch through 9-inch total thickness, that match a 24-inch diameter frame and grate;
 3. Steps: See Paragraph 2.03 – Manhole steps;
 4. Pipe Connectors: ASTM C923, resilient, of size required, for each pipe connecting to base section.
- B. Cast-in-Place: Construct of reinforced concrete in conformance with Section 03300 – Cast-in-Place Concrete, designed according to ASTM C857 for structural loading. Include depth, shape, dimensions, and appurtenances indicated.
 1. Bottom, Walls, and Top: Reinforced concrete;
 2. Channels and Benches: Concrete;
 3. Steps: Fiberglass, individual steps or ladder. Include a width that allows a worker to place both feet on one step and is designed to prevent lateral slippage off the step. Cast steps or anchor ladder into sidewalls at 12-inch through 16-inch intervals. Omit steps for catch basins less than 60-inches deep.
- C. Frames and Grates: ASTM A536, Grade 60-40-18, heavy-duty ductile iron, 24-inch inside diameter by 7-inch through 9-inch riser with 4-inch minimum width flange, and 26-inch diameter flat grate having small square or short-slotted drainage openings.
- D. Inlet Configurations

1. Curb Inlets: Made with vertical curb opening, of materials and dimensions according to utility standards;
2. Gutter Inlets: Made with horizontal gutter opening, of materials and dimensions according to utility standards. Include heavy-duty frames and grates;
3. Combination Inlets: Made with vertical curb and horizontal gutter openings, of materials and dimensions according to utility standards. Include heavy-duty frames and grates.

2.06 STRUCTURE CHANNELS AND BENCHES:

- A. Include channels and benches in manholes. Precast or Cast-in-Place Concrete, in accordance with Section 03300 - Cast-in-Place Concrete, from concrete. Class A Portland-cement design mix, 4000 psi minimum.
- B. Include channels and benches in storm drainage manholes.
 1. Manhole Channels: Concrete invert, formed to same width as connected piping, with height of the vertical sides to three fourths of the pipe diameter. Form curved channels with smooth, uniform radius and slope.
 - a. Invert Slope: 1.2 inches through manhole;
 - b. Invert Slope: 2.5% (1:40) through manhole;
 - c. Invert Slope: None.
 2. Manhole Benches: Concrete, sloped to drain into channel.
 - a. Slope: 1 inch per foot (1:12).
 - b. Slope: 0.5 inches per foot (1:24).
- C. Include channels and benches in storm drainage catch basins.
 1. Catch Basin Channels: Concrete invert, formed to same width as connected piping, with height of the vertical sides to three fourths of the pipe diameter. Form curved channels with smooth, uniform radius and slope.
 - a. Invert Slope: 1.2 inches through catch basin;
 - b. Invert Slope: 2.5% (1:40) through catch basin;
 - c. Invert Slope: None.
 2. Catch Basin Benches: Concrete, sloped to drain into channel.
 - a. Slope: 1 inch per foot (1:12).
 - b. Slope: 0.5 inches per foot (1:24).

2.07 CLEANOUTS

- A. Description: ASME A112.36.2M, round, cast iron housing with clamping device and round, secured, scoriated, cast iron cover. Include cast iron ferrule with inside caulk or spigot connection and countersunk, tapered-thread, brass closure plug. Use units with top-loading classifications according to the following applications:
 1. Light Duty: In earth or grass, foot-traffic areas;
 2. Medium Duty: In paved, foot-traffic areas;
 3. Heavy Duty: In vehicle traffic service areas;
 4. Extra Heavy Duty: In roads.

- B. Sewer Pipe Fitting and Riser to Cleanout: ASTM A74, service class, cast iron soil pipe and fittings.

2.08 DRAINS

- A. Area Drains: ASME A112.21.1M, round, cast iron body with anchor flange and round, secured, cast iron grate. Include bottom outlet with inside caulk or spigot connection, of sizes indicated. Use units with top-loading classifications according to the following applications:
 - 1. Medium Duty: In paved, foot-traffic areas;
 - 2. Heavy Duty: In vehicle traffic service areas.
- B. Cast-iron Trench Drains: ASME A112.21.1M, 6-inch wide top surface, rectangular body with anchor flange or other anchoring device and rectangular, secured grate. Include units of total lengths indicated and number of bottom outlets with inside caulk or spigot connections, of sizes indicated. Use units with top-loading classifications according to the following applications:
 - 1. Medium Duty: In paved, foot-traffic areas;
 - 2. Heavy Duty: In vehicle traffic service areas;
 - 3. Extra Heavy Duty: In roads.

2.09 OUTFALLS

- A. Install precast, reinforced concrete headwalls in accordance with the applicable GDOT detail.
- B. Riprap: Broken stone, irregular size and shape, weighing 25 to 75 pounds each, or as otherwise indicated on the drawings.
- C. Energy Dissipators: Construction as indicated, from materials indicated.

PART 3 - EXECUTION

3.01 EXCAVATION AND BACKFILL

- A. Perform work in accordance with Section 02222 – Excavation, Trenching and Backfill.
- B. Provide a minimum 12-inch layer of compacted aggregate base material under all base units.

3.02 INSTALLATION OF PRECAST STRUCTURES

- A. General: Handling and unloading shall be performed in a careful, timely manner to provide flaw-free completed installation. Coordinate with work of other trades to ensure completion without delay to job progress. Setting and adjustments shall be performed to provide completed installation at finish grade. Apply specified gasket seals at precast concrete mating surfaces as recommended in writing by material manufacturer to provide watertight completed installation.
- B. Manhole and Structure Bases: Precast structure bases shall be precast monolithic base/riser sections of the dimensions indicated. For gravity drainage – storm, plant drain, and sewer structures; the portion of the base above the invert elevation of the incoming and outgoing pipes

shall be formed with grout to provide a smooth channel section. Channels shall vary uniformly in size and shape from inlet(s) to outlet.

- C. Adjustment of Manhole Frame and Cover Sets: Manhole and vault and structure frames and covers which are located within an area to be paved or graded shall be set to finish grade.
 - 1. In concrete pavement, manhole frames shall be set to finish grade before paving. Repaving required as a result of reconstructing or adjusting all manhole and vault frames and covers to grade shall be the responsibility of the Contractor.
 - 2. The Contractor shall exercise caution to prevent debris from falling into structures. In the event that debris should fall into a structure, it shall be immediately removed.
- D. Penetrations:
 - 1. A flexible pipe-to-structure connector shall be employed in the connection of all pipe to precast structures.
 - 2. The connector shall be the sole element relied on to ensure a flexible watertight seal of the pipe to the manhole. No adhesives or lubricants shall be employed in the installation of the connector into the manhole. The connector shall be installed in the manhole wall by activating the expanding mechanism in strict accordance with the recommendation of the connector manufacturer. The connector shall be of a size specifically designed for the pipe material and size being utilized.
- E. General: Structures and excavations shall be properly covered while work is not in progress. This includes night shifts, non-regular working hours and weekends.

3.03 MANHOLE INSTALLATION

- A. General: Install manholes, complete with accessories, as indicated.
- B. At least one foot of rock (57 stone) will be placed under the bottom of the manhole. Additional rock will be added as required by the City inspector.
- C. Form continuous concrete channels and benches between inlets and outlet, where indicated.
- D. Set tops of frames and covers flush with finished surface where manholes occur in pavements. Set tops 3 inches above finished surface elsewhere, except where otherwise indicated.
- E. Place precast concrete manhole sections as indicated, and install according to ASTM C891.
 - 1. Provide rubber joint gasket complying with ASTM C443/ASTM C443M, at joints of sections.
 - 2. Apply bituminous mastic coating at joints of sections.
- F. Construct cast-in-place manholes as indicated.

3.04 CATCH BASIN INSTALLATION

- A. Construct catch basins to sizes and shapes indicated.
- B. Set frames and grates to elevations indicated.

3.05 DROP INLET AND OUTFALL INSTALLATION

- A. Construct inlet head walls, aprons, and sides of reinforced concrete, as indicated.
- B. Construct outlet head walls, aprons, and sides of reinforced concrete, as indicated.
- C. Construct riprap of broken stone, as indicated.
- D. Install outlets that spill onto grade, anchored with concrete, where indicated.
- E. Install outlets that spill onto grade, with flared end sections that match pipe, where indicated.
- F. Construct energy dissipaters at outlets, as indicated.

3.06 STORM DRAINAGE SYSTEM INSTALLATION

- A. Assemble and install components according to manufacturer's written instructions and as indicated.
- B. Assemble and install components according to manufacturer's written instructions, ASME A112.3.1, and as indicated.
- C. Install with top surfaces of components, except piping, flush with final finished surface.
- D. Fasten grates to channel sections if indicated.
- E. Assemble trench sections with flanged joints.
- F. Embed trench sections and appurtenances in a 4-inch minimum depth of concrete around bottom and sides.
- G. Make piping connections and install stainless-steel piping with gasketed joints between system components.

3.07 CLEANOUT INSTALLATION

- A. Install cleanouts and riser extension from sewer pipe to cleanout at grade. Use cast iron soil pipe fittings in sewer pipes at branches for cleanouts and cast iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
- B. Set cleanout frames and covers in earth in a cast-in-place concrete block, 18 inches by 18 inches by 12 inches deep. Set with tops 1 inch above surrounding earth grade.
- C. Set cleanout frames and covers in concrete paving with tops flush with surface of paving.

3.08 DRAIN INSTALLATION

- A. Install type drains in locations indicated.
- B. Embed drains in a 4-inch minimum depth of concrete around bottom and sides.

- C. Fasten grates to drains if indicated.
- D. Set drain frames and covers with tops flush with surface of paving.

END OF SECTION 02513

SECTION 02584
PIPELINE CONSTRUCTION

PART 1 - GENERAL

1.01 SCOPE

- A. The Work of this Section includes providing general requirements for pipelines, including pipe, joints, specials, and appurtenances, complete and in place.

1.02 STANDARD SPECIFICATIONS

- A. Except as otherwise indicated in this Section of the Specifications, the Contractor shall comply with the latest adopted edition of the City of Valdosta Standards and Specifications.
- B. Related Sections include but are not necessarily limited to:
 - 1. Requirements specified in Drawings;
 - 2. Section 01300 – Submittals;
 - 3. Section 01500 – Construction Facilities and Temporary Controls;
 - 4. Section 02222 – Excavation, Trenching, and Backfill;
 - 5. Section 02240 – Dewatering;

1.03 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Delivery of Materials: Products shall be delivered in original, unbroken packages, containers, or bundles bearing the name of the manufacturer. Materials delivered onsite without an approved submittal for verification shall be rejected and payment withheld.
- B. Storage: Products shall be carefully stored in a manner that will prevent damage and in an area that is protected from the elements.

PART 2 - PRODUCTS

2.01 PIPE AND APPURTENANCES

- A. Provide pipe materials, coatings and linings, and appurtenances of the sizes and types indicated on the Drawings and comply with individual pipe Sections.

2.02 FILL AND BACKFILL MATERIAL

- A. Fill and backfill materials shall be in accordance with Section 02222 - Excavation, Trenching, and Backfill.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Utility Relocation: Notify the Engineer of property of existing public utilities and franchise holders which must be relocated and the reasonable time for doing so. The Owner will contact the utility or franchise holder and request relocation. Relocation and protection of existing utilities which are the Contractor's responsibility shall be in accordance with Section 01500.
- B. Before submitting joint shop drawings, where the proposed piping will connect to existing piping, the Contractor shall excavate the point of connection to verify size, layout, and depth. Prepare a sketch of the proposed point of connection for submittal with the joint shop drawings. The Contractor shall give the Engineer a minimum of 48 hours notice to inspect the existing piping before backfilling.

3.02 DEWATERING

- A. Install and operate according to Section 02240 a continuous dewatering system capable of maintaining the ground water level 2 feet below the excavated trench bottom. Only well points located on both sides of the trench shall be used for dewatering, unless otherwise approved by the Engineer.
- B. Operate the dewatering system 7 days per week, 24 hours per day with water level as indicated above until backfilling is completed.
- C. Field-determined departures from the dewatering plans may necessitate adjustments to the trench shoring and bracing methods to achieve soil stability. Adjustment shall be at no additional cost to the Owner.
- D. Dewatering shall prevent softening of the bottom of excavations or formation of quick conditions. Dewatering shall not remove native soils. All loose soil shall be removed and re-compacted in accordance with Section 02222.

3.03 EXCAVATION

- A. Unless indicated otherwise, excavation and over-excavation shall be in accordance with Section 02222.
- B. Trench width shall be as indicated.
- C. Stabilize the trench subgrade by compaction to 95% relative density. Where trench bottom has been over-excavated, compact the bedding to 95% in 1-foot thick layers.

3.04 LAYOUT AND HANDLING

- A. Handling of Pipe and Accessories: Pipe shall be lifted in such a manner as to minimize bending and prevent damage to the pipe. During transport, pipe shall be supported to prevent distortion or damage to the pipe. When not being handled, pipe shall be stockpiled on timber cradles or properly prepared ground with all rocks larger than 3 inches eliminated. All pipe, fittings, valves and accessories shall be carefully lowered into the trench in such a manner as to prevent damage

to pipe and fittings. Under no circumstances shall pipe or accessories be dropped or dumped into the trench. The Contractor shall smooth out any burrs, gouges, or weld splatter and repair other defects prior to laying the pipe. Any pipe section, including coatings and linings, that becomes damaged as a result of handling or stockpiling shall be replaced with a new unit or repaired at the discretion of the Engineer at no additional cost to the Owner.

3.05 DIVERSION PUMPING

- A. Where the proposed piping will connect to existing piping which is in sewage service, install and operate bulkheads, plugs, piping, and diversion pumping equipment to maintain sewage flow and to prevent backup or overflow.
- B. Design diversion piping, joints, and accessories to withstand 50 psi.
- C. No sewage shall be diverted into any open area outside of a sanitary sewer.
- D. In the event of spill or overflow, immediately stop the overflow and take action to clean up and disinfect the spillage area to original condition. Promptly notify the Engineer.

3.06 INSTALLATION

- A. General: Pipe shall be installed in accordance with the pipe manufacturer's recommendations and the applicable provisions of the City of Valdosta Standard and Specifications, and the requirements herein.
- B. Interferences
 - 1. Contractor shall protect and maintain all underground and surface utility structures, drains, sewers, and other obstructions encountered in the progress of the Work in compliance with Section 01500. Where indicated that the grade or alignment of the pipe is obstructed by existing utility structures such as conduits, ducts, or pipes, the obstruction shall be supported until it is relocated, removed, or reconstructed by the Contractor in cooperation with owners of such utility structures. Unless otherwise indicated, this Work shall be performed at no additional cost to the Owner.
 - 2. Where necessary to raise or lower the pipe due to unforeseen obstructions or other causes, the Engineer may direct a change in the alignment or the grades. Such change shall be made by the deflection of joints, by the use of bevel adapters, or by the use of additional fittings. However, in no case shall the deflection in the joint exceed the maximum deflection recommended by the pipe manufacturer. No joint shall be misfit any amount which will be detrimental to the strength and integrity of the finished joint.
- C. Line and Grade Tolerance: Each section of pipe shall be laid in the order and position shown on the laying schedule. Unless indicated otherwise, the pipe shall be laid to the design line and grade, within approximately one inch, plus or minus. No tolerance is permitted on pipes designed for zero slope.
- D. Curved Alignments: Where curved alignments are indicated, deflecting the joints will be allowed only in accordance with the written instructions of the pipe manufacturer and these specifications. Where a smaller radius of curvature is required than can be accommodated by deflecting the joints, sections of pipe with beveled ends may be laid unless fabricated bends are indicated.

Maximum joint deflection and maximum bevel for different pipe sizes and joint designs shall be in accordance with the pipe manufacturer's recommendations and these specifications.

- E. Cutting and machining of the pipe shall only be in accordance with the pipe manufacturer's standard procedures for this operation. Pipe shall not be cut with a cold chisel, standard iron pipe cutter, nor any other method that may fracture the pipe, produce ragged, uneven edges, or otherwise impair the condition of the pipe.
- F. The Contractor shall install all pipe, fittings, closure pieces, bends, reducers, wyes, tees, crosses, outlets, manifolds, and other steel plate specials, bolts, nuts, gaskets, jointing materials, and all other appurtenances as indicated and as required to provide a complete and workable installation. No pipe or appurtenance shall be installed when the interior or exterior surfaces show cracks or other defects that may be harmful as determined by the Engineer. Damaged interior and exterior surfaces shall be repaired to the satisfaction of the Engineer or a new undamaged pipe or appurtenance shall be provided.
- G. Pipe laying operations shall be stopped and dewatering operations shall be adjusted to prevent the pipe from floating due to water entering the trench from any source. The Contractor shall reinstall all affected pipe to its specified condition and grade.
- H. All foreign matter or dirt shall be removed from the interior of the pipe before lowering into position in the trench. Pipe shall be kept clean during and after laying. All openings in the pipe line shall be closed with water tight expandable type sewer plugs or PVC test plugs at the end of each day's operation or whenever the pipe openings are left unattended. The use of burlap, wood, or other similar temporary plugs will not be permitted.
- I. Immediately before placing each section of pipe in final position for jointing, the bedding shall be checked for firmness and uniformity of surface.
- J. Pipe shall be laid directly on the bedding material. No blocking will be permitted and the bedding shall form a continuous, solid bearing for the full length of the pipe. Excavate to facilitate removal of handling devices after the pipe is laid. Bell holes shall be formed at the ends of the pipe to prevent point loading at the bells or couplings and to facilitate placement of grout bands. Excavation shall be adequate to permit access to the joints for bonding operations and for application of coating on field joints.
- K. Backfilling and compaction shall comply with Section 02222 and the pipe specifications.
- L. Lay section of pipe with the bell end up grade unless it is shown on the drawing otherwise.
- M. Except for short runs which may be permitted by the Engineer, sections of pipe shall be laid in a sequence moving in an upgrade direction on grades exceeding 10 percent. Pipe which is laid in a downgrade direction shall be blocked and held in place until sufficient support is furnished by the following pipes to prevent movement.

3.07 FIELD TESTING

- A. Field testing shall be in accordance with City of Valdosta Utilities Department Standard Specifications.

3.08 SITE RESTORATION

- A. Backfill and compact soil in accordance with Section 02222.
- B. Place subgrade and base materials in accordance with Section 02222.
- C. Replace damaged pavement, curbs, gutters, and sidewalks, shrubs, and trees to pre-construction conditions.
- D. Provide vegetative soil stabilization in areas indicated in accordance with Section 02440. Grade surface as indicated on the Drawings.

END OF SECTION 02584

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SECTION 02590
PAINTING SCHEDULE

PART 1 - GENERAL

1.01 SCOPE

- A. Provide all labor, apparatus, scaffolding, and all appurtenant Work in connection the providing and application of painting and protective coating systems, complete as indicated, specified and required.

- A. Related Sections include but are not necessarily limited to:
 - 1. Drawings;
 - 2. Section 01300 – Submittals.

1.02 STANDARD SPECIFICATIONS

- A. Except as otherwise indicated in this Section of the Specifications, the Contractor shall comply with the latest adopted edition of the City of Valdosta Standards and Specifications.

1.03 QUALITY ASSURANCE

- A. Products shall be manufactured by a reputable and qualified company specializing in the manufacture of high performance corrosive chemical resistant coating products described hereinafter, with a minimum of five continuous years' experience of performance in similar applications at wastewater treatment facilities.

- B. Applicator/Installer: The coating applicator/installer shall be a company that has been technically instructed and approved by the coating manufacturer and is skilled in the application of special coatings whose installation have performed in a satisfactory manner under comparable conditions for a period of at least 5 years.
 - 1. Maintain throughout duration of the work a crew of painters who are fully qualified to satisfy requirements of these Specifications.

- C. Guarantee: A three (3) year guarantee which commences on the date of acceptance against failure of all coatings shall be provided. Failure of any coating during the guarantee period shall be repaired by the Contractor who shall absorb all costs related to the repair and replacement of the coating.

- D. Evaluation of surface preparation for ferrous metals shall be based upon SSPC-Vis 1 ASTM Designation D 2200 and "Standard Methods of Evaluating Degree of Rusting on Painted Steel Surfaces". SSPC-Vis 2 ASTM Designation D610.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Surfaces to receive paint or protective coating materials as herein specified in this Section shall be coated in conformance with the applicable systems specified herein. All materials specified by name and/or manufacturer or selected for use under these Specifications, shall be delivered unopened at the job site in their original containers and shall not be opened until inspected by the Engineer. Whenever a manufacturer's band name is specified, it is intended to define the general type and quality of paint or coating desired. Other approved manufacturers of coatings or paints of equal quality may be used. All paint, and coatings shall be produced and applied as herein called for or, if not specifically called for, it shall be applied in accordance with the manufacture's printed recommendations as approved by Engineer. So far as available, all paint and coating materials shall be provided by no more than two suppliers.

2.02 PAINT AND COATING MATERIALS

- A. Acceptable Manufacturers
 1. PPG Industries, Inc.
 2. Tnemec
 3. Carboline
 4. Sherwin Williams
 5. GML Coatings
 6. Raven Lining Systems

2.03 SERVICE CONDITION B

- A. Galvanized and ferrous metals, other than stainless steel, not subject to chemical attack; normal indoor or outdoor exposure, shall be prepared and coating in accordance with the following requirements.
- B. Surface Preparation. All surfaces shall be freed of dirt, dust, grease, or other foreign matter before coating. Surfaces shall be cleaned in accordance with the Steel Structures Painting Council Specification SSPC-3 Power Tool Cleaning. Weld surfaces and rough edges shall be ground as required to make the piece neat and for proper application of coating, and weld splatter shall be removed. Galvanized surfaces shall be cleaned in accordance with SSPC-SP1 (Solvent Cleaning)
- C. Application. Application shall be in strict conformance with the manufacturer's printed recommendations. All sharp edges, nuts, bolts, or other items difficult to coat shall receive a brush-applied coat of the specified coating prior to application of each coat.
- D. Coating Service Condition B. Conform with the following to provide the specified dry film thickness. On ferrous metals apply minimum total DFT 7 mils:

PPG's System	Primer: Fast Dry 35 Rust Inhibitive Metal Primer (1.0-2.0 mils DFT) Finish Coats: Pitt-Tech Plus 90-1210 or 90-1310 series (2.0-4.0 mils DFT)
Tnemec's System:	Tnemec's System 231 Primer- Series 1 (2.0-3.0 mils DFT)

Two Finish Coats- Series 1029 or 1028 (2.0-4.0 mils DFT per coat)

Carboline's System: Primer- Carbocoat 115 (1.5-2.0 mils DFT) – ferrous metals or Carbocrylic 120 (1.0-2.0 mils DFT) – galvanized
Two Finish Coats- Carbocoat 45 (2.0-3.0 mils DFT)

Sherwin William's System: Primer- DTM Primer/Finish (2.0-3.0 mils DFT)
Finish Coat- SherCryl VOC-Complying (3.0-4.0 mils DFT)

PART 3 - EXECUTION

3.01 COLORS

- A. Final colors to be used are to be selected by the Owner in coordination with Engineer during shop drawing submittal review.

Service	Flowstream Identification	Color
Plant Service Water	PSW	Purple
Raw Wastewater	RWW	Gray

END OF SECTION 02590

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SECTION 02610

GEOCOMPOSITE DRAINAGE LAYER

PART 1 - GENERAL

1.01 SCOPE

- A. Manufacture, deliver, unload and install geocomposite drainage layer in a timely manner as indicated, specified and required.
- B. Related Sections include but are not necessarily limited to:
 - 1. Requirements specified in Drawings;
 - 2. Section 01300 – Submittals;
 - 3. Section 02222 – Excavation, Trenching, and Backfill;

1.02 REFERENCES

- A. Publications listed below form a part of this Section to the extent referenced. The publications are referenced in the text by the basic designation only.
 - 1. American Society for Testing Materials (ASTM).
 - a. ASTM D1238 – Standard Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer
 - b. ASTM D1505-98 – Standard Test Method for Density of Plastics by the Density-Gradient Technique
 - c. ASTM D4218 – Standard Test Method for Determination of Carbon Black Content in Polyethylene Compounds by the Muffle Furnace Technique D 1603-94 Standard Test Method for Carbon Black in Olefin Plastics
 - d. ASTM D4355-02 – Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus
 - e. ASTM D4491-99 – Standard Test Method for Water Permeability of Geotextiles by Permittivity
 - f. ASTM D4533 – Standard Test Method for Trapezoid Tearing Strength of Geotextiles
 - g. ASTM D4716-00 – Standard Test Method for Determining the (In-Plane) Flow Rate Per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head
 - h. ASTM D4751-99 – Standard Test Method for Determining Apparent Opening Size of a Geotextile
 - i. ASTM D6241 – Standard Test Method for the Static Puncture Strength of Geotextiles and Geotextile- Related Products Using a 50-mm Probe D 4833-88 (1996) Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes and Related Products
 - j. ASTM D5261-92 (1996) – Standard Test Method for Measuring the Mass Per Unit Area of Geotextiles
 - k. ASTM D7005-03 – Determining The Bond Strength (Ply-Adhesion) of Geocomposites

1. ASTM D7179 – Standard Test Method for Determining Geonet Breaking Force
2. Relevant publications from the Environmental Protection Agency (EPA).
 - a. Daniel, D.E. and R.M. Koerner, (1993), Technical Guidance Document: Quality Assurance and Quality Control for Waste Containment Facilities, EPA/600/R-93/182.

1.03 DEFINITIONS

- A. Construction Quality Assurance Consultant (CONSULTANT): Party, independent from MANUFACTURER and INSTALLER that is responsible for observing and documenting activities related to quality assurance during the lining system construction.
- B. ENGINEER: The individual or firm responsible for the design and preparation of the project's Contract Drawings and Specifications.
- C. Geocomposite Manufacturer (MANUFACTURER): The party responsible for manufacturing the geocomposite rolls.
- D. Geosynthetic Quality Assurance Laboratory (TESTING LABORATORY): Party, independent from the MANUFACTURER and INSTALLER, responsible for conducting laboratory tests on samples of geosynthetics obtained at the site or during manufacturing, usually under the direction of the OWNER.
- E. INSTALLER: Party responsible for field handling, transporting, storing and deploying the geocomposite.
- F. Lot: A quantity of resin (usually the capacity of one rail car) used to manufacture polyethylene geocomposite rolls. The finished rolls will be identified by a roll number traceable to the resin lot.

1.04 QUALIFICATIONS

- A. Manufacturer
 1. Geocomposite shall be manufactured by the following:
 - a. AGRU America, Inc.
 - b. approved equal
 2. MANUFACTURER shall have manufactured a minimum of 10,000,000 square feet of polyethylene geocomposite material during the last year.
- B. Installer
 1. INSTALLER shall have installed a minimum of 10,000,000 square feet of geocomposite in the last 3 years.
 2. INSTALLER shall have worked in a similar capacity on at least 5 projects similar to the project described in the contract documents, and within at least 160,000 square feet of geonet installation on each project.
 3. The Installation Supervisor shall have worked in a similar capacity on projects similar in size and complexity to the project described in the Contract Documents.

1.05 MATERIAL LABELING, DELIVERY, STORAGE AND HANDLING

- A. Labeling- Each roll delivered to the site shall be wrapped and labeled by the MANUFACTURER. The label will identify:
 - 1. manufacturer's name
 - 2. product identification
 - 3. length
 - 4. width
 - 5. roll number
- B. Delivery- Rolls will be prepared to ship by appropriate means to prevent damage to the material and to facilitate off-loading.
- C. Storage- The on-site storage location provided by the CONTRACTOR to protect the geonet from abrasions, excessive dirt and moisture shall have the following characteristics:
 - 1. level (no wooden pallets)
 - 2. smooth
 - 3. dry
 - 4. protected from theft and vandalism
 - 5. adjacent to the area being lined
- D. Handling
 - 1. The CONTRACTOR and INSTALLER shall handle all rolls in such a manner to ensure they are not damaged in any way.
 - 2. The INSTALLER shall take any necessary precautions to prevent damage to underlying layers during placement of the drainage material.

1.06 WARRANTY

- A. Material shall be warranted, on a pro-rata basis against defects for a period of 1-year from the date of the geocomposite installation.
- B. Installation shall be warranted against defects in workmanship for a period of 1-year from the date of geocomposite completion.

1.07 SUBMITTALS

- A. Provide shop drawings for the work included in this Section in conformance with applicable requirements of Section 01300 - Submittals.

PART 2 - PRODUCTS

2.01 GEOCOMPOSITE PROPERTIES

- A. A geocomposite shall be manufactured by extruding two crossing strands to form a bi-planar drainage net structure with a non-woven geotextile bonded to one or both sides.

B. The geocomposite specified shall have properties that meet or exceed the values listed in the following data sheets below.

Table 1: Geocomposite Properties

Property	Test Method	Frequency	Value
Geocomposite			
Ply Adhesion, lbs/in. (g/cm)	ASTM D7005	50,000 SF	1 (178)
Transmissivity ⁽¹⁾ , m ² /sec (gal/min/ft)	ASTM D4716	1 Per Project	5 x 10 ⁻⁴ (2.4)
Geonet			
Thickness, mil (mm)	ASTM D5199	50,000 SF	250 (6.4)
Peak Tensile Strength MD, lbs/in. (N/mm)	ASTM D5035/7179	50,000 SF	55 (9.6)
Density, g/cm ²	ASTM D792 Method B	50,000 SF	0.94
Carbon Black Content (%)	ASTM D4218	50,000 SF	2 - 3
Transmissivity ⁽²⁾ , m ² /sec (gal/min/ft)	ASTM D4716	500,000 SF	3 x 10 ⁻³ (14.5)
Geotextile			
Mass/Unit Area, oz/yd ² (g/m ²)	ASTM D5261	100,000 SF	8 (271)
Grab Tensile, lbs (N)	ASTM D4632	100,000 SF	220 (979)
Elongation, %	ASTM D4632	100,000 SF	50
CBR Puncture, lbs (kN)	ASTM D6241	500,000 SF	600 (2.7)
Trapezoidal Tear, lbs (N)	ASTM D4533	100,000 SF	95 (423)
UV Resistance % Retained after 500 hrs	ASTM D4355	Per Formulation	70

Apparent Opening Size ^{(3), (4)} , US Sieve (mm)	ASTM D4751	500,000 SF	80 (0.180)
Permittivity, sec ⁻¹	ASTM D4491	500,000 SF	1.3
Permeability cm/sec	ASTM D4491	500,000 SF	0.30
Water Flow Rate, g/min/sf (l/min/m ²)	ASTM D4491	500,000 SF	95 (3895)

Notes:

1. Geocomposite Transmissivity at 21°C, gradient of 0.1, load of 10,000 psf, seat time 15 minutes, between steel plates.
2. Geonet Index Transmissivity at 21°C, gradient of 0.1, load of 10,000 psf, seat time of 15 minutes, between steel plates.
3. Values established at time of manufacturing. Handling, storage, and shipping may change these properties.
4. Apparent Opening Size, (AOS), reported as maximum roll value.

C. Resin

1. Resin shall be new first quality, compounded polyethylene resin.
2. Natural resin (without carbon black) shall meet the following additional minimum requirements.

Table 2: Raw Material Properties

Property	Test Method ⁽¹⁾	Value
Density (g/cm ³)	ASTM D792 Method B	>0.94
Melt Flow Index (g/10 min)	ASTM D1238	≤1.0

2.02 MANUFACTURING QUALITY CONTROL

- A. The geocomposite shall be manufactured in accordance with the Manufacturer's Quality Control Plan submitted to and approved by the ENGINEER.
- B. The geocomposite shall be tested according to the test methods and frequencies listed on Table 1 which has been prepared based on product data sheets.

PART 3 - EXECUTION

3.01 FAMILIARIZATION

A. Inspection

1. Prior to implementing any of the work in the Section to be lined, the INSTALLER shall carefully inspect the installed work of all other Sections and verify that all work is complete to the point where the installation of the Section may properly commence without adverse impact.
2. If the INSTALLER has any concerns regarding the installed work of other Sections, he shall notify the Project ENGINEER.

3.02 MATERIAL PLACEMENT

- A. The geocomposite roll should be installed in the direction of the slope and in the intended direction of flow unless otherwise specified by the ENGINEER.
- B. If the project contains long, steep slopes, special care should be taken so that only full length rolls are used at the top of the slope.
- C. In the presence of wind, all geocomposites shall be weighted down with sandbags or the equivalent. Such sandbags shall be used during placement and remain until replaced with cover material.
- D. If the project includes an anchor trench at the top of the slopes, the geocomposite shall be properly anchored to resist sliding. Anchor trench compacting equipment shall not come into direct contact with the geocomposite.
- E. In applying fill material, no equipment can drive directly across the geocomposite. The specified fill material shall be placed and spread utilizing vehicles with a low ground pressure.
- F. The cover soil shall be placed in the geocomposite in a manner that prevents damage to the geocomposite. Placement of the cover soil shall proceed immediately following the placement and inspection of the geocomposite.

3.03 SEAMS AND OVERLAPS

- A. Each component of the geocomposite will be secured or seamed to the like component at overlaps.
- B. Geonet Components
 1. Adjacent edges of the geonet along the length of the geocomposite roll shall be placed with the edges of each geonet butted against each other.
 2. The overlaps shall be joined by tying the geonet structure with cable ties. These ties shall be spaced every 5 feet along the roll length.
 3. Adjoining geocomposite rolls (end to end) across the roll width should be shingled down in the direction of the slope, with the geonet portion of the top overlapping the geonet portion of the bottom geocomposite a minimum of 12 inches across the roll width.
 4. The geonet portion should be tied every 6 inches in the anchor trench or as specified by the ENGINEER.

3.04 REPAIR

- A. Prior to covering the deployed geocomposite, each roll shall be inspected for damage resulting from construction.
- B. Any rips, tears or damaged areas on the deployed geocomposite shall be removed and patched. The patch shall be secured to the original geonet by tying every 6 inches with the approved tying devices. If the area to be repaired is more than 50 percent of the width of the panel, the damaged area shall be cut out and the two portions of the geonet shall be cut out and the two portions of the geonet shall be joined in accordance with Subsection 3.3.

END OF SECTION 02610

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SECTION 02620

GEOSYNTHETIC CLAY LAYER

PART 1 - GENERAL

1.01 SCOPE

- a. Manufacture, deliver, unload and install geosynthetic clay liner in a timely manner as indicated, specified and required.
- b. Related Sections include but are not necessarily limited to:
 1. Requirements specified in Drawings;
 2. Section 01300 – Submittals;
 3. Section 02222 – Excavation, Trenching, and Backfill;

1.02 REFERENCES

- a. Publications listed below form a part of this Section to the extent referenced. The publications are referenced in the text by the basic designation only.
 1. American Society for Testing Materials (ASTM).
 - a. ASTM D4632 – “Standard Test Method for Grab Breaking Load and Elongation of Geotextiles”
 - b. ASTM D4643 – “Determination of Water (Moisture) Content of Soil by the Microwave Oven Method”
 - c. ASTM D5261 – “Standard Test Method for Measuring Mass Per Unit Area of Geotextiles”
 - d. ASTM D5887 – “Measurement of Index Flux Through Saturated Geosynthetic Clay Liner Specimens Using a Flexible Wall Permeameter”
 - e. ASTM D5888 – “Standard Guide for Storage and Handling of Geosynthetic Clay Liners”
 - f. ASTM D5889 – “Standard Practice for Quality Control of Geosynthetic Clay Liners”
 - g. ASTM D5890 – “Standard Test Method for Swell Index of Clay Mineral Component of Geosynthetic Clay Liners”
 - h. ASTM D5891 – “Standard Test Method for Fluid Loss of Clay Component of Geosynthetic Clay Liners”
 - i. ASTM D5993 – “Standard Test Method for Measuring Mass Per Unit of Geosynthetic Clay Liners”
 - j. ASTM D6102 – “Standard Guide for Installation of Geosynthetic Clay Liners”
 - k. ASTM D6243 – “Standard Test Method for Determining the Internal and Interface Shear Resistance of Geosynthetic Clay Liner by the Direct Shear Method”
 - l. ASTM D6496 – “Standard Test Method for Determining Average Bonding Peel Strength Between the Top and Bottom Layers of Needle-Punched Geosynthetic Clay Liners”

- m. ASTM D6768 – “Standard Test Method for Tensile Strength of Geosynthetic Clay Liners”
- 2. Geosynthetic Research Institute
 - a. GRI GCL 3, “Test Methods, Required Properties, and Testing Frequencies of Geosynthetic Clay Liners (GCLs)”

1.03 DEFINITIONS

- a. Geosynthetic Clay Liner (GCL) - A factory manufactured hydraulic barrier consisting of granular sodium bentonite clay, sandwiched between, supported and encapsulated by two geotextiles, held together by needlepunching.
- b. Geotextile - A semi-permeable woven or nonwoven fabric used to contain the bentonite used in a GCL.
- c. Sodium Bentonite - The high swelling clay component of GCLs consisting primarily of the mineral Montmorillonite.
- d. Needlepunching - A GCL manufacturing process whereby boards of barbed needles incorporate the staple fibers from a nonwoven geotextile, through a sodium bentonite clay layer, into the matrix of a second geotextile layer.
- e. Burnishing - A needlepunching enhancement process utilizing heat to bond the needlepunched fibers and more permanently lock them into the second geotextile to increase the internal shear strength characteristics.
- f. Minimum Average Roll Value (MARV) - The minimum average value of the material in a particular lot calculated as the mean of the tested values minus two standard deviations providing a 95% confidence level.

1.04 CONSTRUCTION QUALITY ASSURANCE (CQA)

- a. The OWNER/CONTRACTOR will engage and pay for the services of a third party CQA inspector and lab for monitoring the quality and installation of the GCL.
- b. The specific CQA inspector designated by the OWNER/CONTRACTOR shall be responsible for all aspects of the QA program, including the documentation and monitoring of the manufacturing and installation processes.

1.05 QUALIFICATIONS

- a. Manufacturer
 - 1. Geomembrane shall be manufactured by the following:
 - a. Agru America, Inc.

Georgetown Plant	Fernley Plant
500 Garrison Road	2000 East Newlands Drive
Georgetown, SC 29440	Fernley, NV 89408
843-546-0600	775-835-8282
 - b. Engineer approved equal

2. MANUFACTURER shall have manufactured a minimum of 10,000,000 square feet of GCL during the last year.

b. Installer

1. Installation shall be performed by an Agru approved Installer.
2. Installer shall have experience installing GCLs on at least 5 projects and have installed a minimum of 2 million square feet of GCL materials.

1.06 MATERIAL LABELING, DELIVERY, STORAGE AND HANDLING

a. General: Conform to the MANUFACTURER'S requirements and ASTM D5888 unless otherwise specified.

b. Delivery:

1. Deliver material to the site only after the CQA Inspector accepts required submittals.
2. Material shall be covered with a waterproof plastic covering resistant to ultraviolet degradation.
3. Ship less than one month prior to scheduled installation unless otherwise approved by engineer.
4. Each roll shall be marked with the following information:
 - a. manufacturer's name
 - b. product identification
 - c. roll number

c. Handling:

1. The QCA inspector shall verify that proper handling equipment exists which does not pose any danger to installation personnel or risk of damage or deformation to the liner material itself. Suitable handling equipment is described below:
2. Spreader Bar Assembly - A spreader bar assembly shall include both a core pipe or bar and a spreader bar beam. The core pipe shall be used to uniformly support the roll when inserted through the GCL core while the spreader bar beam will prevent chains or straps from chafing the roll edges.
3. Stinger - A stinger is a rigid pipe or rod with one end directly connected to a forklift or other handling equipment. If a stinger is used, it should be fully inserted to its full length into the roll to prevent excessive bending of the roll when lifted.
4. Straps - A properly structured and supported pole or "carpet puller" can be used to unload GCL rolls onsite. As an alternative, straps that are appropriately rated and located across the roll can be used as an approved lifting method to unload GCL rolls.

d. Storage:

1. Store rolls in space allocated by ENGINEER. Space should be at high ground level or elevated above ground surface.
2. Stack no more than 3 rolls high.
3. Protect rolls from UV, precipitation, other sources of moisture, mud, dirt, dust, puncture, cutting or any other damaging or deleterious conditions.
4. Preserve integrity and readability of roll labels.

5. Bagged bentonite material shall be stored and tarped next to GCL rolls unless other more protective measures are available. Bags shall be stored on pallets or other suitably dry surface which will prevent undue prehydration.
- e. GCL Inspection upon Delivery:
1. Each roll shall be visually inspected when unloaded to determine if any packaging or material has been damaged during transit.
 2. Repairs to damaged GCL shall be performed in accordance with Section 3.7 of this specification.
 - a. Rolls exhibiting damage shall be marked and set aside for closer examination during deployment.
 - b. Minor rips or tears in the plastic packaging shall be repaired with moisture resistant tape prior to being placed in storage to prevent moisture damage.
 - c. GCL rolls delivered to the project site shall be only those indicated on GCL manufacturing quality control certificates.
 - d. For needlepunched GCLs, the presence of free-flowing water within the packaging shall require that roll to be set aside for further examination to ascertain the extent of damage, if any. Free-flowing water within the packaging of unreinforced GCLs shall be cause for rejection of that roll.

1.07 WARRANTY

- a. Material shall be warranted, on a pro-rata basis against Manufacturer's defects for a period of 1 year from the date of the geomembrane installation.
- b. Installation shall be warranted against defects in workmanship for a period of 1 year from the date of geomembrane completion.

1.08 SUBMITTALS

- a. Provide shop drawings for the work included in this Section in conformance with applicable requirements of Section 01300 - Submittals.
 1. Manufacturer's Quality Control Manual
 2. Manufacturer's Product Datasheet for proposed material
 3. Project Reference List for GCL consisting of at least ten projects totaling 10 million square feet in size.
 4. A representative sample, approximately 3" x 5" of proposed GCL
 5. Prior to shipping material to site:
 - a. Certification of quality control tests from manufacturer on GCL product
 - b. Certification of quality control tests from manufacturer on Bentonite
 6. Prior to installing GCL:
 - a. Certification signed by the Contractor and CQA Inspector of subgrade acceptance
 7. Upon completion of gel installation:
 - a. Certification by Installer that the GCL was installed per project specifications
 - b. Material and Installation Warranties

PART 2 - PRODUCTS

2.01 QUALIFICATIONS

- a. The GCL product supplied to the project shall be in full accordance with the requirements of this section.
- b. The GCL shall be manufactured by mechanically bonding the geotextiles using a needlepunching process as described in Section 1.3 to enhance frictional and internal shear strength characteristics.
- c. The needlepunched GCL shall thermally heat set the nonwoven fibers where they protrude from the second geotextile (woven or nonwoven depending upon product) to more permanently secure the reinforcement in place. Other means may be used to lock the fibers in place if the process demonstrates similar performance to the thermal heat set process.
- d. In order to maintain these characteristics, no glues, adhesives or other non-mechanical bonding processes shall be used in lieu of the needlepunch process. Their use to enhance the physical properties of the GCL is permitted.

2.02 MATERIALS

- a. Acceptable Products
 1. Agru Geoclay WN36-7-03S
 2. Engineer approved alternative
- b. Alternative Materials
 1. Prior to considering an alternative GCL material, the Contractor shall submit certified test results and statements of quality from the proposed GCL supplier to the engineer, indicating without exception that the proposed GCL meets the requirements of this specification. Submittals shall be delivered to the engineer a minimum of five business days in advance of the bid.

2.03 GCL PHYSICAL PROPERTIES

- a. The GCL material shall be in accordance with the test methods, test frequencies and material physical properties as listed in the following data sheets.
- b. Dimensions - The minimum acceptable dimensions for the GCL panels shall be 15 feet wide and 150 feet long. Short rolls (rolls less than 125 feet long) may be supplied, but at a rate not to exceed 5% of the total square footage produced for this project.
- c. Overlap Markings - A minimum overlap guide-line and a construction match-line delineating the overlap zone shall be imprinted with non-toxic ink on both edges of the GCL panel to ensure the accuracy of the seam. These lines shall be used during CQA to ensure the minimum overlap is achieved. The minimum overlap guideline shall indicate where the edge of the panel must be placed in order to achieve the correct overlap for each panel.
- d. The GCL will have seam overlaps a minimum of 6 inches for all woven/nonwoven GCLs. GCL's comprised of a nonwoven/nonwoven geotextiles will have a minimum seam overlap of 6 inches

for scrim reinforced and 12 inches minimum for all non-scrim reinforced nonwoven GCLs. End of panel or butt end seams shall be a minimum of 12 inches for all woven/nonwoven GCLs, 12 inches for all scrim-reinforced double nonwoven GCLs, and 24 inches for non-scrim reinforced double nonwoven GCLs.

- e. Accessory Bentonite - Any accessory bentonite used for sealing seams, penetrations, or repairs, shall be the same granular bentonite as used in the production of the GCL itself.

Table 1: Agru Geoclay WN36-7-03S

Tested Property	Test Method	Frequency	Minimum Average Roll Value
Geotextile Property			
Cap Nonwoven, Mass/Unit Area	ASTM D5261	1/200,000 ft ²	6.0 oz/yd ²
Carrier Woven, Mass/Unit Area	ASTM D5261	1/200,000 ft ²	3.1 oz/yd ²
Bentonite Property⁽¹⁾			
Swell Index	ASTM D5890	1/100,000 lb	24 ml/2 g min
Moisture Content	ASTM D4643	1/100,000 lb	12% max
Fluid Loss	ASTM D5891	1/100,000 lb	18 ml max
Finished GCL Property			
Bentonite, Mass/Unit Area ⁽²⁾	ASTM D5993	1/40,000 ft ²	0.75 lb/ft ²
Tensile Strength ⁽³⁾	ASTM D6768	1/40,000 ft ²	30 lb/in
Peel Strength	ASTM D6496	1/40,000 ft ²	3.5 lb/in
Hydraulic Conductivity ⁽⁴⁾	ASTM D5887	1/Week	5 x 10 ⁻⁹ cm/sec max
Index Flux ⁽⁴⁾	ASTM D5887	1/Week	1 x 10 ⁻⁸ m ³ /m ² /sec max
Internal Shear Strength ⁽⁵⁾	ASTM D6243	Periodically	500 psf Typical

NOTES:

- ⁽¹⁾Bentonite Properties tests performed at a bentonite processing facility prior to shipment to GCL production facility.
 - ⁽²⁾At 0% moisture content.
 - ⁽³⁾Tested in machine direction.
 - ⁽⁴⁾Deaired, deionized water @ 5 psi maximum effective confining stress and 2 psi head pressure.
 - ⁽⁵⁾Typical peak value for specimen hydrated for 24 hours and sheared under a 200 psf normal stress.
- Rolls are 15.5' x 150' and weight approximately 2,600 lbs. Supplied with two straps and wound on a 4.75" core.

PART 3 - EXECUTION

3.01 GENERAL

a. Execution

1. The following installation procedures are as specific as possible while recognizing that the specific requirements of the project may necessitate minor modifications. Significant deviations from these procedures shall be pre-approved by the project engineer or other designated party.

3.02 SUBGRADE PREPARATION

- a. The subgrade upon which the GCL shall be suitable for the placement of GCL material, subject to the applicable section of this specification.
- b. Earthen Subgrade - The surface upon which the GCL material will be installed shall be inspected by the CQA inspector and certified by the earthwork contractor to be in accordance with the requirements of this document or the project specification.
- c. The surface upon which the GCL is to be installed should be smooth and free of wheel ruts, debris, roots, sticks, and rocks larger than 1.0 in. Site specific compaction requirements should be followed in accordance with the project plans and specifications. At a minimum, the site should be smooth rolled the level of compaction such that installation equipment and other construction vehicles traffic does not cause rutting greater than 1.0 in deep. Furthermore, all protrusions extending more than 0.5 in from the subgrade shall be removed, crushed, or compacted into the subgrade.
- d. In applications where the product is the sole barrier, subgrade surfaces consisting of gravel or granular soils may not be acceptable due to their large void content. For these applications, the subgrade shall be greater than 80% fines and contain no particles larger than 1 in.
- e. Immediately prior to deployment of the GCL, the subgrade shall be final compacted to fill in any remaining voids or desiccation cracks and to ensure that no sharp irregularities or abrupt elevation changes exist greater than 1.0 in. The surfaces to be lined shall be maintained in this condition and free of standing water. GCL can be deployed on a frozen subgrade, if the subgrade would meet all the conditions as previously outlined if unfrozen. The subgrade surface and preparation should be inspected and certified by the CQA inspector prior to GCL placement. Upon approval by the CQA inspector, it is the geosynthetic installer's responsibility to communicate to the engineer of any changes in the condition of the subgrade that might render it out of compliance, with any of the requirements of the project specification or ASTM Standard D 6102.D.
- f. Site specific compaction requirements should be followed in accordance with the project drawings and specifications. At a minimum, the level of compaction should be such that no rutting is caused by installation equipment or other construction vehicles which traffic the area of deployment (typically 85% of standard proctor or greater).
- g. The surfaces to be lined shall be smooth and free of any debris, vegetation, roots, sticks, sharp rocks, or other deleterious materials larger than two inches as well as free of any voids, large cracks or standing water or ice.

- h. Subsequent to the CQA inspector's approval, it shall be the installer's responsibility to indicate to the Engineer any change in the subgrade condition that could cause it to be out of compliance with any of the requirements of this section or the project specification.

3.03 ANCHOR TRENCH

- a. An anchor trench shall be excavated by the earthwork contractor or liner installer to the lines and grades shown on the project drawings at the top of slopes.
 - 1. The anchor trench shall be constructed free of sharp edges or corners and maintained in a dry condition. No loose soil shall be permitted beneath the GCL within the trench.
 - 2. The anchor trench shall be inspected and approved by the CQA inspector prior to GCL placement, back-filling and compaction of the anchor key material.

3.04 MATERIAL PLACEMENT

- a. GCL Material shall be placed in general accordance with the procedures specified below, or modified to account for site specific conditions.
 - 1. GCL Orientation - GCL panels are typically placed with the nonwoven side up (heat burnished side down) to maximize the shear strength characteristics. However, the heat burnished side up if it maximizes the shear strength characteristics of a site specific interface. In base or flat areas, the GCL does not require any particular orientation.
 - 2. GCL Panel Position - Where possible, all slope panels should be installed parallel to the maximum slope while panels installed in flat areas require no particular orientation.
 - 3. Panel Deployment - GCL materials shall be installed in general accordance with the procedures set forth in this section, subject to site specific conditions which would necessitate modifications.
 - a. The GCL may be deployed on slopes by pulling the material from a suspended roll, or securing a roll end into an anchor trench and unrolling each panel as the handling equipment slowly moves backwards.
 - b. Deployment on flat areas shall be conducted in the same manner as that for the slopes, however, care should be taken to minimize "dragging" the GCL.
 - c. Slip sheets shall be required for use when installing over blown-film textured material or when the installation of blown film textured liner is performed over the GCL.
 - d. The GCL will have seam overlaps a minimum of 6 inches for all woven/nonwoven GCLs. GCL's comprised of a nonwoven/nonwoven geotextiles will have a minimum seam overlap of 6 inches for scrim reinforced and 12 inches minimum for all non-scrim reinforced nonwoven GCLs. End of panel or butt end seams shall be a minimum of 12 inches for all woven/nonwoven GCLs, 12 inches for all scrim-reinforced double nonwoven GCLs, 24 inches for non-scrim reinforced double nonwoven GCLs, and be free of wrinkles, folds or "fish-mouths".
 - e. The contractor shall only install as much GCL that can be covered at the end of the day. No GCL shall be left exposed overnight. The exposed edge of the GCL shall be covered by a temporary tarpaulin or other such water resistant sheeting until the next working day.

3.05 SEAMS AND OVERLAPS

- a. Overlap Line

1. Woven/Nonwoven and Scrim Reinforced Nonwoven GCLs
 - a. A 6 inch lap line and a 9 inch match line for scrim reinforced GCLs shall be imprinted on both edges of the upper geotextile component of the GCL to assist in installation overlap quality control. Lines shall be printed as continuous dashes in easily observable non-toxic ink.
2. Non-Scrim Reinforced Nonwoven GCLs
 - a. A 12 inch lap line and 15 inch match line for non-scrim reinforced GCLs shall be imprinted on both edges of the upper geotextile component of the GCL to assist in installation overlap quality control. Lines shall be printed as continuous dashes in easily observable non-toxic ink.
3. Seams
 - a. Woven/Nonwoven and Scrim Reinforced Nonwoven GCLs
 - i. Overlap seams shall be a minimum of six inches on panel edges and one foot on panel ends.
 - b. Non-Scrim Reinforced Nonwoven GCLs
 - i. Overlap seams shall be a minimum of 12 inches on panel edges and 2 foot on panel ends.
 - c. Loose granular bentonite shall be placed between panel overlaps at a rate of 0.25 pound per lineal foot.

3.06 DETAILING

- a. Detail work, defined as the sealing of the liner to pipe penetrations, foundation walls, drainage structures, spillways, and other appurtenances, shall be performed as recommended by the GCL Manufacturer.

3.07 DAMAGE REPAIR

- a. Prior to cover material placement, damage to the GCL shall be identified and repaired by the installer. Damage is defined as any rips or tears in the geotextiles, delamination of geotextiles or a displaced panel.
- b. Rip and Tear Repair (Flat Surfaces) - Rips or tears may be repaired by completely exposing the affected area, removing all foreign objects or soil, and by then placing a patch cut from unused GCL over the damage (damaged material may be left in place), with a minimum overlap of 12 inches on all edges. Accessory bentonite should be placed between the patch edges and the repaired material at a rate of a quarter pound per lineal foot of edge spread in a continuous six inch fillet.
- c. Rip and Tear Repair (Slopes) - Damaged GCL material on slopes shall be repaired by the same procedures above, however, the edges of the patch should also be adhered to the repaired liner with heat tacking or an adhesive to keep the patch in position during backfill or cover operations.

3.08 DISPLACED PANELS

- a. Displaced panels shall be adjusted to the correct position and orientation. The adjusted panel shall then be inspected for any geotextile damage or bentonite loss. Damage shall be repaired by the above procedure.

3.09 PREMATURE HYDRATION

- a. If the GCL is prematurely hydrated, installer shall notify the QA/QC technician and project engineer for a site specific determination as to whether the material is acceptable or if alternative measures must be taken to ensure the quality of the design.

3.10 COVER MATERIAL

- a. The cover materials shall be compatible as well as suitable for use over the GCL, and placed in a manner appropriate to the particular subgrade. Regardless of the cover material, the uncovered edge of GCL panels shall be protected at the end of the working day with a waterproof sheet which is secured adequately with ballast.
- b. Earthen Cover Soil - If the cover material is soil or gravel, a minimum thickness of 12 inches shall be placed over the GCL. The soil cover shall be free of sharp-edged stones greater than 0.5 inches in size.
 1. Equipment - Soil cover shall be placed with low ground pressure equipment. Care should be taken to avoid damaging the GCL by making sharp turns or pivots with equipment as well as sudden starts or stops.
 2. Placement - Soils may be placed on the GCL by pushing with a track dozer or by carefully placing it with a loader or a back-hoe. The use of scrapers or pans directly over the GCL is strictly prohibited.
 3. Thickness - A minimum thickness of 12 inches of cover shall be kept between heavy equipment and the GCL at all times. No heavy vehicles should be driven directly on the GCL until the proper thickness of cover has been placed.
 4. Compaction - To prevent damage to the GCL, the initial lift(s) of soil cover shall not be compacted in excess of 85 percent Modified Proctor density or as specified by the engineer.
 5. Slope Placement - When covering GCL on sloped areas, cover soil should be pushed up-slope to minimize tension on the GCL.
- c. Geosynthetic Cover - Precautions shall be taken to prevent damage to the GCL by restricting the use of heavy equipment over the liner system.
 1. Equipment - Installation of the overlying geosynthetic component can be accomplished through the use of lightweight, rubber-tired equipment such as a 4-wheel all-terrain vehicle (ATV) or low ground pressure rubber-tracked bobcat type equipment. This vehicle can be driven directly on the GCL, provided no sudden stops, starts, or turns are made.
 2. Placement - Smooth HDPE may be dragged across the GCL surface with equipment or by hand labor during positioning. Similarly, the HDPE may be unrolled with the use of low ground pressure equipment.
 3. Use of Textured Liners - If a blown-film textured geomembrane is placed over the GCL, a slip sheet (such as 20-mil smooth HDPE) should be placed over the GCL in order to allow the geomembrane to slide into its proper position. Once the overlying geomembrane is properly positioned, the slip-sheet shall be carefully removed paying close attention to avoiding any movement to the geomembrane.

END OF SECTION 02620

SECTION 02630
GEOMEMBRANE

PART 1 - GENERAL

1.01 SCOPE

- A. Manufacture, deliver, unload and install HDPE Conductive® (GEOMEMBRANE). All materials meet or exceed the requirements of this specification, and all work will be performed in accordance with the procedures provided in these project specifications.
- B. Related Sections include but are not necessarily limited to:
 - 1. Requirements specified in Conditions of the Contract and Division 1 form a part of this Section;
 - 2. Section 01300 – Submittals;
 - 3. Section 02222 – Excavation, Trenching, and Backfill;

1.02 REFERENCES

- A. Publications listed below form a part of this Section to the extent referenced. The publications are referenced in the text by the basic designation only.
 - 1. American Society for Testing Materials (ASTM).
 - a. ASTM D792 – Method B, Density and Specific Gravity of Plastics by Displacement
 - b. ASTM D1004 – Initial Tear Resistance of Plastic Film and Sheeting
 - c. ASTM D1238 – Flow Rates of Thermoplastics by Extrusion Plastometer
 - d. ASTM D3895 – Oxidative-Induction Time of Polyolefins by Differential Scanning Calorimetry
 - e. ASTM D4218 – Determination of Carbon Black in Polyethylene Compounds
 - f. ASTM D4833 – Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products
 - g. ASTM D5199 – Measuring Nominal Thickness of Geotextiles and Geomembranes
 - h. ASTM D5596 – Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics
 - i. ASTM D5994 – Measuring Core Thickness of Textured Geomembranes
 - j. ASTM D6392 – Determining the Integrity of Nonreinforced Geomembrane Seams Produced Using Thermo-Fusion Methods
 - k. ASTM D6693 – Determining Tensile Properties of Nonreinforced Polyethylene and Nonreinforced Flexible Polypropylene Geomembranes
 - l. ASTM D7466 – Measuring Asperity Height of Textured Geomembranes
 - m. ASTM D7240 – Standard Practice for Electrical Leak Location Using Geomembranes with an Insulating Layer in Intimate Contact with a Conductive Layer via Electrical Capacitance Technique (Conductive-Backed Geomembrane Spark Test)

2. Geosynthetic Research Institute
 - a. GRI GM 13 Test Properties, Test Properties and Testing Frequency for High Density Polyethylene (HDPE) Smooth and Textured Geomembranes

1.03 DEFINITIONS

- A. Lot: A quantity of resin (usually a rail car) used in the manufacture of geomembranes. Finished roll will be identified by a roll number traceable to the resin lot used.
- B. Construction Quality Assurance Consultant (CONSULTANT): Party, independent from MANUFACTURER and INSTALLER that is responsible for observing and documenting activities related to quality assurance during the lining system construction.
- C. ENGINEER: The individual or firm responsible for the design and preparation of the project's Contract Drawings and Specifications.
- D. Geomembrane Manufacturer (MANUFACTURER): The party responsible for manufacturing the geomembrane rolls.
- E. Geosynthetic Quality Assurance Laboratory (TESTING LABORATORY): Party, independent from the OWNER, MANUFACTURER and INSTALLER, responsible for conducting laboratory tests on samples of geosynthetics obtained at the site or during manufacturing, usually under the direction of the OWNER.
- F. INSTALLER: Party responsible for field handling, transporting, storing and deploying the geocomposite.
- G. PANEL: Area of geomembrane that will be seamed in the field that is larger than 100 ft².
- H. PATCH: Area of geomembrane that will be seamed in the field that is less than 100 ft².
- I. SUBGRADE SURFACE: Soil layer surface which immediately underlies the geosynthetic material(s).

1.04 QUALITY ASSURANCE

- A. The OWNER will engage and pay for the services of a Geosynthetic Quality Assurance Consultant and Laboratory to monitor geomembrane installation.

1.05 QUALIFICATIONS

- A. Manufacturer
 1. Geomembrane shall be manufactured by the following:
 - a. Agru America, Inc.

Georgetown Plant	Fernley Plant
500 Garrison Road	2000 East Newlands Drive
Georgetown, SC 29440	Fernley, NV 89408
843-546-0600	775-835-8282

- b. approved equal
2. MANUFACTURER shall have manufactured a minimum of 10,000,000 square feet of polyethylene geomembrane during the last year.

B. Installer

1. INSTALLER shall have installed a minimum of 10,000,000 square feet of HDPE geomembrane during the 3 last years.
2. INSTALLER shall have worked in a similar capacity on at least 10 projects similar in complexity to the project described in the contract documents, and with at least 250,000 square feet of HDPE geomembrane installation on each project.
3. The Installation Supervisor shall have worked in a similar capacity on projects similar in size and complexity to the project described in the Contract Documents.
4. The INSTALLER shall provide a minimum of one Master Seamer for work on the project.
 - a. Must have completed a minimum of 1,000,000 square feet of geomembrane seaming work using the type of seaming apparatus proposed for the use on this Project.

1.06 MATERIAL LABELING, DELIVERY, STORAGE AND HANDLING

- A. Labeling- Each roll delivered to the site shall be wrapped and labeled by the MANUFACTURER. The label will identify:
 1. manufacturer's name
 2. product identification
 3. thickness
 4. length
 5. width
 6. roll number
- B. Delivery- Rolls will be prepared to ship by appropriate means to prevent damage to the material and to facilitate off-loading.
- C. Storage- The on-site storage location for geomembrane material, provided by the CONTRACTOR to protect the geomembrane from punctures, abrasions and excessive dirt and moisture for should have the following characteristics:
 1. level (no wooden pallets)
 2. smooth
 3. dry
 4. protected from theft and vandalism
 5. adjacent to the area being lined
- D. Handling- Materials are to be handled so as to prevent damage.

1.07 WARRANTY

- A. Material shall be warranted, on a pro-rata basis against Manufacturer's defects for a period of 1-year from the date of the geomembrane installation.

- B. Installation shall be warranted against defects in workmanship for a period of 1-year from the date of geomembrane completion.

1.08 SUBMITTALS

- A. Provide shop drawings for the work included in this Section in conformance with applicable requirements of Section 01300 - Submittals.
- B. Furnish the following product data, in writing, to ENGINEER prior to installation of the geomembrane material:
 - 1. Resin Data shall include the following.
 - a. Certification stating that the resin meets the specification requirements (see Table 1.9).
 - 2. Geomembrane Roll
 - a. Statement certifying no recycled polymer and no more than 10% rework of the same type of material is added to the resin (product run may be recycled).
- C. The INSTALLER shall furnish the following information to the ENGINEER and OWNER prior to installation:
 - 1. Installation layout drawings
 - a. Must show proposed panel layout including field seams and details
 - b. Must be approved prior to installing the geomembrane
 - 2. Approved drawings will be for concept only and actual panel placement will be determined by site conditions.
 - 3. Installer's Geosynthetic Field Installation Quality Assurance Plan
- D. The INSTALLER will submit the following to the ENGINEER upon completion of installation:
 - 1. Certificate stating the geomembrane has been installed in accordance with the Contract Documents
 - 2. Material and installation warranties
 - 3. As-built drawings showing actual geomembrane placement and seams including typical anchor trench detail and location of repairs.

PART 2 - PRODUCTS

2.01 GEOMEMBRANE PROPERTIES

- A. Material shall be textured or structured polyethylene geomembrane as shown on the drawings.
- B. Resin
 - 1. Resin shall be new, first quality, compounded and manufactured specifically for producing geomembrane.
 - 2. Natural resin (without carbon black) shall meet the following requirements:

Table 1: Raw Material Properties

Property	Test Method	HDPE
Density (g/cc)	ASTM D792, Method B	≤ 0.932
Melt Flow Index (g/10 min)	ASTM D1238 (190/2.16)	≤ 1.0

C. Geomembrane Rolls

1. Do not exceed a combined maximum total of 1 percent by weight of additives other than carbon black.
2. Geomembrane shall be free of holes, pinholes, bubbles, blisters, excessive contamination by foreign matter, and nicks and cuts on roll edges.
3. Geomembrane material is to be supplied in roll form. Each roll is to be identified with labels indicating roll number, thickness, length, width and MANUFACTURER.
4. All liner sheets produced at the factory shall be inspected prior to shipment for compliance with the physical property requirements listed in section 1.9 D.
5. All geomembrane shall contain edge markings which shall denote the name of the manufacturer, the product thickness, the year of manufacture and the length of the roll. These marking shall occur at uniformly spaced intervals throughout the entire length of the roll.

- D. Textured surface geomembrane shall contain a smooth surface on each edge. Otherwise, texturing shall be uniform from edge to edge and roll to roll. Textured geomembrane shall be manufactured with an embossed surface to ensure uniformity of texture. Textured and/or structured geomembrane shall meet the requirements shown in the following table:

Table 2: Agru HDPE MicroSpike Conductive® Liner

TESTED PROPERTY	TEST METHOD FREQUENCY MINIMUM AVERAGE VALUE		
	60 mil	80 mil	100 mil
Thickness, (min. average) mil (mm) Min 8 of 10 Measurements (-10%) Lowest individual reading (-15%)	ASTM D5994	every roll	57 (1.4) 54 (1.43) 51 (1.28)
Density, g/cm ³	ASTM D792 Method B	200,000 lb	0.94
Tensile Properties (each direction) Strength at Break, lb/in-width (N/mm) Strength at Yield, lb/in-width (N/mm) Elongation at Break, % Elongation at Yield, %	ASTM D6693, Type IV Dumbell, 2 ipm G.L. 2.0 in (51 mm) G.L. 1.3 in (33 mm)	20,000 lb	132 (23) 132 (23) 200 12
Tear Resistance, lb (N)	ASTM D1004	45,000 lb	45 (200)
Puncture Resistance, lb (N)	ASTM D4833	45,000 lb	120 (534)
Carbon Black Content, % (Range) ¹	ASTM D4218	20,000 lb	2.0 - 3.0
Carbon Black Dispersion	ASTM D5596	45,000 lb	Note ⁽²⁾
Asperity Height, mil (mm)	ASTM D7466	second roll	20 (0.5)
Notched Constant Tensile Load, hr	ASTM D5397, App.	200,000 lb	500
Oxidative Induction Time, min	ASTM D3895, 200° C; O ₂ , 1 atm	200,000 lb	>140

NOTES:

- ⁽¹⁾Ash Content may be $\geq 3\%$ due to conductive layer
- ⁽²⁾Dispersion only applies to near spherical agglomerates. 10 views shall be Category 1 or 2.
- All Agru geomembranes have dimensional stability of $\pm 2\%$ when tested according to ASTM D 1204 and LTB of $< -77^\circ \text{C}$ when tested according to ASTM D 746.

E. Extruded Rod or Beam

1. Extrudate material shall be made from same type resin as the geomembrane.
2. Additives shall be thoroughly dispersed.
3. Materials shall be free of contamination by moisture or foreign matter.

2.02 EQUIPMENT

A. Welding equipment and accessories shall meet the following requirements:

1. Gauges showing temperatures in apparatus such as extrusion welder or fusion welder shall be present.
2. An adequate number of welding apparatus shall be available to avoid delaying work.
3. Power source must be capable of providing constant voltage under combined line load.

PART 3 - EXECUTION

3.01 DEPLOYMENT

- A. Assign each panel a simple and logical identifying code. The coding system shall be subject to approval and shall be determined at the job site.
- B. Visually inspect the geomembrane during deployment for imperfections and mark faulty or suspect areas.
- C. Deployment of geomembrane panels shall be performed in a manner that will comply with the following guidelines:
 - 1. Geomembranes shall be installed according to site-specific specifications.
 - 2. Unroll geomembrane using methods that will not damage geomembrane and will protect underlying surface from damage (spreader bar, protected equipment bucket).
 - 3. Place ballast (commonly sandbags) on geomembrane which will not damage geomembrane to prevent wind uplift.
 - 4. Personnel walking on geomembrane shall not engage in activities or wear shoes that could damage it. Smoking will not be permitted on the geomembrane.
 - 5. Do not allow heavy vehicular traffic directly on geomembrane. Rubber-tired ATV's and trucks are acceptable if wheel contact is less than 8 psi.
 - 6. Protect geomembrane in areas of heavy traffic by placing protective cover over the geomembrane.
- D. Sufficient material (slack) shall be provided to allow for thermal expansion and contraction of the material.

3.02 FIELD SEAMING

- A. Seams shall meet the following requirements:
 - 1. To the maximum extent possible, orient seams parallel to line of slope, i.e., down and not across slope.
 - 2. Minimize number of field seams in corners, odd-shaped geometric locations and outside corners.
 - 3. Slope seams (panels) shall extend a minimum of five-feet beyond the grade break into the flat area.
 - 4. Use a sequential seam numbering system compatible with panel numbering system that is agreeable to the CONSULTANT and INSTALLER.
 - 5. Align seam overlaps consistent with the requirements of the welding equipment being used. A 6-inch overlap is commonly suggested.
- B. During Welding Operations
 - 1. Provide at least one Master Seamer who shall provide direct supervision over other welders as necessary.
- C. Extrusion Welding
 - 1. Hot-air tack adjacent pieces together using procedures that do not damage the geomembrane.

2. Clean geomembrane surfaces by disc grinder or equivalent.
3. Purge welding apparatus of heat-degraded extrudate before welding.
4. On materials 80 mil and thicker, bevel the top edge of liner to be welded to avoid air pockets.

D. Hot Wedge Welding

1. Welding apparatus shall be a self-propelled device equipped with an electronic controller which displays applicable temperatures.
2. Clean seam area of dust, mud, moisture and debris immediately ahead of hot wedge welder.
3. Protect against moisture build-up between sheets.

E. Trial Welds

1. Perform trial welds on geomembrane samples to verify welding equipment is operating properly.
2. Make trial welds under the same surface and environmental conditions as the production welds, i.e., in contact with subgrade and similar ambient temperature.
3. Minimum of two trial welds per day, per welding apparatus, one made prior to the start of work and one completed at mid shift.
4. Cut four, one-inch wide by six-inch long test strips from the trial weld.
5. Quantitatively test specimens for peel adhesion, and then for shear strength.
6. Trial weld specimens shall pass when the results shown in the following tables for LLDPE are achieved in both peel and shear test.

Table 3: Minimum Weld Values for HDPE Geomembranes

Property	Test Method	30 (0.75)	40 (1.0)	60 (1.5)	80 (2.0)	100 (2.5)	120 (3.0)
Peel Strength (fusion), ppi (kN/m)	ASTM D6392	45 (197)	60 (263)	91 (398)	121 (530)	151 (661)	181 (793)
Peel Strength (extrusion), ppi (kN/m)	ASTM D6392	39 (170)	52 (225)	78 (340)	104 (445)	130 (570)	156 (680)
Shear Strength (fusion & ext.), ppi (kN/m)	ASTM D6392	57 (250)	80 (350)	120 (525)	160 (701)	200 (876)	240 (1050)

- a. The break when peel testing, occurs in the liner material itself, not through peel separation (FTB).
- b. The break is ductile.
7. Repeat the trial weld, in its entirety, when any of the trial weld samples fail in either peel or shear.
8. No welding equipment or welder shall be allowed to perform production welds until equipment and welders have successfully completed trial weld.

- F. Seaming shall not proceed when ambient air temperature or adverse weather conditions jeopardize the integrity of the liner installation. INSTALLER shall demonstrate that acceptable seaming can be performed by completing acceptable trial welds.
- G. Defects and Repairs
 - 1. Examine all seams and non-seam areas of the geomembrane for defects, holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter.
 - 2. Repair and non-destructively test each suspect location in both seam and non-seam areas. Do not cover geomembrane at locations that have been repaired until test results with passing values are available.

3.03 FIELD QUALITY ASSURANCE

- A. MANUFACTURER and INSTALLER shall participate in and conform to all terms and requirements of the Owner's quality assurance program. CONTRACTOR shall be responsible for assuring this participation.
- B. Quality assurance requirements are as specified in this Section and in the Field Installation Quality Assurance Manual if it is included in the contract.
- C. Field Testing
 - 1. Installed conductive geomembrane shall be tested for leaks via ASTM D7240.
 - 2. Non-destructive testing may be carried out as the seaming progresses or at completion of all field seaming.
 - a. Vacuum Testing
 - i. Shall be performed in accordance with ASTM D5641, Standard Practice for Geomembrane Seam Evaluation by Vacuum Chamber.
 - b. Air Pressure Testing
 - i. Shall be performed in accordance with ASTM D5820, Standard Practice for Pressurized Air Channel Evaluation of Dual Seamed Geomembranes.
 - c. Other approved methods.
 - 3. Destructive Testing (performed by CONSULTANT with assistance from INSTALLER)
 - a. Location and Frequency of Testing
 - i. Collect destructive test samples at a frequency of one per every 500 lineal feet of seam length.
 - ii. Test locations will be determined after seaming.
 - iii. Exercise Method of Attributes as described by GRI GM-14 (Geosynthetic Research Institute, <http://www.geosynthetic-institute.org>) to minimize test samples taken.
 - b. Sampling Procedures are performed as follows:
 - i. INSTALLER shall cut samples at locations designated by the CONSULTANT as the seaming progresses in order to obtain field laboratory test results before the geomembrane is covered.
 - ii. CONSULTANT will number each sample, and the location will be noted on the installation as-built.

- iii. Samples shall be twelve (12) inches wide by minimal length with the seam centered lengthwise.
 - iv. Cut a 2-inch wide strip from each end of the sample for field-testing.
 - v. Cut the remaining sample into two parts for distribution as follows:
 - a) One portion for INSTALLER, 12-inches by 12 inches
 - b) One portion for the Third Party laboratory, 12-inches by 18-inches
 - c) Additional samples may be archived if required.
 - vi. Destructive testing shall be performed in accordance with ASTM D6392, Standard Test Method for Determining the Integrity of Non-Reinforced Geomembrane Seams Produced Using Thermo-Fusion Methods.
 - vii. INSTALLER shall repair all holes in the geomembrane resulting from destructive sampling.
 - viii. Repair and test the continuity of the repair in accordance with these Specifications.
 - ix. CQA activities should not be more than one day behind deployment.
4. Failed Seam Procedures
- a. If the seam fails, INSTALLER shall follow one of two options:
 - i. Reconstruct the seam between any two passed test locations.
 - ii. Trace the weld to intermediate location at least 10 feet minimum or where the seam ends in both directions from the location of the failed test.
 - b. The next seam welded using the same welding device is required to obtain an additional sample
 - c. If sample passes, then the seam shall be reconstructed or capped between the test sample locations.
 - d. If any sample fails, the process shall be repeated to establish the zone in which the seam shall be reconstructed.

3.04 REPAIR PROCEDURES

- A. Remove damaged geomembrane and replace with acceptable geomembrane materials if damage cannot be satisfactorily repaired.
- B. Repair any portion of unsatisfactory geomembrane or seam area failing a destructive or non-destructive test.
- C. INSTALLER shall be responsible for repair of defective areas.
- D. Agreement upon the appropriate repair method shall be decided between CONSULTANT and INSTALLER by using one of the following repair methods:
 - 1. Patching- Used to repair large holes, tears, undispersed raw materials and contamination by foreign matter.
 - 2. Abrading and Re-welding- Used to repair short section of a seam.
 - 3. Spot Welding- Used to repair pinholes or other minor, localized flaws or where geomembrane thickness has been reduced.
 - 4. Capping- Used to repair long lengths of failed seams.

5. Remove the unacceptable seam and replace with new material.
- E. The following procedures shall be observed when a repair method is used:
1. All geomembrane surfaces shall be clean and dry at the time of repair.
 2. Surfaces of the polyethylene which are to be repaired by extrusion welds shall be lightly abraded to assure cleanliness.
 3. Extend patches or caps at least 6 inches for extrusion welds and 4 inches for wedge welds beyond the edge of the defect, and around all corners of patch material.
- F. Repair Verification
1. Number and log each patch repair (performed by CONSULTANT).
 2. Non-destructively test each repair using methods specified in this Specification.

3.05 MEASUREMENT AND PAYMENT

- A. Payment for geomembrane installation will be as per contract unit price per square foot, including designed anchor trench material and is based upon net lined area.
- B. Net lined area is defined to be the true area of all surfaces to be lined plus designed burial in all anchor trenches, rubsheets, and sacrificial layers.
- C. Prices shall include full compensation for furnishing all labor, material, tools, equipment, and incidentals.
- D. Prices also include doing all the work involved in performing geomembrane installation completely as shown on the drawing, as specified herein, and as directed by the ENGINEER.

END OF SECTION 02630

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SECTION 02640

FABRIC FORMS OF CONCRETE

PART 1 - GENERAL

1.01 SCOPE

- A. The work shall consist of furnishing all labor, materials, and equipment for installing fabric-formed concrete revetment as indicated in the contract drawings and specified herein.
- B. The work shall consist of installing an unreinforced concrete revetment, as indicated in the contract drawings, by positioning a specially woven dual wall, 100% nylon fabric form on the slope or surface to be protected and injecting it with fine aggregate concrete (grout). The surfaces to be protected shall be prepared and graded to such an extent that they are normally stable in the absence of erosive forces.
- C. Related Sections include but are not necessarily limited to:
 - 1. Requirements specified in Drawings;
 - 2. Section 01300 – Submittals;
 - 3. Section 02222 – Excavation, Trenching, and Backfill;
 - 4. Section 02440 – Soil Erosion, Sediment and Pollution Control;

1.02 REFERENCES

- A. Publications listed below form a part of this Section to the extent referenced. The publications are referenced in the text by the basic designation only.
 - 1. American Society for Testing Materials (ASTM).
 - a. ASTM C31 – Standard Practice for Making and Curing Concrete Test Specimens in the Field
 - b. ASTM C39 – Standard Test Method for Compressive Strength Cylindrical Concrete Specimens

1.03 DEFINITIONS

- A. Construction Quality Assurance Consultant (CONSULTANT): Party, independent from MANUFACTURER and INSTALLER that is responsible for observing and documenting activities related to quality assurance during the lining system construction.
- B. ENGINEER: The individual or firm responsible for the design and preparation of the project's Contract Drawings and Specifications.
- C. Fabric-formed concrete Manufacturer (MANUFACTURER): The party responsible for manufacturing the fabric-formed concrete.
- D. INSTALLER: Party responsible for field handling, transporting, storing and deploying the fabric-formed concrete.

1.04 QUALIFICATIONS

A. Installer

1. INSTALLER shall furnish records of past successful experience in performing this type of work. The INSTALLER shall save the OWNER harmless from liability of any kind arising from the use of any patented or unpatented invention in the performance of work.

PART 2 - PRODUCTS

2.01 FIBER AND FABRIC SPECIFICATIONS

- A. Fiber and fabric materials shall meet the minimum requirements, as listed and reported by an independent testing agency, shown below:

PROPERTY	TEST METHOD	UNIT	VALUE
PHYSICAL			
Composition			NYLON
Weight (both layers)	ASTM D-5761	oz/yd (g/m)	13 (440)
Thickness	ASTM D-5199	in (mm)	.30 (0.76)
MECHANICAL			
Grain Tensile Strength	ASTM D-4632	lbf (N)	WAFP 400 (1780)
			FILL 250 (1110)
Grain Tensile Elongation	ASTM D-4632	%	WAFP 30
			FILL 30
Wide Width Strip Tensile Strength	ASTM D-4595	lbf/in (kN/m)	WAFP 300 (52.5)
			FILL 200 (35)
Elongation At Break	ASTM D-4595	%	WAFP 15
			FILL 20
Trapezoidal Tear Strength	ASTM D-4533	lbf (N)	WAFP 175 (775)
			FILL 150 (665)
HYDRAULIC			
Apparent Opening Size (AOS)	ASTM D 4751	U.S. Standard (mm)	40 (0.425)
Flow Rate	ASTM D-4491	gal/min/sf (l/min/m ²)	90 (3665)

2.02 FABRIC DESIGN

- A. Fabric-forming material shall consist of double-layer, open-selvage fabric joined in a mat configuration. Fabric shall be woven of 100% high-tenacity, continuous multifilament nylon of which as least 50% by weight shall be textured fiber. Polyester, staple, and partially oriented yarn shall not be allowed.
 1. Unimat Fabric, designated on the drawings, shall be woven in such a manner with nylon spacer cords to provide points of attachment on specific centers. The spacer cords shall serve to control the thickness of the revetment without bursting the fabric during fine aggregate injection.
 2. Thickness of the finished revetment shall be measured as designed in Section 3.04 of these specifications.

2.03 FABRIC POROSITY

- A. Fabric porosity is essential for the successful execution of this work. At the direction of the ENGINEER, the INSTALLER shall demonstrate the suitability of fabric design by injecting the proposed grout into 5 1/2" (140 mm) diameter sleeves. The sleeves shall be constructed of a single layer of the same basic fabric material. Test cylinders, 12" (300 mm) long, shall be cut from each specimen and tested in accordance with ASTM C-39. This test will be run once at the start of the project unless otherwise directed by the ENGINEER.

2.04 RELIEF OF HYDROSTATIC UPLIFT

- A. Where groundwater conditions require provision for relief of hydrostatic uplift, 7/8" (22mm) I.D. weep tube assemblies shall be inserted through the fabric. These weep tube assemblies shall be held in place during grout injection by means of a snap on collar attached to the lower end of the weep tube assembly. If the revetment has not been placed over a geotextile filter cloth, the lower end of the weep tube assembly shall be covered with a piece of filter cloth. The weep tube assemblies shall be located as called for on the plans.

2.05 FABRIC ASSEMBLY

- A. The Unimat fabric can be factory sewn into predetermined custom sized panels. The fabric rolls are first cut into the lengths specified on the shop drawings. These fabric pieces are then joined together, top layer to top layer and bottom layer to bottom layer. This will allow for the finished revetment to have the full mat thickness between the top and bottom seam. A single seam in which all four layers of fabric are joined at one point will not be permitted. All factory seams shall face downwards and shall be made using a double-needled machine utilizing the Standard Type 401 stitch. If required, bulkheads (grout stops) may be installed parallel to and in between individual mill widths at predetermined intervals to regulate the flows of fine aggregate concrete. Grout stops shall be designed as to produce full mat thickness along the full length of the grout stop.

2.06 FINE AGGREGATE CONCRETE (GROUT)

- A. Fine aggregate concrete (grout) shall consist of a mixture of Portland cement, fine aggregate, and water so proportioned and mixed as to provide a readily flowable grout. Admixtures and/or a pozzolan may be used with the approval of the ENGINEER. Use of super plasticizers requires special precautions; silica fume is not recommended. The hardened fine aggregate concrete shall exhibit a compressive strength of 2,500 psi (117 MPa) at 28 days when specimens are made and tested according to the provisions of ASTM C-31 and C-39. The average compressive strength of fabric cast test cylinders, as described herein, shall be at least 20% higher at 7 days than that of companion test cylinders made in accordance with ASTM C-31, and not less than 3,000 psi (21 MPa) at 28 days.

PART 3 - EXECUTION

3.01 FABRIC STORAGE

- A. Immediately following receipt of fabric on the job site, fabric shall be inspected and stored in a clean, dry area where it will not be subject to mechanical damage or exposure to moisture or

direct sunlight. Fabric allowed to become wet and then dried before installation will be subject to shrinkage.

3.02 SITE PREPARATION

- A. The surface to be protected shall be constructed to the line and dimensions as shown on the contract drawings. The area shall be free of all obstruction and organic material, such as rocks and roots. Areas below grade shall be brought to grade using engineered fill or a drainage stone as specified by the ENGINEER. Anchor and flank trench installation will be in accordance with project plans and specifications.

3.03 FABRIC PLACEMENT

- A. The Unimat fabric panels shall be positioned, as specified by the ENGINEER, at their approximate design location. The factory assembled panels shall be joined in the field by means of sewing or zipper closures. Adjacent panels shall be joined top layer to top layer and bottom layer to bottom layer. The contractor must make the approximate allowance for approximately 4% contraction of the fabric in each direction, which will occur as a result of grout injection. If joining of panels as described above is impractical, adjacent panels may be overlapped a minimum of 3 feet (900 mm), subject to Engineer's approval. In no case will simple butt joints between panels be allowed. However, a modified butt joint where an underlayment of similar fabric is sewn to one panel and overlapped a minimum of 2 feet (600 mm) by the adjacent panel is allowed subject to ENGINEER'S approval.

3.04 FINE AGGREGATE CONCRETE (GROUT) INJECTION

- A. Following placement of the Unimat fabric panels, fine aggregate (grout) shall be injected between the upper and lower layers of fabric through small slits cut in the upper layer of fabric. The injection pipe shall be wrapped tightly at the point of inject with a strip of burlap during pumping. First pump the upper edge of the mat which has been placed in the anchor trench followed by injection into the lower edge, working back up the slope. Avoid overpressuring of the fabric. After pumping, the burlap shall be pushed into the slit as the injection pipe is withdrawn in order to minimize spillage of grout on the revetment surface. The burlap seal shall be removed prior to the final set of the fine aggregate concrete and the injection area hand-finished. The sequence of grout injection shall be such as to ensure complete filling of the revetment-forming fabric to the thickness specified by the fabric manufacturer.
- B. Foot traffic will not be permitted on the freshly pumped mat when such traffic will cause permanent indentions in the mat surface. Walk board shall be used where necessary.
- C. Excessive grout which has been inadvertently spilled on the mat surface shall be cleaned up with a broom and shovel. Use of a water hose to remove spilled grout from the surface of a freshly pumped mat will not be permitted.
- D. During grout injection, the mat thickness may be measured by inserting a short piece of stiff wire through the mat at several locations from the crest to the toe of the slope. Any mat measuring less than 90% of the average of all thickness measurements shall be re-injected until desired average thickness has been attained.

END OF SECTION 02640

SECTION 02730

CONCRETE CURBS AND SIDEWALKS

PART 1 - GENERAL

1.01 SCOPE

- A. Work Included: This section covers the work necessary to construct the concrete curbs and sidewalks, complete.
- B. Related Sections include but are not necessarily limited to:
 - 1. Requirements of Drawings;
 - 2. Section 02222 – Excavation, Trenching, and Backfill

1.02 REFERENCES

- A. Publications listed below form a part of this Section to the extent referenced. The publications are referenced in the text by the basic designation only.
 - 1. American Society for Testing Materials (ASTM).
 - a. ASTM A185 – Specification for Steel Welded Wire Reinforcement, Plain, for Concrete;
 - b. ASTM C94 – Specification for Ready Mixed Concrete;
 - c. ASTM C309 – Specification for Liquid Membrane-Forming Compounds for Curing Concrete;
 - d. ASTM D994 – Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
 - 2. American Concrete Institute (ACI).
 - a. ACI-302 – Guide for Concrete Floor and Slab Construction.

PART 2 - PRODUCTS

2.01 FORMS

- A. Materials for sidewalk forms shall be 2-inch dressed lumber, straight and free from defects, or standard metal forms may be used. Where short-radius forms are required, 1-inch dressed lumber or plywood may be used. Provide stakes and bracing materials as required to hold forms securely in place.

2.02 CRUSHED ROCK BASE

- A. Granular fill material shall be No. 57 stone.

2.03 EXPANSION JOINT FILLER

- A. Expansion joint filler shall be ½ -inch thick, preformed asphalt-impregnated, expansion joint material conforming to ASTM D994.

2.04 CONCRETE

- A. Concrete shall be ready-mixed conforming to ASTM C94, Alternate 2, and shall be Class B with a compressive strength of 3,000 psi at 28 days in conformance with Section 03300 – Cast-in-Place Concrete. Reinforce sidewalk concrete with ASTM A185 WWF - 6x6-6/6 , conforms to Section 03200 - Concrete Reinforcement and Doweling, and placed at 2 inches from crushed rock base. WWF shall be discontinuous at expansion joints.

2.05 CURING COMPOUND

- A. Liquid membrane-forming curing compound shall be clear or translucent, suitable for spray application and shall conform to ASTM C309, Type 1.

2.06 ACCEPTANCE OF MATERIALS

- A. All materials shall be subject to inspection for suitability as the Engineer may elect, prior to or during incorporation into the work.

PART 3 - EXECUTION

3.01 EXCAVATION AND BACKFILL

- A. Excavation and backfill are included in Section 02222 – Excavation, Trenching and Backfill.

3.02 PREPARATION OF SUBGRADE

- A. Bring the areas on which curbs and sidewalks are to be constructed to required grade on undisturbed ground and compact by sprinkling and rolling or mechanical tamping. As depressions occur, refill with suitable material and recompact until the surface is at the proper grade. Subgrade on fill shall be compacted to 95% relative compaction.

3.03 PLACING GRANULAR FILL MATERIAL

- A. After the subgrade for sidewalks is compacted and at the proper grade, spread 3 inches or more of granular fill material. Sprinkle with water and compact by rolling or other method. Top of the compacted gravel shall be at the proper level to receive the concrete.

3.04 SETTING FORMS

- A. Construct forms to the shape, lines, grades, and dimensions called for on the Drawings. Stake wood or steel forms securely in place, true to line and grade.
- B. Brace forms to prevent change of shape of movement in any direction resulting from the weight of the concrete during placement. Construct short-radius curved forms to exact radius. Tops of

forms shall not depart from gradeline more than 1/8 inches when checked with a 10-foot straightedge. Alignment of straight sections shall not vary more than 1/8 inch in 10 feet.

3.05 SIDEWALK CONSTRUCTION

- A. Sidewalks shall be 4 inches thick in walk areas and 6 inches thick in driveway areas.
- B. At locations where the new sidewalk is to abut existing concrete, saw concrete for a depth of 2-inches and chip the old concrete back to sound material on a straight line, clean the surface, and apply a neat cement paste just prior to pouring the new sidewalk.
- C. Place preformed asphalt expansion joints where the sidewalk ends at a curb, and around posts, poles, or other objects protruding through the sidewalk and at intervals along the walk not to exceed 40 feet.
- D. Provide contraction joints transversely to the walks at intervals not exceeding 5 feet. These joints shall be 3/16 inches x 1 inch weakened plane joints. They shall be straight and at right angles to the surface of the walk.
- E. Place, process, finish, and cure concrete in conformance with the applicable requirements of ACI 302 and this Specification. Where the requirements differ, the higher shall govern.
- F. Broom the surface with a fine-hair broom at right angles to the length of the walk and tool at all edges, joints, and markings. Mark the walks transversely at 5-foot intervals with a jointing tool. Upon completion of the finishing, apply an approved curing compound to exposed surfaces. Protect the sidewalk from damage for a period of 7 days.

3.06 CURB CONSTRUCTION

- A. Curbs shall be constructed to the dimensions shown on the Drawings using commercial curb forms.
- B. At locations where the new curb is to abut existing concrete, saw concrete for a depth of 2 inches and chip the old concrete back to sound material on a straight line, clean the surface, and apply a neat cement paste just prior to pouring the new sidewalk.
- C. Place preformed asphalt expansion joints as in the adjacent sidewalk, where the sidewalk ends at a curb.
- D. Install expansion joints in curb at intervals not exceeding 24 feet.
- E. Place, process, finish, and cure concrete in conformance with the applicable requirements of ACI 302 and this Specification. Where the requirements differ, the higher shall govern.
- F. Broom the surface with a fine-hair broom parallel to the length of the curb and tool at all edges, joints, and markings. Upon completion of the finishing, apply an approved curing compound to exposed surfaces. Protect the curb from damage for a period of 7 days.

END OF SECTION 02730

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SECTION 02831
CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.01 SCOPE

- A. This Section includes the following:
 - 1. Galvanized-steel chain link fabric.
 - 2. Galvanized-steel framework.
 - 3. Gate operator.

- B. Related Sections include but are not necessarily limited to:
 - 1. Drawings;
 - 2. Section 01300 – Submittals;
 - 3. Section 02222 - Excavation, Trenching, and Backfill, for filling and grading work.

1.02 SUBMITTALS

- A. General: Submit the following according to Section 01300 – Submittals.

- B. Product data in the form of manufacturer’s technical data, specifications and installation instructions for fence and gate posts, fabric, gates, gate operators and accessories.

- C. Shop drawings showing location of fence, gates, each post and details of post installation, extension arms, gate swing, hardware and accessories.

- D. Wiring diagrams from manufacturer for electrically operated gates.

1.03 QUALITY ASSURANCE

- A. Installer Qualification: Engage an experienced Installer who has at least three years’ experience and has completed at least five chain link fence projects with same material and of similar scope to that indicated for this Project with a successful construction record of in-service performance.

- B. Single-Source Responsibility: Obtain chain link fences and gates, including accessories, fittings and fastenings, from a single source.

1.04 PROJECT CONDITIONS

- A. Field Measurements: Verify layout information for fences and gates shown on the Drawings in relation to the property survey and existing structures. Verify dimensions by field measurements.

PART 2 - PRODUCTS

2.01 FABRIC

- A. Selvage: As indicated.
- B. Steel Chain-Link Fence Fabric: Fabricated in one-piece widths for fencing 12-feet and less in height to comply with Chain Link Fence Manufacturers Institute (CLFMI) "Product Manual" and with requirements indicated below:
 - 1. Mesh and Wire Size: 2-inch mesh, 0.148-inch diameter (9 gage).
 - 2. Coating: ASTM A 817, Type 2, Class 1, zinc-coated (galvanized) applied after weaving.

2.02 FRAMING

- A. Type I Round Posts: Standard weight (schedule 40) galvanized-steel pipe conforming to ASTM F 1083, according to heavy industrial requirements of ASTM F 669, Group IA, with minimum yield strength of 25,000 psi, not less than 1.8 oz. of zinc per sq. ft. Type A coating inside and outside according to ASTM F 1234, as determined by ASTM A 90 and weights per foot as follows:

<u>Actual OD</u>	<u>Weight (lb/ft)</u>	<u>NPS Size</u>
1.315	1.68	1
1.660	2.27	1-1/4
1.900	2.72	1-1/2
2.375	3.65	2
2.875	5.79	2-1/2
3.500	7.58	3
4.000	9.11	3-1/2
6.625	8.97	6
8.625	28.55	8

- B. Top Rail: Manufacturer's longest lengths (17-feet to 21-feet) with swaged-end or expansion-type coupling, approximately 6-inches long for joining. Provide rail ends or other means for attaching top rail securely to each gate corner, pull and end post.
 - 1. Round Steel: 1.660-inch OD Type I or II steel pipe.
- C. Steel posts for fabric heights up to 6-feet:
 - 1. Round Line or Intermediate Posts: 1.90-inch OD Type I steel pipe.
 - 2. Round End, Corner and Pull Posts: 2.375-inch OD Type I steel pipe.
- D. Steel posts for fabric heights over 6-feet:
 - 1. Round Line or Intermediate Posts: 2.375-inch OD Type I steel pipe.
 - 2. Round End, Corner and Pull Posts: 2.875-inch OD Type I steel pipe.
- E. Swing Gate Posts: Furnish posts to support single gate leaf or one leaf of a double-gate installation, according to ASTM F 900, sized as follows for steel and aluminum pipe posts:
 - 1. Steel posts for fabric height of 6-feet or less and gate leaf width:

- a. Up to and including 4-feet: 2.375-inch OD pipe weighing at least 3.11 lb per ft.
- b. Over 4-feet to 10-feet: 2.875-inch OD pipe weighing at least 4.64 lb per ft.
- c. Over 10-feet to 18-feet: 4.000-inch OD pipe weighing at least 8.65 lb per ft.
- 2. Steel posts for fabric height over 6-feet and gate leaf width:
 - a. Up to and including 6-feet: 2.875-inch OD pipe weighing at least 4.64 lb per ft.
 - b. Over 6-feet to 12-feet: 4.000-inch OD pipe weighing at least 8.65 lb per ft.
 - c. Over 12-feet to 18-feet: 6.625-inch OD pipe weighing at least 10.02 lb per ft.
 - d. Over 18-feet to 24-feet: 8.625 OD pipe weighing at least 27.12 lb per ft.
- F. Horizontal Slide Gate Posts: Provide steel pipe gate posts sized as follows, according to ASTM F 1184, for Type I, overhead slide gates:
 - 1. Overhead Clearance: Up to 14-feet with opening width:
 - a. Not more than 10-feet: 2.875-inch OD pipe weighing not less than 4.64 lb per ft.
 - 2. Overhead Clearance: Up to 22-feet with opening width:
 - a. Between 10-feet and 24-feet: 4.000-inch OD pipe weighing not less than 6.56 lb per ft.
 - b. Between 22-feet and 40-Foot: Two sets of 4.000-inch OD pipe weighing not less than 6.56 lb per ft.
 - c. Between 22-feet and 40-Foot: 6.625-inch OD pipe weighing not less than 18.97 lb per ft.

2.03 FITTINGS AND ACCESSORIES

- A. Material: Comply with ASTM F626. Mill-finished aluminum or galvanized iron or steel to suit manufacturer's standards.
 - 1. Steel and Iron: Unless specified otherwise, hot-dip galvanized pressed steel or cast-iron fence fittings and accessories with at least 1.2 oz. Zinc per sq. ft. as determined by ASTM A90.
- B. Post and line Caps: Provide weathertight closure cap for each post. Provide line post caps with loop to receive tension wire or top rail.
- C. Post Brace Assembly: Manufacturer's standard adjustable brace. Use material specified below for brace and truss to line posts with 3/8-inch-diameter rod and adjustable tightener. Provide manufacturer's standard galvanized-steel, cast-iron or cast-aluminum cap for each end.
 - 1. Round Steel: 1.660-inch OD Type I or II steel pipe.
- D. Bottom and Center Rail: Same material as top rail. Provide manufacturer's standard galvanized-steel, cast-iron or cast-aluminum cap for each end.
- E. Tension or Stretcher Bars: Hot-dip galvanized steel with a minimum length 2-inches less than the full height of fabric, a minimum cross section of 3/16-inch by 3/4-inch and a minimum of 1.2 oz. of zinc coating per sq. ft. Provide one bar for each gate and end post and two for each corner and pull post, except where fabric is integrally woven into the post.

- F. Tension and Brace Bands: 3/4-inch-wide minimum hot-dip galvanized steel with a minimum of 1.2 oz of zinc coatings per sq. ft.
 - 1. Tension Bands: 0.074-inch thick (14 gage) minimum.
 - 2. Brace Bands: 0.105-inch thick (12 gage) minimum.
- G. Tension Wire: 0.177-inch-diameter metallic-coated steel marcelled tension wire conforming to ASTM A 824 with finish to match fabric.
 - 1. Coating Type II zinc in the following class as determined by ASTM A90.
 - a. Class 1, with a minimum coating weight of 0.80 oz. per sq. ft. of uncoated wire surface.
- H. Tie Wires: 0.106-inch-diameter (12 gage) galvanized steel with a minimum of 0.80 oz. per sq. ft. of zinc coating according to ASTM A641, Class 3 or 0.148-inch-diameter (9-gage) aluminum wire allow 1350-H19 or equal, to match fabric wire.

2.04 CONCRETE

- A. Concrete: Provide concrete consisting of portland cement per ASTM C150, aggregates per ASTM C33 and potable water. Mix materials to obtain Class B concrete with a minimum 28-day compressive strength of 3000 psi in accordance with Section 03300 - Cast-in-Place Concrete.
- B. Packaged Concrete Mix: Mix dry-packaged normal-weight concrete conforming to ASTM C387 with clean water to obtain a 2-inch to 3-inch slump.

2.05 GATES

- A. Fabricate perimeter frames of gates from same material and finish as fence framework. Assemble gate frames by welding. Provide horizontal and vertical members to ensure proper gate operation and attachment of fabric, hardware and accessories. Space frame members maximum of 8-feet apart unless otherwise indicated.
 - 1. Fabric: Same as for fence unless otherwise indicated. Secure fabric at vertical edges with tension bars and bands and to top and bottom of frame with tie wires.
 - 2. Bracing: Install diagonal cross-bracing consisting of 5/16-inch-diameter adjustable-length truss rods on gates to ensure frame rigidity without sag or twist.
 - 3. Barbed Wire: Extend end members of gate frames 12-inches above top member and prepare to receive three strands of wire. Provide necessary clips for securing wire to extensions.
- B. Swing Gates: Comply with ASTM F900.
 - 1. Steel: Gates up to 8-feet wide:
 - a. Up to 6-Feet High: Fabricate perimeter frames of 1.660-inch minimum OD Type I or II steel pipe or 1-1/2-inch-square galvanized-steel tubing weighing 1.84 lb per sq. ft.
 - b. Over 6-Feet High: Fabricate perimeter frames of 1.90-inch minimum OD Type I or II steel pipe or 2-inch-square galvanized-steel tubing weighing 2.52 lb per sq. ft.
 - 2. Gate Hardware: Provide galvanized hardware and accessories for each gate according to the following:

- a. Hinges: Size and material to suit gate size, non-lift-off type, offset to permit 180-degree gate opening. Provide 1-1/2 pair of hinges for each leaf over 6-foot nominal height.
 - b. Latch: Forked type or plunger-bar type to permit operation from either side of gate, with padlock eye as an integral part of latch.
 - c. Keeper: Provide a keeper for vehicle gates that automatically engages gate leaf and holds it in the open position until manually released.
 - d. Gate Stops: Provide gate stops for double gates consisting of mushroom-type flush plate with anchors, set in concrete and designed to engage a center drop rod or plunger bar. Include a locking device and padlock eyes as an integral part of the latch, permitting both gate leaves to be locked with a single padlock.
- C. Sliding Gates: Comply with ASTM F1184.
- 1. Type II Cantilever: Manufacturer's standard cantilever type top rail gate incorporating a track for top ball bearing rollers. Brace frame to prevent sagging and apply fabric to entire gate. Provide a lockable positive latch and other hardware and accessories as required. Provide external rollers with accessible grease fittings, a safety enclosure and guide posts to keep the gate on the rollers.
- D. Barrier Arm: The body and chassis of the operator shall be constructed of 10-gauge steel, the cover shall be 14-gauge steel and shall be resistant to all visible signs of corrosion. Operations of the arm to fully open or fully closed positions shall be limited by cam operated limit switches. The use of gears, pulleys, chains or counter balance springs, to operate the arm shall not be allowed. Operator shall be powered by a 3/4 HP motor, 208 VAC or 480 VAC, and shall have a control circuit voltage of 24 VAC. Operator shall contain an internal safety switch that re-opens the arm if travel of arm is obstructed. In case of power failure, arm shall fully open and remain open until power is restore.
- 1. Operation shall be by means of a hydraulic cylinder pulling on a crank arm that rotates a shaft from zero to ninety degrees. Gate arm travel time from fully closed to fully open shall not exceed 2.00 seconds. Closing time shall not exceed 3.0 seconds. Stopping and starting of the arm shall not cause shock loads to the arm or the shaft. Manual operations shall be accomplished by opening a by-pass valve and manually lifting the arm.
 - 2. Standard Components shall include as a minimum:
 - a. Standard barrier arms shall be 1" x 4" extruded polyethylene tube 14' - 0" maximum in length.
 - b. Arms shall be diagonally striped in appropriate warning colors.
 - c. Cam operated limit switches.
 - d. Arm shall be easily removed from operator without removing cover.
 - e. Shaft shall be supported on heavy duty industrial ball bearings.
 - f. Hydraulic hose shall be 1/4 inch synthetic, rated to 2750 PSI.
 - g. Finish shall be high gloss safety yellow powder paint.
 - h. Cover shall be equipped with a key lock. Cover shall be removable without the use of tools.
 - 3. Minimum standard electrical components: Meet U.L. or C.S.A. requirements.
 - a. Operator shall be powered by a 3/4 HP motor with internal overload protection.
 - b. Standard control circuit of 24 VAC shall contain fully capable relay logic.

- c. Power on/off switch.
 - d. Transformer, 50 VA, with multiple primary taps.
 - e. Convenience outlet for servicing and other tasks.
4. Included Options:
- a. Coordinate card reader and access controls with barrier arm.
 - b. Coordinate push button controls with barrier arm.
 - c. Provide safety loops device for stopping or reversing the closing action of the operator.
 - d. Provide photo beam device for stopping or reversing the closing action of the operator.

2.06 GATE OPERATOR

- A. General: Manufacturer's standard design and construction, suitable for gate specified. Select operator size and features according to manufacturer's published data, taking into consideration size, type, weight and construction of gate, as well as Project conditions and specified requirements.
- B. Type: Electric motor with enclosed gear reducer and chain drive.
- C. Speed: Minimum 45-feet per minute.
- D. Features: Continuous duty without overloading or overheating. Rated by manufacturer at 30 or more complete cycles per hour. All components UL approved. Furnish disconnect switch with NEMA KS 1; Type 3R enclosure.
 - 1. Provide equipment with suitable electrical characteristics including phase, voltage, branch circuit wire size, overcurrent protection and connection devices coordinated with Division 16.
 - 2. Self-locking.
 - 3. Weather-resistant steel enclosure protecting all operating parts.
 - 4. Automatic reversing upon obstruction during closing cycle and automatic stop upon obstruction during opening cycle.
- E. Controls: Electric and electronic programmable controls separated from motor and drive mechanism, sealed from water and insects, with space for additional optional equipment. Provide adjustable automatic closing timer and the remote control operator interface including interface to the plant security system. Submit card reader/local control station and remote control interface to security system for approval.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. General: Install fence to comply with ASTM F567. Do not begin installation and erection before final grading is completed, unless otherwise permitted.
 - 1. Apply fabric to outside of framework. Install new fencing and gate at location of existing gate.

- B. Excavation: Drill or hand-excavate (using post-hole digger) holes for posts to diameters and spacings indicated, in firm, undisturbed or compacted soil. Unless otherwise indicated on Drawings, excavate holes for each post to minimum diameter recommended by fence manufacturer, but not less than four times the largest cross section of post. Unless otherwise indicated, excavate hole depths approximately 3-inches lower than post bottom, with bottom of posts set not less than 36-inches below finish grade surface.
- C. Setting Posts: Center and align posts in holes 3-inches above bottom of excavation. Space a maximum of 10-feet o.c., unless otherwise indicated.
 - 1. Protect portion of posts above ground from concrete splatter. Place concrete around posts and vibrate or tamp for consolidation. Check each post for vertical and top alignment and hold in position during placement and finishing operations.
 - a. Unless otherwise indicated, extend concrete footings 2-inches above grade and trowel to a crown to shed water.
- D. Top Rails: Run rail continuously through line post caps, bending to radius for curved runs and at other posts terminating into rail end attached to posts or post caps fabricated to receive rail. Provide expansion couplings as recommended by fencing manufacturer.
- E. Center Rails: Install center rails in one piece between posts and flush with post on fabric side, using rail ends and special offset fittings where necessary.
- F. Brace Assemblies: Install braces at end and gate posts and at both sides of corner and pull posts. Locate horizontal braces at midheight of fabric on fences with top rail and at two thirds fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.
- G. Bottom Tension Wire: Install tension wire within 6-inches of bottom of fabric before stretching fabric and tie to each post with not less than same gage and type of wire. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch-diameter (11 gage) hog rings of same material and finish as fabric wire, spaced a maximum of 24-inches o.c.
- H. Top Tension Wire: Install tension wire through post cap loops before stretching fabric. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch-diameter (11 gage) hog rings of same material and finish as fabric wire, spaced a maximum of 24-inches o.c.
- I. Fabric: Leave approximately 2-inches between finish grade and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts, rails and tension wires. Install fabric on security side of fence and anchor to framework so that fabric remains under tension after pulling force is released.
- J. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull and gate posts with tension bands spaced not over 15-inches o.c.
- K. Tie Wires: Use wire of proper length to secure fabric firmly to posts and rails. Bend ends of wire to minimize hazard to persons or clothing.
 - 1. Maximum Spacing: Tie fabric to line posts 12-inches o.c. and to rails and braces 24-inches o.c.

- L. Fasteners: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side. Peen ends of bolts or score threads to prevent removal of nuts for added security.

3.02 GATE INSTALLATION

- A. Install gates plumb, level and secure for full opening without interference. Install ground-set items in concrete for anchorage unless otherwise shown on the Drawings. Minimum anchorage shall include two anchorages, one adjacent to the road and the other at the furthest extent of the gate when open. Each anchorage shall be a drilled pier 3-feet in diameter and 3-feet in depth and shall include a reinforcement cage consisting of #4 bars circumferentially at 10-inches on center and vertically around the perimeter at 10-inches on center. Gate support structure shall be securely anchored to concrete anchorages. All gate hardware shall be 316 Stainless Steel. Adjust hardware for smooth operation and lubricate where necessary. Install gates according to manufacturer's instructions, plumb, level and secure.

3.03 GATE OPERATOR INSTALLATION

- A. Install gate operators according to manufacturer's instructions. Adjust for smooth, trouble-free operation.
- B. Advise and consult with the Engineer to obtain the Owner's requirements for standard available programmable features or adjustable controls (such as time delays, interlocks or safety devices) and make necessary adjustments.

3.04 ADJUSTING

- A. Gates and Gate Operators: After repeated operation of completed installation equivalent to 3 days' use by normal traffic, readjust gates and gate operators and controls for optimum operating condition and safety. Lubricate operating equipment and clean exposed surfaces.

3.05 DEMONSTRATION

- A. Instruct the Owner's personnel on proper operation and maintenance of gate operators.

END OF SECTION 02831

SECTION 02920
LAWNS AND GRASSES

PART 1 - GENERAL

1.01 SCOPE

- A. The work covered by this Section consists of furnishing all labor, equipment and material required to place topsoil, temporary seed, sod, commercial fertilizer, agricultural limestone and mulch material, including seedbed preparation, harrowing, compacting and other placement operations on graded earthen areas as described herein and/or shown on the Drawings. In general, sod shall be placed on all newly graded earthen areas not covered by structures, pavement or sidewalks; all cleared or grubbed areas which are to remain as finish grade surfaces; and on all existing turf areas which are disturbed by construction operations and which are to remain as finish grade surfaces. Areas disturbed by borrow activities shall also be sodded according to these Specifications.
- B. The Work shall include temporary seeding operations to stabilize earthen surfaces during construction or inclement weather and to minimize stream siltation and erosion. Temporary seeding shall be performed at the times and locations as directed by the Engineer.
- C. Related Sections include but are not necessarily limited to:
 - 1. Requirements specified in Drawings;
 - 2. Section 01300 – Submittals;
 - 3. Section 02222 – Excavation, Trenching, and Backfill;
 - 4. Section 02440 – Soil Erosion, Sediment and Pollutant Control

1.02 REFERENCES

- A. Publications listed below form a part of this Section to the extent referenced. The publications are referenced in the text by the basic designation only.
 - 1. US Department of Agriculture Federal Seed Act.
 - 2. American Society for Testing Materials (ASTM).
 - a. ASTM D977 – Specification for Emulsified Asphalt.

1.03 SUBMITTALS

- A. Submittals shall be made in accordance with the requirements of Section 01300 – Submittals. In addition, the following specific information shall be provided:
 - 1. Prior to temporary seeding operations, the Contractor shall furnish to the Engineer labels or certified laboratory reports from an accredited commercial seed laboratory or a state seed laboratory showing the analysis and germination of the seed to be furnished. Acceptance of the seed test reports shall not relieve the Contractor of any responsibility or liability for furnishing seed meeting the requirements of this Section.

2. Prior to topsoil operations, the Contractor shall obtain representative samples and furnish soil test certificates including textural, pH, and organic ignition analysis from the State University Agricultural Extension Services or other certified testing laboratory.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Wood-cellulose fiber mulch shall be manufactured by Weyerhaeuser Company, Conway Corporation or approved equal.

2.02 MATERIALS AND CONSTRUCTION

A. Topsoil:

1. Utilizing designated stockpiles or borrow areas on site, the Contractor shall place a minimum of 6-inches of topsoil over all graded earthen areas and over any other areas to be seeded. Sources of topsoil shall be approved by the Engineer prior to disturbance.
2. Topsoil shall be a friable loam containing a large amount of humus and shall be original surface soil of good, rich, uniform quality, free from any material such as hard clods, stiff clay, hardpan, partially disintegrated stone, pebbles larger than 1/2-inch in diameter, lime, cement, bricks, ashes, cinders, slag, concrete, bitumen or its residue, boards, sticks, chips or other undesirable material harmful or unnecessary to plant growth. Topsoil shall be reasonably free from perennial weeds and shall not contain objectionable plant material, toxic amounts of either acid or alkaline elements or vegetable debris undesirable or harmful to plant life. Soil produced from bogs or marshy bottom land is not acceptable.
3. Topsoil shall be natural topsoil without admixture of subsoil material, and shall be classifiable as loam, silt loam, clay loam, sandy loam or a combination thereof. The pH shall range from 5.5 to 6.8. Topsoil shall contain not less than 5% nor more than 20%, by weight, or organic matter as determined by loss on ignition of oven-dried samples to 150 Degrees F.

B. Seed:

1. Temporary grass shall be Italian rye grass (*Lolium Multiflorum*).
2. Seed shall be delivered in new bags or bags that are sound and labeled in accordance with the U.S. Department of Agriculture Federal Seed Act.
3. All seed shall be from the last crop available at time of purchase and shall not be moldy, wet or otherwise damaged in transit or storage. Seed shall be free of Pea annua, bent grass and noxious weed seed.
4. Seed shall bear the growers analysis testing to 98% for purity and 90% for germination. At the discretion of the Engineer, samples of seed may be taken for check against the growers analysis.

C. Fertilizer and Liming Materials:

1. Fertilizer and liming materials shall comply with applicable state, local and federal laws concerned with their production and use.
2. Commercial fertilizer shall be a ready mixed complete fertilizer, the content of which shall meet the following minimum requirements: 10% nitrogen, 10% phosphoric acid, 10% potash, available materials. It shall be uniform in composition, dry and free flowing, and

shall be delivered to the site in original unopened containers bearing the manufacturer's statement of guarantee.

3. Agricultural limestone shall be a pulverized limestone having a calcium carbonate content of not less than 85% by weight. Use approximately 200 lbs/1,000 sq. ft. Quantity may vary according to results of soil tests.

D. Mulch Material:

1. All mulch materials shall be air dried and reasonably free of noxious weeds and weed seeds or other materials detrimental to plant growth.
2. Mulch shall be composed of wood cellulose fiber or straw, as specified herein. Mulch shall be suitable for spreading with standard mulch blowing equipment.
3. Straw mulch shall be partially decomposed stalks of wheat, rye, oats or other approved grain crops.

E. Mulch Binder:

1. Mulch on slopes exceeding 3 to 1 ratio shall be held in place by the use of an approved mulch binder. The mulch binder shall be non-toxic to plant life and shall be acceptable to the Engineer.
2. Emulsified asphalt binder shall be Grade SS-1, ASTM D977. Cutback asphalt binder shall be Grade RC 70 or RC 250.

F. Water: Water shall be clean, clear water free from any objectionable or harmful chemical qualities or organisms and shall be furnished by the Contractor.

G. Sod:

1. Sod shall be living, growing sod of bermuda tifway. All sod shall be obtained from approved sources. The presence of weeds or other noxious growth or any other foreign material which may be detrimental to the proposed planting will be cause of rejection. At least 85% of the plants in the sod shall be composed of the designated variety of grass.
2. The Engineer shall be notified of sources before it is harvested. Approval of such sources shall not be construed as an acceptance of the material. The sod will be subject to inspection while it is being planted and any material which has been permitted to dry out excessively or exposed to extreme heat, or which is not viable, will be rejected.
3. In the harvesting of the sod, grass more than 3-inches tall shall be mowed to a height of 3-inches, raked and removed before sod cutting begins. The sod shall be cut into square or rectangular sections which may vary in length, but which shall be of uniform width and thickness, and shall have at least 1/2-inch of soil adhering firmly to the roots. Care shall be exercised at all times to retain the soil on the roots of the sod during the process of cutting, transporting and planting. Sod shall be transplanted within 24 hours from the time it is harvested. All sod stored shall be kept moist, shall be protected from exposure to the air and sun and from freezing, and shall not be stored for more than 10 days. Sod shall be cut and moved only when the soil moisture conditions are such that favorable results can be expected.

PART 3 - EXECUTION

3.01 GENERAL

- A. Provide temporary seeding for erosion control in all disturbed areas non paved or otherwise stabilized and as directed by the Engineer.
- B. Maintain temporary rye grass until work will no longer disturb the area and until proper growing season for the permanent sod.
 - 1. Before placing permanent sod, the rye grass shall be thoroughly scarified and dead material raked and removed. Not more than 20% dead rye grass may be left in the soil and shall be incorporated into the top 3-inches of topsoil.

3.02 SECURING AND PLACING TOPSOIL

- A. Topsoil shall be secured from areas from which topsoil has not been previously removed, either by erosion or mechanical methods. Topsoil shall not be removed to a depth in excess of the depth approved by the Engineer.
- B. The area or areas from which topsoil is secured shall possess such uniformity of soil depth, color, texture, drainage and other characteristics as to offer assurance that, when removed the product will be homogeneous in nature and will conform to the requirements of these Specifications.
- C. All areas from which topsoil is to be secured, shall be cleaned of all sticks, boards, stones, lime, cement, ashes, cinders, slag, concrete, bitumen or its residue and any other refuse which will hinder or prevent growth.
- D. In securing topsoil from a designated pit, or elsewhere, should strata or seams of material occur which do not come under the requirements for topsoil, such material shall be removed from the topsoil or if required by the Engineer, the pit shall be abandoned.
- E. Before placing or depositing topsoil upon any areas, all improvement within the area shall be completed, unless otherwise approved by the Engineer.
- F. The areas in which topsoil is to be placed or incorporated shall be prepared before securing topsoil for use.

3.03 SEEDBED PREPARATION

- A. Prepare areas to be seeded by spraying persistent weeds and existing grasses with an approved non-persistent herbicide.
- B. Loosen topsoil of lawn areas to minimum 4-inch depth. Remove stones over 1-inch in any dimension, sticks, roots, rubbish and extraneous matter.
- C. Grade areas to smooth, free draining and even surface with a loose, uniformly fine texture. Roll and rake, and remove ridges and depressions as required to drain.

- D. Apply limestone at a rate determined by the soil test, to adjust pH of topsoil to not less than 6.0, nor more than 6.8. Distribute evenly by machine and incorporate thoroughly into topsoil.
- E. Apply fertilizer at the rate equal to 30 lbs. of fertilizer per 1,000 sq. ft. evenly incorporated with the soil to a depth of 3-inch by discing or other approved methods. Fertilize areas inaccessible to power equipment with hand tools and incorporate it into soil.
- F. Apply fertilizers by mechanical rotary or drop type distributor, thoroughly and evenly incorporating with soil to 3-inch depth by discing or other approved method. Fertilize areas inaccessible to power equipment with hand tools and incorporation into soil.

3.04 SODDING PREPARATION

- A. Prepare areas to be sodded immediately prior to sodding.
- B. Loosen topsoil of lawn areas to minimum 4-inch depth. Remove stones over 1-inch in any dimension, sticks, roots, rubbish and extraneous matter.
- C. Grade lawn areas to smooth, free draining and even surface with a loose, uniformly fine texture. Roll and rake, and remove ridges and depressions as required to drain.
- D. Apply limestone at a rate determined by the soil test, to adjust pH of topsoil to not less than 6.0, nor more than 6.8. Distribute evenly by machine and incorporate thoroughly into topsoil.
- E. Apply fertilizer at the rate equal to 30 lbs. of fertilizer per 1,000 sq. ft. evenly incorporated with the soil to a depth of 3-inches by discing or other approved methods. Fertilize areas inaccessible to power equipment with hand tools and incorporate it into soil.
- F. Dampen dry soil prior to sodding.
- G. Restore prepared areas to specified condition if eroded, settled or otherwise disturbed after fine grading and prior to sodding.

3.05 INSTALLATION OF TEMPORARY SEED

- A. Temporary grass shall be evenly seeded with a mechanical spreader at the rate of 5 lbs. per 1,000 sq. ft. of area, lightly rake, suitable compact and thoroughly water.
- B. Seed shall be uniformly sown by any approved mechanical method suitable for the slope and size of the areas to be seeded, preferably with a broadcast type seeder, windmill hand seeder or approved mechanical power drawn seed drills. Hydro-seeding and hydro-mulching may be used on steep embankments, provided full coverage is obtained. Care shall be taken to adjust the seeder for seedings at the proper rate before seeding operations are started and to maintain their adjustment during seeding. Seed in hoppers shall be agitated to prevent segregation of the various seeds in a seeding mixture.
- C. Immediately after sowing, the seeds shall be covered and compacted to a depth of 1/8-inch to 3/8-inch by a cultipacker or suitable roller.

3.06 INSTALLATION OF SODDING

- A. Lay sod to form a solid mass with tightly-fitted joints. Butt ends and sides of sod strips. Do not overlay edges. Stagger strips to offset joints in adjacent courses. Remove excess sod to avoid smothering of adjacent grass. Provide sod pad top flush with adjacent curbs, sidewalks, drains and seeded areas.
- B. Do not lay dormant sod or install sod on saturated or frozen soil.
- C. Install initial row of sod in a straight line, beginning at bottom of slopes, perpendicular to direction of the sloped area. Place subsequent rows parallel to and lightly against previously installed row.
- D. Peg sod on slopes greater than 3 to 1 to prevent slippage at a rate of 2 stakes per square foot of sod.
- E. Water sod thoroughly with a fine spray immediately after laying.
- F. Roll with lift lawn roller for uniform contact with subgrade.

3.07 MULCHING

- A. All seeded areas shall be uniformly mulched in a continuous blanket immediately after seeding. The mulch shall be applied so as to permit some sunlight to penetrate and the air to circulate and at the same time shade the ground, reduce erosion and conserve soil moisture. Approximately 25% of the ground shall be visible through the mulch blanket.
- B. One of the following mulches shall be spread evenly over the seeded areas at the following application rates:

Mulch Type	Application Rate
Wood Cellulose Fiber	1,400 pounds/acre
Straw	4,000 pounds/acre

- 1. These rates may be adjusted at the discretion of the Engineer at no additional cost to the Owner, depending on the texture and condition of the mulch material and the characteristics of the seeded area.
- C. The Contractor shall cover structures, poles, fence and appurtenances if the mulch binder is applied in such a way that it would come in contact with or discolor the structures.
- D. Mulch and binder shall be applied by suitable blowing equipment at closely controlled application rates in a manner acceptable to the Engineer.

3.08 WATERING

- A. The Contractor shall be responsible for maintaining the proper moisture content of the soil to insure adequate plant growth until a satisfactory stand is obtained. If necessary, watering shall be performed to maintain an adequate water content in the soil.
- B. Watering shall be accomplished by hoses, tank truck or sprinklers in such a way to prevent erosion, excessive runoff and overwatered spots.

3.09 MAINTENANCE

- A. Upon completion of permanent seeding and sodding operations, the Contractor shall clear the area of all equipment, debris and excess material and the premises shall be left in a neat and orderly condition.
- B. The Contractor shall maintain all seeded and sodded areas without additional payment until final acceptance of the work by the Engineer, and any regrading, refertilizing, reliming, reseeding or remulching shall be done at Contractor's own expense. Seeding work shall be repeated on defective areas until a satisfactory uniform stand is accomplished. Damage resulting from erosion, gullies, washouts or other causes shall be repaired by filling with topsoil, compacting and repeating the seeding or sodding work at Contractor's expense.
- C. Contractor's guarantee of one (1) year following final completion shall also cover a fully rooted stand of sod.

END OF SECTION 02920

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VOLUME I



STANDARD SPECIFICATIONS FOR WATER AND SEWER CONSTRUCTION

PREPARED BY:
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Revised July 2012

NOTICE

These specifications; Volume I, Standard Specifications for Water and Sewer Construction; along with GDOT Standards and Specifications; the Project plans; and issued Addenda make up the entire requirements for the specific project being constructed.

**CITY OF VALDOSTA
VOLUME I
STANDARD SPECIFICATIONS
FOR
WATER AND SEWER CONSTRUCTION**

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DIVISION 470

GENERAL CONSTRUCTION

DIVISION 470

SECTION 473

WORK WITHIN RIGHTS OF WAY

SECTION 473-1
WORK WITHIN STATE OF GEORGIA RIGHT-OF-WAY

473.1.1 SCOPE

The work under this section includes the furnishing of all labor, material and equipment required to install the pipe under highways or roads or in rights-of-way or in properties as shown on the drawings that are under the jurisdiction of the State of Georgia Department of Transportation.

473.1.2 PERMITS

Permits for all work within the rights-of-way of a State roadway for a project designed by the **CITY** will be obtained by the **CITY**. Permits for all work designed by another Engineer for developers for all work within the rights-of-way of a State highway will be obtained by the Engineer. The **CONTRACTOR** shall, however, verify the existence of the permit before commencing work within this area. In some cases, the **CITY** may not have obtained the required State permits by the time the **CONTRACTOR** wishes to commence work on a portion of the project requiring such permits. In these cases, the **CONTRACTOR** shall be required to commence work on another portion of the project for which no such permits are required. No additional compensation shall be allowed to the **CONTRACTOR** in said cases.

473.1.3 INSTALLATION

473.1.3.1 All work related to State rights-of-way or property shall be in full compliance with all requirements of the permit and to the satisfaction of the State of Georgia Department of Transportation. Work within the rights-of-way of public thoroughfares, which are not under the jurisdiction of the State of Georgia Department of Transportation, shall conform to the requirements of the agency having jurisdiction. Installation shall include all the required work and necessary signs to provide the required traffic control, detours, and any other work to maintain traffic.

473.1.3.2 The **CONTRACTOR** shall notify the local Georgia Department of Transportation Maintenance Engineer at least 48 hours prior to commencing work within the State rights-of-way and shall pay for any additional tests the State may require.

473.1.3.3 All work related to construction within the State rights-of-way shall be in full compliance with the terms of the permit and in accordance with the State of Georgia Department of Transportation "Utility Accommodation Policy and Standards".

473.1.3.4 In the event of conflict between the requirements of the Specifications and Details, and those of the State of Georgia Department of Transportation, the more stringent requirements as determined by the **CITY ENGINEER**, shall govern.

473.1.3.5

The costs of any and all items of work required by the State of Georgia, payment for which is not specifically provided by bid items in the proposal, shall be included in the prices of bid items to which said items of work are related, incidental, or appurtenant. No additional compensation shall be allowed therefore.

SECTION 473-2
WORK WITHIN LOWNDES COUNTY RIGHT-OF-WAY

473.2.1 SCOPE

The work under this section includes the furnishing of all labor, material and equipment required to install the pipe under highways or roads or properties as shown on the drawings that are under the jurisdiction of Lowndes County.

473.2.2 PERMITS

Permits for all work within the rights-of-way of a County roadway for a project designed by the **CITY** will be obtained by the **CITY**. Permits for all work designed by another engineer for developers within the rights-of-way of a County highway will be obtained by the engineer. The **CONTRACTOR** shall, however, verify the existence of the permit before commencing work within this area. In some cases, the **CITY** may not have obtained the required County permits by the time the **CONTRACTOR** wishes to commence work on a portion of the project requiring such permits. In these cases, the **CONTRACTOR** shall be required to commence work on another portion of the project for which any and all required permits have been obtained or for which no such permits are required. No additional compensation shall be allowed to the **CONTRACTOR** in said cases.

473.2.3 INSTALLATION

- 473.2.3.1** All work in County right-of-way or property shall be in full compliance with all requirements of the permit and to the satisfaction of Lowndes County. Work within the rights-of-way of public thoroughfares which are not under the jurisdiction of Lowndes County shall conform to the requirements of the agency having jurisdiction. Installation shall include all the required work and necessary signs to provide the required traffic control, detours, and any other work to maintain traffic.
- 473.2.3.2** The **CONTRACTOR** shall notify the Lowndes County Public Works Department and County Engineer's Office at least 48 hours prior to commencing work within the County right-of-way, and shall pay for any additional tests that the County may require.
- 473.2.3.3** All work related to the County highway crossings and within County highway right-of-way shall be in full compliance with the terms of the permit and in accordance with the Lowndes County Utility Code.
- 473.2.3.4** In the event of conflict between the requirements of these Specifications and details and those of Lowndes County, the more stringent requirements as determined by the **CITY ENGINEER**, shall govern.

473.2.3.5 The costs of any and all items of work required by Lowndes County, payment for which is not specifically provided by bid items in the Proposal, shall be included in the prices of bid items to which said items of work are related, incidental, or appurtenant. No additional compensation shall be allowed therefore.

SECTION 473-3
WORK WITHIN RAILROAD RIGHT-OF-WAY

473.3.1 SCOPE

The work under this section includes the furnishing of all labor, material and equipment required to install the pipe under railroads or within Railroad rights-of-way as shown on the drawings.

473.3.2 PERMITS

Permits for all work within the rights-of-way of a railroad for a project designed by the **CITY** will be obtained by the **CITY**. Permits for all work designed by another engineer for developers within the rights-of-way of a railroad will be obtained by the engineer. The **CONTRACTOR** shall, however, verify the existence of the permit before commencing work within this area. In some cases, the **CITY** may not have obtained the required railroad permits by the time the **CONTRACTOR** wishes to commence work on a portion of the project requiring such permits. In these cases, the **CONTRACTOR** shall be required to commence work on another portion of the project for which any and all required permits have been obtained or for which no such permits are required. No additional compensation shall be allowed to the **CONTRACTOR** in said cases.

473.3.3 INSTALLATION

- 473.3.3.1** All work within railroad right-of-way shall be in full compliance with all requirements of the permit and to the satisfaction of the railroad. Installation shall include all the required work and necessary signs to provide the required traffic control, detours, and any other work to maintain traffic.
- 473.3.3.2** The **CONTRACTOR** shall notify the Railroad Company a minimum of fourteen (14) days prior to commencing work on Railroad property, and shall pay all charges for supervision by the Railroad Company during installation of the line work across or within said property.
- 473.3.3.3** All work related to the railroad crossings and within railroad right-of-way shall be in full compliance with the terms of the permit and in accordance with all requirements of the Railroad Company.
- 473.3.3.4** The costs of any and all items of work required by the railroad, payment for which is not specifically provided by bid items in the proposal, shall be included in the prices of bid items to which said items of work are related, incidental, or appurtenant. No additional compensation shall be allowed therefore.
- 473.3.3.5** In the event of conflict between the requirements of the railroad and these Contract Documents, the more stringent requirements as determined by the **CITY ENGINEER**, shall govern.

DIVISION 470

SECTION 474

BORING AND JACKING

SECTION 474
BORING AND JACKING OPERATIONS

474.1 SCOPE

The **CONTRACTOR** shall furnish and install steel casing pipe complete with carrier pipe and all materials and equipment shown on drawings and specified herein.

474.2 GENERAL REQUIREMENTS

- 474.2.1** Steel casing pipe shall be placed by boring, jacking or tunneling. Open cut will not be allowed unless authorized by the **CITY ENGINEER**. It shall be the responsibility of the **CONTRACTOR** to install the casing pipe so that the carrier pipe can be installed true to line and grade. Casing pipe sizes shown on the drawings are minimum sizes. Casing pipe shall be of the minimum length shown on the drawings and the ends shall be sealed around the carrier pipe as detailed.

474.3 MATERIALS

- 474.3.1** Steel Casing Pipe - Casing shall be Grade B steel pipe, minimum yield strength 35,000 psi, conforming to Specifications for Pipeline Crossings Under Railway Tracks for Non-Flammable Substances - latest, with allowance for corrosion; and shall conform to ASTM A-53 or AWWA C-202 for mill pipe and ASTM A-139 or AWWA C-201 for fabricated pipe. Diameter and thickness shall be as shown on the drawings.

- 474.3.1.1** Joints, where required, shall be electric-fusion (arc) welded by operators qualified in accordance with American Welding Society Standard Procedures or at the discretion of the **UTILITY DIRECTOR**.

- 474.3.1.2** Where required, on a case by case basis, casing vent pipe shall be two inch (2") Schedule 40 galvanized steel pipe conforming to ASTM Specification A120-73, with galvanized malleable iron screwed fittings conforming to ANSI B16.3 on a case by case basis per plans.

- 474.3.2** Ductile Iron Carrier Pipe – Carrier pipe shall be ductile iron restrained joint and conform to Material Specification 489-07-02-01 and 489-07-02-02 for water mains, and 499-07-15-01 and 489-07-15-02 for sanitary sewer force mains, and 509-07-02-01 and 509-07-02-02 for reuse mains. Restraints will be used at the end of the casing and will not be required inside the casing.

- 474.3.3** PVC Carrier Pipe – Carrier pipe shall be PVC for sewer gravity pipe and shall conform to Material Specification 499-07-06-02. Carrier pipe for PVC water mains shall be restrained joint conforming to Material Specifications 489-07-08-01 and 489-07-08-03. Carrier pipe for PVC sewer force mains should be restrained joint and shall conform to Material Specifications 499-07-99-05 and 499-07-99-06. Carrier pipe for PVC reuse mains shall be restrained joint conforming to Material

Specifications 509-07-08-01 and 509-07-08-03. Restraints will be used at the end of the casing and will not be required inside the casing.

474.4 CONSTRUCTION

474.4.1 Permits - Permits for work within State, County or Railroad rights-of-way shall be obtained by the **CITY ENGINEER** for **CITY** projects. The **CONTRACTOR** shall, however, verify the existence of the permit before commencing work within this area. All work within these rights-of-way shall conform to Section 473.

474.4.2 Installation

474.4.2.1 Crossings, unless otherwise indicated on the drawings, shall be made by use of steel casing pipe of the size shown on the drawings. Casing for gravity sewer pipes shall be installed to the grades and alignment indicated on the drawings. The **CONTRACTOR** shall make every effort to keep the casing on a true heading and grade.

474.4.2.2 Excavation and backfill for boring and jacking operations shall conform to the GDOT Utility Accommodation Policy and Standards manual.

474.4.2.3 Casing spacers shall be used, filling void between casing and pipe completely.

474.4.2.4 Rotation of carrier pipe inside the casing pipe will not be permitted. Restrained joint pipe shall be used to help prevent such rotation.

474.4.2.5 Where required, on a case by case basis, casings for crossing shall be provided with a two inch (2") vent pipe at one end extending not less than four feet (4') above ground surface and above maximum elevation of high water. Top of vent pipe shall be turned down 180° with elbow fittings and properly screened.

474.4.2.6 After installation of the carrier pipe, the ends of the casing pipe shall be sealed up with a minimum of six inches (6") thickness of concrete and concrete pre-cast bricks. Concrete can be mixed on site using Portland cement and sand mixture or grout mixture. A rubber connection boot can be used as an alternative.

474.4.2.7 Where carrier pipe other than ductile iron are to be connected to the installation, proper adaptors shall be installed and shall conform to Section 499-01.

474.4.2.8 If casing cannot achieve proper elevation, grade, or provide minimum carrier pipe slope, the casing shall be abandoned by filling with concrete on the ends. The bore and jack would then be relocated and re-bored at a new location determined by the **CITY ENGINEER**, whose decision shall be final. All re-bores, not bored properly, shall be at the **CONTRACTOR'S** expense.

DIVISION 470

SECTION 475

**DIRECTIONAL
BORE OPERATIONS**

SECTION 475
DIRECTIONAL BORE OPERATIONS

475.1 SCOPE

The **CONTRACTOR** shall furnish and install specified pipe by directional boring as shown on drawings and specified herein.

475.2 GENERAL REQUIREMENTS

475.2.1 The pipe specified shall be installed by directional boring the pipe without damaging existing utilities, structures or pavement. Directional boring is a multi-stage process consisting of site preparation and restoration, equipment setup, drilling a pilot bore along the predetermined path and then pulling the product back through the drilled space.

475.2.2 Select or design drilling fluids for the site specific soil and conditions. Confine free flowing slurry or drilling fluids at the ground surface during pull back or drilling. Remove all residual slurry from the surface and restore the site to preconstruction conditions.

475.3 MATERIALS

475.3.1 Directional Bore in GDOT ROW and under GDOT roads – Refer to GDOT specifications.

475.3.2 Directional Bore in City ROWS and under City roads – Pipe shall be HDPE fusion pipe conforming to Material Specifications 489-07-05-01 and 489-07-05-02 for water mains, 499-07-20-01 for sewer mains, and 509-07-05-01 for reuse mains. Pipe shall be DIP restrained joint pipe conforming to 489-07-02-01 and 489-07-02-02 for water mains, 499-07-15-01 and 489-07-15-02 for sewer mains, and 509-07-02-01 and 509-07-02-02 for reuse mains. Pipe shall be PVC fusion pipe conforming to Material Specifications 489-07-08-05 for water mains, 499-07-99-04 for sewer mains and 509-07-08-04 for reuse mains. Pipe shall be PVC restrained joint Certa-Lok pipe, or equal, conforming to 489-07-08-01 and 489-07-08-03 for water mains, 499-07-99-05 and 499-07-99-06 for sewer mains, and 509-07-08-01 and 509-07-08-03 for reuse mains.

475.4 CONSTRUCTION

475.4.1 Excavate for entry, exit, recovery and slurry sump pits as required for proper boring operations.

475.4.2 Provide MOT in accordance with City of Valdosta requirements.

475.4.3 Restore any damage caused by heaving, settlement, separation of pavement, escaping drilling fluid from the boring operation at no additional cost to the **CITY**.

- 475.4.4** Ensure that the site is restored to original condition.
- 475.4.5** Pipe will be tested with the other pipes installed or separately in accordance with Section 481.5 for water mains, Section 492.5 for sewer mains and Section 501.5 for reuse mains.
- 475.4.6** Use a locating and tracking system for the boring to ensure that the proposed installation is installed as intended.
- 475.4.7** Ensure adequate removal of soil cuttings and stability of the bore hole by monitoring the drilling fluids, pumping rate, back reaming and pipe installation.
- 475.4.8** When there is any indication that the installed pipe has sustained damage, stop all work, notify the **ENGINEER** and investigate the damage. The **ENGINEER** will determine if the installation is in or not in compliance with the specifications. The **ENGINEER** may require non-compliant installations to be abandoned and capped on both ends or filled with flowable fill. The new location will be determined by the **ENGINEER** at the **CONTRACTOR'S** expense.
- 475.4.9** If the pipe is not bored properly the pipe may have to be abandoned by capping both ends or filled with flowable fill determined by the **ENGINEER**. The boring would then be relocated and rebored at a new location determined by the **ENGINEER**. All re-bores, not bored properly, shall be at the **CONTRACTOR'S** expense.

DIVISION 470

SECTION 477

**GENERAL
CONSTRUCTION**

**MEASUREMENT AND
PAYMENT**

SECTION 477

GENERAL CONSTRUCTION MEASUREMENT AND PAYMENT

477.1 GENERAL

- 477.1.1** All measurements and payment shall be based on completed work performed in strict accordance with the drawings and specifications and in accordance with the unit and lump sum prices in the Proposal.
- 477.1.2** The **CONTRACTOR** shall be responsible for any debris and foreign matter which is allowed to enter the system as a result of construction and shall be solely responsible for any damage resulting therefrom.
- 477.1.3** Whenever any authorized change or combination of changes in the plans results in an increase or decrease in the original contract quantities, and the work added or eliminated is of the same general character as that shown on the original plans, the **CONTRACTOR** shall accept payment in full at the original contract unit prices for actual quantities of work done, and no allowance will be made for any loss of anticipated profits because of increases or decreases in quantities; provided, however, that increased or decreased work covered by a supplemental agreement shall be paid for as stipulated in such agreement.
- 477.1.4** The **CITY ENGINEER** or **UTILITY DIRECTOR** shall have the right to make alterations in the plans or character of the work as may be considered necessary or desirable during the progress of the work for satisfactory completion of the proposed construction, provided that no alteration shall be made which will result in a substantial change in the general plan or character of the work such as to evade the competitive bidding statute. Alterations provided for herein shall not be considered as a waiver of any conditions of the contract or the bond, nor to invalidate any of the provisions thereof.
- 477.1.5** These specifications, the plans, special provisions, and all supplementary documents are integral parts of the contract, and a requirement occurring in one is as binding as though occurring in all. They are intended to be complementary and to describe and provide for a complete work. In addition to the work and materials specifically called for in the specifications as being included in any specific pay item, additional incidental work, not specifically mentioned, will be included in such pay item when so shown in the plans, or if indicated, or obvious and apparent, as being necessary for the proper completion of the work under such pay item and not stipulated as being covered under other pay items. No additional compensation shall be allowed for such incidental work. In case of discrepancy, computed dimensions shall govern over scaled dimensions, plans shall govern over standard specifications, and special provisions shall govern over both standard specifications and plans unless otherwise specified by the **CITY ENGINEER**.
- 477.1.6** Unless otherwise provided in the specifications for the particular items involved, all measurements shall be taken from "finished grades and elevations" for vertical measurements and from pipe end to pipe end horizontally for lineal measurements. The method or combination of methods or measurements shall be those which will reflect

with reasonable accuracy the actual areas of the finished work as determined by the **CITY ENGINEER**.

477.1.7 No additional payment shall be made for clean-up work. The cost thereof shall be included in the price for related items as set forth in the Proposal.

477.1.8 It is the intent of this contract that all pavement replacement including trench width, resurfacing, and full width to be done at the same time.

477.1.9 The term "finished grade" as used herein shall mean the final elevation of the accepted work as approved by the **CITY ENGINEER** and when located in GDOT right-of-way shall be the elevation required and approved by GDOT to conform to its work as proposed or later modified. It shall be the **CONTRACTOR'S** responsibility to determine the finished grade at any point as required by the **CITY ENGINEER** or GDOT

477.1.10 No additional payment shall be made for the furnishing and installing of locating wire(s) and locating tape. The cost thereof shall be included in the unit price of the particular pipe installation for which it is called.

477.2 DETAILED MEASUREMENT AND PAYMENT

477.2.1 For those pay items which were not included in the Schedule of Prices Bid, it shall be mutually understood that all items for payment shall be made from the master list of pay items set forth below. Items that are not specifically listed hereafter shall utilize the basic numbering system set forth.

477.2.2 **RESERVED**

477.2.3 STANDARD PAY ITEMS

GENERAL CONSTRUCTION

101 Mobilization

101-01	Mobilization	LS
101-01.01	General Conditions	LS
101-01.02	Bonds	%

Payment for these bid items shall be made at the unit price set forth in the bid schedule and shall constitute full compensation for work specified in the contract documents. Payments shall include all costs for mobilizing, general conditions for project divided by months to complete, field office, temporary facilities, and other items required to complete the project.

102 Maintenance of Traffic

102-01	Traffic Control	LS
102-01.01	Traffic Control	DAY
102-01.02	Traffic Control w/Signs and Barricades	DAY
102-01.03	Traffic Control w/Signs, Barricades and Flag	HR

Payment for these bid items shall be made at the unit price set forth in the bid schedule and shall constitute full compensation for work specified in the contract documents. Payment shall include all costs for traffic control, road closures, detours, and other items required by the **CITY** and **GDOT**, and other items required to complete the traffic control specified.

103 Runoff Protection

103-01	Silt Fence and Sediment Control	LS
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Payment for this bid item shall be made at the unit price set forth in the bid schedule and shall constitute full compensation for work specified in the contract documents. Payment shall include all costs for tree protection, silt fence installation, protection of inlets and pipes, and other costs associated with runoff water protection.

110 Clearing and Grubbing

110-01	Clearing and Grubbing	LS
110-01.01	Clearing and Grubbing - Light	SY
110-01.02	Clearing and Grubbing - Heavy	SY

Payment for these bid items shall be made at the unit price set forth in the bid schedule and shall constitute full compensation for work specified in the contract documents. Payment shall include all costs for clearing and grubbing, disposal of materials, and other items required to complete the clearing and grubbing specified.

120 Excavation and Backfill

120-02.01	Excavation	CY
120-02.02	Borrow Excavation	CY
120-02.03	Backfill Material	LS
120-02.03.01	Backfill w/On-site Material	CY
120-02.03.02	Backfill w/Off-site Material	CY
120-02.04	Earthwork	LS
120-02.05	Ditch Excavation	LF
120-02.06	Excavate and Stockpile Select Material	CY
120-02.07	Construct Berm	LF

120-02.08	Construct Swale	LF
120-02.09	Backfill Washout Areas	CY
120-02.10	Grading	SY
120-02.11	Ditch Block, Soil	EA
120-02.12	Ditch Block, Concrete	LS
120-02.13	Dewatering	LS
120-02.14	On-site Hauling	LS
120-02.15	Remove and Replace Dirt Road	SY

Payment for these bid items shall be made at the unit price set forth in the bid schedule and shall constitute full compensation for work specified in the contract documents. Payment shall include all costs for excavation, backfill, grading, dewatering and other items required to complete the site work specified.

120-04 Unsuitable Material

120-04.01	Remove and Replace Unsuitable Material	CY
120-04.02	Remove Unsuitable Material	CY
120-04.03	Remove Rock Material	CY

Payment for these bid items shall be made at the unit price set forth in the bid schedule and shall constitute full compensation for work specified in the contract documents. Payment shall include all costs for excavation, removal of unsuitable material, replacement of backfill and other items required to complete the removal of unsuitable material specified.

160-04 Stabilized Subgrade

160-04.01	6" Stabilized Subgrade	SY
160-04.02	8" Stabilized Subgrade	SY
160-04.03	10" Stabilized Subgrade	SY
160-04.04	12" Stabilized Subgrade	SY

Payment for these bid items shall be made at the unit price set forth in the bid schedule and shall constitute full compensation for work specified in the contract documents. Payment shall include all costs for excavation, mixing, grading, compaction, and other items required to stabilize the road subgrade as specified.

200-01 Limerock Base

200-01.01	Limerock 6" Base	SY
200-01.02	Limerock 8" Base	SY
200-01.03	Limerock 10" Base	SY
200-01.04	Limerock 12" Base	SY
200-01.05	Limerock 14" Base	SY
200-01.06	Scarify Limerock and Compact	SY

Payment for these bid items shall be made at the unit price set forth in the bid schedule and shall constitute full compensation for work specified in the contract documents. Payment shall include

all costs for excavation, installation, grading, compaction, and other items required to complete the limerock base installation specified.

300 Tack and Prime Coat

300-01	Prime Coat	GAL
300-02	Crack Fill	GAL
300-03	Tack Coat	GAL

Payment for these bid items shall be made at the unit price set forth in the bid schedule and shall constitute full compensation for work specified in the contract documents. Payment shall include all costs for prime coat, tack coat, crack fill, sand, and other items required to complete the sealing of the limerock.

331 Asphalt Pavement

331-01.01	S-I Leveling Course	TON
331-01.02	S-III Leveling Course	TON
331-01.03	Superpave Leveling Course	TON
331-02.01	¾" Superpave Overlay	SY
331-02.02	1" Superpave Overlay	SY
331-02.03	1 ½" Superpave Overlay	SY
331-02.04	2" S-III Overlay	SY
331-72.01	Asphalt Pavement 1" Superpave	SY
331-72.02	Asphalt Pavement 1 ½" Superpave	SY
331-72.03	Asphalt Pavement 2" Superpave	SY
331-72.04	Asphalt Pavement 3" Superpave	SY
331-72.05	Asphalt Pavement 4 ½" Superpave	SY

Payment for these bid items shall be made at the unit price set forth in the bid schedule and shall constitute full compensation for work specified in the contract documents. Payment shall include all costs for asphalt installation, compaction, and other items required to complete the asphalt installation as specified.

425 Stormwater Structures

425-01.01	Type 1019 Stormwater Inlet, 0' – 6'	EA
425-01.02	Type 1019 Stormwater Inlet, 6' – 12'	EA
425-03.01	Type 1033 Stormwater Inlet, 0' – 6'	EA
425-03.02	Type 1033 Stormwater Inlet, 6' – 12'	EA
425-05.01	Type 1034 Catch Basin, 0' – 6'	EA
425-05.02	Type 1034 Catch Basin, 6' – 12'	EA
425-10.01	Stormwater Manhole, 0' – 6'	EA
425-10.02	Stormwater Manhole, 6' – 12'	EA
425-10.03	Stormwater Manhole, 12' – 18'	EA
425-10.04	Stormwater Manhole, 18' – 24'	EA
425-11.01	Remove and Replace Stormwater Manhole, 0' – 6'	EA
425-11.02	Remove and Replace Stormwater Manhole, 6' – 12'	EA
425-11.03	Remove and Replace Stormwater Manhole, 12' – 18'	EA
425-11.04	Remove and Replace Stormwater Manhole, 18' – 24'	EA

Payment for these pay items shall be made at the unit price set forth in the bid schedule and shall constitute full compensation for work specified in the contract documents. Payment shall include all costs for excavation, installation of structures, compaction, backfill, and other items required to complete the installation of the structures as specified.

430 Stormwater Piping

430-01.01	12" RCP Stormwater Pipe	LF
430-01.02	15" RCP Stormwater Pipe	LF
430-01.03	18" RCP Stormwater Pipe	LF
430-01.04	24" RCP Stormwater Pipe	LF
430-01.05	30" RCP Stormwater Pipe	LF
430-01.06	36" RCP Stormwater Pipe	LF
430-01.07	42" RCP Stormwater Pipe	LF
430-01.08	48" RCP Stormwater Pipe	LF
430-02.01	14" x 23" ERCP Stormwater Pipe	LF
430-02.02	19" x 30" ERCP Stormwater Pipe	LF
430-02.03	29" x 45" ERCP Stormwater Pipe	LF
430-02.04	34" x 53" ERCP Stormwater Pipe	LF
430-03.01	12" HDPE Stormwater Pipe	LF
430-03.02	15" HDPE Stormwater Pipe	LF
430-03.03	18" HDPE Stormwater Pipe	LF
430-03.04	24" HDPE Stormwater Pipe	LF
430-03.05	36" HDPE Stormwater Pipe	LF
430-03.06	42" HDPE Stormwater Pipe	LF
430-03.07	48" HDPE Stormwater Pipe	LF
430-19.01	Remove and Replace 12" RCP Storm Pipe	LF
430-19.02	Remove and Replace 18" RCP Storm Pipe	LF
430-19.03	Remove and Replace 24" RCP Storm Pipe	LF
430-19.04	Remove and Replace 30" RCP Storm Pipe	LF
430-19.05	Remove and Replace 36" RCP Storm Pipe	LF
430-19.06	Remove and Replace 48" RCP Storm Pipe	LF
430-19.07	Remove and Replace 54" RCP Storm Pipe	LF

Payment for these pay items shall be made at the unit price set forth in the bid schedule and shall constitute full compensation for work specified in the contract documents. Payment shall include all costs for excavation, installation of pipe, backfill, compaction, and other items required to complete the installation of the stormwater piping as specified.

430-22 Stormwater Concrete Mitered End

430-22.01	12" Concrete Mitered End	EA
430-22.02	15" Concrete Mitered End	EA
430-22.03	18" Concrete Mitered End	EA
430-22.04	24" Concrete Mitered End	EA

430-22.05	30" Concrete Mitered End	EA
430-22.06	36" Concrete Mitered End	EA
430-22.07	42" Concrete Mitered End	EA
430-22.08	48" Concrete Mitered End	EA
430-22.10	14" x 23" Concrete Mitered End	EA
430-22.11	19" x 30" Concrete Mitered End	EA
430-22.12	29" x 45" Concrete Mitered End	EA
430-22.13	34" x 53" Concrete Mitered End	EA

Payment for these pay items shall be made at the unit price set forth in the bid schedule and shall constitute full compensation for work specified in the contract documents. Payment shall include all costs for excavation, formwork, rebar, concrete, grading, and other items required to complete the installation of the concrete mitered ends as specified.

430-40 Stormwater Flared End Sections

430-40.01	12" HDPE Flared End Section	EA
430-40.02	15" HDPE Flared End Section	EA
430-40.03	18" HDPE Flared End Section	EA
430-40.04	24" HDPE Flared End Section	EA
430-40.05	30" HDPE Flared End Section	EA
430-40.06	36" HDPE Flared End Section	EA
430-40.07	42" HDPE Flared End Section	EA
430-40.08	48" HDPE Flared End Section	EA

Payment for these pay items shall be made at the unit price set forth in the bid schedule and shall constitute full compensation for work specified in the contract documents. Payment shall include all costs for connecting piping to flared end sections, and other items required to complete the connections as specified.

430-50 Existing Stormwater Pipe Removal

430-50.01	Remove Existing 8" Pipe	LF
430-50.02	Remove Existing 12" Pipe	LF
430-50.03	Remove Existing 18" Pipe	LF
430-50.04	Remove Existing 24" Pipe	LF
430-50.05	Remove Existing 30" Pipe	LF
430-50.06	Remove Existing 36" Pipe	LF
430-50.07	Remove Existing 42" Pipe	LF
430-50.08	Remove Existing 48" Pipe	LF
430-50.09	Remove Existing 54" Pipe	LF
430-50.10	Remove Existing 60" Pipe	LF

Payment for these pay items shall be made at the unit price set forth in the bid schedule and shall constitute full compensation for work specified in the contract documents. Payment shall include all costs for excavation, removal of pipe, disposal of pipe, backfill, compaction, and other items required to complete the removal of existing stormwater piping as specified.

430-70 Stormwater Connections

430-70.01	Connect 12" Pipe to Existing Piping	EA
430-70.02	Connect 15" Pipe to Existing Piping	EA
430-70.03	Connect 18" Pipe to Existing Piping	EA
430-70.04	Connect 24" Pipe to Existing Piping	EA
430-70.05	Connect 30" Pipe to Existing Piping	EA
430-70.06	Connect 36" Pipe to Existing Piping	EA
430-70.07	Connect 42" Pipe to Existing Piping	EA
430-70.08	Connect 48" Pipe to Existing Piping	EA
430-71.01	Connect 12" Pipe to Existing Structure	EA
430-71.02	Connect 15" Pipe to Existing Structure	EA
430-71.03	Connect 18" Pipe to Existing Structure	EA
430-71.04	Connect 24" Pipe to Existing Structure	EA
430-71.05	Connect 30" Pipe to Existing Structure	EA
430-71.06	Connect 36" Pipe to Existing Structure	EA
430-71.07	Connect 42" Pipe to Existing Structure	EA
430-71.08	Connect 48" Pipe to Existing Structure	EA
430-72.01	Connect 12" Pipe to New Structure	EA
430-72.02	Connect 15" Pipe to New Structure	EA
430-72.03	Connect 18" Pipe to New Structure	EA
430-72.04	Connect 24" Pipe to New Structure	EA
430-72.05	Connect 30" Pipe to New Structure	EA
430-72.06	Connect 36" Pipe to New Structure	EA
430-72.07	Connect 42" Pipe to New Structure	EA
430-72.08	Connect 48" Pipe to New Structure	EA

Payment for these pay items shall be made at the unit price set forth in the bid schedule and shall constitute full compensation for work specified in the contract documents. Payment shall include all costs for connecting piping to stormwater structures, and other items required to complete the connections as specified.

440-01 Stormwater Underdrain

440-01.01	6" Underdrain	LF
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Payment for this pay item shall be made at the unit price set forth in the bid schedule and shall constitute full compensation for work specified in the contract documents. Payment shall include all costs for excavation, installation of underdrain piping, backfill, compaction, and other items required to complete the underdrain installation as specified.

477 Surveys

477-01	Construction Survey	LS
486-01	Water System Asbuilt	LS
496-01	Sanitary Sewer System Asbuilt	LS
506-01	Reclaimed Water System Asbuilt	LS
596-01	Stormwater System Asbuilt	LS

Payment for these pay items shall be made at the unit price set forth in the bid schedule and shall constitute full compensation for work specified in the contract documents. Payment shall include all costs for survey layout, survey asbuilts, and other items required to complete the survey requirements specified.

477-03 Power Poles

477-03 Hold Power Pole EA

Payment for this pay item shall be made at the unit price set forth in the bid schedule and shall constitute full compensation for work specified in the contract documents. Payment shall include all costs for holding poles, and other items required to complete the work specified around existing power or traffic poles.

477-04.01 Asphalt Pavement Replacements

477-04.01.02	Asphalt Pavement Removal and Replacement	SY
477-04.01.03	Trench Width Asphalt Pavement Removal and Replacement	SY
477-04.01.04	Full Width Asphalt Pavement Removal and Replacement	SY
477-04.01.05	Asphalt Removal – Small Quantity	SY
477-04.01.06	Asphalt Removal – Large Quantity	SY
477-04.01.07	Asphalt Driveway Removal and Replacement	SY

Payment for these pay items shall be made at the unit price set forth in the bid schedule and shall constitute full compensation for work specified in the contract documents. Payment shall include all costs for asphalt removal, limerock base installation, grading, priming, asphalt installation, disposal, and other items required to complete the asphalt pavement replacements as specified.

477-06 Miscellaneous Concrete

477-06.01.01	Concrete Encasements	CY
477-06.02.02	Concrete Fill	CY
477-06.02.01	Concrete Thrust Blocks	CY
477-06.03.01	4” Bollards	EA
477-06.03.02	6” Bollards	EA
477-06.04.01	Remove and Replace Concrete Driveways	SY
477-06.04.02	Concrete Driveways	SY
477-06.05.01	Remove and Replace Concrete Sidewalks	SY
477-06.05.02	Concrete Sidewalks	SY
477-06.06.01	Remove and Replace Concrete Swales	SY
477-06.06.02	Concrete Swales	SY

Payment for these pay items shall be made at the unit price set forth in the bid schedule and shall constitute full compensation for work specified in the contract documents. Payment shall include all costs for excavation, formwork, rebar, concrete, installations, backfill, compaction, and other items required to complete the miscellaneous concrete installations as specified.

477-06 Pipe and Fitting Restraint

477-06.10.01	Pipe Rodded Thrust Restraint	FITTING
477-06.11.01	4" Mega-Lug Fitting Restraint	EA
477-06.11.02	4" Pipe Joint Restraint	EA
477-06.12.01	6" Mega-Lug Fitting Restraint	EA
477-06.12.02	6" Pipe Joint Restraint	EA
477-06.13.01	8" Mega-Lug Fitting Restraint	EA
477-06.13.02	8" Pipe Joint Restraint	EA
477-06.14.01	10" Mega-Lug Fitting Restraint	EA
477-06.14.02	10" Pipe Joint Restraint	EA
477-06.15.01	12" Mega-Lug Fitting Restraint	EA
477-06.15.02	12" Pipe Joint Restraint	EA
477-06.16.01	14" Mega-Lug Fitting Restraint	EA
477-06.16.02	14" Pipe Joint Restraint	EA
477-06.17.01	16" Mega-Lug Fitting Restraint	EA
477-06.17.02	16" Pipe Joint Restraint	EA
477-06.18.01	18" Mega-Lug Fitting Restraint	EA
477-06.18.02	18" Pipe Joint Restraint	EA
477-06.19.01	20" Mega-Lug Fitting Restraint	EA
477-06.19.02	20" Pipe Joint Restraint	EA
477-06.20.01	24" Mega-Lug Fitting Restraint	EA
477-06.20.02	24" Pipe Joint Restraint	EA
477-06.20.03	30" Mega-Lug Fitting Restraint	EA
477-06.20.04	30" Pipe Joint Restraint	EA

Payment for these pay items shall be made at the unit price set forth in the bid schedule and shall constitute full compensation for work specified in the contract documents. Payment shall include all costs for excavation, pipe restraint, installations, backfill, compaction, and other items required to complete the pipe restraints specified.

520 Concrete Curbs

520-01.01	Concrete Curb & Gutter Removal and Replacement	LF
520-01.02	Concrete Valley/Drop Curb and Gutter	LF
520-02.01	Concrete Curb Removal & Replacement	LF
520-02.02	Concrete Curb Type "2"	LF

Payment for these pay items shall be made at the unit price set forth in the bid schedule and shall constitute full compensation for work specified in the contract documents. Payment shall include all costs for removal, formwork, rebar, concrete, excavation, backfill, compaction, and other items required to complete the concrete curbs specified.

530 Miscellaneous Stormwater

530-01.01	Sand Cement Rip Rap	CY
530-02.01	Concrete Rubble 1' Thick	SY
530-02.02	Concrete Rubble 2' Thick	SY

530-03.01	Remove and Replace End Wall	LS
530-03.02	Remove and Replace Block Wall	LS
530-02.01	Stone Rip Rap	SY

Payment for these pay items shall be made at the unit price set forth in the bid schedule and shall constitute full compensation for work specified in the contract documents. Payment shall include all costs for excavation, installation, backfill, compaction, and other items required to complete the installations as specified.

550 Fencing

550-01.01	Farm Fencing Removal and Replacement	LF
550-01.02	Farm Fencing	LF
550-01.03	Farm Fencing Gate	EA
550-02.00	Chain Link Fencing	LF
550-02.01	Chain Link Fencing with PVC Coating	LF
550-02.02	Chain Link Fencing Removal and Replacement	LF
550-02.03	14' Chain Link Fence Gate	EA
550-02.04	14' Chain Link Fence Gate with PVC Coating	EA
550-02.05	16' Chain Link Fence Gate	EA
550-02.06	16' Chain Link Fence Gate with PVC Coating	EA
550-02.07	20' Chain Link Fence Gate	EA
550-02.08	20' Chain Link Fence Gate with PVC Coating	EA
550-02.09	30' Chain Link Fence Gate	EA
550-02.10	30' Chain Link Fence Gate with PVC Coating	EA

Payment for these pay items shall be made at the unit price set forth in the bid schedule and shall constitute full compensation for work specified in the contract documents. Payment shall include all costs for removal, fencing, barb wire, gates, posts, top rails, grading, concrete, and other items required to complete the fencing as specified.

570 Grassing

570-01.01	Seed and Mulch	SY
575-02.01	Sod – St. Augustine	SY
575-02.02	Sod – Bahia	SY
575-02.03	Sod – Tifton 419 Bermuda	SY
575-02.04	Sod – Centipede	SY
575-03.01	Install #57 Stone around Lift Station	SY

Payment for these pay items shall be made at the unit price set forth in the bid schedule and shall constitute full compensation for work specified in the contract documents. Payment shall include all costs for grading, grassing, watering, fertilizer, and other items required to complete the grassing as specified.

706 Miscellaneous Markers and Stops

706-01.AB	Reflective Pavement Markers	EA
708-01	Standard Wheel Stop	EA

Payment for these pay items shall be made at the unit price set forth in the bid schedule and shall constitute full compensation for work specified in the contract documents. Payment shall include all costs for reflective pavement marker installation, wheel stop installation, and other items required to complete the requirements specified.

710 Temporary Striping

710.02.01	Temporary Skip Traffic Stripe – 6” Yellow	LF
710-02.02	Temporary Skip Traffic Stripe – 6” White	LF
710-06.01	Temporary Solid Traffic Stripe – 6” Yellow	LF
710-06.02	Temporary Solid Traffic Stripe – 6” White	LF
710-06.03	Temporary Solid Double Yellow – 6”	LF
710-06.04	Temporary Stop Bar – 24”	EA

Payment for these pay items shall be made at the unit price set forth in the bid schedule and shall constitute full compensation for work specified in the contract documents. Payment shall include all costs for temporary striping, and other items required to complete the specified temporary striping.

711 Thermoplastic Striping

711-01	Stop Bar – 24”	EA
711-02	Skip Traffic Stripe – 6” Yellow	LF
711-03	Skip Traffic Stripe – 6” White	LF
711-04	Directional Arrows	EA
711-06.01	Solid Traffic Stripe – 6” Yellow	LF
711-06.02	Solid Traffic Stripe – 6” White	LF
711-06.03	Solid Double Yellow - 6”	LF
711-07.01	Crosswalk – 6” White	LF

Payment for these pay items shall be made at the unit price set forth in the bid schedule and shall constitute full compensation for work specified in the contract documents. Payment shall include all costs for thermoplastic striping, and other items required to complete the specified striping.

712 Traffic Loops and Signs

712-01	Traffic Control Signage Removal and Replacement	LS
712-02	Traffic Loops Removal and Replacement	LS
712-03	Traffic Loops	LS
712-04	Arrow Boards	LS

Payment for these pay items shall be made at the unit price set forth in the bid schedule and shall constitute full compensation for work specified in the contract documents. Payment shall include all costs for removal, repair, traffic loop installation, and other items required to complete the traffic loops as specified.

DIVISION 470

SECTION 478

**GENERAL
CONSTRUCTION**

STANDARD DETAILS

SECTION 478

GENERAL CONSTRUCTION STANDARD DETAILS

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478-7 LOCATING WIRE

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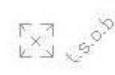



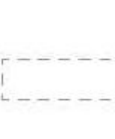
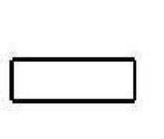




- A) Locating Wire

478-8 BOLLARD INSTALLATION

478-8.1 Bollard Installation

- A) Bollard Installation

478-8 RESERVED

ITEM	EXISTING	PROPOSED
TRAFFIC CONTROL BOX		
STREET SIGN		
LOOP DETECTOR		
PEDESTRIAN LIGHT		
DISABLED PARKING		

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


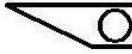










ITEM	EXISTING	PROPOSED
WATER MAIN	— 8" w —	— 8 WM — 8 WM — 8 WM —
BUTTERFLY VALVE	b.v.	
GATE VALVE	g.v.	
AIR RELEASE VALVE	air release valve	
SPRINKLER HEAD	sprinkler head	
FLUSH POINT	flush point	
SAMPLING POINT	sampling point	
FIRE HYDRANT	fire hydrant	
TEE		
PLUG OR CAP		
BEND		
CROSS		
PUMPING STATION	pumping station	
WATER METER	water meter	
CHECK VALVE	check valve	
REDUCER	reducer	
WATER SERVICE (SINGLE)	W.S.	
WATER SERVICE (DOUBLE)	W.S.	
BLOW OFF	W.S.	

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CITY OF VALDOSTA	CITY OF VALDOSTA STANDARD DETAIL	WATER SYSTEM LEGEND	B
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ITEM	EXISTING	PROPOSED
SEWER MAIN		
FORCE MAIN		
MANHOLE		
DROP MANHOLE		
MANHOLE STUB OUT		
LIFT STATION (WET WELL)		
PLUG VALVE		
GATE VALVE		
BUTTERFLY VALVE		
AIR RELEASE VALVE		
REDUCER		
SEWER SERVICE (MANHOLE)		
SEWER SERVICE (MAIN LINE)		

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			C 478-1.1

ITEM	EXISTING	PROPOSED
DITCH BOTTOM INLET (1019)		
CURB INLET (1033)		
CURB INLET (1034)		
DRAINAGE FLOW		
SWALE		
STORM PIPE		
END WALL		

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CITY OF VALDOSTA	CITY OF VALDOSTA STANDARD DETAIL	STORM DRAINAGE SYSTEM LEGEND GENERAL	D 478-1.1
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ITEM	EXISTING	PROPOSED
CENTERLINE		
BASELINE	B/L	B/L
RIGHT OF WAY PROPERTY LINE	P/L	P/L
EASEMENT LINE		
RIGHT OF WAY LINE		
STATIONING ALONG C/L OR B/L		
FENCE (CHAIN LINK)		
FENCE (WIRE)		
FENCE (WOOD)		
FENCE (BLOCK/ BRICK)		
FENCE (STONE)		
TREE		
EDGE OF WOODED AREA		
HEDGE		
POWER POLE (WOOD)		
POWER POLE (CONCRETE)		
POWER POLE (METAL)		
GUY WIRE & ANCHOR		
CONTOUR LINE		
MAIL BOX		
BUILDING		
RAILROAD TRACKS		

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		GENERAL		478-1.1

ITEM	EXISTING	PROPOSED
PAVED ROAD		
DIRT ROAD		
CURB & GUTTER		
DROP CURB & GUTTER		
DRIVEWAY (CONCRETE)		
DRIVEWAY (ASPHALT)		
DRIVEWAY (DIRT OR LIMEROCK)		
PAVEMENT REMOVAL & REPLACEMENT		
PAVEMENT REMOVAL		
HANDICAP RAMP		

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CITY OF VALDOSTA	CITY OF VALDOSTA STANDARD DETAIL				STREET LEGEND GENERAL						E 478-1.1				

ITEM	EXISTING	PROPOSED
BURIED TELEPHONE CABLE	— BT — BT —	— BT — BT —
GAS MAIN	— GAS — GAS —	— GAS — GAS —
UNDERGROUND CABLE TELEVISION	— B CATV —	— B CATV —

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A

ABD. ABANDONED
 AC. ACRES
 ACT. ACTUAL
 ADJ. ADJUST
 A.T.G. ADJUST TO GRADE
 A.R.V. AIR RELEASE VALVE
 ALT. ALTERNATE
 A.N.S.I. AMERICAN NATIONAL
 STANDARDS INSTITUTE
 A.S.T.M. AMERICAN STANDARDS FOR
 TESTING & MATERIALS
 A.W.W.A. AMERICAN WATER WORKS
 ASSOCIATION
 APPRH. APPROACH
 APPR. APPROVE
 APPROX. APPROXIMATE
 A. AREA
 A.C.P. ASBESTOS CEMENT PIPE
 ASPH. ASPHALT
 ASSEM. ASSEMBLY
 A.C.L. ATLANTIC COASTLINE RAILROAD
 AVE. AVENUE
 Asp. Dr. ASPHALT DRIVEWAY

B

BK. BACK
 B. TO B. BACK TO BACK
 B.W.F. BARBED WIRE FENCE
 B/L. BASELINE
 BRG. BEARING
 BEG. BEGIN
 B.M. BENCH MARK
 BIT. BITUMINOUS
 B.C.P. BITUMINOUS COATED PIPE
 BL.W. BLOCK WALL
 B.O.V. BLOW OFF VALVE
 BOT. BOTTOM
 B. ELEV. BOTTOM ELEVATION
 BLVD. BOULEVARD
 BLKHD. BULKHEAD
 B.V. BUTTERFLY VALVE
 B.C. BURIED CABLE
 B.O. BY OTHERS
 B. & J. BORE & JACK
 B/C. BACK OF CURB

C

C.I. CAST IRON
 C.I.P. CAST IRON PIPE
 C.B. CATCH BASIN
 CTR. CENTER
 C/L. CENTERLINE
 C. TO C. CENTER TO CENTER
 CH. CHAIN
 C.L.F. CHAIN LINK FENCE
 CHAN. CHANNEL
 C.V. CHECK VALVE
 CHD. CHORD
 CIR. CIRCLE
 CL. CLEAR
 COL. COLUMN
 CO. COMPANY
 CONC. CONCRETE
 C.B.S. CONCRETE BLOCK STRUCTURE
 C. & G. CURB & GUTTER
 Conc. Dr. CONCRETE DRIVEWAY
 C. HDW. CONCRETE HEADWALL
 C.M. CONCRETE MONUMENT
 C. P/L. CONCRETE PARKING LOT
 C.P. CONCRETE PIPE
 CONC. P. CONCRETE POLE
 C. S/W. CONCRETE SIDEWALK
 CONN. CONNECTION
 CONST. CONSTRUCT/CONSTRUCTION
 CONT. CONTINUE/CONTINUOUS
 CONTR. CONTRACT/CONTRACTOR
 COORD. COORDINATE
 COR. CORNER
 C.M.P. CORRUGATED METAL PIPE
 CT. COURT
 C.F. CUBIC FEET
 C.F.S. CUBIC FEET PER SECOND
 C.Y. CUBIC YARD
 CULV. CULVERT
 C.I.P. CAST IN PLACE

SPECIFICATION

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CITY OF VALDOSTA

CITY OF VALDOSTA
STANDARD DETAIL

ABBREVIATIONS

ABBREVIATIONS

A

478-1.2

D

D DEGREE OF CURVE
 DEG. DEGREES
 DEPT. DEPARTMENT
 D.O.T. DEPARTMENT OF
 TRANSPORTATION (GA.)
 D.H.W. DESIGN HIGH WATER
 DIAG. DIAGONAL
 DIM. DIMENSION
 DIR. DIRECTION
 D.D/W DIRT DRIVEWAY
 D/R DIRT ROAD
 D.S/W DIRT SIDEWALK
 DIST. DISTANCE
 DIT. DITCH
 DBL. DOUBLE
 DR. DRIVE
 D/W DRIVEWAY
 DRN DRAIN
 D.R.A. DRAINAGE RETENTION AREA
 DWG. DRAWING
 D/IN. DROP INLET
 D/M.H. DROP MANHOLE
 D/C DROP CONNECTION
 D.I.P. DUCTILE IRON PIPE

E

EA. EACH
 ESMT. EASEMENT
 E/L EASEMENT LINE
 E. EAST
 E.B.L. EASTBOUND LANE
 E/P EDGE OF PAVEMENT
 ELEC. ELECTRIC
 E.M.S. ELECTRONIC MARKING SYSTEM
 ELEV. ELEVATION
 ELLIP. ELLIPTICAL
 EMBK. EMBANKMENT
 EMUL. EMULSIFIED
 ENCL. ENCLDSURE
 E.O.S. END OF SURVEY
 E.W. END WALL
 E. TO E. END TO END
 ENG. ENGINEER
 ENT. ENTRANCE
 EQ. EQUAL
 EQUIP. EQUIPMENT
 EST. ESTIMATE
 ETC. ETCETRA
 EXC. EXCAVATE
 EXIST. EXISTING
 E.G. EXISTING GRADE
 EXP. EXPANSION
 EXP. JT. EXPANSION JOINT
 EXT. EXTENSION
 EA. W. EACH WAY
 E.G. FOR EXAMPLE

F

F. TO F. FACE TO FACE
 FED. FEDERAL
 F.A. FEDERAL AID
 F.A.P. FEDERAL AID PROJECT
 F.H.W.A. FEDERAL HIGHWAY ADMINISTRATION
 FT. FEET
 F.PF. FEET PER FOOT
 F.P.M. FEET PER MINUTE
 F.P.S. FEET PER SECOND
 F./FEN. FENCE (HOGWIRE OR BARBED WIRE)
 FERT. FERTILIZE
 F.B. FIELD BOOK
 FIN. FINISH
 F.F. FINISHED FLOOR
 F.H. FIRE HYDRANT
 F.E.S. FLARED END SECTION
 FLEX. FLEXIBLE
 FLR. FLOOR
 FL. FLOW
 F.L. FLOW LINE
 F/H. FLUSH HEADER
 F.P. FLUSHING POINT
 FTG. FOOTING
 F.M. FORCE MAIN
 F.C.M. FOUND CONCRETE MONUMENT
 F.D.I.P. FOUND IRON PIPE
 F.D. N&D FOUND NAIL & DISK
 FOUND. FOUNDATION
 FR. FRAME
 F. & G. FRAME & GATE
 FURN. FURNISH
 F. & I. FURNISH & INSTALL
 FUT. FUTURE

G

GAL. GALLON
 GALV. GALVANIZED
 GDOT GEORGIA DEPARTMENT
 OF TRANSPORTATION
 G.I.P. GALVANIZED IRON PIPE
 G.M. GAS MAIN
 G.S. GAS SERVICE
 G.V. GATE VALVE
 GR. GRADE
 GRT. GRATE
 GRD. GROUND
 G.R. GUARD RAIL
 GUT. GUTTER
 G.W. GUY WIRE
 G.P. GUY POLE
 G.P.D. GALLONS PER DAY
 G.P.H. GALLONS PER HOUR
 G.P.M. GALLONS PER MINUTE

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CITY OF VALDOSTA		CITY OF VALDOSTA STANDARD DETAIL			ABBREVIATIONS					A
ABBREVIATIONS										478-1.2

H

HNDRL. HANDRAIL
 H.C. HEADER CURB
 HDWL. HEADWALL
 H. HEIGHT
 H.W. HIGH WATER
 HWY. HIGHWAY
 HORIZ. HORIZONTAL
 HR. HOUR
 HSE. HOUSE
 HYD. HYDRANT
 H.C. HOUSE CONNECTION
 HNDCP. HANDICAPPED

I

IN. INCH
 IN/FT INCHES PER FOOT
 INC. INCORPORATED
 INCR. INCREASER
 I.D. INSIDE DIAMETER
 INSTL. INSTALL
 INV. INVERT
 I.P. IRON PIPE
 I.E. THAT IS

J

JT. JOINT
 JCT. JUNCTION
 J.B. JUNCTION BOX

L

L.B. LIMEROCK BASE
 L.B.R. LIMEROCK BEARING RATIO
 L.R.D/W LIMEROCK DRIVEWAY
 LIN. LINEAR
 L.F. LINEAR FOOT
 LK. LINK
 L.C. LONG CHORD
 L.S. LUMP SUM
 LA. LANE
 L.S. LIFT STATION
 LT. LEFT
 LB. POUND

M

MAINT. MAINTENANCE
 M.B. MAILBOX
 M.H. MANHOLE
 M.U.T.C.D. MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES
 MFG. MANUFACTURING
 MAT. MATERIAL
 MAX. MAXIMUM
 M.H.W. MEAN HIGH WATER
 M.L.W. MEAN LOW WATER
 M.S.L. MEAN SEA LEVEL
 MECH. MECHANIC
 MED. MEDIAN
 M.P. MILE POST
 M.P.H. MILES PER HOUR
 MIN. MINIMUM
 MISC. MISCELLANEOUS
 MOD. MODIFY
 MON. MONUMENT
 M/L MORE OR LESS
 M.J. MECHANICAL

N

N. & R. NAIL & RIBBON
 N. & D. NAIL & DISK
 N. NORTH
 N.B.L. NORTH BOUND LANE
 N.E. NORTH EAST
 N.W. NORTH WEST
 N.I.C. NOT IN CONTRACT
 N.T.S. NOT TO SCALE
 NO. NUMBER

O

O.C. ON CENTER
 OPT. OPTION
 ORG. ORIGINAL
 OZ. OUNCE
 O.D. OUTSIDE DIAMETER
 O. TO O. OUTSIDE TO OUTSIDE
 O.F. OVERFLOW
 O.H. OVERHEAD
 O.H./P. OVERHEAD POWER
 O.H./T. OVERHEAD TELEPHONE
 O.H.C. OVERHEAD CABLE
 O-PASS OVERPASS

SPECIFICATION

REVISIONS

SECTION

SHT. 3 OF 5

CITY OF VALDOSTA

CITY OF VALDOSTA
STANDARD DETAIL

ABBREVIATIONS

A

ABBREVIATIONS

478-1.2

P

PVMT. PAVEMENT
 Q. PEAK DISCHARGE
 PED. PEDESTRIAN
 P.C.P. PERMANENT CONTROL POINT
 P.R.M. PERMANENT REFERENCE MONUMENT
 PH. PHASE
 PL. PLACE
 PT. POINT
 P.O.B. POINT OF BEGINNING
 P.C.C. POINT OF COMPOUND CURVE
 P.C. POINT OF CURVATURE
 P.O.C. POINT OF CURVE
 P.I. POINT OF INTERSECTION
 P.R.C. POINT OF REVERSE CURVE
 P.T. POINT OF TANGENT
 P.V.C. POINT OF VERTICAL CURVE
 P.V.I. POINT OF VERTICAL INTERSECTION
 P.V.T. POINT OF VERTICAL TANGENCY
 PBT. POLYBUTYLENE TUBING
 PET. POLYETHYLENE TUBING
 PVC. POLYVINYLCHLORIDE
 LB. POUND
 P.S.I. POUNDS PER SQUARE INCH
 P.P. POWER POLE
 PRCST. PRECAST
 PREST. PRESTRESSED
 P.G. PROFILE GRADE
 PROJ. PROJECT
 P/C PROPERTY CORNER
 P/L PROPERTY LINE
 PROP. PROPOSED
 P.S. PUMP STATION

R

R. or RAD. RADIUS
 R.R. RAILROAD
 RGE. RANGE
 R.B. RECORD BOOK
 RED. REDUCER
 REF. REFERENCE
 R.M. REFERENCE MONUMENT
 R.P. REFERENCE POINT
 REINF. REINFORCEMENT
 R.C.P. REINFORCED CONCRETE PIPE
 RELOC. RELOCATE
 REM. REMOVAL
 R. & R. REMOVAL & REPLACEMENT
 REP. REPLACEMENT
 REQ. REQUIRED
 RES. RESIDENCE
 RET. W. RETAINING WALL
 RT. RIGHT
 R/W RIGHT OF WAY
 RD. ROAD
 RDWY. ROADWAY
 RK. ROCK
 RTE. ROUTE

S

S.P. SAMPLING POINT
 SAN. SANITARY
 S.C.L. SEABOARD COASTLINE RAILROAD
 SEC. SECTION
 SEC. COR. SECTION CORNER
 S. & M. SEED & MULCH
 SEP. SEPARATOR
 S/S SEWER SERVICE
 SH. SHEET
 S/W SIDE WALK
 SL. SLOPE
 S.A. SODDED AREA
 S. SOUTH
 S.B.L. SOUTHBOUND
 S.E. SOUTHEAST
 S.W. SOUTHWEST
 SPCL. SPECIAL
 S.C. SPECIAL TO CURVE
 SPEC. SPECIFICATION
 S.T. SPECIAL TO TANGENT
 S.H. SPRINKLER HEAD
 SQ. FT. SQUARE FEET
 SQ. IN. SQUARE INCH
 SQ. YD. SQUARE YARD
 STD. STANDARD
 S.R. STATE ROAD
 STA. STATION
 S. D/W STONE DRIVEWAY
 STM. SEW. STORM SEWER
 ST. STREET
 S.P. STREET POST
 S.S. STREET SIGN
 STRUC. STRUCTURE
 SUBGR. SUBGRADE
 SUPPLE. SUPPLEMENTAL
 SURF. SURFACE
 SURV. SURVEY
 SWL. SWALE
 SYMM. SYMMETRICAL
 S.B.V. SOIL BEARING VALVE

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CITY OF VALDOSTA			CITY OF VALDOSTA STANDARD DETAIL				ABBREVIATIONS				A	
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T

TAB. TABULATION
 TAN. TANGENT
 T.L.C. TANGENT LENGTH TO CURVE
 T.T.C. TANGENT TO CURVE
 T.S. TANGENT TO SPIRAL
 T.B. TELEPHONE BOX
 TERR. TERRACE
 T.B.P. TEST BORING POINT
 T.B.A. TO BE ABANDONED
 T.B.R. TO BE REMOVED
 T.B.R.&RP. TO BE REMOVED
 & REPLACED
 T.B.R.&RL. TO BE REMOVED
 & RELOCATED
 T.B.S. TO BE SALVAGED
 T.EL. TOP ELEVATION
 T.C. TOP OF CURVE
 TOPO. TOPOGRAPHY
 T.S. & V. TAPPING SLEEVE & VALVE
 TWP. TOWNSHIP
 T.S. TRAFFIC SIGN
 T.S.B. TRAFFIC SIGNAL BOX
 TRANS. TRANSITION
 TYP. TYPICAL
 T.D.H. TOTAL DYNAMIC HEAD
 T.B.R.B.O. TO BE REMOVED BY OTHERS

W

W/M WATER MAIN
 WM WATER METER BOX
 W.R.A. WATER RETENTION AREA
 W/S WATER SERVICE
 W.V. WATER VALVE
 WT. WEIGHT
 W.P. WELL POINT
 W. WEST
 W.B.L. WESTBOUND LANE
 WD. WIDE/WIDTH
 W. WITH
 W/OUT WITHOUT
 W.F. WOODEN FENCE

U

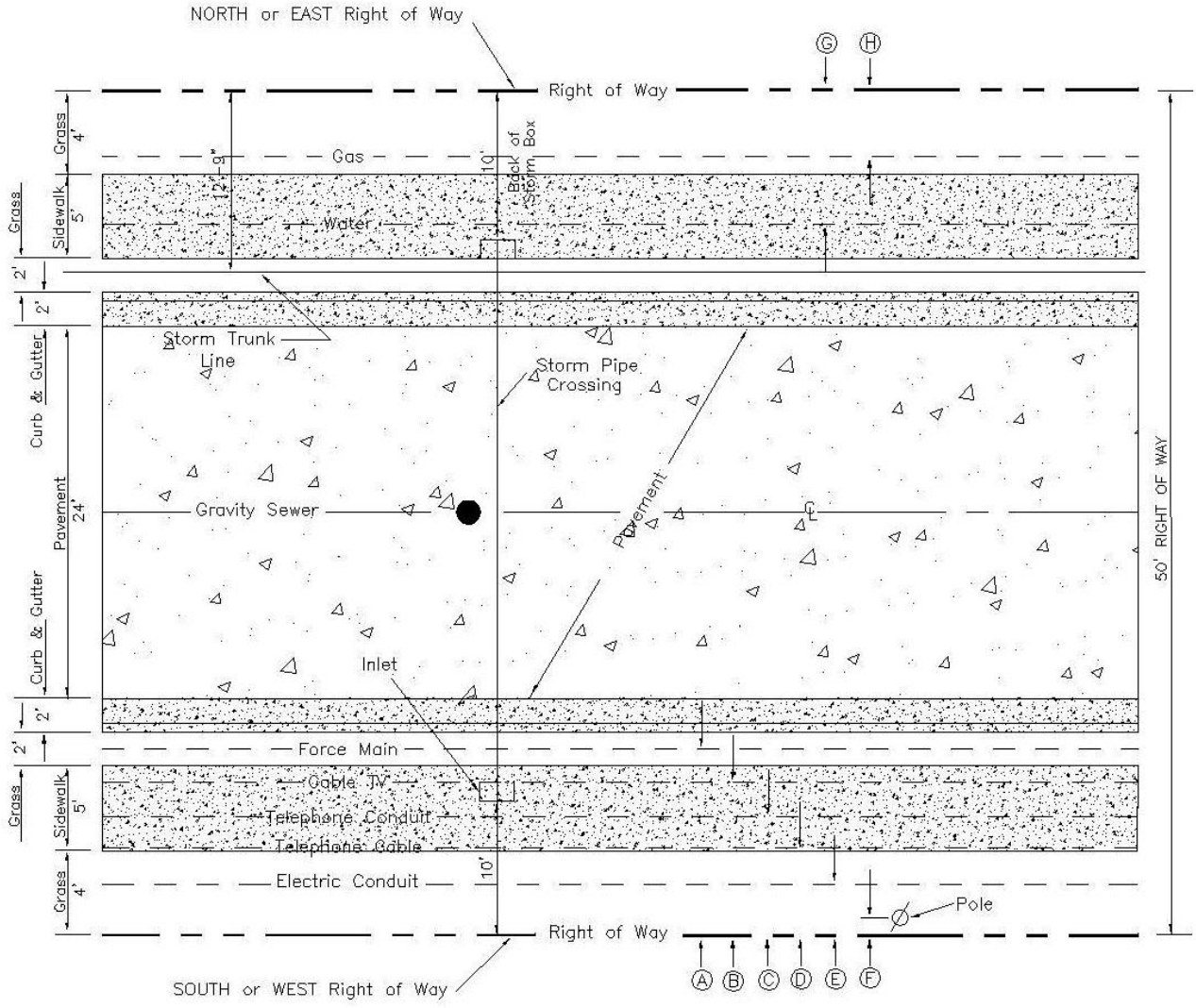
U.G. UNDERGROUND
 U.G./P. UNDERGROUND POWER
 U.G./T. UNDERGROUND TELEPHONE CABLE
 U.G./T.V. UNDERGROUND TELEVISION CABLE
 U.-PASS UNDERPASS
 UN. UNIT
 U.I.P. USE IN PLACE
 US C&GS US COAST & GEODETIC SURVEY
 US G.S. US GEOLOGICAL SURVEY

V

V. VALVE
 V.B. VALVE BOX
 VAR. VARIABLE
 VEH. VEHICLE
 VER. VERTICAL
 V.C. VERTICAL CURVE
 V.P.C. VERTICAL POINT OF CURVE
 V.P.I. VERTICAL POINT OF INTERSECTION
 V.P.T. VERTICAL POINT OF TANGENCY
 V.C.P. VITRIFIED CLAY PIPE
 VOL. VOLUME

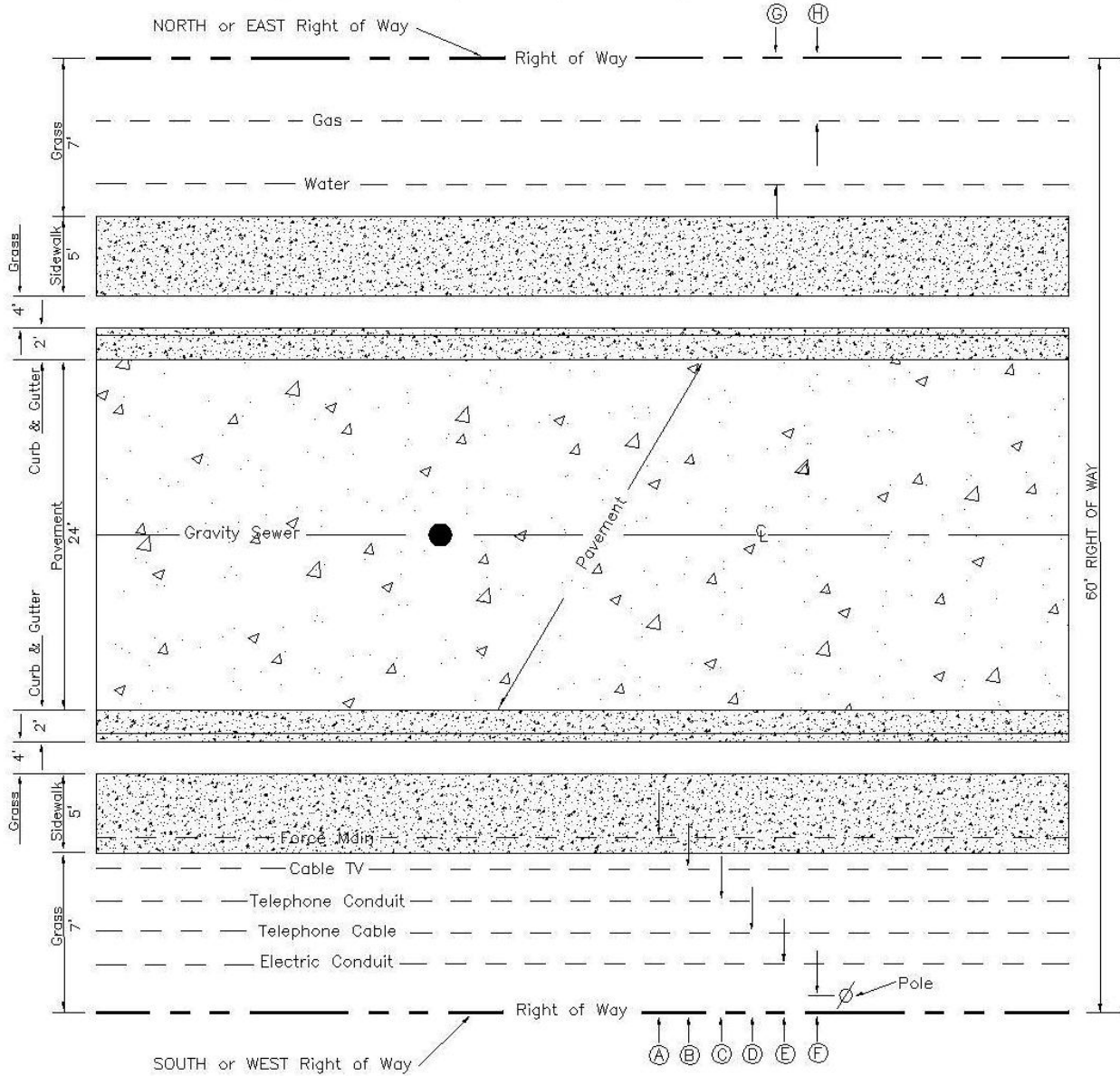
SPECIFICATION										SECTION		
REVISIONS										SHT. 5 OF 5		
CITY OF VALDOSTA			CITY OF VALDOSTA STANDARD DETAIL				ABBREVIATIONS				A	
										ABBREVIATIONS		478-1.2

UTILITY	DIMENSION SYMBOL	LOCATION	UNDERGROUND DEPTH
Force Main	A	11'	48"
Cable TV	B	9'	24"
Telephone Conduit	C	7'	30"
Telephone Cable	D	5'	30"
Electric Conduit	E	3'	36"
Pole	F	1'	
Sanitary Sewer		CENTER	Varies
Water	G	8'	48"
Gas	H	4'	36"



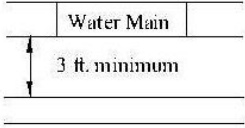
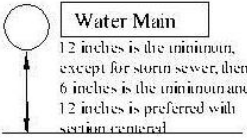
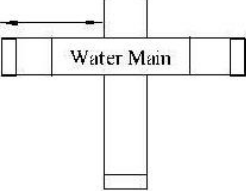
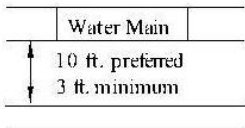
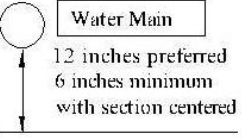
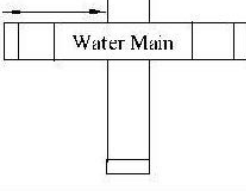
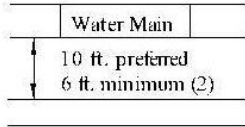
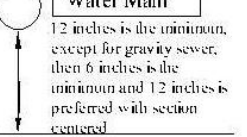
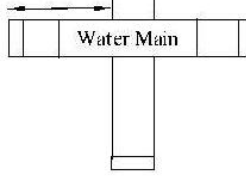
SPECIFICATION		DATE REVISED:	SECTION
CITY OF VALDOSTA		CITY OF VALDOSTA STANDARD DETAIL	TYPICAL UTILITY LOCATIONS IN 50' RIGHT OF WAY WITH CURB & GUTTER
			SHT 1 OF 1
			A
			478-1.3

UTILITY	DIMENSION SYMBOL	LOCATION	UNDERGROUND DEPTH
Force Main	A	11'	48"
Cable TV	B	9'	24"
Telephone Conduit	C	7'	30"
Telephone Cable	D	5'	30"
Electric Conduit	E	3'	36"
Pole	F	1'	
Sanitary Sewer		CENTER	Varies
Water	G	8'	48"
Gas	H	4'	36"



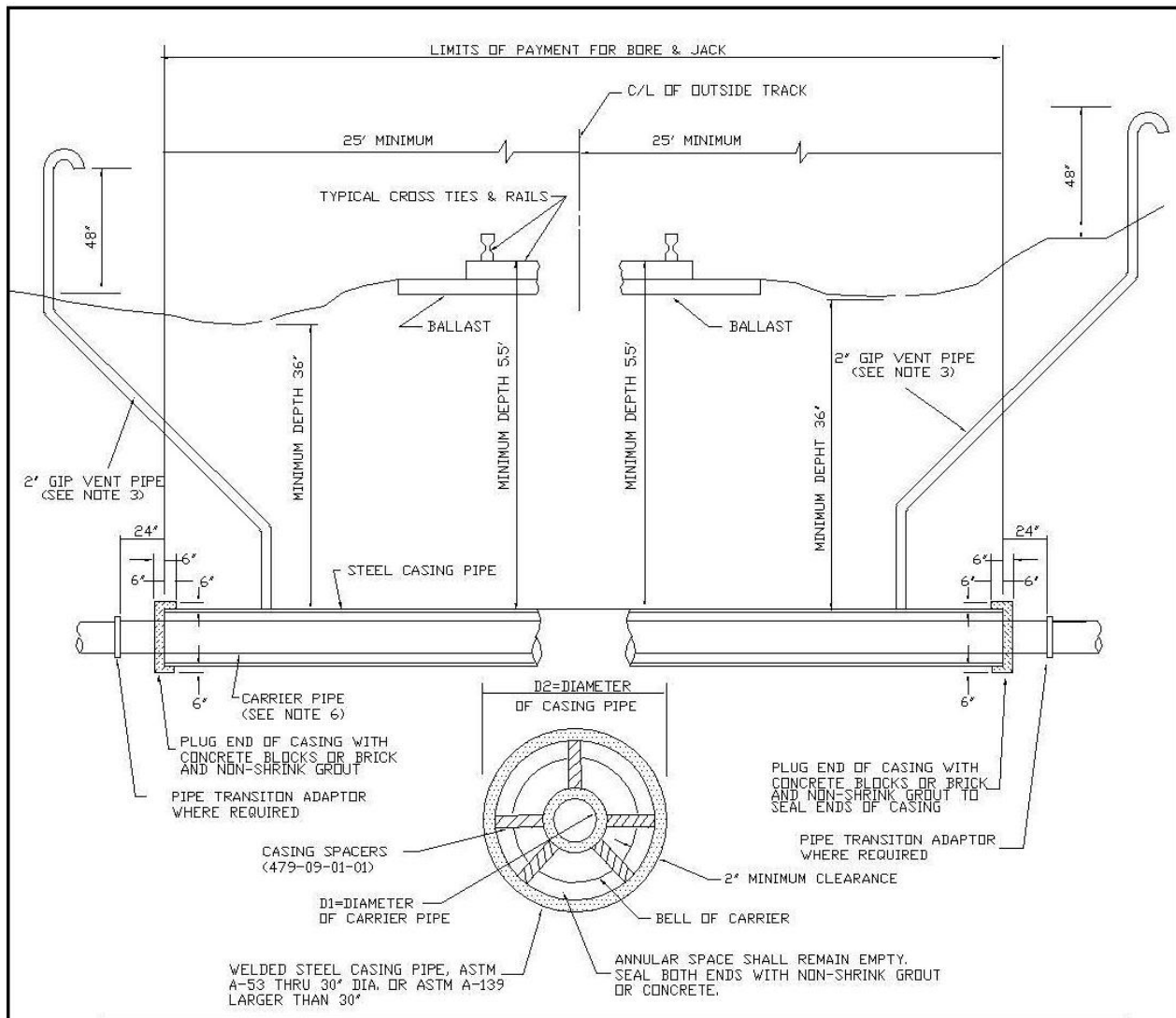
SPECIFICATION	DATE REVISED:	SECTION
		SHT 1 OF 1

CITY OF VALDOSTA	CITY OF VALDOSTA STANDARD DETAIL	TYPICAL UTILITY LOCATIONS IN 60' RIGHT OF WAY WITH CURB & GUTTER	B
			478-1.3

Other Pipe	Horizontal Separation	Crossings	Joint Spacing @ Crossing (Full Joint Centered)
Storm Sewer, Reclaim Water			<p>Alternate 3 ft. minimum</p> 
Vacuum Sanitary Sewer			<p>Alternate 3 ft. minimum</p> 
Gravity or Pressure Sanitary Sewer, Sanitary Sewer Force Main, Reclaimed Water			<p>Alternate 6 ft. minimum</p> 
On-Site Sewage Treatment & Disposal System	<p>10 ft. minimum</p>		

- (1) Water main should cross above other pipe. When water main must be below other pipe, the minimum separation is 12 inches.
- (2) 3 Ft. for gravity sanitary sewer where the bottom of the water main is laid at least 6 inches above the top of the gravity sanitary sewer.

SPECIFICATION		DATE REVISED:	SECTION SHT. 1 OF 1
CITY OF VALDOSTA	CITY OF VALDOSTA STANDARD DETAIL	SEPARATION OF WATER MAINS	A 478-1.4

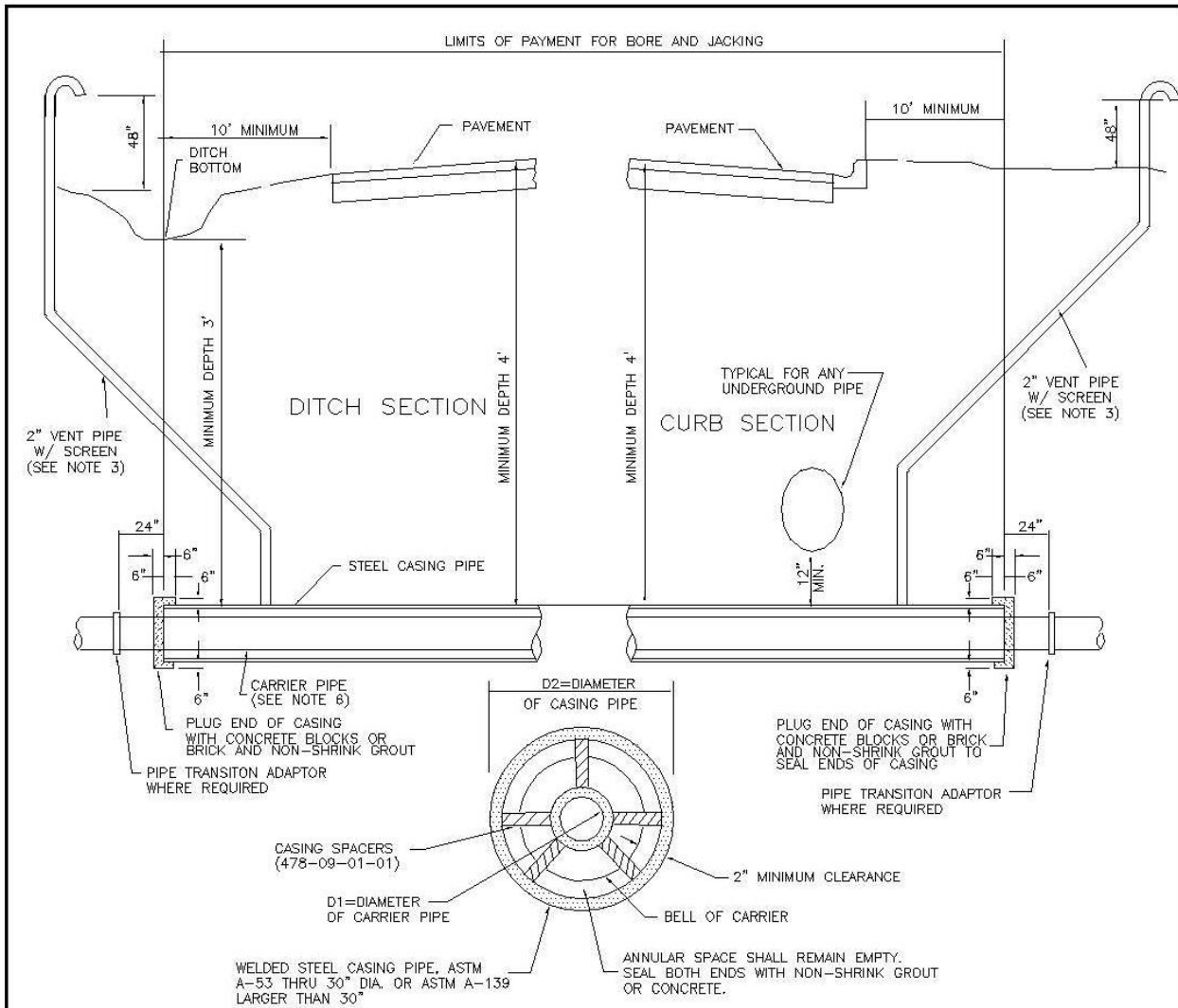


CARRIER PIPE NOMINAL DIAMETER (D1)	4	6	8	10	12	14	16	18	20	24	30	36	42
CASING PIPE NOMINAL DIA (D2)	18	18	18	24	24	30	30	36	36	48	48	54	60
WALL THICKNESS-INCHES	0.31	0.31	0.31	0.33	0.33	0.38	0.38	0.42	0.42	0.52	0.52	0.58	0.61

NOTES

- ALL REQUIREMENTS OF THE RAILROAD AS SPECIFIED BY THE AMERICAN RAILWAY ENGINEERING ASSOCIATION AND THE RAILROAD COMPANY SHALL BE ADHERED TO WHEN CROSSING RAILROADS. THE MORE STRINGENT REQUIREMENTS BETWEEN THE R/R AND THE CITY OF VALDOSTA SHALL GOVERN IN ALL CASES.
- THE INSIDE DIAMETER OF THE CASING SHALL BE A MINIMUM OF 6" GREATER THAN THE OUTSIDE DIAMETER OF THE CARRIER PIPE BELL OR COUPLING.
- CASING FOR THE FORCE MAIN AND GRAVITY SEWER SHALL BE INSTALLED WITH A 2" VENT PIPE, WHERE REQUIRED, AT ONE END EXTENDING NOT LESS THAN 4' ABOVE GROUND SURFACE, AND ABOVE THE MAXIMUM ELEVATION OF HIGH WATER. THE TOP OF THE VENT PIPE SHALL BE FITTED WITH DOWN TURNED ELBOW PROPERLY SCREENED. THE VENT PIPE SHALL BE SCHEDULE NO. 40 GALVANIZED STEEL. VENT PIPE FOR WATER MAIN AND REUSE MAIN CASING IS NOT REQUIRED.
- PAYMENT FOR BORE AND JACK SHALL INCLUDE CASING, END ENCASEMENTS, CARRIER PIPE, TRANSITION ADAPTORS, VENT PIPES AND SPACERS.
- INSTALL CASING SPACERS TO PROVIDE A MINIMUM OF THREE PER JOINT OF PIPE. INSTALL IN ACCORDANCE WITH THE MANUFACTURER'S WRITTEN INSTRUCTIONS.
- WATER MAIN AND FORCE MAIN PIPING INSIDE CASING IS TO BE RESTRAINED JOINT PIPING AS SPECIFIED IN 489-07-02-02 AND 499-07-99-06.

SPECIFICATION										DATE REVISED:				SECTION	
														SHT 1 OF 1	
CITY OF VALDOSTA					CITY OF VALDOSTA STANDARD DETAIL					RAILROAD BORING AND JACKING					A
										BORING & JACKING				478-2.1	

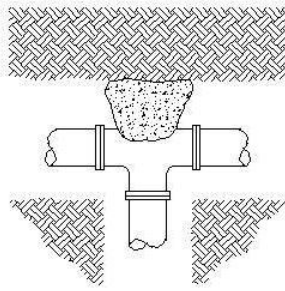


CARRIER PIPE AND CASING PIPE SIZES (MIN)													
CARRIER PIPE NOMINAL DIAMETER (D1)	4	6	8	10	12	14	16	18	20	24	30	36	42
CASING PIPE NOMINAL DIA (D2)	18	18	18	24	24	30	30	36	36	48	48	54	60
WALL THICKNESS-INCHES	0.31	0.31	0.31	0.33	0.33	0.38	0.38	0.42	0.42	0.52	0.52	0.58	0.61

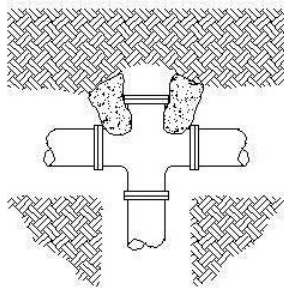
NOTES

1. ALL REQUIREMENTS OF DOT AS SPECIFIED IN THE DOT "UTILITY ACCOMODATION GUIDE" SHALL BE ADHERED TO WHEN CROSSING HIGHWAYS. THE MORE STRINGENT REQUIREMENTS BETWEEN THE DOT AND THE CITY OF VALDOSTA SHALL GOVERN IN ALL CASES OF CONFLICT.
2. THE INSIDE DIAMETER OF THE CASING SHALL BE A MINIMUM OF 6" GREATER THAN THE OUTSIDE DIAMETER OF THE CARRIER PIPE BELL OR COUPLING.
3. CASING FOR THE FORCE MAIN & GRAVITY SEWER CROSSING SHALL BE INSTALLED WITH A 2" VENT PIPE, WHERE REQUIRED, AT ONE END EXTENDING NOT LESS THAN 4' ABOVE GROUND SURFACE, AND ABOVE THE MAXIMUM ELEVATION OF HIGH WATER. THE TOP OF THE VENT PIPE SHALL BE FITTED WITH DOWN TURNED ELBOW PROPERLY SCREENED. THE VENT PIPE SHALL BE SCHEDULE NO. 80 GALVANIZED STEEL. VENT PIPE FOR WATER MAIN AND REUSE MAIN CASINGS IS NOT REQUIRED.
4. PAYMENT FOR BORE AND JACK SHALL INCLUDE CASING, END ENCASUREMENTS, CARRIER PIPE, TRANSITION ADAPTORS, VENT PIPE AND SPACERS.
5. INSTALL CASING SPACERS TO PROVIDE A MINIMUM OF THREE PER JOINT OF PIPE. INSTALL IN ACCORDANCE WITH MANUFACTURERS WRITTEN INSTRUCTIONS.
6. WATER MAIN AND FORCE MAIN PIPING INSIDE CASING IS TO BE RESTRAINED JOINT PIPING AS SPECIFIED IN DETAIL 489-07-02-02 AND 499-07-99-06.

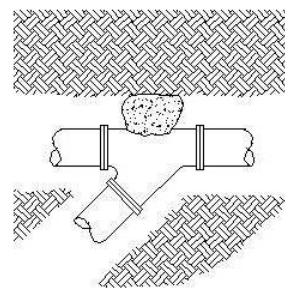
SPECIFICATION	SECTION 473-1 AND 474	DATE REVISED:	SECTION
			SHT. 1 OF 1
CITY OF VALDOSTA	CITY OF VALDOSTA STANDARD DETAIL	D.O.T. HIGHWAY BORING AND JACKING BORING & JACKING	B 478-2.1



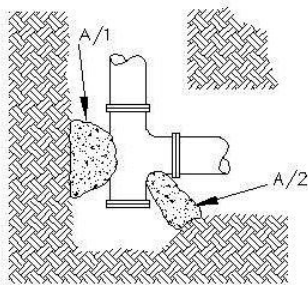
TEE



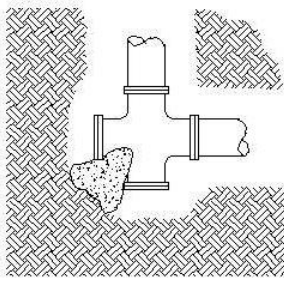
PLUGGED CROSS (1)



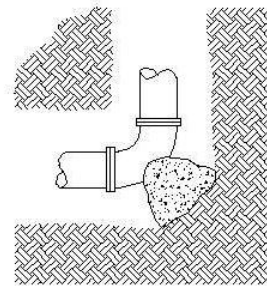
WYE



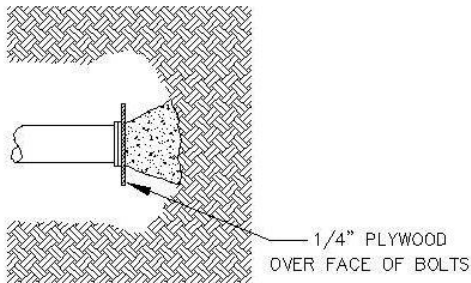
PLUGGED TEE



PLUGGED CROSS (2)



BEND

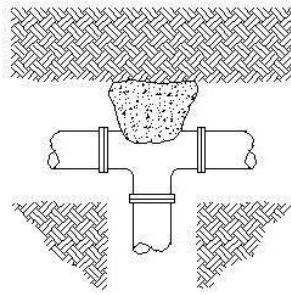


PLUG

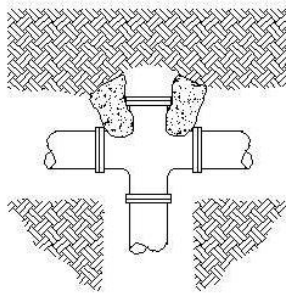
NOTES :

1. BEARING AREA OF THRUST BLOCK SHALL NOT BE LESS THAN 1.0 SQ. FT. BEARING AREA SHALL HAVE EQUAL HEIGHT AND WIDTH.
2. ALLOWABLE SOIL BEARING STRESS IS 2000 LBS./SQ. FT.
3. BEARING AREAS, VOLUMES, AND SPECIAL BLOCKING DETAILS SHOWN ON PLANS TAKE PRECEDENCE OVER THIS STANDARD. THRUST BLOCKS FOR VERTICAL BENDS HAVING DOWNWARD RESULTANT THRUSTS SHALL BE THE SAME AS FOR HORIZONTAL BENDS. BEARING AREAS FOR HORIZONTAL BEND THRUST BLOCKS ARE BASED ON TEST PRESSURE OF 150 PSIG, AND AN ALLOWABLE SOIL BEARING STRESS OF 2000 LBS./SQ. FT. TO COMPUTE BEARING AREAS FOR DIFFERENT TEST PRESSURES AND SOIL BEARING STRESSES, MULTIPLY TABLE VALUES BY THE FACTOR (P'/S'_g) . WHERE: P' = ACTUAL TEST PRESSURE, PSIG S'_g = ACTUAL OR BEARING PRESSURE, PSF.

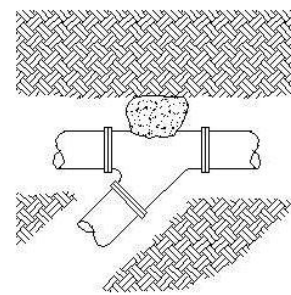
SPECIFICATION										DATE REVISED:					SECTION	
															SHT 1 OF 2	
CITY OF VALDOSTA			CITY OF VALDOSTA STANDARD DETAIL					THRUST BLOCKS CAST IN PLACE							A	
															478-3.1	



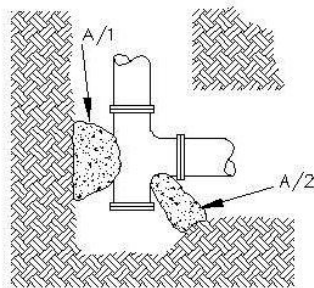
TEE



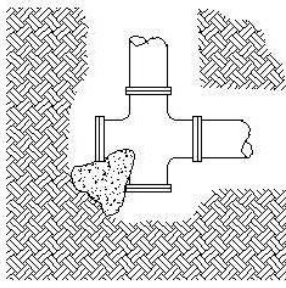
PLUGGED CROSS (1)



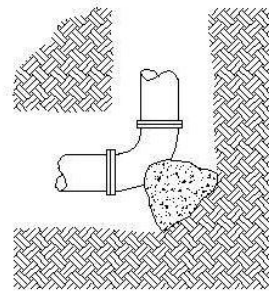
WYE



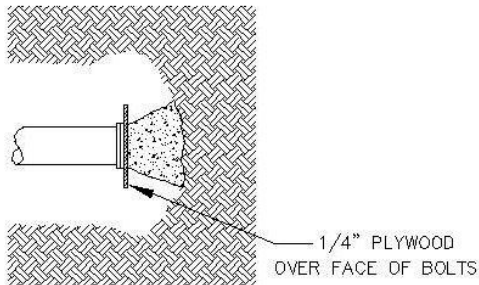
PLUGGED TEE



PLUGGED CROSS (2)



BEND

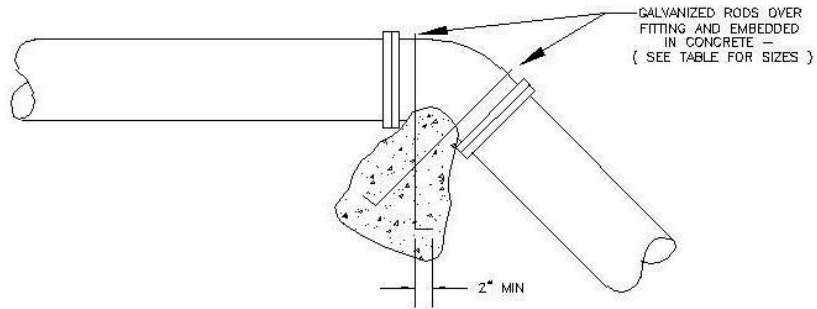


PLUG

NOTES :

1. BEARING AREA OF THRUST BLOCK SHALL NOT BE LESS THAN 1.0 SQ. FT. BEARING AREA SHALL HAVE EQUAL HEIGHT AND WIDTH.
2. ALLOWABLE SOIL BEARING STRESS IS 2000 LBS./SQ. FT.
3. BEARING AREAS, VOLUMES, AND SPECIAL BLOCKING DETAILS SHOWN ON PLANS TAKE PRECEDENCE OVER THIS STANDARD. THRUST BLOCKS FOR VERTICAL BENDS HAVING DOWNWARD RESULTANT THRUSTS SHALL BE THE SAME AS FOR HORIZONTAL BENDS. BEARING AREAS FOR HORIZONTAL BEND THRUST BLOCKS ARE BASED ON TEST PRESSURE OF 150 PSIG, AND AN ALLOWABLE SOIL BEARING STRESS OF 2000 LBS./SQ. FT. TO COMPUTE BEARING AREAS FOR DIFFERENT TEST PRESSURES AND SOIL BEARING STRESSES, MULTIPLY TABLE VALUES BY THE FACTOR (P'/S'_g) , WHERE: P' = ACTUAL TEST PRESSURE, PSIG S'_g = ACTUAL OR BEARING PRESSURE, PSF.

SPECIFICATION										DATE REVISED:			SECTION	
													SHT 1 OF 2	
CITY OF VALDOSTA				CITY OF VALDOSTA STANDARD DETAIL				THRUST BLOCKS CAST IN PLACE				A		
												478-3.1		



VOLUME OF THRUST BLOCK IN CUBIC FEET (VERTICAL BENDS)			
FITTING SIZE	BEND ANGLE		
	45°	22½°	11¼°
4	1.1	0.4	0.2
6	2.7	1.0	0.4
8	4.0	1.5	0.6
10	6.0	2.3	0.9
12	8.5	3.2	1.3
14	11.5	4.3	1.8
16	14.8	5.6	2.3

ANCHOR ROD SIZES		
FITTING SIZE	ROD SIZE	EMBEDMENT
12" OR LESS	#6	30"
14" - 16"	#8	36"

NOTES :

- THRUST BLOCK VOLUMES FOR VERTICAL BENDS HAVING UPWARD RESULTANT THRUSTS ARE BASED ON TEST PRESSURE OF 150 PSIG AND THE WEIGHT OF CONCRETE - 4050 LBS./ CU. YD. TO COMPUTE VOLUMES FOR DIFFERENT TEST PRESSURES, USE THE FOLLOWING EQUATION : VOLUME = (TEST PRESSURE / 150 x TABLE VALUE) .
- KEEP CONCRETE CLEAR OF JOINT AND JOINT ACCESSORIES.
- THRUST BLOCKS FOR VERTICAL BENDS HAVING DOWNWARD RESULTANT THRUSTS SHALL BE THE SAME AS FOR HORIZONTAL BENDS.
- BEARING AREA VOLUMES, AND SPECIAL BLOCKING DETAILS SHOWN ON THE PLANS TAKE PRECEDENCE OVER THE STANDARD.

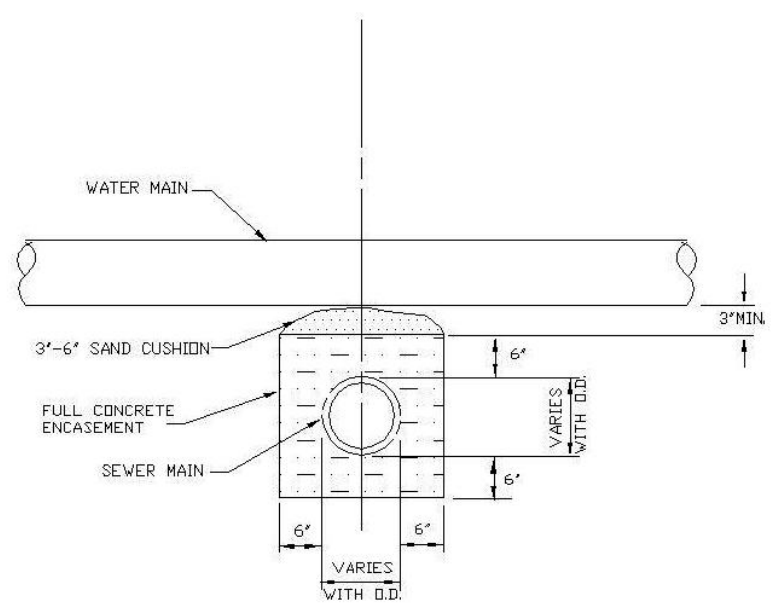
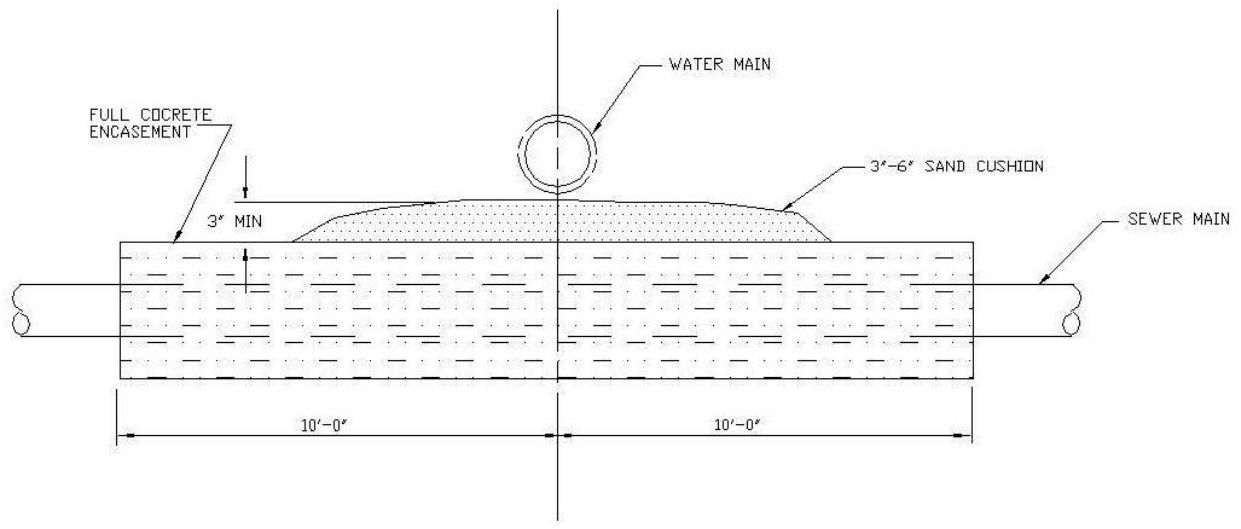
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														SHT 1 OF 1	
CITY OF VALDOSTA				CITY OF VALDOSTA STANDARD DETAIL				THRUST BLOCKS ANCHORED				B			
												478-3.1			

THRUST RESTRAINT TABLE FOR DIP HORIZONTAL FITTINGS					
NOMINAL PIPE DIAMETER	TEE, 90 BEND	45 BEND	22.5 BEND	11.25 BEND	PLUG
4-6	40'	20'	20'	20'	80'
8	60'	40'	20'	20'	100'
12	80'	40'	20'	20'	140'
16	120'	60'	40'	20'	180'
18	140'	80'	40'	20'	220'
24-30	160'	80'	40'	20'	300'
36	180'	80'	40'	20'	360'

NOTES

1. MINIMUM RESTRAINED LENGTH SHALL BE ALWAYS 20 FEET.
2. IN LINE VALVES AND THROUGH RUN OF TEES OUTSIDE LIMITS OF RESTRAINED JOINTS FROM OTHER FITTINGS NEED NOT BE RESTRAINED UNLESS OTHERWISE INDICATED ON THE DRAWINGS.
3. RESTRAINED JOINTS CAN BE USED IN LIEU OF THRUST BLOCKS.

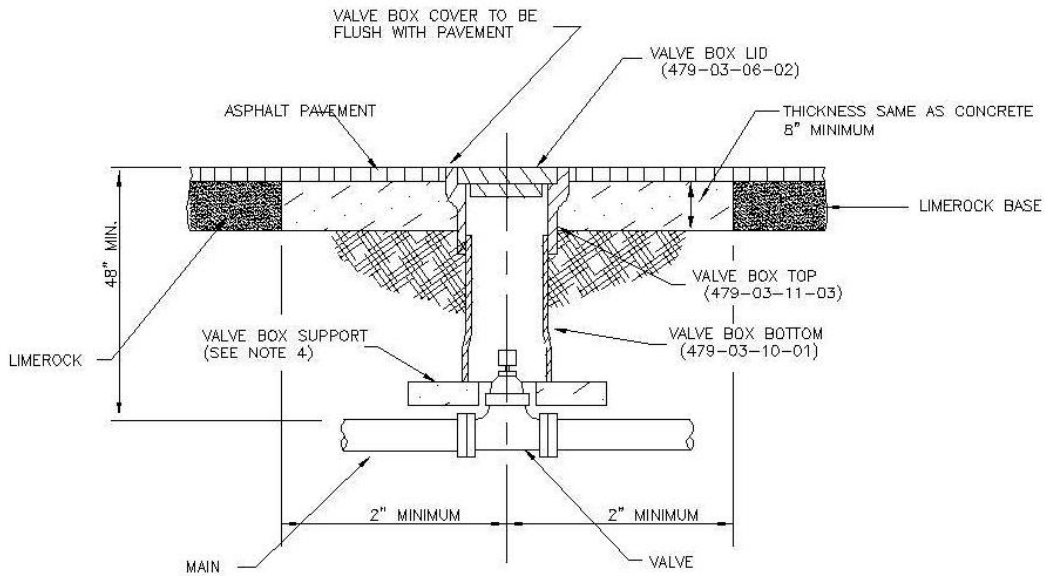
SPECIFICATION										DATE REVISED:				SECTION	
														SHT. 1 OF 1	
CITY OF VALDOSTA				CITY OF VALDOSTA STANDARD DETAIL				RESTRAINED JOINT SYSTEM				C			
														478-3.1	



NOTES

1. USE CONCRETE ENCASEMENT WHERE VERTICAL CLEARANCE BETWEEN WATERMAIN AND SEWER IS 18" OR LESS.
2. WHEN CROSSING SEWER ONE FULL JOINT OF WATER MAIN SHALL BE CENTERED OVER THE SEWER MAIN.
3. CONCRETE FOR ENCASEMENT SHALL BE 3000 PSI.

SPECIFICATION										REVISED:					SECTION																																		
															SHT 1 OF 1																																		
CITY OF VALDOSTA															CITY OF VALDOSTA STANDARD DETAIL															CONCRETE ENCASEMENT CONCRETE ENCASEMENT															A 478-3.3				



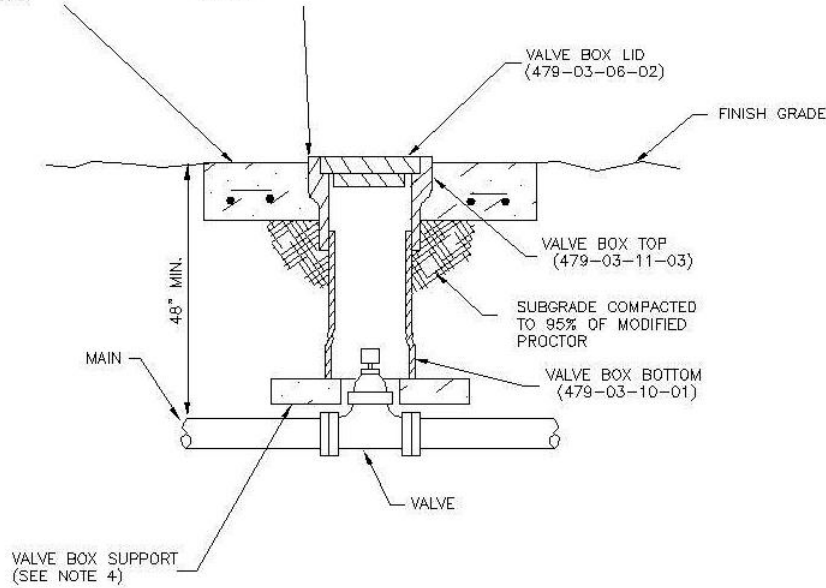
NOTES

1. WHERE ONE VALVE BOX EXTENSION IS REQUIRED USE STANDARD VALVE BOX EXTENSION 479-03-11-02.
2. WHERE MORE THAN ONE VALVE BOX EXTENSIONS ARE REQUIRED USE 6" D.I.P. CUT TO PROPER LENGTH SO VALVE BOX BOTTOM IS ONE CONTINUOUS SECTIONS.
3. VALVE BOX LID TO BE FURNISHED WITH THE WORD "WATER", FOR WATER MAIN INSTALLATION OR "SEWER" FORCE MAIN INSTALLATION OR "REUSE" FOR REUSE MAIN INSTALLATION.
4. FOR VALVES 4" AND ABOVE, USE FOUR (4) OR FIVE (5) SOLID COMMON BRICKS LAID FLAT. FOR 2" VALVES USE 4"x 8"x 16" SOLID PRECAST CONCRETE BLOCKS.
5. FLOWABLE FILL OR CONCRETE CAN BE USED IN LIEU OF LIMEROCK IF APPROVED BY THE CITY ENGINEER.

SPECIFICATION										DATE REVISED:					SECTION	
															SHT. 1 OF 1	
CITY OF VALDOSTA				CITY OF VALDOSTA STANDARD DETAIL				VALVE BOX INSTALLATION					A			
								TRAFFIC AREA IN PAVEMENT							478-4.1	

CONCRETE COLLAR 24" SQ OR
24" DIA. x 8" THICK W/ TWO (2)
NUMBER THREE (3) ROUND
BARS EACH WAY

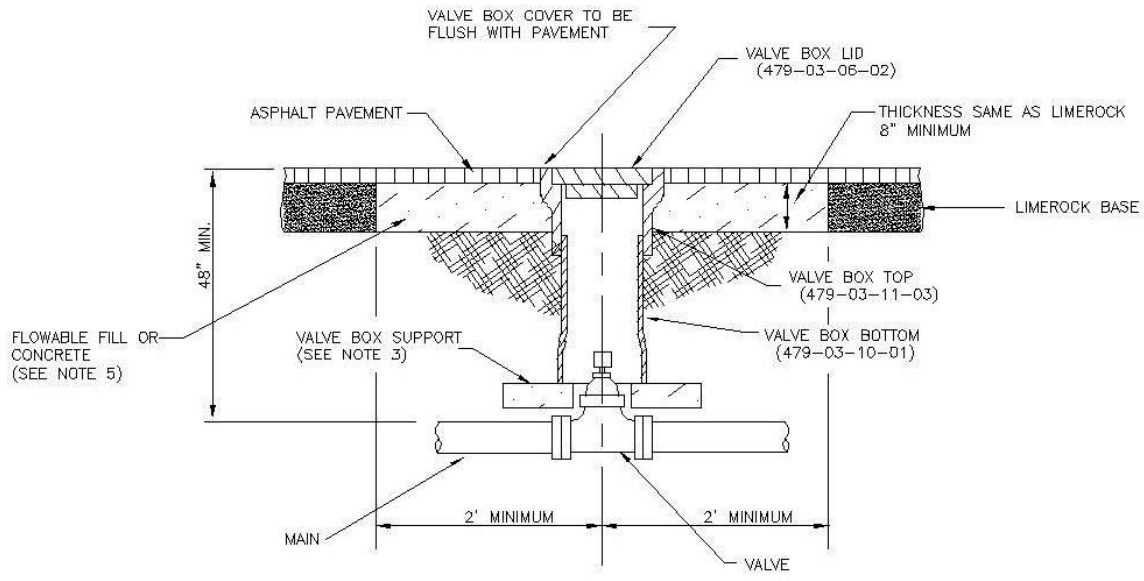
VALVE BOX COVER TO BE SET
1/8"-1/4" ABOVE TOP OF CONCRETE
COLLAR



NOTES

1. WHERE ONE VALVE BOX EXTENSION IS REQUIRED USE STANDARD VALVE BOX EXTENSIONS 479-03-11-02.
2. WHERE MORE THAN ONE VALVE BOX EXTENSIONS ARE REQUIRED USE 6" D.I.P. CUT TO PROPER LENGTH SO VALVE BOX BOTTOM IS CONTINUOUS SECTION.
3. VALVE BOX LID TO BE FURNISHED WITH THE WORD "WATER". FOR WATER MAIN INSTALLATION OR "SEWER" FOR FORCE MAIN INSTALLATION. OR "REUSE" FOR REUSE MAIN INSTALLATION.
4. FOR VALVES 4" AND ABOVE USE FOUR (4) OR FIVE (5) SOLID COMMON BRICKS LAID FLAT. FOR 2" VALVES USE 4"x 8"x 16" SOLID PRECAST CONCRETE BLOCKS.

SPECIFICATION										DATE REVISED:				SECTION	
														SHT. 1 OF 1	
CITY OF VALDOSTA				CITY OF VALDOSTA STANDARD DETAIL				VALVE BOX INSTALLATION TRAFFIC AREA NOT IN PAVEMENT				B			
												478-4.1			



NOTES

1. WHERE ONE VALVE BOX EXTENSION IS REQUIRED USE STANDARD VALVE BOX EXTENSION 479-03-11-02.
2. WHERE MORE THAN ONE VALVE BOX EXTENSIONS ARE REQUIRED USE 6" D.I.P. CUT TO PROPER LENGTH SO VALVE BOX BOTTOM IS ONE CONTINUOUS SECTIONS.
3. VALVE BOX LID TO BE FURNISHED WITH THE WORD "WATER"
4. FOR VALVES 4" AND ABOVE, USE FOUR (4) OR FIVE (5) SOLID COMMON BRICKS LAID FLAT. FOR 2" VALVES USE 4"x 8"x 16" SOLID PRECAST CONCRETE BLOCKS.
5. FLOWABLE FILL CONCRETE WILL BE PLACED UP TO FINISH LIMEROCK ELEVATION, BOTTOM OF ASPHALT.
6. LIMEROCK CAN BE USED IN LIEU OF FLOWABLE FILL CONCRETE AS APPROVED BY THE CITY ENGINEER.

SPECIFICATION										DATE REVISED:										SECTION																			
																				SHT. 1 of 1																			
CITY OF VALDOSTA										CITY OF VALDOSTA STANDARD DETAIL										VALVE BOX INSTALLATION FOR FIRE MAIN TRAFFIC AREA IN PAVEMENT										A									
																				478-4.2																			

CONCRETE COLLAR 24" SQ OR
24" DIA. x 8" THICK W/ TWO (2)
NUMBER THREE (3) ROUND
BARS EACH WAY

VALVE BOX COVER TO BE SET
1/8"-1/4" ABOVE TOP OF CONCRETE
COLLAR

VALVE BOX LID
(479-03-06-02)

VALVE BOX TOP
(479-03-11-03)

FINISH GRADE

SUBGRADE COMPACTED
TO 95% OF MODIFIED
PROCTOR

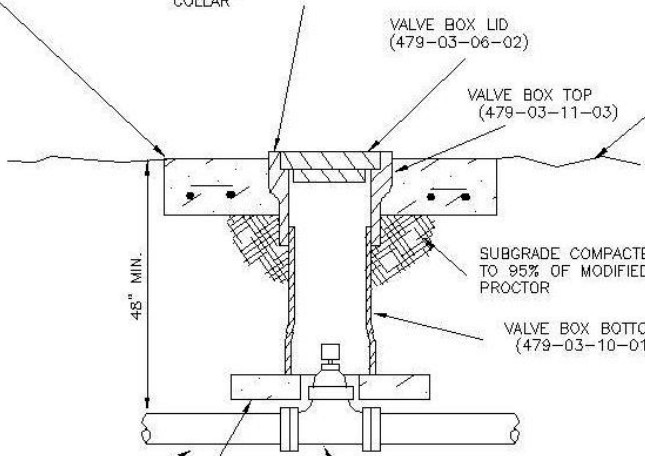
VALVE BOX BOTTOM
(479-03-10-01)

48" MIN.

FIRE MAIN

VALVE

VALVE BOX SUPPORT
(SEE NOTE 3)



NOTES

1. WHERE ONE VALVE BOX EXTENSION IS REQUIRED USE STANDARD VALVE BOX EXTENSIONS 479-03-11-02.
2. WHERE MORE THAN ONE VALVE BOX EXTENSIONS ARE REQUIRED USE 6" D.I.P. CUT TO PROPER LENGTH SO VALVE BOX BOTTOM IS CONTINUOUS SECTION.
3. VALVE BOX LID TO BE FURNISHED WITH THE WORD "WATER"
4. FOR VALVES 4" AND ABOVE USE FOUR (4) OR FIVE (5) SOLID COMMON BRICKS LAID FLAT. FOR 2" VALVES USE 4"x 8"x 16" SOLID PRECAST CONCRETE BLOCKS.

SPECIFICATION

DATE REVISED:

SECTION

SHT 1 OF 1

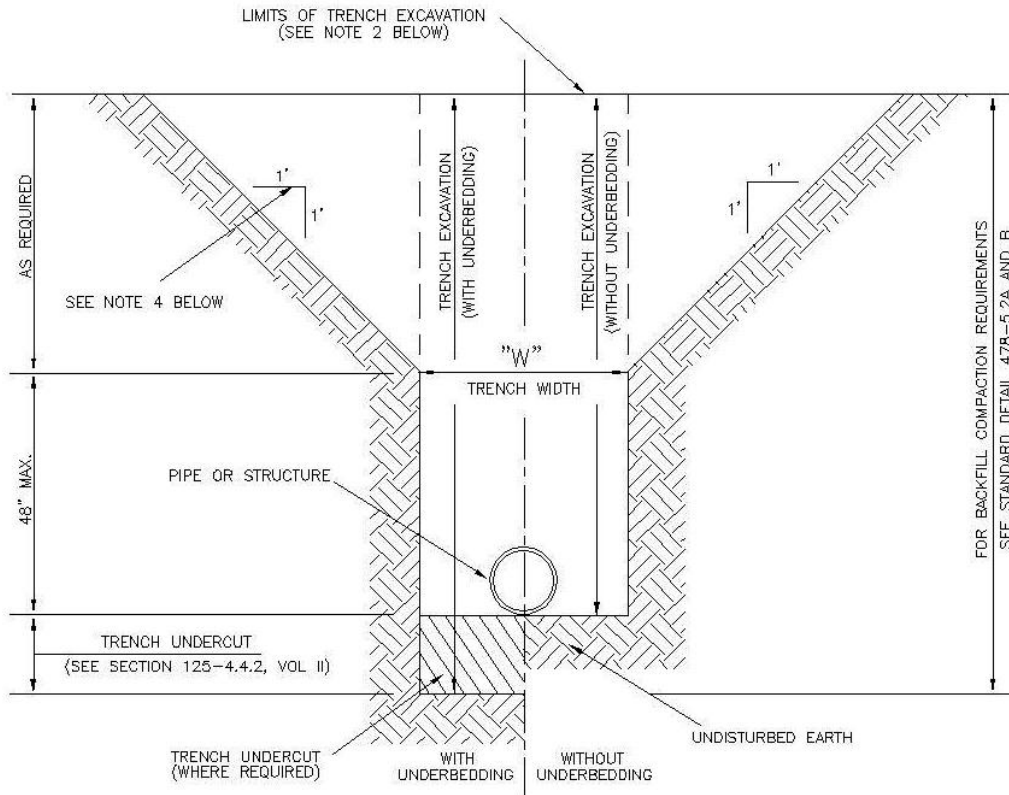
CITY OF VALDOSTA

CITY OF VALDOSTA
STANDARD DETAIL

VALVE BOX INSTALLATION
FOR FIRE MAIN
TRAFFIC AREA NOT IN PAVEMENT

B

478-4.2



PIPE INSTALLATION

PIPE DIAMETER	2"–7"	8"–16"	17" – 24"	OVER 24"
TRENCH WIDTH "W"	36"	48"	54"	60"

STRUCTURE INSTALLATION

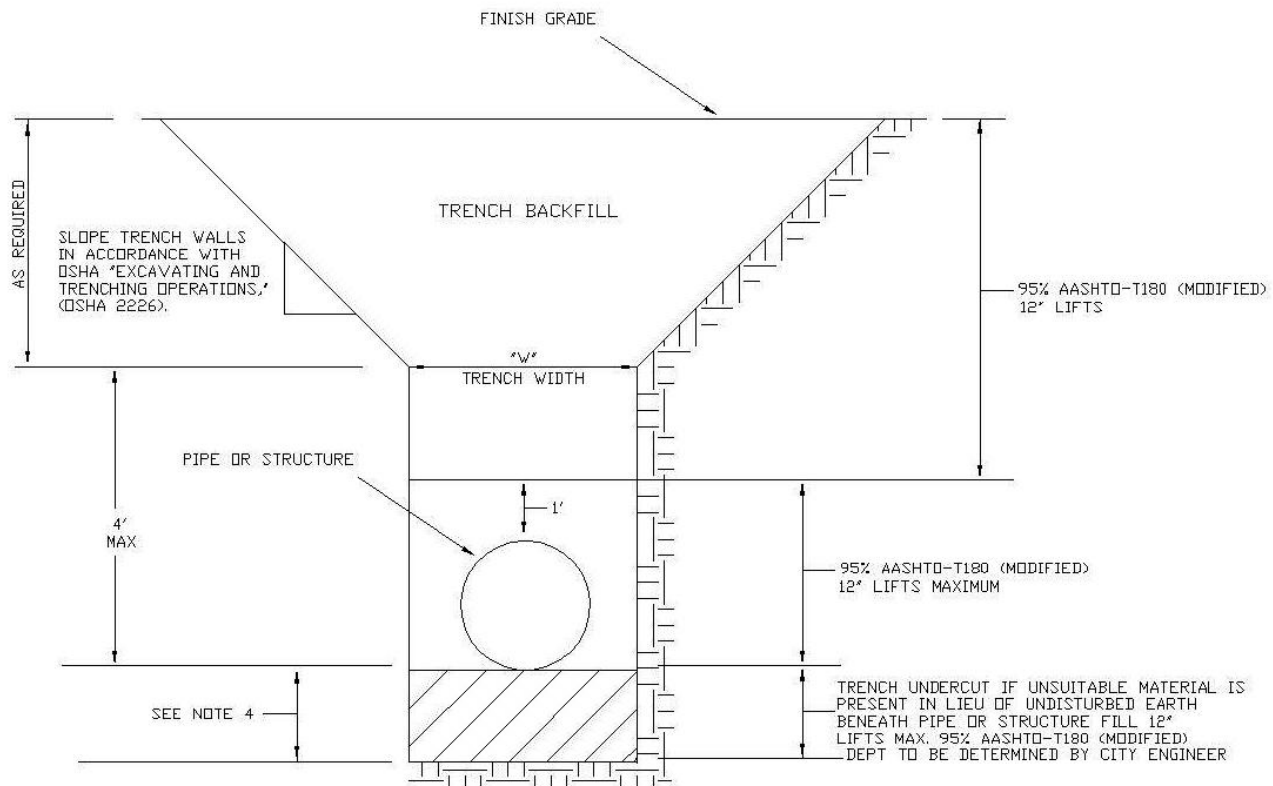
DEPTH OF TRENCH	0' – 6'	6' – 12'	12' – 18'	OVER 18'
STRUCTURE WIDTH "SW"	VARIES	VARIES	VARIES	VARIES
TRENCH WIDTH "W"	SW + 36"	SW + 48"	SW + 54"	SW + 60"

NOTES

1. IN THE EVENT UNSTABLE OR UNSUITABLE BEDDING MATERIAL IS ENCOUNTERED AT OR BELOW THE LIMITS OF EXCAVATION NOTED ON THE DRAWINGS, SUCH MATERIAL SHALL BE REMOVED AND REPLACED WITH FILL APPROVED BY THE CITY ENGINEER.
2. UPPER LIMITS OF TRENCH EXCAVATION AND FOR CALCULATION OF UNSUITABLE MATERIAL REFERS TO ONE OF THE FOLLOWING CONDITIONS (REFER TO DETAIL 478-5.2):
 - A. BOTTOM OF LIMEROCK BASE WHERE UNDER A PAVED ROADWAY EXCEPT WHERE A TWO FOOT UNDERCUT BELOW THE ROADWAY BASE IS REQUIRED. SEE "B" BELOW.
 - B. BOTTOM OF TWO FOOT UNDERCUT BELOW THE ROADWAY SUBGRADE WHERE CALLED FOR IN THE CONTRACT DOCUMENTS.
 - C. FINISH GRADE WHERE NOT UNDER A PAVED ROADWAY.
3. TRENCH WIDTH FOR CALCULATION OF UNSUITABLE MATERIAL IS THE TRENCH WIDTH, THE WIDTH "W" REQUIRED TO INSTALL THE PIPE, PLUS THE TWO TRIANGULAR AREAS BEGINNING FOUR FEET HIGHER THAN THE TRENCH BOTTOM, EXTENDING AWAY FROM THE TRENCH ON A ONE TO ONE SLOPE ON EITHER SIDE OF THE TRENCH TO THE UPPER LIMITS OF THE UNSUITABLE MATERIAL. UNSUITABLE MATERIAL TO BE REMOVED AS PART OF ROADWAY EXCAVATION WILL NOT BE INCLUDED IN THIS CALCULATION.
4. TYPICAL TRENCH SLOPES ARE 1:1 EXCEPT WHERE SOIL CONDITIONS WARRANT DEVIATIONS BUT SHALL BE SUBJECT TO THE DISCRETION OF THE CITY ENGINEER OR HIS REPRESENTATIVE. WHERE DEVIATION IS WARRANTED SLOPES ARE IN ACCORDANCE WITH OSHA REQUIREMENTS. FOR PURPOSES OF CALCULATING UNSUITABLE MATERIAL TRENCH SLOPES ARE ASSUMED TO BE 1:1 UNLESS OTHERWISE DIRECTED BY THE ENGINEER.
5. IN DEEP CUTS TRENCH SHORING OR TRENCH BOX SHALL BE USED AS DIRECTED BY THE CITY ENGINEER.

SPECIFICATION	DATE REVISED:	SECTION
		SHT. 1 OF 1

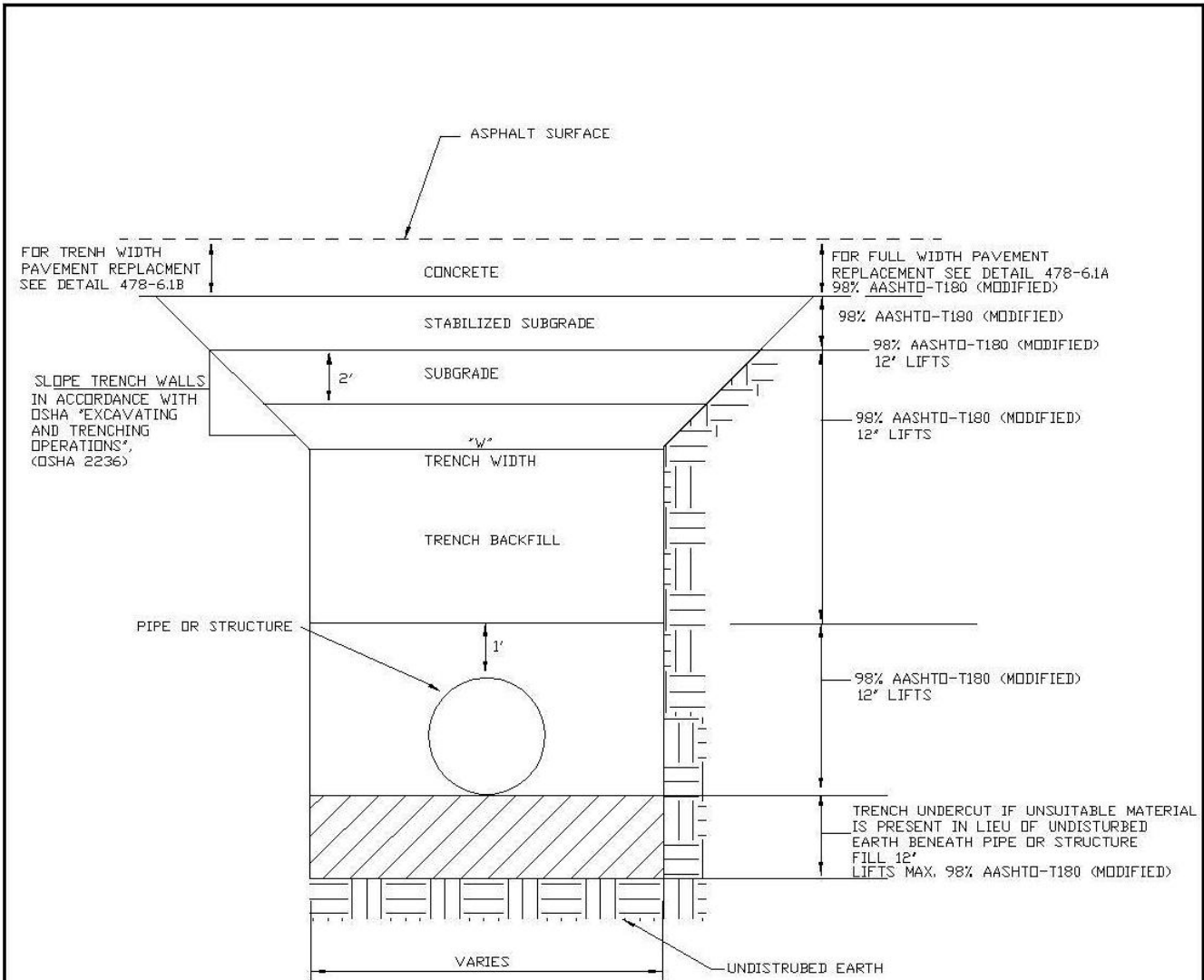
CITY OF VALDOSTA	CITY OF VALDOSTA STANDARD DETAIL	TRENCH EXCAVATION	A
		UNSUITABLE MATERIAL	
			478-5.1



NOTES

1. DENSITY TESTS TO BE TAKEN AT EACH 12" OF COMPACTED FILL, NOT MORE THAN 500 FEET APART OR AS DIRECTED BY A GEOTECHNICAL ENGINEER.
2. IF THE CONTRACTOR HAS COMPACTION EQUIPMENT WITH WHICH THE REQUIRED DENSITY CAN BE OBTAINED IN THICKER LIFTS THAN PERMITTED ABOVE AND UPON SATISFACTORY EVIDENCE THAT THE PROPOSED EQUIPMENT WILL PRODUCE WORK EQUAL IN QUALITY TO THAT PRODUCED BY THE SPECIFIED METHODS, THE ENGINEER MAY PERMIT PLACEMENT OF GRANULAR MATERIAL SOIL GROUPS A-1, A-2, OR A-3 IN LIFTS UP TO A MAXIMUM OF TWO FOOT COMPACTED THICKNESS, THE CONTRACTOR WILL BE REQUIRED TO FURNISH EQUIPMENT AND LABOR TO EXCAVATE AND BACKFILL TEST PITS TO BE DUG FOR THE PERFORMANCE OF DENSITY TESTS.
3. USE OF THICK LIFT COMPACTION PROCEDURES WILL NOT BE ALLOWED FOR THE FIRST STAGE BACKFILLING (BENEATH THE HAUNCHES) OF PIPE AND ON SIDES OF PIPE.
4. REFER TO PROJECT PLANS AND SPECIFICATIONS AND GDOT STANDARD SPECIFICATIONS FOR ROAD CONSTRUCTION, UNSUITABLE MATERIAL FOR UNDERCUTTING REQUIREMENTS.
5. REFER TO PROJECT PLANS AND SPECIFICATIONS AND GDOT STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE REPLACEMENT.

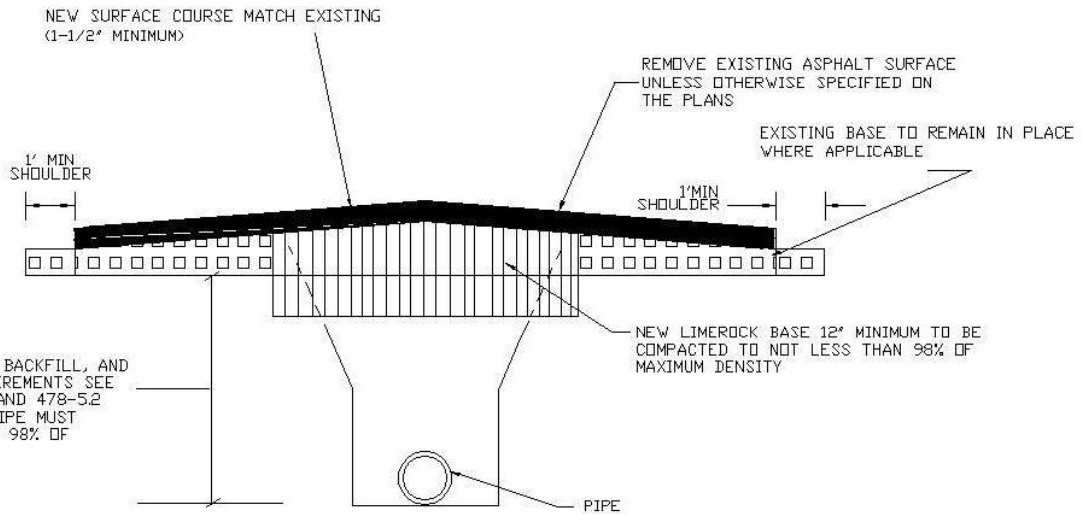
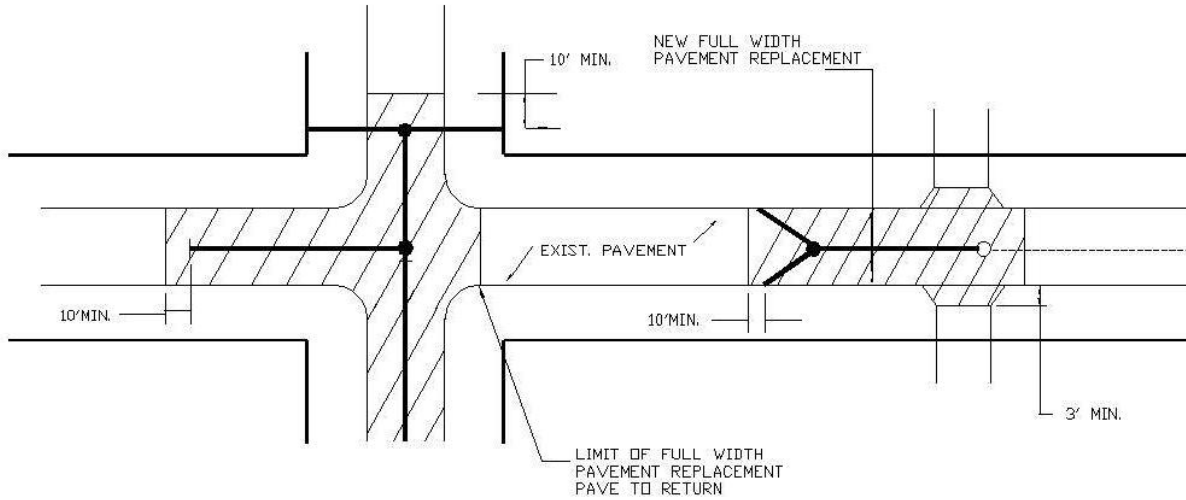
SPECIFICATION		DATE REVISED:	SECTION
			SHT. 1 OF 1
CITY OF VALDOSTA	CITY OF VALDOSTA STANDARD DETAIL	TRENCH BACKFILL NOT WITHIN STREET RIGHTS OF WAY	
		A	478-5.2



NOTES

1. DENSITY TESTS TO BE TAKEN AT EACH 12" OF COMPACTED FILL, NOT LESS THAN 500 FEET APART OR AS DIRECTED BY A GEOTECHNICAL ENGINEER.
2. IF THE CONTRACTOR HAS COMPACTION EQUIPMENT WITH WHICH THE REQUIRED DENSITY CAN BE OBTAINED IN THICKER LIFTS THAN PERMITTED ABOVE AND UPON SATISFACTORY EVIDENCE THAT THE PROPOSED EQUIPMENT WILL PRODUCE WORK EQUAL IN QUALITY TO THAT PRODUCED BY THE SPECIFIED METHODS, THE ENGINEER MAY PERMIT PLACEMENT OF GRANULAR MATERIAL SOIL GROUPS A-1, A-2, OR A-3 IN LIFTS UP TO A MAXIMUM OF TWO FOOT COMPACTED THICKNESS. THE CONTRACTOR WILL BE REQUIRED TO FURNISH EQUIPMENT AND LABOR TO EXCAVATE AND BACKFILL TEST PITS TO BE DUG FOR THE PERFORMANCE OF DENSITY TESTS.
3. USE OF THICK LIFT COMPACTION PROCEDURES WILL NOT BE ALLOWED FOR THE FIRST STAGE BACKFILLING (BENEATH THE HAUNCHES) OF PIPE AND ON SIDES OF PIPE.
4. REFER TO PROJECT PLANS AND SPECIFICATION AND GDOT STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION, UNSUITABLE MATERIAL FOR UNDERCUTTING REQUIREMENTS.
5. REFER TO PROJECT PLANS AND SPECIFICATIONS AND GDOT STANDARD SPECIFICATIONS FOR ROAD REPLACEMENT.
6. IN DEEP CUTS USE TRENCH SHORING OR TRENCH BOX AS DIRECTED BY THE CITY ENGINEER.
7. THE 2' SUBGRADE UNDER CONCRETE AND STABILIZED SUBGRADE BASES MUST BE CLEANFILL WITH NO PLASTICS PRESENT.

SPECIFICATION		DATE REVISED:	SECTION
			SHT 1 OF 1
CITY OF VALDOSTA	CITY OF VALDOSTA STANDARD DETAIL	TRENCH BACKFILL UNDER TRAVELED WAY FOR ALL STREETS - PAVED AND UNPAVED	B 478-5.2

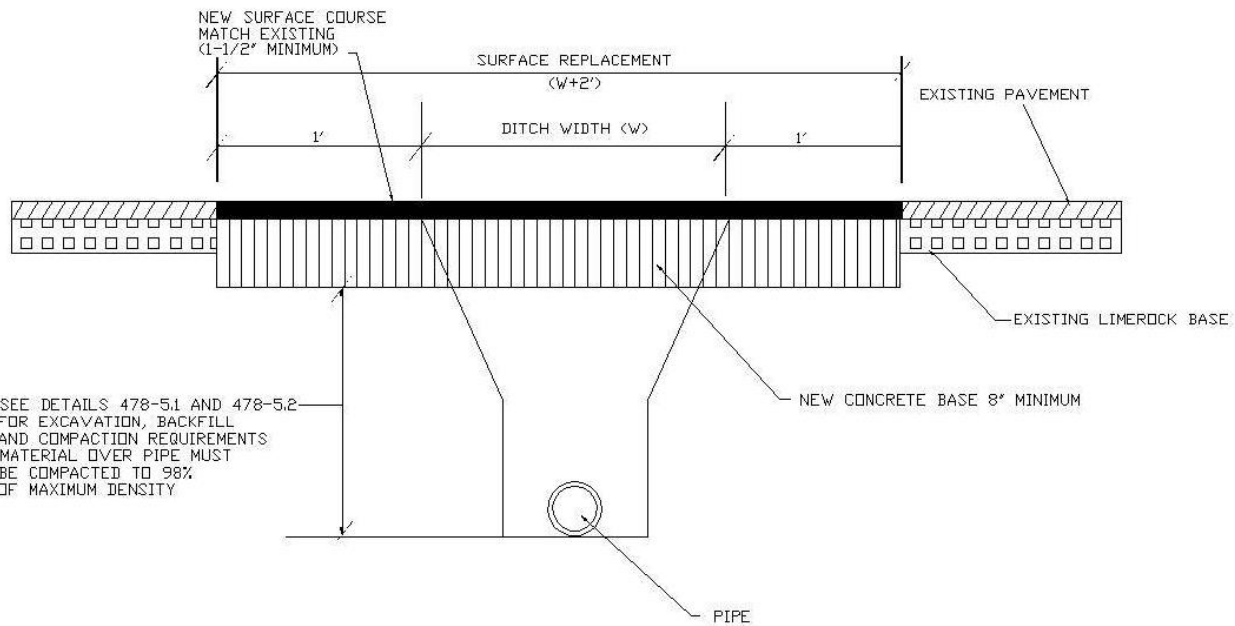
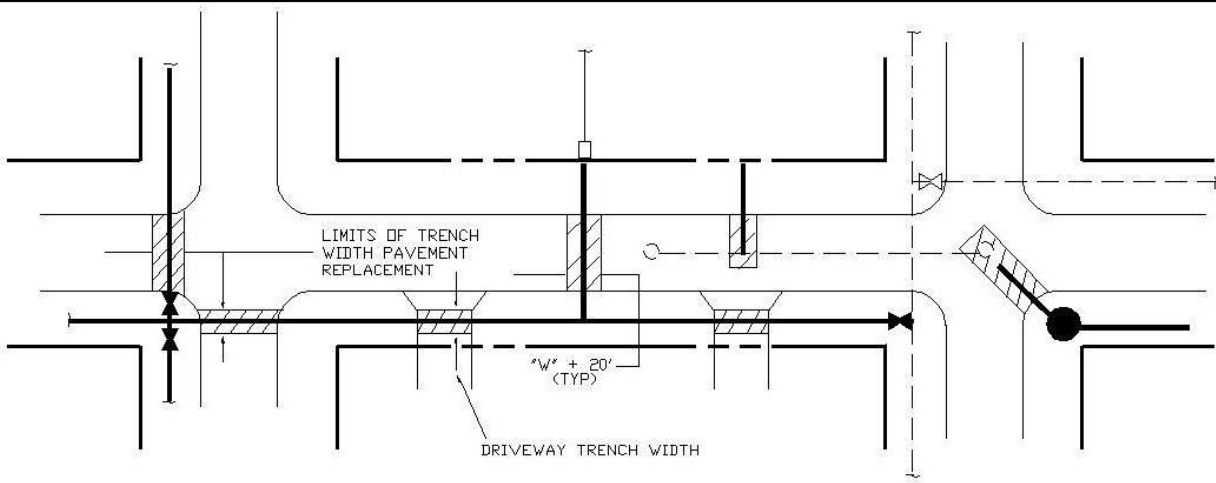


FOR EXCAVATION, BACKFILL, AND COMPACTION REQUIREMENTS SEE DETAILS 478-5.1 AND 478-5.2 MATERIAL OVER PIPE MUST BE COMPACTED TO 98% OF MAXIMUM DENSITY

NOTES

1. UNLESS OTHERWISE SPECIFIED, MATERIALS AND METHODS OF OPERATION REQUIRED TO INSTALL NEW AND REPLACEMENT PAVEMENT SHALL BE IN ACCORDANCE WITH THE LATEST APPLICABLE REQUIREMENTS AND SPECIFICATIONS GDOT STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION.
2. ALL EXISTING DRIVEWAYS AND ROADWAYS SHALL HAVE PAVEMENT RETURNS PAVED DURING THE ROAD PAVING OPERATION.
3. THE TYPE AND THICKNESS OF THE NEW SURFACE MATERIAL SHALL BE CONSISTENT WITH THAT OF THE EXISTING SURFACE. TYPICAL STREETS VARY FROM 1" TO 4" THICK. BUT IN ALL CASES SHALL MEET THE MINIMUM STANDARDS ESTABLISHED BY THE PLANS AND SPECIFICATIONS. WHERE NO ASPHALT TYPE IS SPECIFIED THE REPLACEMENT PAVEMENT SHALL BE 1-1/2" OF SUPERPAVE ASPHALT.

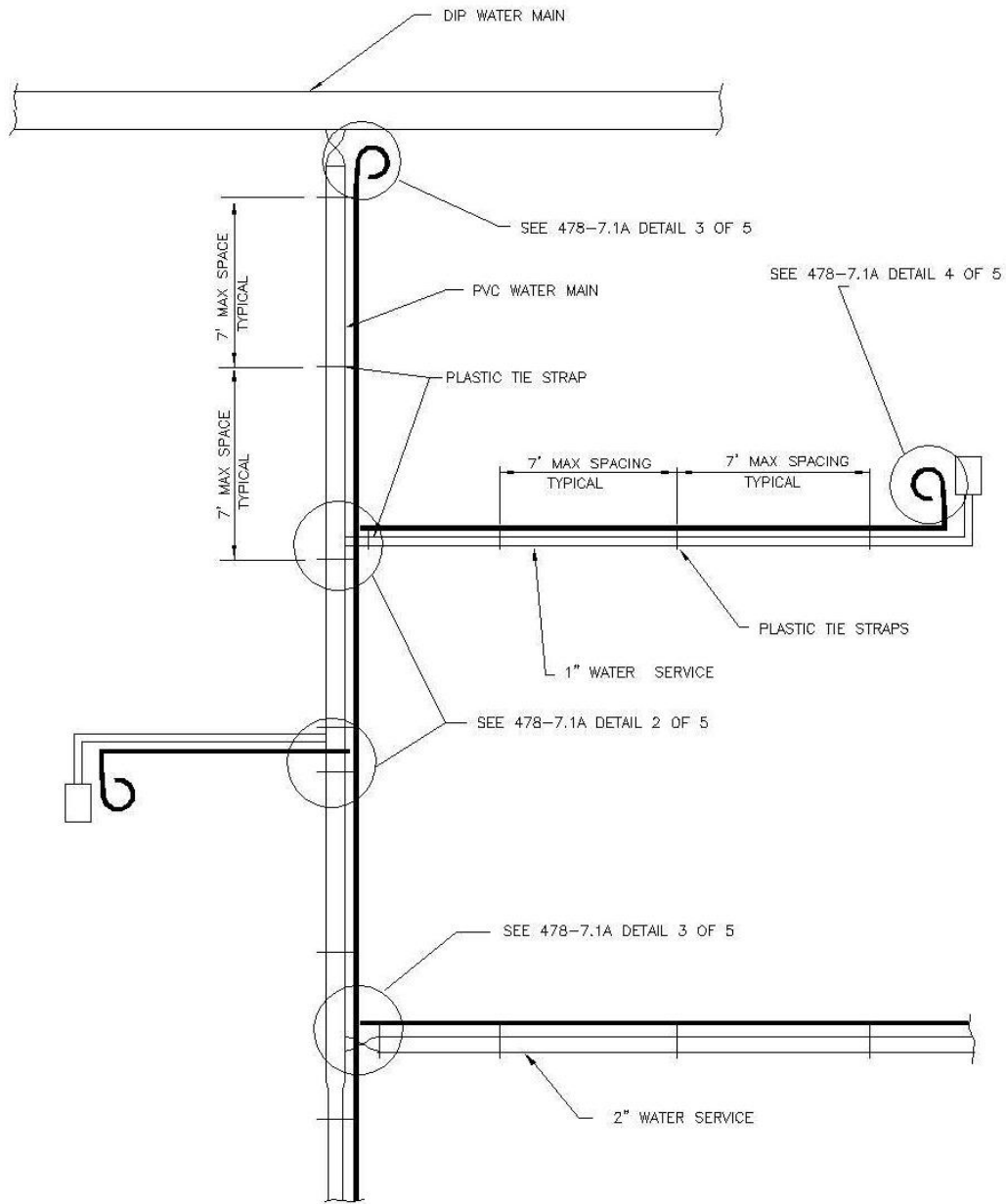
SPECIFICATION										DATE REVISED:										SECTION	
																				SHT. 1 OF 1	
CITY OF VALDOSTA					CITY OF VALDOSTA STANDARD DETAIL					FULL WIDTH PAVEMENT REPLACEMENT										A	
																				478-6.1	



NOTES

1. UNLESS OTHERWISE SPECIFIED, MATERIALS AND METHODS OF OPERATION REQUIRED TO INSTALL NEW AND REPLACEMENT PAVEMENT SHALL BE IN ACCORDANCE WITH THE LATEST APPLICABLE REQUIREMENTS AND SPECIFICATIONS OF CITY OF VALDOSTA
2. PAVEMENT SHALL BE REMOVED TO NEATLY SAWS STRAIGHT EDGES. SAWCUTS SHALL BE MADE TO MIN DEPTH OF 1-1/2" (INCHES).
3. BACKFILL SHALL BE IN ACCORDANCE WITH SPECIFICATIONS AND GDOT STANDARD SPECIFICATIONS.
4. THE TYPE AND THICKNESS OF THE NEW SURFACE MATERIAL SHALL BE CONSISTANT WITH THAT OF THE EXISTING SURFACE. TYPICAL STREETS VARY FROM 1" TO 4" THICK, BUT IN ALL CASES SHALL MEET THE MINIMUM STANDARDS ESTABLISHED BY THE PLANS AND SPECIFICATIONS. WHERE MATERIAL TYPE IS NOT SPECIFIED THE REPLACEMENT PAVEMENT SHALL BE 1-1/2" OF SUPERPAVE ASPHALT.
5. MINIMUM 1' UNDISTURBED BRIDGE FOR THE CONCRETE BASE.

SPECIFICATION				DATE REVISED:				SECTION	
								SHT. 1 OF 1	
CITY OF VALDOSTA		CITY OF VALDOSTA STANDARD DETAIL		TRENCH WIDTH PAVEMENT REPLACEMENT				B 478-6.1	

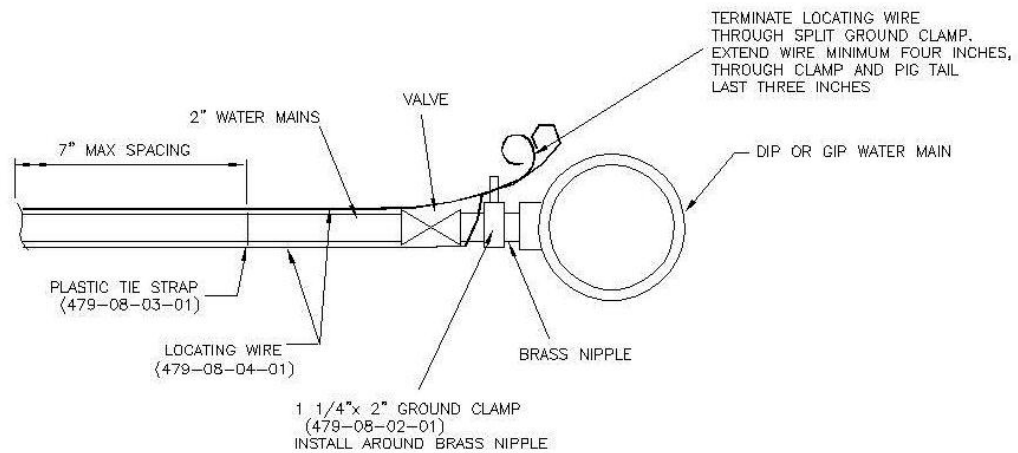


LOCATING WIRE SYSTEM

NOTES

1. LOCATING WIRE TO BE INSTALLED IN BOTH SIX AND TWELVE O'CLOCK POSITIONS OR AT JUST THE TWELVE O'CLOCK POSITION IF IT MEETS THE SPECIFICATIONS FOR A 'SINGLE WIRE' LOCATE WIRE.
2. SECURE LOCATING WIRES TO WATER MAIN BY USE OF PLASTIC TIE STRAPS SPACED AT A MAXIMUM DISTANCE OF SEVEN FEET (7').
3. THE ENTIRE LOCATING SYSTEM SHALL BE SUBJECTED TO TESTING TO DETERMINE ITS RELIABILITY. WHERE INSTALLED UNDER PAVEMENT AREAS, TESTING SHALL BE DONE PRIOR TO PLACEMENT OF ASPHALT BY THE CONTRACTOR.
4. AFTER WIRE INSTALLATION THROUGH GROUND CLAMPS WRAP ALL BARE WIRE WITH ELECTRICAL TAPE.

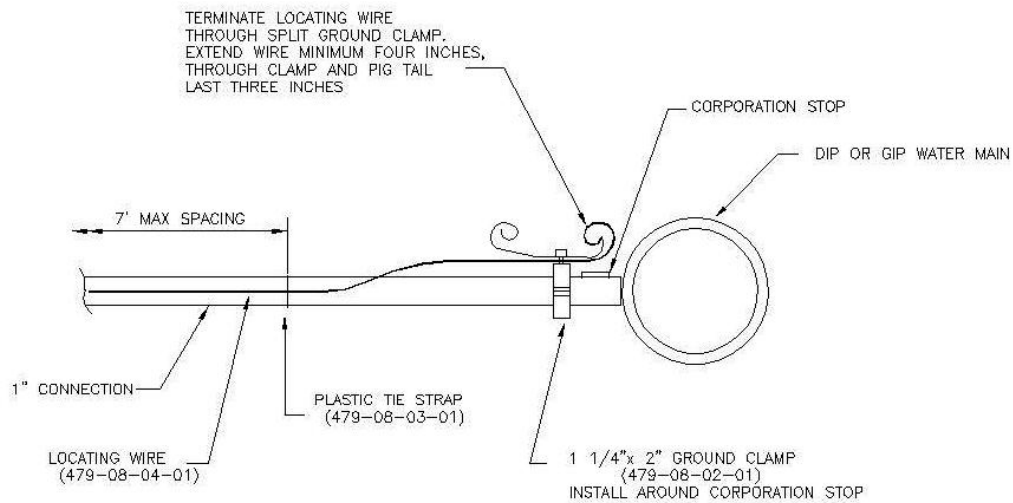
SPECIFICATION	DATE REVISED:	SECTION
		SHT. 1 OF 6
CITY OF VALDOSTA	CITY OF VALDOSTA STANDARD DETAIL	LOCATING WIRE
		A
		478-7.1



2" CONNECTION TO DIP OR GIP MAINS

2" WATER SERVICE

(SEE STANDARD 488-2.1)



1" CONNECTION TO DIP OR GIP MAIN

SINGLE FAMILY WATER SERVICE

(SEE STANDARD DETAIL 488-2.1)

SPECIFICATION

DATE REVISED:

SECTION

SHT. 2 OF 6

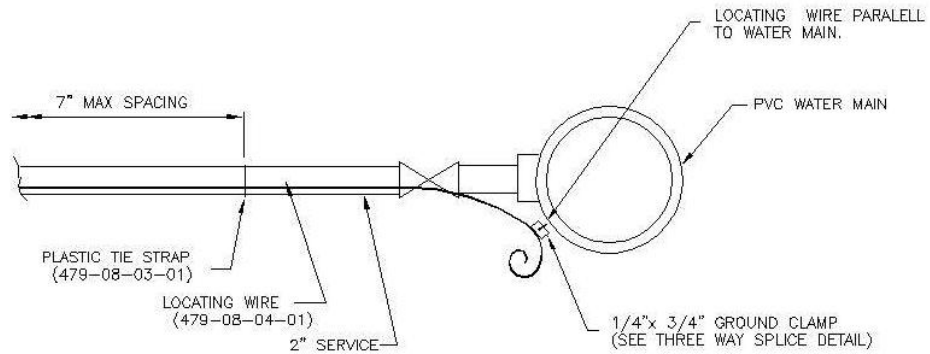
CITY OF VALDOSTA

CITY OF VALDOSTA
STANDARD DETAIL

LOCATING WIRE
CONNECTION TO DIP OR GIP MAIN

A

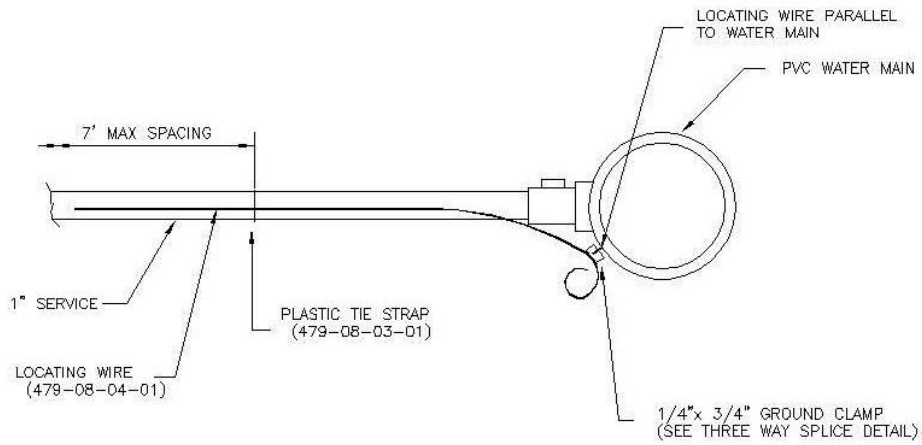
478-7.1



2" CONNECTION TO PVC WATER MAIN

MULTI FAMILY WATER SERVICE

(SEE STANDARD 488-2.2)



1" CONNECTION TO PVC WATER MAIN

SINGLE FAMILY WATER SERVICE

(SEE STANDARD DETAIL 488-2.1)

SPECIFICATION		DATE REVISED:	SECTION
			SHT. 3 OF 6
CITY OF VALDOSTA	CITY OF VALDOSTA STANDARD DETAIL	LOCATING WIRE CONNECTION TO PVC MAIN	A
			478-7.1

TERMINATING LOCATING WIRE THROUGH SPLIT GROUND CLAMP. EXTEND WIRE, MINIMUM FOUR INCHES THRU CLAMP AND PIG TAIL LAST THREE INCHES.

1 1/4"x 2" GROUND CLAMP (479-08-02-01)

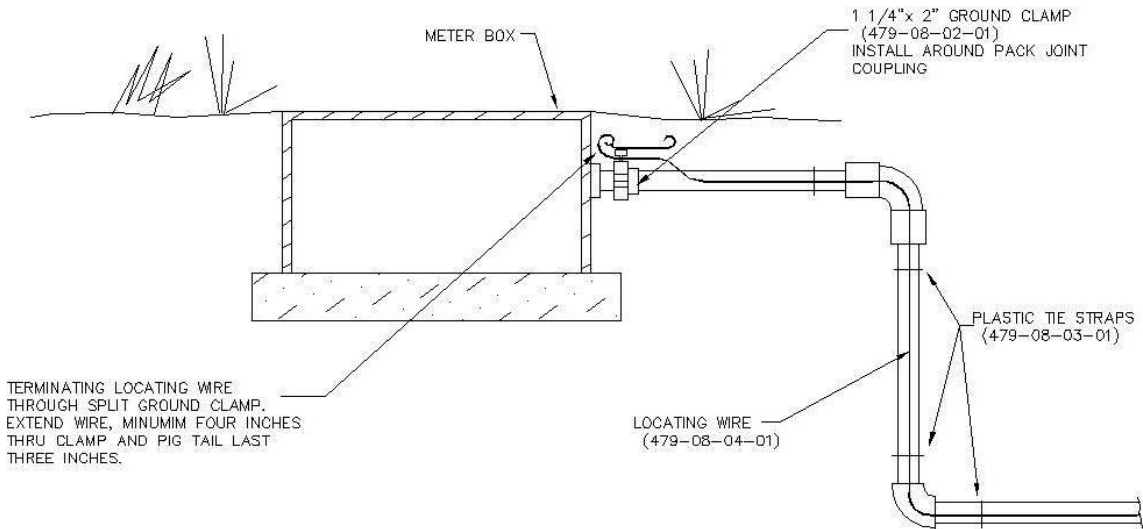
PLASTIC TIE STRAP (479-08-03-01)

LOCATING WIRE (479-08-04-01)

TERMINATION AT METER BOX

MULTIFAMILY WATER SERVICE

SEE STANDARD DETAIL 488-2.2

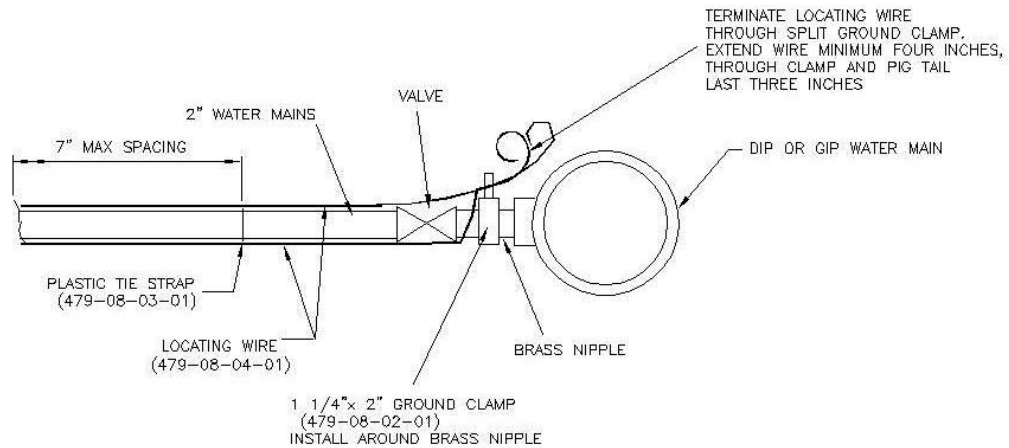


TERMINATION AT METER BOX

SINGLE FAMILY WATER SERVICE

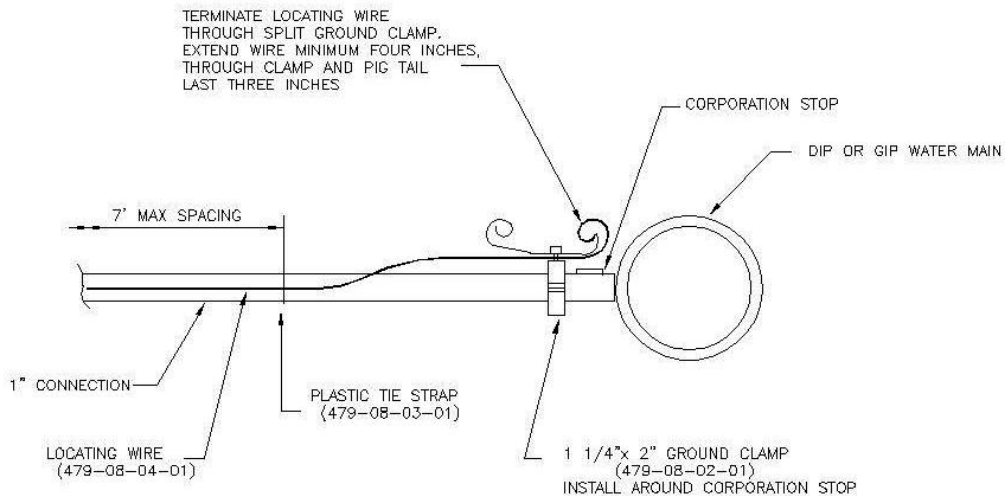
SEE STANDARD DETAIL 488-2.1

SPECIFICATION										DATE REVISED:					SECTION	
															SHT. 4 OF 6	
CITY OF VALDOSTA				CITY OF VALDOSTA STANDARD DETAIL				LOCATING WIRE TERMINATION AT METER BOX					A			
													478-7.1			



2" CONNECTION TO DIP OR GIP MAINS

2" WATER SERVICE
(SEE STANDARD 488-2.1)

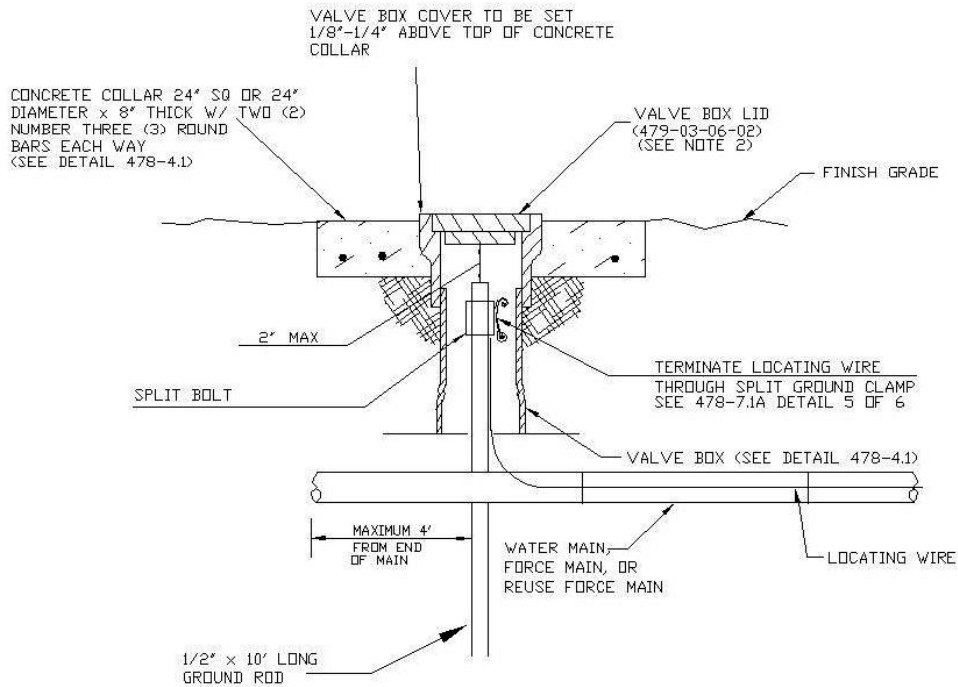


1" CONNECTION TO DIP OR GIP MAIN

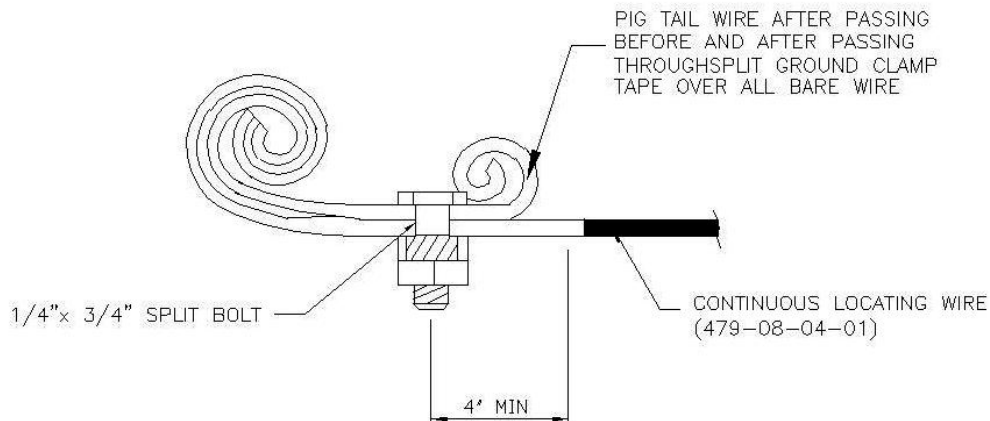
SINGLE FAMILY WATER SERVICE
(SEE STANDARD DETAIL 488-2.1)

NOTE:
TRACE-SAFE(NEPTCO) CONNECTORS AND LOCATE CLIPS TO BE USED WITH SAFE-TRACE(NEPTCO) WIRE.

SPECIFICATION		DATE REVISED:		SECTION
				SHT. 2 OF 6
CITY OF VALDOSTA	CITY OF VALDOSTA STANDARD DETAIL	LOCATING WIRE CONNECTION TO DIP OR GIP MAIN		A
				478-7.1



GROUND ROD TERMINATION



END TERMINATION

NOTES

1. USE ONLY ONE STANDARD VALVE BOX EXTENSION 479-03-11-02.
2. VALVE BOX LID TO BE FURNISHED WITH THE WORD "WATER" FOR WATER MAIN INSTALLATION, "SEWER" FOR SEWER MAIN INSTALLATION OR "REUSE" FOR REUSE MAIN INSTALLATION.
3. MAXIMUM SPACING BETWEEN GROUNDING ROD IS 500 FEET.
4. TRACE-SAFE (NEPTCO) CONNECTORS AND LOCATE CLIPS SHALL BE USED WITH TRACE-SAFE (NEPTCO) WIRE.

SPECIFICATION		DATE REVISED:	SECTION
			SHT. 6 OF 6
CITY OF VALDOSTA	CITY OF VALDOSTA STANDARD DETAIL	<u>LOCATING WIRE</u> END TERMINATION	A
			478-7.1

DIVISION 470

SECTION 479

**GENERAL
CONSTRUCTION**

**STANDARD
MATERIALS
SPECIFICATIONS**

SECTION 479

GENERAL CONSTRUCTION STANDARD MATERIALS SPECIFICATIONS

Following is a list of standard materials to be used in the installation of the water and sanitary sewer main systems. Shop drawings are to be submitted. Materials requiring the traditional "Shop Drawing Submittal" are identified by the words "Shop Drawing Required" at the bottom of the specification sheet. All materials must be submitted on Form WSCM001. A copy of form WSCM001 is provided in the Appendix section of this manual.

The Material Specification Number for each item is located in the upper right hand corner of the specification sheet.

LIST OF WATER AND SEWER STANDARD MATERIALS

479-01 RESERVED

479-02 RESERVED

479-03 BOXES & LIDS

- 479-03-06-02 Valve Box, Lid
- 479-03-06-03 Valve Box, Non-Pop Lid
- 479-03-10-01 Valve Box, Bottom
- 479-03-11-02 Valve Box, Extension
- 479-03-11-03 Valve Box, Top
- 479-03-99-01 Hatch, Aluminum Single Door Lightweight
- 479-03-99-02 Hatch, Aluminum Single Door Heavyweight
- 479-03-99-03 Hatch, Aluminum Double Door Lightweight
- 479-03-99-04 Hatch, Aluminum Double Door Heavyweight
- 479-03-99-20 Valve Box

479-04 CASINGS

- 479-04-01-01 Steel Casings
- 479-04.01.02 PVC and HDPE Casings

479-05 CARRIER PIPE

- 479-05-01-01 Carrier Pipe for Gravity Sewers
- 479-05-02-01 Carrier Pipe for Water Mains and Sewer Force Mains

479-06 RESERVED

479-07 RESERVED

479-08 **WIRE AND HARDWARE**

479-08-02-01 Ground Clamp

479-08-03-01 Tie Wire

479-08-04-01 Wire

479-09 **MISCELLANEOUS**

479-09-01-01 Casing Spacer

479-09-02-01 Marking Tape

MATERIAL SPECIFICATION: 479-03-06-02

NOMENCLATURE:

VALVE BOX, LID

DESCRIPTION:

Provide cast iron, ASTM A48, heavy duty, valve box, 5 ¼" shaft. Cover shall be marked "Water," "Sewer," or "Reuse" as called for on the plans.

APPROVED MANUFACTURING AND CATALOG NUMBERS

MANUFACTURER

<u>SIZE</u>	<u>SIGMA</u>	<u>TYLER</u>	<u>OPELIKA FOUNDRY</u>	<u>STAR PIPE PRODUCTS</u>
5 ¼"	VB261 or equal			

MATERIAL SPECIFICATION: 479-03-06-03

NOMENCLATURE:

VALVE BOX, NON-POP LID

DESCRIPTION:

Provide high tech molded polymer replacement lid for conventional cast iron lid. Cover shall be marked "Water, "Sewer," or "Reuse" as called for on the plans.

APPROVED MANUFACTURING AND CATALOG NUMBERS

MANUFACTURER

SIZE

SWS

5 1/4"

5 1/4" Non-Pop Lid

MATERIAL SPECIFICATION: 479-03-10-01

NOMENCLATURE:

VALVE BOX, BOTTOM

DESCRIPTION:

Cast iron, ASTM A48, heavy duty screw type as specified. Cast iron screw valve box will be only type allowed in asphalt pavement. Cast iron screw or sliding type valve box may be used in right of way as specified per project.

APPROVED MANUFACTURING AND CATALOG NUMBERS

MANUFACTURER

<u>SIZE</u>	<u>TYLER</u>	<u>OPELIKA FOUNDRY</u>	<u>SIGMA</u>	<u>STAR PIPE PRODUCTS</u>
24" – 36"			VB 261 or equal	

MATERIAL SPECIFICATION: 479-03-11-02

NOMENCLATURE:

VALVE BOX, EXTENSION

DESCRIPTION:

Cast iron, ASTM A48, heavy duty screw type extension. For deep valves use six inch (6") ductile or cast iron pipe cut to proper length so only one valve box extension is used.

APPROVED MANUFACTURING AND CATALOG NUMBERS

MANUFACTURER

<u>SIZE</u>	<u>TYLER</u>	<u>OPELIKA FOUNDRY</u>	<u>SIGMA</u>	<u>STAR PIPE PRODUCTS</u>
24" – 36"			VB302-18	

MATERIAL SPECIFICATION: 479-03-11-03

NOMENCLATURE:

VALVE BOX, TOP

DESCRIPTION:

Cast iron, ASTM A48, screw type.

APPROVED MANUFACTURING AND CATALOG NUMBERS

MANUFACTURER

<u>SIZE</u>	<u>TYLER</u>	<u>OPELIKA FOUNDRY</u>	<u>SIGMA</u>	<u>STAR PIPE PRODUCTS</u>
24" – 36"			VB261 or equal	

MATERIAL SPECIFICATION: 479-03-99-01

NOMENCLATURE:

HATCH, SINGLE DOOR, LIGHTWEIGHT, ALUMINUM

DESCRIPTION:

Shall be made of one-quarter inch (1/4") Floor Diamond Plate Aluminum with one-quarter inch (1/4") extruded aluminum angle frame with concrete anchors and integral neoprene gasket strip, single door, stainless steel hinges, stainless steel bolts and fasteners, hold open arm mechanism, cast aluminum drop handle and safety hasp. Cover shall be designed to withstand 300 lb/ft². Aluminum shall be mill finished with coal tar epoxy applied to surfaces to be in contact with concrete. All stainless steel is to be 316 grade stainless steel.

APPROVED MANUFACTURING AND CATALOG NUMBERS (or equal)

MANUFACTURER

<u>SIZE</u>	<u>U. S. FOUNDRY</u>	<u>HALLIDAY</u>
24" x 24"		
24" x 30"		
24" x 36"		
30" x 30"		
30" x 36"		
30" x 48"		
36" x 36"		
36" x 48"		
42" x 42"		

MATERIAL SPECIFICATION: 479-03-99-02

NOMENCLATURE:

HATCH, SINGLE DOOR, HEAVYWEIGHT, ALUMINUM

DESCRIPTION:

Shall be made of one-quarter inch (1/4") Floor Diamond Plate Aluminum with one-quarter inch (1/4") extruded aluminum angle frame with concrete anchors and integral neoprene gasket strip, single door, stainless steel hinges, stainless steel bolts and fasteners, hold open arm mechanism, cast aluminum drop handle and safety hasp. Cover shall be designed for H-20 wheel loading. Aluminum shall be mill finished with coal tar epoxy applied to surfaces to be in contact with concrete. All stainless steel is to be 316 grade stainless steel.

APPROVED MANUFACTURING AND CATALOG NUMBERS (or equal)

MANUFACTURER

<u>SIZE</u>	<u>U. S. FOUNDRY</u>	<u>HALLIDAY</u>
24" x 24"		
24" x 30"		
30" x 30"		
30" x 36"		
30" x 48"		
36" x 36"		

MATERIAL SPECIFICATION: 479-03-99-03

NOMENCLATURE:

HATCH, DOUBLE DOOR, LIGHTWEIGHT, ALUMINUM

DESCRIPTION:

Shall be made of one-quarter inch (1/4") Floor Diamond Plate Aluminum with one-quarter inch (1/4") extruded aluminum angle frame with concrete anchors and integral neoprene gasket strip, double doors, stainless steel hinges, stainless steel bolts and fasteners, hold open arm mechanism, cast aluminum drop handle and safety hasp. Cover shall be designed to withstand 300 lb/ft². Aluminum shall be mill finished with coal tar epoxy applied to surfaces to be in contact with concrete. All stainless steel is to be 316 grade stainless steel.

APPROVED MANUFACTURING AND CATALOG NUMBERS (or equal)

MANUFACTURER

<u>SIZE</u>	<u>U. S. FOUNDRY</u>	<u>HALLIDAY</u>
30" x 48"		
30" x 54"		
36" x 48"		
36" x 60"		
42" x 48"		
48" x 48"		
48" x 54"		
48" x 72"		
60" x 60"		

MATERIAL SPECIFICATION: 479-03-99-04

NOMENCLATURE:

HATCH, DOUBLE DOOR, HEAVYWEIGHT, ALUMINUM

DESCRIPTION:

Shall be made of one-quarter inch (1/4") Floor Diamond Plate Aluminum with one-quarter inch (1/4") extruded aluminum angle frame with concrete anchors and integral neoprene gasket strip, double doors, stainless steel hinges, stainless steel bolts and fasteners, hold open arm mechanism, cast aluminum drop handle and safety hasp. Cover shall be designed for H-20 wheel loading. Aluminum shall be mill finished with coal tar epoxy applied to surfaces to be in contact with concrete. All stainless steel is to be 316 grade stainless steel.

APPROVED MANUFACTURING AND CATALOG NUMBERS (or equal)

MANUFACTURER

<u>SIZE</u>	<u>U. S. FOUNDRY</u>	<u>HALLIDAY</u>
30" x 48"		
30" x 54"		
36" x 48"		
36" x 60"		
42" x 48"		
48" x 48"		
48" x 54"		
48" x 72"		

MATERIAL SPECIFICATION: 479-03-99-20

NOMENCLATURE:

VALVE BOX

DESCRIPTION:

Cast iron, ASTM A-48, heavy duty screw or sliding type valve box. Complete with bottom and top sections and lid. Lid to be marked "Water," "Sewer," or "Reuse" as called for on the plans.

APPROVED MANUFACTURING AND CATALOG NUMBERS (or equal)

	<u>MANUFACTURER</u>			
<u>SIZE</u>	<u>TYLER</u>	<u>OPELIKA FOUNDRY</u>	<u>SIGMA</u>	<u>STAR PIPE PRODUCTS</u>
24" – 36"			VB261 or equal	

MATERIAL SPECIFICATION: 479-04-01-01

NOMENCLATURE:

STEEL CASINGS

DESCRIPTION:

Steel, ASTM A-53 or ASTM A-139, steel casing, welded joints

APPROVED MANUFACTURING AND CATALOG NUMBERS

MANUFACTURER

<u>SIZE</u>	<u>THICKNESS</u>
2"	0.25
4"	0.25
6"	0.25
8"	0.25
12"	0.28
18"	0.31
24"	0.33
30"	0.38
36"	0.42
48"	0.52
54"	0.58
60"	0.61

MATERIAL SPECIFICATION: 479-04-01-02

NOMENCLATURE:

CASINGS

DESCRIPTION:

PVC, SCH 80

PVC, C900

HDPE, C906

APPROVED MANUFACTURING AND CATALOG NUMBERS

<u>SIZE</u>	<u>PVC</u>	<u>HDPE</u>	<u>MANUFACTURER</u>
2"	PVC, SCH80, DR18	HDPE, C906	JM Eagle or equal
4"	PVC, C900, DR18	HDPE, C906	JM Eagle or equal
8"	PVC, C900, DR18	HDPE, C906	JM Eagle or equal
12"	PVC, C900, DR18	HDPE, C906	JM Eagle or equal

MATERIAL SPECIFICATION: 479-05-01-01

NOMENCLATURE:

CARRIER PIPE FOR GRAVITY SEWERS

DESCRIPTION:

PVC Gravity pipes, see Material Specification 499-07-06-02

MATERIAL SPECIFICATION: 479-05-02-01

NOMENCLATURE:

CARRIER PIPE FOR WATER MAINS & SEWER FORCE MAINS

DESCRIPTION:

PVC water and sewer Force Mains use Certa-Lok C900 restrained joint PVC piping system, Specifications 489-07-08-03 and 499-07-99-06

DIP Sewer Force Mains: See Material Specification 499-07-15-01, using restrained joints, Specification 499-07-15-02

DIP Water Mains: See Material Specification 489-07-02-01, using restrained joints, Specification 489-07-02-02

APPROVED MANUFACTURING AND CATALOG NUMBERS

MANUFACTURER

SIZE

MATERIAL SPECIFICATION: 479-08-02-01

NOMENCLATURE:

GROUND CLAMP

DESCRIPTION:

Ground clamp, bronze head with brass-bronze screws for use on locating wire terminations.
Trace-Safe(Neptco) locate clip to be used with Trace-Safe wire at valve boxes and termination points.

APPROVED MANUFACTURING AND CATALOG NUMBERS (or equal)

<u>SIZE</u>	<u>MANUFACTURER</u>
1"	
2"	

MATERIAL SPECIFICATION: 479-08-03-01

NOMENCLATURE:

TIES, WIRE

DESCRIPTION:

Must be dielectric for fastening locating wire to PVC pipe.

APPROVED MANUFACTURING AND CATALOG NUMBERS

MANUFACTURER

SIZE

6"
12"

MATERIAL SPECIFICATION: 479-08-04-01

NOMENCLATURE:

WIRE

DESCRIPTION:

Wire, solid, TW, color – Water(blue), Sewer(green), Reclaim(purple) 300 volt for locating wire.
Trace-Safe(Neptco) connectors must be used when using Trace-Safe(Neptco) locating wire.

APPROVED MANUFACTURING AND CATALOG NUMBERS

<u>SIZE</u>	<u>No. of Wires</u>	<u>MANUFACTURER</u>
#14	2	Service Wire Company
#19	1	Trace-Safe(Neptco) or approved equal

MATERIAL SPECIFICATION: 479-09-01-01

NOMENCLATURE:

CASING SPACERS

DESCRIPTION:

Casing spacers shall be bolt on style with a two (2) piece shell made of polymer or glass reinforced plastic or 304 stainless steel of a minimum 14-gauge thickness. Each shell section shall have bolt flanges and/or a hinged side, bolt flange shall be formed with ribs for added strength. Connecting side shall have a minimum of three (3) $\frac{5}{16}$ " 304 stainless steel bolts. The shell shall be lined with ribbed PVC with a retaining section that overlaps the edge of the shell and prevents slippage. Bearing surfaces (runners) made from UHMW Polymer or glass reinforced plastic and attached to support structures (risers) at appropriate position to properly support the carrier within the casing and to ease installation. Runners shall be attached mechanically by 304 stainless steel threaded fasteners that are inserted through the riser section and TIG welded for strength. Risers shall be made of 304 stainless steel of a minimum 10-gauge. Risers shall be TIG welded to the shell. All metal surfaces shall be fully chemically passivated.

APPROVED MANUFACTURING AND CATALOG NUMBERS

Applications: For PVC carrier pipe, polymer, plastic or stainless steel spacers.
For DIP carrier pipe, stainless steel spacers only.

MANUFACTURER

CASCADE WATERWORKS MFG **PIPELINE SEAL & INSULATOR** **RACI CASING SPACERS**

THE BWM COMPANY

MATERIAL SPECIFICATION: 479-09-02-01

NOMENCLATURE:

MARKING TAPE, DETECTABLE UNDERGROUND

DESCRIPTION:

Aluminum foil marking tape used in underground application to mark the location of water mains, sewage force mains, reuse mains and gravity sewers. Tape shall have a minimum 5 mil overall thickness with 0.35 mil solid aluminum foil core. Construction shall be 0.8 mil clear fiber, reverse print laminated to aluminum foil to 3.75 mil clear fiber, making a film permanently printed. Tape shall meet the thickness requirements of ASTM D2103, 5.0 mil, and tensile strength meeting requirements of ASTM D882, 15,000 psi. Color shall be blue for water, green for sewage force mains and gravity sewer, and purple for reuse mains, with "Potable Water", "Sewer Force Main", "Sewer", and "Reclaimed Water" written on the tape.

SIZE

4"

6"

12"

DIVISION 490

SANITARY SEWER SYSTEM CONSTRUCTION

DIVISION 490

SECTION 491

SANITARY SEWER CONSTRUCTION

SECTION 491
SANITARY SEWER CONSTRUCTION

491.1 SCOPE

The work under this section includes the furnishing, installing, laying, jointing, and testing of all sewer lines, manholes, fittings and appurtenances, including necessary service connections required for a complete system as shown on the drawings and specified herein. The work shall also include such connections, reconnections, relocations, temporary services, abandonments, and all other provisions in regard to existing sewer operations and modifications as required.

491.2 GENERAL REQUIREMENTS

- 491.2.1** All work shall be proven to be in first class condition and constructed properly in accordance with the drawings and specifications. All defects and leaks disclosed by tests shall be remedied and re-tested.
- 491.2.2** The location of existing sewer laterals (active and inactive) are to be considered approximate and have been plotted from the best available records. It shall be the responsibility of the **CONTRACTOR** to field locate all existing laterals.
- 491.2.2.1** If, upon excavating any sewer lateral a conflict, is found to exist between the proposed construction and an existing or proposed utility (telephone, gas, storm, etc.), the **CONTRACTOR** shall notify the **CITY ENGINEER** and at least 24 hours shall be allowed for remedial action unless otherwise specified by the **CITY ENGINEER**.
- 491.2.3** Excavation and backfill, seeding and mulching, dewatering, clearing and grubbing, cleanup and other related site work for sanitary sewer construction are specified in GDOT Utility Accommodation Policy and Standards Manual.
- 491.2.4** All tests and re-tests shall be performed in the presence of the **CITY ENGINEER** or a designated representative. The **CONTRACTOR** shall be responsible for low pressure air testing, structure leak testing, deflection testing, and compaction testing. The **CITY ENGINEER** shall be responsible for lamping. Re-testing and any other additional testing required by this section shall be at the **CONTRACTOR'S** expense.
- 491.2.5** Sewer mains, services, lift stations, and force mains shall be as-built after construction. As-built drawings for sanitary sewer shall be in accordance with Section 496.
- 491.2.6** Compaction and density tests are specified in this manual, Section 478, Standard Details 478-6.1A, B, and C, and GDOT Utility Accommodation Policy and Standards Manual.
- 491.2.7** Contractor shall contact the **UTILITY DEPARTMENT** a minimum of 24 hours prior to connecting to the **CITY** utility system.

491.3 MATERIALS

- 491.3.1** All materials required by this section, which are necessary for the construction of sanitary sewer mains shall be of the type, model, and manufacture specified under the applicable specifications of Section 499.
- 491.3.2** Materials not specified herein or under Section 499 shall not be installed in the sanitary sewer system unless specifically authorized, in writing, by the **UTILITY DIRECTOR**. The **CITY** reserves the right to have said materials removed at the **CONTRACTOR'S** expense.
- 491.3.3** Requests for materials to be approved by the **CITY** shall be made to the **UTILITY DIRECTOR**, in writing, in accordance with set procedures. Copies of the procedure policy may be obtained from the **UTILITY DIRECTOR**.
- 491.3.4** All materials shall be free from defects impairing strength and durability and be of the best commercial quality for the purpose specified. They shall have structural properties sufficient to safely sustain or withstand strains and stresses to which they are normally subjected and be true to detail.
- 491.3.5** All pipe and fittings shall be clearly marked with the name or trademark of the manufacturer, the batch number, the location of the plant, strength designation, and pressure rating. Where ductile iron pipe is to be installed in the system, the words "Epoxy Coated" or "Epoxy Lined" shall be clearly marked on the pipe.
- 491.3.6** The **CONTRACTOR** shall submit to the **UTILITY DIRECTOR** and **CITY ENGINEER** for approval before work begins, certificates of inspection in triplicate from the pipe manufacturer that the pipe and fittings supplied have been inspected at the plant and meet the requirements of these specifications.
- 491.3.7** The **CONTRACTOR** shall submit to the **UTILITY DIRECTOR** and **CITY ENGINEER** for approval before work begins, certification for pipe linings, in triplicate, shall be furnished by the pipe manufacturer certifying that the pipe lining has been installed in accordance with the specifications set forth herein.
- 491.3.8** Refer to Section 499 for materials requiring shop drawing submittals.

491.4 MANHOLE INSTALLATION

- 491.4.1** Bottom of Hole - Keep excavation free of water during the construction process. Build structures to the line and grade shown on the plans. Grade the excavation bottom to provide a smooth, firm and stable foundation underneath the structure. Remove large gravel or cobbles encountered in the excavation bottom from beneath the structure and replace with clean, compacted granule materials to provide uniform support and a firm foundation. Excavate undesirable material to a minimum depth of 12" below the proposed grade and backfill in compacted lifts as specified in these specifications. Place gravel under manholes in wet soil conditions. Manholes are considered confined spaces and the **CONTRACTOR** needs to follow the **OSHA** requirements for confined

spaces entry. Confined space is defined as large enough for a person to work with restricted means of entry and exit. The **CONTRACTOR** is responsible for safety of his/her personnel. The **CONTRACTOR** must use a gas detector to measure the gases present. If no gases are present the structure may be entered. When gases are detected, fresh air must be forced into the area until acceptable levels of air quality are obtained. A tripod/hoist unit shall be set up and manned.

- 491.4.1.1** At least one foot of rock (57 stone) will be placed under the bottom of the manhole. Additional rock will be added as required by the City inspector.
- 491.4.2** Installing Sections - Installation of precast manholes shall comply with the manufacturer's recommendations. Precast concrete sections shall be set so the manhole will be vertical and with sections in true alignment. Joint surfaces of the base or previously set section shall have an O-ring installed in the recess or shall be sealed with pre-molded plastic joint sealer equal to "Ramnek"®. If "Ramnek" is used, joints shall be pre-primed and wrapped on the exterior to provide a sealed manhole.
- 491.4.3** Patching Holes - All holes in sections used for their handling shall be thoroughly plugged with Embeco 167 and 381 Mortar, non-shrinking grout, or approved equal applied and cured in strict conformance with the manufacturer's recommendations so that there will be zero leakage through openings and around pipes. The grout or mortar shall be finished smooth and flush with the adjoining interior and exterior manhole wall surfaces. As soon as grout or mortar is hydrated to the point where it will not be marred by such application, and within two (2) hours after installation, the **CONTRACTOR** shall apply Master Builders' Master Seal or approved equal membrane curing compound, conforming to ASTM C309-latest, Type 1, Class B, to the finished grout surfaces both inside and outside the manhole. Submission of alternate grouts shall include alternate membrane curing compound or indicate which of the above approved products is proposed for use. This method shall also be applied to the annular space between the wall and entering pipes where new pipes are added to existing structures or where new pipes are repositioned in new manholes. Grout mixed on-site shall be used with potable water and masonry sand from concrete supplier. Dirty pond water and existing excavated sand shall not be used. Entire interior of manhole shall be coated with coal tar epoxy or liner as specified.
- 491.4.4** Setting Manhole Frames - Manhole frames and covers shall be set to conform accurately to the finished ground or pavement surface as established by the contract drawings, unless otherwise directed by the **CITY ENGINEER**. Frames shall be set concentric with the manhole base and adjusted to grade as specified in Paragraph 491.4.5 below.

491.4.5 Adjusting Manhole Frames

- 491.4.5.1** Adjustment of manhole frames due to delayed construction, new grade elevations, manhole rehabilitation or other work requiring adjustment of manhole frame and covers shall be adjusted with brick masonry or precast concrete adjusting rings. Frames shall be adjusted to conform accurately with the specified grade established on the drawings and in accordance with these specifications and Detail 498-1.1. If specified tolerances can not be met, manhole will have to be modified.
- 491.4.5.2** The **CONTRACTOR** may elect, unless otherwise specified by the **CITY ENGINEER**, to either remove the manhole top completely to facilitate construction or leave in place until the base course is constructed.
- 491.4.5.2.1** If the manhole is to be left in place until final adjustment, it shall be protected.
- 491.4.5.2.2** If the **CONTRACTOR** elects to remove the manhole top, he shall place sufficient covering over the manhole, to the satisfaction of the **CITY ENGINEER**, to eliminate infiltration of dirt, limerock, stone, brick, debris, etc, until the top is adjusted to grade.
- 491.4.5.2.3** In either of the cases above, the **CONTRACTOR** will be responsible for any undesirable material entering the manhole or sewer system as a result of this construction.
- 491.4.5.3** The **CONTRACTOR** shall prepare the base for the manhole frame to a condition satisfactory to the **CITY ENGINEER**. All loose, broken or cracked brick shall be removed along with excess grout to provide a smooth, solid, level surface to receive the new buildup of the manhole top.
- 491.4.5.4** Only clean brick shall be used in brick adjustment. If required, the bricks shall be moistened prior to application of the grout or mortar. Each brick shall be laid in a full bed and joint of grout or mortar without requiring subsequent grouting, flushing, or filling, and shall be thoroughly bonded as directed. Grout shall be one part cement and two parts sand. Lime shall not be used.
- 491.4.5.5** Outside faces of brick masonry or concrete adjusting rings shall be covered with grout or mortar from 3/8" to 1/2" thick. If required, brick concrete shall be properly moistened prior to application of the grout or mortar. The mortar or grout shall be carefully spread and troweled so that all cracks are thoroughly worked out. After hardening, the grout or mortar shall be thoroughly checked for bond and soundness by being tapped. Unbonded or unsound grout or mortar shall be removed and replaced.

491.4.5.6 Frame shall be set concentric with the masonry and in a full bed of grout or mortar so that the space between the top of the manhole masonry and the bottom flange of the frame shall be completely filled and made watertight.

491.4.5.6.1 The frame shall be completely embedded and sealed to the manhole with grout or mortar. Grout or mortar shall be applied so as to leave no air pockets or voids and shall cover the area from the top of the frame to the outside edge of the manhole.

491.4.6 Installation of manholes over existing mains - Doghouse manholes installed over existing sewer mains must have concrete slabs installed under the existing pipe for the doghouse manhole to sit on. Precast slabs must have keyways to connect walls to slab. Formed-in-place slabs shall be a minimum of 12" and sized by the manhole manufacturer with rebar. Manholes will be sealed on the interior and must be leak tested or vacuum tested as specified for water tightness.

491.4.7 Manhole Test - It is the intent of these specifications that manholes and appurtenance be watertight and free from infiltration, seeping or surface moisture. Water or air tightness of manholes shall be tested at the time the manhole is completed and ready for test. The **CONTRACTOR** shall repair any evidence of leakage. The leakage tests shall be conducted in the following manner:

Water Tightness Test

The **CONTRACTOR** shall plug all inlets and outlets with approved stoppers or plugs. Fill the structure with water to an elevation one foot (1') below ring and cover with a minimum depth of four feet (4'). The water shall stand before the test measurements begin or until the water level stabilizes. If the water level does not stabilize within twenty-four (24) hours, the structure shall be considered to have failed the test. The maximum allowable drop in the water surface is 1/10 of 1% in 24 hours.

Air Tightness Test

The **CONTRACTOR** shall plug all inlets and outlets with approved stoppers or plugs. Air vacuum test shall test manhole from one foot (1') below the ring and cover to bottom of manhole. A vacuum of 1" of mercury shall be drawn on the manhole, let stabilize, time specified in Table WSCM 112 in the Appendix. If a one inch (1") drop or more occurs during the test time, the manhole has failed the test. (See Sewer Pipe Air Test Table for actual test pressure and times.)

Even though the leakage is less than the specified amount, the **CONTRACTOR** shall stop any leaks that may be observed. The manhole will not be accepted until it passes the manhole test.

- 491.4.8** Flow Channels - Manhole bases shall be formed of Class I concrete while the manholes are under construction. Cut off pipes at inside face of the manhole and construct the invert to the shape and size of the pipe indicated. All inverts shall follow the grades of the pipe entering the manholes. Changes in direction of the sewer and entering branch or branches shall be laid out in smooth curves of the longest possible radius which is targeted to the centerlines of adjoining pipelines. Regardless of differences in entrance and exit elevations, flow channels for all pipes are to be formed to present a smooth transition of flow and shall be subject to the approval of the **CITY ENGINEER**. Flow channels shall be constructed in accordance with Standard Detail 498-1.2B.
- 491.4.9** Outside Drop Connections - Shall be cast in place using concrete. Pipes shall be held firmly in place while concrete is being formed. Drop connections shall be constructed in accordance with Standard Detail 498-1.2C.
- 491.4.10** Inside Drop Connections – Shall be placed inside the structure. Pipes should be held firmly in place with steel brackets coated with the same coating used to coat the inside of the manhole. Inside drop connections shall be constructed in accordance with Standard Detail 498-1.2C2.
- 491.4.11** Stub Lines - Where shown on the drawings, stub lines shall be provided for the connection of future sewer lines. The end of each stub line shall be provided with a bell end which shall be closed by an approved stopper as specified in Section 499. Each stub line shall be accurately referenced. The actual invert elevation of each end of the stub line shall be accurately recorded on the as-built drawings along with the distance from the end of the pipe to the center of the manhole.
- 491.4.12** Stub Outs - Where shown on the drawings, stub outs shall be provided for the connection of future sewer lines to manholes. Stub outs shall be installed in accordance with Standard Detail 498-1.2D.
- 491.4.13** Pipes - Connect pipes to new manholes using pipe boots and clamps. Connect pipes to lined manholes after liners have been completed and sealed.

491.5 PIPE INSTALLATION

- 491.5.1** General - The method of pipe laying shall be subject to the approval of the **CITY ENGINEER**. Each pipe length shall be inspected for cracks. The pipe laying shall proceed upgrade, beginning at the lower end of the sewer, with pipe bell ends upgrade. Extreme care shall be exercised to keep the pipe in exact alignment and elevation. Pipe shall be laid to conform accurately to the lines and grades indicated on the drawings. If approved by the **CITY ENGINEER**, minor changes in the alignment but not the grade will be permitted to avoid underground facilities provided that straight alignment can be maintained between manholes. In no case shall the pipe be walked on, either before or after the joints have been made. Upon discovery, any defective pipe which may have been laid shall be removed and replaced with sound pipe, at no additional cost to the **CITY**. The **CONTRACTOR** shall be responsible for locating all underground utilities in advance of construction to insure that no conflicts occur with the proposed line and grade. If a conflict is found between an existing utility and the proposed grade,

the **CONTRACTOR** is to furnish the **CITY ENGINEER** all pertinent information so that remedial design can be performed. Unless otherwise specified or required by the **CITY ENGINEER**, the bedding and installation shall be Class B. Class B bedding is sand or sandy soil with 100 percent passing the 3/8- inch sieve and no more than 10 percent passing the No. 200 sieve.

491.5.2 Laying and Jointing - The pipe shall be laid on an unyielding foundation with uniform bearing under the full length of the barrel of the pipe. Suitable excavations shall be made to receive the bell of each pipe, which shall be carefully laid true to line and grade.

All adjustments to line and grade must be made by scraping away or filling in under the barrel of the pipe and not by wedging or blocking up any portion of the pipe. The spigot end of the pipe shall abut against the base of the socket of the adjacent pipe in such a manner that there will be no gaps or unevenness of any kind along the bottom halves of the pipes. Just before jointing the pipe, the mating ends shall be thoroughly cleaned of all dirt, debris, and foreign material. The pipe shall be jointed in accordance with the recommendations of the manufacturers of the pipe and gasket. In all jointing operations, the trench must be de-watered when joints are made and kept de-watered until sufficient time has elapsed to assure efficient hardening of the jointing material, or as may be required. The pipe shall not be driven down to grade by striking it with a shovel handle, timber, rammer, or other unyielding object. The **CONTRACTOR** shall take all necessary precautions to prevent flotation of the pipe due to flooding of the trench.

491.5.2.1 Cutting and Beveling PVC Pipe - Cutting of PVC pipe shall be done with either hand or mechanical saws or plastic pipe cutters. Ends shall be cut square and perpendicular to the pipe axis. Spigots shall have burrs removed and ends smoothly beveled by a mechanical beveler or by hand with a rasp or file. Field spigots shall be stop-marked with felt tip marker or wax crayon for the proper length of assembly insertion. The angle and depth of field bevels and length to stop-markers shall be comparable to factory pipe spigot.

491.5.2.2 Bell Holes for Elastomeric Seal Joints - The bell hole shall be no larger than necessary to accomplish proper joint assembly. When the joint has been made, the void under the bell should be filled with bedding or haunching material to provide adequate support to the pipe throughout its entire length.

491.5.2.3 Assembly of Joints - Assemble all joints in accordance with recommendations of the manufacturer. If a lubricant is required to facilitate assembly, it shall have no detrimental effect on the gasket or on the pipe when subjected to prolonged exposure. Proper jointing may be verified by rotation of the spigot by hand or with a strap wrench. If unusual jointing resistance is encountered, or if the insertion mark does not reach the flush position, disassemble the joint, inspect for damage, re-clean the joint components, and repeat the assembly steps. Note that fitting bells may permit less insertion depth than pipe bells. (**NOTE:** When mechanical equipment is used to assemble joints, care should be taken to prevent over-insertion).

491.5.2.4 Stoppers - Openings such as stubs, wyes, tees, or other services along the lines shall be securely closed by means of an approved stopper that fits into the bell of the pipe and is recommended by the pipe manufacturer. This stopper shall be jointed in such a manner that it may be removed at some future time without injury to the pipe itself. At the close of each day's work, and at other times when pipe is not being laid, the end of the pipe shall be temporarily closed with a close-fitting stopper as specified under Section 499.

491.5.2.5 Cleaning - All necessary precautions shall be taken to prevent the entrance of mud, sand or other obstructing material into the pipelines. As the work progresses, the interior of the sewer shall be cleaned of all dirt, jointing material, and superfluous materials of every description. Prior to final inspection, the **CONTRACTOR** shall flush all sewer lines constructed under this contract with clean water to assure complete removal of all debris and foreign materials.

491.5.2.6 Bedding and Backfill - Immediately after the pipe has been jointed and inspected, sufficient backfill shall be performed to protect the pipe adequately from injury and movement. Where so indicated on the drawings, or where directed by the **CITY ENGINEER**, the pipe shall be supported by compacted granular fill, concrete cradle, or encasement according to the applicable detail shown on the plans. Pipe bedded in compacted granular backfill shall not be supported on blocking, wedges, bricks, or anything except the bedding material. Where concrete cradle or encasement is required, the pipe shall be supported on solid concrete blocks or precast concrete saddles which shall become part of the completed cradle or encasement. Where no other bedding is indicated, pipe shall be placed on a shaped bed of undisturbed material.

491.6 SERVICE CONNECTIONS

491.6.1 Connections - Types of connections shall be as shown on the drawings. Although the general location of connections may be shown on the drawings, the actual location shall be determined by the **CONTRACTOR**, subject to approval by the **UTILITY DIRECTOR**. Service connections shall, if elevations permit, be placed at the most convenient connection point for the building or property served. The **CONTRACTOR** shall make every effort to ascertain this location. Unless authorized by the **UTILITY DIRECTOR** in writing, or shown on the drawings, service connections shall not be tied into new or existing manholes. All service connections shall be terminated at the property line unless otherwise indicated on the drawings or as directed by the **UTILITY DIRECTOR**. In no case shall a service connection stop short of the right-of-way line. It is the intent of these contract documents that every property be provided with at least one service connection and, unless otherwise directed by the **UTILITY DIRECTOR**, the **CONTRACTOR** shall be responsible to see that this intent is fulfilled.

- 491.6.2** PVC Branch Fittings - Fittings for PVC service branches in new construction shall be molded or fabricated with all gasketed connections. Taps into existing lines shall use a gasketed saddle wye or tee with all stainless steel clamps. Saddles may be mounted on pipe with solvent cement or gasket but shall be secured by metal banding. Install saddles in accordance with manufacturer's recommendations. Holes for saddle connections shall be made by mechanical hole cutters or by keyhole saw or saber saw. Holes for wye saddles shall be laid out with a template and shall be de-burred and carefully beveled where required to provide a smooth hole shaped to conform to the fitting. The **CONTRACTOR** will be permitted use of fittings which are prefabricated using pipe sections, molded saddles and PVC solvent cement, provided the solvent cement is used in fabrications 24 hours prior to installation. Cemented mitered connections without socket reinforcement shall not be permitted. Only PVC primer and solvent cement shall be used in cementing in accordance with the cement manufacturer's recommendations and ASTM D-2855, "Making Solvent- Cemented Joints with PVC pipe and Fittings". Quickly place temporary band clamps both upstream and downstream of the saddle and tighten.
- 491.6.3** Service Lines - Unless required otherwise by the drawings, service lines from the property line to the collection sewer shall be at a minimum depth of four feet (4') at the property line and shall be laid to straight alignment and uniform slope of not less than 0.6% for six inch (6") pipe. It shall be uniformly compacted backfill. All service lines shall be at least six inches (6") in diameter and referenced in accordance with Paragraph 491.6.5 below.
- 491.6.4** Pipe Caps and Plugs - All caps and plugs shall be braced, staked, anchored, wired on, or otherwise secured to the pipe to prevent leakage under the maximum anticipated thrust conditions from internal abnormal operating conditions or pressures from water or air.
- 491.6.5** Referencing Service Connections - All sewer service connections installed shall be referenced in accordance with Standard Detail 498-2.1C.
- 491.6.6** Recording Service Connections - Each service connection (new or existing) located or installed shall be accurately recorded on "Asbuilt Drawings" as specified under Section 496.

491.7 CONCRETE ENCASEMENT

- 491.7.1** Provide concrete pipe encasement or special pipe supports as shown on the drawings and as approved by the **CITY ENGINEER**.
- 491.7.2** Ductile iron pipe may be used in lieu of concrete encasement where water line crosses sewer lines with less than six inches (6") vertical clearance, with a length of pipe centered at the point of crossing, so as to locate joints at a maximum distance from the water line.

491.8 CONNECTIONS TO EXISTING STRUCTURES

- 491.8.1** Opening - Where shown on the drawings, new lines shall be connected into existing manholes or structures. Unless stubs of correct size are found to exist, the **CONTRACTOR** shall put suitable openings into the existing structure (wall masonry and floor slab as required) or remove the existing pipe to accommodate the pipelines as indicated on the drawings and as herein specified. The portion of each existing structure removed for new installation shall be confined to the smallest opening possible, consistent with the work to be done, then a pipe boot shall be embedded in the new hole.
- 491.8.2** Connections - Connections to existing structures with stubouts shall be made by installing an appropriate adaptor as approved by the **CITY ENGINEER**.
- 491.8.3** Repair - After the pipe is installed, the **CONTRACTOR** shall carefully close up the openings around the pipe to make a watertight joint using "Embeco" No. 167 or No. 381 Mortar as manufactured by the Masters Building Co., or approved equal, and repair the existing manhole invert in a manner satisfactory to the **CITY ENGINEER**. The floor shall be reformed and finished to provide flow channels as specified for new manholes. All such work shall be done with the proper tools and by careful workmen competent to do such work. Entire interior of manhole shall be coated with epoxy. If pipe is a force main, the interior shall be lined with calcium aluminate cementitious coating.

491.9 PIPE ADAPTORS

- 491.9.1** Where ductile iron pipe is to be joined upstream from vitrified clay pipe, the pipes shall be connected by means of a Fernco joint sleeve or a ductile iron to vitrified clay pipe adaptor as specified under Section 499. Installation shall be in accordance with the manufacturer's recommendations.
- 491.9.2** Where ductile iron pipe occurs downstream from vitrified clay pipe, the ductile iron bell shall be cut off. The plain ends shall be butted together and connected with a flexible PVC "Coupler" as specified under Section 499. Installation shall be in accordance with manufacturer's recommendations.
- 491.9.3** The work described by this section shall be considered incidental to the construction and no additional compensation allowed therefore.

491.10 BORING AND JACKING

Where highways, railroads, structures, or other obstacles require that the pipe be bored and jacked, the procedure shall be in conformance with Sections 473 and 474 of this manual.

491.11 PVC EXPANDED-IN-PLACE PIPELINE RECONSTRUCTION

491.11.1 General

This work shall include the furnishing of all labor, equipment, and materials necessary to complete the reconstruction of pipelines as stipulated herein and as shown on the Contract Drawings. The work shall include the preparation of the construction site, including cleaning and flushing of existing piping; flow control bypass pumping; protection of existing conditions during the installation work; unloading; hauling; distributing and installation; testing of all pipe, and other accessories as required for the proper installation.

491.11.2 Intent of Specifications

It is the intent to provide for the reconstruction of existing pipelines by the installation of a high strength PVC expanded in place new pipe. Expansion shall be accomplished by circulating steam, or other approved method and providing pressure to properly expand the PVC pipe tight against the host pipe. After expansion the PVC pipe shall extend over the length of the host pipe from manhole to manhole in a continuous, jointless, tight fitting, watertight pipe-within-a-pipe.

491.11.3 Reference Specifications

ASTM

D-638	Test Method for Tensile Properties of Plastics
D-696	Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics
D-790	Test Method for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
D-1784	Specifications for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
F-1504	Specification for Folded Poly (Vinyl Chloride) (PVC) Pipe for Existing Sewer and Conduit Rehabilitation

491.11.4 Materials

The PVC pipe shall be fabricated to a size that, when installed, will neatly and tightly fit the internal circumference of the existing pipe. Allowance for longitudinal stretching during insertion shall be made.

The minimum length shall span the distance from inlet to outlet of the respective pipe to be reconstructed. The **CONTRACTOR** shall verify the lengths in the field before starting work.

The minimum thickness for PVC pipe shall conform to ASTM 3034-SDR26.

The PVC compound shall be chemically resistant to withstand exposure to domestic sewage.

The **CONTRACTOR** shall furnish, prior to use of the materials, satisfactory written certification of compliance with the manufacturer's standards and specifications for all materials.

491.11.5 Existing Conditions

Prior to all work, the **CONTRACTOR** shall carefully inspect the area for "present" existing conditions.

The **CONTRACTOR** shall verify all existing pipe diameters prior to ordering pipe materials. In the event of a discrepancy, the **CONTRACTOR** shall immediately notify the **PROJECT ENGINEER**. No work shall be performed in an area of discrepancy until it has been fully resolved by the **PROJECT ENGINEER**.

491.11.6 Shop Drawings and Certifications

After the award of the contract and before any pipe system materials are delivered to the job site, the **CONTRACTOR** shall submit to the **PROJECT ENGINEER** a complete list of all materials proposed to be furnished and installed.

Show manufacturer's name and catalog number for each item, furnish complete catalog cuts and technical data, and furnish the manufacturer's recommendations as to the method of installation.

Upon approval of the **PROJECT ENGINEER**, the manufacturer's recommendations shall become the basis for acceptance or rejection of actual methods of installation used in the work. No pipe shall be reconstructed without prior notification of the **PROJECT ENGINEER**. Each pipe shall be subject to inspection by the **PROJECT ENGINEER** immediately before it is installed and defective pipe may be rejected.

The **CONTRACTOR** shall submit to the **PROJECT ENGINEER** as part of the shop drawings, the manufacturer's design calculations for the minimum thickness of the pipe materials being supplied.

491.11.7 Construction

The **CONTRACTOR** shall use all means necessary to protect pipe materials before, during, and after installation, and to protect the installed work and materials of all other trades.

The **CONTRACTOR** shall make all required connections to existing pipes and manholes and carry out such work in accordance with local standards and requirements and as directed by the **PROJECT ENGINEER**. Extreme care shall be used to prevent debris from entering existing pipe prior to reconstruction.

In the event of damage caused to materials, the **CONTRACTOR** shall make all repairs and replacement necessary to the approval of the **PROJECT ENGINEER** at no additional cost to the **OWNER**.

The **CONTRACTOR** shall maintain in operating condition all active pipes encountered during the pipeline reconstruction.

The following installation procedures shall be adhered to unless otherwise approved by the **PROJECT ENGINEER**:

- 491.11.7.1 Safety** - The **CONTRACTOR** shall carry out all operations in strict accordance with OSHA and manufacturer's safety requirements. Particular attention is drawn to those safety requirements involving working with hazardous/combustible material (if needed), scaffolding (if required) and entering confined spaces.
- 491.11.7.2 Cleaning of Sewer Line** – It shall be the responsibility of the **CONTRACTOR** to remove all internal debris from the pipeline prior to installing the new PVC pipe.
- 491.11.7.3 Inspection of Pipelines** – Inspection of pipelines shall be performed by experienced personnel trained in locating breaks, obstacles and service connections by closed circuit television. The interior of the pipeline shall be carefully inspected to determine the location of any condition which may prevent proper installation of the new pipe.
- 491.11.7.4 Bypassing Flow** – The **CONTRACTOR**, when required, shall provide for the flow around the section of pipe designated for reconstruction. The bypass shall be made by plugging the line at an existing upstream manhole and pumping the flow into a downstream manhole or adjacent system. The pump and bypass lines shall be of adequate capacity and size to handle the flow. Once the PVC pipe has been pulled into the host pipe, no flow shall be allowed to pass through that section of pipe until the PVC pipe is fully expanded.

491.11.7.5 **Line Obstructions** – It shall be the responsibility of the **CONTRACTOR** to clear the line of obstructions or collapsed pipe that will prevent reconstruction. If inspection reveals an obstruction that cannot be removed by conventional pipe cleaning equipment, then the **CONTRACTOR** shall hydraulically re-round the pipe or make a point repair excavation to uncover and remove or repair the obstruction. Such excavation shall be approved in writing by the **OWNER’S** representative prior to the commencement of the work and shall be considered as a separate pay item.

491.11.7.6 **Installation** – The method of installation shall be compatible with the manufacturer’s recommended practices.

The new pipe shall be inserted into the existing pipe through existing manholes, without modification of manholes, other than minor chipping of manhole channels or removing processing equipment.

491.11.7.6.1 **Finish** – The finished liner pipe shall be continuous over the entire length of run between two (2) manholes and be as free as requirements or pressure tests specified.

Any defects which will affect in the foreseeable future or warrant period, the integrity or strength of the new PVC pipe shall be repaired at the **CONTRACTOR’S** expense. Any ribs resulting in the cross sectional area of the pipe shall be removed or the pipe replaced in its entirety unless approved otherwise by the **PROJECT ENGINEER**.

Sealing at Manholes – If, due to broken or offset pipe at the manhole wall, the pipe fails to make a tight seal, the **CONTRACTOR** shall apply a seal at that point. The seal shall be of a resin mixture compatible with the pipe material.

497.11.7.6.2 **Service Connections** – After the pipe has been expanded in place, the **CONTRACTOR** shall reconnect the existing active service connections. The **CONTRACTOR** shall be responsible to confirm the active laterals prior to reconnection. This shall be done without excavation from the interior of the pipeline by means of a television camera and a cutting device that re-establishes the service connections to not less than 90% capacity.

497.11.7.6.3 The **CONTRACTOR** shall restore or replace all removed or damaged paving, curbing, sidewalks, gutters, shrubbery, fences, sod or other disturbed surfaces or structures in a condition equal to that before the work began, to the satisfaction of the **PROJECT ENGINEER**, and shall furnish all labor and material incidental thereto.

Surplus pipe, tools, and temporary structures shall be removed by the **CONTRACTOR**. All dirt, rubbish, and pipe material from the operation shall be legally disposed of by the **CONTRACTOR**.

491.11.8 Testing

The **CONTRACTOR** shall provide a pipe “coupon” specimen from each run of pipe for testing, after installation, by an approved laboratory. All expenses for the testing of these specimens will be paid for by the **OWNER**. The cost of re-tests made necessary by the failure of the samples of specimens to meet the specified requirements shall be paid for by the **CONTRACTOR**.

As part of the testing requirement, upon completion of the installation, a visual inspection shall be performed of the pipe expanded in place via a closed circuit television camera. A CD or DVD disc of the inspection shall be provided to the **OWNER**.

491.12 CURED-IN-PLACE PIPELINE RECONSTRUCTION

491.12.1 General

It is the intent of this specification to provide for the reconstruction of clay sewer mains by the installation of a resin-impregnated flexible tube which is formed to the original pipe by use of a hydrostatic head. The resin is cured using hot water under hydrostatic pressure within the tube. The Cured-In-Place Pipe (CIPP) will be continuous and tight fitting.

491.12.2 Referenced Documents

This specification references ASTM F1216 (Rehabilitation of pipelines by the inversion and curing of a resin-impregnated tube), ASTM F1743 (Rehabilitation of pipelines by pulled-in-place installation of a cured-in-place thermosetting resin pipe), and ASTM D790 (Test methods for flexural properties of un-reinforced plastics) which are made a part hereof by such reference and shall be the latest edition and revision thereof. In case of conflicting requirements between this specification and these referenced documents, this specification will govern.

491.12.3 Product, Manufacturer/Installer Qualification Requirements

Since sewer products are intended to have a 50 year design life, and in order to minimize the **OWNER’S** risk, only proven products with substantial successful long term track records will be approved. All trenchless rehabilitation products and installers must meet the requirements in the General Conditions and listed below.

Products and Installers must meet all of the following criteria:

- 491.12.3.1** For a *Product* to be considered Commercially Proven, a minimum of 400,000 linear feet or 1,000 manhole-to-manhole line sections of successful wastewater collection system installations in the U.S. must be documented to the satisfaction of the **OWNER** to assure commercial viability.

- 491.12.3.2** For an *Installer* to be considered as Commercially Proven, the Installer must satisfy all insurance, financial, and bonding requirements of the **OWNER**, and must have had at least 5 (five) years active experience in the commercial installation of the product bid. In addition, the Installer must have successfully installed at least 400,000 feet of the product bid in wastewater collection systems. Acceptable documentation of these minimum installations is required.
- 491.12.3.3** Sewer rehabilitation products submitted for approval must provide *Third Party Test Results* supporting the long-term performance and structural strength of the product and such data shall be satisfactory to the **OWNER**. Test samples shall be prepared so as to simulate installation methods and trauma of the product. No product will be approved without independent third party testing verification.
- 491.12.3.4** Both the rehabilitation manufacturing and installation processes shall operate under a quality management system, which is third party certified to ISO 9000 or other internationally recognized organization standards. Proof of certification shall be required for approval.

491.12.4 Materials

Tube – The sewn Tube shall consist of one or more layers of absorbent non-woven felt fabric and meet the requirements of ASTM F1216 or ASTM F1743, Section 5. The tube shall be constructed to withstand installation pressures, have sufficient strength to bridge missing pipe, and stretch to fit irregular pipe sections.

- 491.12.4.1** The wetout tube shall have a uniform thickness that when compressed at installation pressures will meet or exceed the design thickness.
- 491.12.4.2** The tube shall be sewn to a size that when installed will tightly fit the internal circumference and length of the original pipe. Allowance should be made for circumferential stretching during inversion. Overlapped layers of felt in longitudinal seams that cause lumps in the final product shall not be utilized.
- 491.12.4.3** The outside layer of the tube (before wetout) shall be coated with an impermeable, flexible membrane that will contain the resin and facilitate monitoring of resin saturation during the resin impregnation (wetout) procedure.
- 491.12.4.4** The tube shall be homogeneous across the entire wall thickness containing no intermediate or encapsulated elastomeric layers. No material shall be included in the Tube that may cause delamination in the cured CIPP. No dry or unsaturated layers shall be evident.
- 491.12.4.5** The wall color of the interior pipe surface of CIPP after installation shall be a light reflective color so that a clear detailed examination with closed circuit television inspection equipment may be made.

491.12.4.6 Seams in the tube shall be stronger than the unseamed felt.

491.12.4.7 The outside of the tube shall be marked for distance at regular intervals along its entire length, not to exceed five (5) feet. Such markings shall include the Manufacturers name or identifying symbol. The tubes must be manufactured in the USA.

491.12.5 Resin

The resin system shall be a corrosion resistant polyester, vinyl ester, or epoxy and catalyst system that when properly cured within the tube composite meets the requirements of ASTM F1216 and ASTM F1743, the physical properties herein, and those which are to be utilized in the design of the CIPP for this project. The resin shall produce CIPP which will comply with the structural and chemical resistance requirements of this specification.

491.12.6 Structural Requirements

491.12.6.1 The CIPP shall be designed as per ASTM F1216, Appendix X1. The CIPP design shall assume no bonding to the original pipe wall.

491.12.6.2 **CONTRACTOR** must have performed long-term testing for flexural creep of the CIPP pipe material installed by his company. Such testing results are to be used to determine the long-term, time dependent flexural modulus to be utilized in the product design. This is a performance test of the materials (Tube and Resin) and general workmanship of the installation and curing. A percentage of the instantaneous flexural modulus value (as measured by ASTM D-790 testing) will be used in design calculations for external buckling. The percentage, or the long-term creep retention value utilized, will be verified by this testing. Values in excess of 50% will not be applied unless substantiated by qualified third party test data. The materials utilized for the contracted project shall be of a quality equal to or better than the materials used in the long-term test with respect to the initial flexural modulus used in design.

491.12.6.3 The Enhancement Factor 'K' to be used in 'Partially Deteriorated' design conditions shall be assigned a value of seven (7). Application of Enhancement (K) Factors in excess of seven (7) shall be substantiated through independent test data.

491.12.6.4 The layers of the cured CIPP shall be uniformly bonded. It shall not be possible to separate any two layers with a probe or point of a knife blade so that the layers separate cleanly or the probe or knife blade moves freely between the layers. If separation of the layers occur during testing of field samples, new samples will be cut from the work. Any reoccurrence may cause rejection of the work.

491.12.6.5 The cured pipe material (CIPP) shall conform to the structural properties, as listed below.

MINIMUM PHYSICAL PROPERTIES

<u>Property</u>	<u>Test Method</u>	<u>Cured Composite Per ASTM F1216</u>	<u>Cured Composite (400 k Resin)</u>
Modulus of Elasticity	ASTM D-790 (Short term)	250,000 psi	400,000 psi
Flexural Stress	ASTM D-790	4,500 psi	4,500 psi

491.12.6.6 The required structural CIPP wall thickness shall be as based as a minimum, on the physical properties in Section 5.01.5 and in accordance with the design equations in the appendix of ASTM F1216, and the following design parameters:

Design Safety Factor	=	2.0
Retention Factor for Long-Term Flexural Modulus to be used in design (as determined by Long-Term tests described in paragraph 491.12.6.2)	=	1% - 60%
Ovality*	=	2%
Enhancement Factor, k	=	See Section 5.01.3
Soil Depth (above crown)*	=	3 – 20 ft.
Soil Density **	=	120 pcf
Design Condition (partially or fully deteriorated)***	=	PD

* Denotes information which can be provided here or in inspection video tapes or project construction plans.

** Denotes information required only for fully deteriorated design conditions.

*** Based on review of video logs, conditions of pipeline can be fully or partially deteriorated. (See ASTM F1216 Appendix) The **OWNER** will be sole judge as to pipe conditions and parameters utilized in design.

491.12.6.7 Refer to the attached dimensional ratio table for specific pipe section requirements, based on the pipe condition, depth, ovality, etc. as computed for the conditions shown, using ASTM F1216 design equations.

491.12.6.8 Any layers of the tube that are not saturated with resin prior to insertion into the existing pipe shall not be included in the structural CIPP wall thickness computation.

491.12.7 Testing Requirements

- 497.12.7.1** Chemical Resistance - The CIPP shall meet the chemical resistance requirements of ASTM F1216, Appendix X2. CIPP samples for testing shall be of tube and resin system similar to that proposed for actual construction. It is required that CIPP samples with and without plastic coating meet these chemical testing requirements.
- 497.12.7.2** Hydraulic Capacity – Overall, the hydraulic profile shall be maintained as large as possible. The CIPP shall have a minimum of the full flow capacity of the original pipe before rehabilitation. Calculated capacities may be derived using a commonly accepted roughness coefficient for the existing pipe material taking into consideration its age and condition.
- 497.12.7.3** CIPP Field Samples – When requested by the **OWNER**, the **CONTRACTOR** shall submit test results from field installations in the USA of the same resin system and tube materials as proposed for the actual installation. These test results must verify that the CIPP physical properties specified in Section 5.01.5 have been achieved in previous field applications. Samples for this project shall be made and tested as described in Section 10.1

491.12.8 Installation Responsibilities for Incidental Items

- 491.12.8.1** It shall be the responsibility of the **OWNER** to locate and designate all manhole access points open and accessible for the work, and provide rights of access to these points. If a street must be closed to traffic because of the orientation of the sewer, the **CONTRACTOR** shall institute the action necessary to do this for the mutually agreed time period. The **OWNER** shall also provide access to water hydrants for cleaning, inversion and other work items requiring water, **CONTRACTOR** must purchase a meter from the City of Valdosta and provide his/her owner testable backflow preventer after he/she applies for water service at the City Inspections Department.
- 491.12.8.2** Cleaning of Sewer Lines – The **CONTRACTOR**, when required, shall remove all internal debris out of the sewer line that will interfere with the installation of CIPP. The **OWNER** shall also provide a dump site for all debris removed from the sewers during the cleaning operation. Unless stated otherwise, it is assumed this site will be at or near the sewage treatment facility to which the debris would have arrived in absence of the cleaning operation. Any hazardous waste material encountered during this project will be considered as a changed condition.

- 491.12.8.3** Bypassing Sewage – The **CONTRACTOR**, when required, shall provide for the flow of sewage around the section or sections of pipe designated for repair. The bypass shall be made by plugging the line at an existing upstream manhole and pumping the flow into a downstream manhole or adjacent system. The pump and bypass lines shall be of adequate capacity and size to handle the flow. The **OWNER** may require a detail of the bypass plan to be submitted.
- 491.12.8.4** Inspection of Pipelines – Inspection of pipelines shall be performed by experienced personnel trained in locating breaks, obstacles and service connections by close circuit television. The interior of the pipeline shall be carefully inspected to determine the location of any conditions which may prevent proper installation of CIPP into the pipelines, and it shall be noted so that these conditions can be corrected. A video tape and suitable log shall be kept for later reference by the **OWNER**.
- 491.12.8.5** Line Obstructions – It shall be the responsibility of the **CONTRACTOR** to clear the line of obstructions such as solids and roots that will prevent the insertion of CIPP. If pre-installation inspection reveals an obstruction such as a protruding service connection, dropped joint, or a collapse that will prevent the inversion process, that was not evident on the pre-bid video and it cannot be removed by conventional sewer cleaning equipment, then the **CONTRACTOR** shall make a point repair excavation to uncover and remove or repair the obstruction. Such excavation shall be approved in writing by the **OWNER'S** representative prior to the commencement of the work and shall be considered as a separate pay item.
- 491.12.8.6** Public Notification – The **CONTRACTOR** shall make every effort to maintain service usage throughout the duration of the project. In the event that a service will be out of service, the maximum amount of time of no service shall be eight (8) hours for any property served by the sewer. A public notification program shall be implemented, and shall as a minimum, require the **CONTRACTOR** to be responsible for contacting each home or business connected to the sanitary sewer and informing them of the work to be conducted, and when the sewer will be off-line. The **CONTRACTOR** shall also provide the following:
- A. Written notice to be delivered to each home or business the day prior to the beginning of work being conducted on the section, and a local telephone number of the **CONTRACTOR** they can call to discuss the project or any problems which could arise.
 - B. Personal contact with any home or business, which cannot be reconnected within the time stated in the written notice.
- 491.12.8.7** The **CONTRACTOR** shall be responsible for confirming the locations of all branch service connections prior to installing and curing the CIPP.

491.12.9 Installation

CIPP installation shall be in accordance with ASTM F1216, Section 7, or ASTM F1743, Section 6, with the following modifications:

- 491.12.9.1** Resin Impregnation – The quantity of resin used for tube impregnation shall be sufficient to fill the volume of air voids in the tube with additional allowances for polymerization shrinkage and the loss of resin through cracks and irregularities in the original pipe wall. A vacuum impregnation process shall be used. To insure thorough resin saturation throughout the length of the felt tube, the point of vacuum shall be no further than 25 feet from the point of initial resin introduction. After vacuum in the tube is established, a vacuum point shall be no further than 75 feet from the leading edge of the resin. The leading edge of the resin slug shall be as near to perpendicular as possible. A roller system shall be used to uniformly distribute the resin throughout the tube. If the Installer uses an alternate method of resin impregnation, the method must produce the same results. Any alternate resin impregnation method must be proven.
- 491.12.9.2** Tube Insertion – The wetout tube shall be positioned in the pipeline using either inversion or a pull-in method. If pulled into place, a power winch should be utilized and care should be exercised not to damage the tube as a result of pull-in friction. The tube should be pulled-in or inverted through an existing manhole or approved access point and fully extend to the next designated manhole or termination point.
- 491.12.9.3** Temperature gauges shall be placed inside the tube at the invert level of each end to monitor the temperatures during the cure cycle.
- 491.12.9.4** Curing shall be accomplished by utilizing hot water under hydrostatic pressure in accordance with the manufacturer's recommended cure schedule.

491.12.10 Reinstatement of Branch Connections

It is the intent of these specifications that branch connections to buildings be reopened without excavation, utilizing a remote controlled cutting device, monitored by a video TV camera. The **CONTRACTOR** shall certify he has a minimum of two complete working cutters plus spare key components on the site before each inversion. Unless otherwise directed by the **OWNER** or his authorized representative, all laterals will be reinstated. No additional payment will be made for excavations for the purpose of reopening connections and the **CONTRACTOR** will be responsible for all costs and liability associated with such excavation and restoration work.

491.12.11 Inspection

- 491.12.11.1** CIPP Samples shall be prepared and physical properties tested in accordance with ASTM F1216 or ASTM F1743, Section 8, using either method proposed. The flexural properties must meet or exceed the values listed in Table 1 of the applicable ASTM.
- 491.12.11.2** Wall thickness of samples shall be determined as described in paragraph 8.1.6 of ASTM F1743. The minimum wall thickness at any point shall not be less than 87 1/2% of the design thickness as calculated in paragraph 5.01.6 of this document.
- 491.12.11.3** Visual inspection of the CIPP shall be in accordance with ASTM F1743, Section 8.6.

491.12.12 Clean-Up

Upon acceptance of the installation work and testing, the **CONTRACTOR** shall restore the project area affected by the operations to a condition at least equal to that existing prior to the work.

491.13 WET WELL AND MANHOLE LINER RECONSTRUCTION

491.13.1 General

This specification defines the approved method and material for the rehabilitation of sanitary sewer manholes and wet wells utilizing a spray applied calcium aluminate cementitious structural rehabilitation system. The purpose is to obtain a dense and durable concrete lining that is resistant to biosulfuric acid attack and meets the strength requirements described in this specification. The work covered in the specifications consists of furnishing all labor, equipment, materials, and supervision necessary to accomplish the rehabilitation as specified.

491.13.2 Contractor's Sequence of Operation

- 491.13.2.1** Plug all sources of groundwater infiltration and voids in walls;
- 491.13.2.2** Pressure clean all surfaces with a minimum 2,000 psi water spray;
- 491.13.2.3** Rehabilitate all interior surfaces including walls, ceilings, and floors in accordance with specification;
- 491.13.2.4** Cure material applied;
- 491.13.2.5** Test material applied.

491.13.3 Submittals

- 491.13.3.1** The **CONTRACTOR** shall furnish detailed and complete data pertaining to the rehabilitation product and installation to the **PROJECT ENGINEER**. Prior to initiating the work, the **CONTRACTOR** shall submit specific technical data with complete physical properties of the product proposed to rehabilitate the structure.
- 491.13.3.2** Prior to initiating the work, the **CONTRACTOR** shall submit specific technical data with complete physical properties of the product proposed to rehabilitate the structure.
- 491.13.3.3** A certificate of “Compliance with Specifications” shall be furnished for all materials supplied.
- 491.13.3.4** A work plan.

491.13.4 Materials

- 491.13.4.1** Application Material furnished under these specifications shall be a pre-packaged mortar mix, including all cement, aggregates, and any required additives. It is the intent of this specification that the **CONTRACTOR** only be required to add the proper amount of potable water so as to produce concrete suitable for pneumatic application.
- 491.13.4.2** The chemical composition of the cement portion as well as the aggregates of the mortar mix shall be submitted and approved.
- 491.13.4.3** The design properties of the mortar mix shall be as follows:

Compressive Strength (ASTM C495)	<5,000 psi	24 hours
	<7,000 psi	28 days
Shrinkage (ASTM C596)	0% when cured @ 95% relative humidity	

- 491.13.4.4** The mortar mix shall be SewperCoat as manufactured by Lafarge Calcium Aluminates, or Strong-Seal as manufactured by Strong-Seal.
- 491.13.4.5** Material must have at least five (5) years of successful performance in similar applications and be supplied by an ISO 9002 approved manufacturer.
- 491.13.4.6** Water used in mixing shall be fresh, clean, potable water, free from injurious amounts of oil, acid, alkali, vegetable, sewage, and/or organic matter.

- 491.13.4.7** Mortar mix shall be stored with adequate provisions for the prevention of absorption of moisture. It shall be stored in a manner that will permit easy access for inspection and identification of each shipment.

491.13.5 Sampling and Testing

- 491.13.5.1** Mortar materials used on the project shall be tested by a recognized laboratory or provided to the manufacturer for testing. The testing laboratory shall then test the materials recommended by the **PROJECT ENGINEER** and the manufacturer.
- 491.13.5.2** The cost of sampling and testing mortar mix during placement shall be borne by the **CONTRACTOR**. Other testing required showing conformance with these specifications shall be the responsibility of the **CONTRACTOR**/material supplier. Certified test reports and certificates, when so directed, shall be submitted in duplicate to the **PROJECT ENGINEER** and to such other agencies or persons as designated by said **PROJECT ENGINEER**.
- 491.13.5.3** No materials, which fail to meet the requirements of these specifications, shall be incorporated into the work.
- 491.13.5.4** Before beginning work on the project the **CONTRACTOR** must satisfy the **PROJECT ENGINEER** that the **CONTRACTOR** work crew(s) have done satisfactory work in similar capacities elsewhere for sufficient period of time to be fully qualified to properly perform the work in accordance with the requirements of the related specifications.

491.13.6 Surface Preparation

- 491.13.6.1** To insure sufficient bond, all surfaces shall be cleaned with a high-pressure water spray or sand blasting (minimum 2,000 psi). Surface shall be thoroughly moistened with water prior to application of shotcrete. In no instance shall shotcrete be applied in an area where running water exists. It is the intent of this specification that the existing surface be saturated.
- 491.13.6.2** All structures to be lined shall be saturated prior to applying lining material. If saturation does not occur naturally, this can be accomplished by pre-soaking the structure for 24 hours before applying the shotcrete.

491.13.7 Operations

- 491.13.7.1** Shotcrete shall be thoroughly mixed by machine to insure all large particles are removed before placing into hopper of the mortar gun. Each batch should be entirely discharged before recharging is begun. The mixer shall be cleaned to remove all adherent materials from the mixing vanes and from the drum at regular intervals.

- 491.13.7.2 The addition of water to the mix shall be in strict accordance with the manufacturer's recommendations.
- 491.13.7.3 Re-mixing or tempering shall not be permitted. Rebound materials shall not be reused.
- 491.13.7.4 During progress of the work, where appearance is important, adjacent areas or grounds which may be permanently discolored, stained, or otherwise damaged by dust and rebound, shall be adequately protected and, if contacted, shall be cleaned by early scraping, brushing, or washing as the surroundings permit.

491.13.8 Application of Materials

- 491.13.8.1 Sequence of application may be from bottom to top or vice versa if rebound is properly removed.
- 491.13.8.2 Application shall be from an angle as near perpendicular to the surface as practical, with the nozzle held at least one foot (1') from the work (except in confined control). If the flow of material at the nozzle is not uniform and slugs, sand spots, or wet sloughs result, the nozzleman shall direct the nozzle away from the work until the faulty conditions are corrected. Such defects shall be replaced as the work progresses.
- 491.13.8.3 The time interval between successive layers in sloping, vertical, or overhanging work must be sufficient to allow "tackiness" to develop but not final set. If final set does occur, the surface shall be cleaned to remove the thin film of laitance in order to provide a sufficient bond with succeeding applications.
- 491.13.8.4 Construction joints within a manhole shall be avoided. In the event a construction joint is necessary and approved by the **PROJECT ENGINEER**, it shall be sloped off to a thin, clean, regular edge, preferably at a 45° slope. Before placing the adjoining work, the slope portion and adjacent applied material shall be thoroughly cleaned as necessary, then moistened and scoured with an air jet.
- 491.13.8.5 After the body coat has been placed, the surface shall be trued with a thin-edge screed to remove high areas and expose low areas. Low areas shall be properly filled with additional material to insure a true, flat surface.
- 491.13.8.6 The minimum thickness of the SewperCoat shall be ½" over all surfaces.

491.13.9 Curing

Once the material has been applied and furnished in accordance to the specifications, and it has been determined that the environment is not moist enough for natural curing, the **CONTRACTOR** will be required to apply a curing compound to all coated surfaces. The curing compound used shall meet the requirements of ASTM C309 and have the approval of the shotcrete material manufacturer and the **PROJECT ENGINEER** prior to use.

491.14 INSPECTION AND TESTING

- 491.14.1** General - All work shall be subject to inspection and testing to detect cracks, open joints, misalignments, infiltration, tightness of the system, dips in the pipe grade, lateral locations or other items the **CITY ENGINEER** may require. Inspections and testing shall include but not be limited to lamping, televising, air pressure testing, deflection testing, or other testing as may be required by the **CITY ENGINEER**.
- 491.14.2** Sections of sewer main failing to pass any of the above tests shall not be accepted until such defects found by tests and/or inspections are located and corrected and subsequent tests and inspections are made and proven to be acceptable to the **CITY ENGINEER**. Corrections of defects may require the excavation of newly laid sewer mains. Such excavation shall be at the **CONTRACTOR'S** expense with no reimbursement. The **CONTRACTOR** shall take necessary measures, subject to the approval of the **CITY ENGINEER**, to locate and correct defects and shall notify the **CITY ENGINEER** when such defects have been corrected so that re-testing or re-inspection may be performed. Under no circumstance shall asphalt be placed prior to successful completion of all tests and inspections.
- 491.14.3** The **CONTRACTOR** shall thoroughly clean all sections of pipe to be tested or inspected. The **CONTRACTOR** is warned that if during the inspection process the sewer main is found to contain debris, rocks, sand, concrete or other solid materials, the **CONTRACTOR** shall immediately be required to clean the sewer main and may, at the option of the **CITY ENGINEER**, be required to pay for any costs incurred in re-testing or re-inspection.
- 491.14.4** Lamping - Lamping shall be performed by the **CITY**, at the **CITY'S** option. Each section of pipe shall show a full circle of light between manholes. Only sewer mains shall be subjected to lamping inspections.
- 491.14.5** Low Pressure Air Test - Shall be performed by the **CONTRACTOR**. The entire sewer system shall be subjected to a low pressure air test as described by ASTM C828-latest. Piping will be pumped up to 5 - 10 psi for five (5) minutes minimum based on piping size and length. If a one (1) psi drop or more occurs during the test time, the line has failed and will need to be corrected. See Table on Sewer Pipe Air Testing in Appendix for actual testing requirements.
- 491.14.6** Televising - Televising of sewer mains shall be in accordance with Section 496-3 and performed by the **CONTRACTOR** as deemed necessary by the **UTILITY DIRECTOR**.

491.14.7 Deflection Testing

491.14.7.1 Deflection testing shall be performed by the **CONTRACTOR**. The maximum allowable pipe deflection (reduction in vertical inside diameter) shall be five percent (5%). Such deflection shall be calculated using Table III according to ASTM D-3034 for SDR 35 PVC Pipe. The most common and least expensive method in use is the rigid Go-No-Go device. This device is pulled through the line and measures only a "Go-No-Go" basis.

491.14.7.2 When using a Go-No-Go device to check deflection, several steps should be followed.

1. Make sure the line is clean and free of debris that might cause the device to jam. It is recommended that the line be cleaned with a hydro-cleaner washing in the direction of flow.
2. The next step is to pull a line through the pipe with which to pull the Go-No-Go device. This can be done in several ways:
 - a. If a hydro cleaner is being used, attach the pull line to the nozzle end before the actual cleaning cycle starts. As the hose is pulled through the line, it will carry the pull line with it. When the hose nozzle reaches the manhole, disconnect the pull line and tie it off.
 - b. A parachute device can be blown through the line with a lightweight string attached. Detach the string, and attach the pull line. Manually drag the pull line through the pipe. Tie off at each manhole.
 - c. If a sewer line is in service, a string can be floated through the manhole run. When the string reaches the next manhole, attach it to the pull line and drag through. Tie the pull line at each manhole.
3. Pulling of the gauge will be done by hand or mechanically. The pulling motion should be smooth and easy to avoid jamming the gauge if an obstruction is encountered in the line. The gauge should have a line on each end to facilitate removal should the gauge become obstructed in the direction of pull. If the gauge stops lightly, pull on it to see if it will clear the obstruction. When it appears that the gauge will not go forward, record the distance from the manhole at which point the gauge is stuck and then pull the gauge back out. Do not use mechanical equipment to force the gauge through. This may result in a broken pull line.

TABLE I

PVC sewer pipe minimum wall thicknesses and outside diameter

<u>Nominal Pipe Size, Inches</u>	<u>Minimum Wall Thickness, Inches</u>	<u>Average O. D., Inches</u>	<u>Tolerance on Average, Inches</u>
6	0.180	6.275	0.011
8	0.240	8.400	0.012
10	0.300	10.500	0.015
12	0.360	12.500	0.018
15	0.437	15.600	0.023
18	0.520	18.600	0.026

TABLE III

Base inside diameters and 5% deflection mandrel dimension

<u>Nominal Size, Inches</u>	<u>Average Inside Diameter</u>	<u>Base Inside Diameter*</u>	<u>5% Deflection Mandrel</u>
6	5.764	5.612	5.33 ± .01"
8	7.715	7.488	7.12 ± .01"
10	9.644	9.342	8.87 ± .01"
12	11.480	11.102	10.54 ± .01"
15	14.053	13.586	12.90 ± .01"
18	16.96	16.586	15.76 ± .01"

*Base inside diameter is a minimum pipe inside diameter derived by subtracting a statistical tolerance package from the pipe's average inside diameter. The tolerance package is defined as the square root of the sum of squared standard manufacturing tolerances.

Average inside diameter = average outside diameter - 2(1.06)t

Tolerance package = square root of ("A" square + 2 ("B" square) + "C" square).

Where:

t = minimum wall thickness (Table I).

A = outside diameter tolerance (Table I).

B = excess wall thickness tolerance = 0.06t, and

C = out-of-roundness tolerance.

The values for "C" were derived statistically from field measurement data, and are given as follows for various sizes of pipe:

<u>Nominal Size, Inches</u>	<u>Value for "C", Inches</u>
6	0.150
8	0.225
10	0.300
12	0.375
15	0.475
18	0.575

4. Deflection testing shall be done prior to any paving operation and before the project is accepted by the **CITY**.
5. Re-rounding of failed sections shall not be allowed. Failed sections must be excavated and replaced to the **CITY'S** satisfaction. In the event pavement is disturbed, only a full-width pavement replacement, extending at least 10' beyond the limits of the excavation, will be allowed.

491.14.8 Manhole Testing - Manholes shall be leak tested as specified in Section 491.4.6.

DIVISION 490

SECTION 492

SANITARY SEWER FORCE MAIN CONSTRUCTION

SECTION 492
SANITARY SEWER FORCE MAIN CONSTRUCTION

492.1 SCOPE

The work under this section includes the furnishing, installing, laying, jointing, and testing of all force mains, fittings, air release valves, plug valves, and appurtenances required for a complete system as shown on the drawings and specified herein. The work shall also include such connections, reconnections, relocations, temporary force mains, temporary pumping, abandonments, and all other provisions in regard to existing force main operations and modifications required to perform the new work.

492.2 GENERAL REQUIREMENTS

- 492.2.1** All work shall be proved to be in first class condition and constructed properly in accordance with the drawings and specifications. All defects and leaks disclosed by the tests shall be remedied and re-tested.
- 492.2.2** All tests and re-tests shall be performed in the presence of the **CITY ENGINEER** or a designated representative. The **CONTRACTOR** shall be responsible for hydrostatic pressure testing of the force mains. The **CONTRACTOR** shall be responsible for compaction and density testing. Re-testing and any other additional testing required by this section shall be at the **CONTRACTOR'S** expense.
- 492.2.3** Compaction and density are specified in this manual, Section 478, Standard Details – 478-6.1A, B, and C, and in GDOT Utility Accommodation Policy and Standards Manual.
- 492.2.4** Force mains, air release valves, and plug valves shall be asbuilited after construction. Asbuilited drawings for force mains shall be in accordance with Section 486 of this manual except where reference is made to "water main" or "water valve" it shall be interpreted to mean "force main" or "force main valve".
- 492.2.5** Excavation and backfilling, seeding and mulching, dewatering, clearing and grubbing, cleanup and other related site work for force main construction are specified in GDOT Utility Accommodation Policy and Standards Manual and project specifications.
- 492.2.6** Unless otherwise specified, force mains shall be installed in accordance with AWWA C-600, latest.
- 492.2.7** All installed force mains constructed of PVC shall be installed with solid copper locating wire(s) as specified in Paragraph 481.4.7.3 and as shown on Standard Detail 478-7.1A.
- 492.2.8** Boring and Jacking operations shall be in accordance with Section 474 of this manual.
- 492.2.9** Where force mains are cresting a hill and air release valves are to be installed, install force main at minimum 48" cover to facilitate proper ARV installation.

492.3 MATERIALS

492.3.1 General

- 492.3.1.1** All materials required under this section, which are necessary for the construction of force mains, shall be of the type, model and manufacture specified under the applicable specifications of Section 499.
- 492.3.1.2** Materials not specified herein or under Section 499 shall not be installed in the force main system unless specifically authorized, in writing, by the **UTILITY DIRECTOR**. The **CITY** reserves the right to have said materials removed at the **CONTRACTOR'S** expense.
- 492.3.1.3** Requests for materials to be approved by the **CITY** shall be made to the **UTILITY DIRECTOR**, in writing, in accordance with set procedures. Copies of the procedure policy may be obtained from the **CITY ENGINEER**.
- 492.3.1.4** All materials shall be free from defects impairing strength and durability, and be of the best commercial quality for the purpose specified. It shall have structural properties sufficient to safely sustain or withstand strains and stress to which it is normally subjected and be true to detail.
- 492.3.1.5** The **CONTRACTOR** shall submit to the **CITY ENGINEER** for approval before work begins certificates of inspection in triplicate from the pipe manufacturer that the pipe and fittings supplied have been inspected at the plant and meet the requirements of these specifications.

492.4 CONSTRUCTION

- 492.4.1** Excavation, Trenching and Backfilling shall conform to GDOT Utility Accommodation Policy and Standards Manual and project specifications.
- 492.4.2** Pipe Installation
- 492.4.2.1** General - The method of pipe laying shall be subject to the approval of the **CITY ENGINEER**. Each pipe length shall be inspected for cracks. Care shall be exercised to keep the pipe in close alignment and every effort shall be made to avoid creating low or high points in the force main. If approved by the **CITY ENGINEER**, minor changes in alignment may be permitted to avoid underground facilities. Upon discovery, any defective pipe which may have been laid shall be removed and replaced with sound pipe, at no additional cost to the **CITY**. It shall be the **CONTRACTOR** responsibility to locate all underground utilities in advance of construction to insure that no conflicts occur with the proposed alignment and depth. The **CONTRACTOR** is to furnish the **CITY ENGINEER** all pertinent information so that remedial design can be performed. Unless otherwise specified or required by the **CITY ENGINEER**, the bedding and installation shall be Class B. Class B bedding shall be sand or sandy soil with 100% passing the 3/8-inch sieve and no more than 10% passing the No. 200 sieve.

- 492.4.2.2** Laying and Jointing - The pipe shall be laid on an unyielding foundation with uniform bearing under the full length of the barrel of the pipe. Suitable excavations shall be made to receive the bell of each pipe. The spigot end of the pipe shall abut against the base of the socket of the adjacent pipe in such a manner that there will be no gaps along the perimeter of the mating halves. Just before jointing the pipe, the mating ends shall be thoroughly cleaned of all dirt, debris, and foreign material. The pipe shall be jointed in accordance with the recommendations of the manufacturer of the pipe and gasket. In all jointing operations, the trench must be de-watered when joints are made and kept de-watered until sufficient time has elapsed to assure sufficient hardening of the jointing material or as may be required. The pipe shall not be driven down to grade by striking it with a shovel handle, timber, rammer, or other unyielding object. The **CONTRACTOR** shall take all necessary precautions to prevent flotation of the pipe due to flooding of the trench.
- 492.4.2.3** Assembly of Joints - Assemble all joints in accordance with recommendations of the manufacturer. If a lubricant is required to facilitate assembly, it shall have no detrimental effect on the gasket or on the pipe when subjected to prolonged exposure. Proper jointing may be verified by rotation of the spigot by hand or with a strap wrench. If unusual jointing resistance is encountered, or if the insertion mark does not reach the flush position, disassemble the joint, inspect for damage, re-clean the joint components, and repeat the assembly steps. Note that fitting bells may permit less insertion depth than pipe bells. (NOTE: When mechanical equipment is used to assemble joints, care should be taken to prevent over-insertion).
- 492.4.2.4** Cleaning - All necessary precautions shall be taken to prevent the entrance of mud, sand or other obstructing material into the pipeline. As the work progresses, the interior of the water main shall be cleaned of all dirt, jointing material, and superfluous materials of every description. Prior to final inspection, the **CONTRACTOR** shall flush all water lines constructed under this contract with clean water to assure complete removal of all debris and foreign materials.
- 492.4.2.5** Bedding and Backfill - Immediately after the pipe has been jointed and inspected, sufficient backfill shall be performed to protect the pipe adequately from injury and movement. Where so indicated on the drawings, or where directed by the **CITY ENGINEER**, the pipe shall be supported by compacted granular fill, concrete cradle, or encasement according to the applicable detail shown on the plans. Pipe bedded in compacted granular backfill shall not be supported on blocking, wedges, bricks, or anything except the bedding material. Where concrete cradle or encasement is required, the pipe shall be supported on solid concrete blocks or pre-cast concrete saddles which shall become part of the completed cradle or encasement. Where no other bedding is indicated, pipe shall be placed on a shaped bed of undisturbed material.
- 492.4.2.6** Early Warning Tape - The **CONTRACTOR** shall install early warning tape 12" to 18" above all force mains.

492.4.3 Air Release Valves

- 492.4.3.1 Provide air release valves in high spots of force mains as shown on the drawings or as directed. If obstructions are encountered during construction that cause a dip and a consequent sharp rise in the force main, then an air release valve shall be installed at the newly created high point upstream from the dip. Payment therefore will be in accordance with the unit price set forth in the proposal.
- 492.4.3.2 Since it is important that no high points be created other than those absolutely necessary, the **CONTRACTOR** shall lay the force main on uniform grades to permit all air to flow with the sewage to the nearest air discharge point.
- 492.4.3.3 Two-inch taps into force mains shall be made as per manufacturer's instructions and applicable sections of these specifications, all as approved by the **CITY ENGINEER**. Taps shall be made by using appropriately sized two-inch service clamps and coated with pipe liner repair epoxy.

492.4.4 Installing Valve Boxes

- 492.4.4.1 All valves shall be fitted with a cast iron valve box and cover. Valve boxes shall be long enough to reach from the valve to finished ground level and shall be installed as recommended by the manufacturer. They shall have suitable barrel and shaft extension sections to cover and protect the valve bonnet section. Extension sections fabricated by cutting pieces of pipe shall be allowed. No more than one (1) shaft extension shall be used in any one (1) valve installation.
- 492.4.4.2 Valve boxes shall be in vertical alignment and so positioned as to facilitate operation of the valve with a standard valve wrench. The box shall be installed as shown on the drawings and shall be set on firmly packed soil or bricks so as to prevent settlement and to prevent bearing on the valve or the main at any point.
- 492.4.4.3 Installation of valve boxes shall be in accordance with these specifications and Standard Detail 478-4.1. Install non-pop valve box lids in all asphalt pavement.

492.4.5 Adjusting Valve Boxes

- 492.4.5.1 All valve boxes which lie within the area of finished construction shall be adjusted to finish grade in accordance with these specifications and Standard Detail 478-4.1.
- 492.4.5.2 Valve boxes shall be protected during construction in accordance with these specifications. Any valve boxes damaged during construction shall be replaced at the **CONTRACTOR'S** expense. Removal and replacement of the valve box during construction may be authorized provided **CONTRACTOR** insures that sufficient valve ties are available and on site in order to quickly locate the valve.

492.4.5.3 Adjustment of valve boxes shall be subject to the approval of the **UTILITY DIRECTOR**. The **CONTRACTOR** shall maintain vertical alignment and position so as to permit operation of the valve with a standard valve wrench.

492.4.6 Temporary Plugs

At all times when pipe laying is not actually in progress, the open ends of pipe shall be closed by temporary watertight plugs or by other approved means. If water is in the trench when work is resumed, the plug shall not be removed until all danger of water entering the pipe has passed.

492.4.7 Handling and Cutting Pipe

492.4.7.1 The **CONTRACTOR** attention is directed to the fact that cast iron used for pipe and fittings is comparatively brittle. Every care shall be taken in handling and laying pipe and fittings to avoid damaging the pipe, scratching or marring machined surfaces, and abrasion of the pipe coating.

492.4.7.2 Any fitting showing a crack and any fitting or pipe which has received a severe blow that may have caused an incipient fracture, even though no such fracture can be seen, shall be marked as rejected and removed at once from the work.

492.4.7.3 In any pipe showing a distinct crack and in which it is believed there is no incipient fracture beyond the limits of the visible crack, the cracked portion, if so approved, may be cut off by and at the expense of the **CONTRACTOR** before the pipe is laid so that the pipe used may be perfectly sound. The cut shall be made in the sound barrel at a point at least 12" from the visible limits of the crack. Exposed pipe ends shall be properly sealed as specified in Section 492.4.7.5.1.

492.4.7.4 Except as otherwise approved, all cuttings shall be done with a machine having rolling wheel cutters or knives adapted to the purpose. All cut ends shall be examined for possible cracks caused by cutting.

492.4.7.5 Pipe that has been cut for field fabrication or pipe and fittings with damaged lining shall be field repaired in strict accordance with the manufacturers written instructions. Repair shall be as follows:

492.4.7.5.1 Procedure for Sealing Cut Ends and Repairing Field Damaged Area

1. Remove burrs caused by field cutting of ends or damaged by handling and smooth out the edge of the lining if rough.
2. Remove all traces of oil, grease, asphalt, dust, dirt, etc.
3. Remove damaged lining caused by field cutting operation or handling and clean any exposed metal by sanding or scraping. Sandblasting or power tool cleaning the roughening is also acceptable. It is recommended that any loose lining be removed by chiseling, cutting, or

scraping into well adhered lined area before patching. Be sure to overlap at least one inch (1") of lining in the area to be repaired.

4. With the area to be sealed or repaired absolutely clean and suitably roughened, apply a coat of repair compound specified in the applicators "Certificate of Application" as furnished and approved with the pipe submittal. The **CONTRACTOR** shall apply the repair compound in strict accordance with the manufacturer's written instructions.

492.4.7.6 It is important to coat the entire freshly cut exposed metal surface of cut pipe ends or where the lining has been damaged during handling. It shall be the **CONTRACTOR'S** responsibility to obtain recommended repair compound to make repairs as specified herein.

492.4.7.7 The cost of repair to cut pipe ends or damaged linings shall be incidental to construction and the **CONTRACTOR** shall absorb the cost thereof in the unit price specified for fittings or related items.

492.4.8 Sleeve-Type Couplings

492.4.8.1 Sleeve-type couplings shall be stainless steel couplings for plain-end cast iron pipe. The couplings shall be furnished with the pipe stop removed. Couplings shall be provided with plain, Grade 27, rubber gaskets and with stainless steel, track-head bolts with nuts.

492.4.8.2 To ensure correct fitting of pipe and couplings, all sleeve-type couplings, and accessories shall be furnished by the supplier of the pipe.

492.4.9 Setting Appurtenances

492.4.9.1 All valves, fittings and appurtenances needed upon the pipelines shall be set and jointed by the **CONTRACTOR** as indicated on the drawings or as required.

492.4.9.2 Valves shall be set vertically so that stems form a vertical line. Care shall be taken to keep out dirt and sand, and no valve shall be operated until it has been cleaned of sand, grit, or other foreign material.

492.4.10 Piping Support and Thrust Blocking

492.4.10.1 The **CONTRACTOR** shall furnish and install all supports necessary to hold the piping and appurtenances in a firm, substantial manner at the lines and grades indicated on the drawings or specified.

492.4.10.2 All bends, tees, and other fittings in pipelines buried in the ground shall be backed with Class I concrete placed against undisturbed earth where firm support can be obtained. If the soil does not provide firm support, then suitable tie rods, clamps, and accessories to brace the fitting properly shall be provided. Such tie-rods, etc., shall be zinc plated or coated thoroughly and heavily with an approved bituminous paint after assembly or, if necessary, before assembly.

492.4.10.3 Where buried piping contains fittings which raise or lower the centerline of the pipe, suitable socket clamps and tie rods or restrained joints shall be used to prevent movement of the fittings. The restraining devices shall be coated thoroughly and heavily with an approved bituminous paint or wrapped.

492.4.11 Connections to Existing Force Mains

492.4.11.1 Connections to existing force mains shall be where shown on the plans and shall be done as detailed on the plans or as directed by the **CITY ENGINEER**. Connection of new to existing main shall be performed in the normal accepted method for connecting mains and shall be done without unduly disrupting service. All connections regardless of how done are subject to the approval of the **CITY ENGINEER** as to method, time and location.

492.4.11.2 Where existing lines are connected to proposed lines, the **CONTRACTOR** shall take appropriate action to insure that the existing lines do not interfere with the pressure testing portions of the work. Failure to do so will not relieve the **CONTRACTOR** of the responsibility of properly pressure-testing the entire system installed. The **CONTRACTOR** shall bear full responsibility for the action or inaction on this matter and shall not claim damages, injuries or additional compensation for said action or inaction.

492.4.11.3 At least 48 hours prior to excavating for the actual connection operation, the **CONTRACTOR** shall excavate and expose the main to be cut out at the proposed location and shall so advise the **PROJECT INSPECTOR** so that the **PROJECT INSPECTOR** may inspect the exposed area and verify, if appropriate, to the **PROJECT ENGINEER** that no conditions are present that would hamper the connection operation. The method of connecting shall be subject to the approval of the **CITY ENGINEER**.

492.4.11.4 Damage caused by sewage from an accidentally cut force main or gravity sewer shall be mitigated by either pumping the sewage back into the gravity sewer system, or cleaned by flushing with either fire hoses or tank trucks. Where practical, the affected area shall be treated with a disinfectant, such as HTH. The **CONTRACTOR** shall notify the City of Valdosta Utilities Department immediately.

492.4.11.5 The **CONTRACTOR** shall notify the City of Valdosta Utilities Department, at least 48 hours prior to making connections to existing force mains.

492.4.12 Connections to Manholes

Where force mains are to be connected to manholes, the complete interior of the manhole shall be protected. The **CONTRACTOR** shall take upstream measurements necessary to properly install boots, grout pipe openings and thoroughly clean the walls. Apply lining in accordance with Material Specification 499-11-99-06. The application shall be installed in strict accordance with the manufacturer's written instructions.

492.4.13 Cleaning and Flushing

492.4.13.1 Prior to the pressure and leakage tests, all piping shall be thoroughly cleaned of all dirt, dust, oil, grease and other foreign matter. This work shall be done with care to avoid damage to any inside coating.

492.4.13.2 All lines shall be thoroughly flushed with clean water to clear the lines of all foreign matter.

492.4.14 Open Cut Pavement Crossings

492.4.14.1 Bases, Sidewalk, Curb, and Driveway Repairs – The **CONTRACTOR** shall replace any and all bases, sidewalks, curbs and gutter, and driveways with materials and workmanship sufficient to give an equal and similar surface to the disturbed areas as existed before construction with minimum standards as established elsewhere in the Contract Documents.

492.4.14.2 Pavement removal and replacement shall be in accordance with GDOT Standard Specifications.

492.5 INSPECTION AND TESTING

492.5.1 General

492.5.1.1 All pipe, fittings, valves, and other items shall be inspected and tested at the foundry as required by the standard specifications to which the material is manufactured.

492.5.1.2 Pipes and fittings shall be subjected to a careful inspection just before being laid or installed.

492.5.2 Field Testing

492.5.2.1 In this section, the terms "piping" and "pipelines" shall include the pipe, fittings, joints, valves, and all other appurtenances necessary for the complete work.

492.5.2.2 Except as otherwise directed, all pipelines shall be tested.

492.5.2.3 All piping to operate under liquid pressure shall be tested in sections of approved length. For these tests, the **CONTRACTOR** shall be furnished clean water, suitable temporary testing plugs or caps, and other necessary equipment and all labor required, without additional compensation. The **CONTRACTOR** shall furnish suitable pressure gauges, pumps, and measuring tank.

492.5.2.4 Water for testing shall be at the **CONTRACTOR'S** expense unless otherwise specified by the **CITY ENGINEER**. The **CONTRACTOR** shall make suitable arrangements with the City Utilities Department for the monitoring of water consumption and locations to which water may be made available.

- 492.5.2.5** Unless it has already been done, the section of pipe to be tested shall be filled with water of approved quality and all air shall be expelled from the pipe. If air release valves or other outlets are not available at high points for releasing air, the **CONTRACTOR** shall make the necessary taps at such points, and shall plug said holes after completion of the test.
- 492.5.2.6** All force main piping shall be subjected to hydrostatic testing in accordance with Section 481.5.2.6 - "Hydrostatic Testing" of C-600-latest. Pressure tests shall be at 150 psi minimum for a minimum of two hours duration. No pipe installation will be accepted if leakage is greater than the formula or five (5) psi.
- 492.5.2.7** If the section fails to pass the tests, the **CONTRACTOR** shall do everything necessary to locate, uncover, (even to the extent of uncovering the entire section) and repair or replace the defective pipe, fitting, joint, valve, or other appurtenance.
- 492.5.2.8** If, in the judgment of the **CITY ENGINEER**, it is impractical to follow the foregoing procedures exactly for any reason, modifications in the procedure shall be made as required and approved by the **CITY ENGINEER**; but, in any event, the **CONTRACTOR** shall be responsible for the ultimate tightness of the piping within the above requirements.
- 492.5.2.9** It is the intent of this section to insure that all parts of the work including but not being limited to pipe, fittings, joints, valves and any other appurtenances are subjected to testing as described herein. To achieve this, all methods of testing shall be approved by the **CITY ENGINEER**.

492.6 ASBUILTS

After all work has been completed on the force main system, the entire project shall be asbuilts in accordance with Section 496. This shall include asbuilts of construction plans and preparation of valve tie sheets.

DIVISION 490

SECTION 493

SANITARY SEWER LIFT STATION CONSTRUCTION

SECTION 493
SANITARY SEWER LIFT STATION CONSTRUCTION

493.1 SCOPE

The work under this section includes the furnishing of all labor, materials, and equipment necessary for the construction of new lift stations and wet wells. Work shall include construction of new wet wells together with all work involved in the installation of new factory built lift stations complete with concrete slab, service panels, electric service, electrical wiring, hose bibbs, water services, pump tests, pipe connections, temporary pumping facilities, and other equipment, materials and work necessary to provide a complete functional lift station. Force main work is specified in Section 492.

493.2 GENERAL REQUIREMENTS

- 493.2.1 All work shall be proved to be in first class condition and be constructed and installed in accordance with the drawings and specifications. All defects, leaks or equipment malfunctions disclosed by tests shall be remedied. All tests shall be performed by the **CONTRACTOR** and observed by the **CITY ENGINEER**. Water for testing will be furnished by the **CONTRACTOR**.
- 493.2.2 See Standard Details 498-4.1A and B for “Typical Site Plan” layout for clearing and grubbing and excavation and backfill specifications.
- 493.2.3 Where lift stations exist and are being replaced or modified as specified herein and on the drawings, the **CONTRACTOR** shall take all measures required, including plugging, temporary pumping, installing temporary screens or basket strainers, or any other work necessary in order to maintain continuous service of the lift station until the modifications or replacement has been completed. The **CONTRACTOR** shall be responsible for any damage to the **CITY**, customers, or to the existing equipment resulting from the temporary measures specified above.
- 493.2.4 All lift stations are to be a minimum of 2-foot above 100-year flood elevations, existing ground elevations, whichever is greater.

493.3 MATERIALS

- 493.3.1 All materials required under this section which are necessary for the construction of sanitary sewer lift stations shall be of the type, model and manufacturer specified under the applicable specifications of Section 499.
- 493.3.2 Materials not specified herein or under Section 499 shall not be installed in the sanitary sewer system unless specifically authorized, in writing, by the **UTILITY DIRECTOR**. The **CITY** reserves the right to have said materials removed at the **CONTRACTOR’S** expense.
- 493.3.3 Requests for materials to be approved by the **CITY** shall be made to the **UTILITY DIRECTOR**, in writing, in accordance with set procedures. Copies of the procedure policy may be obtained from the **UTILITY DIRECTOR**.

- 493.3.4** All materials shall be free from defects impairing strength and durability and be of the best commercial quality for the purpose specified. It shall have structural properties sufficient to safely sustain or withstand strains and stresses to which it is normally subjected and be true to detail.

493.4 COATINGS

493.4.1 Concrete Wet Well

- 493.4.1.1** General - It is the intent of this specification that all interior surfaces of the wet well or exposed steel be covered with a coating as specified in the Contract Documents and as herein specified below. This shall include the annular space formed by the installation of pipes through the wet well wall and the underside of the concrete slab covering the wet well.

- 493.4.1.2** Surface Preparation - Sandblast according to Specification SSPC-SP-7 ("Brush Off Blast Cleaning") with 60-80 mesh sand and air pressure of 50-60 psi to remove all cement glaze and residue of form release agents and provide a uniform surface profile of approximately one (1) mil. Vacuum clean or air blast surface prior to coating. Apply coating to a dry surface (less than [15%] moisture-free as measured by a moisture meter) only.

- 493.4.1.3** Coating - Apply approved coatings as specified in Material Specifications 499-02-99-06, 499-11-99-06, 499-11-99-07 and 499-11-99-08. Apply liner and coatings to uniform thickness and in strict accordance with manufacturer's instructions and these requirements. After pre-cast sections have been assembled seal all joints to minimum of six inch (6") overlap at each joint.

493.4.2 Metal, Non-Submerged (Interior & Exterior)

- 493.4.2.1** General - Paint all exposed steel work, exposed pipe work (except PVC), fittings, and all mechanical equipment with Tnemec 231 coating.

- 493.4.2.2** Surface Preparation - Clean all metal surfaces according to Specification SSPC-SP6 ("Commercial Blast Cleaning").

493.5 PUMP EQUIPMENT

- 493.5.1** General - Pumping equipment shall be submersible pumps installed in the wet well. The station shall be complete with all equipment specified herein. The principle items of equipment shall be motor driven sewage pumps, valves, internal piping, control panel with heavy duty circuit breakers, magnetic motor starters, automatic liquid level control system, and internal wiring as specified.

493.5.2 Submittals

- 493.5.2.1** Shop Drawings - Submit shop drawings and product data for equipment furnished under this Section in accordance with the GENERAL CONDITIONS.

493.5.2.2 Operating and Maintenance Manual - Furnish Operation and Maintenance Manuals in accordance with Section 493.5.16.4.

493.5.2.3 Equipment Installation Certificate - The manufacturer shall provide a written report, through the **CONTRACTOR**, and endorsed in writing by the **CONTRACTOR**, certifying that the equipment has been properly installed, checked and is ready for placement into routine permanent service.

493.5.3 Manufacturer's Start-up Services

493.5.3.1 Furnish services of manufacturer's technical representative to inspect the completed installation, correct or supervise correction of any defects or malfunctions, and instruct operating personnel in proper operation and maintenance procedures as described in Section 493.5.16 - Execution.

493.5.4 Unitary Responsibility

In order to unify responsibility for proper operation and service of the pumping station, it is the intent of these specifications that all system components shall be furnished by a single manufacturer for the pump station and for the control panel, or the same (unitary source) for both.

493.5.5 Manufacturer

Approved manufacturers of submersible pumps shall be Gorman-Rupp or Flygt as specified in Material Specification 499-12-99-03.

493.5.8 Submersible Pump Station

493.5.8.1 System Power Characteristics: Electrical power to be furnished to the site will be 3-phase, 60Hz, 4-wire, 480/277 volts, 240/120 volts, or 230/120 volts determined by the power company, maintained within plus or minus ten percent ($\pm 10\%$). Control voltage shall not exceed 120 volts. Pump station will need to operate at 480/277 volts 3-phase, provide step up transformers to accomplish this. If only single-phase power is available, provide variable frequency drives to convert to three-phase.

493.5.8.2 Pump Station Configuration: Pump station shall be submersible pumps mounted in the wet well with the valves and panel mounted above ground.

493.5.8.3 Pumps

493.5.8.3.1 Description: Pumps shall be submersible sewage pumps, specifically designed for pumping raw, unscreened domestic sanitary sewage.

493.5.8.3.2 Materials: All parts of the pump casing and volute which are exposed to sewage shall be constructed of gray cast iron, ASTM A-48, Class 35-B, with smooth surfaces devoid of blow holes or other irregularities.

- 493.5.8.3.3** Internal Passages: All openings and internal passages shall be large enough to permit the passage of a sphere three inches (3") in diameter, and any trash or stringy material which may pass through the average house collection system without clogging.
- 493.5.8.3.4** Automatic Re-Priming: Each pump shall be so designed as to retain adequate liquid in the pump casing to insure unattended automatic re-priming while operating at its rated speed in a completely open system.
- 493.5.8.3.5** Metal Surfaces Coating: All metal surfaces coming into contact with the pumpage, other than stainless steel or brass, shall be protected by a factory applied spray coating of acrylic dispersion zinc phosphate primer with a polyester resin paint finish on the exterior of the pump. Critical mating surfaces, where watertight sealing is required, shall be machined and fitted with Nitrile or Viton rubber o-rings.
- 493.5.8.3.6** Motor Cable Entry: The cable entry seal design shall preclude specific torque requirements to insure a watertight and submersible seal. The cable entry shall consist of a single cylindrical elastomer grommet, flanked by washers, all having a close tolerance fit against the cable outside diameter and the entry inside diameter and compressed by the body containing a strain relief function, separate from the function of sealing the cable. The assembly shall provide ease of changing the cable when necessary using the same entry seal. The cable entry junction chamber and motor shall be separated by a stator lead sealing gland or terminal board, which shall isolate the interior from foreign material gaining access through the pump top. Epoxies, silicones, or other secondary sealing systems shall not be considered acceptable.
- 493.5.8.3.7** Motor Cooling System: On pumps less than 20 hp, motors are sufficiently cooled by the surrounding environment or pumped media. A water jacket is not required. On pumps 20 hp and larger, each unit shall be provided with an adequately designed cooling system utilizing a water jacket. The water jacket shall encircle the stator housing; thus, providing heat dissipation for the motor regardless of the type of installation. Impeller back vanes shall provide the necessary circulation of the cooling liquid through the water jacket. The cooling media channels and ports shall be non-clogging by virtue of their dimensions. Provisions for external cooling and seal flushing shall also be provided. The cooling system shall provide for continuous pump operation in liquid temperature of up to 104° F. Restrictions below this temperature are not acceptable.
- 493.5.8.3.8** Pump Mechanical Seals: Each pump shall be provided with a tandem mechanical shaft seal system consisting of two (2) totally independent seal assemblies. The seals shall operate in a lubricant reservoir that hydrodynamically lubricates the lapped seal faces at a constant rate. The lower, primary seal unit, located between the pump and the lubricant chamber, shall contain one stationary and one positively driven rotating tungsten-carbide ring. The upper, secondary seal unit, located between the

lubricant chamber and the motor housing, shall contain one (1) stationary tungsten-carbide seal ring and one positively driven rotating tungsten-carbide seal ring. Each seal interface shall be held in contact by its own spring system. The seals shall require neither maintenance nor adjustment nor depend on direction of rotation for sealing. The position of both mechanical seals shall depend on the shaft. Mounting of the lower mechanical seal on the impeller hub will not be acceptable. Each pump shall be provided with a lubricant chamber for the shaft sealing system. The lubricant chamber shall be designed to prevent overfilling and to provide lubricant expansion capacity. The drain and inspection plug, with positive anti-leak seal shall be easily accessible from the outside. The seal system shall not rely upon the pumped media for lubrication. The motor shall be able to operate dry without damage while pumping under load. Seal lubricant shall be FDA approved, non-toxic.

- 493.5.8.3.9** Pump Bearings: The pump shaft shall rotate on two (2) bearings. Motor bearings shall be permanently grease lubricated. The upper bearing shall be a single roller bearing. The lower bearing shall be a two row angular contact bearing to compensate for axial thrust and radial forces. Single row lower bearings are not acceptable. Minimum L_{10} bearing life shall be 50,000 hours at any point along the useable portion of the pump curve at maximum product speed.
- 493.5.8.3.10** Pump Shaft: Pump and motor shaft shall be the same unit. The pump shaft shall be an extension of the motor shaft. Couplings shall not be acceptable. For pumps under 25 hp, the shaft shall be AISI Type 420 stainless steel. For pumps 25 hp and larger, the shaft shall be C1035 Carbon Steel and shall be completely isolated from the pumped liquid.
- 493.5.8.3.11** Pump Impeller: The impeller shall be of gray cast iron, Class 35B, dynamically balanced, double shrouded non-clogging design having a long throughlet without acute turns. The impeller shall be capable of handling solids, fibrous materials, heavy sludge and other matter found in wastewater. All impellers shall be coated with an acrylic dispersion zinc phosphate primer.
- 493.5.8.3.12** Pump Wear Rings: A wear ring system shall be used to provide efficient sealing between the volute and suction inlet of the impeller. Each pump shall be equipped with a nitrile rubber coated steel ring insert that is drive fitted to the volute inlet. On pumps 20 hp and larger, a stainless steel impeller wear ring heat-shrink fitted onto the suction inlet of the impeller will also be provided.
- 493.5.8.3.13** Pump Spare Parts: Provide spare top and bottom seals, spare O-ring kit and spare impeller.
- 493.5.8.3.14** Pump Discharge Piping: Discharge piping shall be equipped with one (1) three quarter (3/4") NPT tapped hole, with ball valve, pressure gauge and saddle.

493.5.8.3.15 Pump Performance Requirements: The pumps furnished shall meet the "Initial Performance Requirements" set forth on the plans. The pump discharge bases and rail systems furnished shall be capable of supporting future pumps which will meet the "Future Performance Requirements" set forth.

493.5.10 Motors and Drive Transmission

493.5.10.1 Pump Motor: The pump motor shall be induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber, NEMA B type. The stator windings and stator leads shall be insulated with moisture resistant Class H insulation rated for 180° C (311° F). The stator shall be insulated by the trickle impregnation method using Class H monomer-free polyester resin resulting in a winding fill factor of at least 95%. The stator shall be heat-shrink fitted into the stator housing. The use of bolts, pins or other fastening devices requiring penetration of the stator housing is not acceptable. The motor shall be designed for continuous duty handling pumped media of 40° C (104° F) and capable of up to 15 evenly spaced starts per hour. The rotor bars and short circuit rings shall be made of cast aluminum. Thermal switches set to open at 125° C (260° F) shall be embedded in the stator lead coils to monitor the temperature of each phase winding. These thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to the control panel. The junction chamber containing the terminal board shall be hermetically sealed from the motor by an elastomer seal. Connection between the cable conductors and stator leads shall be made with threaded compression type binding posts permanently affixed to a terminal board. Wire nuts or crimping type connection devices are not acceptable. The motor and pump shall be designed and assembled by the same manufacturer. The combined service factor (combined effect of voltage, frequency and specific gravity) shall be a minimum of 1.15. The motor shall have a voltage tolerance of $\pm 10\%$. The motor shall be designed for operation up to 40° C (104° F) ambient and with a temperature rise not to exceed 80° C. Leakage sensors within the stator housing shall only be supplied if required by the pump manufacturer for warranty purposes. Motor horsepower shall be adequate so that the pump is non-overloading throughout the entire pump performance curve.

The motors shall be designed for use without overheating in a submerged, partially submerged, or un-submerged condition.

493.5.10.2 Motor Power Cable: The power cable shall be sized according to the NEC and ICEA standards and shall be of sufficient length to reach the junction box without the need of any splices. The outer jacket of the cable shall be oil resistant rubber. The motor and cable shall be capable of continuous submergence under water without loss of watertight integrity to a depth of 65'. Each pump shall be supplied with a minimum of 40' of power cable.

493.5.11 Valves and Piping

- 493.5.11.1** Piping: All suction and discharge piping including valves shall be capable of passing three inch (3") spherical solids. Flanged pipe shall be centrifugally cast ductile iron, complying with ANSI/AWWA A21.51/C 115 and Class 53 thickness. Flanges shall be cast iron Class 125 rated and complying with ANSI B16.1.
- 493.5.11.2** Pump Suction Spool: Each pump shall be equipped with a one-piece, cast iron suction spool, flanged on each end. Each spool shall have one (1) 1 ¼" NPT and ¼" NPT tapped hole with saddle and plugs for mounting of gauges or other instrumentation.
- 493.5.11.3** Check Valves: Full flow type swing check valves shall have cast iron body with flanged ends rated at 125 lbs. Valves shall be fitted with an external lever and spring. Bronze body ring shall be threaded into the valve port. Valve clapper shall be cast iron, bronze face, and shall swing completely clear of waterway when valve is full open. Hinge pin shall be of 18-8 stainless steel construction and shall be utilized with bronze bushings and O-ring seals. Valves shall be equipped with removable cover plate to permit entry or for complete removal of internal components without removing the valve from the line. Valve rating shall be 200 psi water working pressure.
- 493.5.11.4** Plug Valves: Plug valves shall be of the non-lubricated, tapered type. Valve body shall be semi-steel with flanged end connections drilled to ANSI 125 lb. standard. Valves shall be furnished with a drip-tight shutoff plug mounted in stainless steel bearings, and shall have a resilient facing bonded to the sealing surface.
- 493.5.11.5** Air Release Valve: Each pump shall be equipped with one (1) automatic air release valve, designed to permit the escape of air into the atmosphere during initial priming or unattended re-priming cycles. Upon completion of the priming or re-priming cycle, the valve shall close to prevent re-circulation. Valves shall provide visible indication of valve closure, and shall operate solely on discharge pressure. Valves which require connection to the suction line shall not be acceptable.

All air release valve parts exposed to sewage shall be constructed of cast iron, stainless steel, PVC, or similar corrosion resistant materials. Diaphragms, if used, shall be of fabric-reinforced neoprene or similar inert material.

A clean out port, three inches (3") or larger in diameter, shall be provided on the air release valve for ease of inspection, clean out, and service. Valves shall be field adjustable for varying discharge heads.

493.5.12 Finish

The pumps, piping, and exposed steel framework shall be cleaned with industrial grade chemical cleaner. The prime coat shall be a zinc base synthetic primer. The finish coat shall be an epoxy grade as specified in Material Specification 499-11-99-04, with color selected by the **UTILITY DIRECTOR**.

493.5.13 Electrical System Panel Components

493.5.13.1 Panel Enclosure: The electrical components and control equipment shall be mounted within NEMA 3R or similar, dead front type control enclosures fabricated of stainless steel. Enclosure doors shall be gasketed with neoprene, hinged, and equipped with captive closing hardware. Control compartments shall incorporate removable back panels on which control components shall be mounted. Back panel shall be secured to enclosures with collar studs.

493.5.13.2 Motor Branch Components: All motor branch components shall be of the highest industrial quality, securely fastened to removable sub-plate with stainless steel screws and lockwashers. The sub-plate shall be tapped to accept all mounting screws. Self-tapping screws shall not be used to mount any components.

493.5.13.3 Circuit Breaker and Operating Mechanism: A properly sized heavy duty air circuit breaker shall be furnished for each pump motor. All circuit breakers shall be sealed by the manufacturer after calibration to prevent tampering.

A padlocking operation mechanism shall be installed on each motor circuit breaker. Operator handles for the mechanisms shall be located on the exterior of the control compartment door with interlocks which permit the door to be opened only when circuit breakers are in the OFF position.

493.5.13.4 Motor Starters/Contactors: An open frame, across the line, NEMA rated magnetic motor starter shall be furnished for each pump motor. Starters shall be NEMA size one (1) or above, and shall be designed for addition of at least two auxiliary contacts. Power contacts shall be double-break and made of cadmium oxide silver. All motor starters shall be equipped to provide under voltage release and overload protection on all three-phases. Motor starter contacts shall be easily replaceable without removing the motor starter from its mounted position. Siemens Heavy Duty Starters, ESP 100 series.

493.5.13.5 Soft Starters: Solid state soft start starters shall be installed on motors 20 hp or larger.

493.5.13.6 Overload Reset Button: An overload reset push-button shall be mounted through the door of the control panel in such a manner as to permit resetting the overload relays without opening the control panel door.

493.5.13.7 Overload Relays: Temperature compensated, three (3) pole, solid state thermal overload relays shall be of block-type, utilizing melting alloy type spindles, and

shall have visual trip indication with trip-free operation. Overload relays shall be manually reset only, and not be convertible to automatic reset. Trip setting shall be determined by heater element only and not by adjustable settings.

- 493.5.13.8** Emergency Disconnect Breaker: Provide manual transfer switch breaker to switch to generator power. Provide Russell-Stol generator receptacle sized to main breaker so lift station can be operated by generator. Provisions shall be made to prevent main and emergency breakers from being on at the same time.
- 493.5.13.9** Circuit Breakers: Circuit breakers shall be properly sized breakers for outlets, lighting, control system, and other uses. Breakers shall be mounted with cutouts through the dead front panel so that breaker faces will be flush with the dead front.
- 493.5.13.10** Surge Protector: An electronic epoxy encapsulated surge protector shall be provided to protect the control circuitry in the main panel. The protector shall be of solid-state construction with two (2) stages separated by an indicator that will not saturate under full load conditions. The final stage shall utilize a series of high speed silicon avalanche devices. Total response time shall be two (2) nano-seconds or less. A neon indicator shall signal failure.
- 493.5.13.11** Phase Monitor: A line voltage rate phase sequence and loss monitor shall be provided. The monitor will be pre-wired into the control circuitry to take the station out of service if a phase is reversed, lost, or drops below 83% of normal voltage. The unit shall automatically restore the station to normal conditions when normal power is restored.
- 493.5.13.12** Warning Light and Horn: The main panel shall be provided with a lexon shielded warning light and weatherproof horn. A silence switch shall be mounted on the front door.
- 493.5.13.13** Lightning Arrestors: Provide lightning arrestor to protect the control circuitry in the main panel from lightning.
- 493.5.13.14** GFI Receptacle: A weatherproof duplex ground fault indicating utility receptacle providing 115 volts, 60Hz, single-phase current, shall be mounted on the front of the main panel. Receptacle circuit shall be protected by a 20 ampere thermal-magnetic circuit breaker.
- 493.5.13.15** Control Circuitry: The control circuit shall be protected by a thermal-magnetic air circuit breaker which shall be connected in such a manner as to allow control power to be disconnected from all control circuits.
- 493.5.13.16** Pump Run Indicators: Control panel shall be provided with one pilot light for each pump motor for run, stop, and fault. Light shall be wired in parallel with the related pump motor starter to indicate that the motor is or should be running, stopped, or in fault.

- 493.5.13.17** Pump Mode Selection: Pump mode selector switches shall be connected to permit manual start and stop of each pump individually, and to select automatic operation of each pump under control of the level control system. Manual operation shall override all shutdown systems, but not the motor overload relays. Selector switches shall be toggle switches meeting Military Standards (MS) for quality. Switch contacts shall be rated 15 amperes minimum at 120 volts non-inductive.
- 493.5.13.18** Elapsed Time Meters: Six (6) digit elapsed time meters (non-reset type) shall be connected to each motor starter to indicate the total running time of each pump in "hours" and "tenths of hours".
- 493.5.13.19** High Pump Temperature Protection: The control panel shall be equipped with circuitry to override the level control system and shut down the pump motor(s) when required to protect the pump from damage caused by excessive temperature. A thermostat shall be mounted on each pump to detect its temperature, and a signal relay shall be supplied for each thermostat. If the pump temperature should rise to a level which could cause pump damage, the thermostat shall cause the signal relay to drop out the motor starter. An electrical or mechanical indicator, visible on the front of the control panel, shall indicate that the pump motor has been stopped because of a high temperature condition. The pump shall remain locked out until the pump has cooled and the circuit has been manually reset. Automatic reset of such a circuit shall not be acceptable.
- 493.5.13.20** Wiring: The pump station as furnished by the manufacturer shall be completely wired except for the power feeder lines to the branch circuit breakers and final connections to remote alarm devices. All wiring, workmanship, and schematic wiring diagrams shall be in compliance with applicable standards and specifications set forth by the National Electric Code (NEC).
- 493.5.13.21** Wire Identification and Sizing: Control circuit wiring inside the panel, with the exception of the internal wiring of individual components, shall be 16 gauge minimum, Type MTW or THW, 600 volts. Wiring in conduit shall be 14 gauge minimum.

493.5.14 Level Control System

- 493.5.14.1** Description: The level control system shall start and stop the pump motors in response to change in wet well level, as set forth herein.
- 493.5.14.2** Type: The level control system shall be wet transducer type, a pressure transducer contained in the wet well. Level floats are also required.
- 493.5.14.3** Sequence of Operation: The electronic controller shall continuously monitor the wet well level, permitting the operator to read wet well level at any time. Upon operator selection of automatic operation, the controller shall start the motor for one pump when the liquid level in the wet well rises to the "lead pump start

level". When the liquid is lowered to the "lead pump stop level", the electronic controller shall stop this pump. These actions shall constitute one pumping cycle. Should the wet level continue to rise, the electronic controller shall start the second pump when the liquid level reaches the "lag pump start level" so that both pumps are operating. These levels shall be adjustable as described below.

493.5.14.4 Automatic Pump Alternation: The level control system shall utilize the alternator relay to select first one pump, then the second pump, to run as lead pump for a pumping cycle. Alternation shall occur at the end of a pumping cycle.

493.5.14.5 Electronic Controller: The electronic controller shall include integral components to perform all pressure sensing signal conditioning, EMI and RFI suppression, DC power supply and 120V outputs. Comparators shall be solid state, and shall be integrated with other components to perform as described below. Control range shall be 01 to 12.01 of water with an overall repeat accuracy of ± 0.1 feet of water.

The electronic controller shall consist of the following integral components: pressure sensor, display, electronic comparators, and output relays.

493.5.14.6 Pressure Sensor: The pressure sensor shall be a strain gauge transducer and shall receive and input pressure from the air bubbler system. The transducer shall convert the input to a proportional electrical signal for distribution to the display and electronic comparators. The transducer output shall be filtered to prevent control response to level pulsations or surges. Transducer over-pressure rating shall be three times full scale.

493.5.14.7 Electronic Comparators: Level adjustments shall be electronic comparator setpoints to control the levels at which the lead and lag pumps start and stop. Each of the level settings shall be adjustable, and accessible to the operator without opening the control panel or any cover panel on the electronic pressure switch. Controls shall be provided to permit the operator to read the selected levels on the display. Such adjustments shall not require hard wiring, the use of electronic test equipment, artificial level simulation, or introduction of pressure to the electronic pressure switch. It shall be possible to change setpoints while the unit is in operation without affecting other setpoints or operation.

493.5.14.8 Output Relays: Each output relay in the electronic pressure switch shall be solid state. Each relay input shall be optically isolated from its output and shall incorporate zero crossover switching to provide high immunity to electrical noise. The ON state of each relay shall be indicated by illumination of a light emitting diode. The output relay shall be individually fused providing fused overload and short circuit protection. Each output relay shall have an inductive load rating equivalent to one NEMA Size 4 contactor. A pilot relay shall be incorporated for loads greater than a Size 4 contactor.

493.5.14.9 Serviceability: The electronic pressure switch shall be equipped with replaceable plug-in integrated circuits and output fuses. The main circuit board

assembly shall be provided with keyed plug-in connections to “off board” components permitting main board removal without de-soldering. All printed circuits shall have a conformal coating applied to both sides to protect against moisture or fungus.

493.5.14.10 Independent Lag Pump: Circuit design in which application of power to the lag pump motor starter is contingent upon completion of the lead pump circuit shall not be acceptable.

493.5.14.11 High Water Alarm with Alarm Silencer: The electronic pressure switch shall be equipped with an additional electronic comparator and solid state output relay to alert maintenance personnel to a high liquid level in the wet well. In the event that the wet well liquid reaches a preset high water alarm level, the high water output relay shall energize a signal relay. The signal relay shall complete a 115-volt circuit for an external alarm device. An electrical or mechanical indicator, visible on the front of the control panel, shall indicate that a high wet well level exists. The signal relay shall maintain the alarm signal until the wet level has been lowered and the circuit has been manually reset.

An alarm silence switch and relay shall be provided to permit maintenance personnel to de-energize the external alarm device while corrective actions are underway. After silencing the alarm device, manual reset of the signal relay shall provide automatic reset of the alarm silence relay. Located outside of panel on left side as well as on dead front.

493.5.15 Main Disconnect Switch Panel

493.5.15.1 A 316 Stainless Steel NEMA panel shall be provided.

493.5.15.2 Main Disconnect Switch: A main disconnect switch shall be provided, non-fused, sized to handle full service load, 100 amp minimum.

493.5.15.3 Surge Protector: An electronic epoxy encapsulated surge protector shall be provided to protect the secondary line voltage circuitry in the main panel. The protector shall be of solid-state construction with two stages separated by an indicator that will not saturate under full load conditions. The final stage shall utilize a series of high speed silicon avalanche devices. Total response time shall be two (2) nano-seconds or less. A neon indicator shall signal failure. (Install one in main disconnect and one in main panel.)

493.5.15.4 Lightning Arrestors: Provide lightning arrestor to protect the secondary line voltage circuitry in the pump control panel and main feed from lightning. (Install one in main disconnect panel and one in main panel.)

493.5.16 Manufacturer's Responsibility

493.5.16.1 Operational Test: The pumps, motors, and controls shall be given an operational test in accordance with the standards of the Hydraulic Institute. Recordings of

the test shall substantiate the correct performance of the equipment at the design head, capacity, suction lift, speed, and horsepower as herein specified.

493.5.16.2 Support Literature: The manufacturer of the pump station shall be responsible for delivery to the **UTILITY DIRECTOR** five (5) copies of the support literature required herein.

493.5.16.3 Installation Instructions: Installation of the pump station and related appurtenances shall be performed in accordance with written instructions by the manufacturer.

493.5.16.4 Operation and Maintenance Instructions: The pump station manufacturer shall be responsible for supplying written instructions, which shall be sufficiently comprehensive to enable the operator to operate and maintain the pump station and all equipment supplied by the station manufacturer. Instructions shall assume that the operator is familiar with pumps, motors, piping, valves, and controls, but that operator has not previously operated and/or maintained the exact equipment supplied.

The instructions shall be prepared as a system manual applicable solely to the pump station and equipment supplied by the manufacturer to these specifications, and shall include those devices and equipment supplied by them. However, items of equipment for which the station manufacturer has made mounting or other provisions, but which they have not supplied, may be excluded from these instructions.

Operation and maintenance instructions shall be specific to the equipment supplied in accordance with these specifications. Instruction manuals applicable to many different configurations and pump stations, and which require the operator to selectively read portions of the instructions shall not be acceptable.

493.5.16.5 Manufacturer's Abilities: Upon request of the **UTILITY DIRECTOR**, the pump station manufacturer shall demonstrate proof of financial responsibility with respect to performance and delivery date.

Upon request of the **UTILITY DIRECTOR**, the pump station manufacturer shall provide proof of evidence of facilities, equipment, and skills required to produce the equipment specified herein.

493.5.17 Manufacturer's Warranty

493.5.17.1 The manufacturer of the pump station shall warrant it to be of quality construction, free from defects in material and workmanship. This warranty shall include specific details described below.

493.5.17.2 Enclosure: The pump station enclosure shall be warranted for a period of ten (10) years to be completely resistant to rust, corrosion from moisture, corrosive soils, or physical failures occurring in normal service, without protective

coating, when installation is made according to the manufacturer's recommendations.

- 493.5.17.3** Overall Pump Station: The equipment, apparatus, and parts furnished shall be warranted for a period of one (1) year, excepting only those items that are normally consumed in service such as light bulbs, oil, grease, etc. The pump station manufacturer shall be solely responsible for the warranty of the station and all components.

Components failing to perform as specified by the **UTILITY DIRECTOR**, or as represented by the manufacturer, or proven defective in service during the warranty period, shall be replaced, repaired, or satisfactorily modified by the manufacturer without cost of parts or labor to the **CITY**.

It is not intended that the manufacturer assume liability for consequential damages or contingent liabilities arising out of failure of any product or parts thereof to operate properly, however caused by, or resulting from, or arising out of defects in design or manufacture, delays in delivery, replacement, or otherwise.

- 493.5.17.4** Effective Date: The warranty shall become effective upon acceptance by the City of Valdosta after successful start-up.

493.5.18 Testing and Training

- 493.5.18.1** Inspection and Testing: Upon completion of installation, the **CONTRACTOR**, in the presence of the **UTILITY DIRECTOR** and a qualified manufacturer's representative, shall perform a preliminary test on the system to insure the functioning of the station and all component parts as specified herein to the satisfaction of the **UTILITY DIRECTOR**.

- 493.5.18.2** Approval of the preliminary test by the **UTILITY DIRECTOR** shall not constitute final acceptance of the equipment furnished.

- 493.5.18.3** After the system is in full operation, a full operating test shall be performed in the presence of the **UTILITY DIRECTOR** and a qualified manufacturer's representative. The **CONTRACTOR** shall furnish all labor, materials, and equipment required for such test and shall correct any deficiencies noted by repairing or replacing the defective component, and re-testing as required until the equipment meets the satisfaction of the **UTILITY DIRECTOR**.

- 493.5.18.4** Operating personnel shall be trained in operation and maintenance of equipment at start-up. Instruction shall be given in operation, service, adjustments, and routine maintenance. Recommended spare parts lists and maintenance schedules shall be provided.

493.6 WET WELL INSTALLATION

- 493.6.1** Bottom of Excavated Hole - Keep excavation free of water during the construction process. Build structures to the line and grade shown on the plans. For the wet well, the **CONTRACTOR** shall excavate one foot (1') deeper than the elevation of the bottom of the wet well base and replace the material with suitable bearing rocks or gravel approved by the **CITY ENGINEER**. The bottom shall provide a firm and stable foundation for the structure.

At least one foot (1') of 57 stone shall be placed under the wet well. It is expressly agreed and understood that the **CITY** reserves the right to require additional rock or a compaction test to achieve a stable foundation for the proposed wet well. Compaction tests shall be in accordance with Standard Details 478-5.2A and B.

- 493.6.2** Installing Sections - Installation of pre-cast wet wells shall comply with the manufacturer's recommendations. Pre-cast concrete sections shall be set so the wet well will be vertical and with sections in true alignment. Joints between pre-cast sections shall be jointed using non-shrink grout as specified below. Wet wells are considered confined spaces and the **CONTRACTOR** must follow the **CITY** requirements for confined space entry.

All holes in sections used for their handling and the annular space between the wall and entering pipe shall be thoroughly plugged and sealed in strict conformance with the manufacturer's recommendations so that there will be zero leakage through openings and around pipes.

After all holes, joints, annular spaces or other exposed areas have been jointed as specified above, the areas shall be sealed in accordance with its manufacturers written instructions with liner material.

- 493.6.3** Stub Lines - Where shown on the drawings, stub lines shall be provided for the connection of future sewer lines to wet wells. The end of each stub line shall be provided with a bell end which shall be closed by an approved stopper as specified herein. Each stub line shall be accurately referenced to the center of the wet well, and the actual invert elevation of each end of the stub line shall be accurately recorded on the asbuilt drawings.

- 493.6.4** Wet Well Test - It is the intent of these specifications that wet wells and appurtenances be watertight and free from infiltration. Wet wells shall be free of seeping or surface moisture. The **CONTRACTOR** shall repair any evidence of leakage. Water tightness of the wet well shall be demonstrated by the **CONTRACTOR** by a leakage test which shall be conducted in the following manner:

The **CONTRACTOR** shall fill the structure with water to an elevation one foot (1') below the slab. Plug all inlets and outlets with approved stoppers or plugs. The water shall stand for thirty (30) minutes before the test measurements begin or until the water level stabilizes. If the water level does not stabilize within thirty (30) minutes, the structure shall be considered to have failed the test. The maximum allowable drop in the water surface is 1/10 of one percent (1%) in 24 hours of testing. Even though the

leakage is less than the specified amount, the **CONTRACTOR** shall repair any leaks that may be observed.

493.7 ELECTRICAL

493.7.1 Scope of Work - Furnish all equipment, transportation, tools and labor, unless otherwise specified, to install a complete electrical system with wire, conduit, service panel, emergency hookup, control panel, emergency horn and light, and all other items called for or that can be reasonably inferred from the drawings, including excavation, backfill, placing of conduit, pulling wires, and testing for a complete job ready to operate.

493.7.2 Permits and Inspection - The **CITY** shall make application for electrical service.

493.7.3 Codes and Standards - Nothing in these specifications or on the drawings shall be interpreted as permission or direction to violate any governing code or ordinance. Electrical equipment, materials, and workmanship shall comply with the latest revisions of the following codes and standards:

- State and local codes and ordinances and inspecting authorities.
- The National Board of Fire Underwriters.
- National Fire Protection Association (NFPA)
- Underwriters Laboratories, Inc. (UL)
- National Electrical Manufacturers Association (NEMA)
- American National Standards Institute, Inc. (ANSI)
- Insulated Power Cable Engineers Association (IPCEA)
- Occupational Safety and Health Association (OSHA)

493.7.4 Products - Make equipment of the same type of catalogued product of the same manufacturer. Use weatherproof switches and receptacles with weatherproof covers for outdoor locations or locations subject to moisture intrusion.

493.7.5 Execution - Install all equipment in accordance with approved shop drawings, manufacturer's instructions, and to operate as specified.

493.7.6 Identification - Engrave nameplates, white-on-black laminated plastic, and attach with mounting frames or drive screws. Provide nameplates for all lighting and power panel boards, distribution circuit breakers, receptacles (other than standard convenience), motor control centers, switchboards, disconnect switches, selector switches, push buttons, and other major pieces of electrical equipment.

Provide typewritten circuit directories for each panel board. Color code conductors black, red, and blue for phase wires; white for neutral; and green for ground. Color code control conductors as approved by the **UTILITY DIRECTOR**.

Identify conductor as to load served:

- a. Leave all branch circuits tagged in the panel boards, in all gutters, and in all junction boxes where unused circuits terminate for the purpose of identifying the various circuits.
- b. Tag feeders and mains in the switchboards.
- c. Place identification tags within three inches (3”) of the terminal connections at each feeder circuit breaker. Tag with adhesive-type marker.

493.7.7 Service Entrance – All services shall be reviewed on a case by case basis.

493.7.8 Junction and Pull Boxes – Provide NEMA 4X watertight stainless steel enclosures for junction and pull boxes.

493.7.9 Raceway

493.7.9.1 Rigid Aluminum Conduit - Provide rigid aluminum conduit, including bushings, couplings, elbows, and nipples meeting requirements of ANSI C 80.1 and NEC.

493.7.9.2 PVC Schedule 40 Conduit – Provide rigid Schedule 40 PVC conduit for underground burial.

493.7.9.3 Warning Tape – Provide heavy-gauge, yellow plastic tape for use in trenches containing buried conduit. Warning tape shall state “Warning, Buried Electrical.”

493.7.9.4 Raceway Schedule – Minimum Size: 3/4”
 Exterior: Aluminum
 Underground: PVC Schedule 40

493.7.10 Conductors

Identify power and control conductors at each termination and in all accessible locations such as handholes, panels, pull boxes, and terminal boxes.

For power conductors provide all single conductors and individual conductors of multi-conductor power cables with integral insulation pigmentation of the designated colors, except conductors larger than No. 6 AWG may be provided with color coding by wrapping the conductor at each end with vinyl tape.

Use the following colors:

<u>System</u>	<u>Conductor</u>	<u>Color</u>
All	Equipment grounding	Green
120/240 volts, 1-phase, 3-wire	Grounded neutral	White
	One hot leg	Black
	Other hot leg	Red

230/120 volts, 3-phase, 4 wire	Grounded neutral	White
	Phase A	Black
	Phase B	Red
	Phase C	Blue
480/277 volts, 3-phase, 4-wire	Grounded neutral	White/black tracer
	Phase A	Brown
	Phase B	Orange
	Phase C	Yellow

Phase A, B, C, implies the direction of positive phase rotation. Phase rotation shall be counter clockwise beyond first point of entry.

Provide stranded conductors, except provide solid conductors where No. 10 AWG and No. 12 AWG are required in lighting and receptacle circuits.

Utilize only conductors meeting applicable requirements of NEMA WC3, WC5, WC7, and ICEA S-19-81, S-61-402, and S-66-524.

Provide conductors with Type THW or Type THHN/THWN except for sizes No. 6 and larger, provide conductors with XHHW insulation. Provide copper conductors.

493.7.11 Grounding

Ground all exposed metallic parts of electrical equipment, raceway systems, and the neutral of all wiring systems in accordance with the NEC, state, local, and other applicable laws and regulations.

Provide copper-clad steel ground rods not less than $\frac{5}{8}$ " in diameter, ten foot (10') long, driven full length into earth, six feet (6') apart.

493.7.12 Testing

Test all wiring and connections as required by the **CITY** representative and other authorities having jurisdiction. Correct all failures in a manner satisfactory to the **CITY** representative. The **CONTRACTOR** shall pay all costs of testing, including costs of correcting failures, furnishing all necessary testing equipment and of replacing or repairing any damage to associated work or surrounding area resulting there from and correcting faulty installations. Test resistance to ground by use of a megohm instrument with a maximum resistance to ground of five (5) ohms, and provide additional grounding as required.

Accomplish the following tests for all wire and connections:

- a. Continuity
- b. Proper grounding
- c. Short circuits in system
- d. Electrical motor controls

- e. Panels with main disconnected from the feeder
- f. Sub and branch feeder connections
- g. Proper rotation of all motors.

Subject all electrical systems to complete operational tests in accordance with placing the station in operation.

493.8 LIFT STATION INSTALLATION

- 493.8.1** Installation - The **CONTRACTOR** shall install one submersible automatic lift station. The station shall be complete with all equipment specified herein, factory installed in a fiberglass reinforced polyester resin enclosure or lined per section 499-02-99-06. The equipment shall be installed in strict accordance with the approved shop drawings, manufacturers instruction, and to operate as intended by the manufacturer.
- 493.8.2** Manufacturer's Representative - The equipment manufacturer for the submersible lift station shall furnish services of a representative approved by the **CITY** to aid and be present during installation, inspect the completed installation, operate the equipment, place the equipment in operation, instruct the **CITY'S** operational personnel in the maintenance of the units, send written notice that the above has been complied with, and the equipment is working in accordance with these specifications.
- 493.8.3** Test - After the lift station has been installed, the pumps shall be tested for amperage draw and voltage with Total Dynamic Head (TDH) pressure and rate of flow at three (3) points on the pump curve including the design point specified. Rate of flow and head must be within ten percent (10%) and five percent (5%) above design curve respectively for acceptance.
- 493.8.4** Equipment Installation Certification - A written report shall be submitted to the **UTILITY DIRECTOR** after the lift station has been installed and satisfactory pump tests have been run and all necessary operational features of the lift station are in accordance with the plans and specifications. The report shall certify that equipment has been satisfactorily installed, operated, and test run and that **CITY** personnel have been instructed by the pump manufacturer's representative.

493.9 WET WELL AND MANHOLE ABANDONMENT

Existing wet wells and manholes that are no longer to be used in the sanitary sewer system shall be abandoned. The **CONTRACTOR** shall divert existing sewage flows as called for on the plans and as specified herein. Pipe openings shall be plugged in a manner satisfactory to the **UTILITY DIRECTOR**. Where manholes are to be abandoned, the rim and cover shall be removed and salvaged in accordance with the Special Conditions. Manhole and wet well tops shall be removed and disposed of by the **CONTRACTOR** as specified elsewhere in the specifications. Remove top sections to the elevations shown on the plans. Where no elevation is shown, the manhole or wet well top section shall be removed to the first joint or 24" whichever is greater. The **CONTRACTOR** shall fill and compact the remaining bottom section with select backfill.

493.11 SCADA

Lift Stations shall be furnished with Supervisory Control and Data Acquisition (SCADA) equipment and shown as a part of the construction plans. SCADA shall be furnished and installed by the **CONTRACTOR** under the **CITY'S** direction. Refer to Section 495-2.7 for further requirements.

DIVISION 490

SECTION 495

**SANITARY SEWER
SYSTEM
DESIGN,
PROCEDURES
AND
POLICIES**

SECTION 495

SANITARY SEWER SYSTEM DESIGN, PROCEDURES, AND POLICIES

495.1 GENERAL

495.1.1 This section has been provided as a guide for engineers, developers and other users to convey information concerning the **CITY** sanitary sewer system. The information provided hereinafter is general in content but represents the policies, resolutions and ordinances established by the **CITY** with regard to certain criteria the **CITY** feels is necessary in the expansion of its Sanitary Sewer System. Certain items, more particularly specified in other Sections of Division 490 or as provided in official resolutions, ordinances, or policies of the **CITY** shall govern over the guidelines specified herein.

495.1.2 Reference to materials under this section are used in general. Refer to Section 499 for particular sizes, manufacturers, and model numbers.

495.2 DESIGN OF SANITARY SEWER SYSTEM

495.2.1 Sewer Gravity Mains

495.2.1.1 Pipe Sizes

Sewer main pipe diameters shall be 8", 10", 12", 15", 18" or 24". Sewer service laterals shall be six inches (6") in diameter.

495.2.1.2 Pipe Slopes

Sewer mains and laterals shall be designed and constructed so they conform to the following minimum pipe slopes.

<u>Diameter</u>	<u>Min. Slope (%)</u>
6"	0.6
8"	0.4
10"	0.30
12"	0.24
15"	0.18
18"	0.14
24"	0.10

If the system does not meet minimum slope, the system will not be accepted by the **CITY** until corrected. Systems need to be designed above these requirements to allow for field installation deviations.

Maximum slope of sewer mains shall be designed to limit sewage flows to eight feet (8') per second, or less.

495.2.1.3 Type of Pipe

495.2.1.3.1 Sewer mains shall be constructed of PVC except as specified in Section 495.2.1.3.2.

495.2.1.3.2 D.I.P. shall be installed where sewer mains fall under any of the following installations:

- a. Cover over sewer main is less than 48".
- b. Where vertical or horizontal separation between water mains and storm sewer mains cannot be met.

495.2.1.4 Location

495.2.1.4.1 Sewer mains shall be constructed in the center of rights-of-way and easements.

495.2.1.4.2 Sewer mains and manholes constructed in easements shall be installed in a 20' minimum utility easement.

495.2.1.4.3 No permanent structures shall be constructed within ten (10) ft. of the edge of a permanent easement on front or rear setbacks or within two (2) ft. on side setbacks.

495.2.1.5 Depth

495.2.1.5.1 PVC sewer mains shall maintain a minimum cover of forty-eight inches (48"). The depth of cover shall be measured from the top of PVC sewer main to the finished grade directly above the pipe or from the top of the pipe to the centerline of the roadway, whichever is greater.

495.2.1.5.2 Minimum clearance between sewer mains and water mains shall be ten foot (10' preferred) six foot (6') minimum, horizontally or 12" (preferred), six inches (6") minimum, vertically. Where the minimum standard cannot be met for horizontal separation, or vertical separation, the sewer main crossing shall be constructed of ductile iron pipe so that one (1) joint of pipe is centered under the water main or encased in concrete to a minimum of ten feet (10') to either side of the water main.

495.2.1.5.3 Sewer mains shall not exceed fifteen feet (18') in depth unless approval is made by the **CITY ENGINEER** and the **UTILITY DIRECTOR**.

495.2.2 Sewer Manholes

- 495.2.2.1 Maximum spacing between sewer manholes shall be four hundred feet (400'). Provide manholes where changes in slope or alignment occur.
- 495.2.2.2 Manhole depths from 0' to 12' shall be constructed using 24" ring covers. Manholes in excess of 12' shall use 32" diameter ring covers.
- 495.2.2.3 Where the depth of manhole from the top of ring to the invert of effluent main is less than 48", a flat top manhole shall be used.
- 495.2.2.4 Drop connections shall be provided where the difference in elevation between the incoming sewer and the manhole invert is 30" or greater.
- 495.2.2.5 The minimum diameter of manholes shall be 48".
- 495.2.2.6 All manholes shall be lined on the inside with a material in section 499.11.99.08.
- 495.2.2.7 Pipes entering manholes in line with flow channel shall be 0.1' minimum above the effluent invert, not to exceed 30" without a drop connection. Pipes entering manholes not in line with flow channel shall be 0.2' minimum above the effluent invert.
- 495.2.2.8 Total depth of manholes shall not exceed 18' in depth unless approved by the **UTILITY DIRECTOR**.
- 495.2.2.9 All new connections to existing manholes shall be done by coring the opening and installing a boot for the pipe to connect to. Reconstruct flow channel as required.
- 495.2.2.10 Manholes located below the 100-year flood elevation will have a bolt-down, water tight rings and covers pre-cast into the manhole cone.
- 495.2.2.11 All manhole adjusting rings used on manholes in the street will be brick or precast adjusting rings.

495.2.3 Service Laterals

- 495.2.3.1 Sewer service laterals shall be centered in lots and shall be one (1) service lateral for each property.

- 495.2.3.2** Laterals shall be deep enough to serve the lowest point on the property being served, using minimum slopes established by the Southern Standard Plumbing Code. Minimum depth at the property line shall be four feet (4’).
- 495.2.3.3** Minimum size of service laterals shall be six inches (6’’).
- 495.2.3.4** All laterals shall be installed perpendicular to main except dead end manhole connections where lateral length is limited to a maximum of 75’.
- 495.2.3.5** When connecting to laterals, a clean-out shall be installed at the property line as detailed in Section 498-2.2B.
- 495.2.3.6** All laterals shall be installed straight without bends from the main to the property line, except for the wye and 45° bend connecting to the main.
- 495.2.3.7** New service connections to existing sewer mains shall be installed in accordance to Detail 498-.1A.

495.2.4 Force Mains

- 495.2.4.1** City maintained force main pipe diameters shall be 4’’, 6’’, 8’’, 12’’, 18’’, 20’’, or 24’’. Other size pipe diameters shall not be allowed except that where new mains are to be connected to existing mains which are of a lesser diameter.
- 495.2.4.2** Privately maintained force main pipe line diameters shall be 1’’, 2’’, 3’’, 4’’, 6’’, 8’’, 12’’, 18’’, 20’’, or 24’’.
- 495.2.4.3** Four inch (4’’) to twenty four inch (24’’) sewer force mains shall be polyvinylchloride (PVC), ductile iron pipe (DIP), OR High Density Polyethylene (HDPE) based on pressure. All PVC pipe shall be sewer green with locating wire(s).
- 495.2.4.4** Sizing of sewer force mains shall be in accordance with sound engineering practices and the City of Valdosta Water and Sewer System Master Plan.
- 495.2.4.5** Air release valves shall be installed at all high points in the force main. Force main to be installed with a minimum 48’’ cover to facilitate proper ARV installation.
- 495.2.4.6** Force mains shall be designed to maintain a minimum velocity of two (2) FPS and shall not exceed eight (8) FPS.
- 495.2.4.7** Force mains shall be constructed eight feet (8’) off the right of way. For projects where a new road is being constructed parallel with the force main location, the force main may be installed under the pavement at a depth of 48’’.
- 495.2.4.8** PVC force main pipe shall meet requirements of ANSI/AWWA C-900, DR 14 and DR 18 for sizes four inch (4’’) through 12’’; C-905, DR18 for sizes 14’’ through 36’’.

- 495.2.4.9** Fittings shall be DIP fittings for DIP and PVC pipe installations. Mega-lugs or concrete thrust block can be used on DIP pipe and on PVC pipes. Mega-Lugs on PVC have to be non-penetrating mega lugs, specifically designed for PVC.
- 495.2.4.10** For PVC force mains, DIP tees and valves will be installed at any potential future connection points where the future connection is six inch (6") or larger in diameter.
- 495.2.4.11** Taps are not allowed on sewer force mains. Wyes will have to be cut in when connections to existing force mains are approved by **UTILITY DIRECTOR**.
- 495.2.4.12** Locating wire(s) will be installed on all PVC and HDPE force mains.
- 495.2.4.13** Provide design calculations showing the pressures designed for the forcemain system. The working pressures within the system shall not exceed the pressure class of the pipe with a 1.5 safety factor. PVC C-900, DR-14 is rated at 305 psi, PVC C-900, DR-18 is rated at 235 psi.
- 495.2.4.14** Where new force mains are to be connected to existing City manholes the interior of the manhole shall be relined with a material listed in section 499.11.99.08.
- 495.2.4.15** Where new force mains are to be connected to existing City manholes the manhole shall be cored with a boot installed. The inside of the manhole shall be lined to the satisfaction of the **UTILITY DIRECTOR**. The existing flow channel shall be reconstructed to properly handle the new influent flow.
- 495.2.4.16** Force mains shall connect to manholes near the manhole bottom and in such a manner so as to provide maximum direction into the effluent pipe, between 90 and 180 degrees, 180 degrees preferred.

495.2.5 Lift Stations

- 495.2.5.1** Lift stations shall be submersible as specified in Section 498-4. Submersible pump stations are more desirable lift stations
- 495.2.5.2** Provide a 5/8" x 3/4" water service and meter. Meter box shall be located at the property line.
- 495.2.5.3** Provide a 50' x 50' lift station site, minimum unless otherwise approved by the **UTILITY DIRECTOR**.

- 495.2.5.4** Access to the lift station shall be provided by a twelve foot (12') wide concrete driveway. Driveway shall be six inches (6") minimum over compacted subgrade 98% of modified proctor. Concrete driveways shall be eight inches (6") thick with re-bar reinforcement, #4 @ twelve inches (12") each way, minimum.
- 495.2.5.5** Chain link fencing around the lift station site is required with #57 stone 4-inches deep inside fence, so there is no grass to maintain. Fabric under rock.
- 495.2.5.6** Provide a lift station site plan showing the location of the wet well and pump station, electric service, water service, driveway apron, and relativity of connecting pipes which include gravity sewers and force main. See Standard Details 498-4.1A and B for "Typical Site Plan" layout.
- 495.2.5.7** Electrical service to the lift station shall be underground from an electric pole located along the right of way line. Voltage shall be 277/480 or 240/120 volts. Developer will need to pay for electric until lift station has been accepted by the **CITY**, all punch list items have been completed, and all submittals and asbuilts received. If only single-phase power is available, provide variable frequency drives to convert to three-phase.

495.2.5.8 Wet Wells

- 495.2.5.8.1** Only one (1) influent invert shall be installed into wet well. Provide a junction manhole upstream from the wet well. Junction manhole must be lined as specified in Material Specification 499-11-99-06.
- 495.2.5.8.2** City maintained wet wells shall be concrete and lined as specified in Material Specification 499-11-99-08.
- 495.2.5.8.3** Fiberglass wet wells will not be accepted as stand alone privately maintained systems. Fiberglass wet wells must be installed with a reinforced concrete slab and concrete walls for structural support.
- 495.2.5.8.4** City maintained wet well shall have nominal inside diameters of either 6', 8', 10', or 12'. Minimum wall thickness shall be eight inches (8"), as specified in Material Specification 499-02-99-02, 499-02-99-07 or 499-02-99-20.
- 495.2.5.8.5** Maximum depth of wetwells shall be 20' unless otherwise approved by the **UTILITY DIRECTOR**.

495.2.6 Level Controls

- 495.2.6.1** Provide a minimum of forty eight inches (48") between the bottom of the wet well and the elevation for both pumps to be turned off (low liquid level).

- 495.2.6.2 Provide minimum 24” between the elevation for both pumps off and the elevation for the first pump to come on.
- 495.2.6.3 Provide 12” between the elevation for the first pump to come on and the elevation for the second pump, or lag pump, to come on.
- 495.2.6.4 Provide 12” between the elevation for the second pump to come on and the elevation of the lowest influent pipe invert.
- 495.2.6.5 Provide 12” between the influent pipe invert and the high level alarm or as directed by the **UTILITY DIRECTOR**.

495.2.7 SCADA- City Maintained Lift Stations

- 495.2.7.1 Provide for Supervisory Control and Data Acquisition (SCADA). All lift stations shall be installed with a SCADA system. System shall be installed by the **CONTRACTOR** with the lift station. Installation of the SCADA system shall be required for final acceptance of the lift station.
- 495.2.7.2 SCADA systems will be installed before the lift station is on-line and functional. The **DEVELOPER** must do a radio survey to determine height of the antennae required. Coordination with the Utility Department shall be made for the radio survey and the installation of the SCADA system.

495.2.8 Site Plans

The following information and data must be provided on all site plans in order to obtain approval.

- 495.2.8.1 Provide an individual plan drawing titled “Utility Plan”. The Utility Plan should adhere to or show the following requirements as applicable.
- 495.2.8.2 All water and sanitary sewer construction shall be in accordance with the latest edition of the Volume I, City of Valdosta Standard Specifications for Water and Sanitary Sewer Construction. A note shall be placed on the plan accordingly.
- 495.2.8.3 The location of all existing and proposed sewer mains, manholes and sewer services relative to this site are to be shown.
- 495.2.8.4 City will maintain all sewer mains eight inch (8”) diameter and above that include manholes both onsite and offsite. Sewer services and cleanouts will be maintained by the City when they are located within City easements or the City Right-of-way. A note shall be placed on plans accordingly.
- 495.2.8.5 Sewer system asbuilt to be submitted to **UTILITY DIRECTOR** prior to issuance of Certificate of Occupancy (CO). Asbuilt to be in accordance with Section 496.

- 495.2.8.6 If the site is connecting to an existing sewer service the sewer service should be shown in its correct location. Also show location of all existing sewer services relative to the site.
- 495.2.8.7 Show manhole locations on both sides of sewer service locations.
- 495.2.8.8 Show rim and inverts of all sewer manholes relative to this site.
- 495.2.8.9 Show the distance between manholes.
- 495.2.8.10 Show distance from the downstream manhole to the sewer service.
- 495.2.8.11 Show diameter of all sewer mains.
- 495.2.8.12 Existing sewer services that are to be connected to should be verified as to existence, location and elevation. Show date sewer service was excavated and verified along with invert elevation and ground elevation on the plans.
- 495.2.8.13 If no sewer service is available and the site is to connect to a City sewer main show the distance from the downstream manhole to the new service location.
- 495.2.8.14 If a new sewer service is to connect to an existing manhole show the connection to be made by “coring” the manhole and installing a boot.
- 495.2.8.15 If a new sewer service is to connect to an existing manhole show the manhole rim and invert elevations as well as the new invert in bold.
- 495.2.8.16 If a new service is to connect to an existing manhole provide a note that the manhole flow channels are to be reconstructed as required by the **UTILITY DIRECTOR**.
- 495.2.8.18 Show the diameter, pipe material and slope of the new sewer service pipes.
- 495.2.8.19 If verification of the sewer service is to be postponed until site excavation a note must be put on the cover sheet as follows:

“By approval of this site plan the developer hereby acknowledges that the location and elevation of the City’s sewer service has not been verified and hereby accepts full responsibility for any costs or delays incurred in the location, installation or connection thereto. The owner further understands that any service locations provided by the City are from the best available records and that the City in no case will be held liable for any consequences resulting from the service being at the wrong elevation or not being where specified including any delays to remedy the situation. The owner further agrees to excavate the service prior to any construction on the site and to provide the City Utility Department (229) 259-3592 with the actual location and elevation of

the service, relative to the downstream manhole.”

Acknowledgement Signature of the site developer

- 495.2.8.20** A cleanout must be shown at the property line for all sewer service connections.
- 495.2.8.21** If the site has an existing structure and the structure is connected to City sewer there must be a cleanout at the property line. If the sewer service does not have a cleanout, provide one at the property line.
- 495.2.8.22** All existing sanitary sewer manhole covers that fall in areas of new construction are to be adjusted to the new surrounding grade. Add note if applicable.
- 495.2.8.23** If the site has a private lift station and the force main is to connect to a City manhole show the inside of the manhole to be relined with a material from specification 299-11-99-08.
- 495.2.8.24** All sewer mains will require an asbuilt drawing. The drawing shall show the location of all sewer mains, manholes and services. Asbuilt drawing shall be in accordance with Section 496, Volume I, City of Valdosta Standard Specifications for Water and Sanitary Sewer Construction. A note should be placed on the plans accordingly.
- 495.2.8.25** All City maintained sewer mains and manholes will require an easement to be provided prior to obtaining a Certificate of Occupancy (CO). Add a note to the plans accordingly. Minimum width of easement shall be 20’.
- 495.2.8.26** When landscaping is to be installed no large trees can be installed over sewer mains.
- 495.2.8.27** Indicate number of stories and units for all buildings.

495.3 PROCEDURES

495.3.1 Locating Laterals

- 495.3.1.1** Locations of sanitary sewer laterals can be obtained from the office of the **UTILITY DIRECTOR** either in person or by telephoning (229) 259-3592. Distances will be provided from the downstream manhole to the lateral location from asbuilt drawings. When inquiring to obtain lateral locations, one or more of the following must be provided:

- A) physical address of the property
- B) parcel account number as assigned by the Lowndes County Property Appraiser's office
- C) copy of the deed to the property or authorized legal document such as a boundary survey or site plan.

495.3.1.2 Where locations given are proven to be inaccurate, due to inaccurate asbuilts, and after a reasonable effort to locate the lateral, the **UTILITY DIRECTOR** shall be notified. A reasonable effort shall be defined as excavating a minimum distance of ten feet (10') either side of the location provided and to a depth equal to the elevation of the sewer main. If the **UTILITY DIRECTOR** ascertains that a reasonable effort has been made, he will issue a work order to the City Utility Department to locate or provide a service lateral. Should a work order be necessary, sufficient time shall be allowed to locate the lateral. Generally a minimum of 48 hours is required to locate a lateral by excavation.

495.3.1.3 If no lateral has been provided to a property and the property is located within an annexed island, a new lateral will be installed at no cost to the property owner. If an additional lateral to a property is requested where at least one (1) lateral has already been provided, the total cost of the lateral installation, shall be borne by the property owner. Requests for lateral locations shall be made in writing to the **UTILITY DIRECTOR**. A written estimate of the installation cost will be provided. If the lateral is requested to be installed, a check in the amount of the estimate shall be delivered to the **UTILITY DIRECTOR** prior to installation of the lateral. Upon completion of the installation, the requestor shall pay any difference between the actual and the estimated cost of the installation or will be reimbursed the difference should the actual installation cost be less than the estimated cost.

495.3.2 Lateral Stoppages

495.3.2.1 Where lateral sewer services are suspected to be stopped up, the following procedure must be adhered to before notifying the City Utility Department to clear the stoppage. The plumber shall insert a sewer tape (snake) into the customer's sewer line to unstop the blockage. If the plumber cannot unstop the sewer line and feels that an adequate amount of tape inserted to be into the right of way, they shall call the City Utility Department at (229) 259-3592. At this time, the plumber is to request verification from the Utility Department personnel of that fact. If it is agreed to be a **CITY** problem by this

means, the plumber's work shall be terminated. At this point, he will be entitled to submit a reasonable bill to the Utility Department for reimbursement. The **CITY** will then excavate if necessary and make the appropriate repairs. If, following excavation, it is discovered that the problem is the customer's, the customer will be required to recall the plumber and the full bill will be the customer's responsibility.

495.3.2.2 If the stoppage is at the property line and appears it is the connection to the lateral (doughnut) it will be considered the customer's problem, and the excavation will be done by the plumber. If at all possible, the **CITY'S** representative will remain on site to witness the excavation and verify the findings. If roots are the problem, and it is determined the problem originated from this connection, the **CITY** will make the repairs to its lateral but not reimburse any monies for the excavation.

495.3.2.3 As an alternate method of determining stoppage responsibility, the owner or plumber shall excavate the lateral at the property line and make a hole in the pipe. If the pipe is full at this point, the owner or plumber shall call the City Utility Department as specified above. If the pipe is not full the owner or plumber shall resolve the situation and repair the pipe. Should the pipe be stopped up the bill should be handled as specified in this section.

495.4 POLICIES

495.4.1 Extending City Sewers

495.4.1.1 The **CITY** has developed a master plan for the extension of the sanitary sewer system. Any extensions, either constructed by the **CITY** or by private developer, shall adhere to the plan.

495.4.1.2 Annually, the **CITY** budgets for extending sewers throughout the **CITY**. The extensions stem from written requests to extend sewer and from the **CITY'S** master plan providing for a chronological method of extending the **CITY'S** sewer system annually.

495.4.1.3 The **CITY** will require that any land or development receiving sanitary sewer services from the **CITY** will annex into the **CITY** if or when it is contiguous to the **CITY**. A "Petition for Annexation" must be executed prior to the **CITY** authorizing the connection.

- 495.4.1.4** All new residential and commercial structures in the **CITY** shall be required to connect to the **CITY'S** sanitary sewer system if available within 200-feet.
- 495.4.1.5** When an existing on-site sewage disposal system (septic tank and drain field) for development fails to function properly or requires pumping, it shall be abandoned and the structure connected to the sewer system if service available 200-feet.
- 495.4.1.6** New or replacement septic systems will not be permitted if sewer service is available within 200-feet of the development.
- 495.4.1.7** Where sewer is required to be extended in order for a development to adhere to the policies set forth herein, it is the policy of the **CITY** that the applicant requiring the extension provide a request to the office of the **UTILITY DIRECTOR** for the extension. Requests to extend the **CITY'S** sewers must be in the form of either a written request or by a developers' agreement. Written requests shall contain the following information:
- A) Owner of the property
 - B) Owner's address
 - C) Property Appraiser's tax number
 - D) Sketch, plan, or map showing the location of the property
 - E) Legal description of the property
- Contact the City of Valdosta Utility Department at (229) 259-3592 for more information concerning developers' agreements.
- 495.4.1.8** All extensions shall be in accordance with the requirements and specifications of this manual. The cost of the extension shall include but not be limited to administration, engineering, surveying, inspection, testing permitting, pipes, manholes, appurtenances, construction, financing, and other costs relating to the construction of the extension. The extension shall be designed in accordance with the provisions of this section.
- 495.4.1.9** Except for those extensions where the applicants' connection charge exceeds the estimated construction cost or for those extensions authorized by the City Manager under Paragraph 495.3.1.1 all extensions must be approved by City Council.
- 495.4.1.10** No extension will be made outside the **CITY** limits unless the applicant agrees to annex all property to be served or, if the applicant's property is not annexable, agrees by appropriate document to annex into the **CITY** upon the property becoming annexable. If the applicant cannot annex into the **CITY**, all costs of the extension shall be borne by the applicant.
- 495.4.1.11** When estimating the construction cost of the extension, the length considered shall be the lesser of the distances from the end of the existing sewer main to the

farthest point of the applicant's property or to the termination point consistent with good engineering practice.

495.4.1.12 In cases where individual sewage disposal systems (septic and drain field) have failed or necessitate abandonment or relocation for any reason, or have been deemed a public health hazard by the local health authority, the **CITY** specifically reserves the right to exercise discretion in the adherence to the terms set forth herein.

495.4.1.13 Construction of the extension shall be in accordance with plans and specifications approved by the **CITY ENGINEER AND UTILITY DIRECTOR** and may be by contract awarded by the **CITY**, by the **CITY** forces, or by the applicant with the approval of the City Council, all as addressed by the agreement between the **CITY** and the applicant.

DIVISION 490

SECTION 496

**SANITARY SEWER
SYSTEM**

ASBUILTS

SECTION 496
SANITARY SEWER SYSTEM ASBUILTS

496.1 GENERAL

- 496.1.1** All as-builts for projects are required to be on at least 24" x 36" paper, and shall bear the name, address, and telephone number of the firm preparing the drawing and the date the as-built data is added to the original via the revision block. 3-sets of plans and one electronic copy of the plans are required to be submitted. The electronic AutoCAD drawing files shall be referenced to Georgia State Plane Coordinates, West Zone (NAD 83, 2007 adjustment) and NAVD 88.
- 496.1.2** Surveyor's statement (with seal and with an original signature on each sheet) shall verify that as-built drawings reflect the true conditions in the field or Engineer's statement (with seal and an original signature on each sheet) shall state that the project will function as was originally intended on the approved construction plans.
- 496.1.3** Contractors' statement (with an original signature on each sheet) shall verify that all construction specifications and product qualities have been met or exceeded.
- 496.1.4** "AS-BUILT DRAWING" or "RECORD DRAWING", the name of the project and the date shall be clearly labeled on each sheet.
- 496.1.5** Street names shall be on all streets. All easements and right-of-ways shall be shown and clearly labeled.
- 496.1.6** If the utility system is to be private (not to be dedicated to City), then so state on each sheet.
- 496.1.7** The location and elevation of the benchmark referenced will be shown on the drawing. If the referenced benchmark is not within the project, then a complete description of its location will be provided to assist in future locating.
- 496.1.8** The locations and description of any utility lines and other installations of any kind or other description known to exist within the construction area. The location includes dimensions to permanent features. The construction area is defined as the area on site that is disturbed.
- 496.1.9** The locations and dimensions of any changes to buildings and structures.
- 496.1.10** Correct grade and alignment of roads.
- 496.1.11** Changes in details of design or additional information such as approved placement details, pipe sizes, material changes, etc.

496.2 ASBUILT PLANS

496.2.1 General

The following information is required on all asbuilt drawings. The **CONTRACTOR** shall note that additional information may be required by the **CITY ENGINEER AND UTILITY DIRECTOR** when deemed necessary.

496.2.2 Public Projects

- 496.2.2.1** All piping, wyes, valves, manholes and special cases shall be located in two directions horizontally and one direction vertically, in the same manner as water locations. All wyes should be located in two directions horizontally.
- 496.2.2.2** Horizontal dimensions shall be to the nearest tenth of a foot (i.e., 78.6'). Vertical dimensions shall be to the nearest hundredth of a foot (i.e., 217.65').
- 496.2.2.3** Identify runs of gravity mains (i.e., 300.4 feet of 8" PVC SDR 35 at 0.4%).
- 496.2.2.4** Elevations shall be given for the top of all manhole covers and for all inverts.
- 496.2.2.5** Service laterals are to be identified with location of end service or plug (station and offset measured upstream).
- 496.2.2.6** Manholes shall be identified by types.

496.2.3 Private Projects

- 496.2.3.1** All piping, wyes, valves, manholes and special cases located within City right-of-way and easements shall be located in two directions horizontally and one direction vertically, in the same manner as water locations. All wyes should be located in two directions horizontally.
- 496.2.3.2** Horizontal dimensions shall be to the nearest tenth of a foot (i.e., 78.6'). Vertical dimensions shall be to the nearest hundredth of a foot (i.e., 217.65').
- 496.2.3.3** Identify runs of gravity mains (i.e., 300.4 feet of 8" PVC SDR 35 at 0.4%).
- 496.2.3.4** Elevations shall be given for the top of all manhole covers and for all inverts located within City right-of-way and easements.
- 496.2.3.5** Service laterals are to be identified with location of end service or plug (station and offset measured upstream).

496.2.4 Force Mains

- 496.2.4.1 Locate all valves, fittings, etc. in two directions as above.
- 496.2.4.2 Locations of pipe shall be shown at all changes in direction and at a maximum of every 100'.
- 496.2.4.3 Show all sizes and types of valves, fittings, pipe, etc.
- 496.2.4.4 Special detail drawings will be required where installations were not as shown on original drawings due to field conditions or where required for clarity.

496.2.4.2 Lift Stations

- 496.2.4.3.1 Wet well size and location shall be shown.
- 496.2.4.3.2 Elevations for top, bottom, inverts, adjacent ground and type and size of lines and fittings for all lines entering or leaving the wet well.
- 496.2.4.3.3 All schedules which show pump, motor and electrical data shall be amended and shall be submitted with wet well drawings.
- 496.2.4.3.4 All improvements within the pump station boundaries shall be located horizontally and vertically to the nearest tenth of a foot (i.e., 5.6', including valve pit, pump-out, water spigot, backflow device, wet well, control panel, bends, fittings, etc.).

496.3 TELEVISION INSPECTION

496.3.1 General

- 496.3.1.1 The **CONTRACTOR** shall furnish all labor, materials and equipment and perform all operations for the television inspection of the completed sanitary sewer system including necessary cleaning of the sewers.
- 496.3.1.2 All materials, equipment and workmanship shall be first class and to the highest industry standards. Material and equipment shall be in good condition and designed specifically for the functions for which the **CONTRACTOR** utilizes them.

- 496.3.1.3** The term “manhole section” as used in this section shall mean the entire length of pipe between and connecting two (2) manholes. The term “clean” as used in this section shall mean the complete and total removal of all solid or semi-solid materials from the sewer.
- 496.3.1.4** Necessary cleaning and the television inspection shall not be done until after the sewer system improvements, or an appropriate portion thereof, described by the plans and Contract Documents have been completed, roadway construction is completed, and remaining work would not be expected to damage the sewer system. However, the television inspection must be completed prior to placement of the final course of asphalt.
- 496.3.1.5** The sequence of operations shall be:
- a. Cleaning
 - b. Hand pulling mandrel
 - c. Additional cleaning if required
 - d. Television inspection with continuous CD or DVD and audio
- 496.3.1.6** **CONTRACTOR** or selected subcontractors shall meet, as a minimum, the following requirements:
- a. At least two (2) projects of similar magnitude and nature satisfactorily completed within the last year.
 - b. At least three (3) satisfactory references from professionals attesting to the **CONTRACTOR** or subcontractors ability to do the work.
- 496.3.1.7** The **CONTRACTOR** shall be responsible for and pay all costs for correcting any and all defects in the sewer system made apparent by any and all inspections and tests, even if the work or parts of the work may have passed the other tests and inspections. Further, the **CONTRACTOR** shall be held completely and solely responsible for the repair of other items of work including but not being limited to roadways, manholes, lift stations, etc., and shall pay any and all costs incurred by any party or anyone whatsoever resulting from defects in material, equipment or labor or his failure to properly protect the work.
- 496.3.1.8** The **CONTRACTOR** shall be responsible for securing an adequate means of providing water for the cleaning operation and, if a fire hydrant is used, shall pay all required meter deposits and charges. The **CONTRACTOR** shall not use un-metered water. Television inspection will not take place unless lines are properly cleaned.

496.3.1.9 Provide written report and CD or DVD upon completion to the City of Valdosta.

496.3.2 Line Cleaning

496.3.2.1 General

496.3.2.1.1 The **CONTRACTOR** shall provide all equipment, materials, labor and plans for the cleaning and material removal operation. Cleaning shall be done as deemed necessary by the **CITY ENGINEER** or **UTILITY DIRECTOR** for the proper television inspection of the sewer line.

496.3.2.1.2 Cleaning shall be by hydraulically propelled or mechanically operated cleaning equipment. Roots, grease, and other debris or intrusions shall first be removed by appropriate mechanical cleaning equipment if necessary, then hydraulic cleaning shall be accomplished to insure line sections are sufficiently clean for inspecting.

496.3.2.1.3 The **CONTRACTOR** shall determine prior to submission of his bid, the amount of material to be removed from the pipeline, the type of cleaning, and the equipment required by making a field inspection of the pipeline.

496.3.2.1.4 The equipment used for cleaning line sections shall be capable of removing dirt, rocks, roots, and other deleterious materials and obstructions from line sections.

496.3.2.2 Cleaning Equipment

496.3.2.2.1 Whenever bucket machines are used, the bucketing process shall be in one line section at a time. A bucket of proper size shall be placed into the downstream manhole and pulled toward the upstream manhole. The bucket shall be retrieved and emptied at varying intervals, depending upon the amount of material being removed. This process shall be repeated until the bucket has been pulled through the entire line section. Upon completion of the bucketing, a movable dam of size equal to the line size, shall be propelled through the line to insure that all sand, grease, and other material have been removed.

496.3.2.2.2 Power rodding machines shall be of a continuous rod type capable of operating between manholes. Machine shall have a positive rod drive and be capable of performing the task required. Cutters shall be the proper size for the pipe being cleaned. Satisfactory precautions shall be taken to protect sewer lines from damage that might be caused by the improper use of cleaning equipment.

Material removed from line sections either by bucketing or rodding shall be disposed of at a sanitary landfill or as designated by the **CITY ENGINEER**.

496.3.2.2.3 Whenever hydraulically propelled cleaning tools are used which depend on water pressure for their cleaning force, precautions shall be taken to insure that the water pressure created does not cause any damage or flooding to public or private property being served by the line section involved. Water for cleaning trucks may be obtained from fire hydrants where available, but the **CONTRACTOR** shall take all precautions to conserve water and not use it unnecessarily. No fire hydrant shall be obstructed in case of fire in the area served by the hydrant. The **CONTRACTOR** shall exercise care so as not to damage the hydrants used. Proper precautions shall be taken at the downstream manhole to allow only the cleaning water to enter the line section downstream of the one being cleaned. All sludge, dirt, sand, rocks, grease, or other solid material resulting from the cleaning operation shall be trapped at and removed from the downstream manhole of the line section being cleaned. The solids shall then be disposed of at an approved disposal site.

496.3.2.3 Transporting Material

Trucks or trailers used with the cleaning equipment to transport the material removed from the pipeline shall be of adequate size for the service intended. They shall be of a type to preclude dropping, spilling, or leaking of material removed from the pipeline onto the roadway over the route between the cleaning operation and the point of disposal.

496.3.2.4 Sewer Line Flow Control

When elimination of flow in a line section is necessary for proper inspection, as determined by the **UTILITY DIRECTOR**, the following method of flow control shall be used:

When designated by the **UTILITY DIRECTOR**, a sewer line plug shall be inserted into the line at a manhole upstream of the section to be inspected. The plug shall be so designed that all or any portion of the sewage flow can be released. During inspection operations, flows shall be blocked in order to properly inspect the pipe at the invert. After inspection is complete, flow may be restored to normal or not more than one-half of the pipe diameter in order to avoid damage downstream. The **CONTRACTOR** shall be responsible for any damage caused by flooding during the time the sewer is plugged and shall take care to avoid any such occurrence and shall hold the **CITY**, the **CITY ENGINEER**, and **UTILITY DIRECTOR** harmless.

496.3.3 Television Inspection

496.3.3.1 General

The **CONTRACTOR** shall provide all equipment, materials, labor and plans for the inspection of the entire length of pipeline following the cleaning operation. Inspection shall be accomplished by means of closed circuit television. The work shall be performed under the continuous inspection of the **UTILITY DIRECTOR** or a designated representative.

496.3.3.2 Equipment

The television camera used for the inspection shall be one specifically designed and constructed for such inspection. The camera shall be mounted on a carriage to keep it in the center of the pipe. Lighting for the camera shall be supplied by a lamp on the camera capable of being dimmed or brightened remotely from the control panel. The lighting system shall be capable of lighting the entire periphery of the pipe, satisfactory to the **UTILITY DIRECTOR**. The camera shall be operative in 100% humidity conditions and shall have a minimum of 650 lines of resolution and tested to 400 psi. Telephones, sound power communication systems, or other suitable means of communication shall be set up between the winch at the manholes and the monitor control and operation van. Picture quality and definition shall be to the satisfaction of the **UTILITY DIRECTOR** and if unsatisfactory, the equipment shall be removed and no payment made for unsatisfactory inspection. A level gauge shall be attached to the camera so depth of water held in the lines can be measured.

496.3.3.3 Televising

The camera shall be moved through the sewer line in either direction at a uniform rate, stopping when necessary to insure proper documentation of the sewer's condition but in no case shall the television camera be pulled at a speed greater than thirty feet (30') per minute. Manual winches, power winches, television cable, powered rewinds, or other devices that do not obstruct the camera view or interfere with proper documentation of the sewer conditions shall be used to move the camera through the sewer line.

496.3.3.4 Written Record

Written location records shall be kept by the **CONTRACTOR** and shall clearly show the exact location, in relation to adjacent manholes, of each infiltration point discovered by the television camera. In addition, all wyes, tees, and other discernible features, including any defects, shall be recorded on a CD or DVD and a copy of such records shall be supplied to the **UTILITY DIRECTOR** and **CITY ENGINEER**. The **CONTRACTOR** shall also supply the **UTILITY DIRECTOR** and **CITY ENGINEER** with a typed copy of such records. The format of such records shall be as approved by the **UTILITY DIRECTOR** and **CITY ENGINEER** and shall contain all information pertinent to the inspection which may be required by the **UTILITY DIRECTOR** and **CITY ENGINEER**.

496.3.3.5 Continuous Video Tapes

496.3.3.5.1 The television inspection of each manhole section shall be continuous and shall be on not more than one continuous CD or DVD. The CD or DVD shall be made immediately after the section has been cleaned. All tapes shall be delivered to the **CITY** and become the **CITY'S** property upon delivery. All tapes shall be made in color, not black-and-white.

496.3.3.5.2 All video shall have a continuous display of footage, manhole section, and date. At the beginning of each manhole section, the **CONTRACTOR** shall identify the name of the program, the location of the project, the number of the tape, the beginning manhole number, and the ending manhole number.

496.3.3.5.3 CDs or DVDs shall be designed for use on computers.

496.3.3.5.4 Each CD or DVD shall be clearly identified on the outside by a typed label providing the following information:

Bid Number – (when applicable)	
Project Name	Written Report Number(s)
Date Televised	Contractor

496.3.3.6 Measurements

Measurement for location of defects, wyes, open joints, and other points of significance shall be above-ground by means of a meter device. Marking on cable, or the like, which would require interpolation for depth of manhole, will not be allowed. Measurement meters shall be accurate to two-tenths (0.2) of a foot over the length of the section being inspected. Accuracy of the measurement meters shall be checked daily by a suitable device.

496.3.3.7 Audio

All comments made for the written record as required by the **UTILITY DIRECTOR** and **CITY ENGINEER** and those comments required by the industry's highest standards shall be made on the video. The audio shall be clearly understandable and of a quality satisfactory to the **UTILITY DIRECTOR** and **CITY ENGINEER**. If unsatisfactory to the **UTILITY DIRECTOR** and **CITY ENGINEER**, the **CONTRACTOR** shall provide satisfactory equipment and perform again the inspections which were deemed unacceptable by the **UTILITY DIRECTOR** and **CITY ENGINEER**. No payment shall be made for unsatisfactory inspection.

496.3.3.8 Acceptance

If television inspection shows that the lines have not been properly cleaned, inspection will cease and will not proceed or be accepted until the lines are clean as determined by the **CITY ENGINEER, UTILITY DIRECTOR**, or a designated representative.

Lines that show a ponding of water will have to be corrected before acceptance. Lines that show more than one-half inch ($\frac{1}{2}$ "") of ponding will have to be excavated and corrected. The intent is not to have any areas that would collect sediment. The ponding will be measured using a level gauge measured in inches. No other method will be accepted.

After all areas are corrected, the lines in question will be re-televised to ensure they have been corrected.

DIVISION 490

SECTION 497

**SANITARY SEWER
SYSTEM**

**MEASUREMENT
AND PAYMENT**

SECTION 497

SANITARY SEWER SYSTEM MEASUREMENT AND PAYMENT

497.1 GENERAL

- 497.1.1** All measurements and payments shall be based on completed work performed in strict accordance with the drawings and specifications and in accordance with the unit and lump sum prices in the Proposal.
- 497.1.2** Unless otherwise specified, the price for those items which involve excavation shall include compensation for disposal of surplus excavated materials and furnishing and installing any required supplemental fill; furnishing, placing and later removing such sheeting and bracing as may be necessary, and handling water or sewage flows as necessary.
- 497.1.3** Each unit or lump sum price stated in the proposal shall constitute full compensation for each complete item of work and shall be installed complete.
- 497.1.4** The **CONTRACTOR** shall be responsible for any debris and/or foreign matter which is allowed to enter the system as a result of construction and shall be solely responsible for any damage resulting therefrom.
- 497.1.5** Whenever any authorized change or combination of changes in the plans results in an increase or decrease in the original contract quantities, and the work added or eliminated is of the same general character as that shown on the original plans, the **CONTRACTOR** shall accept payment in full at the original contract unit prices for actual quantities of work done, and no allowance will be made for any loss of anticipated profits because of increases or decreases in quantities; provided, however, that increased or decreased work covered by a supplemental agreement shall be paid for as stipulated in such agreement.
- 497.1.6** The **CITY ENGINEER** and **UTILITY DIRECTOR** shall have the right to make alterations in the plans or character of the work as may be considered necessary or desirable during the progress of the work for satisfactory completion of the proposed construction, provided that no alteration shall be made which will result in a substantial change in the general plan or character of the work such as to evade the competitive bidding statute. Alterations provided for herein shall not be considered as a waiver of any conditions of the contract or the bond, nor to invalidate any of the provisions thereof.
- 497.1.7** These specifications, the plans, special provisions, and all supplementary documents are integral parts of the contract, and a requirement occurring in one is as binding as though occurring in all. They are intended to be complementary and to describe and provide for a complete work. In addition to the work and materials specifically called for in the specifications as being included in any specific pay item, additional incidental work, not specifically mentioned, will be included in such pay item when so shown in the plans, or if indicated, or obvious and apparent, as being necessary for the proper completion of the work under such pay item and not stipulated as being

covered under other pay items. No additional compensation shall be allowed for such incidental work. In case of discrepancy, computed dimensions shall govern over scaled dimensions, plans shall govern over standard specifications, and special provisions shall govern over both standard specifications and plans unless otherwise specified by the **CITY ENGINEER** or **UTILITY DIRECTOR**.

- 497.1.8** The **CONTRACTOR** is warned that some abandonments of portions of the sewer system as well as connections, activations, replacements, extensions thereto and thereof may necessitate work being done after or before normal work hours, said decision resting solely with the **CITY ENGINEER** and **UTILITY DIRECTOR**. Normally such work will be required only to maintain service to existing customers or to minimize inconvenience to those customers or members of the public. However, this work shall be considered incidental to the construction and no additional compensation shall be allowed therefore.
- 497.1.9** Unless otherwise provided in the specifications for the particular items involved, all measurements shall be taken from “finished grades and elevations” for vertical measurements and from pipe ends horizontally for lineal measurements. The method or combination of methods or measurements shall be those which will reflect with reasonable accuracy the actual areas of the finished work as determined by the **CITY ENGINEER** and **UTILITY DIRECTOR**.
- 497.1.10** Unless provided by specific bid items in the Schedule of Prices Bid, compensation for any and all clearing and grubbing which may be required for the work shall be deemed to have been included in the payments for bid items to which said clearing and grubbing is incidental and no additional compensation shall be allowed therefore.
- 497.1.11** The **CONTRACTOR** shall not be allowed additional payment or compensation for removing and replacing, relocating or otherwise protecting or adjusting existing culverts or other existing storm water facilities which may be affected by the construction. The cost thereof shall be included in the cost of bid items to which they are incidental or appurtenant.
- 497.1.12** No additional payment will be made for the work specified in GDOT Standard Specifications, Random Clearing and Grubbing – except those items outlined in the Schedule of Prices Bid. The **CONTRACTOR’S** unit or lump sum price as set forth in the proposal for the size of sewer and type of sewer required; for the installation of manholes and miscellaneous structures; for the installation of pumping stations and related work; for the removal and later replacement of pavement, curb and gutter; or for other appurtenant work items; shall include the cost of the work items in this section.
- 497.1.13** No additional payment will be made for the work specified in GDOT Standard Specifications, Excavation and Backfill for Minor Structures – except those items outlined in the Schedule of Prices Bid. The cost thereof is to be included in the unit price set forth in the Proposal for the items to which the excavation and backfill is incidental or appurtenant.

- 497.1.14** No measurement or payment shall be made for steel drag shields or trench boxes; for timber sheeting driven and left in place; for timber sheeting driven and pulled; for steel sheeting driven and pulled, all depths; nor for sheeting for pumping stations, treatment plant facilities, etc. The cost therefore shall be merged with the cost of items to which they are incidental or appurtenant.
- 497.1.15** No separate payment will be made for the work inherent to Dewatering. The cost thereof shall be included in the price for related items as set forth in the proposal.
- 497.1.16** No additional payment shall be made for the work specified in GDOT Standard Specifications – Random Clearing and Grubbing. The cost thereof shall be included in the price for related items as set forth in the proposal.
- 497.1.17** No additional payment shall be made for the work specified in GDOT Standard Specifications–Seed and Sod, except for those items outlined in the Schedule of Prices Bid. The cost thereof shall be included in the price for related items as set forth in the proposal.
- 497.1.18** Except those items outlined in the Schedule of Prices Bid, the **CONTRACTOR** shall not be allowed additional payment or compensation for removing and replacing, shoring or bracing, relocating or otherwise protecting or adjusting any and all utilities shown on the plans which may be affected by the construction. Specifically, the **CONTRACTOR** shall adjust all manhole frames and covers to required grades. All methods of adjusting utilities shall be subject to the approval of the **UTILITY DIRECTOR** and **CITY ENGINEER**. The cost of items described herein shall be included in the cost of bid items to which they are incidental or appurtenant.
- 497.1.19** The **CONTRACTOR** shall furnish and install any and all materials necessary for manhole ring and cover adjustments, miscellaneous concrete and appurtenant items that they may be necessary for the proper execution of the work. The adjustments of manhole rings and covers shall include the “breaking down” of these items to facilitate road construction, if required. Adjustments shall also include any concrete collars required. It is the intent of this paragraph that all manhole rings and covers be installed and subsequently adjusted to finished grade. The cost of these items of work is to be included in the bid items to which they are incidental or appurtenant and no additional compensation shall be allowed therefore.
- 497.1.21** Except for those bid items detailed in the Schedule of Prices Bid, no additional payment shall be made for connecting lines to existing lines or for making the various connections in the system as shown on the plans.
- 497.1.22** It is the intent of this contract that all pavement replacement including trench width, resurfacing, and full width to be done at the same time.
- 497.1.23** Pipe which has not been properly laid, bedded, jointed, or backfilled shall not be included for payment in any pay estimate.
- 497.1.24** The term “finished grade” as used herein shall mean the final elevation of the accepted work as approved by the **CITY ENGINEER**, and in GDOT right-of-way,

shall be the elevation required and approved by the GDOT to conform to its work as proposed or later modified. It shall be the **CONTRACTOR'S** responsibility to determine the finished grade at any point as required by the **CITY ENGINEER** or GDOT.

497.2 **DETAILED MEASUREMENT AND PAYMENT**

497.2.1 The following list of pay items are standard items used by the **CITY** for sanitary sewer construction. This list includes pay item numbers and the detailed measurement and payment relating to those items. For those pay items which were not included in the schedule of prices bid, it shall be mutually understood that all items for payment shall be made from the master list of pay items set forth below. Items that are not specifically listed hereafter shall utilize the basic numbering system set forth.

497.2.2 Reserved

497.2.3 Standard Pay Items

497 **SANITARY SEWER SYSTEM**

497-01.01.01	8" PVC – 0' to 6'	LF
497-01.01.02	8" PVC – 6' to 8'	LF
497-01.01.03	8" PVC – 8' to 10'	LF
497-01.01.04	8" PVC – 10' to 12'	LF
497-01.01.05	8" PVC – 12' to 14'	LF
497-01.01.06	8" PVC – 14' to 16'	LF
497-01.01.07	8" PVC – 16' to 18'	LF
497-01.01.08	8" PVC – 18' to 20'	LF
497-01.01.09	Reserved	
497-01.02.01	10" PVC – 0' to 6'	LF
497-01.02.02	10" PVC – 6' to 8'	LF
497-01.02.03	10" PVC – 8' to 10'	LF
497-01.02.04	10" PVC – 10' to 12'	LF
497-01.02.05	10" PVC – 12' to 14'	LF
497-01.02.06	10" PVC – 14' to 16'	LF
497-01.02.07	10" PVC – 16' to 18'	LF
497-01.02.08	10" PVC – 18' to 20'	LF
497-01.02.09	Reserved	
497-01.03.01	12" PVC – 0' to 6'	LF
497-01.03.02	12" PVC – 6' to 8'	LF
497-01.03.03	12" PVC – 8' to 10'	LF
497-01.03.04	12" PVC – 10' to 12'	LF
497-01.03.05	12" PVC – 12' to 14'	LF
497-01.03.06	12" PVC – 14' to 16'	LF
497-01.03.07	12" PVC – 16' to 18'	LF
497-01.03.08	12" PVC – 18' to 20'	LF

497-01.03.09	Reserved	
497-01.04.01	15" PVC – 0' to 6'	LF
497-01.04.02	15" PVC – 6' to 8'	LF
497-01.04.03	15" PVC – 8' to 10'	LF
497-01.04.04	15" PVC – 10' to 12'	LF
497-01.04.05	15" PVC – 12' to 14'	LF
497-01.04.06	15" PVC – 14' to 16'	LF
497-01.04.07	15" PVC – 16' to 18'	LF
497-01.04.08	15" PVC – 18' to 20'	LF
497-01.04.09	Reserved	
497-01.05.01	18" PVC – 0' to 6'	LF
497-01.05.02	18" PVC – 6' to 8'	LF
497-01.05.03	18" PVC – 8' to 10'	LF
497-01.05.04	18" PVC – 10' to 12'	LF
497-01.05.05	18" PVC – 12' to 14'	LF
497-01.05.06	18" PVC – 14' to 16'	LF
497-01.05.07	18" PVC – 16' to 18'	LF
497-01.05.08	18" PVC – 18' to 20'	LF
497-01.05.09	Reserved	
497-01.06.01	24" PVC – 0' to 6'	LF
497-01.06.02	24" PVC – 6' to 8'	LF
497-01.06.03	24" PVC – 8' to 12'	LF
497-01.06.04	24" PVC – 12' to 14'	LF
497-01.06.05	24" PVC – 14' to 16'	LF
497-01.06.06	24" PVC – 16' to 18'	LF
497-01.06.07	24" PVC – 18' to 20'	LF
497-01.06.08	Reserved	
497-01.07.01	30" PVC – 0' to 6'	LF
497-01.07.02	30" PVC – 6' to 8'	LF
497-01.07.03	30" PVC – 8' to 10'	LF
497-01.07.04	30" PVC – 10' to 12'	LF
497-01.07.05	30" PVC – 12' to 14'	LF
497-01.07.06	30" PVC – 14' to 16'	LF
497-01.07.07	30" PVC – 16' to 18'	LF
497-01.07.08	30" PVC – 18' to 20'	LF
497-01.07.09	Reserved	
497-01.10.01	8" DIP – 0' to 6'	LF
497-01.10.02	8" DIP – 6' to 8'	LF
497-01.10.03	8" DIP – 8' to 10'	LF
497-01.10.04	8" DIP – 10' to 12'	LF
497-01.10.05	8" DIP – 12' to 14'	LF
497-01.10.06	8" DIP – 14' to 16'	LF
497-01.10.07	8" DIP – 16' to 18'	LF
497-01.10.08	8" DIP – 18' to 20'	LF
497-01.10.09	Reserved	
497-01.11.01	10" DIP – 0' to 6'	LF
497-01.11.02	10" DIP – 6' to 8'	LF

497-01.11.03	10" DIP – 8' to 10'	LF
497-01.11.04	10" DIP – 10' to 12'	LF
497-01.11.05	10" DIP – 12' to 14'	LF
497-01.11.06	10" DIP – 14' to 16'	LF
497-01.11.07	10" DIP – 16' to 18'	LF
497-01.11.08	10" DIP – 18' to 20'	LF
497-01.11.09	Reserved	
497-01.12.01	12" DIP – 0' to 6'	LF
497-01.12.02	12" DIP – 6' to 8'	LF
497-01.12.03	12" DIP – 8' to 10'	LF
497-01.12.04	12" DIP – 10' to 12'	LF
497-01.12.05	12" DIP – 12' to 14'	LF
497-01.12.06	12" DIP – 14' to 16'	LF
497-01.12.07	12" DIP – 16' to 18'	LF
497-01.12.08	12" DIP – 18' to 20'	LF
497-01.12.09	Reserved	
497-01.20.01	Abandon Sanitary Sewer Main	LS
497-01.20.02	Reserved	

Measurement of sewer mains shall be in linear feet of actual pipe installed from end to end. Payment for these pay items shall be made at the unit price set forth in the bid schedule and shall constitute full compensation for work specified in the contract documents. Payment shall include all costs for excavation, backfilling, dewatering, pipe installation, and other items required to complete the installation.

497-10.01.01	Sewer Manhole w/Epoxy - 0' to 6'	EA
497-10.01.02	Sewer Manhole w/Epoxy – 6' to 8'	EA
497-10.01.03	Sewer Manhole w/Epoxy – 8' to 10'	EA
497-10.01.04	Sewer Manhole w/Epoxy – 10' to 12'	EA
497-10.01.05	Sewer Manhole w/Epoxy – 12' to 14'	EA
497-10.01.06	Sewer Manhole w/Epoxy – 14' to 16'	EA
497-10.01.07	Sewer Manhole w/Epoxy – 16' to 18'	EA
497-10.01.08	Sewer Manhole w/Epoxy – 18' to 20'	EA
497-10.01.09	Reserved	
497-10.02.01	Sewer Manhole w/HDPE Liner – 0' to 6'	EA
497-10.02.02	Sewer Manhole w/HDPE Liner – 6' to 8'	EA
497-10.02.03	Sewer Manhole w/HDPE Liner – 8' to 10'	EA
497-10.02.04	Sewer Manhole w/HDPE Liner – 10' to 12'	EA
497-10.02.05	Sewer Manhole w/HDPE Liner – 12' to 14'	EA
497-10.02.06	Sewer Manhole w/HDPE Liner – 14' to 16'	EA
497-10.02.07	Sewer Manhole w/HDPE Liner – 16' to 18'	EA
497-10.02.08	Sewer Manhole w/HDPE Liner – 18' to 20'	EA
497-10.02.09	Reserved	
497-10.03.01	Sewer Manhole over Existing 8" Pipe – 0' to 6'	EA
497-10.03.02	Sewer Manhole over Existing 8" Pipe – 6' to 8'	EA
497-10.03.03	Sewer Manhole over Existing 8" Pipe – 8' to 10'	EA
497-10.03.04	Sewer Manhole over Existing 8" Pipe – 10' to 12'	EA
497-10.03.05	Sewer Manhole over Existing 8" Pipe – 12' to 14'	EA
497-10.03.06	Sewer Manhole over Existing 8" Pipe – 14' to 16'	EA

497-10.03.07	Sewer Manhole over Existing 8" Pipe – 16' to 18'	EA
497-10.03.08	Sewer Manhole over Existing 8" Pipe – 18' to 20'	EA
497-10.03.09	Sewer Manhole over Existing 8" Pipe w/HDPE Liner – 0' to 6'	EA
497-10.03.10	Sewer Manhole over Existing 8" Pipe w/HDPE Liner – 6' to 8'	EA
497-10.03.11	Sewer Manhole over Existing 8" Pipe w/HDPE Liner – 8' to 10'	EA
497-10.03.12	Sewer Manhole over Existing 8" Pipe w/HDPE Liner – 10' to 12'	EA
497-10.03.13	Sewer Manhole over Existing 8" Pipe w/HDPE Liner – 12' to 14'	EA
497-10.03.14	Sewer Manhole over Existing 8" Pipe w/HDPE Liner – 14' to 16'	EA
497-10.03.15	Sewer Manhole over Existing 8" Pipe w/HDPE Liner – 16' to 18'	EA
497-10.03.16	Sewer Manhole over Existing 8" Pipe w/HDPE Liner – 18' to 20'	EA
497-10.03.17	Sewer Manhole over Existing 10" Pipe – 0' to 6'	EA
497-10.03.18	Sewer Manhole over Existing 10" Pipe – 6' to 8'	EA
497-10.03.19	Sewer Manhole over Existing 10" Pipe – 8' to 10'	EA
497-10.03.20	Sewer Manhole over Existing 10" Pipe – 10' to 12'	EA
497-10.03.21	Sewer Manhole over Existing 10" Pipe – 12' to 14'	EA
497-10.03.22	Sewer Manhole over Existing 10" Pipe – 14' to 16'	EA
497-10.03.23	Sewer Manhole over Existing 10" Pipe – 16' to 18'	EA
497-10.03.24	Sewer Manhole over Existing 10" Pipe – 18' to 20'	EA
497-10.03.25	Sewer Manhole over Existing 10" Pipe w/HDPE Liner – 0' to 6'	EA
497-10.03.26	Sewer Manhole over Existing 10" Pipe w/HDPE Liner – 6' to 8'	EA
497-10.03.27	Sewer Manhole over Existing 10" Pipe w/HDPE Liner – 8' to 10'	EA
497-10.03.28	Sewer Manhole over Existing 10" Pipe w/HDPE Liner – 10' to 12'	EA
497-10.03.29	Sewer Manhole over Existing 10" Pipe w/HDPE Liner – 12' to 14'	EA
497-10.03.30	Sewer Manhole over Existing 10" Pipe w/HDPE Liner – 14' to 16'	EA
497-10.03.31	Sewer Manhole over Existing 10" Pipe w/HDPE Liner – 16' to 18'	EA
497-10.03.32	Sewer Manhole over Existing 10" Pipe w/HDPE Liner – 18' to 20'	EA
497-10.04.01	Conflict Manhole – 0' to 6'	EA
497-10.04.02	Conflict Manhole – 6' to 8'	EA
497-10.04.03	Conflict Manhole – 8' to 10'	EA
497-10.04.04	Conflict Manhole – 10' to 12'	EA
497-10.04.05	Conflict Manhole – 12' to 14'	EA
497-10.04.06	Conflict Manhole – 14' to 16'	EA
497-10.04.07	Conflict Manhole – 16' to 18'	EA
497-10.04.08	Conflict Manhole – 18' to 20'	EA
497-10.04.09	Reserved	
497-10.05.01	Remove and Replace Sewer Manhole – 0' to 6'	EA
497-10.05.02	Remove and Replace Sewer Manhole – 6' to 8'	EA
497-10.05.03	Remove and Replace Sewer Manhole – 8' to 10'	EA
497-10.05.04	Remove and Replace Sewer Manhole – 10' to 12'	EA
497-10.05.05	Remove and Replace Sewer Manhole – 12' to 14'	EA
497-10.05.06	Remove and Replace Sewer Manhole – 14' to 16'	EA
497-10.05.07	Remove and Replace Sewer Manhole – 16' to 18'	EA
497-10.05.08	Remove and Replace Sewer Manhole – 18' to 20'	EA
497-10.05.09	Reserved	
497-10.06.01	Remove and Replace 22" Ring and Cover on Existing Manhole	EA
497-10.06.02	Remove and Replace 32" Ring and Cover on Existing Manhole	EA
497-10.06.03	Remove Existing 22" Ring and Cover and Replace w/24" Ring & Cover	EA
497-10.06.04	Remove Existing 32" Ring and Cover and Replace w/36" Ring & Cover	EA

497-10.10.01	Raise Existing Manhole to Grade	EA
497-10.10.02	Reserved	
497-10.11.01	Remove and Replace Inverts in Existing Manhole	LS
497-10.11.02	Reserved	

Payment for these pay items shall be made at the unit price set forth in the bid schedule and shall constitute full compensation for work specified in the contract documents. Payment shall include all costs for excavation, backfilling, dewatering, gravel, structure installation, and other items required to complete the installation.

497-10.20.01	8" Sewer Manhole Drop Connection – 0' to 6'	EA
497-10.20.02	8" Sewer Manhole Drop Connection – 6' to 8'	EA
497-10.20.03	8" Sewer Manhole Drop Connection – 8' to 10'	EA
497-10.20.04	8" Sewer Manhole Drop Connection – 10' to 12'	EA
497-10.20.05	8" Sewer Manhole Drop Connection – 12' to 14'	EA
497-10.20.06	8" Sewer Manhole Drop Connection – 14' to 16'	EA
497-10.20.07	8" Sewer Manhole Drop Connection – 16' to 18'	EA
497-10.20.08	8" Sewer Manhole Drop Connection – 18' to 20'	EA
497-10.20.09	Reserved	
497-10.20.10	10" Sewer Manhole Drop Connection – 0' to 6'	EA
497-10.20.11	10" Sewer Manhole Drop Connection – 6' to 8'	EA
497-10.20.12	10" Sewer Manhole Drop Connection – 8' to 10'	EA
497-10.20.13	10" Sewer Manhole Drop Connection – 10' to 12'	EA
497-10.20.14	10" Sewer Manhole Drop Connection – 12' to 14'	EA
497-10.20.15	10" Sewer Manhole Drop Connection – 14' to 16'	EA
497-10.20.16	10" Sewer Manhole Drop Connection – 16' to 18'	EA
497-10.20.17	10" Sewer Manhole Drop Connection – 18' to 20'	EA
497-10.20.18	Reserved	
497-10.20.20	12" Sewer Manhole Drop Connection – 0' to 6'	EA
497-10.20.21	12" Sewer Manhole Drop Connection – 6' to 8'	EA
497-10.20.22	12" Sewer Manhole Drop Connection – 8' to 10'	EA
497-10.20.23	12" Sewer Manhole Drop Connection – 10' to 12'	EA
497-10.20.24	12" Sewer Manhole Drop Connection – 12' to 14'	EA
497-10.20.25	12" Sewer Manhole Drop Connection – 14' to 16'	EA
497-10.20.26	12" Sewer Manhole Drop Connection – 16' to 18'	EA
497-10.20.27	12" Sewer Manhole Drop Connection – 18' to 20'	EA
497-10.20.23	Reserved	
497-10.20.30	15" Sewer Manhole Drop Connection – 0' to 6'	EA
497-10.20.31	15" Sewer Manhole Drop Connection – 6' to 8'	EA
497-10.20.32	15" Sewer Manhole Drop Connection – 8' to 10'	EA
497-10.20.33	15" Sewer Manhole Drop Connection – 10' to 12'	EA
497-10.20.34	15" Sewer Manhole Drop Connection – 12' to 14'	EA
497-10.20.35	15" Sewer Manhole Drop Connection – 14' to 16'	EA
497-10.20.36	15" Sewer Manhole Drop Connection – 16' to 18'	EA
497-10.20.37	15" Sewer Manhole Drop Connection – 18' to 20'	EA
497-10.20.33	Reserved	

Payment for these pay items shall be made at the unit price set forth in the bid schedule and shall constitute full compensation for work specified in the contract documents. Payment shall

include all costs for excavation, backfilling, dewatering, fitting installation, and other items required to complete the installation.

497-10.30.01	8" Sewer Manhole Stubout	EA
497-10.30.02	10" Sewer Manhole Stubout	EA
497-10.30.03	12" Sewer Manhole Stubout	EA
497-10.30.04	15" Sewer Manhole Stubout	EA
497-10.30.05	Reserved	

Payment for these pay items shall be made at the unit price set forth in the bid schedule and shall constitute full compensation for work specified in the contract documents. Payment shall include all costs for excavation, backfilling, dewatering, pipes, caps, and other items required to complete the installation.

497-10.40.01	Resurface Existing Manhole Interior – 0' to 6'	LS
497-10.40.02	Resurface Existing Manhole Interior – 6' to 8'	LS
497-10.40.03	Resurface Existing Manhole Interior – 8' to 10'	LS
497-10.40.04	Resurface Existing Manhole Interior – 10' to 12'	LS
497-10.40.05	Resurface Existing Manhole Interior – 12' to 14'	LS
497-10.40.06	Resurface Existing Manhole Interior – 14' to 16'	LS
497-10.40.07	Resurface Existing Manhole Interior – 16' to 18'	LS
497-10.40.08	Resurface Existing Manhole Interior – 18' to 20'	LS
497-10.40.09	Reserved	
497-10.40.10	Resurface Existing Manhole Interior, 4' Diameter	FT
497-10.40.11	Resurface Existing Manhole Interior, 5' Diameter	FT
497-10.40.12	Resurface Existing Manhole Interior, 6' Diameter	FT
497-10.40.13	Resurface Existing Wet Well Interior, 8' Diameter	FT
497-10.40.14	Resurface Existing Wet Well Interior, 10' Diameter	FT
497-10.40.15	Resurface Existing Wet Well Interior, 12' Diameter	FT

Payment for these pay items shall be made at the unit price set forth in the bid schedule and shall constitute full compensation for work specified in the contract documents. Payment shall include all costs for cleaning, removal of debris, removal of old coatings, application of new coatings, and other items required to complete the resurfacing of existing manholes and wet wells.

497-10.41.01	Reline Existing 6" Pipe Interior	LF
497-10.41.02	Reline Existing 8" Pipe Interior	LF
497-10.41.03	Reline Existing 10" Pipe Interior	LF
497-10.41.04	Reline Existing 12" Pipe Interior	LF
497-10.41.05	Reline Existing 14" Pipe Interior	LF
497-10.41.06	Reline Existing 16" Pipe Interior	LF
497-10.41.07	Reline Existing 18" Pipe Interior	LF
497-10.41.08	Reline Existing 20" Pipe Interior	LF
497-10.41.09	Reline Existing 24" Pipe Interior	LF
497-10.41.10	Reserved	

Payment for these pay items shall be made at the unit price set forth in the bid schedule and shall constitute full compensation for work specified in the contract documents. Payment

shall include all costs for cleaning, excavation, removal of debris, removal of old coatings, application of new lining, and other items required to complete the re-lining of existing piping.

497-10.50.01	Abandon Sanitary Sewer Manhole	EA
497-10.50.02	Reserved	
497-10.60.01	Connect New 8" Main to Existing Manhole	EA
497-10.60.02	Connect New 10" Main to Existing Manhole	EA
497-10.60.03	Connect New 12" Main to Existing Manhole	EA
497-10.60.04	Connect New 15" Main to Existing Manhole	EA
497-10.60.05	Reserved	

Payment for these pay items shall be made at the unit price set forth in the bid schedule and shall constitute full compensation for work specified in the contract documents. Payment shall include all costs for excavation, backfilling, dewatering, cutting of pipe, connections, accessories, and other items required to complete the installation.

497-20.01.01	6" PVC Sewer Service	LF
497-20.01.02	Remove and Replace Sewer Service	EA
497-20.01.03	Extend Plumbing to New Service	LS
497-20.01.04	Reconnect Service to Lined Pipe	EA
497-20.01.05	Reserved	
497-20.02.01	PVC 8" x 6" Wye and Bend	EA
497-20.02.02	PVC 10" x 6" Wye and Bend	EA
497-20.02.03	PVC 12" x 6" Wye and Bend	EA
497-20.02.04	PVC 15" x 6" Wye and Bend	EA
497-20.02.05	Reserved	
497-20.03.01	6" 2-way Cleanout	EA

Payment for these pay items shall be made at the unit price set forth in the bid schedule and shall constitute full compensation for work specified in the contract documents. Payment shall include all costs for excavation, backfilling, dewatering, pipe, fittings installation, and other items required to complete the service installation.

497-30.01.00	Television Inspection 6" Main	LF
497-30.01.01	Television Inspection 8" Main	LF
497-30.01.02	Television Inspection 10" Main	LF
497-30.01.03	Television Inspection 12" Main	LF
497-30.01.04	Television Inspection 15" Main	LF
497-30.01.05	Television Inspection 16" Main	LF
497-30.01.06	Television Inspection 18" Main	LF
497-30.01.07	Television Inspection 21" Main	LF
497-30.01.08	Television Inspection 24" Main	LF
497-30.01.09	Television Inspection 30" Main	LF
497-30.01.10	Television Inspection 36" Main	LF
497-30.01.11	Television Inspection 42" Main	LF
497-30.01.12	Television Inspection 48" Main	LF
497-30.01.13	Television Inspection 54" Main	LF
497-30.01.14	Reserved	

497-30.02.01	Low Pressure Air Test	LS
497-30.02.02	Hydrostatic Testing of Force Main	LS
497-30.02.03	Manhole Leak Testing	EA
497-30.02.04	Leak Survey on Sewer Force Mains	MI
497-30.02.05	Smoke Testing	LF
497-30.02.06	Dye Testing	LF

Payment for these pay items shall be made at the unit price set forth in the bid schedule and shall constitute full compensation for work specified in the contract documents. Payment shall include all costs for excavation, backfilling, dewatering, test equipment, and other items required to complete the testing.

497-30.03.01	Sewer Main Heavy Cleaning – 6” Main	LF
497-30.03.02	Sewer Main Heavy Cleaning – 8” Main	LF
497-30.03.03	Sewer Main Heavy Cleaning – 10” Main	LF
497-30.03.04	Sewer Main Heavy Cleaning – 12” Main	LF
497-30.03.05	Sewer Main Heavy Cleaning – 14” Main	LF
497-30.03.06	Sewer Main Heavy Cleaning – 15” Main	LF
497-30.03.07	Sewer Main Heavy Cleaning – 16” Main	LF
497-30.03.08	Sewer Main Heavy Cleaning – 18” Main	LF
497-30.03.09	Sewer Main Heavy Cleaning – 20” Main	LF
497-30.03.10	Sewer Main Heavy Cleaning – 24” Main	LF
497-30.03.11	Sewer Main Heavy Cleaning – 30” Main	LF
497-30.03.12	Sewer Main Heavy Cleaning – 36” Main	LF
497-30.03.13	Sewer Main Heavy Cleaning – 42” Main	LF
497-30.03.14	Sewer Main Heavy Cleaning – 48” Main	LF
497-30.03.15	Sewer Main Heavy Cleaning – 54” Main	LF
497-30.03.16	Reserved	
497-30.04.01	Sewer Main Point Repairs – 6” Main (0’ – 6’)	LF
497-30.04.02	Sewer Main Point Repairs – 6” Main (6’ – 8’)	LF
497-30.04.03	Sewer Main Point Repairs – 6” Main (8’ – 10’)	LF
497-30.04.04	Sewer Main Point Repairs – 6” Main (10’ – 12’)	LF
497-30.04.05	Reserved	
497-30.04.06	Sewer Main Point Repairs – 8” Main (0’ – 6’)	LF
497-30.04.07	Sewer Main Point Repairs – 8” Main (6’ – 8’)	LF
497-30.04.08	Sewer Main Point Repairs – 8” Main (8’ – 10’)	LF
497-30.04.09	Sewer Main Point Repairs – 8” Main (10’ – 12’)	LF
497-30.04.10	Sewer Main Point Repairs – 8” Main (12’ – 14’)	LF
497-30.04.11	Sewer Main Point Repairs – 8” Main (14’ – 16’)	LF
497-30.04.12	Sewer Main Point Repairs – 8” Main (16’ – 18’)	LF
497-30.04.13	Reserved	
497-30.04.14	Sewer Main Point Repairs – 10” Main (0’ – 6’)	LF
497-30.04.15	Sewer Main Point Repairs – 10” Main (6’ – 8’)	LF
497-30.04.16	Sewer Main Point Repairs – 10” Main (8’ – 10’)	LF
497-30.04.17	Sewer Main Point Repairs – 10” Main (10’ – 12’)	LF
497-30.04.18	Sewer Main Point Repairs – 10” Main (12’ – 14’)	LF
497-30.04.19	Sewer Main Point Repairs – 10” Main (14’ – 16’)	LF

497-30.04.20	Sewer Main Point Repairs – 10” Main (16’ – 18’)	LF
497-30.04.21	Sewer Main Point Repairs – 10” Main (18’ – 20’)	LF
497-30.04.22	Reserved	
497-30.04.23	Sewer Main Point Repairs – 12” Main (0’ – 6’)	LF
497-30.04.24	Sewer Main Point Repairs – 12” Main (6’ – 8’)	LF
497-30.04.25	Sewer Main Point Repairs – 12” Main (8’ – 10’)	LF
497-30.04.26	Sewer Main Point Repairs – 12” Main (10’ – 12’)	LF
497-30.04.27	Sewer Main Point Repairs – 12” Main (12’ – 14’)	LF
497-30.04.28	Sewer Main Point Repairs – 12” Main (14’ – 16’)	LF
497-30.04.29	Sewer Main Point Repairs – 12” Main (16’ – 18’)	LF
497-30.04.30	Sewer Main Point Repairs – 12” Main (18’ – 20’)	LF
497-30.04.31	Reserved	
497-30.04.32	Sewer Main Point Repairs – 15” Main (0’ – 6’)	LF
497-30.04.33	Reserved	
497-30.04.34	Sewer Main Point Repairs – 16” Main (0’ – 6’)	LF
497-30.04.35	Reserved	
497-30.04.36	Sewer Main Point Repairs – 18” Main (0’ – 6’)	LF
497-30.04.37	Reserved	
497-30.04.38	Sewer Main Point Repairs – 20” Main (0’ – 6’)	LF
497-30.04.39	Reserved	
497-30.04.40	Sewer Main Point Repairs – 24” Main (0’ – 6’)	LF
497-30.04.41	Reserved	
497-30.05.01	Bypass Pumping	EA

Payment for these bid items shall be made at the unit price set forth in the bid schedule and shall constitute full compensation for work specified in the contract documents. Sewer Main heavy cleaning shall include all costs for pigging line, flushing line, and vacuuming line clean. Point repairs shall include all costs for excavation, backfilling, dewatering, couplings, pipe and repair sleeves needed to replace the pipe damaged for a complete repair.

497-40.01.01	Bore and Jack 18” Steel Casing w/8” PVC	LF
497-40.01.02	Reserved	
497-40.02.01	Bore and Jack 24” Steel Casing w/8” PVC	LF
497-40.02.02	Bore and Jack 24” Steel Casing w/10” PVC	LF
497-40.02.03	Bore and Jack 24” Steel Casing w/12” PVC	LF
497-40.02.04	Reserved	
497-40.03.01	Bore and Jack 30” Steel Casing w/8” PVC	LF
497-40.03.02	Bore and Jack 30” Steel Casing w/10” PVC	LF
497-40.03.03	Bore and Jack 30” Steel Casing w/12” PVC	LF
497-40.03.04	Bore and Jack 30” Steel Casing w/15” PVC	LF
497-40.03.05	Reserved	
497-40.04.01	Bore and Jack 36” Steel Casing w/8” PVC	LF
497-40.04.02	Bore and Jack 36” Steel Casing w/10” PVC	LF
497-40.04.03	Bore and Jack 36” Steel Casing w/12” PVC	LF
497-40.04.04	Bore and Jack 36” Steel Casing w/15” PVC	LF
497-40.04.05	Bore and Jack 36” Steel Casing w/18” PVC	LF
497-40.04.06	Reserved	
497-40.05.01	Bore and Jack 42” Steel Casing w/12” PVC	LF
497-40.05.02	Bore and Jack 42” Steel Casing w/15” PVC	LF

497-40.05.03	Bore and Jack 42" Steel Casing w/18" PVC	LF
497-40.05.04	Reserved	
497-40.10.01	8" Steel Casing	LF
497-40.10.02	12" Steel Casing	LF
497-40.10.03	18" Steel Casing	LF
497-40.10.04	24" Steel Casing	LF

Payment for these pay items shall be made at the unit price set forth in the bid schedule and shall constitute full compensation for work specified in the contract documents. Payment shall include all costs for excavation, backfilling, dewatering, casing installation, pipe installation, and other items required to complete the bore and jack installation.

497-50.01.01	Abandon Sanitary Sewer Main	LS
497-50.01.02	Abandon Sewer Manhole	LS
497-50.01.03	Abandon and Remove Existing Lift Station	LS
497-50.01.04	Convert Existing Wet Well to Manhole	LS
497-50.01.05	Temporary By-pass Pumping	LS
497-50.01.06	Abandon Sanitary Sewer Force Main	LS

Payment for these pay items shall be made at the unit price set forth in the bid schedule and shall constitute full compensation for work specified in the contract documents. Payment shall include all costs for excavation, backfilling, dewatering, cutting of pipe, removal of pipe, caps, plugs, and other items required to complete the specified abandonment.

497-60.01.01	Above Ground Lift Station Installation	LS
497-60.01.02	Reserved	
497-60.02.01	6' Diameter Wet Well Installation – 0' to 6'	LS
497-60.02.02	6' Diameter Wet Well Installation – 6' to 8'	LS
497-60.02.03	6' Diameter Wet Well Installation – 8' to 10'	LS
497-60.02.04	6' Diameter Wet Well Installation – 10' to 12'	LS
497-60.02.05	6' Diameter Wet Well Installation – 12' to 14'	LS
497-60.02.06	6' Diameter Wet Well Installation – 14' to 16'	LS
497-60.02.07	6' Diameter Wet Well Installation – 16' to 18'	LS
497-60.02.08	6' Diameter Wet Well Installation – 18' to 20'	LS
497-60.02.09	Reserved	
497-60.03.01	Electrical Work	LS
497-60.03.02	Electrical Panels	LS
497-60.03.03	SCADA System	LS
497-60.03.04	SCADA System Survey	LS
497-60.03.05	Pit Evacuator Assembly	LS
497-60.04.01	Lift Station Start-up Testing	LS
497-60.04.02	Reserved	
497-70.01.01	Submersible Lift Station Installation	LS
497-70.01.02	Reserved	
497-70.02.01	8' Diameter Wet Well Installation – 0' to 6'	LS
497-70.02.02	8' Diameter Wet Well Installation – 6' to 8'	LS
497-70.02.03	8' Diameter Wet Well Installation – 8' to 10'	LS
497-70.02.04	8' Diameter Wet Well Installation – 10' to 12'	LS
497-70.02.05	8' Diameter Wet Well Installation – 12' to 14'	LS

497-70.02.06	8' Diameter Wet Well Installation – 14' to 16'	LS
497-70.02.07	8' Diameter Wet Well Installation – 16' to 18'	LS
497-70.02.08	8' Diameter Wet Well Installation – 18' to 20'	LS
497-70.02.09	Reserved	
497-70.02.10	Wet Well Top with Hatches Installation	LS
497-70.02.11	Reserved	
497-70.03.01	Electrical Work	LS
497-70.03.02	Electrical Panels	LS
497-70.03.03	SCADA System	LS
497-70.03.04	SCADA System Survey	LS
497-70.03.05	Pit Evacuator Assembly	LS
497-70.04.01	Submersible Lift Station Start-up Testing	LS
497-70.04.02	Reserved	
497-71.01.01	Submersible Lift Station Installation	LS
497-71.01.02	Reserved	
497-71.02.01	10' Diameter Wet Well Installation – 0' to 6'	LS
497-71.02.02	10' Diameter Wet Well Installation – 6' to 8'	LS
497-71.02.03	10' Diameter Wet Well Installation – 8' to 10'	LS
497-71.02.04	10' Diameter Wet Well Installation – 10' to 12'	LS
497-71.02.05	10' Diameter Wet Well Installation – 12' to 14'	LS
497-71.02.06	10' Diameter Wet Well Installation – 14' to 16'	LS
497-71.02.07	10' Diameter Wet Well Installation – 16' to 18'	LS
497-71.02.08	10' Diameter Wet Well Installation – 18' to 20'	LS
497-71.02.09	Reserved	
497-71.03.01	Electrical Work	LS
497-71.03.02	Electrical Panels	LS
497-71.03.03	SCADA System	LS
497-71.03.04	SCADA System Survey	LS
497-71.03.05	Pit Evacuator Assembly	LS
497-71.04.01	Submersible Lift Station Start-up Testing	LS
497-71.04.02	Reserved	
497-72.01.01	Submersible Lift Station Installation	LS
497-72.01.02	Reserved	
497-72.02.01	12' Diameter Wet Well Installation – 0' to 6'	LS
497-72.02.02	12' Diameter Wet Well Installation – 6' to 8'	LS
497-72.02.03	12' Diameter Wet Well Installation – 8' to 10'	LS
497-72.02.04	12' Diameter Wet Well Installation – 10' to 12'	LS
497-72.02.05	12' Diameter Wet Well Installation – 12' to 14'	LS
497-72.02.06	12' Diameter Wet Well Installation – 14' to 16'	LS
497-72.02.07	12' Diameter Wet Well Installation – 16' to 18'	LS
497-72.02.08	12' Diameter Wet Well Installation – 18' to 20'	LS
497-72.02.09	Reserved	
497-72.03.01	Electrical Work	LS
497-72.03.02	Electrical Panels	LS
497-72.03.03	SCADA System	LS
497-72.03.04	SCADA System Survey	LS
497-72.03.05	Pit Evacuator Assembly	LS
497-72.04.01	Submersible Lift Station Start-up Testing	LS

497-72.04.02	Reserved	
497-73.01.01	Submersible Lift Station Installation	LS
497-73.01.02	Reserved	
497-73.02.01	Concrete Wet Well Installation	LS
497-73.02.02	Shoring	LS
497-73.02.03	Dewatering	LS
497-73.03.01	Masonry Block Building	LS
497-73.03.02	Roof System	LS
497-73.03.03	Doors	LS
497-73.03.04	Reserved	
497-73.04.01	Generator	LS
497-73.04.02	Generator Automatic Transfer Switch	LS
497-73.04.03	Reserved	
497-73.05.01	Electrical Work	LS
497-73.05.02	Electrical Panels	LS
497-73.05.03	SCADA System	LS
497-73.05.04	Reserved	
497-73.05.05	Pit Evacuator Assembly	LF
497-73.06.01	Lift Station Start-up Testing	LS
497-73.06.02	Reserved	

Payment for these pay items shall be made at the unit price set forth in the bid schedule and shall constitute full compensation for work specified in the contract documents. Payment shall include all costs for excavation, backfilling, dewatering, equipment installation, building installations, and other items required to complete the building and lift station installations.

497-73.07.01	Reserved	LS
497-73.07.02	Reserved	LS
497-73.07.03	Reserved	LS
497-73.07.04	8" Schedule 80 PVC Drain Piping	LS
497-73.07.05	Reserved	EA
497-73.07.06	Reserved	
497-73.07.07	Reserved	EA
497-73.07.08	1" PVC Ball Valve	EA
497-73.07.09	3" PVC Ball Valve	EA
497-73.07.10	Reserved	

Payment for these pay items shall be made at the unit price set forth in the bid schedule and shall constitute full compensation for work specified in the contract documents. Payment shall include all costs for excavation, backfilling, dewatering, equipment installation, and other items required to complete the installation of the odor control system.

497-80.01.01	2" PVC Force Main	LF
497-80.01.02	4" PVC Force Main	LF
497-80.01.03	6" PVC Force Main	LF
497-80.01.04	8" PVC Force Main	LF
497-80.01.05	Reserved	
497-80.01.06	12" PVC Force Main	LF
497-80.01.07	Reserved	

497-80.02.01	PVC Flanged Piping and Fittings	LS
497-80.02.02	Reserved	
497-80.03.01	4" DIP Force Main	LF
497-80.03.02	6" DIP Force Main	LF
497-80.03.03	8" DIP Force Main	LF
497-80.03.04	Reserved	
497-80.03.05	12" DIP Force Main	LF
497-80.03.06	16" DIP Force Main	LF
497-80.03.07	18" DIP Force Main	LF
497-80.03.08	Reserved	
497-80.03.09	24" DIP Force Main	LF
497-80.03.10	Reserved	
497-80.04.01	DIP Flanged Piping and Fittings	LS
497-80.04.02	Reserved	
497-80.04.03	4" DIP Flanged Piping	LS
497-80.04.04	6" DIP Flanged Piping	LS
497-80.04.05	8" DIP Flanged Piping	LS
497-80.04.06	10" DIP Flanged Piping	LS
497-80.04.07	12" DIP Flanged Piping	LS
497-80.04.08	16" DIP Flanged Piping	LS
497-80.04.09	18" DIP Flanged Piping	LS
497-80.04.10	Reserved	
497-80.04.11	24" DIP Flanged Piping	LS
497-80.04.12	Reserved	
497-80.05.01	Abandon Sewer Force Main	LS
497-80.05.02	Reserved	

Measurement of sewer mains shall be in linear feet of actual pipe installed from end to end.

Payment for these pay items shall be made at the unit price set forth in the bid schedule and shall constitute full compensation for work specified in the contract documents. Payment shall include all costs for excavation, backfilling, dewatering, pipe installation, and other items required to complete the installation.

497-80.06.02	Compact DIP Fittings, 6"	TON
497-80.06.03	Compact DIP Fittings, 8"	TON
497-80.06.04	Compact DIP Fittings, 10"	TON
497-80.06.05	Compact DIP Fittings, 12"	TON
497-80.06.06	Reserved	
497-80.07.01	6" DIP MJ 22½° Bend	EA
497-80.07.02	6" DIP MJ 45° Bend	EA
497-80.07.03	6" DIP MJ 90° Bend	EA
497-80.07.04	6" DIP MJ Tee	EA
497-80.07.05	6" DIP MJ Plug	EA
497-80.07.06	Reserved	
497-80.08.01	8" DIP MJ 22½° Bend	EA
497-80.08.02	8" DIP MJ 45° Bend	EA
497-80.08.03	8" DIP MJ 90° Bend	EA
497-80.08.04	8" DIP MJ Tee	EA

497-80.08.05	8" DIP MJ Plug	EA
497-80.08.06	Reserved	
497-80.09.01	10" DIP MJ 22½° Bend	EA
497-80.09.02	10" DIP MJ 45° Bend	EA
497-80.09.03	10" DIP MJ 90° Bend	EA
497-80.09.04	10" DIP MJ Tee	EA
497-80.09.05	10" DIP MJ Plug	EA
497-80.09.06	Reserved	
497-80.10.01	12" DIP MJ 22½° Bend	EA
497-80.10.02	12" DIP MJ 45° Bend	EA
497-80.10.03	12" DIP MJ 90° Bend	EA
497-80.10.04	12" DIP MJ Tee	EA
497-80.10.05	12" DIP MJ Plug	EA
497-80.10.06	Reserved	
497-80.20.01	4" DIP Flanged 22½° Bend	EA
497-80.20.02	4" DIP Flanged 45° Bend	EA
497-80.20.03	4" DIP Flanged 90° Bend	EA
497-80.20.04	4" x 6" DIP Flanged Reducer	EA
497-80.20.05	4" x 6" DIP Flanged Wye	EA
497-80.21.01	6" x 6" DIP Flanged Wye	EA
497-80.21.02	6" DIP Flanged 22½° Bend	EA
497-80.21.03	6" DIP Flanged 45° Bend	EA
497-80.21.04	6" DIP Flanged 90° Bend	EA
497-80.21.05	6" x 8" DIP Flanged Reducer	EA
497-80.21.06	6" x 8" DIP Flanged Wye	EA
497-80.21.07	6" Camlock with Cap	EA
497-80.22.01	8" DIP Flanged 22½° Bend	EA
497-80.22.02	8" DIP Flanged 45° Bend	EA
497-80.22.03	8" DIP Flanged 90° Bend	EA
497-80.22.04	8" x 8" DIP Flanged Wye	EA
497-80.25.01	Coated Steel Pipe Supports	EA
497-80.25.02	Reserved	
497-80.30.01	Standard DIP Fittings, 18"	EA
497-80.30.02	Reserved	
497-80.30.03	Standard DIP Fittings, 24"	EA
497-80.30.04	Reserved	
497-80.31.01	18" DIP MJ 22½° Bend	EA
497-80.31.02	18" DIP MJ 45° Bend	EA
497-80.31.03	18" DIP MJ 90° Bend	EA
497-80.31.04	18" DIP MJ Tee	EA
497-80.31.05	18" DIP MJ Plug	EA
497-80.31.06	Reserved	

Payment for these pay items shall be made at the unit price set forth in the bid schedule and shall constitute full compensation for work specified in the contract documents. Payment shall include all costs for excavation, backfilling, dewatering, fitting and accessories installation, and other items required to complete the installation.

497-81.01.01	4" Plug Valve and Valve Box	EA
497-80.01.02	6" Plug Valve and Valve Box	EA
497-81.01.05	12" Plug Valve and Valve Box	EA
497-81.01.07	16" Plug Valve and Valve Box	EA
497-81.01.08	18" Plug Valve and Valve Box	EA
497-81.01.09	20" Plug Valve and Valve Box	EA
497-81.01.10	24" Plug Valve and Valve Box	EA
497-81.01.11	30" Plug Valve and Valve Box	EA
497-81.01.12	Reserved	
497-81.02.01	4" Flanged Plug Valve	EA
497-81.02.02	6" Flanged Plug Valve	EA
497-81.02.03	8" Flanged Plug Valve	EA
497-81.02.04	Reserved	
497-81.02.05	12" Flanged Plug Valve	EA
497-81.02.06	Reserved	
497-81.02.07	18" Flanged Plug Valve	EA
497-81.02.08	Reserved	
497-81.03.01	4" Flanged Check Valve	EA
497-81.03.02	6" Flanged Check Valve	EA
497-81.03.03	8" Flanged Check Valve	EA
497-81.03.04	Reserved	
497-81.03.05	12" Flanged Check Valve	EA
497-81.03.06	Reserved	

Payment for these pay items shall be made at the unit price set forth in the bid schedule and shall constitute full compensation for work specified in the contract documents. Payment shall include all costs for excavation, backfilling, dewatering, valve and accessories installation, and other items required to complete the installation.

497-81.04.01	4" Flanged Magmeter	EA
497-81.04.02	6" Flanged Magmeter	EA
497-81.04.03	8" Flanged Magmeter	EA
497-81.04.04	Reserved	
497-81.04.05	12" Flanged Magmeter	EA
497-81.04.06	Reserved	
497-81.04.07	18" Flanged Magmeter	EA
497-81.04.08	Reserved	

Payment for these pay items shall be made at the unit price set forth in the bid schedule and shall constitute full compensation for work specified in the contract documents. Payment shall include all costs for excavation, backfilling, dewatering, flowmeter installation, and other items required to complete the installation.

497-81.10.01	Air Release Valve Assembly – Type A	EA
497-81.10.02	Air Release Valve Assembly – Type B	EA
497-81.10.03	Air Release Valve Assembly – Type C	EA
497-81.10.04	Air Release Valve Installation	EA
497-81.10.05	Air Release Valve Removal and Replacement	EA

497-81.10.06 Reserved

Payment for these pay items shall be made at the unit price set forth in the bid schedule and shall constitute full compensation for work specified in the contract documents. Payment shall include all costs for excavation, backfilling, dewatering, valve installation, and other items required to complete the installation.

497-85.01.01	Reserved	
497-85.01.02	Connect 4" Force Main to Existing Manhole	EA
497-85.01.03	Connect 6" Force Main to Existing Manhole	EA
497-85.01.04	Connect 8" Force Main to Existing Manhole	EA
497-85.01.05	Reserved	
497-85.01.06	Connect 12" Force Main to Existing Manhole	EA
497-85.01.07	Reserved	
497-85.01.08	Connect 18" Force Main to Existing Manhole	EA
497-85.01.09	Reserved	
497-85.02.01	Connect 4" Force Main to Existing 4" Force Main	EA
497-85.02.02	Connect 4" Force Main to Existing 6" Force Main	EA
497-85.02.03	Connect 4" Force Main to Existing 8" Force Main	EA
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497-85.03.02	Connect 6" Force Main to Existing 8" Force Main	EA
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497-85.05.01	Connect 10" Force Main to Existing 10" Force Main	EA
497-85.06.01	Connect 12" Force Main to Existing 12" Force Main	EA
497-85.07.01	Connect 16" Force Main to Existing 16" Force Main	EA
497-85.08.01	Connect 18" Force Main to Existing 18" Force Main	EA
497-85.09.01	Connect 24" Force Main to Existing 24" Force Main	EA
497-85.10.01	Connect Existing Force Main to New Manhole	EA
497-85.10.02	Connect Existing Force Main to New Wet Well	EA
497-85.10.03	Reserved	

Payment for these pay items shall be made at the unit price set forth in the bid schedule and shall constitute full compensation for work specified in the contract documents. Payment shall include all costs for excavation, backfilling, dewatering, connection, and other items required to complete the installation.

497-90.01.01	2" Tap on Existing 6" Force Main w/Valve	EA
497-90.01.02	2" Tap on Existing 8" Force Main w/Valve	EA
497-90.01.03	2" Tap on Existing 10" Force Main w/Valve	EA
497-90.01.04	2" Tap on Existing 12" Force Main w/Valve	EA
497-90.02.03	4" Tap on Existing 10" Force Main w/Valve	EA
497-90.02.04	4" Tap on Existing 12" Force Main w/Valve	EA

497-90.02.05	Reserved	
497-90.03.01	6" Tap on Existing 8" Force Main w/Valve	EA
497-90.03.02	6" Tap on Existing 10" Force Main w/Valve	EA
497-90.03.03	6" Tap on Existing 12" Force Main w/Valve	EA
497-90.03.04	Reserved	
497-90.04.01	8" Tap on Existing 8" Force Main w/Valve	EA
497-90.04.02	8" Tap on Existing 10" Force Main w/Valve	EA
497-90.04.03	8" Tap on Existing 12" Force Main w/Valve	EA
497-90.04.04	8" Tap on Existing 14" Force Main w/Valve	EA
497-90.04.05	Reserved	

Payment for these pay items shall be made at the unit price set forth in the bid schedule and shall constitute full compensation for work specified in the contract documents. Payment shall include all costs for excavation, backfilling, tapping, valve installation, and other items required to complete the installation.

DIVISION 490

SECTION 498

**SANITARY SEWER
SYSTEM**

STANDARD DETAILS

SECTION 498
SANITARY SEWER SYSTEM STANDARD DETAILS

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498-5 RESERVED

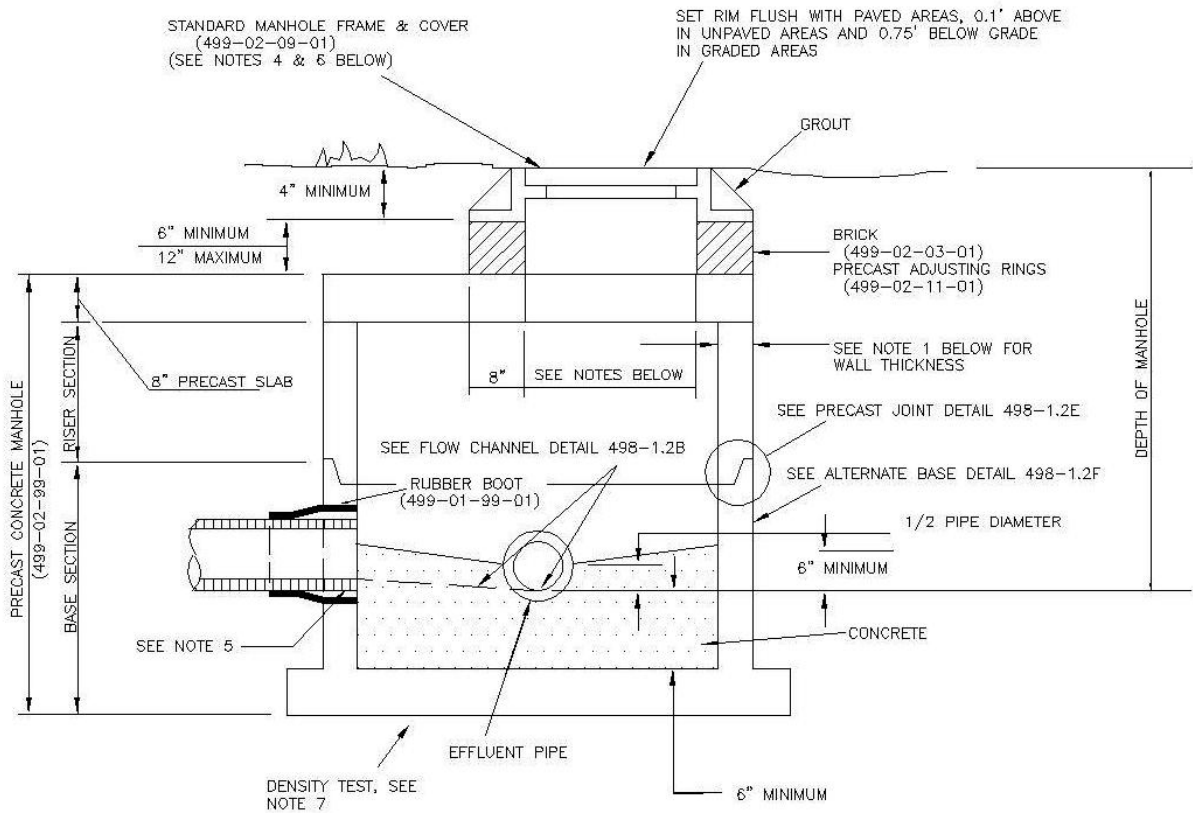
498-6 RESERVED

498-7 RESERVED

498-8 RESERVED

498-9 ASBUILT DRAWING

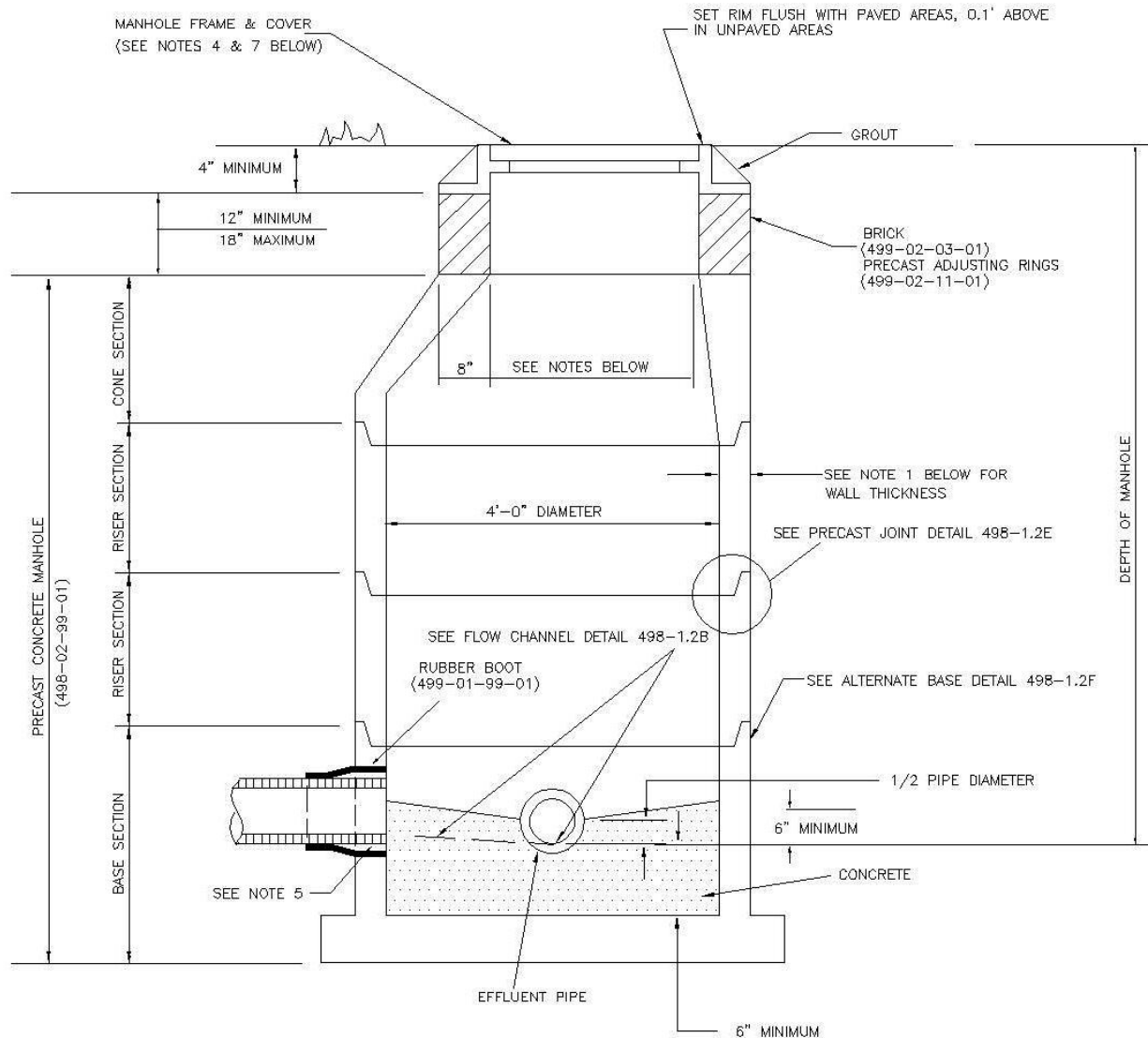
- 498-9.1 A. Typical Sanitary Sewer Asbuilt Drawing



NOTES

1. MINIMUM WALL THICKNESS SHALL BE FIVE INCHES (5") OR 1/12 THE INSIDE DIAMETER, WHICHEVER IS GREATER.
2. ALL MANHOLES TO BE MAINTAINED BY THE CITY SHALL BE LINED. THE LINING SHALL BE HDPE (499-02-99-06). THE EXTERIOR AREAS SHALL BE COATED WITH TWO (2) COATS OF BITUMASTIC SEALER.
3. MANHOLES SHALL BE FURNISHED WITH FACTORY INSTALLED BOOTS (499-01-99-01) TO CONNECT SEWER PIPES TO MANHOLES.
4. MANHOLE TO BE INSTALLED WITH A STANDARD 24" RING AND COVER UNLESS OTHERWISE SPECIFIED.
5. FILL ANNULAR VOID BETWEEN PIPE AND RUBBER BOOT WITH GROUT AND FLUSH WITH MANHOLE WALLS.
6. MANHOLE COVER IN PAVED ROADWAY SHALL BE STANDARD UNLESS OTHERWISE SPECIFIED (499-02-09-01).
7. EACH MANHOLE INSTALLED SHALL HAVE ONE COMPACTION DENSITY TEST PER 491.4.1.1 IN SPECIFICATIONS, 100% STANDARD PROCTOR.

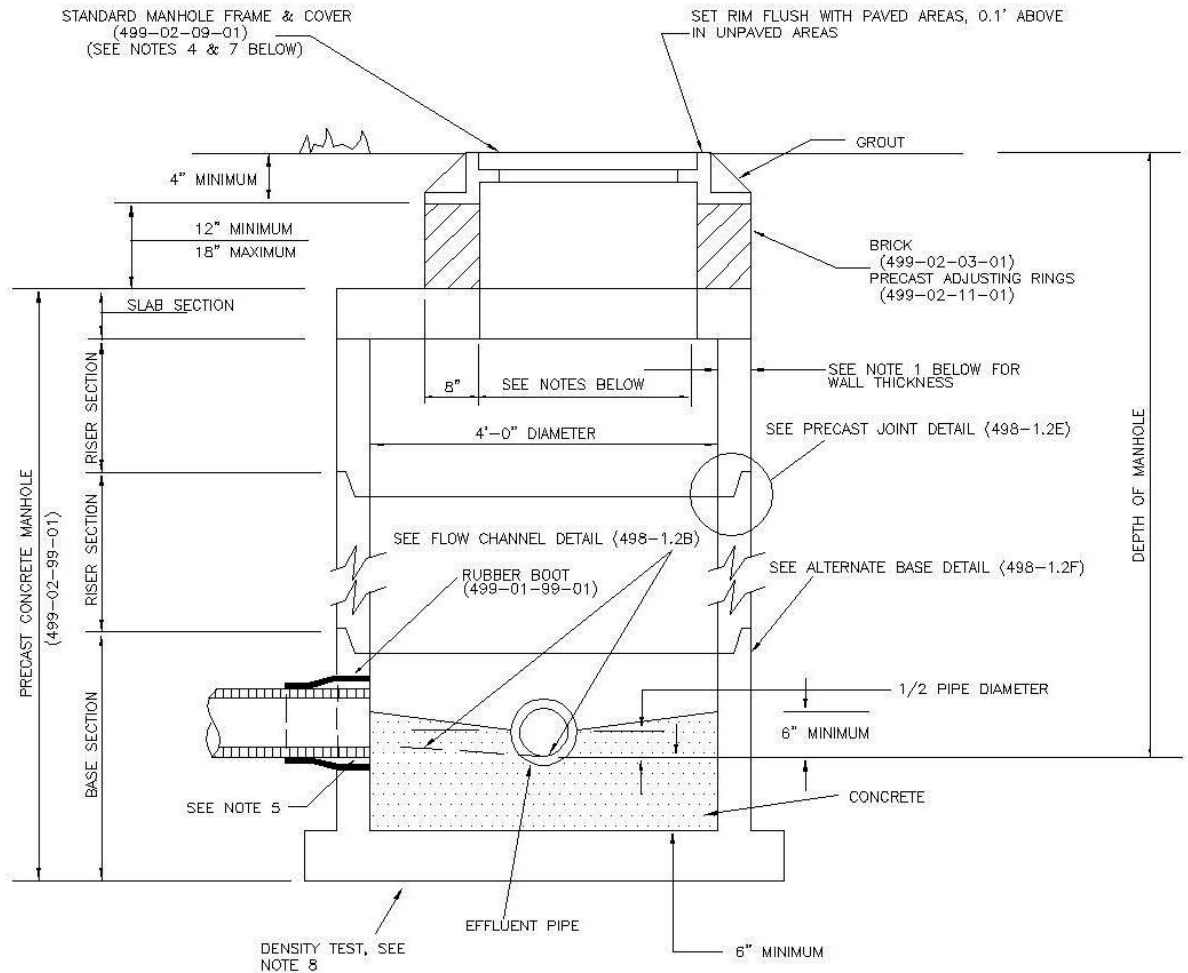
SPECIFICATION										DATE REVISED:					SECTION	
															SHT. 1 OF 1	
CITY OF VALDOSTA					CITY OF VALDOSTA STANDARD DETAIL					PRECAST CONCRETE MANHOLE LESS THAN 5' DEPTH					A	
															498-1.1	



NOTES

1. MINIMUM WALL THICKNESS SHALL BE FIVE INCHES (5") OR 1/12 THE INSIDE DIAMETER, WHICHEVER IS GREATER.
2. ALL MANHOLES THAT WILL BE MAINTAINED BY THE CITY OF VALDOSTA SHALL BE LINED. MANHOLE LINING SHALL BE HDPE (499-02-99-06). THE EXTERIOR AREAS SHALL BE COATED WITH TWO (2) COATS OF BITUMASTIC SEALER.
3. MANHOLES SHALL BE FURNISHED WITH FACTORY INSTALLED BOOTS (499-01-99-01) TO CONNECT SEWER PIPES TO MANHOLES.
4. MANHOLE TO BE INSTALLED WITH 24" STANDARD RING AND COVER UNLESS OTHERWISE SPECIFIED.
5. FILL ANNULAR VOID BETWEEN PIPE AND RUBBER BOOT WITH GROUT AND FLUSH WITH MANHOLE WALL.
6. LIMEROCK WILL BE PLACED AROUND RING & COVER TO BOTTOM OF ASPHALT.
7. MANHOLE COVERS IN PAVEMENT SHALL BE STANDARD OR HINGED (499-02-09-03) WHERE SPECIFIED.
8. EACH MANHOLE INSTALLED SHALL HAVE ONE COMPACTION DENSITY TEST PER 491.4.1.1 IN SPECIFICATIONS, 100% STANDARD PROCTOR.

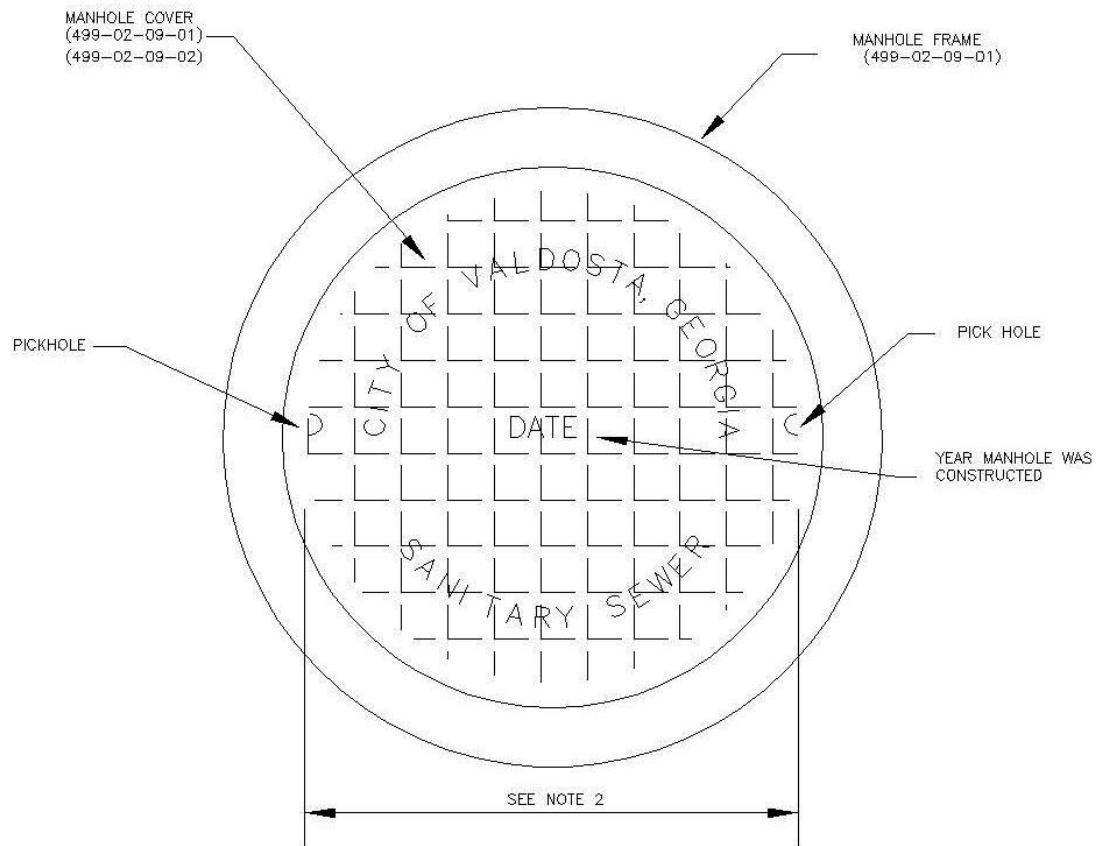
SPECIFICATION		DATE REVISED:	SECTION
			SHT. 1 OF 1
CITY OF VALDOSTA	CITY OF VALDOSTA STANDARD DETAIL	PRECAST CONCRETE MANHOLE 5' TO 12' DEPTH	
			B
			498-1.1



NOTES

1. MINIMUM WALL THICKNESS SHALL BE FIVE INCHES (5") TO A DEPTH OF TEN FEET (10'). WALL THICKNESS SHALL BE INCREASED TO EIGHT INCHES (8") AT TEN FEET BELOW GRADE.
2. THE EXTERIOR AREAS SHALL BE COATED WITH TWO (2) COATS OF BITUMASTIC SEALER. ALL MANHOLES MAINTAINED BY THE CITY OF VALDOSTA SHALL BE LINED. LINING SHALL BE HDPE (499-02-99-06).
3. MANHOLES SHALL BE FURNISHED WITH FACTORY INSTALLED BOOTS (499-01-99-01) TO CONNECT SEWER PIPES TO MANHOLES.
4. MANHOLE TO BE INSTALLED WITH 32" OR 36" STANDARD RING AND COVER UNLESS OTHERWISE SPECIFIED.
5. FILL ANNULAR SPACE BETWEEN PIPE AND BOOT WITH GROUT AND FLUSH WITH WALL OF MANHOLE.
6. LIMEROCK WILL BE PLACED AROUND RING AND COVER TO BOTTOM OF ASPHALT.
7. MANHOLE COVERS IN PAVED ROADWAYS SHALL BE STANDARD (499-02-09-01).
8. EACH MANHOLE INSTALLED SHALL HAVE ONE COMPACTION DENSITY TEST PER 491.4.1.1 IN SPECIFICATIONS 100% STANDARD PROCTOR.

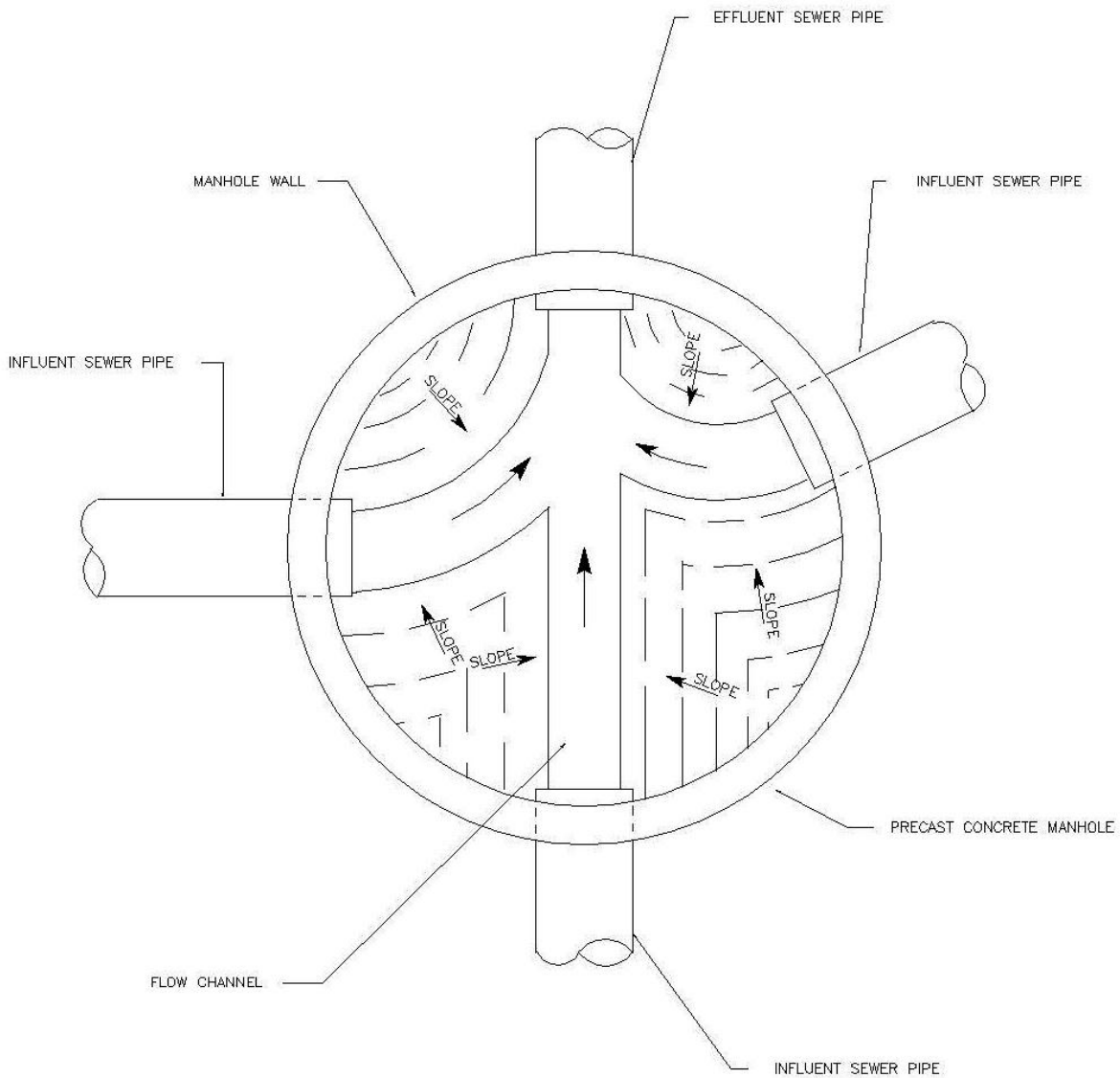
SPECIFICATION		DATE REVISED:		SECTION	
				SHT. 1 OF 1	
CITY OF VALDOSTA		CITY OF VALDOSTA STANDARD DETAIL		PRECAST CONCRETE MANHOLE OVER 12' DEPTH	
				C	
				498-1.1	



NOTES

1. MANHOLE COVER SHALL BE LETTERED WITH THE WORDS "CITY OF VALDOSTA, GEORGIA" ACROSS THE TOP, "SANITARY SEWER" ACROSS THE BOTTOM AND THE YEAR OF THE MANUFACTURE IN CENTER.
2. UNLESS OTHERWISE SPECIFIED MANHOLE COVERS SHALL BE 24" DIAMETER, AND DOUBLE COVERS DEPENDING ON DEPTH. 32" DIAMETER.

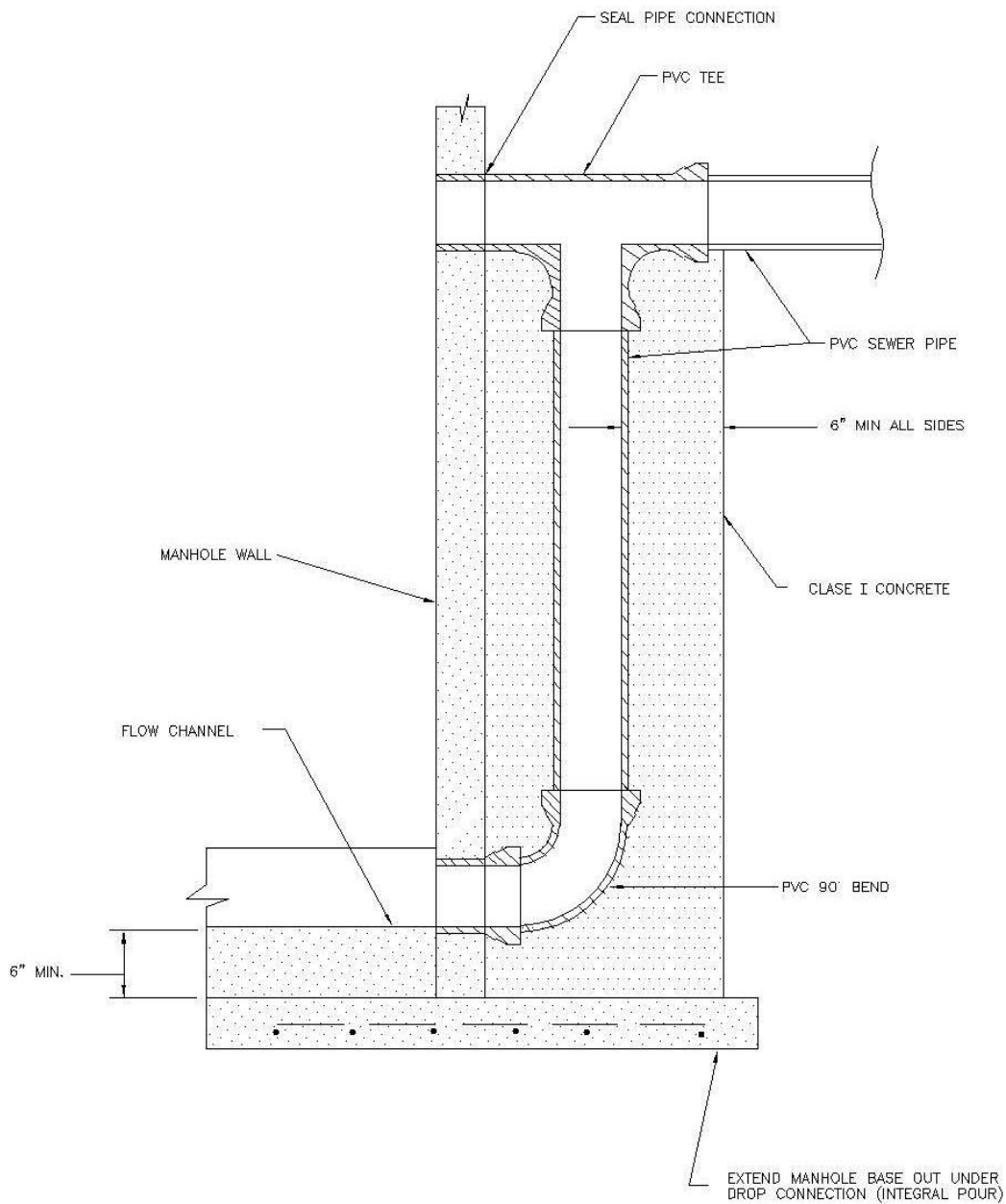
SPECIFICATION		DATE REVISED:	SECTION
			SHT. 1 OF 2
CITY OF VALDOSTA	CITY OF VALDOSTA STANDARD DETAIL	SANITARY SEWER MANHOLE COVER	
			A 498-1.2



NOTES

1. FLOW CHANNELS IN MANHOLE BOTTOM SHALL HAVE SAME RADIUS AS EFFLUENT SEWER LINES.
2. FLOW CHANNELS SHALL BE FORMED OF CLASS I CONCRETE. ALL INVERTS SHALL FOLLOW THE GRADES OF THE PIPE ENTERING THE MANHOLE. BRICKS OR OTHER FILL MATERIALS SHALL NOT BE USED WHEN FORMING FLOW CHANNELS.
3. THAT PORTION OF THE FLOW CHANNEL ABOVE THE SLOPED SIDES SHALL BE FREE OF COVERING TO THE LIMITS SHOWN ABOVE.

SPECIFICATION										DATE REVISED:					SECTION	
															SHT. 1 OF 1	
CITY OF VALDOSTA			CITY OF VALDOSTA STANDARD DETAIL				SANITARY SEWER MANHOLE FLOW CHANNEL					B				
														498-1.2		



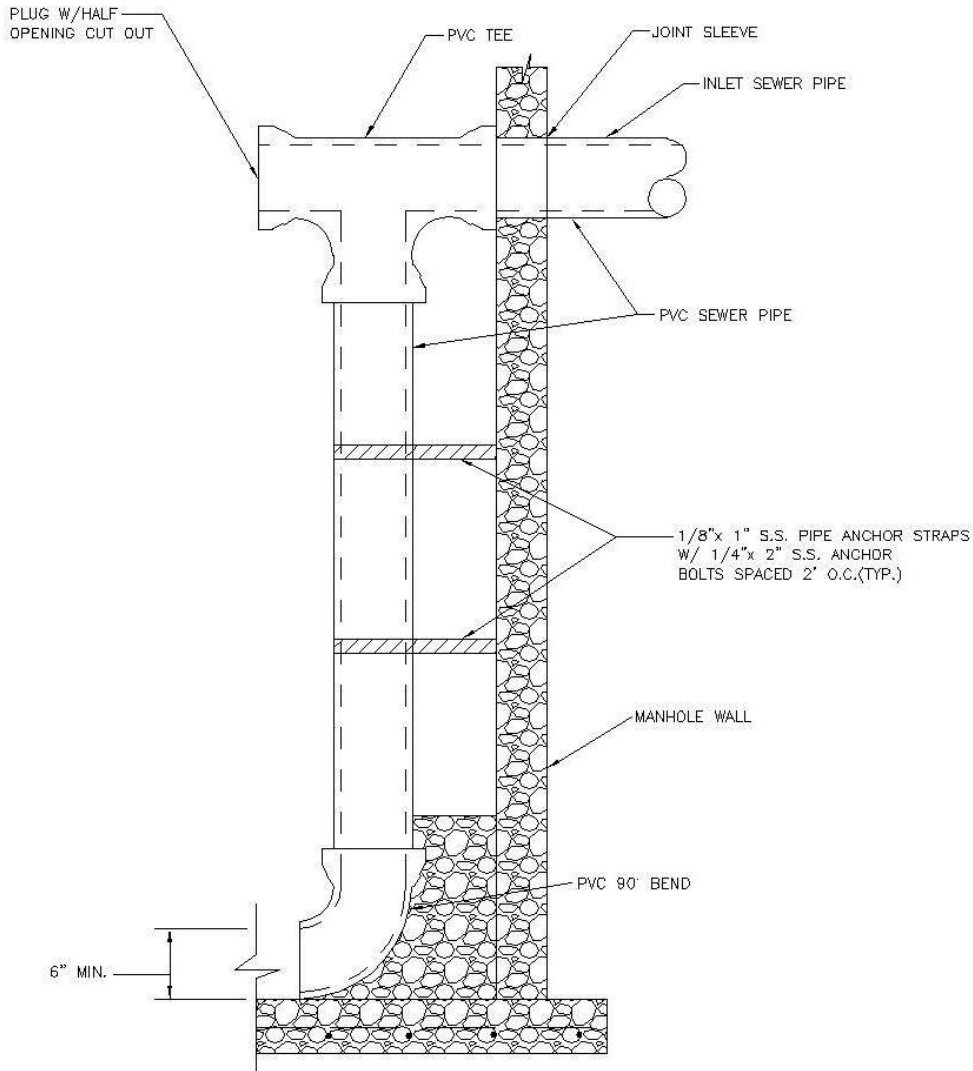
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CITY OF VALDOSTA

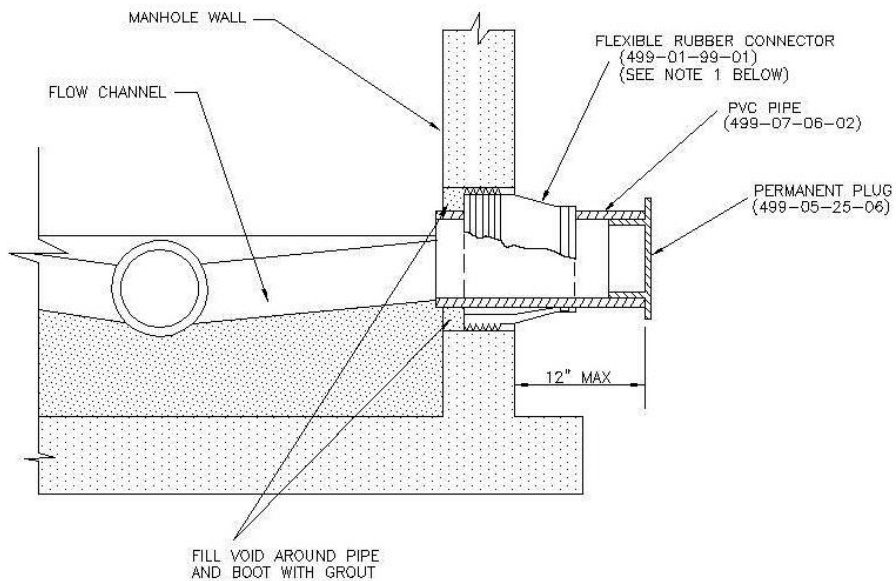
CITY OF VALDOSTA
STANDARD DETAIL

SANITARY SEWER
MANHOLE DROP CONNECTION

C
498-1.2



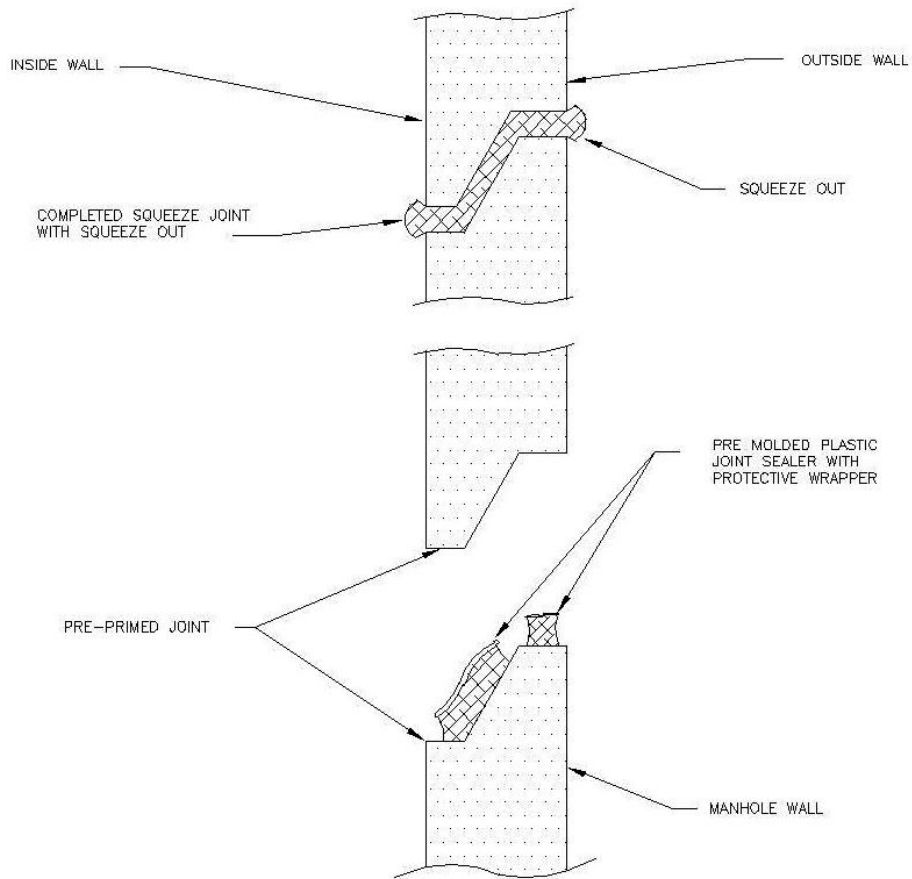
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				SHT. 1 OF 1	
CITY OF VALDOSTA	CITY OF VALDOSTA STANDARD DETAIL	SANITARY SEWER MANHOLE INSIDE DROP CONNECTION		C2	
				498-1.2	



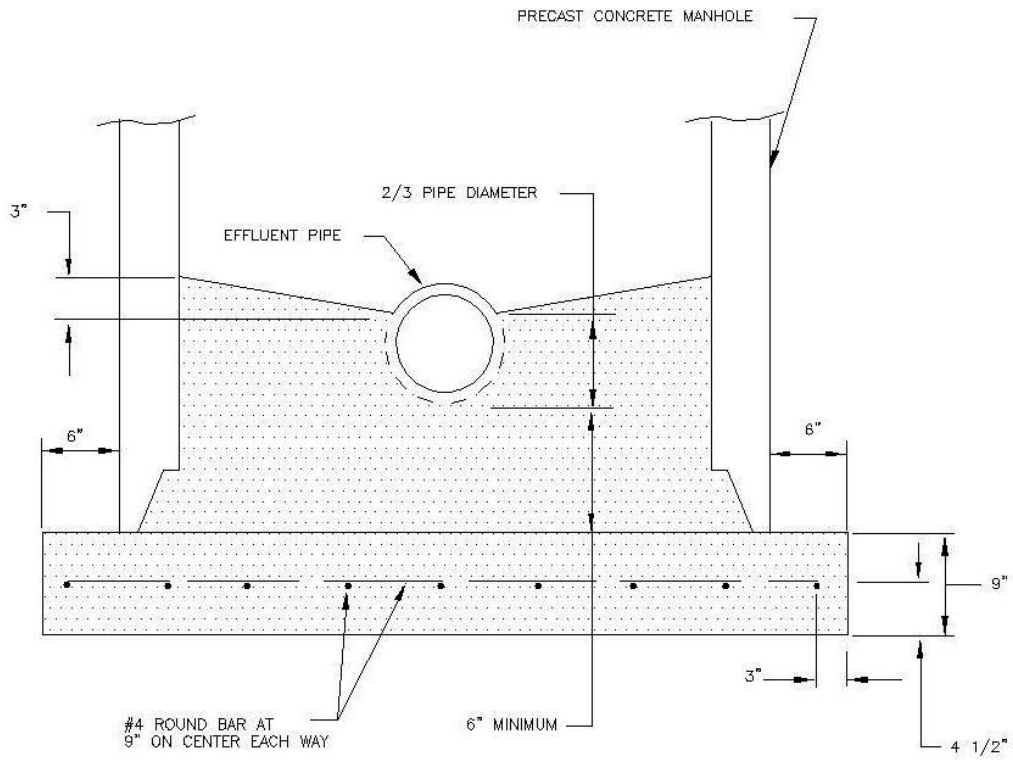
NOTES

1. BOOTS SHALL BE INSTALLED BY THE MANUFACTURER OF THE PRECAST MANHOLE IN ACCORDANCE WITH THE BOOT MANUFACTURERS INSTRUCTIONS.

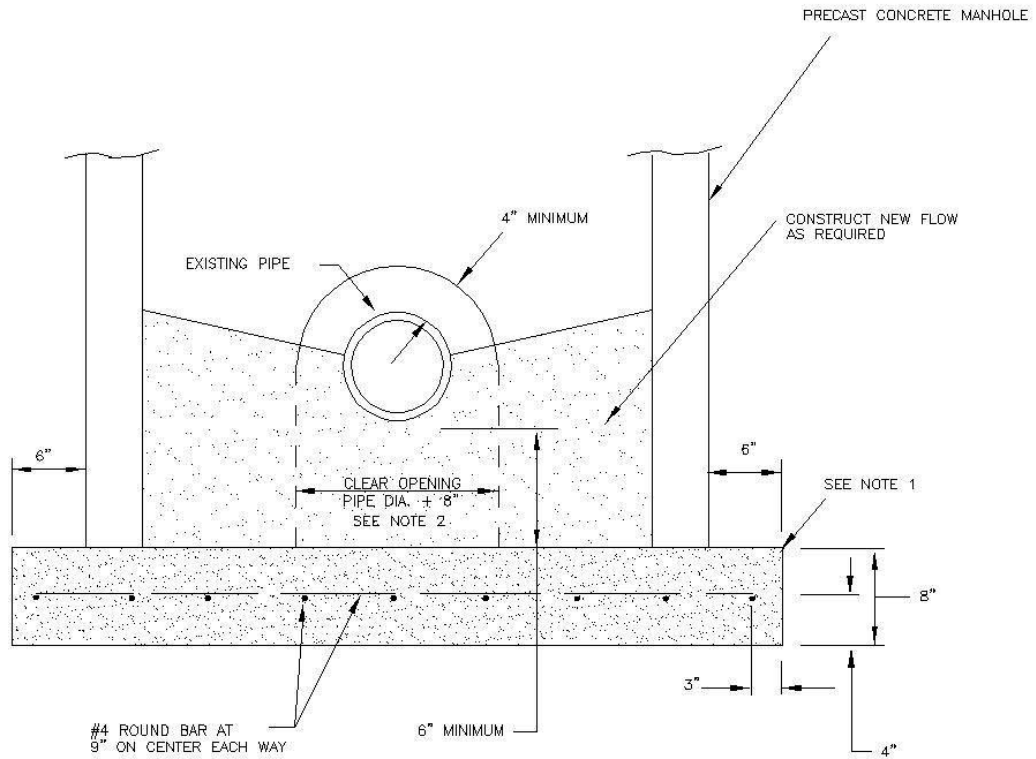
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															SHT 1 OF 1	
CITY OF VALDOSTA			CITY OF VALDOSTA STANDARD DETAIL				SANITARY SEWER MANHOLE STUBOUT					D 498-1.2				



SPECIFICATION										DATE REVISED:										SECTION	
																				SHT. 1 OF 1	
CITY OF VALDOSTA					CITY OF VALDOSTA STANDARD DETAIL					PRECAST CONCRETE MANHOLE JOINT CONSTRUCTION										E	

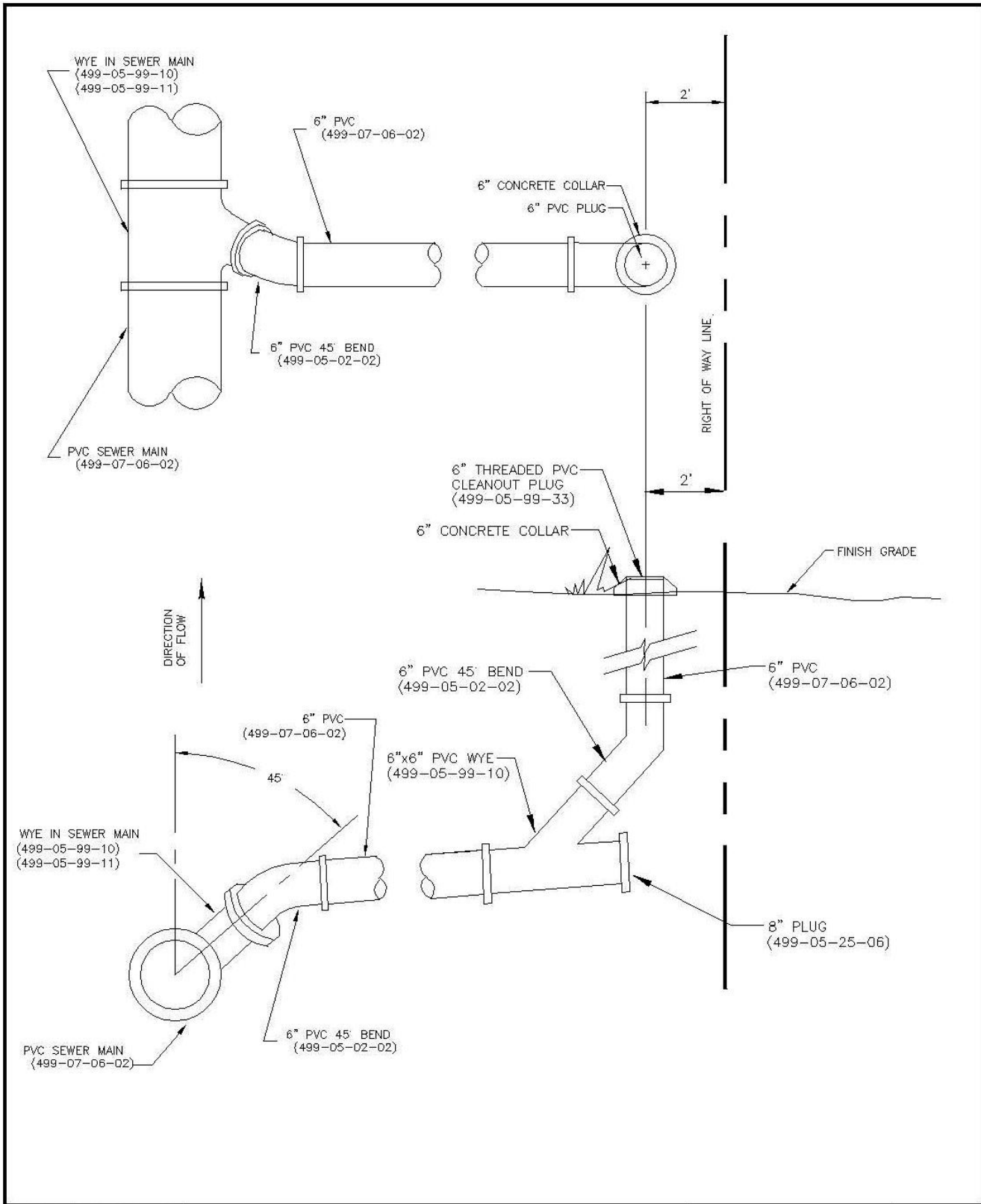


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CITY OF VALDOSTA			CITY OF VALDOSTA STANDARD DETAIL				PRECAST CONCRETE MANHOLE ALTERNATE BASE CONSTRUCTION					 498-1.2				

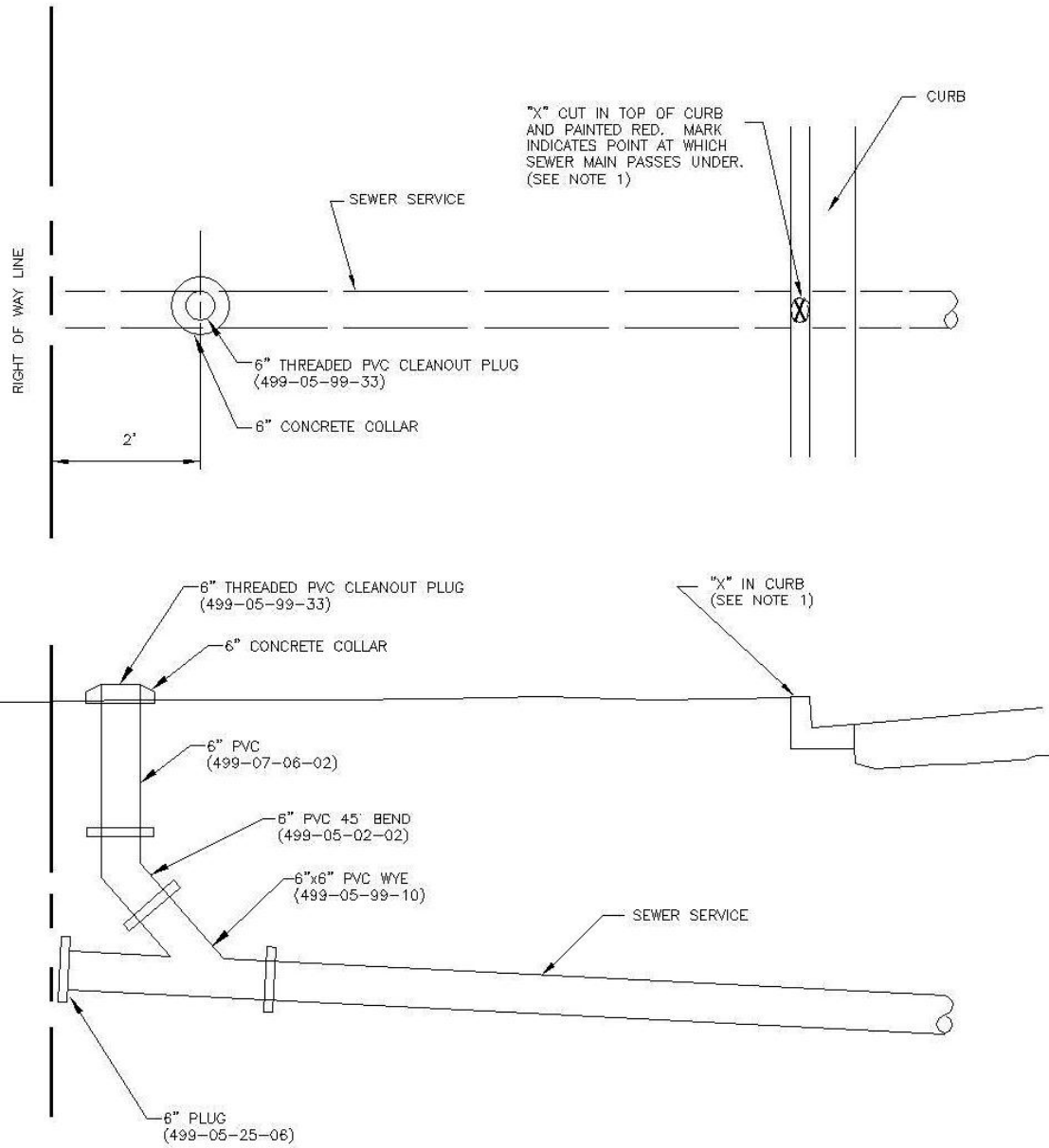


1. MANHOLE BASE CAN BE EITHER CAST IN PLACE AS SHOWN OR PRECAST BY AN APPROVED PRECASTER.
2. FILL VOID WITH BRICK AND GROUT AS APPROVED BY THE CITY ENGINEER.
3. MANHOLE MUST BE LEAK OR AIR TESTED.

SPECIFICATION		DATE REVISED:	SECTION
			SHT. 1 OF 1
CITY OF VALDOSTA	CITY OF VALDOSTA STANDARD DETAIL	DOGHOUSE MANHOLE BASE CONSTRUCTION	
			G 498-1.2



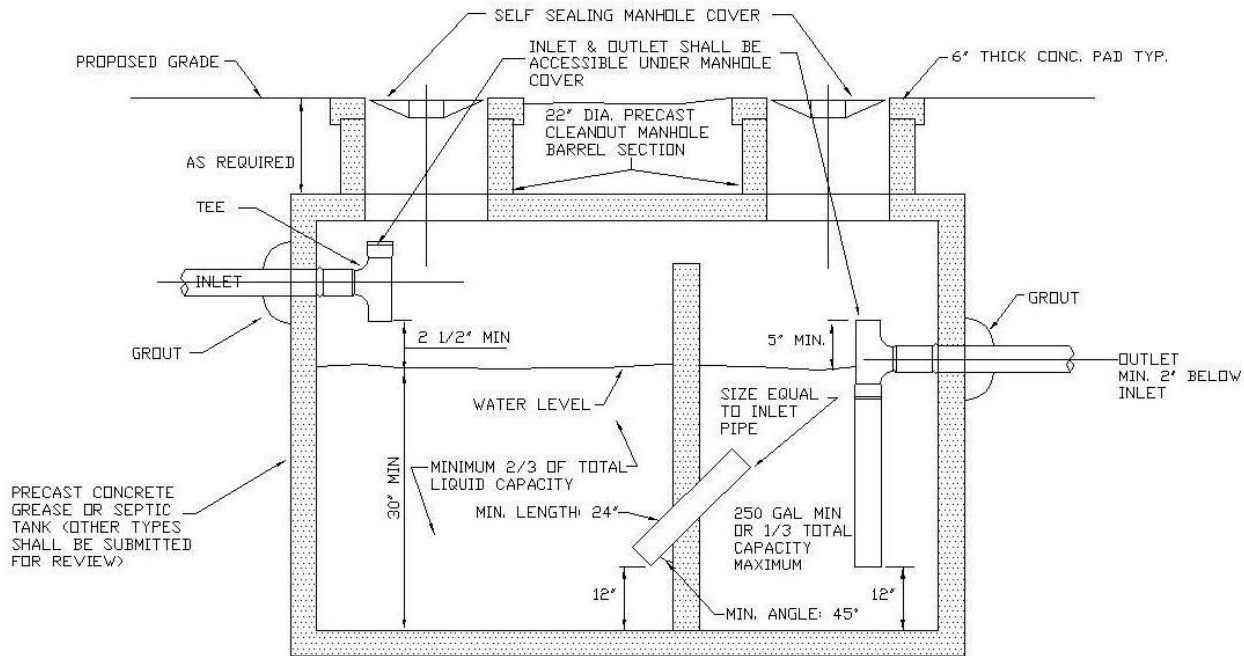
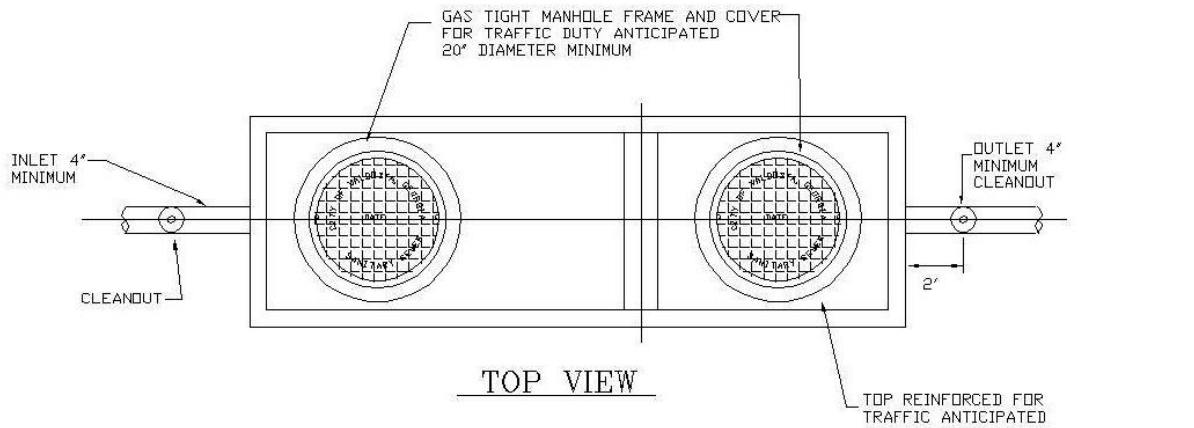
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			SHT. 1 OF 1
CITY OF VALDOSTA	CITY OF VALDOSTA STANDARD DETAIL	SANITARY SEWER SERVICE SINGLE SEWER SERVICE	A
			498-2.1



NOTES

1. WHERE NO CURB AND GUTTER EXIST, THE SEWER SERVICE SHALL BE REFERENCED BY PLACING A NAIL & DISC AND AT THE EDGE OF PAVEMENT.
2. ALL SEWER MAINS SHALL BE TELEVISED ACCURATELY LOCATING WYE LOCATIONS. SEE STANDARD SPECIFICATION 496-3.
3. GRAPHIC ASBUILTS SHALL ACCURATELY LOCATE ALL WYES AND SERVICES. SEE STANDARD SPECIFICATION 496-2.

SPECIFICATION						DATE REVISED:			SECTION	
									SHT. 1 OF 1	
CITY OF VALDOSTA		CITY OF VALDOSTA STANDARD DETAIL		SANITARY SEWER SERVICE				C		
				SERVICE REFERENCING						
								498-2.1		



SECTION

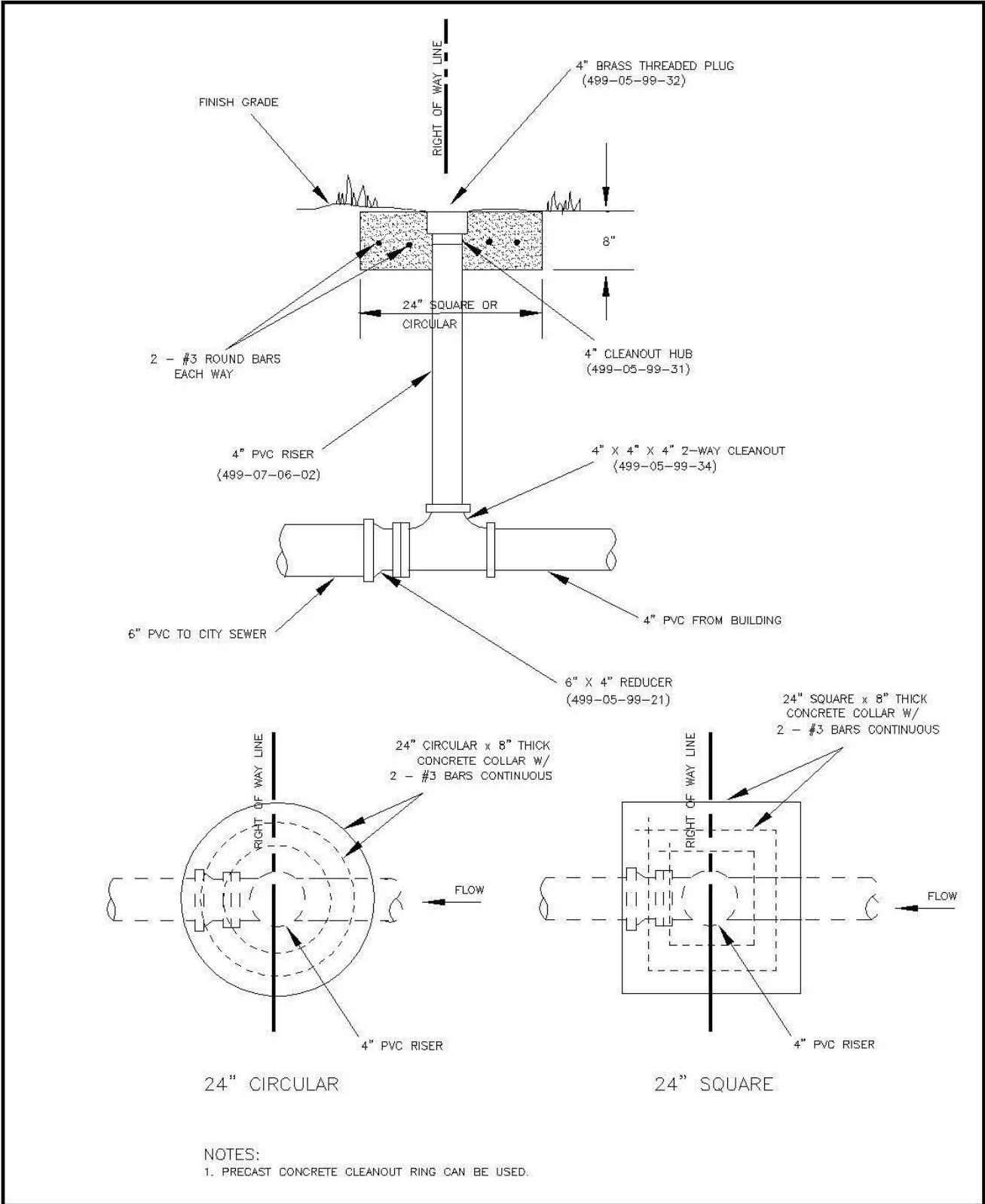
DESIGN CALCULATIONS		
<p>RESTAURANTS $(S) \times (20) \times (HR/12) \times (LF) = \text{CAPACITY IN GALLONS}$ (S) = NUMBER OF SEATS IN DINING AREA (HR) = NUMBER OF HOURS ESTABLISHMENT IS OPEN (LF) = LOADING FACTOR--(1.25 WITH INTERSTATE HIGHWAYS, 1.0 OTHER FREEWAYS, 1.00 RECREATIONAL AREAS, 0.8 MAIN HIGHWAYS AND 1.00 OTHERWISE)</p>	<p>OTHER TYPES OF COMMERCIAL KITCHENS $(M) \times (5) \times (LF) = \text{CAPACITY IN GALLONS}$ (M) = MEALS PER DAY (LF) = LOADING FACTOR--(1.0 WITH DISHWASHER, 0.05 WITHOUT DISHWASHER)</p>	<p>SHOPPING CENTERS AND MIXED USE 1,000 GALLONS FOR THE FIRST 46 SEATS AND 500 ADDITIONAL GALLONS FOR EACH ADDITIONAL 23 SEATS.</p>

NOTE

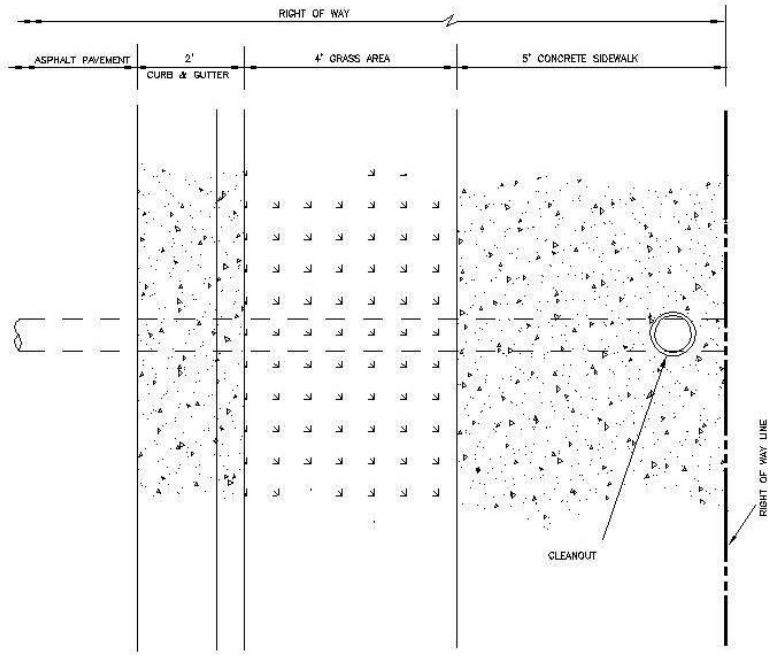
- STANDARDS FOR MONITORING THE INLET AND OUTLET PIPE FITTINGS OR BAFFLES SHALL BE PROVIDED FROM MANHOLES. CLEANDUTS SHALL BE INSTALLED BEFORE THE FIRST GREASE INTERCEPTOR AND WITHIN TWO FEET AFTER THE LAST INTERCEPTOR IN THE SERIES.
- GREASE INTERCEPTOR (OR INTERCEPTORS) SHALL BE DESIGNED TO PRODUCE A CLARIFIED EFFLUENT ACCEPTABLE TO CITY OF VALDOSTA

GREASE INTERCEPTOR DETAIL

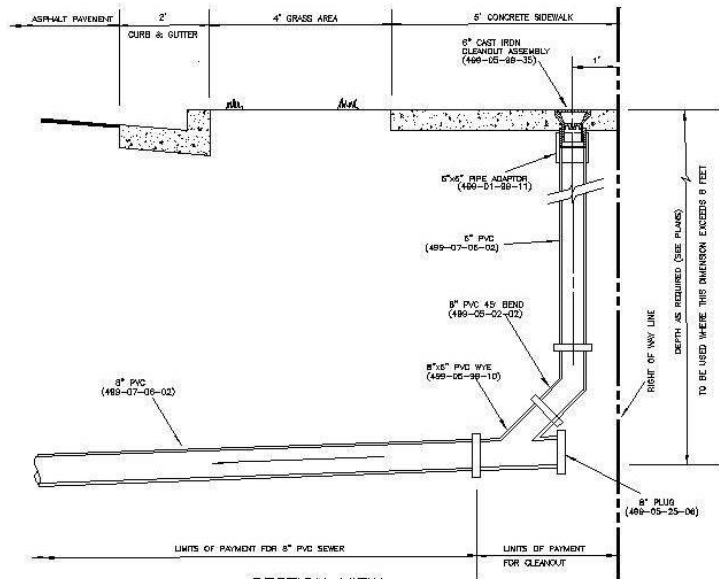
SPECIFICATION		DATE REVISED:	SECTION
			SHT 1 OF 1
CITY OF VALDOSTA	CITY OF VALDOSTA STANDARD DETAIL	GREASE INTERCEPTOR SEPARATOR	A
			498-2.2



SPECIFICATION					DATE REVISED:					SECTION	
REVISIONS										SHT. 1 OF 1	
CITY OF VALDOSTA			CITY OF VALDOSTA STANDARD DETAIL			SANITARY SEWER SERVICE RESIDENTIAL CLEANOUT					B
											498-2.2



PLAN VIEW

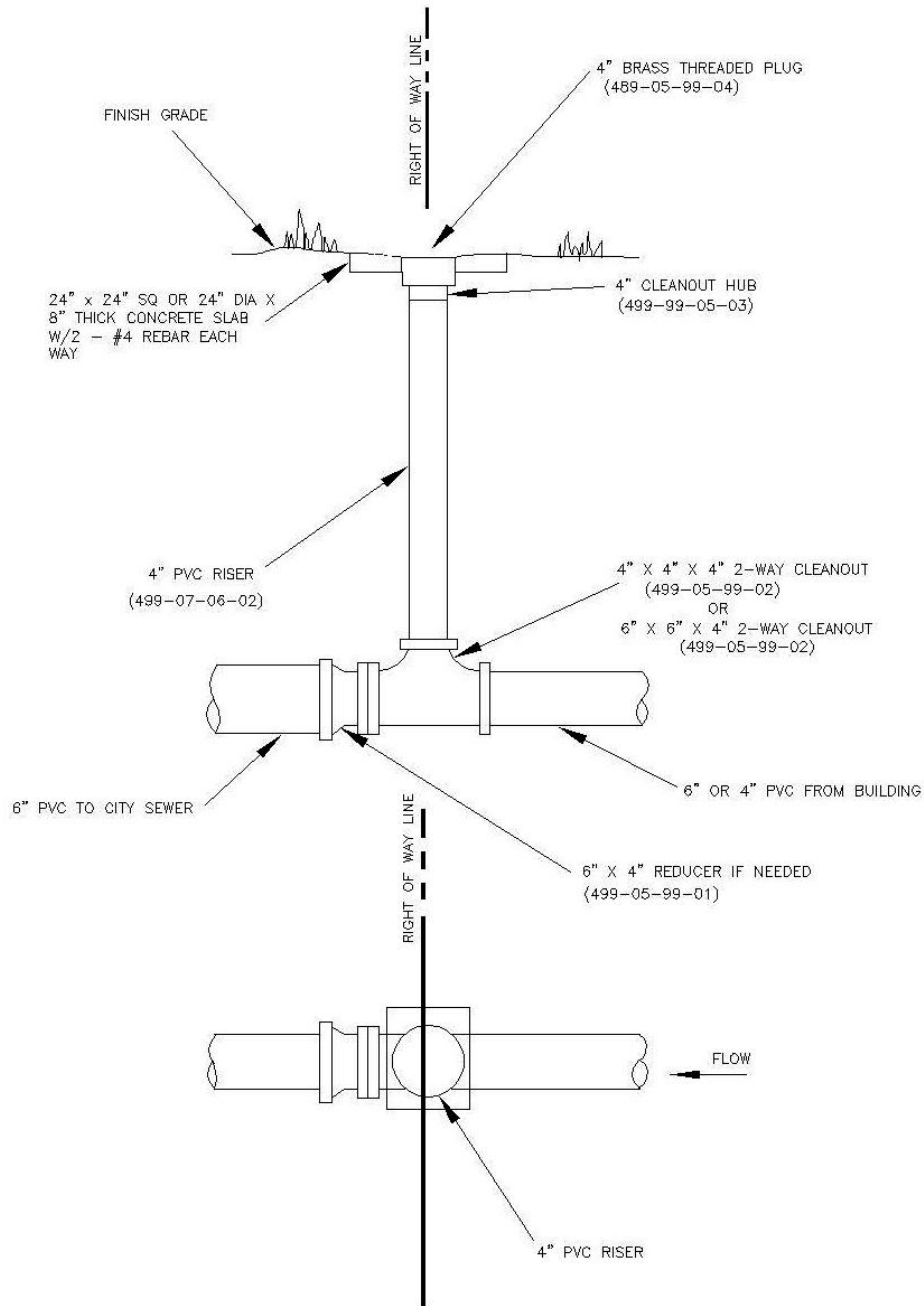


SECTION VIEW

NOTES

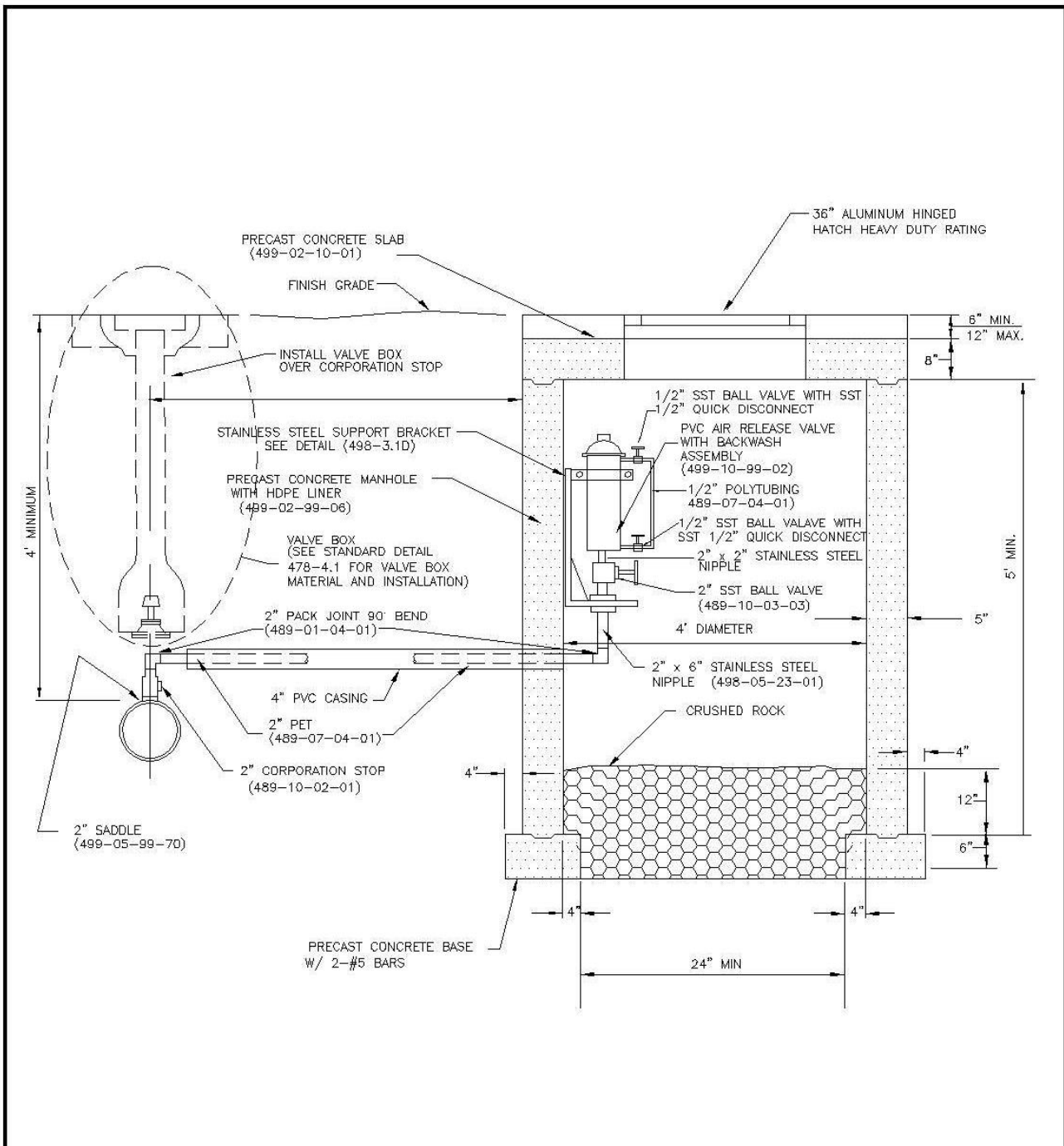
1. CLEANOUT INCLUDES 8"x6" WYE, 6"x45" BEND, CLEANOUT ASSEMBLY, 6" PVC, PIPE ADAPTOR, AND 8" PLUG.
2. IF NO SIDEWALK PLACE 24" SQ OR 24" DIA x 8" THICK SLAB WITH 2 - #3 REBAR EACH WAY

SPECIFICATION		DATE REVISED:	SECTION
			SHT. 1 OF 1
CITY OF VALDOSTA	CITY OF VALDOSTA STANDARD DETAIL	SANITARY SEWER STUBOUT	
			C 498-2.2



1. ALL CLEANOUTS ON SITE NEED TO HAVE CONCRETE PADS.

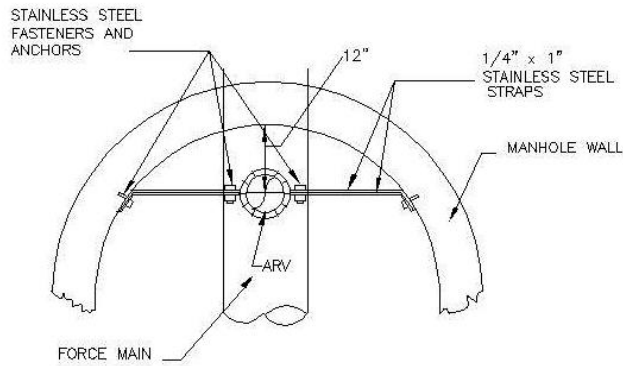
SPECIFICATION		DATE REVISED:		SECTION	
REVISIONS				SHT. 1 OF 1	
CITY OF VALDOSTA		CITY OF VALDOSTA STANDARD DETAIL		SANITARY SEWER SERVICE COMMERCIAL CLEANOUT	
				D 498-2.2	



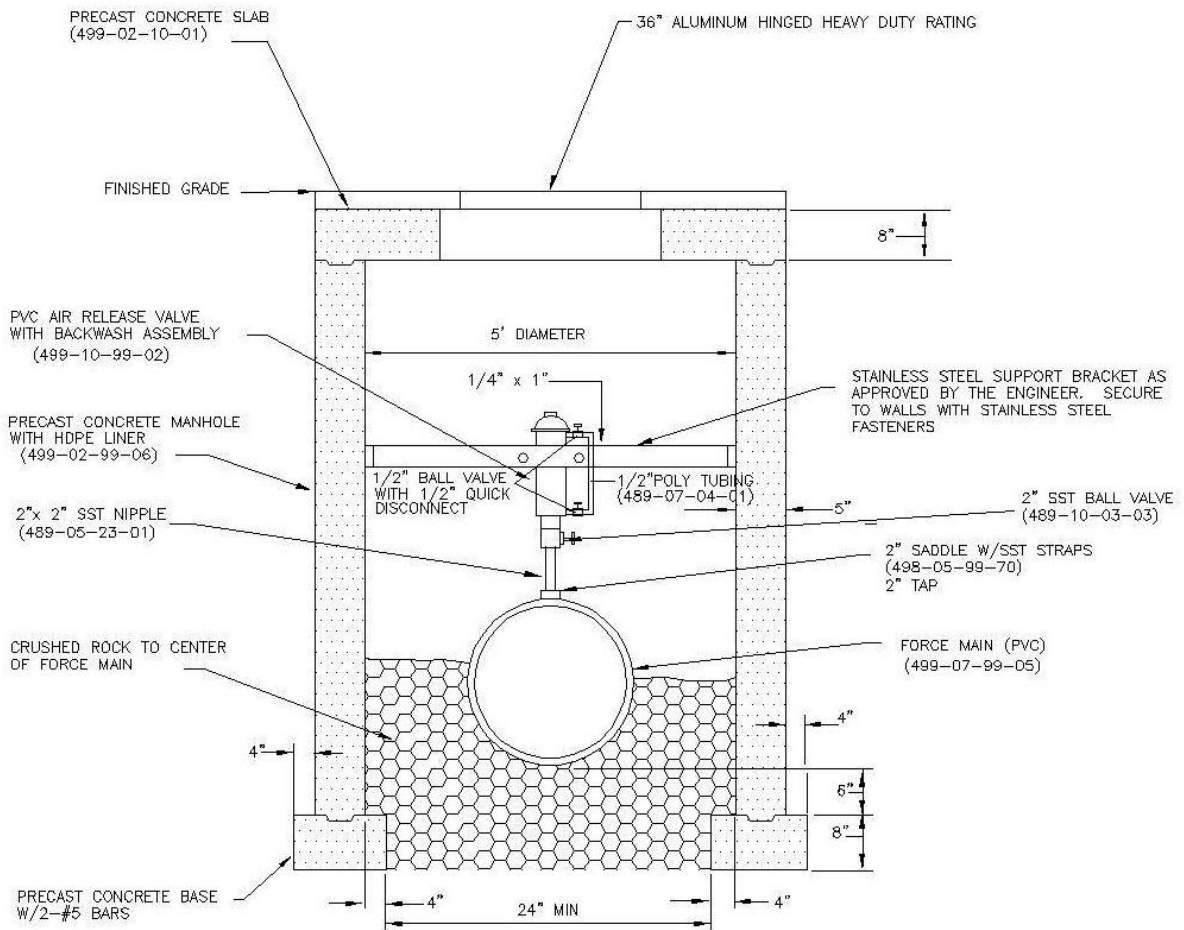
NOTES

1. MANHOLE WALLS SHALL BE LINED AS SPECIFIED IN SECTION 498-1.1.
2. USE STAINLESS STEEL FASTENERS TO SECURE ARV AND APPURTENANCES.
3. COAT INSIDE OF MANHOLE RIM AND COVER WITH EPOXY CEMENT AS SPECIFIED.

SPECIFICATION	DATE REVISED:	SECTION
		SHT 1 OF 1
CITY OF VALDOSTA	CITY OF VALDOSTA STANDARD DETAIL	AIR RELEASE VALVE ASSEMBLY DISCHARGE TO NEW MANHOLE
A		
498-3.1		



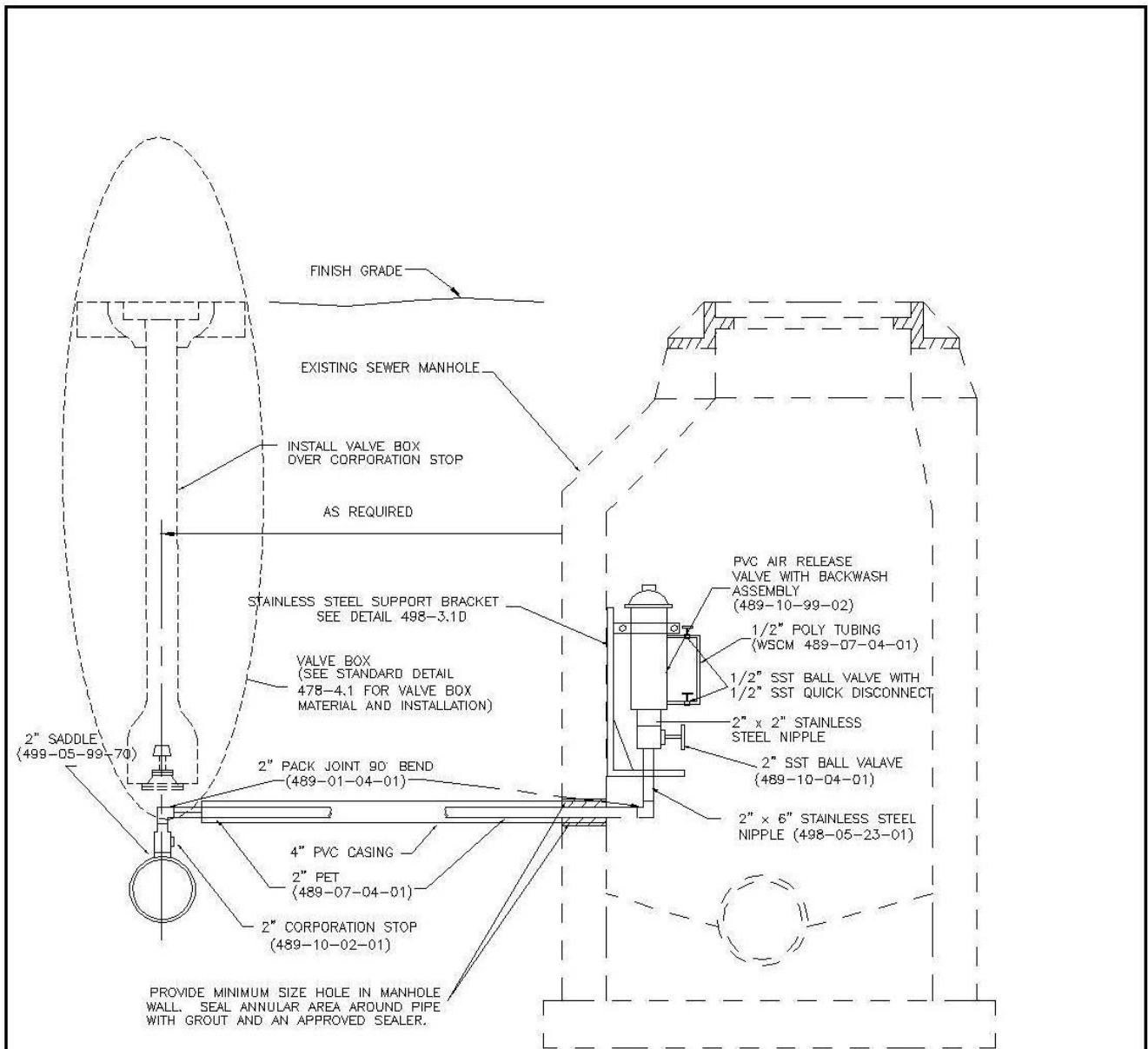
PLAN VIEW



NOTES

1. MANHOLE WALLS SHALL BE LINED AS SPECIFIED IN SECTION 498-1.1.
2. USE STAINLESS STEEL FASTENERS TO SECURE ARV AND APPURTENANCES.
3. FOR DIP FORCE MAINS COAT OUTSIDE EXPOSED AREA OF FORCE MAIN WITH EPOXY COATING (499-11-31-02).
4. LID TO READ SANITARY SEWER FORCE MAIN AIR RELEASE VALVE.

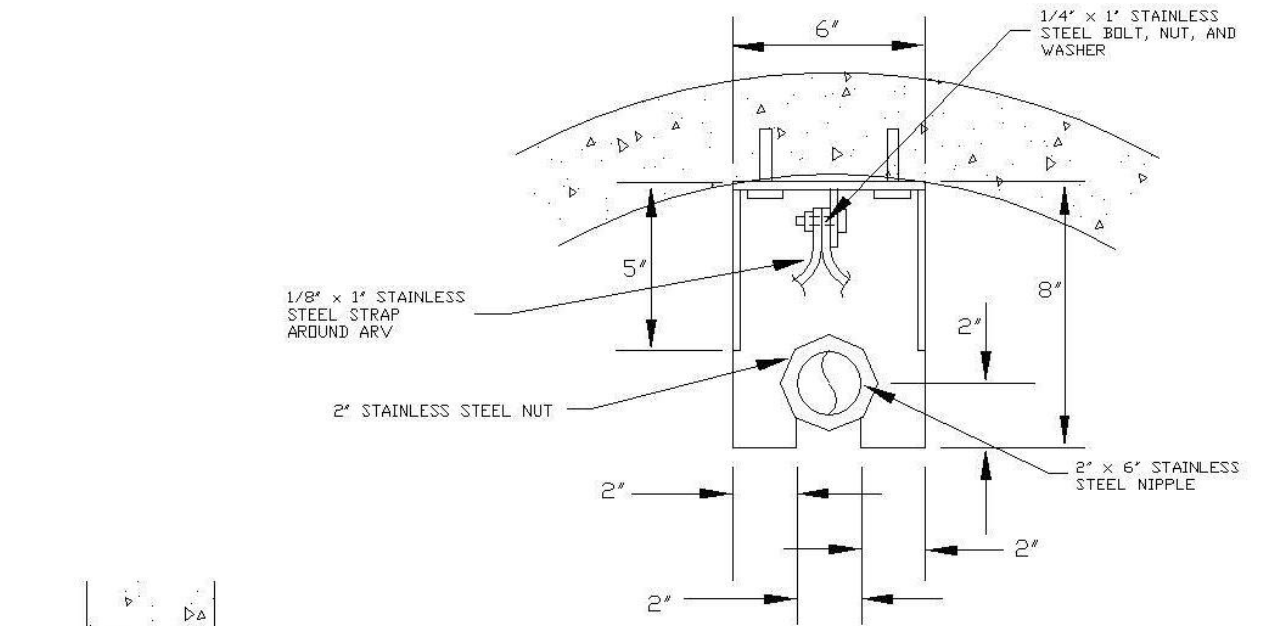
SPECIFICATION		DATE REVISED:	SECTION
			SHT 1 of 1
CITY OF VALDOSTA	CITY OF VALDOSTA STANDARD DETAIL	AIR RELEASE VALVE ASSEMBLY OVER FORCE MAIN	B
			498-3.1



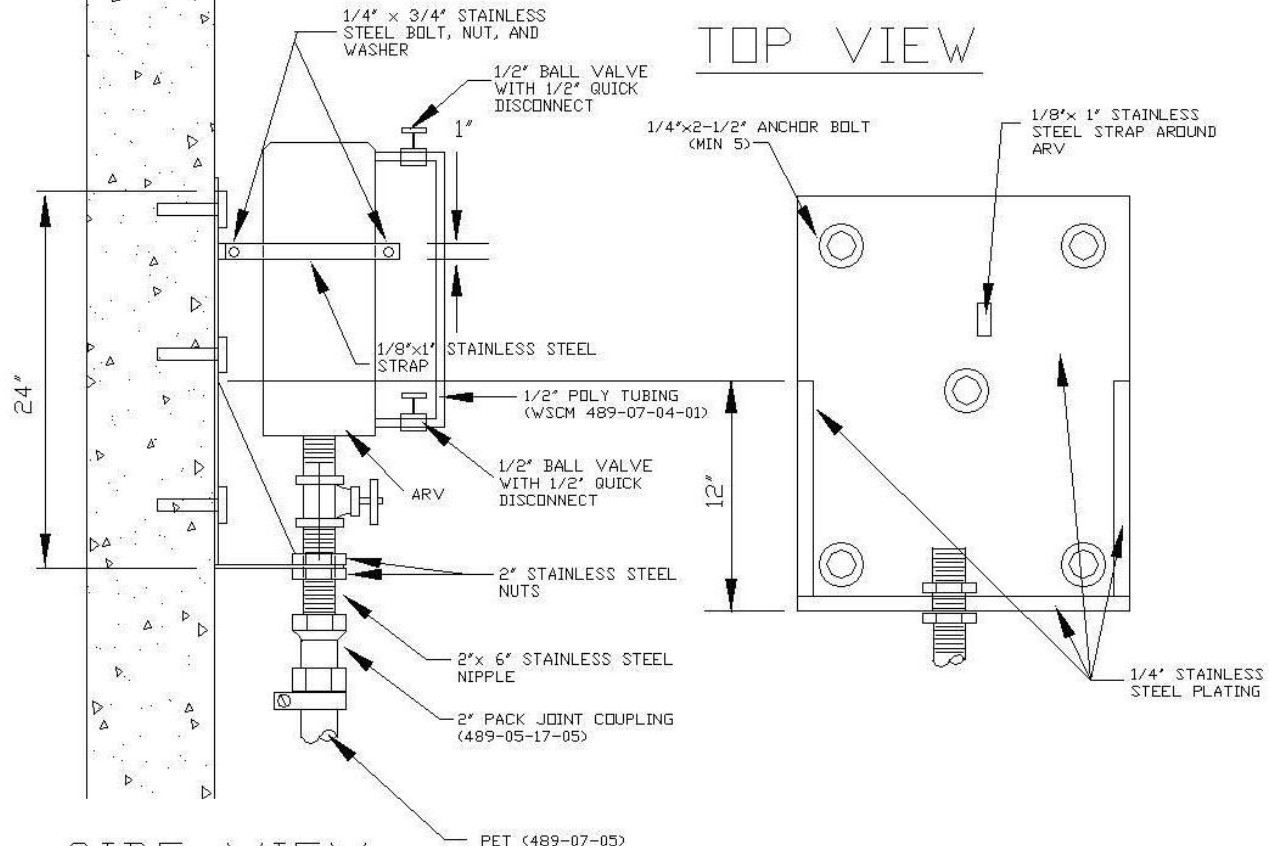
NOTES

1. MANHOLE WALLS SHALL BE LINER AS SPECIFIED IN SECTION 498-1.1.
2. USE STAINLESS STEEL FASTENERS TO SECURE A.R.V. AND APPURTENANCES.
3. COAT INSIDE OF MANHOLE RIM & COVER WITH EXPOX CEMENT AS SPECIFIED.

SPECIFICATION						DATE REVISED:			SECTION	
									SHT. 1 OF 1	
CITY OF VALDOSTA		CITY OF VALDOSTA STANDARD DETAIL			AIR RELEASE VALVE ASSEMBLY DISCHARGE TO EXISTING MANHOLE				C	
									498-3.1	



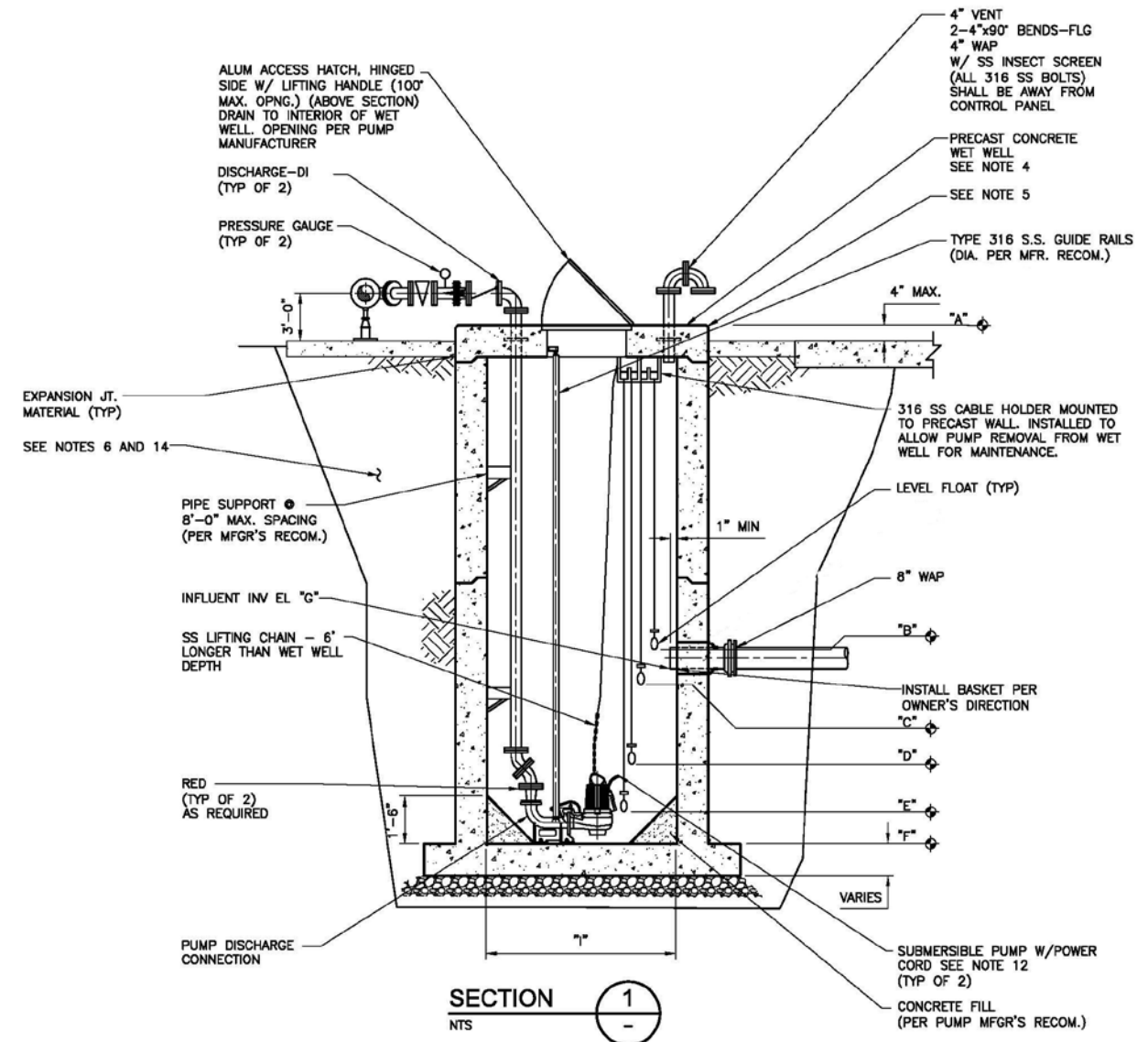
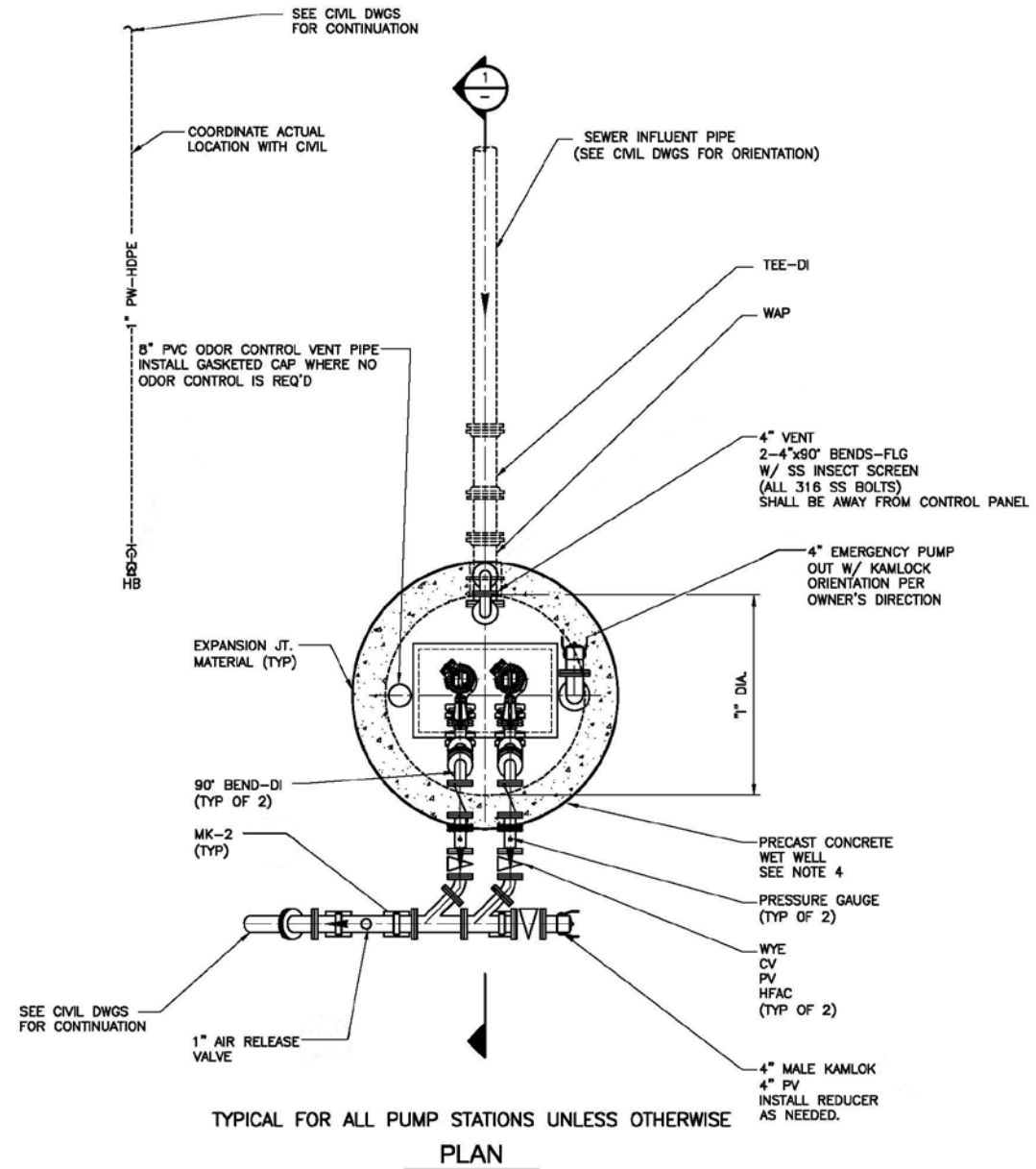
TOP VIEW



SIDE VIEW

SPECIFICATION				DATE REVISED:				SECTION			
								SHT 1 OF 1			
CITY OF VALDOSTA		CITY OF VALDOSTA STANDARD DETAIL		AIR RELEASE VALVE ASSEMBLY SUPPORT BRACKET				D		498-3.1	

City of Valdosta Lift station details



City of Valdosta Lift Station Control Panel Symbols and Abbreviations

ONE LINE OR CONTROL DIAGRAM	PLAN	DESCRIPTION
	LB	LOW VOLTAGE AIR OR MOLDED CASE CIRCUIT BREAKER, 3 POLE UNLESS OTHERWISE NOTED.
	MCB	3 POLE, 240V, 200 AMPERES MOTOR CIRCUIT BREAKER, FULL VOLTAGE NON-REVERSING UNLESS OTHERWISE NOTED. *R - FULL VOLTAGE REVERSING *RV - REDUCED VOLTAGE NON-REVERSING *RV1 - REDUCED VOLTAGE AUTOTRANSFORMER *RV2 - REDUCED VOLTAGE SOLID STATE *TS1 - TWO SPEED, ONE WINDING *TS2 - TWO SPEED, TWO WINDING
	ND	NON-FUSIBLE DISCONNECT SWITCH, 600 VOLT, 3 POLE *A - AMPERE RATING NOTED IF OTHER THAN 30A
	FD	FUSIBLE DISCONNECT SWITCH, 600 VOLT, 3 POLE, AMPERE RATING AND FUSE SIZE AS NOTED *A - AMPERE RATING NOTED IF OTHER THAN 30A *F - FUSE RATING EXAMPLE IS
	M	MANUAL MOTOR STARTER WITH THERMAL OVERLOAD HEATER *P - INDICATES WITH PILOT LIGHT *2 - INDICATES TWO POLE
	—	DRAWOUT TYPE EQUIPMENT OR DEVICE
	TR	TRANSFORMER, RATING AND CONNECTIONS AS NOTED, UNLESS OTHERWISE NOTED ON THIS SHEET. ALL DRY TYPE TRANSFORMERS SERVING AUTOMATIC AND LABORATORY SPACES SHALL HAVE A FACTOR OF 2. ISOLATION TRANSFORMERS SHALL HAVE A 10-20 RATING.
	CT	CURRENT TRANSFORMER *QTY - QUANTITY *P - PRIMARY AMPERES
	PT	POTENTIAL TRANSFORMER *QTY - QUANTITY *V - PRIMARY VOLTAGE
	EH	UNIT HEATER - ELECTRIC HEATING COIL AND FAN *R - RATING
	M	ELECTRIC A.C. MOTOR, MINERAL INDICATES HORSEPOWER
	—	PUSHBUTTON, MOMENTARY CONTACT, SPRING RETURN, NORMALLY CLOSED
	—	PUSHBUTTON, MOMENTARY CONTACT, SPRING RETURN, NORMALLY OPEN
	ES	EMERGENCY STOP PUSHBUTTON WITH RED MUSHROOM HEAD OPERATOR (MAINTAINED CONTACT)
	FS	START-STOP PUSHBUTTON CONTROL STATION (MOMENTARY CONTACT) *L - DENOTES LOCKOUT TYPE
	PS	STOP-START PUSHBUTTON CONTROL STATION, MAINTAINED CONTACT WITH LOCKOUT DEVICE ON STOP
	O/S	OFF/ON SELECTOR SWITCH
	LR	LOCAL/REMOTE SELECTOR SWITCH
	—	CONDUCTORS OR CONTACTS CROSSING PATHS BUT NOT CONNECTED
	—	CONDUCTORS ELECTRICALLY CONNECTED
	—	INDICATES LIMITS OF ELECTRICAL EQUIPMENT OR WIRE ENCLOSURE
	LA	LIGHTNING ARRESTER
	DM	DRAWER MOTOR
	ETM	ELAPSED TIME METER
	MV	MOTOR OPERATED VALVE OR GATE

ONE LINE OR CONTROL DIAGRAM	PLAN	DESCRIPTION
	3PS	3 POSITION SELECTOR SWITCH, MAINTAINED CONTACT *C - CLOSED *O - OPEN
	CR	CONTROL RELAY COIL, NUMBER AS INDICATED
	PL	PILOT LIGHT, COLOR AS NOTED *R - RED *B - BLUE *Y - YELLOW *W - WHITE
	TR	TIME DELAY RELAY, RANGE AS NOTED, SETPOINT AS NOTED, NUMBER AS INDICATED *T - TIME DELAY AFTER DEENERGIZATION-ON DELAY *O - TIME DELAY AFTER DEENERGIZATION-OFF DELAY *N - NORMALLY OPEN, TIMED CLOSING WHEN DE-ENERGIZED *C - NORMALLY CLOSED, TIMED CLOSING WHEN DE-ENERGIZED
	FI	FIELD INSTRUMENT, TAG NO. AS INDICATED * - INDICATES INSTRUMENT TYPE DERIVED ON LOOP SHEETS OR P & ID *# - INDICATES LOOP NO.
	LS	LIQUID LEVEL (FLOAT) SWITCH NORMALLY OPEN, CLOSING ON RISING LEVEL NORMALLY CLOSED, OPENS ON RISING LEVEL
	PS	PRESSURE OR VACUUM SWITCH NORMALLY OPEN, CLOSING ON RISING PRESSURE NORMALLY OPEN, CLOSING ON DROPPING PRESSURE NORMALLY CLOSED, OPENS ON RISING PRESSURE NORMALLY CLOSED, OPENS ON DROPPING PRESSURE
	PS	POSITION SWITCH
	FE	FLOW ELEMENT
	LE	LEVEL ELEMENT
	AE	ANALYZER ELEMENT
	FS	FLOW SWITCH (AIR, WATER, ETC.) NORMALLY OPEN, CLOSING ON INCREASED FLOW NORMALLY CLOSED, OPENS ON INCREASED FLOW
	—	UTILIZED IN CONJUNCTION WITH OTHER CONTROL SCHEMATIC SYMBOLS TO DEPICT THE PHYSICAL LOCATION OF THE DEVICE *R - REPRESENTS LOCATION *L - REPRESENTS LEGEND ON DRAWING
	3/4"	3/4" DIA x 10' LONG COPPER GROUND ROD
	GR	GROUND ROD TEST WELL
	F	FUSE AMPERE RATING AS NOTED
	STR	STRIP HEATER OR HEATING ELEMENT
	EL	ELECTRICAL LINK
	NO	CONTACT, NORMALLY OPEN (NO)

ONE LINE OR CONTROL DIAGRAM	PLAN	DESCRIPTION
	NC	CONTACT, NORMALLY CLOSED (NC)
	OR	OVERLOAD RELAY HEATER
	TB	TERMINAL OR TEST BLOCK
	IF	INCANDESCENT, COMPACT FLUORESCENT OR H.I.D. TYPE LIGHTING FIXTURE *X - FUTURE TYPE (SEE LIGHTING FEATURE SCHEDULE) *Y - CONTROLLED BY SWITCH "Y" *Z - CIRCUIT NUMBER
	FL	FLUORESCENT TYPE LIGHTING FIXTURE, NOTATIONS SAME AS ABOVE
	WIF	WALL MOUNTED INCANDESCENT, COMPACT FLUORESCENT OR H.I.D. TYPE LIGHTING FIXTURE, NOTATIONS SAME AS ABOVE
	ELF	EMERGENCY LIGHTING FIXTURE FOR EMERGENCY EGRESS LIGHTING, SEE CONTROL DRAWING FOR SWITCHING ARRANGEMENT.
	ELB	EMERGENCY LIGHTING BATTERY UNIT WITH TWO LAMP HEADS *X - FUTURE TYPE (SEE LIGHTING FEATURE SCHEDULE) *Y - SAFETY/STAND-BY *Z - FUTURE TAG
	WES	WALL MOUNTED EXIT SIGN, NOTATIONS SAME AS ABOVE, WHEN USED, ARROW INDICATES DIRECTION OF EGRESS.
	SPS	SINGLE POLE SWITCH *M - INDICATES FEATURES CONTROLLED
	PBS	PUSH BUTTON STATION
	PE	PHOTOEYE
	HR	HOME RUN TO DESIGNATED EQUIPMENT, BRANCH CIRCUIT CONDUIT WITH 2 NO. 12 AWG BRANCH CIRCUIT CONDUCTORS AND 1 NO. 12 AWG GROUND CONDUIT UNLESS OTHERWISE NOTED, NUMBER OF APPROX. INDICATE NUMBER OF CIRCUITS FOR MINIMUM SIZE CONDUIT PERMITTED REFER TO THE SPECIFICATIONS.
	CCW	CONDUIT CONCEALED IN WALL, IN SLAB ABOVE, OR ABOVE CEILING.
	CCF	CONDUIT CONCEALED IN OR BELOW FLOOR OR UNDERGROUND.
	CRE	CONDUIT RUN EXPOSED, RUN PARALLEL OR PERPENDICULAR TO STRUCTURE OR WALL.
	CE	CONCRETE ENCASED DUCTWORK.
	CS	CONDUIT STUBBED OUT AND CAPPED
	IC	DENOTES A QUANTITY OF TWO (2) 3-INCH CONDUITS EACH CONTAINING THREE NO. 3/0 AWG CONDUCTORS AND 1 NO. 2 AWG GROUND CONDUCTOR.
	IC	DENOTES A QUANTITY OF TWO (2) INSTRUMENT CABLES, EACH CABLE TO CONSIST OF TWO NO. 16 AWG CONDUCTORS TWISTED TOGETHER AND COVERED WITH A METALLIC SHIELD AND AN OVERALL PROTECTIVE JACKET. REFER TO THE SPECIFICATIONS FOR THE EXACT CABLE TO BE PROVIDED.
	IC	SAME AS ABOVE EXCEPT CABLE TO CONSIST OF THREE NO. 16 AWG CONDUCTORS TWISTED TOGETHER AND COVERED WITH AN OVERALL PROTECTIVE JACKET. REFER TO THE SPECIFICATIONS FOR THE EXACT CABLE TO BE PROVIDED.
	3C	THREE 4-INCH CONDUITS
	FMC	FLEXIBLE METAL CONDUIT "FMC" (3/4", 1", 1 1/2" UNLESS OTHERWISE NOTED) FOR RECESSED LIGHTING FIXTURES AND LIQUID TIGHT MOTOR CONNECTIONS
	GS	GROUND SYSTEM GND OR LOOP, 36" BELLOW FINISHED GRADE UNLESS OTHERWISE NOTED.
	CB	CIRCUIT BREAKER
	LP	LIGHTING PANELBOARD
	ESA	EMERGENCY SHAKER ALARM STATION WITH FLOW SWITCHES
	DR	DUPLEX RECEPTACLE, 10A, 120V, 2P, 3W *C - MOUNTED ABOVE COUNTER-TOP *G - GROUND FAULT INTERRUPTER TYPE *R - RECEPTACLE *S - POWER CABLE FEEL *I - ISOLATED GROUND *4 - CIRCUIT NUMBER
	JB	JUNCTION BOX
	PB	PULL BOX

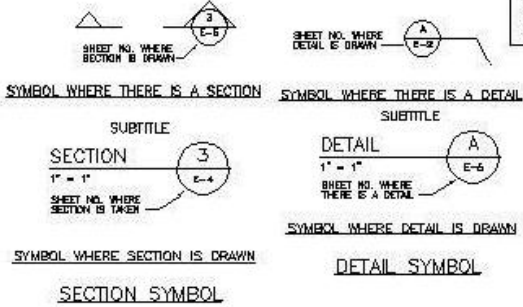
SYMBOL	DESCRIPTION
	TIME SWITCH
	INDICATES MOTOR STARTER AND/OR MOTOR CONTROL EQUIPMENT WITHIN THE ENCLOSURE
	INDICATES THAT ALL ELECTRICAL EQUIPMENT AND MATERIALS INSTALLED WITHIN THE ROOM OR AREA IN WHICH THIS NOTATION APPEARS SHALL BE OF NEMA 12 CONSTRUCTION (OR BASKETED AND SUITABLE FOR USE IN A WET LOCATION WHERE NEMA STANDARDS DO NOT APPLY) UNLESS OTHERWISE NOTED.
	INDICATES THAT ALL ELECTRICAL EQUIPMENT AND MATERIALS INSTALLED WITHIN THE ROOM OR AREA IN WHICH THIS NOTATION APPEARS SHALL BE OF NEMA 4 CONSTRUCTION (OR CORROSION RESISTANT CONSTRUCTION SUITABLE FOR USE IN A WET LOCATION WHERE NEMA STANDARDS DO NOT APPLY) UNLESS OTHERWISE NOTED.
	TERMINAL BOX
	LEVEL INDICATING TRANSMITTER
	FLOW INDICATING TRANSMITTER
	ANALYZER INDICATING TRANSMITTER
	POLE MOUNTED LIGHTING FIXTURE

ABBREVIATIONS	
A	AMPERES
AC	ALTERNATING CURRENT
AF	AMPERES FRAME
AFD	ABOVE FINISHED FLOOR
AFI	AIRFLOW INTERRUPTING CAPACITY
AT	AMERICAN TWP
AWG	AMERICAN WIRE GAUGE
C	CIRCUIT
CB	CIRCUIT BREAKER
CCD	COMBUSTIBLE GAS DETECTOR
CR	CIRCUIT
CPT	CONTROL POWER TRANSFORMER
CR	CONTROL RELAY
CS	CIRCUIT SWITCH
CT	CURRENT TRANSFORMER
CWP	COLD WATER PIPE
DI	DOOR INTERLOCK
DA	DAMPER
DN	DOWN
ED	EMPTY CONDUIT
ECB	EMERGENCY CIRCUIT BREAKER
ELEC	ELECTRICAL
ELEV	ELEVATION
EM	EMERGENCY
EMAP	EQUIPMENT
EST	ESTIMATE
FBO	FURNISHED BY OTHERS
FLA	FULL LOAD AMPERES
FL	FUSE
GFI, GFCI	GROUND FAULT INTERRUPTER
GFI	GROUND FAULT CIRCUIT INTERRUPTER
GMS	GRANULATED MESH STEEL
HFB	HUBBARD
HP	HERTZ
HZA	HAND OFF AUTO
INST	INSTRUMENT
K	KILO (PREFIX)
KVA	1000 CIRCULAR MILS
KVA	1000-VOLT AMPERES
KW	KILOWATT
LA	LIGHTNING ARRESTER
LTC	LIGHTING
LOR	LOCAL OFF REMOTE
MDB	MOTOR CIRCUIT BREAKER
MFC	MOTOR CONTROL CENTER
MCM	1000 CIRCULAR MILS
MFR	MANUFACTURER
MH	MILS
MIM	MILS
MLO	MILS ONLY
MWJ	MICROPROCESSOR METERING UNIT
MTC	MOUNTING
MTO	MOUNTED
NC	NORMALLY CLOSED
NEC	NATIONAL ELECTRIC CODE
NEUT	NEUTRAL
NC	NOT IN CONTRACT
NO	NORMALLY OPEN OR NUMBER
NTS	NOT TO SCALE
OL	OVERLOAD
P	POLE
PC	PHOTOCELL
PCP	PUMP CONTROL PANEL
PH	PHASE
PLC	PROGRAMMABLE LOGIC CONTROLLER
PM	PHASE MOTOR
PNL	PANEL OR PANELBOARD
PR	PANEL
PT	POTENTIAL TRANSFORMER
PVC	POLYVINYL CHLORIDE
RECP	RECEPTACLE
REQD	REQUIRED
QTY	QUANTITY
SA	BUCKLE ARRESTER
SEC	SECONDS OR SECONDARY
SH	SHIELDED OR SHEET
SHF	SHIELD
SFD	BUCKLE PROTECTIVE DEVICE
SS	STAINLESS STEEL
SSRV	SOLID-STATE REDUCED VOLTAGE (STARTER)
SW	SWITCH
TC	TIME TO CLOSE
TO	TIME TO OPEN
TVSS	TRANSIENT VOLTAGE SURGE SUPPRESSOR
TYP	TYPICAL
UG	UNDERGROUND
UPS	UNINTERRUPTIBLE POWER SUPPLY
V	VOLTS
VARS	VOLT AMPS REACTIVE
W	WIRE OR WATTS
WP	WEATHERPROOF
XP	EXPLOSION PROOF
XNFR	TRANSFORMER
ZS	ZENER

GENERAL NOTE
THIS IS A STANDARD LEGEND. SOME SYMBOLS MAY NOT APPEAR ON THE DRAWINGS.

NOTES:

- ITEMS MARKED IN BRACKETS [] ARE ITEMS TO BE DETERMINED IN DESIGN AND FILLED IN WHEN THE INFORMATION BECOMES AVAILABLE.
- THE WIRING DIAGRAMS, QUANTITY AND SIZE OF WIRES AND CONDUIT REPRESENT A SUGGESTED ARRANGEMENT BASED UPON SELECTED STANDARD COMPONENTS OF ELECTRICAL EQUIPMENT. MODIFICATIONS ACCEPTABLE TO THE OWNER MAY BE MADE BY THE CONTRACTOR TO ACCOMMODATE EQUIPMENT ACTUALLY PURCHASED. THE BASIC SEQUENCE AND METHOD OF CONTROL MUST BE MAINTAINED AS INDICATED ON THE DRAWINGS AND/OR SPECIFICATIONS.
- DO NOT SCALE THE ELECTRICAL DRAWINGS. REFER TO THE CIVIL, MECHANICAL, STRUCTURAL DRAWINGS AND APPROVED MANUFACTURER'S SHOP DRAWINGS FOR THE EXACT LOCATION OF ALL EQUIPMENT.
- ALL WORK SHALL COMPLY WITH NEC, NFPA 800 AND LOCAL CODES.
- CONDUITS SHALL NOT BE REPLACED EXCEPT AS APPROVED BY THE OWNER. WHERE SPLICED IS PERMITTED, ALL SPLICING MATERIALS SHALL BE PER OWNER'S DIRECTION.
- ALL CONDUITS SHALL HAVE A BOND WIRE BEZEL PER TABLE 250.122 OF THE NEC UNLESS OTHERWISE NOTED.
- ALL EQUIPMENT SHALL BE UL LISTED OR LABELED.



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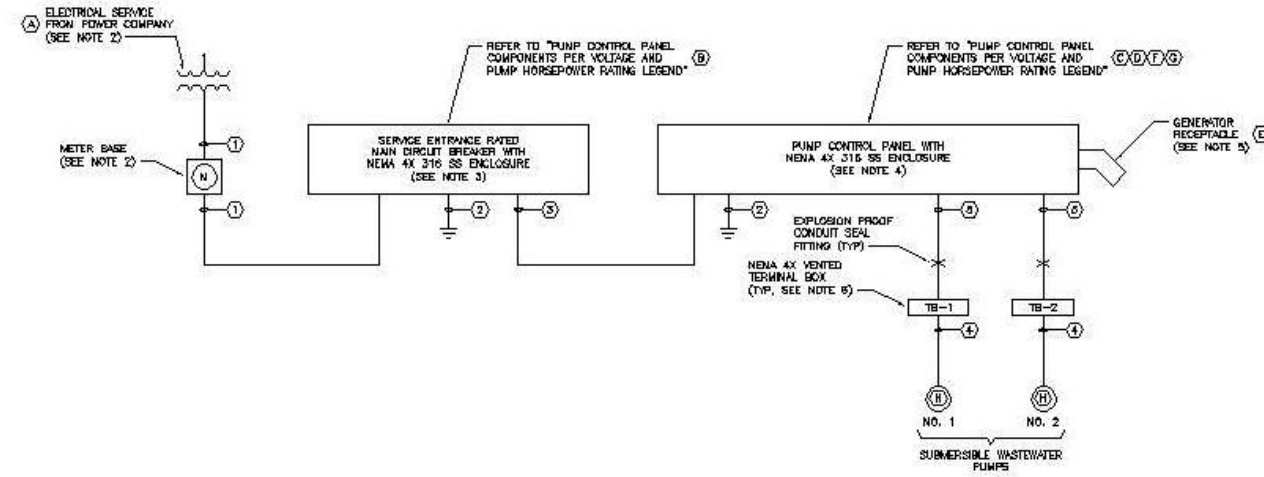
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 DATE: NOVEMBER 2011

VALDOSTA
 PUMP STATION
 STANDARDS

ELECTRICAL SYMBOLS AND ABBREVIATIONS

PROJECT NO. []
 FILE NAME: E01574B
 SHEET NO. E-1

City of Valdosta Pump Station Single Line Power Diagram



TYPICAL PUMP STATION
SINGLE LINE POWER DIAGRAM
NTS

NOTES:

- SINGLE LINE POWER DIAGRAM IS TYPICAL FOR A DUPLEX PUMP STATION WITH SOLID STATE REDUCED VOLTAGE STARTERS SERVING RESIDENTIAL WASTEWATER. HAZARDOUS AREA CLASSIFICATION OF WET WELL IS ASSUMED TO BE CLASS I, DIVISION 2, PER NFPA 820, ROW 11(c).
- DEPENDING ON DESIGN, ELECTRICAL SERVICE FROM THE POWER COMPANY COULD BE A NEW INSTALLATION OR AN EXISTING POINT OF SERVICE. COORDINATE WITH POWER COMPANY FOR CONDUIT, WIRING, GROUNDING AND INSTALLATION REQUIREMENTS OF METER, METER BASE, CT'S, ETC.
- SERVICE ENTRANCE RATED MAIN CIRCUIT BREAKER SHALL BE UL LISTED AND CONTAIN A TYPE 1, UL 1449, 3RD EDITION LISTED SPD. CIRCUIT BREAKER FOR SPD SHALL BE SIZED PER MANUFACTURER.
- PUMP CONTROL PANEL CONTAINS THE FOLLOWING COMPONENTS: MAIN AND GENERATOR CIRCUIT BREAKERS (MECHANICALLY INTERLOCKED), GROUND BUS, TYPE 2, UL 1449, 3RD EDITION LISTED SPD WITH CIRCUIT BREAKER SIZED PER MANUFACTURER, PHASE MONITOR, MOTOR CIRCUIT PROTECTORS, SOLID STATE REDUCED VOLTAGE STARTERS (SERV) AND PLC. REFER TO CONTROL DIAGRAMS FOR ADDITIONAL COMPONENTS AND CONTROLS.
- PROVIDE A GENERATOR RECEPTACLE WITH ANGLE ADAPTER AND MOUNTING BOX. RECEPTACLE SHALL BE BY RUSSELSTOLL OR APPROVED EQUAL. COORDINATE AND VERIFY EXACT PIN ARRANGEMENT, GROUNDING STYLE, MOUNTING BOX STYLE, ETC., WITH THE OWNER.
- TERMINAL BOXES ARE RATED CLASS I, DIVISION 2 HAZARDOUS AREA CLASSIFICATION. SHOULD THE AREA BE CLASSIFIED CLASS I, DIVISION 1, TERMINAL BOXES SHALL BE NEMA 7, EXPLOSION-PROOF RATED AND NOT VENTED.

PUMP CONTROL PANEL COMPONENTS PER VOLTAGE AND HORSEPOWER RATING LEGEND

LETTER	ITEM DESCRIPTION	120/240V, 1Ø, 3W (UP TO 5HP)	120/240V, 3Ø, 4W OPEN DELTA (UP TO 6.5HP)	120/240V, 3Ø, 4W OPEN DELTA (UP TO 15HP)	120/208V, 3Ø, 4W (UP TO 5HP)	120/208V, 3Ø, 4W (UP TO 15HP)	120/208V, 3Ø, 4W (UP TO 25HP)	120/208V, 3Ø, 4W (UP TO 50HP)	480V, 3Ø, 3W (UP TO 5HP)	480V, 3Ø, 3W (UP TO 15HP)	480V, 3Ø, 3W (UP TO 25HP)	480V, 3Ø, 3W (UP TO 50HP)
(A)	AVAILABLE SERVICE	120/240V, 1Ø, 3W	120/240V, 3Ø, 4W, OPEN DELTA	120/240V, 3Ø, 4W, OPEN DELTA	120/208V, 3Ø, 4W	120/208V, 3Ø, 4W	120/208V, 3Ø, 4W	120/208V, 3Ø, 4W	480V, 3Ø, 3W	480V, 3Ø, 3W	480V, 3Ø, 3W	480V, 3Ø, 3W
(B)	SERVICE ENTRANCE MAIN CIRCUIT BREAKER RATING	100A, 2P	100A, 3P	200A, 3P	100A, 3P	200A, 3P	250A, 3P	400A, 3P	100A, 3P	100A, 3P	150A, 3P	200A, 3P
(C)	CONTROL PANEL MAIN CIRCUIT BREAKER RATING	100A, 2P	100A, 3P	200A, 3P	100A, 3P	200A, 3P	250A, 3P	400A, 3P	100A, 3P	100A, 3P	150A, 3P	200A, 3P
(D)	GENERATOR CIRCUIT BREAKER RATING	100A, 2P	100A, 3P	200A, 3P	100A, 3P	200A, 3P	250A, 3P	400A, 3P	100A, 3P	100A, 3P	150A, 3P	200A, 3P
(E)	GENERATOR RECEPTACLE RATING	100A, 4P	200A, 4P	100A, 4P	100A, 4P	200A, 4P	250A, 4P	400A, 4P	100A, 4P	100A, 4P	150A, 4P	200A, 4P
(F)	BUS RATING	100A, 120/240V, 1Ø, 3W	100A, 120/240V, 3Ø, 4W	225A, 120/240V, 3Ø, 4W	100A, 120/208V, 3Ø, 4W	225A, 120/208V, 3Ø, 4W	400A, 120/208V, 3Ø, 4W	400A, 120/208V, 3Ø, 4W	100A, 480V, 3Ø, 3W	100A, 480V, 3Ø, 3W	225A, 480V, 3Ø, 3W	225A, 480V, 3Ø, 3W
(G)	MOTOR CIRCUIT PROTECTOR RATINGS	75A, 2P	35A, 3P	80A, 3P	35A, 3P	80A, 3P	110A, 3P	125A, 3P	75A, 3P	75A, 3P	100A, 3P	100A, 3P
(H)	MAXIMUM SUBMERSIBLE PUMP RATING	5HP	6.5HP	15HP	5HP	15HP	25HP	50HP	5HP	15HP	25HP	50HP

SEE SHEET E-3 FOR EXAMPLE

SEE SHEET E-4 FOR EXAMPLE

SEE SHEET E-5 FOR EXAMPLE

CONDUIT AND WIRE PER VOLTAGE AND HORSEPOWER RATING LEGEND

NUMBER	120/240V, 1Ø, 3W (UP TO 5HP)	120/240V, 3Ø, 4W OPEN DELTA (UP TO 6.5HP)	120/240V, 3Ø, 4W OPEN DELTA (UP TO 15HP)	120/208V, 3Ø, 4W (UP TO 5HP)	120/208V, 3Ø, 4W (UP TO 15HP)	120/208V, 3Ø, 4W (UP TO 25HP)	120/208V, 3Ø, 4W (UP TO 50HP)	480V, 3Ø, 3W (UP TO 5HP)	480V, 3Ø, 3W (UP TO 15HP)	480V, 3Ø, 3W (UP TO 25HP)	480V, 3Ø, 3W (UP TO 50HP)
(1)	2"Ø, 2Ø2, 1Ø2H	2"Ø, 2Ø2, 1Ø2H	3"Ø, 2Ø3/Ø, 1Ø3/ØH	2"Ø, 2Ø2, 1Ø2H	3"Ø, 2Ø3/Ø, 1Ø3/ØH	3"Ø, 2Ø4/Ø, 1Ø4/ØH	3"Ø, 2Ø4/Ø, 1Ø4/ØH	2"Ø, 2Ø2, 1Ø2H	2"Ø, 2Ø2, 1Ø2H	2 1/2"Ø, 2Ø1/Ø, 1Ø1/ØH	3"Ø, 2Ø3/Ø, 1Ø3/ØH
(2)	Ø2/Ø GND TO 3/4" OVP (IF AVAILABLE), 3/4" DIA X 10' COPPERWELD GROUND RODS AND GROUND LOOP	SAME FOR ALL PUMP STATIONS	SAME FOR ALL PUMP STATIONS	SAME FOR ALL PUMP STATIONS	SAME FOR ALL PUMP STATIONS	SAME FOR ALL PUMP STATIONS	SAME FOR ALL PUMP STATIONS	SAME FOR ALL PUMP STATIONS	SAME FOR ALL PUMP STATIONS	SAME FOR ALL PUMP STATIONS	SAME FOR ALL PUMP STATIONS
(3)	2"Ø, 2Ø2, 1Ø2H, 1Ø6Ø	2"Ø, 2Ø2, 1Ø2H, 1Ø6Ø	3"Ø, 2Ø3/Ø, 1Ø3/ØH, 1Ø6Ø	2"Ø, 2Ø2, 1Ø2H, 1Ø6Ø	3"Ø, 2Ø3/Ø, 1Ø3/ØH, 1Ø6Ø	3"Ø, 2Ø4/Ø, 1Ø4/ØH, 1Ø6Ø	3"Ø, 2Ø4/Ø, 1Ø4/ØH, 1Ø6Ø	2"Ø, 2Ø2, 1Ø6Ø	2"Ø, 2Ø2, 1Ø6Ø	2 1/2"Ø, 2Ø1/Ø, 1Ø6Ø	3"Ø, 2Ø3/Ø, 1Ø6Ø
(4)	CONDUIT SIZED PER PUMP MFR CABLE REQUIREMENTS WITH CABLES BY PUMP MFR	CONDUIT SIZED PER PUMP MFR CABLE REQUIREMENTS WITH CABLES BY PUMP MFR	CONDUIT SIZED PER PUMP MFR CABLE REQUIREMENTS WITH CABLES BY PUMP MFR	CONDUIT SIZED PER PUMP MFR CABLE REQUIREMENTS WITH CABLES BY PUMP MFR	CONDUIT SIZED PER PUMP MFR CABLE REQUIREMENTS WITH CABLES BY PUMP MFR	CONDUIT SIZED PER PUMP MFR CABLE REQUIREMENTS WITH CABLES BY PUMP MFR	CONDUIT SIZED PER PUMP MFR CABLE REQUIREMENTS WITH CABLES BY PUMP MFR	CONDUIT SIZED PER PUMP MFR CABLE REQUIREMENTS WITH CABLES BY PUMP MFR	CONDUIT SIZED PER PUMP MFR CABLE REQUIREMENTS WITH CABLES BY PUMP MFR	CONDUIT SIZED PER PUMP MFR CABLE REQUIREMENTS WITH CABLES BY PUMP MFR	CONDUIT SIZED PER PUMP MFR CABLE REQUIREMENTS WITH CABLES BY PUMP MFR
(5)	1"Ø, 2Ø4, 1Ø6Ø	1"Ø, 2Ø4, 1Ø10Ø	2"Ø, 2Ø2, 1Ø6Ø	1 1/2"Ø, 2Ø4, 1Ø6Ø	2"Ø, 2Ø2, 1Ø6Ø	2 1/2"Ø, 2Ø1/Ø, 1Ø6Ø	(2) 2"Ø, 2Ø2/Ø, 1Ø6Ø	3/4"Ø, 2Ø1Ø, 1Ø10Ø	1 1/2"Ø, 2Ø4, 1Ø6Ø	2"Ø, 2Ø2, 1Ø6Ø	2 1/2"Ø, 2Ø1/Ø, 1Ø6Ø

SEE SHEET E-3 FOR EXAMPLE

SEE SHEET E-4 FOR EXAMPLE

SEE SHEET E-5 FOR EXAMPLE

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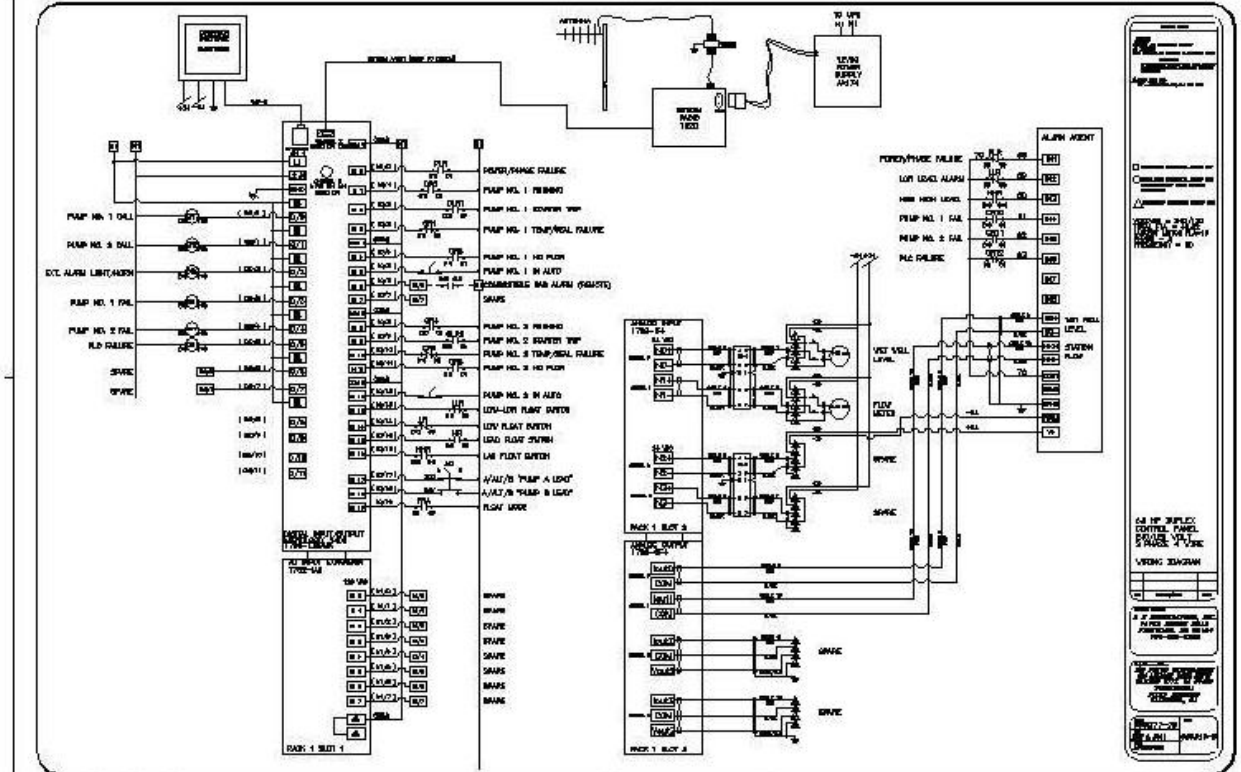
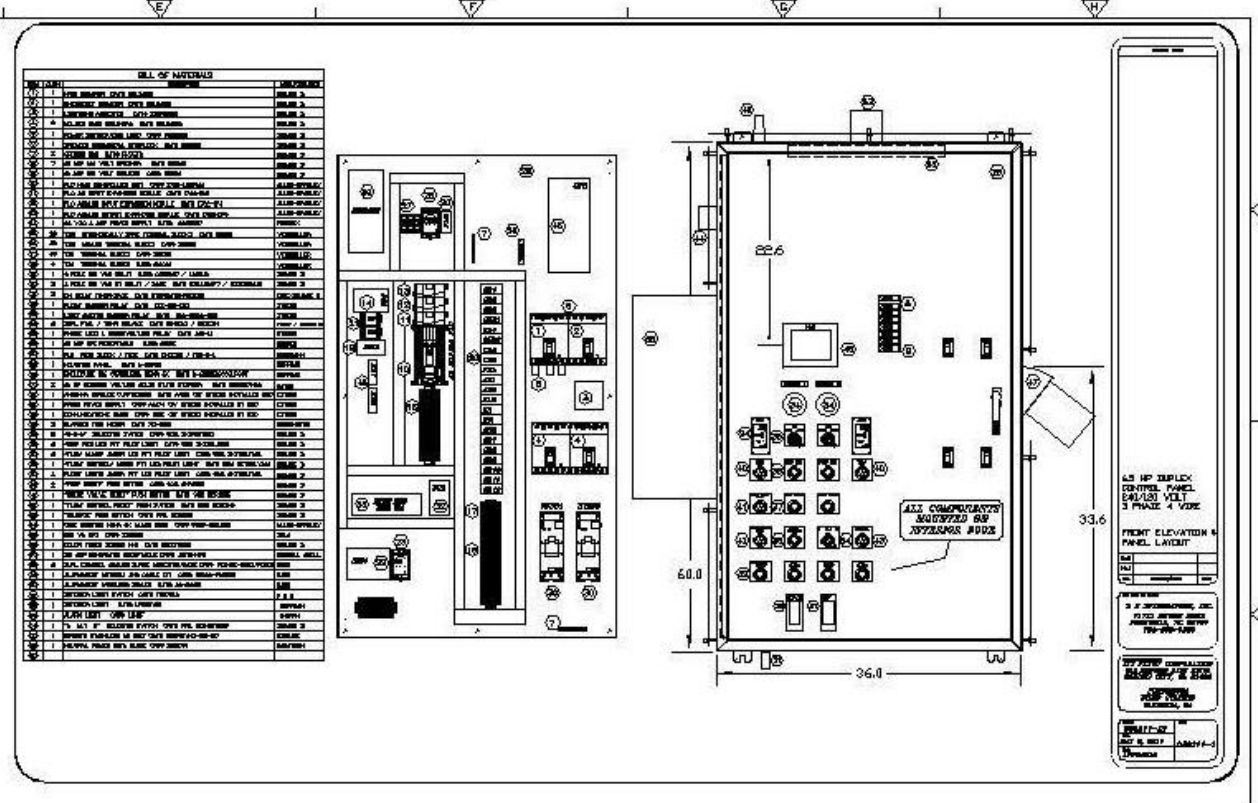
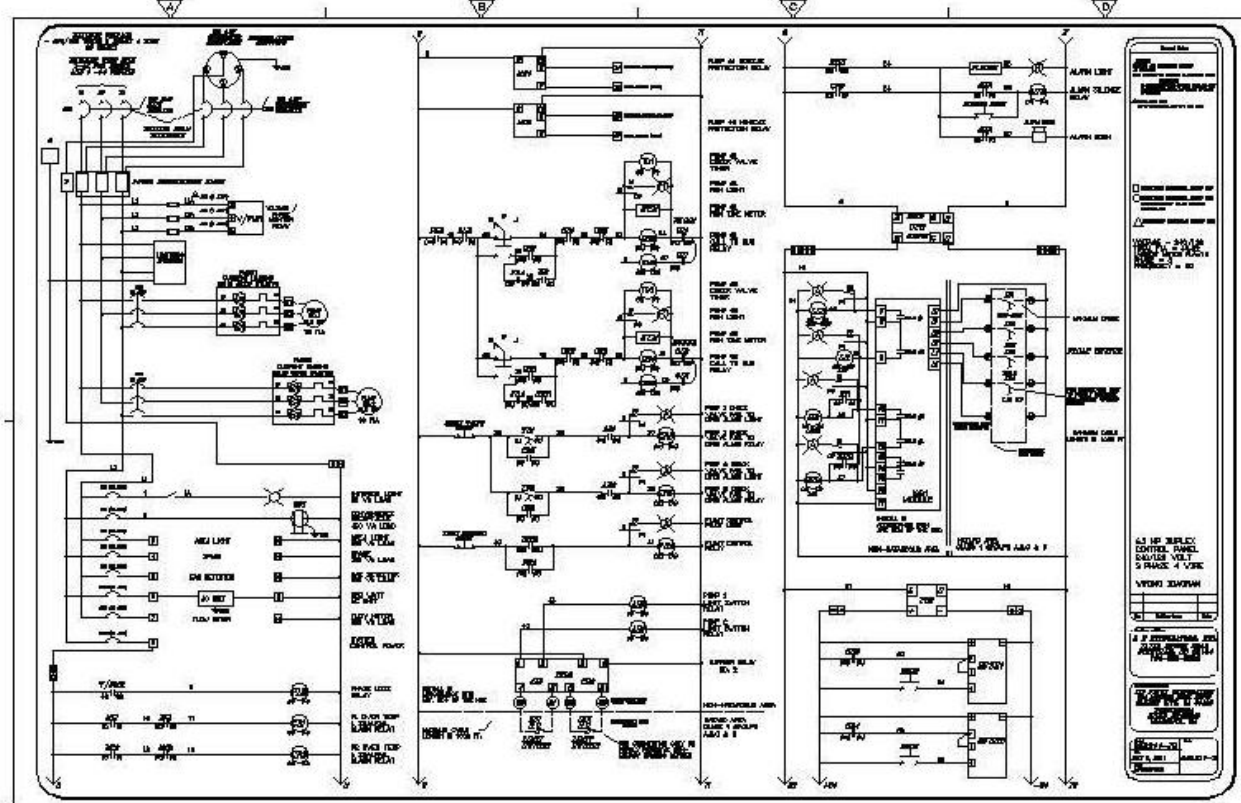
DESIGNED BY:	
DRAWN BY:	
CHECKED BY:	
DATE:	NOVEMBER 2011



TYPICAL PUMP STATION
SINGLE LINE POWER DIAGRAM
AND LOAD SCHEDULES

PROJECT NO.:	ED0205BL
SHEET NO.:	E-2

City of Valdosta Control Panel (240/120 Volt, 3-Phase, 4-wire)



DESIGNED BY:	
DRAWN BY:	
SHEET CHECK'D BY:	
CHECKED BY:	
APPROVED BY:	
DATE:	NOVEMBER 2011

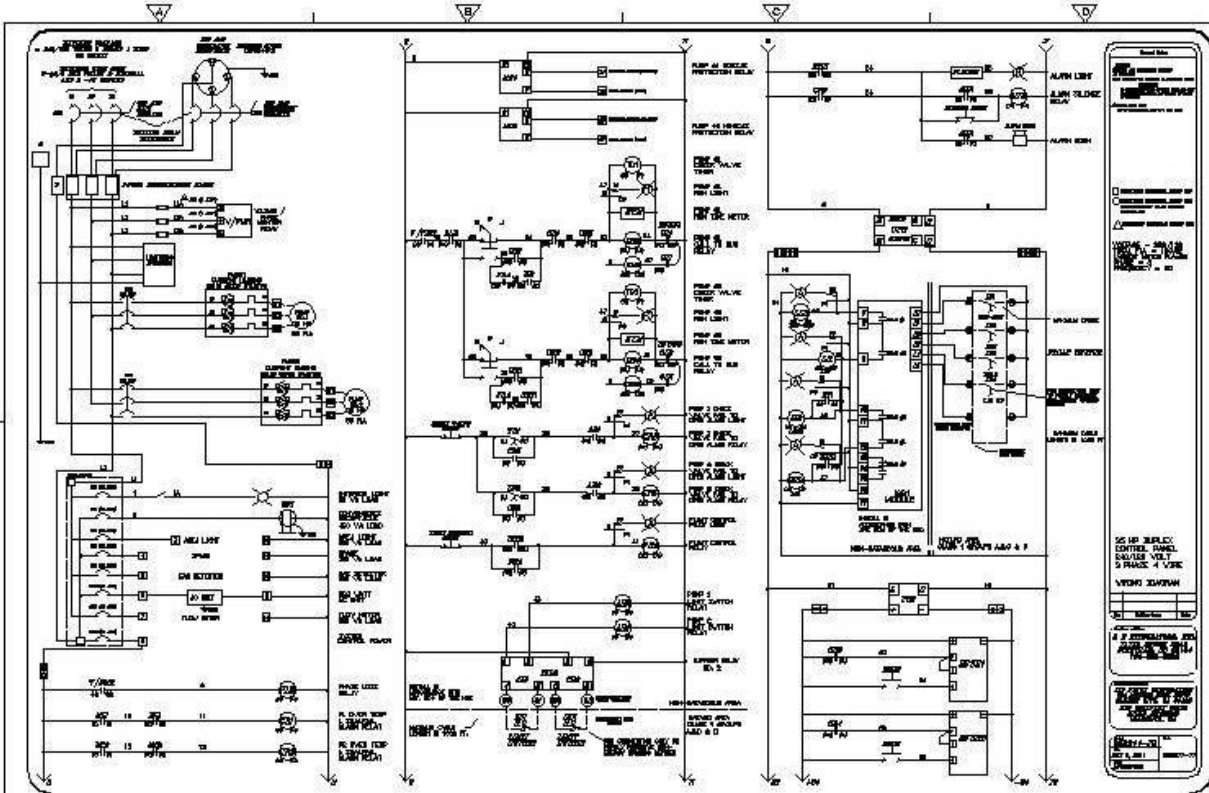


6.5 HP DUPLEX CONTROL PANEL
240/120 VOLT, 3-PHASE, 4 WIRE
LIFT STATION ELECTRICAL

PROJECT NO.:	
FILE NAME:	E003P30T
SHEET NO.:	E-3

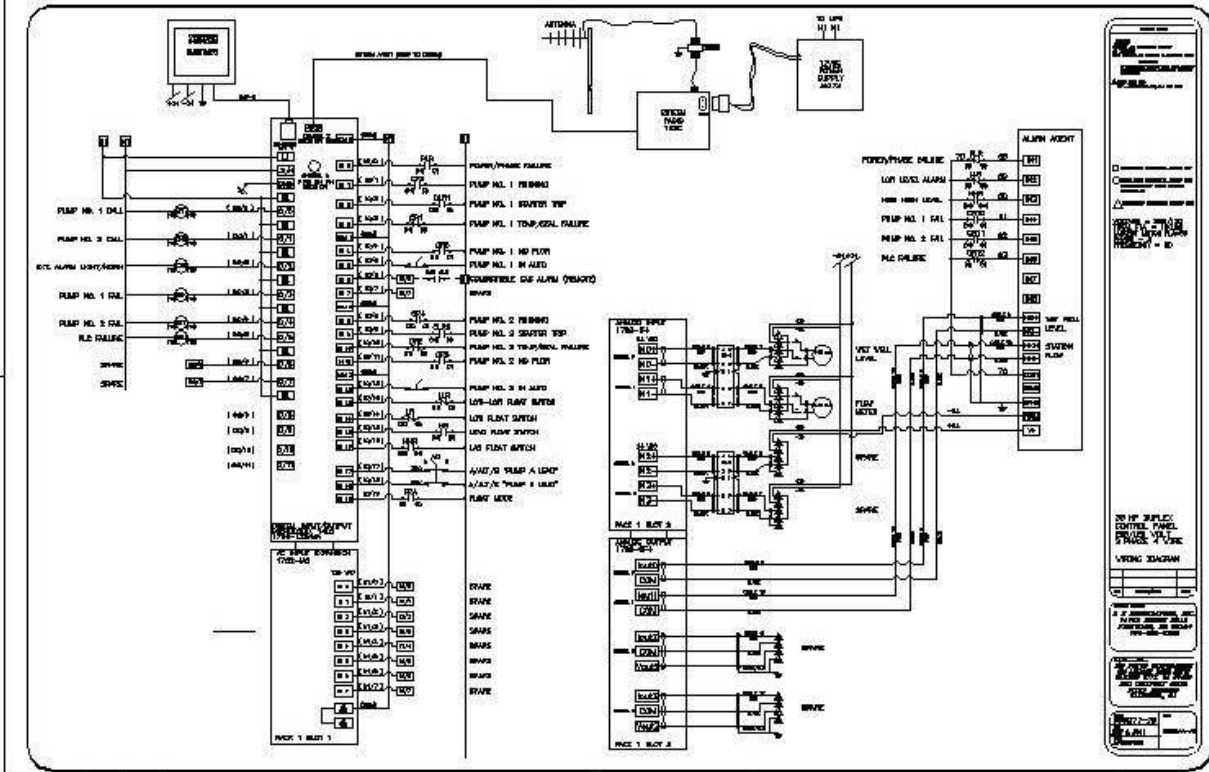
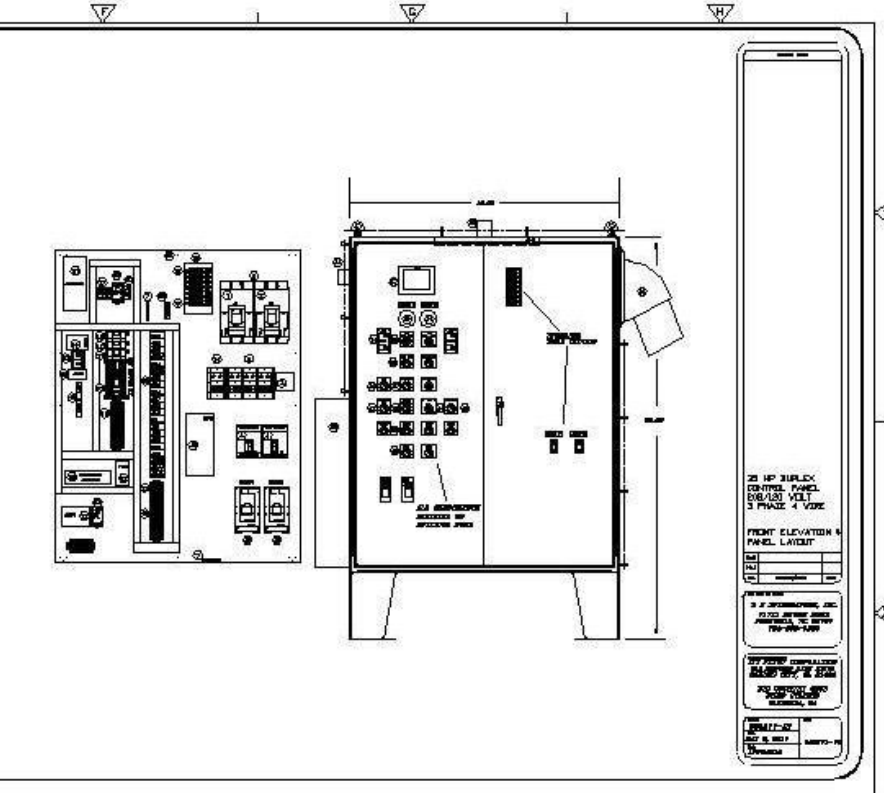
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City of Valdosta Control Panel (208/120 Volt, 3-Phase, 4-wire)



LIST OF MATERIALS

ITEM NO.	DESCRIPTION	QUANTITY	UNIT
1	3 PHASE 4 WIRE 208/120V	1	FEED
2	3 PHASE 4 WIRE 208/120V	1	FEED
3	3 PHASE 4 WIRE 208/120V	1	FEED
4	3 PHASE 4 WIRE 208/120V	1	FEED
5	3 PHASE 4 WIRE 208/120V	1	FEED
6	3 PHASE 4 WIRE 208/120V	1	FEED
7	3 PHASE 4 WIRE 208/120V	1	FEED
8	3 PHASE 4 WIRE 208/120V	1	FEED
9	3 PHASE 4 WIRE 208/120V	1	FEED
10	3 PHASE 4 WIRE 208/120V	1	FEED
11	3 PHASE 4 WIRE 208/120V	1	FEED
12	3 PHASE 4 WIRE 208/120V	1	FEED
13	3 PHASE 4 WIRE 208/120V	1	FEED
14	3 PHASE 4 WIRE 208/120V	1	FEED
15	3 PHASE 4 WIRE 208/120V	1	FEED
16	3 PHASE 4 WIRE 208/120V	1	FEED
17	3 PHASE 4 WIRE 208/120V	1	FEED
18	3 PHASE 4 WIRE 208/120V	1	FEED
19	3 PHASE 4 WIRE 208/120V	1	FEED
20	3 PHASE 4 WIRE 208/120V	1	FEED
21	3 PHASE 4 WIRE 208/120V	1	FEED
22	3 PHASE 4 WIRE 208/120V	1	FEED
23	3 PHASE 4 WIRE 208/120V	1	FEED
24	3 PHASE 4 WIRE 208/120V	1	FEED
25	3 PHASE 4 WIRE 208/120V	1	FEED
26	3 PHASE 4 WIRE 208/120V	1	FEED
27	3 PHASE 4 WIRE 208/120V	1	FEED
28	3 PHASE 4 WIRE 208/120V	1	FEED
29	3 PHASE 4 WIRE 208/120V	1	FEED
30	3 PHASE 4 WIRE 208/120V	1	FEED
31	3 PHASE 4 WIRE 208/120V	1	FEED
32	3 PHASE 4 WIRE 208/120V	1	FEED
33	3 PHASE 4 WIRE 208/120V	1	FEED
34	3 PHASE 4 WIRE 208/120V	1	FEED
35	3 PHASE 4 WIRE 208/120V	1	FEED
36	3 PHASE 4 WIRE 208/120V	1	FEED
37	3 PHASE 4 WIRE 208/120V	1	FEED
38	3 PHASE 4 WIRE 208/120V	1	FEED
39	3 PHASE 4 WIRE 208/120V	1	FEED
40	3 PHASE 4 WIRE 208/120V	1	FEED
41	3 PHASE 4 WIRE 208/120V	1	FEED
42	3 PHASE 4 WIRE 208/120V	1	FEED
43	3 PHASE 4 WIRE 208/120V	1	FEED
44	3 PHASE 4 WIRE 208/120V	1	FEED
45	3 PHASE 4 WIRE 208/120V	1	FEED
46	3 PHASE 4 WIRE 208/120V	1	FEED
47	3 PHASE 4 WIRE 208/120V	1	FEED
48	3 PHASE 4 WIRE 208/120V	1	FEED
49	3 PHASE 4 WIRE 208/120V	1	FEED
50	3 PHASE 4 WIRE 208/120V	1	FEED

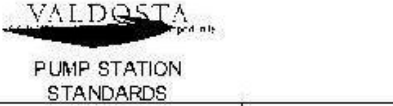


LIST OF MATERIALS

ITEM NO.	DESCRIPTION	QUANTITY	UNIT
1	3 PHASE 4 WIRE 208/120V	1	FEED
2	3 PHASE 4 WIRE 208/120V	1	FEED
3	3 PHASE 4 WIRE 208/120V	1	FEED
4	3 PHASE 4 WIRE 208/120V	1	FEED
5	3 PHASE 4 WIRE 208/120V	1	FEED
6	3 PHASE 4 WIRE 208/120V	1	FEED
7	3 PHASE 4 WIRE 208/120V	1	FEED
8	3 PHASE 4 WIRE 208/120V	1	FEED
9	3 PHASE 4 WIRE 208/120V	1	FEED
10	3 PHASE 4 WIRE 208/120V	1	FEED
11	3 PHASE 4 WIRE 208/120V	1	FEED
12	3 PHASE 4 WIRE 208/120V	1	FEED
13	3 PHASE 4 WIRE 208/120V	1	FEED
14	3 PHASE 4 WIRE 208/120V	1	FEED
15	3 PHASE 4 WIRE 208/120V	1	FEED
16	3 PHASE 4 WIRE 208/120V	1	FEED
17	3 PHASE 4 WIRE 208/120V	1	FEED
18	3 PHASE 4 WIRE 208/120V	1	FEED
19	3 PHASE 4 WIRE 208/120V	1	FEED
20	3 PHASE 4 WIRE 208/120V	1	FEED
21	3 PHASE 4 WIRE 208/120V	1	FEED
22	3 PHASE 4 WIRE 208/120V	1	FEED
23	3 PHASE 4 WIRE 208/120V	1	FEED
24	3 PHASE 4 WIRE 208/120V	1	FEED
25	3 PHASE 4 WIRE 208/120V	1	FEED
26	3 PHASE 4 WIRE 208/120V	1	FEED
27	3 PHASE 4 WIRE 208/120V	1	FEED
28	3 PHASE 4 WIRE 208/120V	1	FEED
29	3 PHASE 4 WIRE 208/120V	1	FEED
30	3 PHASE 4 WIRE 208/120V	1	FEED
31	3 PHASE 4 WIRE 208/120V	1	FEED
32	3 PHASE 4 WIRE 208/120V	1	FEED
33	3 PHASE 4 WIRE 208/120V	1	FEED
34	3 PHASE 4 WIRE 208/120V	1	FEED
35	3 PHASE 4 WIRE 208/120V	1	FEED
36	3 PHASE 4 WIRE 208/120V	1	FEED
37	3 PHASE 4 WIRE 208/120V	1	FEED
38	3 PHASE 4 WIRE 208/120V	1	FEED
39	3 PHASE 4 WIRE 208/120V	1	FEED
40	3 PHASE 4 WIRE 208/120V	1	FEED
41	3 PHASE 4 WIRE 208/120V	1	FEED
42	3 PHASE 4 WIRE 208/120V	1	FEED
43	3 PHASE 4 WIRE 208/120V	1	FEED
44	3 PHASE 4 WIRE 208/120V	1	FEED
45	3 PHASE 4 WIRE 208/120V	1	FEED
46	3 PHASE 4 WIRE 208/120V	1	FEED
47	3 PHASE 4 WIRE 208/120V	1	FEED
48	3 PHASE 4 WIRE 208/120V	1	FEED
49	3 PHASE 4 WIRE 208/120V	1	FEED
50	3 PHASE 4 WIRE 208/120V	1	FEED

REV.	DATE	BY	CHKD.	REMARKS

DESIGNED BY: _____
 DRAWN BY: _____
 SHEET CHECKED BY: _____
 CHECKED BY: _____
 APPROVED BY: _____
 DATE: NOVEMBER 2011

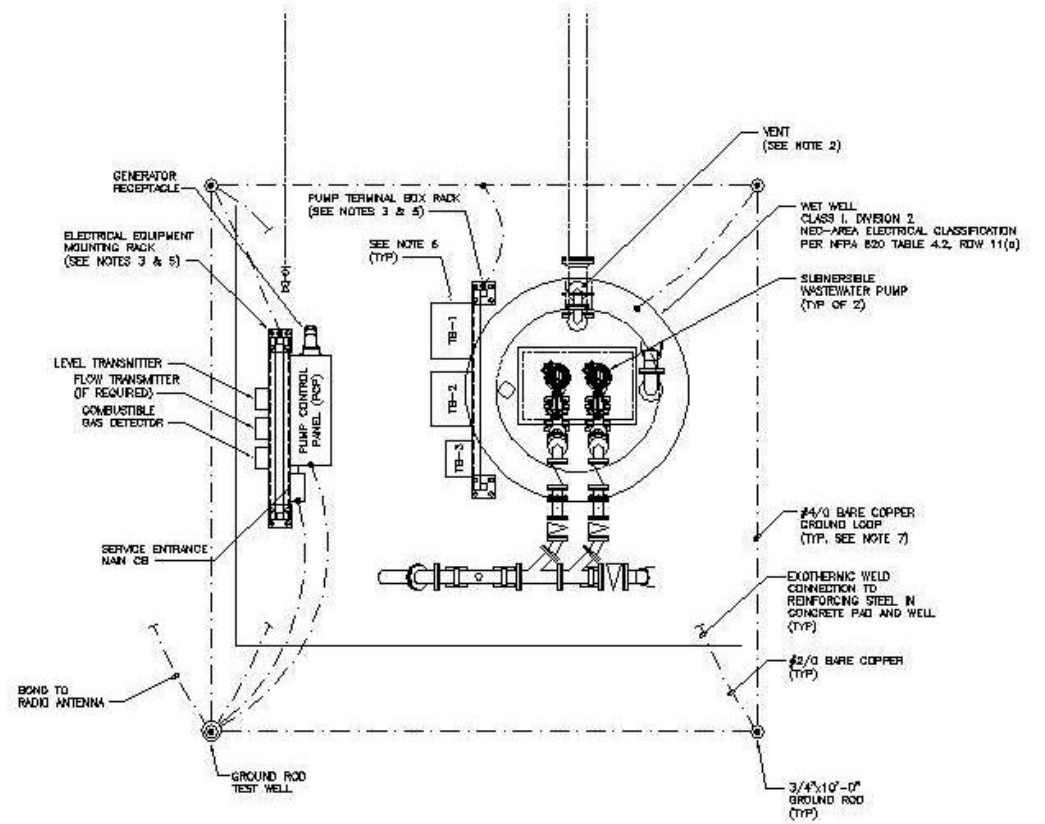


34 HP DUPLEX CONTROL PANEL
 208/120 VOLT, 3-PHASE, 4 WIRE
 LIFT STATION ELECTRICAL

PROJECT NO. _____
 FILE NAME: E005P90T
 SHEET NO. E-5

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City of Valdosta Typical Pump Station Plan



NOTES:

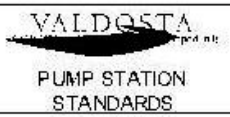
1. PUMP STATION PLAN IS TYPICAL FOR A DUPLEX PUMP STATION WITH SOLID STATE REDUCED VOLTAGE STARTERS, SERVING RESIDENTIAL WASTEWATER. PIPING, WELL, PUMP ORIENTATION AND SIZE ARE SUBJECT TO CHANGE BASED ON THE SITE AND DESIGN.
2. ALL AREAS WITHIN 3'-0" RADIUS OF VENT CLASS 1, DIVISION 2 NEC-AREA ELECTRICAL CLASSIFICATION PER NFPA 820.
3. ELECTRICAL EQUIPMENT ORIENTATION AND LOCATION VARIES BASED ON PUMP STATION. [REFER TO ELECTRICAL SITE PLANS FOR LOCATION AND ORIENTATION.] CONTRACTOR SHALL MAINTAIN NEC WORKING CLEARANCE IN FRONT OF INSTRUMENTS. SERVICE ENTRANCE MAIN CB, PUMP CONTROL PANEL AND PUMP TERMINAL BOXES REGARDLESS OF ORIENTATION.
4. COORDINATE WITH POWER COMPANY FOR LOCATION AND INSTALLATION REQUIREMENTS OF METER, METER BASE, CT'S, ETC.
5. ELECTRICAL EQUIPMENT RACK SHALL BE LOCATED A MINIMUM OF 5'-0" FROM THE WET WELL AND A MINIMUM OF 3'-0" FROM THE PUMP TERMINAL BOX RACK.
6. PROVIDE A 316 SS NEMA 4X RATED VENTED TERMINAL BOX WITH 600V INSULATED TERMINAL BLOCKS, SIZED PER PANEL. THE BOTTOM OF THE PUMP TERMINAL BOXES SHALL BE MOUNTED 36" ABOVE FINISHED SLAB.
7. MINIMUM ALLOWED DISTANCE BETWEEN GROUND RODS IS 20'-0". MAXIMUM ALLOWED DISTANCE IS 50'-0".
8. PUMP CONTROL PANEL, TRANSMITTERS AND SERVICE ENTRANCE MAIN CIRCUIT BREAKER TO BE MOUNTED ABOVE THE 100 YEAR FLOOD ELEVATION.
9. TYPICAL PUMP STATION SITE SIZE IS 50' x 50'.

TYPICAL PUMP STATION
PLAN
N15

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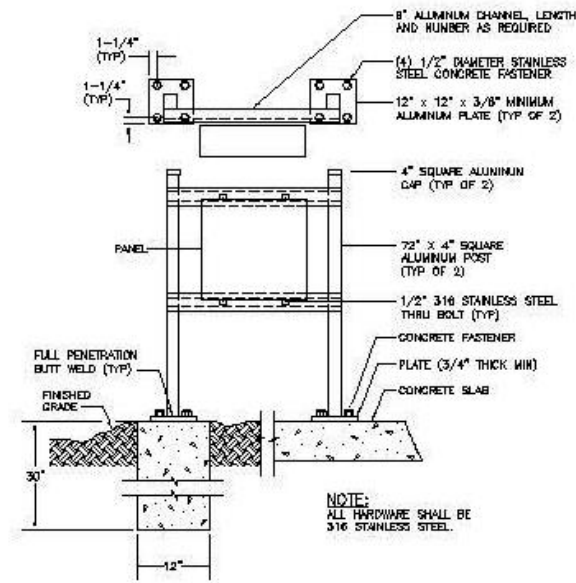
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DATE:	NOVEMBER 2011



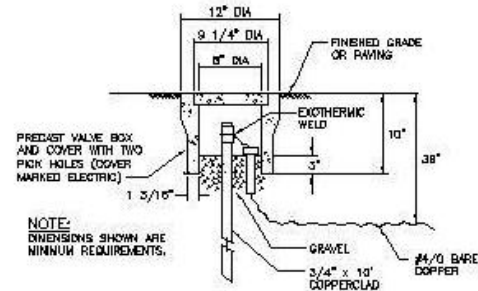
TYPICAL PUMP STATION PLAN

PROJECT NO.:	
FILE NAME:	ED08PSP1
SHEET NO.:	E-6

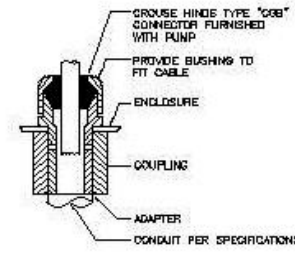
City of Valdosta Typical Pump Station Electrical Details



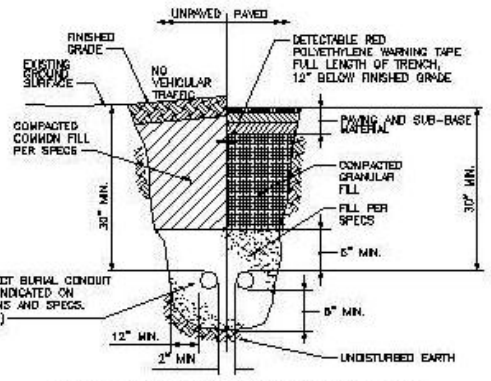
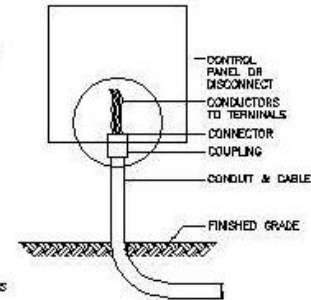
EQUIPMENT MOUNTING
DETAIL
NTS



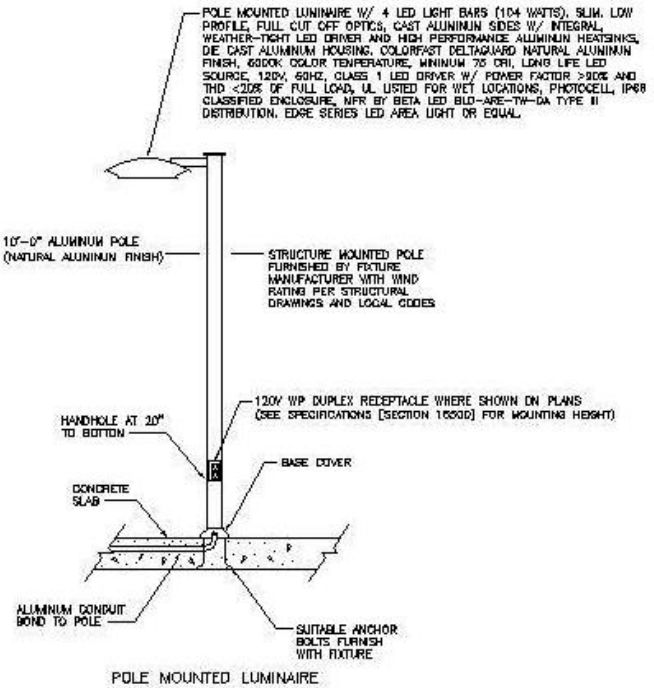
GROUND ROD TEST WELL
DETAIL
NTS



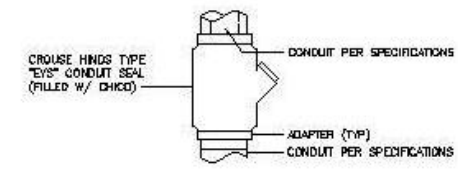
WATER-TIGHT CONNECTION
DETAIL
NTS



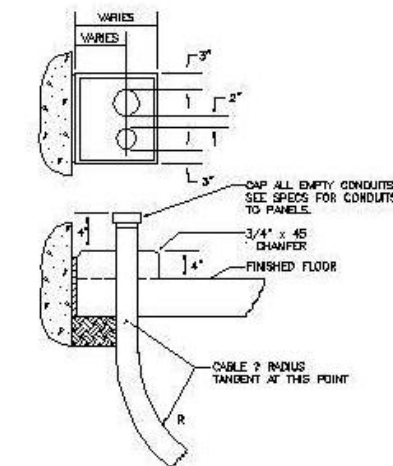
TYPICAL DIRECT BURIED CONDUIT INSTALLATION
DETAIL
NTS



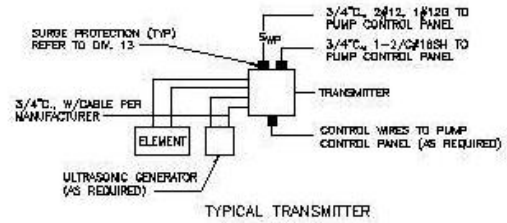
POLE MOUNTED LUMINAIRE
DETAIL
NTS



CONDUIT SEAL CONNECTION
DETAIL
NTS



TYPICAL CONDUIT THROUGH SLAB
DETAIL
NTS

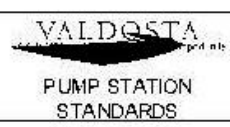


TYPICAL TRANSMITTER
DETAIL
NTS

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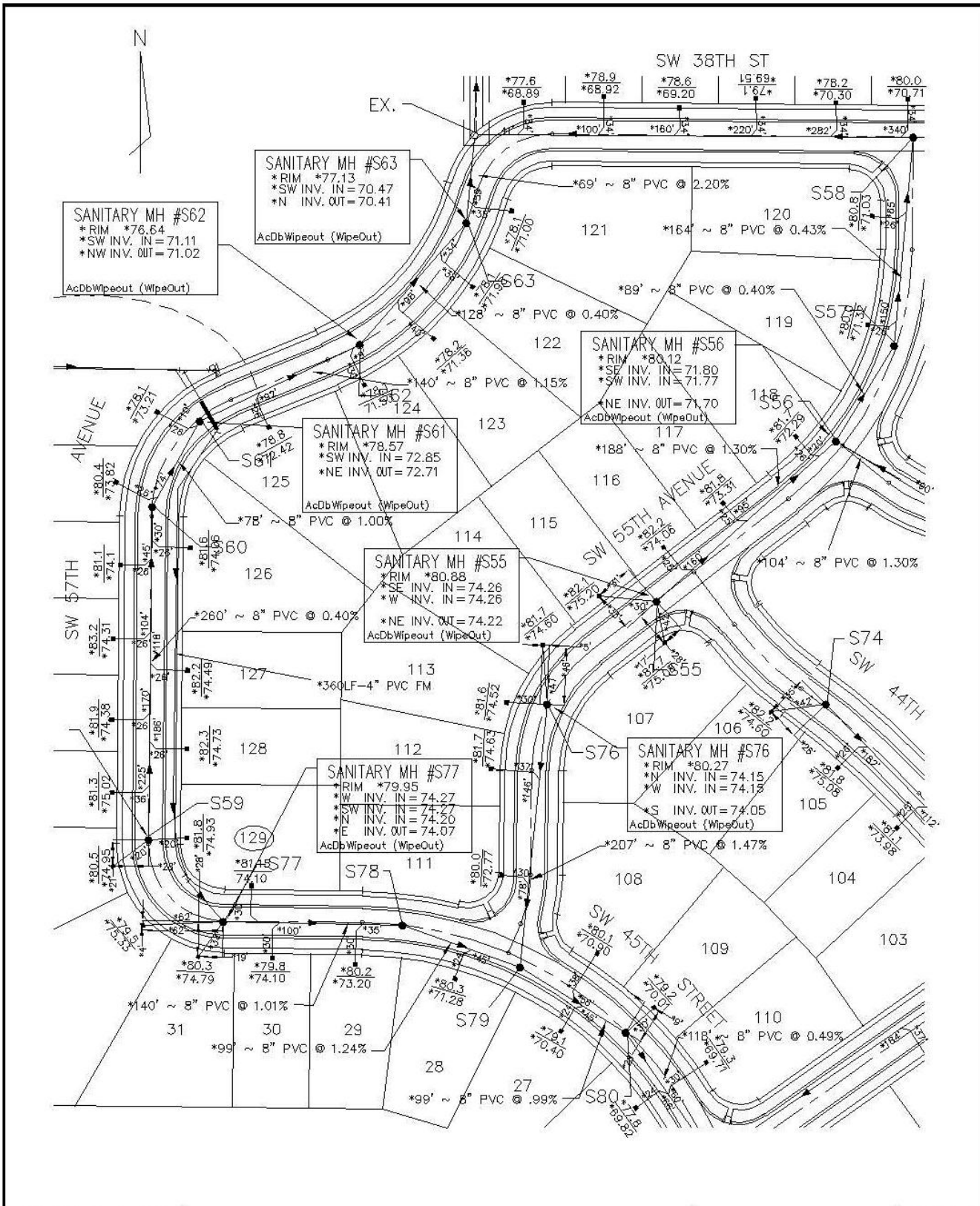
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 SHEET CHECK BY: _____
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 APPROVED BY: _____
 DATE: NOVEMBER 2011



ELECTRICAL DETAILS

PROJECT NO. _____
FILE NAME: EDD101DET
SHEET NO. _____
ED-1



SPECIFICATION		DATE REVISED:		SECTION	
				SHT. 1 OF 1	
CITY OF VALDOSTA		CITY OF VALDOSTA STANDARD DETAIL		TYPICAL SANITARY SEWER ASBUILT DRAWING	
				A	
				498-9.1	

DIVISION 490

SECTION 499

**SANITARY SEWER
SYSTEM**

**STANDARD
MATERIALS
SPECIFICATIONS**

SECTION 499

SANITARY SEWER SYSTEM STANDARD MATERIALS

Following is a list of standard materials to be used in the installation of the sanitary sewer system. Shop drawings are to be submitted in accordance with City of Valdosta, Volume I, General Conditions for Construction. Materials requiring the traditional "Shop Drawing Submittal" are identified by the words "Shop Drawing Required" at the bottom of the specification sheet. All materials must be submitted on form WSCM001. A copy of form WSCM001 is provided in the Appendix section of this manual.

LIST OF SANITARY SEWER STANDARD MATERIALS

499-01 ADAPTOR COUPLINGS

499-01-11-01	Coupling, Rubber Adaptor, Clay to DIP
499-01-12-01	Coupling, Rubber Adaptor, Clay to SCH 40 PVC
499-01-13-01	Coupling, Rubber Adaptor, Clay to 3034 PVC
499-01-99-01	Boot, Rubber

499-02 MANHOLES

499-02-03-01	Brick, Common
499-02-09-01	Ring and Cover
499-02-09-02	Ring and Cover, Manhole, C. I.
499-02-09-03	Hinged Ring & Cover
499-02-10-01	Precast Concrete Slab
499-02-11-01	Precast Adjusting Ring
499-02-99-01	Precast Concrete Manhole (Mildly Corrosive Environs)
499-02-99-02	Precast Concrete Wetwell (Mildly Corrosive Environs)
499-02-99-03	Precast Concrete Pump Pit
499-02-99-05	Precast Concrete Box
499-02-99-06	Precast Manhole w/HDPE liner (Corrosive Environs)
499-02-99-07	Precast Wetwell w/HDPE liner (Corrosive Environs)
499-02-99-20	Fiberglass Wetwell (Highly Corrosive Environs)
499-02-99-21	Fiberglass Manhole (Highly Corrosive Environs)
499-02-99-22	Fiberglass Pump Pit

499-03 RESERVED

499-04 RESERVED

499-05 FITTINGS

499-05-02-01	Bend, 22½° PVC
499-05-02-02	Bend, 45° PVC
499-05-25-06	Plug PVC

499-05-29-01	Stop, Poly
499-05-99-01	Bend, 11 ¼ ° Ductile Iron, Mechanical Joint
499-05-99-02	Bend, 22 ½ ° Ductile Iron, Mechanical Joint
499-05-99-03	Bend, 45° Ductile Iron, Mechanical Joint
499-05-99-04	Bend, 90° Ductile Iron, Mechanical Joint
499-05-99-07	Bend, 45° Ductile Iron, Mechanical Joint X Plain End
499-05-99-08	Bend, 45° Ductile Iron, Flanged
499-05-99-09	Bend, 90° Ductile Iron, Flanged
499-05-99-10	Wye, Single PVC
499-05-99-11	Wye, Double PVC
499-05-99-15	Wye, Single, Ductile Iron, Mechanical Joint
499-05-99-16	Wye, Single, Ductile Iron, Flanged
499-05-99-21	Reducer, PVC
499-05-99-22	Reducer, Bell Mouth
499-05-99-23	Reducer, Ductile Iron, Flanged
499-05-99-25	Adaptor, Ductile Iron, Flange X Plain End
499-05-99-31	Cleanout Hub, PVC Threaded X Slip
499-05-99-32	Cleanout Plug, Brass
499-05-99-33	Cleanout Plug, PVC Threaded
499-05-99-34	Cleanout Tee, PVC
499-05-99-35	Vent Hood
499-05-99-35A	Vent Stock, PVC
499-05-99-36	Tee, PVC, Gasketed
499-05-99-40	Flange Adaptor
499-05-99-42	Blind Flange
499-05-99-51	Retaining Device, Mechanical Joint
499-05-99-60	Cam-lock Assembly
499-05-99-65	Restrained Fitting, Mega-Lug, DIP
499-05-99-70	Saddle, Tapping, Stainless Steel

499-06 RESERVED

499-07 PIPE

499-07-06-02	Pipe, PVC, 3034 DR 26
499-07-15-01	Pipe, Ductile Iron, Pushon, Epoxy Lined
499-07-15-02	Restrained Joint Pipe, Ductile Iron
499-07-20-01	Pipe, HDPE, Fusion
499-07-99-01	Pipe, PVC, Sch 80, Solvent Weld
499-07-99-04	Pipe, PVC, Fusion
499-07-99-05	Pipe, PVC, C-900, DR 18
499-07-99-06	Restrained Joint Pipe, PVC
499-07-99-15	Pipe, Ductile Iron, Flanged, Epoxy Lined

499-08 RESERVED

499-09 RESERVED

499-10 VALVES

499-10-07-02	Valve, Eccentric Plug
499-10-99-01	Valve, Air Release
499-10-99-02	PVC Valve, Air Release
499-10-99-10	Valve, Check, Spring & Lever, Flanged, Epoxy Lined
499-10-99-11	Valve, Check, Swing-Flex, Flanged, Epoxy Lined

499-11 MISCELLANEOUS

499-11-03-01	Marker, Sanitary Sewer
499-11-31-05	Liner, Cement, Calcium Aluminate
499-11-99-01	Link Seal
499-11-99-02	Coating, Bituminous
499-11-99-03	Lining, Amine Cured Epoxy
499-11-99-04	Coating, Exposed Metal and Piping
499-11-99-05	Coating, Submerged Metal and Piping (Highly Corrosive)
499-11-99-06	Coating, Concrete Wetwells and Manholes (Mildly Corrosive)
499-11-99-08	Coating, Concrete Wetwells and Manholes (Highly Corrosive)
499-11-99-21	Backflow Preventer, R.P.
499-11-99-30	Precast Concrete Post
499-11-99-31	Ladder, Fiberglass
499-11-99-40	Dehumidifier
499-11-99-41	Fan, In-Line Duct
499-11-99-42	Fluorescent Light

499-12 PUMPING EQUIPMENT

499-12-99-01	Pump Station, with Enclosure
499-12-99-02	Pump Station, without Enclosure
499-12-99-03	Pump Station, Submersible
499-12-99-10	Sump Pump, 1/4 - 1/3hp
499-12-99-11	Sump Pump, Submersible 1/2hp
499-12-99-20	Float, Ball Type
499-12-99-21	Lift Station Main Disconnect
499-12-99-31	Lift Station Main Electrical Panel

499-13 SCADA

499-13-99-01	Remote Terminal Unit Assembly
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MATERIAL SPECIFICATION: 499-01-11-01

NOMENCLATURE:

COUPLING, RUBBER ADAPTOR

DESCRIPTION:

APPROVED MANUFACTURING AND CATALOG NUMBERS

	<u>MANUFACTURER</u>		
<u>SIZE</u>	<u>FERNCO</u>	<u>INDIANA SEAL</u>	<u>DALLAS SPECIALTY</u>
4"	1003-44	103-44	DS 03-44
6"	1003-66	106-66	DS 03-66
8"	1003-88	103-88	DS 03-88
10"	1003-1010	103-1010	DS 03-1010

MATERIAL SPECIFICATION: 499-01-12-01

NOMENCLATURE:

ADAPTOR COUPLING, RUBBER

DESCRIPTION:

To connect clay pipe to Schedule 40 PVC pipe.

APPROVED MANUFACTURING AND CATALOG NUMBERS

<u>SIZE</u>	<u>MANUFACTURER</u>		
	<u>FERNCO</u>	<u>INDIANA SEAL</u>	<u>DALLAS SPECIALTY</u>
4"	1002-44	102-44	DS 02-44
6"	1002-64	102-64	DS 02-64
8"	1002-88	102-88	DS 02-88
10"	1002-1010	102-1010	DS 02-1010
12"	1002-1212	102-1212	DS 02-1212
15"	1002-1515	102-1515	DS 02-1515
18"	1002-1818	102-1818	DS 02-1818

MATERIAL SPECIFICATION: 499-01-13-01

NOMENCLATURE:

COUPLING, RUBBER ADAPTOR

DESCRIPTION:

To connect clay pipe to #3033 PVC pipe.

APPROVED MANUFACTURING AND CATALOG NUMBERS

	<u>MANUFACTURER</u>
<u>SIZE</u>	<u>CALDER</u>
6"	6" CP TO 6" #3033 PVC

MATERIAL SPECIFICATION: 499-01-99-01

NOMENCLATURE:

BOOT, RUBBER

DESCRIPTION:

Shall be flexible rubber connector boot conforming to ASTM C-923-latest with stainless steel bands.

APPROVED MANUFACTURING AND CATALOG NUMBERS

MANUFACTURER

SIZE

6"
8"
10"
12"
15"
18"

MATERIAL SPECIFICATION: 499-02-03-01

NOMENCLATURE:

BRICK, COMMON CONCRETE

DESCRIPTION:

To fill in holes, adjust manhole ring and covers.
To construct sewer manholes.

APPROVED MANUFACTURING AND CATALOG NUMBERS

MANUFACTURER

SIZE

4" x 8" PRECAST CONCRETE BLOCKS

MATERIAL SPECIFICATION: 499-02-09-01

NOMENCLATURE:

RING AND COVER

DESCRIPTION:

Tough, close-grained gray iron, sound, smooth, clean, free from blisters and defects. Used on sanitary sewer manholes. Shall meet H-20 loading requirement defined in AASHTO, Federal Specification RR-F-621-C, shall be marked as detailed on Detail 498-1.2A. ASTM A-48 Class 30B. All components shall be black coated.

APPROVED MANUFACTURING AND CATALOG NUMBERS

MANUFACTURER

SIZE

U. S. FOUNDRY

VULCAN FOUNDRY

24"

32"

USF 655CW-M

MATERIAL SPECIFICATION: 499-02-09-02

NOMENCLATURE:

RING AND DOUBLE COVER, MANHOLE, C. I.

DESCRIPTION:

Tough, close-grained, gray iron, sound, smooth, clean, free from blisters and defects. Used on sanitary sewer manholes. Shall meet H-20 loading requirement defined in AASHTO, Federal Specification RR-F-621-E. Cover to incorporate a second smaller cover. Shall be marked as detailed on Standard Detail 498-1.2A. ASTM A-48 Class 30B. All components shall be black coated.

APPROVED MANUFACTURING AND CATALOG NUMBERS

<u>SIZE</u>	<u>MANUFACTURER</u>
RING 4" H x 32" CLR OPENING	#655
LARGE COVER - 34 1/8" x 1 1/2"	#CW
SMALL COVER - 22 1/4" x 1 1/2"	#M

MATERIAL SPECIFICATION: 499-02-10-01

NOMENCLATURE:

PRECAST CONCRETE SLAB

DESCRIPTION:

Pre-cast concrete slab, shall have access offset from center, slab to be eight inches (8") thick, five feet four inches (5'- 4") diameter and shall have bituminous coating inside and out, shall meet H-20 loading requirements per GDOT. Refer to Section 498-1 for size of access cover.

APPROVED MANUFACTURING AND CATALOG NUMBERS

MANUFACTURER

SIZE

5' 4" DIAMETER

DEL ZOTTO, HANSON PIPE & PRODUCTS, (OR EQUAL)

***** SHOP DRAWING REQUIRED *****

MATERIAL SPECIFICATION: 499-02-11-01

NOMENCLATURE:

PRECAST ADJUSTING RING

DESCRIPTION:

Shall have 24" or 32" access entrance, to be constructed with 4,000 psi concrete, using one ¼" round steel ring, ¼" in diameter for reinforcing.

APPROVED MANUFACTURING AND CATALOG NUMBERS

MANUFACTURER

SIZE

24" x 2"	DEL ZOTTO, HANSON PIPE & PRODUCTS, (OR EQUAL)
24" x 4"	DEL ZOTTO, HANSON PIPE & PRODUCTS, (OR EQUAL)
24" x 6"	DEL ZOTTO, HANSON PIPE & PRODUCTS, (OR EQUAL)
32" x 2"	DEL ZOTTO, HANSON PIPE & PRODUCTS, (OR EQUAL)
32" x 4"	DEL ZOTTO, HANSON PIPE & PRODUCTS, (OR EQUAL)
32" x 6"	DEL ZOTTO, HANSON PIPE & PRODUCTS, (OR EQUAL)

MATERIAL SPECIFICATION: 499-02-99-01

NOMENCLATURE:

PRECAST CONCRETE MANHOLE (FOR MILDLY CORROSIVE ENVIRONMENTS)

DESCRIPTION:

Manholes shall meet the requirements of ASTM C478-latest, with the exclusion of Section 10 (a), except as modified herein. Cement shall meet the requirements of ASTM C150-latest, specification for Portland Cement, Type II. Concrete for manholes shall meet the minimum requirements for Class III. Minimum wall thickness shall be as specified in Section 498-1. The required minimum strength of concrete and conformance to the design parameters shall be confirmed by testing in accordance with ASTM C14. Contractor shall be responsible for all testing. Manholes shall be fabricated only from eccentric tapered sections or eccentric flat top sections and standard cylinder units with the proper internal diameter. Use a minimum allowable steel hoop of No. 4 wire to be cast into each unit at adequate places as a precautionary measure for handling.

Joint contact surfaces shall be formed exactly parallel with a 2° slope and nominal 1/16" clearance with the tongue equipped with a proper recess for the installation of an o-ring rubber gasket.

Coatings shall cover the interior and exterior surfaces of the manhole except the joint contact surfaces and the annular openings for pipe connections. Interior coating shall be epoxy coating as specified in 499-11-99-06 or 499-11-99-07 as indicated in the Contract Documents. Exterior coating shall be bituminous coating as specified in 499-11-99-02. Coating shall be applied at the place of fabrication.

Manhole connectors shall be installed using a flexible rubber gasket. No adhesives or lubricants shall be employed in the installation of the connector into the manhole. The connector shall be installed in the manhole wall by use of an expanding mechanism in strict accordance with the manufacturer's recommendations.

APPROVED MANUFACTURING AND CATALOG NUMBERS

MANUFACTURER

SIZE

48" DIAMETER	DEL ZOTTO, HANSON PIPE & PRODUCTS, (OR EQUAL)
60" DIAMETER	DEL ZOTTO, HANSON PIPE & PRODUCTS, (OR EQUAL)

***** SHOPDRAWINGREQUIRED *****

MATERIAL SPECIFICATION: 499-02-99-02

NOMENCLATURE:

PRECAST CONCRETE WET WELL (FOR MILDLY CORROSIVE ENVIRONMENTS)

DESCRIPTION:

Wet well shall meet the requirements of ASTM C478-latest, with the exclusion of Section 10(a), except as modified herein. Cement shall meet the requirements of ASTM C150-latest, Specification for Portland Cement, Type II. Concrete for wet well shall meet the minimum requirements for Class III. Minimum wall thickness shall be eight inches or 1/12 the inside diameter whichever is greater. The required minimum strength of concrete and conformance to the design parameters shall be confirmed by testing in accordance with ASTM C14, Contractor shall be responsible for all testing. Wet well shall be fabricated only from eccentric tapered sections or eccentric flat top sections and standard cylinder units with the proper internal diameter. Use a minimum allowable steel hoop of No. 4 wire to be cast into each unit at adequate places as a precautionary measure for handling.

Joint contact surfaces shall be formed exactly parallel with a two degree (2°) slope and nominal 1/16" clearance with the tongue equipped with a proper recess for the installation of an o-ring rubber gasket.

Coatings shall cover the interior and exterior surfaces of the wet well. Interior coating shall be epoxy coatings as specified in 499-11-99-06 or 499-11-99-07 as indicated in the contract documents. Exterior coating shall be of a bituminous coating as specified in 499-11-99-02. Coatings shall be applied at the place of fabrication. Joint surfaces and holes provided for handling capabilities shall be sealed after installation by the Contractor.

Wet well connectors shall be installed using a flexible rubber gasket. No adhesives or lubricants shall be employed in the installation of the connector into the wet well. The connector shall be installed in the wet well wall by use of an expanding mechanism in strict accordance with the manufacturer's recommendations.

APPROVED MANUFACTURING AND CATALOG NUMBERS

MANUFACTURER

SIZE

6' DIAMETER	DEL ZOTTO, HANSON PIPE & PRODUCTS, (OR EQUAL)
8' DIAMETER	DEL ZOTTO, HANSON PIPE & PRODUCTS, (OR EQUAL)
10' DIAMETER	DEL ZOTTO, HANSON PIPE & PRODUCTS, (OR EQUAL)
12' DIAMETER	DEL ZOTTO, HANSON PIPE & PRODUCTS, (OR EQUAL)

- **** SHOP DRAWING REQUIRED ****

MATERIAL SPECIFICATION: 499-02-99-03

NOMENCLATURE:

PRECAST CONCRETE PUMP PIT

DESCRIPTION:

Pump Pit shall meet the requirements of ASTM C478-latest, with the exclusion of Section 10 (a), except as modified herein. Cement shall meet the requirements of ASTM C150-latest, Specification for Portland Cement, Type II. Concrete for pump pit shall meet the minimum requirements for Class III. Minimum wall thickness shall be eight inches or $\frac{1}{12}$ the inside diameter whichever is greater. The required minimum strength of concrete and conformance to the design parameters shall be confirmed by testing in accordance with ASTM C14, Contractor shall be responsible for all testing. Pump pit shall be fabricated only from eccentric tapered sections or eccentric flat top sections and standard cylinder units with the proper internal diameter. Use a minimum allowable steel hoop of No. 4 wire to be cast into each unit at adequate places as a precautionary measure for handling.

Joint contact surfaces shall be formed exactly parallel with a 2° slope and nominal $\frac{1}{16}$ " clearance with the tongue equipped with a proper recess for the installation of an o-ring rubber gasket.

Exterior surface of the Pump Pit shall be coated with a bituminous coating as specified in 499-11-99-02 and shall be applied at the place of fabrication. Joint surfaces and holes provided for handling capabilities shall be sealed after installation by the Contractor.

Openings for piping shall be installed at time of fabrication and shall be to the size and locations shown on the Plans.

APPROVED MANUFACTURING AND CATALOG NUMBERS

SIZE

MANUFACTURER

8' DIAMETER
10' DIAMETER
12' DIAMETER
8' x 8'
10' x 10'
12' x 12'

***** SHOP DRAWING REQUIRED *****

MATERIAL SPECIFICATION: 499-02-99-05

NOMENCLATURE:

BOX, UTILITY, PRECAST CONCRETE

DESCRIPTION:

Pre-cast Concrete Utility Box with lid shall meet the requirements of ASTM C478-latest, with the exclusion of Section 10 (a), except as modified herein. Cement shall meet the requirements of ASTM C150-latest, Specification for Portland Cement, Type I/II. Concrete for utility boxes shall be 4,000 PSI and meet the minimum requirements for Class III. Minimum wall thickness shall be six inches. The required minimum strength of concrete and conformance to the design parameters shall be confirmed by testing in accordance with ASTM C14, Contractor shall be responsible for all testing. Reinforcing shall be #4 GR60 re-bar 12" O.C. both ways. Utility box shall be constructed with open bottom.

Top slab shall be six inches (6") thick, 4,000 PSI with #4 GR60 re-bar 9" O.C. both ways and furnished with aluminum hatch as specified on Detail 498-4.1A(4).

APPROVED MANUFACTURING AND CATALOG NUMBERS

MANUFACTURER

SIZE

48" x 66" x 24" BOX
48" x 66" x 6" TOP

DEL ZOTTO, HANSON PIPE & PRODUCTS, (OR EQUAL)
DEL ZOTTO, HANSON PIPE & PRODUCTS, (OR EQUAL)

***** SHOP DRAWING REQUIRED *****

MATERIAL SPECIFICATION: 499-02-99-06

NOMENCLATURE:

PRECAST CONCRETE MANHOLE WITH HDPE LINING (FOR CORROSIVE ENVIRONMENTS)

DESCRIPTION:

Manholes shall meet the requirements of ASTM C478-latest, with the exclusion of Section 10(a), except as modified herein. Cement shall meet the requirements of ASTM C150-latest, specification for Portland Cement, Type II. Concrete for manholes shall meet the minimum requirements for Class III. Minimum wall thickness shall be as specified in Section 498-1. The required minimum strength of concrete and conformance to the design parameters shall be confirmed by testing in accordance with ASTM C14, Contractor shall be responsible for all testing. Manholes shall be fabricated only from eccentric tapered sections or eccentric flat top sections and standard cylinder units with the proper internal diameter. Use a minimum allowable steel hoop of No. 4 wire to be cast into each unit at adequate places as a precautionary measure for handling.

Joint contact surfaces shall be formed exactly parallel with a 2° slope and nominal 1/16" clearance with the tongue equipped with a proper recess for the installation of an o-ring rubber gasket.

Coatings shall cover the interior and exterior surfaces of the manhole. Coating shall be applied at the place of fabrication. Interior of wet well shall have a non-corrosive high-density polyethylene liner (HDPE) as specified in 499-02-99-07. External coating shall be of a bituminous coating as specified in 499-11-99-02.

Manhole connectors shall be installed using a flexible rubber gasket. No adhesives or lubricants shall be employed in the installation of the connector into the manhole. The connector shall be installed in the manhole wall by use of an expanding mechanism in strict accordance with the manufacturer's recommendations. Manufacturer must certify that manhole and liner have been properly installed.

APPROVED MANUFACTURING AND CATALOG NUMBERS

MANUFACTURER

SIZE

48" DIAMETER	HANSON PIPE & PRODUCTS, DEL ZOTTO (OR EQUAL)
60" DIAMETER	HANSON PIPE & PRODUCTS, DEL ZOTTO (OR EQUAL)

***** SHOP DRAWING REQUIRED *****

***** CERTIFICATION REQUIRED *****

<<<<<<Continued>>>>>>

MATERIAL SPECIFICATION: 499-02-99-07

Installation of the manhole sections and welding of all joints shall be done in accordance with the manufacturer's recommendations for a watertight installation. Manufacturer shall provide certification that wet well and liner have been properly installed to manufacturer's requirements.

APPROVED MANUFACTURING AND CATALOG NUMBERS

MANUFACTURER

SIZE

8' DIAMETER	HANSON PIPE & PRODUCTS, DEL ZOTTO (OR EQUAL)
10' DIAMETER	HANSON PIPE & PRODUCTS, DEL ZOTTO (OR EQUAL)
12' DIAMETER	HANSON PIPE & PRODUCTS, DEL ZOTTO (OR EQUAL)

***** SHOP DRAWING REQUIRED *****

***** CERTIFICATION REQUIRED *****

MATERIAL SPECIFICATION: 499-02-99-20

NOMENCLATURE:

FIBERGLASS WET WELL (FOR HIGHLY CORROSIVE ENVIRONMENTS)

DESCRIPTION:

Fiberglass wet well must be placed with a concrete slab and walls for structural reinforcement and support. Fiberglass reinforced polyester wet well shall be manufactured from commercial grade polyester resin or other suitable polyester or vinyl ester resins, with fiberglass reinforcements. Wet well shall be one piece unit with FRP top and bottom. Resin shall be a commercial grade unsaturated polyester resin. Reinforcing materials shall be commercial grade "E" type glass in the of form of mat, chopped roving, continuous roving, roving fabric, or a combination of the above having a coupling agent that will provide a suitable bond between the glass reinforcement and the resin. Fillers, when used, shall be inert to the sewer environment and wet well conditions. Additives, such as thixotropic agents, catalyst, promoters, etc. may be added as required by the specific manufacturing process to be used. The resulting reinforced plastic material must meet the requirements of this specification. The interior surface of the vessel shall be resin rich with no exposed fibers. The surface shall be free of crazing, delaminations, blisters larger than 1/2" in diameter, and wrinkles of 1/8" or greater in depth. Surface pits shall be permitted up to six (6) per square foot if they are less than 3/4" in diameter and less than 1/16" in depth. The complete wet well shall have a minimum dynamic-load rating of 16,000 ft/lbs when tested in accordance with ASTM D-3753-latest edition, section 8. To establish this rating, the complete wet well shall not leak, crack, or suffer other damage load tested to 40,000 ft/lbs and shall not deflect vertically downward more than 1/4" at the point of load application when loaded to 24,000 pounds. Wet well top shall be closed fiberglass reinforced with a rectangular cutout to accommodate the hatch cover assembly. The top shall also include openings for pipe penetrations as detailed in Section 498-4.1. A neck shall be extended above the top to accommodate concrete slab installation. Bottom shall have a closed reinforced bottom having sufficient stiffening ribs completely enclosed with resin and fiber reinforcement. The bottom shall have a minimum three inch (3") anti-floatation ring or collar. Wet well bottom shall be minimum 5/16" thickness. All incoming and outgoing pipe connections shall be factory installed or installed per factory recommendations. Installation of PVC pipe must be performed by sanding, priming, and using resin fiber- reinforced band lay-up. The resin and fiberglass shall be the same type and grade as used in the fabrication of the wet well. Boots shall be installed by the wet well manufacturer using FRP pipe stub-out for the boot sealing surface. Manufacturer must certify that wet well has been properly installed to manufacturer's requirements.

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MATERIAL SPECIFICATION: 499-02-99-20

APPROVED MANUFACTURING AND CATALOG NUMBERS

MANUFACTURER

SIZE

L & F MANUFACTURING (OR EQUAL)

6' DIAMETER
8' DIAMETER
10' DIAMETER
12' DIAMETER

***** SHOP DRAWING REQUIRED *****

***** CERTIFICATION REQUIRED *****

MATERIAL SPECIFICATION: 499-02-99-21

NOMENCLATURE:

FIBERGLASS MANHOLE (FOR HIGHLY CORROSIVE ENVIRONMENTS)

DESCRIPTION:

Fiberglass manhole must be placed with a concrete slab and walls for structural reinforcement and support. Fiberglass reinforced polyester manholes shall be manufactured from commercial grade polyester resin or other suitable polyester or vinyl ester resins, with fiberglass reinforcements. Manhole shall be one piece unit with FRP top and bottom. Resin shall be a commercial grade unsaturated polyester resin. Reinforcing materials shall be commercial Grade "E" type glass in the form of mat, chopped roving, continuous roving, roving fabric, or a combination of the above having a coupling agent that will provide a suitable bond between the glass reinforcement and the resin. Fillers, when used, shall be inert to the sewer environment and manhole conditions. Additives, such as thixotropic agents, catalyst, promoters, etc. may be added as required by the specific manufacturing process to be used. The resulting reinforced plastic material must meet the requirements of this specification. The interior surface of the vessel shall be resin rich with no exposed fibers. The surface shall be free of crazing, delaminations, blisters larger than 1/2" in diameter, and wrinkles of 1/8" or greater in depth. Surface pits shall be permitted up to six (6) per square foot if they are less than 3/4" in diameter and less than 1/16" in depth. The complete manhole shall have a minimum dynamic-load rating of 16,000 ft/lbs when tested in accordance with ASTM D-3753-latest edition, Section 8. To establish this rating, the complete manhole shall not leak, crack, or suffer other damage load tested to 40,000 ft/lbs and shall not deflect vertically downward more than 1/4" at the point of load application when loaded to 24,000 lbs. Manhole top shall be closed fiberglass reinforced with a circular cutout to accommodate the manhole ring and cover assembly. A neck shall be extended above the top to accommodate ring and cover installation and adjustment requirements. Bottom shall be closed and reinforced, having sufficient stiffening ribs completely enclosed with resin and fiber reinforcement. The bottom shall have a minimum three-inch (3") anti-flotation ring or collar. Manhole bottom shall be minimum 5/16" thickness. All incoming and outgoing pipe connections shall be factory installed or installed per factory recommendations. Installation of PVC pipe must be performed by sanding, priming, and using resin fiber-reinforced band lay-up. The resin and fiberglass shall be the same type and grade as used in the fabrication of the manhole. Boots shall be installed by the manhole manufacturer using FRP pipe stub out for the boot sealing surface.

APPROVED MANUFACTURING AND CATALOG NUMBERS

MANUFACTURER

SIZE

L & F MANUFACTURING (OR EQUAL)

48" DIAMETER

60" DIAMETER

***** SHOP DRAWING REQUIRED *****

NOMENCLATURE:

FIBERGLASS PUMP PIT

DESCRIPTION:

Fiberglass pump pit must be placed with a concrete slab and walls for structural reinforcement and support. Fiberglass reinforced polyester pump pit shall be manufactured from commercial grade polyester resin or other suitable polyester or vinyl ester resins, with fiberglass reinforcements. Pump pit shall be one piece unit with FRP top and bottom. Resin shall be a commercial grade unsaturated polyester resin. Reinforcing materials shall be commercial grade "E" type glass in the of form of mat, chopped roving, continuous roving, roving fabric, or a combination of the above having a coupling agent that will provide a suitable bond between the glass reinforcement and the resin. Fillers, when used, shall be inert to the sewer environment and pump pit conditions. Additives, such as thixotropic agents, catalyst, promoters, etc. may be added as required by the specific manufacturing process to be used. The resulting reinforced plastic material must meet the requirements of this specification. The interior surface of the vessel shall be resin rich with no exposed fibers. The surface shall be free of crazing, delaminations, blisters larger than 1/2" in diameter, and wrinkles of 1/8" or greater in depth. Surface pits shall be permitted up to six (6) per square foot if they are less than 3/4" in diameter and less than 1/16" in depth. The complete pump pit shall have a minimum dynamic-load rating of 16,000 ft/lbs when tested in accordance with ASTM D-3753-latest edition, Section 8. To establish this rating, the complete pump pit shall not leak, crack, or suffer other damage load tested to 40,000 ft/lbs and shall not deflect vertically downward more than 1/4" at the point of load application when loaded to 24,000 pounds. Pump pit top shall be closed fiberglass reinforced with a rectangular cutout to accommodate the hatch cover assembly. The top shall also include openings for pipe penetrations as detailed in Section 498-4.1. A neck shall be extended above the top to accommodate concrete slab installation. Bottom shall be closed and reinforced, having sufficient stiffening ribs completely enclosed with resin and fiber reinforcement. The bottom shall have a minimum three inch (3") anti-floatation ring or collar. Pump pit bottom shall be minimum 5/16" thickness. All incoming and outgoing pipe connections shall be factory installed or installed per factory recommendations. Installation of PVC pipe must be performed by sanding, priming, and using resin fiber-reinforced band lay-up. The resin and fiberglass shall be the same type and grade as used in the fabrication of the pump pit. Boots shall be installed by the pump pit manufacturer using FRP pipe stub-out for the boot sealing surface.

APPROVED MANUFACTURING AND CATALOG NUMBERS

MANUFACTURER

SIZE

L & F MANUFACTURING (OR EQUAL)

8' DIAMETER
10' DIAMETER
12' DIAMETER

***** SHOP DRAWING REQUIRED *****

MATERIAL SPECIFICATION: 499-05-02-01

NOMENCLATURE:

BEND, 22 1/2° PVC

DESCRIPTION:

PVC fitting. Shall conform to ASTM F1336 SDR-26. For gravity piping only.

<u>SIZE</u>	<u>BEND</u>
4"	22 1/2°
6"	22 1/2°

MATERIAL SPECIFICATION: 499-05-02-02

NOMENCLATURE:

BEND, 45° PVC

DESCRIPTION:

PVC fitting. Shall conform to ASTM F1336-80 SDR-26. For gravity piping only.

<u>SIZE</u>	<u>BEND</u>
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4"	45°
6"	45°

MATERIAL SPECIFICATION: 499-05-25-06

NOMENCLATURE:

PLUG, PVC

DESCRIPTION:

PVC Push-on plug used to plug end of sewer gravity pipes.
Shall conform to ASTM F1336-80, SDR-26.

SIZE

4"
6"
8"
10"
12"
15"
18"

MATERIAL SPECIFICATION: 499-05-29-01

NOMENCLATURE:

STOP, POLY

DESCRIPTION:

Plastic with rubber coating.

APPROVED MANUFACTURING AND CATALOG NUMBERS

MANUFACTURER

SIZE

6"

DICKEY

6"

MATERIAL SPECIFICATION: 499-05-99-01

NOMENCLATURE:

BEND, 11 1/4° DUCTILE IRON, MECHANICAL JOINT

DESCRIPTION:

Fitting shall be ductile iron, conform to ANSI A21.53/AWWA C-153 for compact fittings three inch (3") through 36". All fittings shall be cast and machined allowing the bolt holes to straddle the vertical centerline and manufactured so as to distinctly indicate the pressure rating, nominal diameter of the openings, number of degrees or fraction of the circle, manufacturers identification, country where cast and the letters "DI" or "Ductile". Fittings shall be furnished with accessories. Refer to Table WSCM 110 and 111 for estimated weights of fittings.

The exterior of the fittings shall be bituminous coated by airless spray method. The interior lining shall be a factory applied amine cured epoxy as specified in Section 499-11-99-03.

The pipe or fitting manufacturer must supply a "Certificate of Application" that the applicator has met the requirements of Section 499-11-99-03.

<u>SIZE</u>	<u>BEND</u>
4"	11 1/4°
6"	11 1/4°
8"	11 1/4°
12"	11 1/4°
16"	11 1/4°
20"	11 1/4°
24"	11 1/4°
30"	11 1/4°
36"	11 1/4°

***** CERTIFICATION REQUIRED *****

MATERIAL SPECIFICATION: 499-05-99-02

NOMENCLATURE:

BEND, 22 1/2° DUCTILE IRON, MECHANICAL JOINT

DESCRIPTION:

Fitting shall be ductile iron, conform to ANSI A21.53/AWWA C-153 for compact fittings three inch (3") through 36". All fittings shall be cast and machined allowing the bolt holes to straddle the vertical centerline and manufactured so as to distinctly indicate the pressure rating, nominal diameter of the openings, number of degrees or fraction of the circle, manufacturers identification, country where cast and the letters "DI" or "Ductile". Fittings shall be furnished with accessories. Refer to Table WSCM 110 and 111 for estimated weights of fittings.

The exterior of the fittings shall be bituminous coated by airless spray method. The interior lining shall be a factory applied amine cured epoxy as specified in Section 499-11-99-03.

The pipe or fitting manufacturer must supply a "Certificate of Application" that the applicator has met the requirements of Section 499-11-99-03.

SIZE	BEND
4"	22 1/2°
6"	22 1/2°
8"	22 1/2°
12"	22 1/2°
16"	22 1/2°
20"	22 1/2°
24"	22 1/2°
30"	22 1/2°
36"	22 1/2°

***** CERTIFICATION REQUIRED *****

MATERIAL SPECIFICATION: 499-05-99-03

NOMENCLATURE:

BEND, 45° DUCTILE IRON, MECHANICAL JOINT

DESCRIPTION:

Fitting shall be ductile iron, conform to ANSI A21.53/AWWA C-153 for compact fittings three inch (3") through 36". All fittings shall be cast and machined allowing the bolt holes to straddle the vertical centerline and manufactured so as to distinctly indicate the pressure rating, nominal diameter of the openings, number of degrees or fraction of the circle, manufacturers identification, country where cast and the letters "DI" or "Ductile". Fittings shall be furnished with accessories. Refer to Table WSCM 110 and 111 for estimated weights of fittings.

The exterior of the fittings shall be bituminous coated by airless spray method. The interior lining shall be a factory applied amine cured epoxy as specified in Section 499-11-99-03.

The pipe or fitting manufacturer must supply a "Certificate of Application" that the applicator has met the requirements of Section 499-11-99-03.

<u>SIZE</u>	<u>BEND</u>
4"	45°
6"	45°
8"	45°
12"	45°
16"	45°
20"	45°
24"	45°
30"	45°
36"	45°

***** CERTIFICATION REQUIRED *****

MATERIAL SPECIFICATION: 499-05-99-04

NOMENCLATURE:

BEND, 90° DUCTILE IRON, MECHANICAL JOINT

DESCRIPTION:

Fitting shall be ductile iron, conform to ANSI A21.53/AWWA C-153 for compact fittings three inch (3") through 36". All fittings shall be cast and machined allowing the bolt holes to straddle the vertical centerline and manufactured so as to distinctly indicate the pressure rating, nominal diameter of the openings, number of degrees or fraction of the circle, manufacturers identification, country where cast and the letters "DI" or "Ductile". Fittings shall be furnished with accessories. Refer to Table WSCM 110 and 111 for estimated weights of fittings.

The exterior of the fittings shall be bituminous coated by airless spray method. The interior lining shall be a factory applied amine cured epoxy as specified in Section 499-11-99-03.

The pipe or fitting manufacturer must supply a "Certificate of Application" that the applicator has met the requirements of Section 499-11-99-03.

<u>SIZE</u>	<u>BEND</u>
4"	90°
6"	90°
8"	90°
12"	90°
16"	90°
20"	90°
24"	90°
30"	90°
36"	90°

***** CERTIFICATION REQUIRED *****

MATERIAL SPECIFICATION: 499-05-99-07

NOMENCLATURE:

BEND, 45° DUCTILE IRON, MECHANICAL JOINT X PLAIN END

DESCRIPTION:

Fitting shall be ductile iron, conform to ANSI A21.53/AWWA C-153 for compact fittings three inch (3") through 36". All fittings shall be cast and machined allowing the bolt holes to straddle the vertical centerline and manufactured so as to distinctly indicate the pressure rating, nominal diameter of the openings, number of degrees or fraction of the circle, manufacturers identification, country where cast and the letters "DI" or "Ductile". Fittings shall be furnished with accessories. Refer to Table WSCM 110 and 111 for estimated weights of fittings.

The exterior of the fittings shall be epoxy coated as specified in 499-11-99-05. The interior lining shall be a factory applied amine cured epoxy as specified in Section 499-11-99-03.

The pipe or fitting manufacturer must supply a "Certificate of Application" that the applicator has met the requirements of Section 499-11-99-03.

<u>SIZE</u>	<u>BEND</u>	<u>TYPE</u>
4"	45°	MJ X PE
6"	45°	MJ X PE
8"	45°	MJ X PE
12"	45°	MJ X PE
16"	45°	MJ X PE
20"	45°	MJ X PE
24"	45°	MJ X PE
30"	45°	MJ X PE
36"	45°	MJ X PE

***** CERTIFICATION REQUIRED *****

MATERIAL SPECIFICATION: 499-05-99-08

NOMENCLATURE:

BEND, 45° DUCTILE IRON, FLANGED

DESCRIPTION:

Fitting shall be ductile iron, conform ANSI A21.10/AWWA C-110 for standard fittings three inch (3") through 36". All fittings shall be cast and machined allowing the bolt holes to straddle the vertical centerline and manufactured so as to distinctly indicate the pressure rating, nominal diameter of the openings, number of degrees or fraction of the circle, manufacturers identification, country where cast and the letters "DI" or "Ductile". Fittings shall be furnished with accessories. Nuts and bolts shall be stainless steel. Refer to Table WSCM 110 and 111 for estimated weights of fittings.

The exterior of the fittings shall be epoxy coated as specified in 499-11-99-04. The interior lining shall be a factory applied amine cured epoxy as specified in Section 499-11-99-03.

The pipe or fitting manufacturer must supply a "Certificate of Application" that the applicator has met the requirements of Section 499-11-99-03.

<u>SIZE</u>	<u>BEND</u>
4"	45°
6"	45°
8"	45°
12"	45°
16"	45°
20"	45°
24"	45°
30"	45°
36"	45°

***** CERTIFICATION REQUIRED *****

MATERIAL SPECIFICATION: 499-05-99-09

NOMENCLATURE:

BEND, 90°, DUCTILE IRON, FLANGED JOINT

DESCRIPTION:

Fitting shall be ductile iron, conform to ANSI A21.10/AWWA C-110 for standard fittings three inch (3") through 36". All fittings shall be cast and machined allowing the bolt holes to straddle the vertical centerline and manufactured so as to distinctly indicate the pressure rating, nominal diameter of the openings, number of degrees or fraction of the circle, manufacturers identification, country where cast and the letters "DI" or "Ductile". Fittings shall be furnished with accessories. Nuts and bolts shall be stainless steel. Refer to Table WSCM 111 for estimated weights of fittings.

The exterior of the fittings shall be epoxy coated as specified in 499-11-99-04. The interior lining shall be a factory applied amine cured epoxy as specified in Section 499-11-99-03.

The pipe or fitting manufacturer must supply a "Certificate of Application" that the applicator has met the requirements of Section 499-11-99-03.

4"	90°
6"	90°
8"	90°
12"	90°
16"	90°
20"	90°
24"	90°
30"	90°
36"	90°

***** CERTIFICATION REQUIRED *****

MATERIAL SPECIFICATION: 499-05-99-10

NOMENCLATURE:

WYE, SINGLE, PVC

DESCRIPTION:

PVC Wye conforming to ASTM F1336-80, SDR-26.

SIZE

8" x 6"

10" x 6"

12" x 6"

15" x 6"

18" x 6"

MATERIAL SPECIFICATION: 499-05-99-15

NOMENCLATURE:

WYE, SINGLE, DUCTILE IRON, MECHANICAL JOINT

DESCRIPTION:

Fitting shall be ductile iron, conform to ANSI A21.53/AWWA C-153 for compact fittings three inch (3") through 36". All fittings shall be cast and machined allowing the bolt holes to straddle the vertical centerline and manufactured so as to distinctly indicate the pressure rating, nominal diameter of the openings, number of degrees or fraction of the circle, manufacturers identification, country where cast and the letters "DI" or "Ductile". Fittings shall be furnished with accessories. Refer to Table WSCM 110 and 111 for estimated weights of fittings.

The exterior of the fittings shall be bituminous coating. The interior lining shall be a factory applied amine cured epoxy as specified in Section 499-11-99-03.

The pipe or fitting manufacturer must supply a "Certificate of Application" that the applicator has met the requirements of Section 499-11-99-03.

SIZE

4" x 4"
6" x 6"
8" x 8"
12" x 12"
16" x 16"
18" x 18"
20" x 20"
24" x 24"
30" x 30"
36" x 36"

***** CERTIFICATION REQUIRED *****

MATERIAL SPECIFICATION: 499-05-99-16

NOMENCLATURE:

WYE, SINGLE, DUCTILE IRON, FLANGED

DESCRIPTION:

Fitting shall be ductile iron, conform to ANSI A21.10/AWWA C-110 for standard fittings three inch (3") through 36". All fittings shall be cast and machined allowing the bolt holes to straddle the vertical centerline and manufactured so as to distinctly indicate the pressure rating, nominal diameter of the openings, number of degrees or fraction of the circle, manufacturers identification, country where cast and the letters "DI" or "Ductile". Fittings shall be furnished with accessories. Nuts and bolts shall be stainless steel. Refer to Table WSCM 110 and 111 for estimated weights of fittings.

The exterior of the fittings shall be epoxy coated as specified in 499-11-99-04. The interior lining shall be a factory applied amine cured epoxy as specified in Section 499-11-99-03.

The pipe or fitting manufacturer must supply a "Certificate of Application" that the applicator has met the requirements of Section 499-11-99-03.

SIZE

4" x 4"
6" x 6"
8" x 8"
10" x 10"
12" x 12"
16" x 16"
18" x 18"
20" x 20"
24" x 24"
30" x 30"
36" x 36"

***** CERTIFICATION REQUIRED *****

MATERIAL SPECIFICATION: 499-05-99-21

NOMENCLATURE:

REDUCER, PVC

DESCRIPTION:

PVC Reducer conforming to ASTM F1336 SDR-26. For gravity sewer piping only.

SIZE

6" x 4"

8" x 6"

MATERIAL SPECIFICATION: 499-05-99-22

NOMENCLATURE:

REDUCER, BELL MOUTH, PVC

DESCRIPTION:

PVC, Bell Mouth Reducer conforming to ASTM F1336-80, SDR-26. For gravity sewer piping only.

SIZE

4" x 6"
4" x 8"
4" x 10"
4" x 12"
6" x 8"
6" x 10"
6" x 12"

MATERIAL SPECIFICATION: 499-05-99-23

NOMENCLATURE:

REDUCER, DUCTILE IRON, FLANGED JOINT

DESCRIPTION:

Fitting shall be ductile iron, conform to ANSI A21.10/AWWA C-110 for standard fittings three inch (3") through 36". All fittings shall be cast and machined allowing the bolt holes to straddle the vertical centerline and manufactured so as to distinctly indicate the pressure rating, nominal diameter of the openings, number of degrees or fraction of the circle, manufacturers identification, country where cast and the letters "DI" or "Ductile". Fittings shall be furnished with accessories. Nuts and bolts shall be stainless steel. Refer to Table WSCM 111 for estimated weights of fittings.

The exterior of the fittings shall be epoxy coated as specified in 499-11-99-04. The interior lining shall be a factory applied amine cured epoxy as specified in Section 499-11-99-03.

The pipe or fitting manufacturer must supply a "Certificate of Application" that the applicator has met the requirements of Section 499-11-99-03.

SIZE

6" x 4"
8" x 4"
8" x 6"
10" x 6"
12" x 6"
12" x 8"
16" x 6"
16" x 8"
16" x 12"
20" x 6"
20" x 8"
20" x 12"
24" x 6"
24" x 8"
24" x 12"

***** CERTIFICATION REQUIRED *****

MATERIAL SPECIFICATION: 499-05-99-25

NOMENCLATURE:

ADAPTOR, DUCTILE IRON, FLANGE X PLAIN END

DESCRIPTION:

Fitting shall be ductile iron, conform to ANSI A21.10/AWWA C-110 for standard fittings three inch (3") through 36". All fittings shall be cast and machined allowing the bolt holes to straddle the vertical centerline and manufactured so as to distinctly indicate the pressure rating, nominal diameter of the openings, number of degrees or fraction of the circle, manufacturers identification, country where cast and the letters "DI" or "Ductile". Fittings shall be furnished with accessories. Nuts and bolts shall be stainless steel. Refer to Table WSCM 111 for estimated weights of fittings.

The exterior of the fittings shall be epoxy coated as specified in 499-11-99-04. The interior lining shall be a factory applied amine cured epoxy as specified in Section 499-11-99-03.

The pipe or fitting manufacturer must supply a "Certificate of Application" that the applicator has met the requirements of Section 499-11-99-03.

<u>SIZE</u>	<u>TYPE</u>
4"	PE X FLANGE
6"	PE X FLANGE
8"	PE X FLANGE
12"	PE X FLANGE
16"	PE X FLANGE
18"	PE X FLANGE
20"	PE X FLANGE
24"	PE X FLANGE
30"	PE X FLANGE
36"	PE X FLANGE

***** CERTIFICATION REQUIRED *****

MATERIAL SPECIFICATION: 499-05-99-31

NOMENCLATURE:

CLEANOUT HUB, PVC, THREADED/SLIP

DESCRIPTION:

PVC Threaded/Slip Adaptor conforming to ASTM F1336-80, SDR-26.

SIZE

4"

6"

MATERIAL SPECIFICATION: 499-05-99-32

NOMENCLATURE:

CLEANOUT PLUG, BRASS

DESCRIPTION:

Brass threaded recessed plug used in conjunction with PVC threaded/slip hub.

SIZE

4"

MATERIAL SPECIFICATION: 499-05-99-33

NOMENCLATURE:

CLEANOUT PLUG, PVC, THREADED

DESCRIPTION:

PVC Threaded Plug conforming to ASTM F1336-80, SDR-26.

SIZE

4"

6"

MATERIAL SPECIFICATION: 499-05-99-34

NOMENCLATURE:

CLEANOUT TEE, PVC

DESCRIPTION:

PVC Tee-Wye used to clean out sewer systems and shall conform to ASTM F1336-80, SDR-26. For gravity sewer piping only.

SIZE

6" x 6" x 4"

6" x 6" x 6"

MATERIAL SPECIFICATION: 499-05-99-35

NOMENCLATURE:

VENT HOOD

DESCRIPTION:

Stainless steel, vandal-proof, hooded vent cap with large frost proof openings, counter flashing collar, deep protective hood and recessed securing screws. Install with non-corrosive screen.

APPROVED MANUFACTURING AND CATALOG NUMBERS

MANUFACTURER

SIZE

4"

MATERIAL SPECIFICATION: 499-05-99-35A

NOMENCLATURE:

VENT STACK, PVC

DESCRIPTION:

PVC, Schedule 80, vent stack with 90° sweep. Install with non-corrosive screen to prevent debris and bugs entering pipe on 90° sweep. For gravity piping only.

SIZE

4"

6"

MATERIAL SPECIFICATION: 499-05-99-36

NOMENCLATURE:

TEE, PVC, GASKETED

DESCRIPTION:

PVC fitting shall conform to ASTM F1336, SDR-26.

SIZE

8" x 8" TEE
10" x 10" TEE
12" x 12" TEE
15" x 15" TEE
18" x 18" TEE
24" x 24" TEE

MATERIAL SPECIFICATION: 499-05-99-40

NOMENCLATURE:

FLANGE, ADAPTOR

DESCRIPTION:

Cast iron flanged type adaptor with iron pipe threads.

The exterior of the fittings shall be epoxy coated as specified in 499-11-99-04. The interior lining shall be a factory applied amine cured epoxy as specified in Section 499-11-99-03.

The pipe or fitting manufacturer must supply a "Certificate of Application" that the applicator has met the requirements of Section 499-11-99-03.

SIZE

4"

6"

8"

12"

16"

20"

24"

***** CERTIFICATION REQUIRED *****

MATERIAL SPECIFICATION: 499-05-99-42

NOMENCLATURE:

BLIND FLANGE

DESCRIPTION:

Shall conform to ANSI B16.1, shall be ductile iron. The exterior of the flange shall be epoxy coated as specified in 499-11-99-04. The interior shall be factory applied amine cured epoxy as specified in 499-11-99-03.

SIZE

4"

6"

8"

12"

16"

20"

24"

MATERIAL SPECIFICATION: 499-05-99-51

NOMENCLATURE:

RESTRAINING DEVICE, MECHANICAL JOINT

DESCRIPTION:

Shall include a restraining mechanism which when activated, imparts multiple wedging action against the pipe, increasing its resistance as the pressure increases. Flexibility of the joint shall be maintained after burial. Glands shall be manufactured of ductile iron conforming to ASTM A 536-80. Restraining devices shall be of ductile iron, heat treated to a minimum hardness of 370 BHN. Dimensions of the gland shall be such that it can be used with the standardized mechanical joint bell and tee-headed bolts conforming to ANSI/AWWA A21.11 and ANSI/AWWA C153/A21.53 of latest revision. Twist off nuts shall be used to insure proper actuating of the restraining devices. The mechanical joint restraint device shall have a working pressure of at least 250 psi with a minimum safety factor of 2:1. The restraining device shall be primer coated and finish coated with epoxy paint specified in 499-11-99-05.

APPROVED MANUFACTURING AND CATALOG NUMBERS

MANUFACTURER

<u>SIZE</u>	<u>EBAA IRON, (OR EQUAL)</u>	<u>SIGMA-ONE LOK</u>
4"	MEGALUG-1104	SLD
6"	MEGALUG-1106	SLD
8"	MEGALUG-1108	SLD
10"	MEGALUG-1110	SLD
12"	MEGALUG-1112	SLD
14"	MEGALUG-1114	SLD
16"	MEGALUG-1116	SLD
18"	MEGALUG-1118	SLD
20"	MEGALUG-1120	SLD
24"	MEGALUG-1124	SLD
30"	MEGALUG-1130	SLD

NOMENCLATURE:

CAM-LOCK ASSEMBLY

DESCRIPTION:

Cam-Lock Assembly shall be cam and groove type adaptor suitable for quick release and connection of pipes or hoses. Assembly shall consist of an adaptor and dust cap. Dust cap shall connect to the adaptor with a cam arm type locking device. Adaptor shall have NPT threads on one end and a grooved male coupling on the other.

SIZE

6" ADAPTOR

6" DUST CAP

MATERIAL SPECIFICATION: 499-05-99-65

NOMENCLATURE:

RESTRAINED FITTING, MEGA-LUG, DIP

DESCRIPTION:

Shall be ductile iron conforming to ANSI/AWWA C151/A21.51, latest version. All restrained mega-lugs shall be furnished with accessories and have a minimum pressure resistance of 200 psi. The mega-lug shall be epoxy coated throughout.

APPROVED MANUFACTURING AND CATALOG NUMBERS

MANUFACTURER

SIZE

4"	EBA	IRON	SERIES 1100	SIGMA-ONE LOK SLD SERIES
6"				
8"				
10"				
12"				
16"				
18"				
20"				
24"				
30"				

MATERIAL SPECIFICATION: 499-05-99-70

NOMENCLATURE:

SADDLE, TAPPING, STAINLESS STEEL

DESCRIPTION:

Tapping saddle shall be all stainless steel T-304, per ASTM A-240. All welds and metal surfaces shall be chemically passivated to meet ASTM A-380. All saddles to be certified to ANSI/NSF-61. Saddles to be two-piece construction with two inch (2") outlet with IPS thread. Saddles to have double bolt and received bars. Bolts and nuts to be 18-8 stainless steel. Saddle shall be rated for 150 psi.

APPROVED MANUFACTURING AND CATALOG NUMBERS

	<u>MANUFACTURER</u>	
<u>SIZE</u>	<u>FORD</u>	<u>CASCADE</u>
4" x 2"	FRS202-535-TAP	CS22-0566-TAP
6" x 2"	FRS202-760-TAP	CS22-0733-TAP
8" x 2"	FRS202-979-TAP	CS22-0982-TAP
10" x 2"	FRS202-1225-TAP	CS22-1155-TAP
12" x 2"	FRS202-1440-TAP	CS22-1360-TAP
16" x 2"	FRS202-1800-TAP	CS22-1750-TAP
18" x 2"	FRS202-2000-TAP	CS22-2050-TAP
20" x 2"	FRS202-2220-TAP	CS22-2280-TAP
24" x 2"	FRS202-2640-TAP	CS22-2700-TAP

MATERIAL SPECIFICATION: 499-07-06-02

NOMENCLATURE:

PIPE, PVC, 3034 DR 26

DESCRIPTION:

PVC pipe used for gravity sewer pipe, shall conform to ASTM 3034-SDR 26, and be green in color.

The pipe manufacturer must supply a Certificate of Application that the pipe has met requirements of ASTM 3034-SDR26.

SIZE

6"

8"

10"

12"

15"

18"

24"

***** CERTIFICATION REQUIRED *****

MATERIAL SPECIFICATION: 499-07-15-01

NOMENCLATURE:

PIPE, DUCTILE IRON, PUSH-ON, EPOXY LINED

DESCRIPTION:

Pipe shall be ductile iron, conforming to the latest requirements of ANSI/AWWA C150/A21.50 and ANSI/AWWA C151/A21.51, Pressure Class, rated for a minimum 200 psi working pressure (or project requirements, whichever is greater) plus a 100 psi minimum surge allowance and a two to one (2:1) factor of safety, using a Type II laying condition and a depth of cover of 4 feet. Ductile iron pipe shall be manufactured in the U.S.A. and each piece shall be subjected to a hydrostatic pressure test of at least 500 psi at the point of manufacture. Pipe diameters four inch (4") through 12" shall be class 350 minimum, diameters 14" through 20" shall be class 250 minimum and pipe diameters 24" and larger shall be class 200 minimum. Pipe shall have an exterior bituminous coating applied by airless spray method. Pipe shall have an interior Amine Cured Epoxy Lining as specified in Section 499-11-99-03. All pipe shall be furnished with Push-On type joints. Joints shall be in accordance with ANSI/AWWA C111/A21.11, latest revision, and be furnished complete with all necessary accessories. The class or nominal thickness, new weight without lining, and casting period shall be clearly marked on each length of pipe. Additionally, the manufacturer's mark, country where cast, year in which the pipe was produced, and the letters "DI" or "Ductile" shall be cast or stamped on each length of pipe. Pipe with cracked or chipped linings or defects in the pipe will be rejected.

The pipe or fitting manufacturer must supply a "Certificate of Application" that the lining applicator has met the requirements of Section 499-11-99-03. Applicators need to make sure quality control is met by ensuring each pipe is properly coated.

SIZE

4" CLASS 350
6" CLASS 350
8" CLASS 350
10" CLASS 350
12" CLASS 350
14" CLASS 250
16" CLASS 250
18" CLASS 250
20" CLASS 250
24" CLASS 200
30" CLASS 200
36" CLASS 200

***** CERTIFICATION REQUIRED *****

MATERIAL SPECIFICATION: 499-07-20-01

NOMENCLATURE:

PIPE, HDPE, FUSION

DESCRIPTION:

HDPE directional bored pressure pipe shall conform to C906 AWWA latest edition with a DR-11, 160 psi or DR-9, 200 psi pressure rating, with color coded green striping.

SIZE

4"	C906
6"	C906
8"	C906
10"	C906
12"	C906
16"	C906
18"	C906
20"	C906
24"	C906
30"	C906
36"	C906

MATERIAL SPECIFICATION: 499-07-15-02

NOMENCLATURE:

RESTRAINED JOINT PIPE, DUCTILE IRON

DESCRIPTION:

Joint shall be restrained using grip gaskets or lock-rings as described below.

APPROVED MANUFACTURING AND CATALOG NUMBERS

MANUFACTURER

AMERICAN	Ductile Iron Pipe, Fast-Grip Restrained Gaskets, Lok-Ring restrained rings
MC WANE	Ductile Iron Pipe, Field Lok Restrained Gaskets, Super-Lock restrained rings
GRIFFIN	Ductile Iron Pipe, Field Lok Restrained Gaskets, Snap-Lok restrained rings
U.S.	Ductile Iron Pipe, Field Lok Restrained Gaskets, TR Flex Gripper restrained rings
EBBA IRON	Ductile Iron Pipe, Mega-Lug restraint harness, Series 1700

MATERIAL SPECIFICATION: 499-07-99-01

NOMENCLATURE:

PIPE, PVC, SOLVENT WELD, SCH 80

DESCRIPTION:

Schedule 80 PVC pressure pipe conforming to ASTM D-1785, 200 psi, color green.

SIZE

4"

6"

8"

MATERIAL SPECIFICATION: 499-07-99-04

NOMENCLATURE:

PIPE, PVC, FUSION

DESCRIPTION:

PVC directional bored pressure pipe shall conform to C900 and C905 AWWA latest edition with a DR-18, 200 psi pressure rating, color green.

SIZE

4"	C900
6"	C900
8"	C900
10"	C900
12"	C900
16"	C905
18"	C905
20"	C905
24"	C905
30"	C905
36"	C905

MATERIAL SPECIFICATION: 499-07-99-05

NOMENCLATURE:

PIPE, PVC, C-900, DR-18

DESCRIPTION:

PVC pressure pipe shall conform to C-900/C-905 AWWA latest edition with a DR18, 200 psi pressure rating, color green, gasketed bell joint.

The pipe manufacturer must supply a Certificate of Application that the pipe has met requirements of C-905 AWWA, DR-18.

SIZE

4" C-900
6" C-900
8" C-900
12" C-900
18" C-905
20" C-905
24" C-905

***** CERTIFICATION REQUIRED *****

MATERIAL SPECIFICATION: 499-07-99-06

NOMENCLATURE:

RESTRAINED JOINT PIPE, PVC

DESCRIPTION:

Joint shall be restrained using Certa-Lok C900 restrained joint PVC piping system or bell restraint harnesses.

APPROVED MANUFACTURING AND CATALOG NUMBERS

MANUFACTURER

CERTAIN TEED	Certa-Lok C900/RJ Restrained Joint, Mechanical Gland Adapters for DR14 and DR18 pipe
EBBA IRON	Bell Restraint Harness for C900 PVC Pipe, Series 1600 for DR14 and DR18 pipe

MATERIAL SPECIFICATION: 499-07-99-15

NOMENCLATURE:

PIPE, DUCTILE IRON, FLANGED, EPOXY LINED

DESCRIPTION:

Pipe shall be ductile iron conforming to the latest requirements of ANSI/AWWA C151/A21.51, Pressure Class, rated for a minimum 200 psi working pressure (or project requirements, whichever is greater) and a two to one (2:1) factor of safety, using a Type II laying condition and a depth of cover of four (4) feet. Ductile iron pipe shall be manufactured in the U.S.A. and each piece shall be subjected to a hydrostatic pressure test of at least 500 psi at the point of manufacture. Pipe shall have an exterior epoxy coating as specified in section 499-11-99-04. Pipe shall have an interior Amine Cured Epoxy Lining as specified in Section 499-11-99-03. All pipe shall be furnished with Flanged type joints. Joints shall be in accordance with ANSI/AWWA C111/A21.11, latest revision, and be furnished complete with all necessary accessories. The class or nominal thickness, new weight without lining, and casting period shall be clearly marked on each length of pipe. Additionally, the manufacturer's mark, country where cast, year in which the pipe was produced, and the letters "DI" or "Ductile" shall be cast or stamped on each length of pipe.

The pipe or fitting manufacturer must supply a "Certificate of Application" that the lining applicator has met the requirements of Section 499-11-99-03.

SIZE

4" CLASS 350
6" CLASS 350
8" CLASS 350
10" CLASS 350
12" CLASS 350
14" CLASS 250
18" CLASS 250
20" CLASS 250
24" CLASS 200
30" CLASS 200
36" CLASS 200

***** CERTIFICATION REQUIRED *****

MATERIAL SPECIFICATION: 499-10-07-02

NOMENCLATURE:

VALVE, PLUG ECCENTRIC

DESCRIPTION:

To valve off sewage force mains and lift stations, shall come with mechanical joint ends and shall come with accessories. Plug valves shall have a "solids" handling capability utilizing a full-flow round port opening and shall not be less than 81% on valves not to exceed 24". Resilient plug valve shall be permanently lubricated eccentric type with resilient faced plugs. Valve bodies shall be of ASTM A-126 Class B semi-steel to conform to AWWA standard C507-73 Section 5.1 and AWWA Standard C504-80 Section 6.4. Valve pressure rating shall be as follows and shall be established by hydrostatic test as specified by ANSI standard B16.1-1967 pressure rating shall be 175 psi working pressure for all valves through 12". All valves shall be equipped with two inch (2") square operating nut on all sizes through 24", all bolts on plug valves through 24" shall be stainless steel for non-buried service valves. Shall be epoxy coated inside and out. The resilient plug shall be Buna-N or neoprene coated, also all valves 10" and up shall be equipped with gear actuators.

APPROVED MANUFACTURING AND CATALOG NUMBERS

<u>MANUFACTURER</u>				
<u>SIZE</u>	<u>CLOW</u>	<u>VAL-MATIC</u>	<u>DE ZURIK</u>	<u>PRATT</u>
4"	F-5413	SERIES 5000	SERIES 100	BALLCENTRIC
6"	F-5413	SERIES 5000	SERIES 100	BALLCENTRIC
8"	F-5413	SERIES 5000	SERIES 100	BALLCENTRIC
12"	F-5413	SERIES 5000	SERIES 100	BALLCENTRIC
16"	F-5413	SERIES 5000	SERIES 100	BALLCENTRIC
20"	F-5413	SERIES 5000	SERIES 100	BALLCENTRIC
24"	F-5413	SERIES 5000	SERIES 100	BALLCENTRIC

MATERIAL SPECIFICATION: 499-10-99-01

NOMENCLATURE:

VALVE, AIR RELEASE

DESCRIPTION:

Shall be of the type designed for use in sewage force mains to exhaust entrapped air during filling. Valve shall be simple lever type and constructed to 175 psi working pressure, have stainless steel inner working parts with cast iron body and cover, NPT threaded inlet and outlets. Valves shall be furnished with required backwash accessories.

APPROVED MANUFACTURING AND CATALOG NUMBERS

MANUFACTURER

<u>SIZE</u>	<u>EMPIRE</u>	<u>VAL-MATIC</u>
1"	FIG. 935-F	VALVE NO. 15
2"	FIG. 935-A	VALVE NO. 45

MATERIAL SPECIFICATION: 499-10-99-02

NOMENCLATURE:

PVC VALVE, AIR RELEASE

DESCRIPTION:

Shall be of the type designed for use in sewage force mains to exhaust entrapped air during filling. Valve shall be simple lever type and constructed to 175 psi working pressure, have plastic and stainless steel inner working parts with PVC body and cover, NPT threaded inlet and outlets. Valves shall be furnished with required backwash accessories.

APPROVED MANUFACTURING AND CATALOG NUMBERS

<u>SIZE</u>	<u>MANUFACTURER</u>
	<u>ARI FLOW CONTROLS</u>
1"	025-PN10
2"	025-PN10

MATERIAL SPECIFICATION: 499-10-99-10

NOMENCLATURE:

CHECK VALVE, SPRING & LEVER TYPE, FLANGED, EPOXY LINED

DESCRIPTION:

Check valve shall meet the requirements of AWWA C508, be ductile iron body, bronze mounted with flanged ends conforming to ANSI B16. Valve Class 125 shall have bronze disc facing, o-ring sealed stuffing box, adjustable weight to control opening and closing of clapper, lever can be installed on either side. Shall be designed to operate at working pressure of 175 psi.

The exterior of the valve shall be coated as specified in section 499-10-99-04. The interior lining shall be a factory applied amine cured epoxy as specified in Section 499-11-99-03.

The manufacturer must supply a "Certificate of Application" that the applicator has met the requirement of Section 499-11-99-03.

APPROVED MANUFACTURING AND CATALOG NUMBERS

MANUFACTURER

<u>SIZE</u>	<u>M & H</u>	<u>AVK</u>
4"	STYLE 259-02	SERIES 41
6"	STYLE 259-02	SERIES 41
8"	STYLE 259-02	SERIES 41
10"	STYLE 259-02	SERIES 41
12"	STYLE 259-02	SERIES 41

***** SHOP DRAWING REQUIRED *****

***** CERTIFICATION REQUIRED *****

MATERIAL SPECIFICATION: 499-10-99-11

NOMENCLATURE:

CHECK VALVE, SWING-FLEX TYPE, FLANGED, EPOXY LINED

DESCRIPTION:

Check valve shall meet the requirements of AWWA C508, be ductile iron body, bronze mounted with flanged ends conforming to ANSI B16. Valve Class 125 shall have bronze disc facing, o-ring sealed stuffing box, adjustable weight to control opening and closing of clapper, lever can be installed on either side. Shall be designed to operate at working pressure of 175 psi.

The exterior of the valve shall be coated as specified in section 499-10-99-04. The interior lining shall be a factory applied amine cured epoxy as specified in Section 499-11-99-03.

The manufacturer must supply a "Certificate of Application" that the applicator has met the requirement of Section 499-11-99-03.

APPROVED MANUFACTURING AND CATALOG NUMBERS

MANUFACTURER

<u>SIZE</u>	<u>VALMATIC</u>
4"	504-A
6"	506-A
8"	508-A
10"	510-A
12"	512-A

***** SHOP DRAWING REQUIRED *****

***** CERTIFICATION REQUIRED *****

MATERIAL SPECIFICATION: 499-11-31-05

NOMENCLATURE:

LINER, CALCIUM ALUMINATE CEMENT

DESCRIPTION:

Monolithic fiber-reinforced structural/structurally enhanced pure calcium aluminate cementitious liner for the purpose of providing corrosion protection for new manholes and wet wells and the repair of cracks and voids and restoration of the structural integrity of existing manholes. Liner shall be one inch (1") minimum thickness. The first coat shall be applied at a thickness adequate to cover the substrate and be troweled to compact the material into voids and set the bond. The second coat shall be applied to ensure complete coverage at the specified one inch (1") minimum thickness. Inverts shall be lined with patching mix, trowel applied in one coat to one inch (1") minimum thickness. Cleaning, preparation of the manhole wall and application shall be in strict accordance with the manufactures detailed instructions.

APPROVED MANUFACTURING AND CATALOG NUMBERS

MANUFACTURER

<u>LAFARGE</u>	<u>QUADEX</u>	<u>STRONG SYSTEMS, INC.</u>
SEWPERCOAT	ALUMINALINER	STRONG-SEAL

MATERIAL SPECIFICATION: 499-11-99-01

NOMENCLATURE:

LINK SEAL

DESCRIPTION:

Interconnecting solid rubber linkage interconnected with bolt used to seal piping that pass through walls.

APPROVED MANUFACTURING AND CATALOG NUMBERS

MANUFACTURER

SIZE

THUNDERLINE CORP, (OR EQUAL)

4"
6"
8"
12"
18"
24"

***** SHOP DRAWING REQUIRED *****

MATERIAL SPECIFICATION: 499-11-99-02

NOMENCLATURE:

COATING, BITUMINOUS

DESCRIPTION:

Bituminous coating applied in two coats. Total minimum dry film thickness shall be 12 mils. Each coat shall be applied at the rate of one gallon per 100 square feet. The waterproofing material shall be applied by brush or spray and in accordance with the instructions of the manufacturer. Time shall be allowed between coats to permit sufficient drying so that the application of the second coat has no effect on the first coat.

APPROVED MANUFACTURING AND CATALOG NUMBERS - Koppers, Tnemec, or equal.

MANUFACTURER

KOPPERS

BITUMASTIC NO. 300

TNEMEC

46-413

***** SHOP DRAWING REQUIRED *****

MATERIAL SPECIFICATION: 499-11-99-03

NOMENCLATURE:

LINING, AMINE CURED EPOXY

DESCRIPTION:

Two component amine novalac cured epoxies of at least 87% solids and 20% by volume of ceramic quartz pigmented in the dried film. Minimum film thickness shall be 40 mils dry film thickness. The ceramic epoxy shall have a permeability rating of zero permeance when a film of at least 40 mils is tested according to ASTM D1653-79. A permeability rating of 0.0 perms shall be achieved when measured using method A of ASTM E66-96 with a test duration of 42 days.

Surface preparation, curing times, number of coats, and the application methods shall be as contained in the lining material manufacturer's published literature. Ductile iron pipe shall be checked for thickness using a magnetic film thickness gauge. Thickness testing shall be done using the method outlined in SSPC-PA-2 film thickness testing. The lining material shall not be applied above the thickness per coat as recommended in the manufacturer's printed literature. Each pipe joint and fitting shall be marked with the date of the application of the lining system and with its numerical sequence of application on that date.

The applicator must supply a "Certificate of Application" attesting to the fact that he has met the requirements specified above and that the material was applied and tested as specified hereinbefore. In addition the applicator shall also furnish a product number of his recommended repair compound for sealing ends of cut pipe or repairing damaged linings.

APPROVED MANUFACTURING AND CATALOG NUMBERS

MANUFACTURER

FAST FABRICATORS

SP-2000W

INDERALL

PROTECTO 401

***** SHOP DRAWING REQUIRED *****

***** CERTIFICATION REQUIRED *****

MATERIAL SPECIFICATION: 499-11-99-04

NOMENCLATURE:

COATING, EXPOSED METAL AND PIPING

DESCRIPTION:

Metal and piping coating applied in three (3) coats. Polyamide, anti-corrosive epoxy primer applied in one coat, minimum of three (3) mils. Polyurethane enamel applied in two coats at a minimum of three (3) mils each. Total mils for piping and metal shall be a minimum of nine (9) mils.

APPROVED MANUFACTURING AND CATALOG NUMBERS - Koppers, Themec, or equal.

***** SHOP DRAWING REQUIRED *****

MATERIAL SPECIFICATION: 499-11-99-05

NOMENCLATURE:

COATING, SUBMERGED METAL AND PIPING (HIGHLY CORROSIVE)

DESCRIPTION:

Metal and piping coating applied in three (3) coats. Polyamide, anti-corrosive epoxy primer applied in one coat, minimum of three (3) mils. Polyamide epoxy-coal tar applied in two (2) coats at a minimum of eight (8) mils each. Total mils for piping and metal shall be a minimum of 19 mils.

APPROVED MANUFACTURING AND CATALOG NUMBERS - Koppers, Tnemec, or equal.

***** SHOP DRAWING REQUIRED *****

MATERIAL SPECIFICATION: 499-11-99-06

NOMENCLATURE:

COATING, MANHOLES (MILDLY CORROSIVE)

DESCRIPTION:

Concrete coating applied in two (2) coats. Polyamide, epoxy-coal tar applied in two coats, minimum of eight (8) mils. each. Total mils for concrete shall be a minimum of 16 mils.

APPROVED MANUFACTURING AND CATALOG NUMBERS –

GML
RAVEN

***** SHOP DRAWING REQUIRED *****

MATERIAL SPECIFICATION: 499-11-99-08

NOMENCLATURE:

COATING, CONCRETE WET WELLS AND MANHOLES (HIGHLY CORROSIVE)

DESCRIPTION:

Concrete coating applied in two (2) coats. epoxy sealer applied by trowel or spray, 1/8" thick minimum.

APPROVED MANUFACTURING AND CATALOG NUMBERS

GML
RAVEN

***** SHOP DRAWING REQUIRED *****

MATERIAL SPECIFICATION: 499-11-99-21

NOMENCLATURE:

BACKFLOW PREVENTER, REDUCED PRESSURE

DESCRIPTION:

Reduced pressure zone backflow preventer designed to prevent back-siphonage and backpressure backflow of contaminated water into the potable water supply. Backflow Preventer shall be of bronze construction with stainless steel seats, shafts and flange bolts, durable tight seating rubber check valve and relief valve assemblies and bronze body ball valve test cocks. Backflow Preventer to be furnished with N.P.T. body connections.

APPROVED MANUFACTURING AND CATALOG NUMBERS

MANUFACTURER

<u>SIZE</u>	<u>WATTS</u>	<u>FEBCO</u>	<u>HERSEY</u>	<u>CONBRACO</u>	<u>AMES</u>	<u>CLA-VAL</u>
3/4"	709QT	825Y	FRP-2	40-200	4000SS	DC7LW

***** SHOP DRAWING REQUIRED *****

MATERIAL SPECIFICATION: 499-11-99-30

NOMENCLATURE:

PRECAST CONCRETE POST

DESCRIPTION:

Pre-cast concrete post with 4,000 psi concrete and one (1) #4 bar. Cement shall meet the requirements of ASTM C150-latest, Specification for Portland Cement, Type I/II.

APPROVED MANUFACTURING AND CATALOG NUMBERS

MANUFACTURER

SIZE

4" x 4" x 8"

DEL ZOTTO, HANSON PIPE & PRODUCTS, (OR EQUAL)

MATERIAL SPECIFICATION: 499-11-99-31

NOMENCLATURE:

LADDER, FIBERGLASS

DESCRIPTION:

Fiberglass ladder complying with OSHA, pp. 1910.27 entitled "Fixed Ladders", able to withstand a 1,200 pound vertical concentrated load at mid-span of a rung. Use channel side rails and one and three-eighths inch (1 $\frac{3}{8}$ "") minimum diameter rungs with factory applied Epoxy/Glass Bead non-skid coating. Standoff clips to be provided for every six feet (6') of ladder height.

APPROVED MANUFACTURING AND CATALOG NUMBERS - IMCO Reinforced Plastics,
Fibergrate Company, or equal.

MATERIAL SPECIFICATION: 499-11-99-42

NOMENCLATURE:

FLUORESCENT LIGHT

DESCRIPTION:

Shall be standard two (2) tube fluorescent light fixture with transparent plastic cover. Fixture must be fabricated out of non-corrosive material, must be water tight, and all mounting hardware shall be stainless steel.

APPROVED MANUFACTURING AND CATALOG NUMBERS

MANUFACTURER

SIZE

48"

MATERIAL SPECIFICATION: 499-12-99-03

NOMENCLATURE:

PUMP STATION, SUBMERSIBLE

DESCRIPTION:

Shall be a factory built pumping system consisting of two (2) submersible pumps complete with motor control system guide rail and anchoring brackets, power cable, and pump lifting cable.

The discharge connection for each pump elbow shall be permanently installed in the pump station along with the discharge piping. The pumps shall be automatically connected to the discharge connection elbow when lowered into place. There should be no need for personnel to enter the wet well for pump maintenance or pump removal. Sealing of the pumping unit shall be accomplished by a simple linear downward motion of the pump along the guide cable system.

The guide rail system shall be an integral part of the pump unit using Type 316 stainless steel guides in parallel and secured to the discharge connection elbow.

NOTE: Refer to Project Specifications for pump requirements and Section 498-4.1 for detailed technical specifications.

APPROVED MANUFACTURING AND CATALOG NUMBERS

MANUFACTURER

<u>SIZE</u>	<u>GORMAN-RUPP</u>	<u>FLYGT</u>
4"	SUBMERSIBLE	SUBMERSIBLE
6"	SUBMERSIBLE	SUBMERSIBLE
8"	SUBMERSIBLE	SUBMERSIBLE

***** SHOP DRAWING REQUIRED *****

MATERIAL SPECIFICATION: 499-12-99-10

NOMENCLATURE:

SUMP PUMP

DESCRIPTION:

Pump shall be submersible type designed to handle maximum 3/4" solids with cast iron body, stainless steel hardware, two vane bronze impeller, 1-1/4" NPT discharge port, single-phase, 120V.

APPROVED MANUFACTURING AND CATALOG NUMBERS

MANUFACTURER

SIZE

HYDROMATIC, MYERS, PROSSER/ENDO, OR EQUAL

1/4 HP

1/3 HP

MATERIAL SPECIFICATION: 499-12-99-11

NOMENCLATURE:

SUMP PUMP, SUBMERSIBLE

DESCRIPTION:

Pump shall be cast iron construction with stainless hardware and accessories, three inch (3") NPT discharge with a full two inch (2") inlet, non-clogging vortex impeller which passes 2" solids, UL Listed and CSA approved, automatic reset thermal overload protection, hermetically sealed, oil filled, single-phase motor, PSC design, mechanical seals with stainless steel, Buna N, and carbon/ceramic parts. Pump shall be designed to operate on 115V, 60Hz, single-phase. All mounting hardware must be stainless steel.

APPROVED MANUFACTURING AND CATALOG NUMBERS - Hydromatic, Zoeller, or equal

MANUFACTURER

SIZE

ZOELLER

HYDROMATIC

1/2 HP

ZP 553

***** SHOP DRAWING REQUIRED *****

MATERIAL SPECIFICATION: 499-12-99-20

NOMENCLATURE:

FLOAT, BALL TYPE

DESCRIPTION:

Mercury-free float switch for controlling liquid levels in a variety of applications and shall have a snap-action switch activated by a steel ball rolling back and forth within a switching tube in a polypropylene plastic float housing. Minimum differential between "on" and "off" shall be approximately 3.5 inches. All mounting hardware must be stainless steel.

APPROVED MANUFACTURING AND CATALOG NUMBERS - Eco-Float or equal

<u>TYPE</u>	<u>MANUFACTURER</u>
BALL	ECO-FLOAT MODEL G-GSI40NO

MATERIAL SPECIFICATION: 499-12-99-21

NOMENCLATURE:

LIFT STATION MAIN DISCONNECT

DESCRIPTION:

Lift station main disconnect panel shall include but not be limited to a stainless steel NEMA 4X cabinet, main disconnect, lightning arrestor, and surge suppressor. Cabinet and accessories shall be assembled in accordance with Detail 498-4.1A(2) and 498-4.1B(2).

APPROVED MANUFACTURING AND CATALOG NUMBERS - Square D, Siemens, or equal.

***** SHOP DRAWING REQUIRED *****

MATERIAL SPECIFICATION: 499-12-99-31

NOMENCLATURE:

LIFT STATION MAIN ELECTRICAL PANEL

DESCRIPTION:

Lift station control panel shall include but not be limited to a stainless steel NEMA 3R cabinet, Digital Controller, breakers, relays, fuse holders, air pumps, alarm light, alarm horn, lightning arrestor, generator receptacle, phase loss monitor, transformer, GFI receptacle, motor starters, wiring, and terminal board. Cabinet and accessories shall be assembled in accordance with Detail 498-4.1. All hardware must be stainless steel.

APPROVED MANUFACTURING AND CATALOG NUMBERS -

***** SHOP DRAWING REQUIRED *****

MATERIAL SPECIFICATION: 499-13-99-01

NOMENCLATURE:

REMOTE TERMINAL UNIT ASSEMBLY

DESCRIPTION:

Remote Terminal Unit (RTU) shall be a microcomputer-based data collection and dissemination subsystem. The remote terminal unit shall communicate with the central site via a two-way radio link. The remote terminal unit shall be designed to accommodate plug-in function modules. The system shall be capable of being outfitted, at any time, with RTU's capable of being configured with up to fifteen (15) function modules per RTU, with no software or firmware changes to the system. All sheet metal utilized inside the enclosure must be anodized. The RTU assembly shall include but not be limited to Control Box with modules, connecting antenna cable, antenna tower, antenna mast, antenna and all hardware necessary for a complete and operational RTU.

NOTE: Refer to Section 495-3.7 for detailed specifications.

APPROVED MANUFACTURING AND CATALOG NUMBERS