

- B. General Materials Requirements: Conform materials used for backfilling to the requirements specified. Follow common fill requirements whenever drainage or select fill is not specified. Determine and obtain the approval of the appropriate test method where more than one compaction test method is specified.
- C. Classification of Approved Embedment Materials: Embedment materials listed here include a number of processed materials plus the soil types defined according to the Unified Soil Classification System (USCS) in ASTM D2487. These materials are grouped into 5 broad categories according to their suitability for this application.
1. Class I: Angular, 0.25 inch to 1.5 inch (6 to 40 mm) graded stone, including a number of fill materials that have regional significance such as coral, slag, cinders, crushed shells and crushed stone. (Note: The size range and resulting high void ratio of Class I material makes it suitable for use to dewater trenches during pipe installation. This permeable characteristic dictates that its use be limited to locations where pipe support will not be lost by migration of fine grained natural material from the trench walls and bottom or migration of other embedment materials into the Class I material. When such migration is possible, the material's minimum size range should be reduced to finer than 0.25 inch (6 mm) and the gradation properly designed to limit the size of the voids. An alternative to modifying the gradation is to use a geotextile fabric as a barrier to migration to fines.)
 2. Class II: Coarse sands and gravels with maximum particle size of 1.5 inches (40 mm), including variously graded sands and gravels containing small percentages of fines, generally granular and non-cohesive, either wet or dry. Soil Types GW, GP, SW and SP are included in this class. (Note: Sands and gravels, which are clean or borderline between clean and with fines, should be included. Coarse-grained soils with less than 12 percent, but more than 5 percent fines are neglected in ASTM D2487 and the USCS, but should be included. The gradation of Class II material influences its density and pipe support strength when loosely placed. The gradation of Class II material may be critical to the pipe support and stability of the foundation and embedment, if the material is imported and is not native to the trench excavation. A gradation other than well graded, such as uniformly graded or gap graded, may permit loss of support by migration into void spaces of a finer grained natural material from the trench wall and bottom. An alternative to modifying the gradation is to use a geotextile fabric as a barrier to migration of fines.)
 3. Class III: Fine sand and clayey (clay filled) gravels, including fine sands, sand-clay mixtures and gravel-clay mixtures. Soil Types GM, GC, SM and SC are included in this class.

4. Class IV: Silt, silty clays and clays, including inorganic clays and silts of medium to high plasticity and liquid limits. Soil Types MH, ML, CH and CL are included in this class. (Note: Use caution in the design and selection of the degree and method of compaction for Class IV soils because of the difficulty in properly controlling the moisture content under field conditions. Some Class IV soils with medium to high plasticity and with liquid limits greater than 50 percent (CH, MH, CH-MH) exhibit reduced strength when wet and should only be used for bedding, haunching and initial backfill in arid locations where the pipe embedment will not be saturated by groundwater, rainfall or exfiltration from the pipe. Class IV soils with low to medium plasticity and with liquid limits lower than 50 percent (CL, ML, CL-ML) also require careful consideration in design and installation to control moisture content, but need not be restricted in use to arid locations.)
5. Class V: This class includes the organic soils OL, OH and PT as well as soils containing frozen earth, debris, rocks larger than 1.5 inches (40 mm) in diameter and other foreign materials. Do not use these materials for bedding, haunching or backfill.

2.2 SELECT FILL

- A. Materials for Select Fill: Use clean gravel, crushed stone, washed shell, or other granular or similar material as approved which can be readily and thoroughly compacted to 95 percent of the maximum dry density obtainable by ASTM D 1557.

1. Allowed Materials: Grade select fill between the following limits:

U.S. Standard Sieve	Percent Passing By Weight
2 inch	100
1-1/2 inch	90-100
1 inch	75-95
1/2 inch	45-70
#4	25-50
#10	15-40
#200	5-15

2. Unallowed Materials: Very fine sand, uniformly graded sands and gravels, sand and silt, soft earth, or other materials that have a tendency to flow under pressure when wet are unacceptable as select fill.

2.3 COMMON FILL

- A. **Materials for Common Fill:** Material from on-site excavation may be used as common fill provided that it can be readily compacted to 90 percent of the maximum dry density obtainable by ASTM D 1557, and does not contain unsuitable material. Select fill may be used as common fill at no change in the Contract Price.
- B. **Granular Materials On-Site:** Granular on-site material, which is fairly well graded between the following limits may be used as granular common fill:

U.S. Standard Sieve	Percent Passing by Weight
2 inch	100
#10	50-100
#60	20-90
#200	0-20

- C. **Cohesive Materials On-Site:** Cohesive site material may be used as common fill.
1. The gradation requirements do not apply to cohesive common fill.
 2. Use material having a liquid limit less than or equal to 40 and a plasticity index less than or equal to 20.
- D. **Material Approval:** All material used as common fill is subject to approval. If there is insufficient on-site material, import whatever additional off-site material is required which conforms to the specifications and at no additional cost.

2.4 UTILITY PIPE BEDDING

- A. **Gradation for Small Piping:** For pipe 18 inches or less in diameter, use pipe bedding of material 90 percent of which will be retained on a No. 8 sieve and 100 percent of which will pass a 1/2-inch sieve and be well graded between those limits.
- B. **Gradation for Large Piping:** For pipe larger than 18 inches in diameter, use the same pipe bedding material as specified for smaller pipe or use a similar well graded material 90 percent of which will be retained on a No. 8 sieve and 100 percent of which will pass a 1-inch sieve.
- C. Provide a minimum of six (6) inches bedding material under all gravity sewer piping. In areas where poor soil conditions or rock exist, provide a minimum of six (6) inches of pipe bedding material under water or force main pressure pipe.

PART 3 EXECUTION

3.1 PRECAST MANHOLE BEDDING

- A. Bedding Compaction: Bed all precast manholes in well graded, compacted 12-inch layer of crushed stone. Compact bedding thickness no less than 6 inches for precast concrete manhole bases.
- B. Concrete Work Mats: Cast cast-in-place manhole bases and other foundations for structures against a 2500 psi concrete work mat in clean and dry excavations.
- C. Bedding Placement: Place select fill used for bedding beneath precast manhole bases, in uniform layers not greater than 9 inches in loose thickness. Thoroughly compact in place with suitable mechanical or pneumatic tools to not less than 95 percent of the maximum dry density as determined by ASTM D 1557.
- D. Use of Select Fill: Bed existing underground structures, tunnels, conduits and pipes crossing the excavation with compacted select fill material. Place bedding material under and around each existing underground structure, tunnel, conduit or pipe and extend underneath and on each side to a distance equal to the depth of the trench below the structure, tunnel, conduit or pipe.

3.2 PIPE BEDDING AND INITIAL BACKFILL

- A. Placement: Place backfill for initial pipe backfill from top of bedding to 1 foot over top of pipes in uniform layers not greater than 8 inches in loose thickness. Tamp under pipe haunches and thoroughly compact in place the backfill with suitable mechanical or pneumatic tools to not less than 98 percent of the maximum dry density as determined by ASTM D 1557.
- B. Foundation Bedding: Place bedding, to a depth specified by the County Manager or designee, as a foundation in wet, yielding or mucky locations. Construct foundation bedding by removal of the wet, yielding or mucky material and replacement with sufficient Class I material to correct soil instability.
- C. Stone Placement: Do not place large stone fragments in the pipe bedding or backfill within 2 feet over or around pipelines, or nearer than 2 feet at any point from any casing pipe, conduit or concrete wall.
- D. Machine Compaction: Machine Compaction of initial backfill is prohibited unless adequate cover as deemed by the County Manager or designee is provided. In no case shall adequate cover be less than 12 inches.
- E. Unallowed Materials: Pipe bedding containing very fine sand, uniformly graded sands and gravels, sand and silt, soft earth, or other materials that have a tendency to flow under pressure when wet is unacceptable.

3.3 TRENCH BACKFILL

- A. General: Backfill trenches from 1 foot over the top of the pipe, from the top of electrical duct bedding or as shown to the bottom of pavement base course, subgrade for lawns or lawn replacement, to the top of the existing ground surface or to such other grades as may be shown or required.
- B. Materials: All backfill material shall be acceptable dry materials, and shall be free from cinders, ashes, refuse, vegetable or organic material, boulders, rocks, or stones, or other deleterious material which in the opinion of the County Manager or designee is unsuitable.
- C. Depth of Placement - Place trench backfill in uniform layers not greater than 12 inches in loose thickness and that can be thoroughly compacted in place using suitable mechanical or pneumatic equipment to not less than 98 percent of the maximum dry density as determined by ASTM D 1557.
- D. Depth of Placement - Undeveloped Areas: In nondeveloped areas and where select fill material or hand-placed backfill are not specified or required, place suitable job-excavated material or other approved backfill in lifts not exceeding 12 inches in loose thickness. Lifts of greater thickness may be permitted by the County Manager or designee if the CONTRACTOR demonstrates compliance with required densities. When the trench is full, consolidate the backfill by jetting, spading, or tamping to ensure complete filling of the excavation. Mound the top of the trench approximately 12 inches to allow for consolidation of backfill.
- E. Compaction: Compact backfill as a percentage of the maximum density at optimum moisture content as determined by the standard proctor test, ASTM D698 as demonstrated in the following table:

Area	(Mod.) ASTM D1557
Around and 1' (Min) above top of pipe	98
Remaining Trench	98
Pavement Sub-Grade and Shoulders (Last 3' of Fill)	98
Base Material and Pavement	98
Adjacent to Structures (Areas not Paved)	98
Under Structures	98
Sub-Base	98

- F. Density Tests: Density tests will be made at the request of the County Manager or designee. Deficiencies will be corrected at the expense of the CONTRACTOR.
- G. Dropping of Material on Work: Do trench backfilling work in such a way as to prevent dropping material directly on top of any conduit or pipe through any great vertical distance.

- H. Distribution of Large Materials: Break lumps up and distribute any stones, pieces of crushed rock or lumps which cannot be readily broken up, throughout the mass so that all interstices are solidly filled with fine material.

3.4 STRUCTURE BACKFILL

- A. Use crushed stone underneath all structures, and adjacent to structures where pipes, connections and structural foundations are to be located within this fill. Use crushed stone beneath all pavements, walkways, and railroad tracks, and extend to the bottom of pavement base course or ballast.
 - 1. Place backfill in uniform layers not greater than 8 inches in loose thickness and thoroughly compact in place with suitable approved mechanical or pneumatic equipment.
 - 2. Compact backfill to not less than 95 percent of the maximum dry density as determined by ASTM D 1557.
- B. Use of Common Fill: Use common granular fill adjacent to structures in all areas not specified above. Select fill may be used in place of common granular fill at no additional cost.
 - 1. Extend such backfill from the bottom of the excavation or top of bedding to the bottom of subgrade for lawns or lawn replacement, the top of previously existing ground surface or to such other grades as may be shown or required.
 - 2. Place backfill in uniform layers not greater than 8 inches in loose thickness and thoroughly compact in place with suitable equipment, as specified above.
 - 3. Compact backfill to not less than 90 percent of the maximum dry density as determined by ASTM D 1557.

3.5 COMPACTION EQUIPMENT

- A. Equipment and Methods: Carry out all compaction with suitable approved equipment and methods.
 - 1. Compact clay and other cohesive material with sheep's-foot rollers or similar equipment where practicable. Use hand held pneumatic tampers elsewhere for compaction of cohesive fill material.
 - 2. Compact low cohesive soils with pneumatic-tire rollers or large vibratory equipment where practicable. Use small vibratory equipment elsewhere for compaction of cohesionless fill material.

3. Do not use heavy compaction equipment over pipelines or other structures, unless the depth of fill is sufficient to adequately distribute the load.

3.6 FINISH GRADING

- A. Final Contours: Perform finish grading in accordance with the completed contour elevations and grades shown and blend into conformation with remaining natural ground surfaces.
 1. Leave all finished grading surfaces smooth and firm to drain.
 2. Bring finish grades to elevations within plus or minus 0.10 foot of elevations or contours shown.
- B. Surface Drainage: Perform grading outside of building or structure lines in a manner to prevent accumulation of water within the area. Where necessary or where shown, extend finish grading to ensure that water will be carried to drainage ditches, and the site area left smooth and free from depressions holding water.

3.7 RESPONSIBILITY FOR AFTERSETTLEMENT

- A. Aftersettlement Responsibility: Take responsibility for correcting any depression which may develop in backfilled areas from settlement within one year after the work is fully completed. Provide, as needed, backfill material, pavement base replacement, permanent pavement, sidewalk, curb and driveway repair or replacement, and lawn replacement, and perform the necessary reconditioning and restoration work to bring such depressed areas to proper grade as approved.

3.8 INSPECTION AND TESTING OF BACKFILLING

- A. Sampling and Testing: Provide sampling, testing, and laboratory methods in accordance with the appropriate ASTM Standard Specification. Subject all backfill to these tests.
- B. Correction of Work: Correct any areas of unsatisfactory compaction by removal and replacement, or by scarifying, aerating or sprinkling as needed and recompaction in place prior to placement of a new lift.
- C. Testing Schedule:
 1. Compaction Schedule
 2. Optimum Moisture Content (Proctor Test)

END OF SECTION

SECTION 314000

SHORING, SHEETING AND BRACING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes: Work required for protection of an excavation or structure through shoring, sheeting, and bracing.
- B. Related Work Specified In Other Sections Includes:
 - 1. Section 312316 – Excavation – Earth and Rock
 - 2. Section 312323 – Backfilling

1.2 SUBMITTALS

- A. General: Provide all submittals, including the following, as specified in Division 1.
- B. CONTRACTOR's Submittals: All sheeting and bracing shall be the responsibility of the CONTRACTOR to retain qualified design services for these systems, and to be completed with strict adherence to OSHA Regulations. Submit complete design calculations and working drawings of proposed shoring, sheeting and bracing which have been prepared, signed and sealed by a Licensed Professional Engineer experienced in Structural Engineering and registered in the State of Florida, before starting excavation for jacking pits and structures. Use the soil pressure diagram shown for shoring, sheeting and bracing design. ENGINEER's review of calculations and working drawings will be limited to confirming that the design was prepared by a licensed professional engineer and that the soil pressure diagram shown was used.

1.3 REFERENCES

- A. Design: Comply with all Federal and State laws and regulations applying to the design and construction of shoring, sheeting and bracing.
- B. N.B.S. Building Science Series 127 "Recommended Technical Provisions for Construction Practice in Shoring and Sloping Trenches and Excavations."

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements: Do work in accordance with the U.S. Department of Labor Safety and Health Regulations for construction promulgated under the Occupational Safety Act of 1970 (PL 91-596) and under Section 107 of the Contract Work Hours and Safety Standards Act (PL 91-54), and the Florida

Trench Safety Act. Observe 29 CFR 1910.46 OSHA regulations for Confined Space Entry.

PART 2 PRODUCTS

2.1 MANUFACTURERS AND MATERIALS

- A. Material Recommendations: Use manufacturers and materials for shoring, sheeting and bracing as recommended by the Licensed Professional Engineer who designed the shoring, sheeting, and bracing.

- 1. Wood Materials: Oak, or treated fir or pine for wood lagging.

PART 3 EXECUTION

3.1 SHORING, SHEETING AND BRACING INSTALLATION

- A. General: Provide safe working conditions, to prevent shifting of material, to prevent damage to structures or other work, to avoid delay to the work, all in accordance with applicable safety and health regulations. Properly shore, sheet, and brace all excavations which are not cut back to the proper slope and where shown. Meet the general trenching requirements of the applicable safety and health regulations for the minimum shoring, sheeting and bracing for trench excavations.
 - 1. CONTRACTOR's Responsibility: Sole responsibility for the design, methods of installation, and adequacy of the shoring, sheeting and bracing.
- B. Arrange shoring, sheeting and bracing so as not to place any strain on portions of completed work until the general construction has proceeded far enough to provide ample strength.
- C. If ENGINEER is of the opinion that at any point the shoring, sheeting or bracing are inadequate or unsuited for the purpose, resubmission of design calculations and working drawings for that point may be ordered, taking into consideration the observed field conditions. If the new calculations show the need for additional shoring, sheeting and bracing, it should be installed immediately.
- D. Monitoring: Periodically monitor horizontal and vertical deflections of sheeting. Submit these measurements for review.
- E. Accurately locate all underground utilities and take the required measures necessary to protect them from damage. Keep all underground utilities in service at all times as specified in Division 1.

- F. Driven Sheet piling: Drive tight sheet piling in that portion of any excavation in paved or surface streets City collector and arterial streets and in State and County highways below the intersection of a one-on-one slope line from the nearest face of the excavation to the edge of the existing pavement or surface.
- G. Sheet piling Depth: In general drive or place sheet piling for pipelines to a depth at elevation equal to the top of the pipe as approved.
1. If it is necessary to drive sheet piling below that elevation in order to obtain a dry trench or satisfactory working conditions, cut the sheet piling off at the top of the pipe and leave in place sheet piling below the top of the pipe.
 2. Do not cut the sheet piling until backfill has been placed and compacted to the top of the pipe.
- H. Sheet piling Removal: In general, remove sheet piling and bracing above the top of the pipe as the excavation is refilled in a manner to avoid the caving in of the bank or disturbance to adjacent areas or structures. Remove sheet piling as backfilling progresses so that the sides are always supported or when removal would not endanger the construction of adjacent structures. When required to eliminate excessive trench width or other damages, shoring or bracing shall be left in place and the top cut off at an elevation 2.5 feet below finished grade, unless otherwise directed.
1. Carefully fill voids left by the withdrawal of the sheet piling by jetting, ramming or otherwise.
 2. No separate payment will be made for filling of such voids.

END OF SECTION

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SECTION 329200

RESTORATION BY SODDING OR SEEDING

PART 1 GENERAL

1.1 DESCRIPTION OF REQUIREMENTS

- A. The work in this section consists of furnishing all labor, material and equipment to restore all areas disturbed during construction to match preconstruction conditions. Establish a stand of grass within the areas disturbed by furnishing and placing grass sod where required, or by seeding and mulching areas not requiring sod.

1.2 REFERENCE DOCUMENTS

- A. Use materials conforming to the requirements of Florida Department of Transportation Standard Specifications for Road and Bridge Construction as follows:
 - 1. Section 570 – Grassing (by Seeding)
 - 2. Section 575 – Sodding
 - 3. Section 981 – Grassing and Sodding Materials
 - 4. Section 982 – Commercial Fertilizer
 - 5. Section 983 – Water for Grassing

1.3 SUBMITTALS

- A. Submit certifications and identification labels for all sodding supplied in accordance with General Conditions.

PART 2 PRODUCTS

2.1 SODDING

- A. Types: Sod may be of either St. Augustine or Argentine Bahia grass or as that disturbed, as established prior to construction. Use well matted sod with roots. When replacing sod in areas that are already sodded, use sod of the same type as the existing sod.

- B. Provide sod as required in accordance with Florida Department of Transportation Specifications 575 and 981. Furnish sod equal to and similar in type as that disturbed. Place and water in accordance with FDOT Specifications Section 575.
- C. Use sod in commercial-size rectangles, preferably 12-inch by 24-inch or larger, except where 6-inch strip sodding is called for.
- D. Use sod that is sufficiently thick to secure a dense stand of live grass. Use sod that is live, fresh and uninjured at the time of planting, having a soil mat of sufficient thickness adhering firmly to the roots to withstand all necessary handling. It shall be reasonably free of weeds and other grasses. Plant sod as soon as possible after being dug, and shade and keep moist from the time it is dug until it is planted.
- E. Handle sod in a manner to prevent breaking or other damage. Do not handle by dumping from trucks or other vehicles. Use care at all times to retain the native soil on the roots of each sod roll during stripping and handling. Sod that has been damaged by handling during delivery, storage or installation will be rejected.
- F. Swales: Place sod to the proper grade and cross section in all flow areas to ensure the design flow of water in the ditch. In excavating for the placement of sod, provide a minimum of 3 inches of undercut.

2.2 FERTILIZER

- A. Supply chemical fertilizer in suitable bags with the net weight certification of the shipment. Fertilizer shall be 12-8-8 and comply with Section 982 of the FDOT Standard Specification for Road and Bridge Construction.
- B. The numerical designations for fertilizer indicate the minimum percentages (respectively) of (1) total nitrogen, (2) available phosphoric acid and (3) water soluble potash, contained in the fertilizer.
- C. The chemical designation of the fertilizer shall be 12-8-8, with at least 50 percent of the nitrogen from a nonwater-soluble organic source. The nitrogen source may be a unreaformaldehyde source provided it is not derived from a waste product of the plastic industry.

2.3 EQUIPMENT

- A. Spread fertilizer uniformly at the specified rate.

2.4 NETTING

- A. See County Approved Product List, Appendix F.

2.5 SEEDING

- A. Seed all unpaved areas disturbed during construction that do not require sod. Complete all seeding in conformance with FDOT Specifications Sections 570 and 981. Mulch and fertilize the grassed areas shall be mulched and fertilized in accordance with FDOT Specifications.
- B. Provide mulch material free of weeds. Mulch shall be oat straw or rye, Pangola, peanut, Coastal Bermuda, or Bahia grass hay.
- C. All seeds must have been tested within 6 months of planting. Submit a seed bag tag with final payment requests from each type or mixture of seed used.

2.6 TOPSOIL

- A. Topsoil stockpiled during excavation may be used. If additional topsoil is required to replace topsoil removed during construction, it shall be obtained off site at no additional cost to the COUNTY. Topsoil shall be fertile, natural surface soil, capable of producing all trees, plants, and grassing specified herein.

2.7 MULCH

- A. Furnish small grain straw mulch. Apply mulch at a rate of 1.5 tons per acre, corresponding to a depth not less than 1-inch or more than 3-inches according to texture and moisture content of mulch material. Apply asphalt emulsion at a rate of 150 gallons per ton of straw to anchor the straw applied.

2.8 WATER

- A. It is the CONTRACTOR'S responsibility to supply all water to the site, as required during seeding and sodding operations and through the maintenance period and until the work is accepted. Make whatever arrangements may be necessary to ensure an adequate supply of water to meet the needs for the work. Furnish all necessary hose, equipment, attachments, and accessories for the adequate irrigation of lawns and planted areas as may be required. Water shall be suitable for irrigation and free from ingredients harmful to plant life.

2.9 SOIL IMPROVEMENTS

- A. Apply lime at the rate of 1 to 1.5 tons per acre. Apply 10-10-10 commercial fertilizer at the rate of 800 pounds per acre and work well into the top inch of topsoil.

PART 3 EXECUTION

3.1 SOD BED PREPARATION

- A. Clear areas to be sodded and/or seeded of all rough grass, weeds, and debris, and bring soil to an even grade.
- B. Thoroughly till soil to a minimum 4-inch depth.
- C. Bring area to proper grade, free of sticks, stones, or other foreign matter over 1-inch in diameter or dimension. The surface shall conform to finish grade, less the thickness of sod, free of water-retaining depressions, the soil friable and of uniformly firm texture.

3.2 INSPECTION

- A. Verify that soil preparation and related preceding work has been completed.
- B. Do not start work until conditions are satisfactory.

3.3 SOD HANDLING AND INSTALLATION

- A. During delivery, prior to planting, and during the planting of sod areas, protect the sod panels at all times from excessive drying and unnecessary exposure of the roots to the sun. Stack sod during construction and planting so as not to be damaged by sweating or excessive heat and moisture.
- B. After completion of soil conditioning as specified above, lay sod panels tightly together so as to make a solid sodded lawn area. On mounds and other slopes, the long dimension of the sod shall be laid perpendicular to the slope. Immediately following sod laying, roll the lawn areas with a lawn roller customarily used for such purposes, and then thoroughly water.
- C. Place sod at all areas where sod existed prior to construction, on slopes of 3 horizontal to 1 vertical (3:1) or greater, in areas where erosion of soils will occur, and as directed by the ENGINEER. On areas where the sod may slide, due to height and slope, the ENGINEER may direct that the sod be pegged, with pegs driven through the sod blocks into firm earth, at suitable intervals.

3.4 USE OF SOD ON ROADWAY PROJECTS

- A. In accordance with the FDOT District One Standard Practice, establish permanent green grass at the completion of roadway construction and maintenance work. The following shall apply to all restoration involving State or County roadways:
 - 1. Use sod in lieu of seed and mulch on all roadways with urban (raised curb) typical sections.

2. One inch water per week shall be required for a minimum of four (4) consecutive weeks for the purpose of establishing sod. This can be waived during construction, if and only if there is a minimum of one inch of rain per week on all sod on the project.
3. Placed sod on slopes 1:3 or greater. Stake sod on slopes 1:2 or greater.
4. On all curves with superelevation, place sod from the edge of pavement to the toe of slope on the downhill side(s) for the entire length of the superelevated roadway. On multi-lane divided rural facilities, place sod in the median and on the inside of the curve in the superelevated areas. This does not apply to reverse crowns.
5. Use sod for all projects with less than 10,000 square yards grass area.
6. On tangent sections and on outside of curves, use sod between the edge of pavement and a point 4 feet beyond the shoulder break point.
7. The entire width of sod should not exceed 15 feet from the edge of pavement.
8. Sod is to be used to eliminate narrow seed and mulch areas. Sod areas less than 6 feet in width.
9. Place sod around drainage structures as per the standard Indexes and extend to the edge of pavement.

3.5 SOD MAINTENANCE

- A. The sod shall produce a dense, well-established growth. Repair and re-sod all eroded or bare spots until project acceptance. Repair to sodding shall be accomplished as in the original work.
- B. Perform sufficient watering to maintain adequate moisture for optimum development of the seeded and sodded areas, and no less than 1.5 inches of water per week for at least 2 weeks. Thereafter, apply water for a minimum of 60 days as needed until the sod takes root and starts to grow or until final acceptance, whichever is latest.

3.6 GUARANTEE

- A. Guarantee a live and vigorous stand of permanent grass at the time of acceptance of the work consisting of 80 percent minimum coverage for seeded grass areas with no bare spots greater than 5 square feet.

3.7 CLEANING

- A. Remove debris and excess materials from the project site.

END OF SECTION

SECTION 330502

HIGH DENSITY POLYETHYLENE (HDPE) PIPE AND FITTINGS

PART 1 GENERAL

1.1 SCOPE OF WORK

- A. Furnish all labor, materials, equipment, and incidentals required to install High Density Polyethylene (HDPE) pressure pipe, fittings, and appurtenances as shown on the Drawings and specified in the Contract Documents.
- B. High Density Polyethylene (HDPE) – Collier County Utilities has the option of approving the use of HDPE for pipeline crossings of roadways, ditches, canals, and environmentally sensitive lands. HDPE mains shall have the same equivalent internal diameter and equivalent pressure class rating as the corresponding PVC pipe, unless otherwise approved by the County Manager or designee. For all roadway crossings requiring casing pipe, a steel or DR 11 HDPE casing pipe must be provided. The Department of Transportation having jurisdiction of said road and right-of-way must grant specific approval.

1.2 REFERENCED STANDARDS

- A. All standard specifications, i.e., Federal, ANSI, ASTM, etc., made a portion of these Specifications by reference, shall be the latest edition and revision thereof.

1.3 QUALIFICATIONS

- A. Furnish all HDPE pipe, fittings, and appurtenances by a single manufacturer who is fully experienced, reputable and qualified in the manufacture of the items to be furnished.

1.4 SUBMITTALS

- A. Submit to the ENGINEER, a list of materials to be furnished, the names of the suppliers, and the appropriate shop drawings for all HDPE pipe and fittings.
- B. Submit the pipe manufacturer's certification of compliance with the applicable sections of the Specifications.
- C. Submit shop drawings showing installation method and the proposed method and specialized equipment to be used.

1.5 INSPECTIONS AND TESTS

- A. All work shall be inspected by the County Manager or designee who shall have the authority to halt construction if, in his opinion, these specifications or standard construction practices are not being followed. Whenever any portion of these specifications is violated, the County Manager or designee, may order further construction to cease until all deficiencies are corrected.

1.6 WARRANTY AND ACCEPTANCE

- A. Warrant all work to be free from defects in workmanship and materials for a period of one year from the date of completion of all construction. If work meets these specifications, a letter of acceptance, subject to the one year warranty period, shall be given at the time of completion. A final acceptance letter shall be given upon final inspection at the end of the one year warranty period, provided the work still complies with these specifications. In the event deficiencies are discovered during the warranty period, the CONTRACTOR shall correct them without additional charge to the COUNTY before final acceptance. During the warranty period, the ENGINEER will determine if warranty repairs or replacement work shall be performed by the CONTRACTOR. The decision of the ENGINEER shall be binding upon the CONTRACTOR.
- B. Installer Certification for The CONTRACTOR installing thermal butt fused HDPE pipe.

PART 2 PRODUCTS

2.1 POLYETHYLENE PIPE AND FITTINGS

- A. Provide polyethylene pressure pipe manufactured from PE3408 polyethylene meeting AWWA C906 standards. When specified by the ENGINEER on the construction drawings, as an alternate to PVC, HDPE (ductile iron pipe sized) piping can be used for buried applications. Iron pipe sized (IPS) HDPE piping can be used for below-ground applications as determined by the ENGINEER.
- B. The diameter of DR 11 HDPE casing pipe provided for roadway crossings or other purposes shall conform to the following.

For HDPE pressure carrier pipes, casing spacers are not required when HDPE DR11 (or DR17 for 42" to 54" or DR21 for 63") casing is used. The casing inside diameter shall be a minimum of two inches larger than the carrier pipe's outside diameter.

- C. HDPE to HDPE pipe connections shall be by thermal butt fusion. Thermal fusion shall be accomplished in accordance with the pipe manufacturer and fusion equipment supplier specifications. The CONTRACTOR installing thermal butt

fused HDPE pipe shall be certified in this type of work and have a minimum of five years experience performing this type of work. The CONTRACTOR shall provide certification to the Engineer of Record, who will provide the Engineering Review Services Department with the certification.

- D. Qualification of Manufacturer: The Manufacturer shall have manufacturing and quality control facilities capable of producing and assuring the quality of the pipe and fittings required by these specifications. The Manufacturer's production facilities shall be open for inspection by the County Manager or designee. Qualified manufacturers shall be approved by the County Manager or designee.
- E. See the County Approved Product List, Appendix F, for manufacturers that are qualified. Products from other manufacturers proposed for the work must receive approval from the County Manager or designee prior to ordering.
- F. Materials: Materials used for the manufacture of polyethylene pipe and fittings shall be PE3408 high density polyethylene meeting cell classification 345434C or 345434E per ASTM D3350; and meeting Type III, Class B or Class C, Category 5, Grade P34 per ASTM D1248; and shall be listed in the name of the pipe and fitting manufacturer in PPI (Plastics Pipe Institute) TR-4, Recommended Hydrostatic Strengths and Design Stresses for Thermoplastic Pipe and Fittings Compounds, with a standard grade rating of 1600 psi at 73°F. The Manufacturer shall certify that the materials used to manufacture pipe and fittings meet these requirements.
- G. Polyethylene Pipe: Polyethylene pipe shall be manufactured in accordance with ASTM F714, Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter or ASTM D3035, Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter and shall be so marked. Each production lot of pipe shall be tested for (from material or pipe) melt index, density, % carbon, (from pipe) dimensions and either quick burst or ring tensile strength (equipment permitting).
- H. Color Identification: HDPE must have at least three equally spaced horizontal colored marking stripes. Permanent identification of piping service shall be provided by adhering to the following colors.

Blue – potable water (Underground HDPE pipe shall be one of the following:

- a. Solid-wall blue pipe;
- b. Co-extruded blue external skin; or
- c. White or black pipe with blue stripes incorporated into, or applied to, the pipe wall.

White – raw water

Green – wastewater, sewage

Pantone Purple – non-potable irrigation, reclaimed or reuse water

- I. Polyethylene Fittings and Custom Fabrications: Polyethylene fittings and custom fabrications shall be molded or fabricated by the pipe manufacturer. Butt fusion outlets shall be made to the same outside diameter, wall thickness, and tolerances as the mating pipe. All fittings and custom fabrications shall be fully rated for the same internal pressure as the mating pipe. Pressure de-rated fabricated fittings are prohibited.
- J. Molded Fittings: Molded fittings shall be manufactured in accordance with ASTM D3261, Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing, and shall be so marked. Each production lot of molded fittings shall be subjected to the tests required under ASTM D3261.
- K. X-Ray Inspection: The Manufacturer shall submit samples from each molded fittings production lot to x-ray inspection for voids, and shall certify that voids were not found.
- L. Fabricated Fittings: Fabricated fittings shall be made by heat fusion joining specially machined shapes cut from pipe, polyethylene sheet stock, or molded fittings. Fabricated fittings shall be rated for internal pressure service equivalent to the full service pressure rating of the mating pipe. Directional fittings 16" IPS and larger such as elbows, tees, crosses, etc., shall have a plain end inlet for butt fusion and flanged directional outlets. Part drawings shall be submitted for the approval of the ENGINEER.
- M. Polyethylene Flange Adapters: Flange adapters shall be made with sufficient through-bore length to be clamped in a butt fusion joining machine without the use of a stub-end holder. The sealing surface of the flange adapter shall be machined with a series of small v-shaped grooves to provide gasketless sealing, or to restrain the gasket against blow-out.
- N. Back-up Rings and Flange Bolts: Flange adapters shall be fitted with lap joint flanges pressure rated equal to or greater than the mating pipe. The lap joint flange bore shall be chamfered or radiused to provide clearance to the flange adapter radius. Flange bolts and nuts shall be Grade 2 or higher.

2.2 MANUFACTURER'S QUALITY CONTROL

- A. The pipe and fitting manufacturer shall have an established quality control program responsible for inspecting incoming and outgoing materials. Incoming polyethylene materials shall be inspected for density, melt flow rate, and contamination. The cell classification properties of the material shall be certified by the supplier, and verified by Manufacturer's Quality Control. Incoming materials shall be approved by Quality Control before processing into finished goods. Outgoing materials shall be checked for:

1. Outside diameter, wall thickness, and eccentricity as per ASTM D2122 at a frequency of at least once/hour or once/coil, whichever is less frequent.
 2. Out of Roundness at frequency of at least once/hour or once/coil, whichever is less frequent.
 3. Straightness, inside and outside surface finish, markings and end cuts shall be visually inspected as per ASTM F714 on every length of pipe.
- B. Quality Control shall verify production checks and test for:
1. Density as per ASTM D1505 at a frequency of at least once per extrusion lot.
 2. Melt Index as per ASTM D1238 at a frequency of at least once per extrusion lot.
 3. Carbon content as per ASTM D1603 at a frequency of at least once per day per extrusion line.
 4. Quick burst pressure (sizes thru 4-inch) as per ASTM D1599 at a frequency of at least once per day per line.
 5. Ring Tensile Strength (sizes above 4-inch equipment permitting) as per ASTM D2290 at a frequency of at least once per day per line.
 6. ESCR (size permitting) as per ASTM F1248 at a frequency of at least once per extrusion lot.
- C. X-ray inspection shall be used to inspect molded fittings for voids, and knit line strength shall be tested. All fabricated fittings shall be inspected for joint quality and alignment.

2.3 COMPLIANCE TESTS

- A. In case of conflict with Manufacturer's certifications, the CONTRACTOR, ENGINEER, or County Manager or designee may request re-testing by the manufacturer or have re-tests performed by an outside testing service. All re-testing shall be at the requestor's expense, and shall be performed in accordance with the Specifications.
- B. Installation shall be in accordance with Manufacturer's recommendations and this specification. All necessary precautions shall be taken to ensure a safe working environment in accordance with the applicable codes and standards.

PART 3 EXECUTION

3.1 INSTALLATION OF HIGH DENSITY POLYETHYLENE PRESSURE PIPE AND FITTINGS

- A. Install all high density polyethylene (HDPE) pressure pipe by direct bury, directional bore, or a method approved by the COUNTY or ENGINEER prior to construction. If directional bore is used, or if directed by the County Manager or designee or ENGINEER, surround the entire area of construction by silt barriers.

Install all high density polyethylene pressure pipe and fittings in accordance with Manufacturer's recommendations, and this specification. Take all necessary precautions to ensure a safe working environment in accordance with the applicable codes and standards.

3.2 HEAT FUSION JOINING

- A. Make joints between plain end pipes and fittings by butt fusion, and joints between the main and saddle branch fittings by using saddle fusion using only procedures that are recommended by the pipe and fitting Manufacturer. Ensure that persons making heat fusion joints have received training and certification for heat fusion in the Manufacturer's recommended procedure. Maintain records of trained personnel, and shall certify that training was received not more than 12 months before commencing construction. External and internal beads shall not be removed.

3.3 MECHANICAL JOINING

- A. HDPE pipe and fittings shall be fused together by heat welding when possible. HDPE pipe and fittings may be joined together or to other materials by means of flanged connections with back-up rings, by mechanical joint adapter with glands, or mechanical couplings designed for joining HDPE pipe or for joining HDPE pipe to another material. A stainless steel sleeve insert shall be used with a mechanical coupling. Mechanical couplings shall be fully pressure rated and fully thrust restrained such that when installed in accordance with manufacturer's recommendations, a longitudinal load applied to the mechanical coupling will cause the pipe to yield before the mechanical coupling disjoins.

3.4 BRANCH CONNECTIONS

- A. Make branch connections to the main with saddle fittings or tees. Saddle fuse polyethylene saddle fittings to the main pipe.

3.5 EXCAVATION

- A. Excavate trenches in conformance to this specification, the plans and drawings, or as authorized in writing by the County Manager or designee, and in accordance

with all applicable codes. Remove excess groundwater. Where necessary, shore or reinforce trench walls.

3.6 LARGE DIAMETER FABRICATED FITTINGS

- A. Butt fuse fabricated directional fittings 16" IPS and larger to the end of a pipe. Make up the flanged directional outlet connections in the trench.

3.7 MECHANICAL JOINT AND FLANGE INSTALLATION

- A. Install mechanical joints and flange connections in accordance with the Manufacturer's recommended procedure. Center and align flange faces to each other before assembling and tightening bolts. Do not use the flange bolts to draw the flanges into alignment. Lubricate bolt threads, and fit flat washers under the flange nuts. Tighten bolts evenly according to the tightening pattern and torque step recommendations of the Manufacturer. At least one hour after initial assembly, re-tighten flange connections following the tightening pattern and torque step recommendations of the Manufacturer. The final tightening torque shall be 100 ft-lbs or less as recommended by the Manufacturer.

3.8 FOUNDATION AND BEDDING

- A. Lay pipe on grade and on a stable foundation. Remove unstable or mucky trench bottom soils, and install a 6-inch foundation or bedding of compacted Class I material to pipe bottom grade. Remove excess groundwater from the trench before laying the foundation or bedding and the pipe. A trench cut in rock or stony soil shall be excavated to 6 inches below pipe bottom grade, and brought back to grade with compacted Class I bedding. Remove all ledge rock, boulders, and large stones.

3.9 PIPE HANDLING

- A. When lifting with slings, use only wide fabric choker slings to lift, move, or lower pipe and fittings. Do not use wire rope or chain. Slings shall be of sufficient capacity for the load, and shall be inspected before use. Do not use worn or defective equipment.

3.10 TESTING

- A. Hydrostatic Pressure Testing: Pressure test and flush HDPE pipes after swabbing in accordance with Section 022501 and 025400.

END OF SECTION

NO TEXT FOR THIS PAGE

SECTION 330504

DUCTILE IRON PIPE (DIP) AND FITTINGS

PART 1 GENERAL

1.1 SCOPE OF WORK

- A. Furnish all labor, materials, equipment, and incidentals required, and install ductile iron pipe, fittings and appurtenances as shown on the Drawings and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 330518 - Laying and Jointing Buried Pipe

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. Commercial Standards: (Latest Revision)

1. ANSI/AWWA C104/A21.4 Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
2. ANSI/AWWA C105/A21.5 Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids.
3. ANSI/AWWA C110/A21.10 Ductile-Iron Fittings, 3 in. Through 48 Inches, for Water and Other Liquids. (C110 2-48 inches).
4. ANSI/AWWA C111/A21.11 Rubber Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
5. ANSI/AWWA C115/A21.15 Flanged Ductile-Iron Pipe with Threaded Flanges.
6. ANSI/AWWA C150/A21.50 Thickness Design of Ductile-Iron Pipe.
7. ANSI/AWWA C151/A21.51 Ductile-Iron Pipe, Centrifugally Cast for Water or Other Liquids.
8. ANSI/AWWA C153/A21.53 Ductile-Iron Compact Fittings
9. AWWA C600 Installation of Ductile Iron Water Mains and Their Appurtenances.
10. Collier County Utilities Standards and Procedures Ordinance

1.4 CONTRACTOR SUBMITTALS

- A. Shop Drawings: Submit shop drawings of pipe and fittings in accordance with the requirements in the General Conditions, the requirements of the referenced standards and the following supplemental requirements as applicable:
 - 1. Certified dimensional drawings of all valves, fittings, and appurtenances.
 - 2. In all cases, a line layout to indicate the limits of each reach of restrained joints or of concrete encasement shall be supplied. (NOTE: Obtain COUNTY Water Director's approval of all proposed concrete encasement of ductile iron pipe.)
- B. Certifications: Furnish a certified affidavit of compliance for all pipe and other products or materials furnished under this Section of the Specifications, which indicates that all tests have been made and that all results comply with the requirements of AWWA C151, including but not necessarily limited to the following:
 - 1. Acceptance Tests.
 - 2. Hydrostatic Tests.
 - 3. Impact Tests.
- C. Additional Documentation: Upon request, furnish foundry records in the form of written transcripts.
- D. All expenses incurred for certification, testing, and data submittal shall be borne by the CONTRACTOR or the Supplier.

1.5 QUALITY ASSURANCE

- A. Inspection: All pipe shall be available for inspection at the place of manufacture prior to shipping in accordance with the provisions of the referenced standards. Notify the ENGINEER in writing not less than 10 calendar days prior to the shipping of the pipe.
- B. The ENGINEER shall be given access to all areas where manufacturing and testing is performed and shall be permitted to make all inspections necessary to confirm manufacturer compliance with these Specifications.
- C. Tests: Except as modified herein, all materials used in the manufacture of the pipe shall be tested in accordance with the requirements of the referenced standards as applicable.
- D. Provide data on material tests at no additional cost to the COUNTY.

- E. In addition to those tests specifically required, the ENGINEER may request additional samples of any material including lining and coating samples for testing by the COUNTY. Furnish the additional samples at no additional cost to the COUNTY.

1.6 CORROSION PROTECTION

- A. If specifically approved by Collier County Utilities for use, provide exterior protection for underground ductile iron pipe and fittings within areas of severe corrosive conditions. This shall be accomplished by the installation of polyethylene encasement through the area of concern. The soil test evaluation to determine the necessity for extra protection in suspect areas shall be those set forth in ANSI Standard A21.5. Additionally, where other existing utilities are known to be cathodically protected, ductile iron pipe crossing said utility shall be protected for a distance of 20 feet to each side. If ductile iron pipe is to be installed parallel to and within 10 feet of cathodically protected pipe, then protection shall be provided for the entire length. Do not install steel pipe in severe corrosion areas.

PART 2 PRODUCTS

2.1 GENERAL

- A. Protective Lining for Water Mains: Cement mortar lined ductile iron pipe shall conform to ANSI/AWWA C151 and C104, subject to the following supplemental requirements. The pipe shall be of the diameter and class shown, shall be furnished complete with rubber gaskets as indicated in the Contract Documents, and all specials and fittings shall be provided as required under the Contract Documents.
- B. Protective Lining for Force Mains and Sewers: Where lining is shown, specified or required, for the protection of pipelines carrying sewage from corrosive gases, line the pipe using protective ceramic epoxy coating (see County Approved Product List, Appendix F) in accordance with the manufacturer's written instructions. For ceramic epoxy lining, abrasive blast clean pipe and fittings to a near white surface to SSPC SP-10 and provide 40 mils minimum of dry film thickness of ceramic epoxy lining.
- C. Handling and Storage: Handle the pipe by using wide slings, padded cradles, or other devices designed and constructed to prevent damage to the pipe and its lining. The use of equipment or handling, which might injure the pipe and its lining, will not be permitted. Stockpiled pipe shall be suitably supported and shall be secured to prevent accidental rolling. Assure that all other pipe handling equipment and methods is acceptable to the ENGINEER.
- D. Laying lengths: Maximum pipe laying lengths shall be 20 feet.

- E. Finish: The pipe shall have smooth dense interior surfaces and shall be free from fractures, excessive interior surface crazing and roughness, in accordance with ANSI/AWWA C104.
- F. Closures and Correction Pieces: Provide closures and correction pieces as required so that closures may be made due to different headings in the pipe laying operation and so that correction may be made to adjust the pipe laying to conform to pipe stationing shown on the Drawings or line layouts where applicable.

2.2 PIPE DESIGN CRITERIA

- A. General: Ductile Iron pipe shall be designed in accordance with the requirements of ANSI/AWWA C150 as applicable and as modified in this Section.
- B. Pipe Wall Thickness for Internal Pressure: The pipe shall be designed with a net thickness to withstand the design internal pressure in accordance with the hoop stress formula. In addition to the requirements of the Section, the minimum wall thickness shall be in accordance with the minimum thickness wall depicted in table 50.5 of ANSI/AWWA C150.
- C. Potable, Raw and Non-Potable Irrigation Water Mains:
 - 1. Ductile Iron Pipe shall be a minimum pressure Class 250 and will be accepted in any diameter for use within the water distribution system.
 - 2. All aboveground potable water main pipe shall be painted Federal Safety Blue. All aboveground raw water main pipe shall be painted white. All aboveground non-potable irrigation, reclaimed or reuse water main pipe shall be painted Pantone Purple 522C. The pipe wall thickness shall not be less than that required by a working pressure of 250 psi in laying condition Type 4 "B" with 5-foot cover in conformance with ANSI Standard A21.50.
- D. Force Mains and Gravity Sewers:
 - 1. Ductile Iron Pipe shall be a minimum pressure Class 150 and will be accepted in any diameter for use within the wastewater collection system.
 - 2. Ductile iron pipe for Gravity Sewer applications is not permitted unless the ENGINEER can demonstrate that C900 PVC pipe, Class 150 or 200, cannot be utilized from a structural standpoint.
 - 3. All aboveground force main pipe shall be painted Safety Green. The pipe wall thickness shall not be less than that required by a working pressure of 150 psi.

2.3 MATERIALS

- A. Ductile Iron Pipe: Pipe materials shall conform to the requirements of ANSI/AWWA C151.
- B. Adapters to connect ductile iron pipe or fittings to pipe or fittings of dissimilar materials shall be supplied by the CONTRACTOR in accordance with ASTM specifications and the pipe manufacturer recommendations, and as approved by the ENGINEER.
- C. Water Mains:
 - 1. All water mains shall contain cement for mortar lining conforming to the requirements of ANSI/AWWA C104. Cement for mortar lining shall be Type II or V. A fly ash or pozzolan shall not be used.
 - 2. All Ductile Iron buried water main pipelines shall have blue stripes applied to the pipe wall. Stripe width shall comply with AWWA standards. The stripes shall be applied during installation and shall incorporate blue tape or blue paint. The tape or paint shall be applied in a continuous line that runs parallel to the axis of the pipe and be located along the top of the pipe.
 - 3. All pipe with an internal diameter of 24" or greater, tape or paint shall be applied in continuous lines along each side of the pipe as well as along the top of the pipe.
- D. Force Mains and Gravity Sewer:
 - 1. All Ductile iron pipe used within the wastewater system shall be lined with a ceramic epoxy, (see County Approved Product List, Appendix F). Pipe and fittings shall be lined as specified herein. Each piece of pipe shall bear a marking denoting the class to which it belongs.

2.4 SPECIALS AND FITTINGS

- A. Fittings for Potable, Raw, Non-Potable Irrigation, Reclaimed and Reuse Water Systems:
 - 1. Fittings for ductile iron pipe shall conform to the requirements of ANSI/AWWA C153/A21.53 or ANSI/AWWA C110/A21.10 for diameters 3 inches through 48 inches and shall have a minimum pressure rating of 350 psi for pipe sizes 6 inches through 24 inches and 250 psi for sizes larger than 24 inches. Ductile iron fittings shall be double cement lined, seal coated and outside coated with an asphaltic material in accordance with AWWA C104 as specified.
- B. Fittings for Wastewater System:

1. All pipe and fittings in direct contact with wastewater shall be interior coated with a 40 mil thickness of ceramic epoxy coating (see County Approved Product List, Appendix F). Pipe and fittings shall have an outside asphaltic coating as specified in AWWA Standard C151. Each piece of pipe shall bear a marking denoting the class to which it belongs.

2.5 DESIGN OF PIPE

- A. General: The pipe furnished shall be ductile iron pipe, lined as specified, with rubber gasketed joints.
- B. The pipe shall be designed, manufactured, tested, inspected, and marked according to applicable requirements previously stated and except as hereinafter modified, shall conform to ANSI/AWWA C150 and ANSI/AWWA C151.
- C. Pipe Dimensions: The pipe shall be of the diameter and class shown. The minimum wall thickness for each pipe size shall be as specified herein or shown on the Drawings.
- D. Fitting Dimensions: The fittings shall be of the diameter shown and class specified.
- E. Joint Design: Ductile Iron pipe and fittings shall be furnished with mechanical joints, push-on joints and flanged joints as follows:
 1. For buried pipe applications, unless otherwise indicated, mechanical and push-on joints shall conform to ANSI/AWWA C111/A21.11, with the minimum pressure rating of 350 psi.
 2. For above-ground or buried vault applications, unless otherwise indicated, flanged joints shall conform to ANSI/AWWA C115/A21.15, with the minimum pressure rating of 250 psi. All above-ground fittings shall be painted blue.
 3. Use manufactured, labeled gasket lubricant for push on joints with trade name and pipe manufacturer name, other lubricants are prohibited.
 4. Nuts and bolts for flanged joints shall be 304 stainless, as specified by the COUNTY, and conform to ANSI/AWWA C111.
- F. Restraining Devices: Joint restraining devices (see County Approved Product List, Appendix F) shall be placed at all bends, tees, plugs, reducers, and other fittings to provide lateral support, and shall conform to the Collier County Standard Details. Concrete thrust blocks shall only be utilized if approved by Collier County Utilities.
- G. For bell-and-spigot ends with rubber gaskets, the clearance between the bells and spigots shall be such that when combined with the gasket groove configuration and the gasket itself will provide watertight joints under all operating conditions

when properly installed. Require the pipe manufacturer to submit details complete with significant dimensions and tolerances and also to submit performance data indicating that the proposed joint has performed satisfactorily under similar conditions. In the absence of a history of field performance, the results of a test program shall be submitted.

- H. Gaskets shall be a Buna N, Neoprene, or a Nitril-based rubber product. Gaskets shall have clean tips unless otherwise specified. Elastomeric gaskets conforming to ASTM F-477 shall also be acceptable.
- I. Shop-applied interior linings and exterior coatings shall be applied evenly to the nominal thickness specified. Exterior coatings: asphalt coating for buried pipe or primed pipe cannot be furnished holiday free.

2.6 CEMENT-MORTAR LINING

- A. Cement-Mortar Lining For Shop Application: Except as otherwise provided herein, interior surfaces of all ductile iron pipe shall be cleaned and lined in the shop with cement-mortar lining applied centrifugally in conformity with ANSI/AWWA C104. Ductile-Iron pipefittings need not have the cement-mortar lining applied centrifugally. The lining machines shall be of a type that has been used successfully for similar work. Every precaution shall be taken to prevent damage to the lining. If lining is damaged or found faulty at delivery site, the damaged or unsatisfactory portions shall be repaired in the field in accordance with ANSI/AWWA C104.
- B. The nominal wet lining thickness shall be as follows:

Nominal Factory Nominal Replacement		
Nominal Pipe Diameter (in.)	Applied Lining Thickness (in.)	Lining Thickness (in.)
3-12	1/8	1/8
14-24	3/16	3/16
30-64	1/4	1/4

- C. Protection of Pipe Lining/Interior: All shop-applied cement mortar lining shall be given a seal coat of asphaltic material in conformance with ANSI/AWWA C104.

2.7 EXTERIOR COATING OF PIPE

- A. Exterior Coating of Buried Piping: The exterior coating shall be an asphaltic coating approximately 1 mil thick, conforming to ANSI/AWWA C151.

2.8 CORROSION PROTECTION

- A. If specifically approved by Collier County Utilities for use, exterior protection shall be provided for underground ductile iron pipe and fittings within areas of severe

corrosive conditions. This shall be accomplished by the installation of polyethylene encasement through the area of concern. The soil test evaluation to determine the necessity for extra protection in suspect areas shall be those set forth in ANSI Standard A21.5. Additionally, where other existing utilities are known to be cathodically protected, ductile iron pipe crossing said utility shall be protected for a distance of 20 feet to each side. If ductile iron pipe is to be installed parallel to and within 10 feet of cathodically protected pipe, then protection shall be provided for the entire length. Steel pipe shall not be installed in severe corrosion areas.

PART 3 EXECUTION

3.1 INSTALLATION OF PIPE

- A. Handling and Storage: Carefully handle and protect all pipe, fittings, etc., against damage, impact shocks, and free fall and in accordance with ANSI/AWWA C600. Do not place pipe directly on rough rocky ground, but in such instances support the pipe in a manner that will protect the pipe against injury whenever stored at such trench site or elsewhere. Do not install any pipe where the lining or coating show defects that may be harmful as determined by the ENGINEER. Repair such damaged lining or coating, or furnish and install a new undamaged pipe.
- B. Repair or replace all pipe damaged prior to Substantial Completion or during warrantee period.
- C. Inspect each pipe and fitting prior to installation to insure that no damaged portions of pipe are installed.
- D. Before placement of pipe in the trench, thoroughly clean each pipe or fitting of any foreign substance that may have collected therein, and keep the pipe clean at all times thereafter. For this purpose, close the openings of all pipes and fittings in the trench during any interruption to the work.
- E. Pipe Laying: Install the pipe in accordance with ANSI/AWWA C600.
- F. Lay pipe directly on the bedding material. Refer to the Utilities Standards and Procedures Ordinance Section 9.1.2 for laying and backfilling requirements. No blocking will be permitted, and the bedding shall be such that it forms a continuous, solid bearing for the full length of the pipe. Make excavations as needed to facilitate removal of handling devices after the pipe is laid. Form bell holes at the ends of the pipe to prevent point loading at the bells or couplings. Make excavations as needed outside the normal trench section at field joints to permit adequate access to the joints for field connection operations and for application of coating on field joints.
- G. Where necessary to raise or lower the pipe due to unforeseen obstructions or other causes, the ENGINEER may change the alignment and/or the grades. Such

change may 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 70 percent of the maximum deflection recommended by the pipe manufacturer. No joint shall be misaligned any amount which will be detrimental to the strength and water tightness of the finished joint.

- H. Pipe and Specials Protection: Protect the openings of all pipe and specials with suitable bulkheads to prevent unauthorized access by persons, animals, water, or any undesirable substance. At all times, provide means to prevent the pipe from floating.
- I. Pipe Cleanup: As pipe laying progresses, keep the pipe interior free of all debris. Completely clean the interior of the pipe of all sand, dirt, mortar splatter and any other debris following completion of pipe laying, pointing of joints, and any necessary interior repairs per ANSI/AWWA C600 and C602 prior to testing and disinfecting the completed pipeline. For pipe larger than 12" diameter, utilize a polyurethane foam plug "Poly Pig" to remove all debris from main.

3.2 RUBBER GASKETED JOINTS

- A. Rubber Gasketed Joints: Immediately before jointing pipe, thoroughly clean the bell end of the pipe, and place a clean rubber gasket in the bell groove. Carefully clean the bell and spigot end of push-on joint pipe, and lubricate with a vegetable-based lubricant or per manufacturer's recommendation. Insert the spigot end of the pipe section into the bell of the previously laid joint and telescope into the proper position. Do not tilt the pipe to insert the spigot into the bell.

3.3 INSTALLATION OF PIPE APPURTENANCES

- A. Installation of Valves: Handle all valves in a manner to prevent any injury or damage to any part of the valve. Thoroughly clean and prepare all joints prior to installation. Adjust all stem packing and operate each valve prior to installation to insure proper operation.
- B. Install all valves so that the valve stems are plumb and in the location shown on the Drawings.
- C. Mechanical joints consisting of bell, socket, gland, gasket, bolts, and nuts shall conform to ANSI Standard A21.11. Bolts and nuts shall be high strength, low alloy, Cor-Ten, T-Head Type having hexagonal nuts. Bolts and nuts shall be machined through and nuts shall be tapped at right angles to a smooth bearing surface. Single sealed gasket push-on type joints (see County Approved Product List, Appendix F) shall conform to the requirements of ANSI A21.11.
- D. Mechanical joint retainer glands may be used to restrain mechanical joint pipe and fittings to the plain end of ductile iron pipe and fittings when used in conjunction with thrust blocks of reduced size. The Utilities ENGINEER must approve thrust block size. Maintain joint flexibility.

3.4 TESTING AND DISINFECTION

- A. Test completed water or force main pipeline in accordance with Section 022501.
Disinfect completed water pipeline in accordance with Section 025400.

END OF SECTION

SECTION 330518

LAYING AND JOINTING BURIED PIPELINES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes: Installation of all underground pipelines. Provide pipeline materials, coatings and linings as specified and pipe of the types, sizes and classes shown or specified.
 - 1. Use proper and suitable tools and appliances for the safe and convenient cutting, handling, and laying of the pipe and fittings.
 - 2. Use suitable fittings where shown and at connections or where grade or alignment changes require offsets greater than those recommended and approved.
 - 3. Lay all underground pipelines not supported on piles or concrete cradle in select fill bedding material.
 - 4. Close off all lines with bulkheads when pipe laying is not in progress.
- B. Related Work Specified in Other Sections Includes:
 - 1. Section 022501 – Leakage Tests
 - 2. Section 025400 – Disinfection
 - 3. Section 312316 – Excavation - Earth and Rock
 - 4. Section 312319 – Groundwater Control for Open Excavation
 - 5. Section 312323 – Backfilling
 - 6. Section 330502 – High Density Polyethylene (HDPE) Pipe and Fittings
 - 7. Section 330503 - Polyvinyl Chloride (PVC) Pipe and Fittings
 - 8. Section 330504 - Ductile Iron Pipe (DIP) and Fittings

1.2 REFERENCES

- A. Codes and standards referred to in this Section are:

1. ASTM D 2774 - Practice for Underground Installation of Thermoplastic Pressure Piping
2. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances
3. ASTM A 307 - Specification for Carbon Steel Bolts and Studs, 60000 psi Tensile
4. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings, C25, 125, 250, 800
5. ASME B16.21 - Nonmetallic Flat Gaskets for Pipe Flanges
6. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
7. AWWA C115/A21.15 - Flanged Ductile-Iron Pipe With Threaded Flanges
8. Uni-Bell - Handbook of PVC Pipe
9. Collier County - Utilities Standards and Procedures Ordinance

1.3 DELIVERY, STORAGE AND HANDLING

- A. General: Deliver, store and handle all products and materials as specified in Division 1 and as follows:
- B. Transportation and Delivery: Take every precaution to prevent injury to the pipe during transportation and delivery to the site.
- C. Loading and Unloading: Take extreme care in loading and unloading the pipe and fittings.
 1. Work slowly with skids or suitable power equipment, and keep pipe under perfect control at all times.
 2. Under no condition is the pipe to be dropped, bumped, dragged, pushed, or moved in any way that will cause damage to the pipe or coating.
- D. Sling: When handling the pipe with a crane, use a suitable sling around the pipe.
 1. Under no condition pass the sling through the pipe. Interior of pipe is to be kept free of dirt and foreign matter at all times.
 2. Use a nylon canvas type sling or other material designed to prevent damage to the pipe and coating.

3. When handling reinforced concrete pipe or uncoated steel or ductile iron pipe, steel cables, chain or like slings are acceptable.
- E. Damaged Piping: If in the process of transportation, handling, or laying, any pipe or fitting is damaged, replace or repair such pipe or pipes.
- F. Blocking and Stakes: Provide suitable blocking and stakes installed to prevent pipe from rolling.
 1. Obtain approval for the type of blocking and stakes, and the method of installation.
- G. Storage for Gaskets: Store gaskets for pipe joints in a cool place and protect gaskets from light, sunlight, heat, oil, or grease until installed. Store gaskets in a sealed container (such as a vented drum). When long-term storage with exposure to direct sunlight is unavoidable, PVC pipe should be covered with an opaque material while permitting adequate air circulation above and around the pipe as required to prevent excessive heat accumulation (Uni-Bell PVC Handbook).
 1. Do not use any gaskets showing signs of cracking, weathering or other deterioration.
 2. Do not use gasket material stored in excess of six months without approval.

1.4 FIELD CONDITIONS

- A. Repair of Sanitary Sewers and Services: Rebed, in compacted select fill material, sanitary sewers which cross over the new pipe or which cross under the new pipe with less than 12 inches clear vertical separation. Compact the bedding to densities required for new pipeline construction and extend bedding below the sewer to undisturbed earth. Reconstruct sewers damaged by pipeline construction.
 1. Furnish and install all materials and do all work necessary for the reconstruction or repairs of sanitary sewers and services.
 2. Provide pipe for reconstruction of sanitary sewers and services meeting the appropriate specification requirements.
 3. Provide pipe of the same size as the existing sewer or when the same size is not available, use the next larger size of pipe. Obtain approval of joints made between new pipe and existing pipe.

PART 2 PRODUCTS

- A. The materials allowed for buried sewer pipes are PVC, HDPE or Ductile Iron Pipe.

PART 3 EXECUTION

3.1 PREPARATION

- A. Dry Trench Bottoms: Lay pipe only in dry trenches having a stable bottom.
 - 1. Where groundwater is encountered, make every effort to obtain a dry trench bottom in accordance with Section 312319.
 - 2. Perform trench excavation and backfill in accordance with Sections 312316 and 312323.

3.2 INSTALLATION

- A. General: Install all piping in accordance with the manufacturer's recommendations and approved shop drawings and as specified in Division 1. Where pipe joint deflections are used, do not exceed 80 percent of the maximum deflection limits shown in AWWA C600. Gravity systems shall contain no joint deflection.
 - 1. Arrange miscellaneous pipelines, which are shown in diagram form on the Plans, clear of other pipelines and equipment.
 - 2. Gravity systems shall not contain vertical dips greater than one and a half inches (1.5").
- B. Code Requirements: Provide pipeline installations complying with AWWA C600 for iron pipe, AWWA Manual M11 for steel pipe, ASTM D 2774 for thermoplastic pressure piping, and as modified or supplemented by the Specifications.
- C. Pipe Laying - General:
 - 1. Thoroughly inspect all pipe for damage and cleanliness. If found to be defective, tag, remove and replace pipe with satisfactory pipe or fittings at no additional charge to COUNTY.
 - 2. Generally, lay all pipe with bells pointing ahead.
 - 3. Carefully place all pipe, pipe fittings, valves and hydrants into trench by means of a derrick, ropes or other suitable tools or equipment in such a manner as to prevent damage and check for alignment and grade.
 - 4. Make adjustments to bring pipe to line and grade by scraping away or filling in select fill material under the body of the pipe.
 - 5. Wedging or blocking up the pipe barrel is not permitted.

6. Bring the faces of the spigot ends and the bells of pipes into fair contact and firmly and completely shove the pipe home.
7. As the work progresses, clean the interior of pipelines of all dirt and superfluous materials of every description.
8. Keep all lines absolutely clean during construction.
9. Lay pipelines accurately to line and grade.
10. During suspension of work for any reason at any time, a suitable stopper shall be placed in the end of the pipe last laid to prevent mud or other material from entering the pipe.

D. Pipe Laying - Trenches:

1. Carefully lay all pipelines in trench excavations piece by piece using suitable tools or equipment on select fill bedding (refer to Utilities Standards and Procedures Ordinance, Section 9.1.2), concrete cradle or other foundations as shown, specified or ordered in writing. Prevent damage to materials, protective coatings and linings.
2. Do not dump or drop pipe or pipe materials into trench.
3. Properly secure the pipe against movement and make the pipe joints in the excavation as required.
4. Carefully grade and compact pipe bedding.
5. Bell Holes:
 - a. Cut out bell holes for each joint as required to permit the joint to be properly made and allow the barrel of the pipe to have full bearing throughout its length.
 - b. Thoroughly tamp bell holes full of select fill material following the making of each joint to provide adequate support to the pipe throughout its entire length.

E. Other Foundations: Install pipelines laid on other types of foundations as specified for such other foundations or as ordered in writing.

F. Field Cuts of Pipelines: For shorter than standard pipe lengths, make field cuts in a manner producing a cut square and perpendicular to the pipe axis. Remove any sharp, rough edges which otherwise might injure the gasket.

G. Procedure for sealing cut ends and repairing field damaged areas of polyethylene lined pipe and fittings is as follows:

1. Remove burrs caused by field cutting of ends or handling damage and smooth out edge of polyethylene lining if made rough by field cutting or handling damage.
2. Remove oil or lubricant used during field cutting operations.
3. Areas of loose lining associated with field cutting operation must be removed and exposed metal cleaned by sanding or scraping. For larger areas, remove loose lining and dirt, then roughen bare pipe surface by scratching or gouging with a small chisel to provide an anchor pattern for the epoxy. It is recommended that the polyethylene lining be stripped back by chiseling, cutting, or scraping about 1 inch to 2 inches into well adhered lined area before patching. This ensures that all areas of undercutting have been removed. Be sure to roughen an overlap of 1 inch to 2 inches of polyethylene lining in area to be epoxy coated. This roughening should be done with a rough grade emery paper (40 grit), rasp, or small chisel. Avoid honing, buffing, or wire brushing since these tend to make surface to be repaired too smooth for good adhesion.
4. With area to be sealed or repaired clean and suitably roughened, apply a thick coat of a two-part coal tar epoxy (see County Approved Product List, Appendix F). The heavy coat of epoxy must be worked into the scratched surface by brushing. Mixing and application procedure for the epoxy must follow the epoxy manufacturer's instructions.
5. It is important that the entire freshly cut, exposed metal surface of the cut pipe be coated. To ensure proper sealing, overlap at least 1 inch of the roughened polyethylene lining with this two-part epoxy system.

H. Ductile Iron Pipe Mechanical Joints:

1. Assembly: In making up mechanical joints, center the spigot in the bell.
 - a. With a wire brush just prior to assembly of the joint thoroughly brush 8 inches outside of spigot and inside of bell with which the rubber gasket comes in contact. Remove all oil, grit, tar (other than standard coating) and other foreign matter from joint.
 - b. Brush lubricant over the gasket just prior to installation. (Note: There is only one rubber gasket size for each diameter of pipe.)
 - c. Press the gasket into place within the bell and move the gland into position, bolts inserted, and the nuts tightened finger tight.
 - d. Tighten the nuts with a torque wrench so that the gland is brought up toward the pipe evenly. Torque wrenches shall be set as specified in AWWA C111. Spanner type wrenches not longer than specified in

AWWA C111 may be used with the permission of County Manager or designee.

- e. Tighten all nuts 180 degrees apart alternately in order to produce equal pressure on all parts of the gland.

2. Torques: Apply the following range of bolt torques:

<u>Size Inches</u>	<u>Range of Torque - ft. lbs</u>
5/8	40 - 60
3/4	60 - 90
1	70 - 100
1-1/4	90 - 120

3. Remaking of Joints: If effective sealing is not obtained at the maximum torque listed above, disassemble and reassemble the joint after thorough cleaning.

I. Ductile Iron Pipe Rubber Gasket Joints:

1. Assembly: In making up the rubber gasket joint, brush the gasket seat in the socket thoroughly with a wire brush and wipe the gasket with a cloth.
 - a. Place the gasket in the socket with the large round end entering first so that the groove fits over the bead in the seat.
 - b. Apply a thin film of lubricant (AWWA C600) to the inside surface of the gasket that will come in contact with the entering pipe.
 - c. Brush the plain end of the pipe to be entered thoroughly with a wire brush and place it in alignment with the bell of the pipe to which it is to be joined.
 - d. Exert sufficient force on the entering pipe so that its plain end is moved past the gasket until it makes contact with the base of the socket to make the joint.
2. Positioning: Before proceeding with backfilling, feel completely around the joint using a feeler gauge to confirm that the gasket is in its proper position.
 - a. If the gasket can be felt out of position, withdraw the pipe and examine the gasket for cuts or breaks.
 - b. If the gasket has been damaged, replace it with a new one before re-installing the pipe.

3. Optional Mechanical Joints: Use mechanical joint fittings that meet the requirements of Section 330504 with the rubber gasket joint pipe when specified or when rubber gasket fittings are not available.
- J. Temporary Bulkheads: Provide temporary bulkheads at the ends of sections where adjoining pipelines have not been completed, and in connections built into pipelines where adjoining pipelines or structures have not been completed and are not ready to be connected.
1. Remove bulkheads encountered in connecting sewers or structures included in this Contract, or in pipelines or structures previously built, when they are no longer needed or when ordered.
- K. Temporary Blow-Off Assembly: Dead-end water lines shall be temporarily ended with a blow-off as shown in Collier County Standard Details. After full bore flush replace with a fire hydrant meeting the requirements of Section 331619.
- L. Sleeve Type Couplings: For sleeve type couplings, equally tighten diametrically opposite bolts on the connection so that the gaskets will be brought up evenly all around the pipe.
1. Torque Wrenches: Do the final tightening with torque wrenches set for the torque recommended by the coupling manufacturer.
- M. Concrete Encasement: Concrete encasement shall be constructed in accordance with Collier County Standard Details when:
1. A potable water main crosses at a depth that provides less than 18 inches clear distance from sewer lines in which case a Deviation Form request should be completed. Encase the sewer main unless specifically approved by Collier County Utilities. Encasement shall extend a minimum 10 feet on each side of the point of crossing. Pressure test both pipelines to 150 psi after the concrete has properly cured.
 2. A water main running parallel to a sewer line provides less than 10 feet separation from sewer lines, in which case a Deviation Form Request needs to be completed. Encase the sewer main unless specifically approved by Collier County Utilities.
 3. The ENGINEER has ordered the line encased. NO POTABLE WATER MAIN SHALL BE ENCASED IN CONCRETE UNLESS SPECIFICALLY AUTHORIZED BY THE COUNTY MANAGER OR DESIGNEE.

The points of beginning and ending of pipe encasement shall be not more than 6 inches from a pipe joint to protect the pipe from cracking due to uneven settlement of its foundation or the effects of superimposed live loads.

N. Valve Box Setting: Install valve boxes vertical and concentric with the valve stem.

1. Adjust valve-box to final grade at the time designated by the County Manager or designee.
2. Build a collar, as shown in the standard details, 18 inches by 18 inches by 6 inches or 24 inch diameter round by 6 inches flush to grade of top of box. Similar collar shall be poured flush with grade and top of unpaved areas.
3. Satisfactorily reset any valve box that is moved from its original position, preventing the operation of the valve.
4. Replace any valve box that has been damaged.

O. Identification:

1. Metallized Warning Tape: For DIP and PVC pipe (other than gravity sewer pipe and laterals) to be installed, 3-inch detectable marking tape, of appropriate color and appropriate warning statement, shall be placed along the entire pipe length. In all cases, marking tape shall be installed two feet (2') below grade or one-half the pipe's bury, whichever is less, during backfill operations (refer to Utilities Standards Manual Section 1 – 1.1 and 2.2.1). All PVC pipe, PVC fittings, and identification tape shall be color-coded per Collier County Standards. HDPE pipe installed by horizontal directional drilling will not be required to be marked with metalized warning tape.
2. Electronic Markers (see County Approved Product List, Appendix F): Install electronic markers twenty-four inches (24") below final grade, above pipe, at all bends or changes in alignment and every two hundred and fifty feet (250') along the pipe between bends.

P. Separation From Other Pipe Systems:

1. Parallel Water and Sewer or Non-Potable Lines: Sanitary sewer lines, storm sewers or force mains shall be separated from water mains by a minimum clear vertical distance of 18 inches and a horizontal distance of 10 feet. Non-potable, reclaimed or reuse water mains shall be separated from water mains, gravity sewers or force mains by a minimum clear vertical distance of 18 inches and a horizontal distance of 5 feet center to center or 3 feet outside to outside. When this standard cannot be maintained, the sewer line shall be concrete encased for a distance of 10 feet each way from the water line and any other conduit, with a minimum vertical clearance of 12 inches being provided at all times. See Section 1 - Design Criteria, Subsection 1.2.3.
2. Crossing Water and Sewer or Non-Potable Lines: Water mains crossing over a sewer or non-potable water line shall be (bottom of water main to top of sewer) separated by at least 18 inches unless local conditions or barriers

prevent an 18 inch vertical separation. All crossings with vertical clearance less than 18 inches shall be made using sewer pipe thickness Class 200 AWWA C900 PVC pipe, and water pipe of Class 51 Ductile iron pipe, for a distance of 10 feet on each side of the crossing. The gravity sewer pipe in these locations shall be backfilled with USCS Class I bedding stone to a height of 6 inches above the crown of the pipe. When water mains cross under a sewer, both mains shall be constructed of C900 Class 200 PVC pipe with joints equivalent to water main standards for a distance of 10 feet on each side of the point of crossing with no intermediate joints. Additionally, a section of water main pipe shall be centered at the point of crossing. See Section 1 – Design Criteria, Subsection 1.3.

Q. Aerial Crossings:

1. Pipes spanning elevated pier crossings shall be flanged ductile iron Pressure Class 350 pipe conforming to AWWA C115, C150 & C151. Pipe spanning on piers spaced further apart than normal pipe length of 18 or 20 ft. shall be multiple length pipe with interior flanged joints with a rubber gasket pipe (see County Approved Product List, Appendix F). The pipe wall thickness and flanged joints shall be designed to safely span the elevated piers under working pressure without exceeding the allowable stresses and conform to AWWA C150. Limit pipe deflection at center of span with pipe full of water to 1/720 of span length. Provide expansion joints for between above ground and below ground wastewater lines.
2. Flanges shall conform to AWWA C150 and C115. All bolts and nuts used in aerial crossings shall be 304 stainless steel. Gaskets shall be full faced or recessed "O-Ring" type to prevent leaks in pipe under stress in the aerial crossing.
3. Outside surface of all pipe, flanges or spool pieces shall be shop coated with zinc primer, High Build Epoxy protective coat and a finish coat of polyurethane high gloss. Color shall be Federal Safety Blue for potable water mains and Pantone Purple 522 C for non-potable irrigation water mains.
4. Install operating valves or other flow regulating devices on each shoreline or at a safe distance from each shoreline to prevent discharge in the event the line is damaged.
5. Install supports for all joints in pipes utilized for aerial crossings and to prevent overturning and settlement. Expansion jointing is specified between above ground and below ground sewers and force mains.

3.3 FIELD QUALITY CONTROL

- A. Testing: Test pipelines in accordance with Section 022501.

1. Test valves in place, as far as practicable, and correct any defects in valves or connections.
 2. Gravity Sewer Lines: Test in accordance with Section 022501
- B. Inspection: Clean, inspect, and examine each piece of pipe and each fitting and special for defects before it is installed.
1. Cut away any lumps or projections on the face of the spigot end or the shoulder.
 2. Do not use any cracked, broken, or defective pieces in the work.
 3. If any defective piece should be discovered after having been installed, remove and replace this piece with a sound piece in a satisfactory manner at no increase in Contract Amount.

3.4 CLEANING

- A. General: Thoroughly clean all pipe before it is laid and keep it clean until it is accepted in the completed work.
- B. Removal of Materials: Exercise special care to avoid leaving bits of wood, dirt, and other foreign particles in the pipe. If any particles are discovered before the final acceptance of the work, remove and clean the pipe.

3.5 DISINFECTION

- A. General: Disinfect all pipelines that are to carry potable water in accordance with Section 025400.

END OF SECTION

NO TEXT FOR THIS PAGE

SECTION 330520

PIPE REMOVAL AND ABANDONMENT

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes: Removal and abandonment of piping and appurtenances, wholly or in part, as required to complete Work as shown on the Drawings and specified in this Section.
- B. Related Work Specified in other Sections Includes:
 - 1. Section 020500 – Connection to Existing Systems
 - 2. Section 033100 – Concrete, Masonry Mortar and Grout
 - 3. Section 312316 – Excavation – Earth and Rock
 - 4. Section 312323 – Backfilling

1.2 SUBMITTALS

- A. General: Provide all submittals, including the following, as specified in Division 1.
- B. Submit the following:
 - 1. Proposed methods for pipe removal and abandonment;
 - 2. Equipment proposed to be used to do pipe removal and abandonment work;
 - 3. Resume of pipe grouting subcontractor;
 - 4. Pipe removal and abandonment schedule/sequence.
- C. If a detour is required, submit a traffic control plan for approval to County Manager or designee and/or the Florida Department of Transportation as described in Section 015526.

1.3 SITE CONDITIONS

- A. General
 - 1. Prior to any work, a proper and approved maintenance of traffic plan (MOT) shall be submitted to the engineer and the County.
 - 2. Execute pipe removal and abandonment so that there is no injury to persons or damage to adjacent buildings, structures, equipment, materials, piping, wiring, pavement, fences, trees, guardrails, and other adjacent improvements. Execute demolition and abandonment so that access to facilities that are in operation and to residences and businesses is free and safe.
 - 3. Execute pipe removal and abandonment so that interference to vehicular traffic and personnel traffic does not exceed scheduled interference. Do not place rubble,

excavation, piping, or other materials removed on roadways, drives, or sidewalks that are to remain in service.

PART 2 - PRODUCTS

2.1 TEMPORARY MATERIALS

- A. Provide temporary fencing, barricades, barriers, piping, valves, pumps, power and controls, and water necessary to meet the requirements of this Section.
- B. Temporary fencing, barricades, barriers, and enclosures shall be suitable to the purpose intended.

2.2 REPAIR AND REPLACEMENT MATERIALS

For repair or replacement of existing facilities or improvements to remain, use materials identical to, or equal to, materials used in existing work when new.

PART 3 – EXECUTION

3.1 GENERAL

- A. Conduct pipe removal and abandonment as shown and specified in the Contract Documents.
- B. Conduct pipe removal and abandonment so that existing equipment, piping, wiring, structures, and other improvements to remain are not damaged. Repair or replace equipment, piping, wiring, structures, and other improvements damaged at no additional cost to the County.
- C. Do not remove equipment, piping, wiring, structures, or other improvements not shown or specified to be removed. If equipment, piping, wiring, structures, or other improvements not shown or specified to be removed is removed, replace equipment, piping, wiring, structures, or other improvements at no additional cost to the County.

3.2 DISCONNECTIONS

- A. Prior to starting pipe removal or abandonment, check underground and exposed existing utilities, piping, and equipment within the limits of pipe removal or abandonment. Prior to starting, check underground and exposed existing utilities, piping connected to and associated with existing pipe to be removed or abandoned. Verify the following:
 - 1. Piping is inactive (abandoned);
 - 2. Other utilities which may be in conflict have been permanently or temporarily disconnected, if required:
- B. Do not proceed with salvage or demolition if piping is active or utilities have not been disconnected.

3.3 ABANDONMENT

- A. The Contractor shall, as described on the Drawings and as may be directed by the County, abandon in place the following existing utility improvements:
1. All water mains, reuse water mains and raw water mains that are designated to be abandoned shall be filled with grout. Refer to Section 033100 – Concrete, Masonry Mortar and Grout.
 2. All sewer lines, force mains, laterals and services that are designated to be abandoned shall be flushed clean and filled with grout. Prior to grout fill, sewer lines, force mains, laterals and services to be abandoned shall be flushed clean to remove wastewater and solids. Contractor is responsible for securing and providing flushing water, collection of flush water/wastewater, and disposal. The cleaning of these piping systems shall comply with all local and DEP requirements.
 3. Sewer manholes designated to be abandoned shall have the top two feet removed. The remainder of each manhole shall be abandoned and filled with grout or flowable fill. The excavation or pit shall be backfilled with select fill and compacted in accordance with Section 312323 – Backfilling and the trenching details on the Drawings.
- B. Appurtenances: All water hydrants, ARV valves and other appurtenances on abandoned lines shall be removed to the main and the fitting at the main shall be capped or plugged. All valves shall have the valve box, pad and operator removed, with the valve left in the open position unless specifically noted otherwise.
- C. Preparation:
1. The County shall be notified at least 72 hours in advance of grouting operations.
 2. Bulkheads shall be spaced at intervals of not more than 1,000 feet. If the line to be abandoned is longer, bulkheads shall be inserted in the pipe to maintain the required maximum spacing between bulkheads.
 3. Temporary vents shall be installed in the line to be filled at a maximum spacing of 150 ft. The vents shall be capable of being capped to allow further grouting operations.
- D. Equipment:
1. The materials shall be mixed or delivered in equipment of sufficient size and capacity to provide the desired amount of grout material for each stage in a single operation. The equipment shall be capable of mixing the grout at densities required for the approved procedure and shall also be capable of changing density as dictated by field conditions any time during the grouting operation.
 2. Mixers and Pumps - The grout shall be delivered to the injection point at a steady pressure with a non-pulsating centrifugal or triplex pump. Means shall be provided to increase or decrease the water-cement ratio. The system shall mix the grout to a homogeneous consistency. Means of accurately measuring grout component quantities, pumping pressures, and volumes pumped shall be provided.

3. Pressure Gauges - CONTRACTOR shall provide one pressure gauge at the point of injection and one pressure gauge at the grout pump. Grouting shall not proceed without appropriate calibrated gauges in place and in working order. Pressure gauges shall be equipped with diaphragm seals, have a working range between 1.5 to 2.0 times the design grout pressure, and have an accuracy within 0.5 percent of full range. Pressure gauges shall be instrument oil filled and attached to a saddle-type diaphragm seal to prevent clogging with grout.

E. Grouting:

Once grouting operations begin, grouting shall proceed uninterrupted from bulkhead to bulkhead. Grout placement shall not be terminated until both of the following conditions have been met, unless otherwise approved by the County: a) The estimated volume of grout to fill the line has been injected; and, b) grout has been expelled from the furthest vent or bulkhead. Bulkheads and temporary vents shall not be removed until the grout has set.

F. Testing and Sampling:

1. Take four test specimens for each 50 cubic yards of grout or for each four hours of placing.
2. Test in accordance with ASTM C109 except:
 - a. The specimens shall be 3 inch by 6 inch cylinders covered after casting to prevent damage and loss of moisture. Moist cure specimens for a period up to 7 days prior to a 28-day compressive strength test.
 - b. Do not oven dry specimens that are load tested. Specimens may be tested at any age to monitor compressive strength. The material may require special handling and testing techniques.

- G. The CONTRACTOR may remove the pipe in accordance with the Paragraph 3.04 in lieu of abandonment if acceptable to the County. Such removal, however, will be paid at the same price for pipe abandonment.

- H. All work under this Section shall comply with City, County, State and Federal regulations.

3.4 REMOVAL AND DISPOSAL

- A. The Contractor shall, as described on the Drawings and as may be directed by the County, remove the following existing utility improvements:

1. All water mains, reuse water mains and raw water mains that are designated to be removed.
2. All sewer lines, sewer manholes, force mains, laterals and services that are designated to be removed shall be flushed clean with water prior to removal. Contractor is responsible for securing and providing flushing water, collection of flush water/wastewater, and disposal. The cleaning of these piping systems shall comply with all local and DEP requirements.

- B. The pipe removal and disposal shall include all valves, fittings and appurtenances.

3.5 SALVAGE OF EQUIPMENT, PIPING, AND MATERIALS

- A. Remove items identified on the drawings or specified to remain the property of the County. Do not damage equipment, piping, and materials to be salvaged.
- B. Following removal of equipment, piping, and materials to be salvaged, place equipment, piping, and materials in a location within the County limits as designated by the County.

3.6 REPAIRS

Repair structural elements, equipment, piping, conduit, and other improvements to remain that are damaged during demolition. Use workers specifically qualified in trade, or trades, involved to repair damaged work.

3.7 DISPOSAL

- A. Remove and dispose of all equipment, piping, and materials from the jobsite not specifically designated to be retained by the County.
- B. Contractor shall not accumulate or store debris from demolition on the project site.
- C. The disposal of the piping, manholes and appurtenances shall be in accordance with County, State and Federal laws.

3.8 BACKFILLING

- A. Backfill excavations, trenches, and pits resulting from abandonment and removal according to Section 312323 – Backfilling.
- B. Backfill of the pipe trenches shall be according to the County details for pipe trench backfill. Pipe trenches for removed pipes that were within 3 horizontal feet of the edge of pavement shall be backfilled according to the detail for the type of roadway.

3.9 CLEANUP AND CLOSURE

- A. Following pipe abandonment or removal, clean-up areas where other work is to be done as specified in this Section, or Sections applicable to work to be done.
- B. Following pipe abandonment or removal, clean-up areas where no other work is to be done under this Contract. Remove debris and rubbish, temporary facilities, and equipment. Level surface irregularities to eliminate depressions. Leave work in a neat and presentable condition.
- C. In locations where a pipe to be abandoned or removed connects to a pipe that remains in service, the Contractor shall install a suitable cap or plug on the end of the active pipe.

END OF SECTION

NO TEXT FOR THIS PAGE

SECTION 331200
WATER VALVES AND APPURTENANCES

PART 1 GENERAL

1.1 SCOPE OF WORK

- A. Furnish all labor, materials, equipment, and incidentals required and install complete and ready for operation all valves and appurtenances as shown on the Drawings and as specified herein.

1.2 REFERENCES

- A. Codes, specifications, and standards referred to by number or title form a part of this Section to the extent required by the references to codes, specifications, and standards. Latest revisions, as of the date of bid opening, apply, unless otherwise noted on the Drawings or specified in this Section.

B. Standards

<u>Designation</u>	<u>Title</u>
ANSI/AWWA C111/A21.11	Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings
ANSI/AWWA C500	Gate Valves
ANSI/AWWA C509	Resilient-Seated Gate Valves 3 through 12 NPS, for Water and Sewage Systems
ANSI/AWWA C512	Air Release, Air/Vacuum, and Combination Air Valves for Waterworks Service
ANSI/B16.1	Cast Iron Pipe Flanges and Flanged Fittings, Class 125
ANSI/B16.3	Malleable Iron Threaded Fittings, Class 150 and 300
ANSI/B16.5	Pipe Flanges and Flanged Fittings, Steel Nickel Alloy and Other Special Alloys
ASTM A276	Specification for Stainless and Heat-Resisting Steel Bars and Shapes
ASTM A231	Specification for Steel Casting, Austenitic, for High-Temperature Service

ASTM A743 Specification for Castings, Iron-Chromium,
 Iron-Chromium-Nickel, and Nickel-Base
 Corrosion-Resistant for General Application

MSS SP-60 Connecting Flange Joint Between Tapping Sleeves and
 Tapping Valves

1.3 DEFINITIONS

- A. References to valve sizes on the Drawings and in the Specifications are intended to be nominal size, and shall be interpreted as nominal size.

1.4 SUBMITTALS

- A. General: as specified in:
 - 1. General Conditions;
 - 2. Supplementary General Conditions;

1.5 QUALITY ASSURANCE

- A. Testing: Test valves as specified in this Section.

PART 2 PRODUCTS

2.1 GENERAL:

- A. All valves and appurtenances shall be of the size shown on the Drawings and if possible all equipment of the same type shall be from one manufacturer.
- B. All valves and appurtenances shall have the name of the maker and the working pressure for which they are designed cast in raised letters on the body.
- C. All stainless steel components and hardware shall be a minimum of Type 304, unless otherwise specified.

2.2 MANUFACTURERS (SEE COUNTY APPROVED PRODUCT LIST, APPENDIX F).

2.3 DESIGN

- A. Resilient, Wedge or Gate Valves and Boxes
 - 1. Valves for pipe less than 2 inches in diameter shall conform to the requirements of AWWA C509 (latest revisions) and shall be cast iron, single wedge, non-rising stem, screwed bonnet, 125 pounds S.P., 200 pounds W.O.G with stuffing box repackable under pressure and all parts renewable.

Ends shall be as shown or indicated on the drawings. For approved air release line valves, bacterial sampling station line valves, curb stops, corporation stops, and ball valves see County Approved Product List, Appendix F.

2. Resilient, wedge or gate valves 2 inches in diameter and larger shall be ductile iron body, non-rising stem, bronze mounted gate valves, mechanical joint conforming to requirements of the AWWA C515 and shall be provided with a 2 inch square operating nut with the word "open" and an arrow cast in the metal to indicate direction. Valves shall be vertical resilient, wedge, or gate type and shall turn to the left (counter clockwise) to open. The wedge or gate shall be ductile iron per ASTM A536, minimum 65,000-psi strength and, completely encapsulated with urethane rubber, permanently bonded to the wedge or gate to meet ASTM test for rubber metal bond, ASTM D429. The valve stems for non-rising stem assemblies shall be cast bronze with integral collars in full compliance with AWWA. OS & Y stems shall be on bronze bar stock. The NRS stem stuffing box shall be the O-ring seal type with two rings located above thrust collar; the two rings shall be replaceable with valve fully open and subjected to full rated working pressure. The minimum safe working pressure shall be 200 psi. All valves thirty inches (30") or larger shall have a concrete slab placed under the valve to help distribute the total weight of the valve and reduce line sagging. The concrete slab shall have 6"x6" 10/10 welded wire mesh, have lifting eyes, constructed using 3,000 psi concrete, be six inches (6") thick, and sized according to the following table:

Valve Size	Length	Width
30"	42"	30"
36"	48"	36"
42"	54"	42"
48" – 54"	60"	48"
60" – 66"	78"	60"

3. There shall be two low torque thrust bearings located above and below the stem collar. The stem nut shall be independent of wedge and shall be made of solid bronze. There shall be a smooth unobstructed waterway free of all pockets, cavities and depressions in the seat area. The body and bonnet shall be coated with fusion-bonded epoxy both interior and exterior. Each valve shall have the manufacturers name, pressure rating and year manufactured cast on body. The valve shall be designed and tested to be opened and closed under a differential pressure of at least twice the working pressure.

B. Valves for Buried Service

1. Valves for buried service shall meet all the requirements as specified herein but shall have mechanical joint ends and stainless steel cover bolts.

2. All buried valves shall have cast-iron two-piece valve boxes (see County Approved Product List, Appendix F). Valve boxes shall be provided with suitable heavy bonnets to extend to such elevation at the finished grade surface as directed by the ENGINEER. The barrel shall be two-piece, screw type. The upper section shall have a flange at the bottom having sufficient bearing area to prevent settling, shall be designed so as to prevent the transmission of surface loads directly to the valve or piping, and shall be complete with cast iron covers. Covers shall have "WATER" cast into the top. The covers shall be so constructed as to prevent tipping or rattling. All valve boxes located in paved roadways or sidewalks shall have locking covers.
3. Where valves are located out of pavement, the boxes shall be adjusted to finished grade with a concrete collar as shown in the Details.
4. Valve boxes shall be of the heavy duty, traffic bearing cast iron, adjustable screw type with a drop cover. The valve box assembly shall consist of a bottom section, top section and cover which is cast from gray iron, formulated to ASTM specification A-48 latest revision, minimum tensile of 21,000 psi and shall be free from blowholes, shrinkage or other imperfections not true to pattern. The shaft size shall be 5 1/4" and the adjustable length shall be from 18" to 36". The wall thickness shall be 1/4". The weight of the assembly shall be 61 pounds $\pm$ 2 pounds, with the cover weight being a minimum of 13 pounds.
5. The name of the manufacturer and foundry of origin shall be cast into each of the components of the assembly in legible form. The assembly shall be suitable for highway traffic wheel loads of 16,000 pounds and shall withstand a proof load test of 25,000 pounds without failure or permanent deflection.

C. Check Valves

1. All check valve bodies shall be cast iron per ASTM A126 Class B, having integral (not wafer) flanges.
2. The seat shall be centrifugally cast bronze with an O-ring seal and be locked in place with stainless steel lock screws and be field replaceable, without the use of special tools.
3. Swing check valves shall have a shaft of single and continuous stainless steel, extending both sides of the body with a lever and weight. The air cushion cylinder, when specifically required, shall be constructed of corrosion resistant material and the piston shall be totally enclosed within the cylinder and not open at one end. The air cushion cylinder assembly shall be externally attached to either or both sides of the valve body and shall permit adjustability to cushion the closure of the valve. Cushioning shall be by air trapped in the cushion cylinder, which shall be fitted with a one-way adjustable control check valve to cushion disc contact to the seat at

the shut-off point. The bottom cylinder head shall be swivel mounted and not rigid to follow the change of force angles as the lever raises or lowers to open or close the check valve. Valve shall prevent backflow on normal pump shut off or power failure, at zero velocity and be watertight. The disc shall be cast iron utilizing a double clevice hinge connected to a ductile iron disc arm. The disc arm assembly shall be suspended from a stainless steel shaft, which passes through a seal retainer on both sides of the valve body.

4. Rubber flapper swing valves shall have a heavily constructed cast iron body and cover. The body shall be long pattern design (not wafer) with integrally cast-on end flanges. The flapper shall be Buna-N having an O-ring seating edge and be internally reinforced with steel. Flapper shall be captured between the body and the body cover in a manner to permit the flapper to flex from closed to full open position. Flapper shall be easily removed without the need to remove the valve from line. The check valves shall have full pipe size flow area. Seating surface to be on a 45° angle requiring the flapper to travel only 35° from closed to full open position for minimum head loss. Valve has non-slam closure characteristics. Flapper shall create an elastic spring effect to assist the flapper to close against a slight head to prevent or minimize slamming. Valve shall be designed for 175 psi working pressure for water. The valve shall be suitable for buried service.
5. Valve exterior to be painted with Red Oxide Phenolic Primer Paint as accepted by the FDA for use in contact with Potable Water. Materials shall be certified to the following ASTM specifications:
 - a. Body, cover & disc - Cast Iron - ASTM A126, Class B
 - b. Disc Arm - Ductile Iron - ASTM A536
 - c. Seat - Aluminum Bronze or Stainless Steel - ASTM B148, ASTM A276
 - d. Disc Seat - Buna-N or metal
 - e. Cushion cylinder - Corrosion-resistant Commercial material

D. Backflow Prevention Devices

1. Backflow prevention devices shall be reduced pressure principle assemblies and shall be USC approved, and shall meet all requirements of the Collier County Cross-Connection Control/Backflow Prevention Ordinance, as then amended. Refer to Section 3, Utility Detail Drawings.

E. Combination Air Release Valves for Potable Water and Non-Potable Irrigation Systems

1. Air release valves shall exhaust large quantities of air during the filling of a pipeline or vessel. The valve shall be capable of venting air up to sonic

velocity without blowing shut; closing only after all the air has been vented. The valve shall continue to release small quantities of air under pressure as often as needed to keep the system free of accumulated air. The valve shall automatically open to allow air to re-enter during draining or whenever a negative pressure occurs.

2. Combination air valves shall be of the size shown on the plans and conform to the requirements of AWWA C512 and be of the "Kinetic" design capable of exhausting air at up to sonic velocity without blowing shut.
3. Body and cover shall be ASTM A126 Class B cast iron with stainless steel floats and replaceable seats of Buna-N or other suitable material. Internal linkage mechanism shall be 18-8 stainless steel. Plastic or bronze components are not acceptable. Air release orifice shall be suitable for 300 PSI maximum working pressure. Screens shall be installed on the opening of all air release valves.
4. Valves 3-inch size and smaller shall have a threaded inlet connection, and larger valves shall have a flanged inlet faced and drilled per ANSI B16.1 Class 250.
5. Valves shall have a threaded outlet on valves to 4-inch size and a protective cowl on larger sizes.
6. 1 inch NPT inlet and outlet shall be provided, unless otherwise specified on the drawings.
7. Connections from corporation stops to air release valves shall be brass for rigidity.

F. Tapping Valves and Sleeves

1. All tapping sleeve and valve assemblies shall meet the requirements of AWWA Standard C500, latest revision. Cast iron tapping sleeves or stainless steel wrap-around sleeves, and cast iron valves shall be used to make live taps into the existing water mains where shown on the drawings. Flanges must conform to AWWA C207 Class D ANSI 150# drilling. Mechanical Joint (MJ) tapping sleeves are also acceptable. All bolts and nuts shall be stainless steel.
2. CONTRACTOR shall verify type of existing main prior to ordering. The tapping valve shall have an inlet flange to match the sleeve and a mechanical joint outlet for connection to water main pipe. Tapping valve shall meet the requirements for gate valves specified herein. The sleeve shall have provisions for a tap and shall be pressure tested at 150 psi for a minimum of 30 minutes prior to tapping.

G. Service Connection Materials

1. Service Saddles (see County Approved Product List, Appendix F)
 - a. Service saddles or fittings shall be used with taps to all types of pipe. Gasket shall be cemented in place and confined in a retaining groove. Saddles shall be cast iron saddles with double brass straps.
 - b. Tapping sleeves and valves shall be used for all taps.
2. Water Meters
 - a. Potable Water Meters: Potable water meters provided for service connections to the COUNTY water distribution system shall be designed to accept an encoder compatible with the COUNTY Automatic Meter Reading (AMR) system. The COUNTY will install the meter and the AMR encoder unit on 2" and smaller meters. AMRs 3" and larger shall be turned over to the technician doing the full bore flush. All potable water meters larger than 2" shall be installed above ground. These meters shall be equipped with a backflow preventer and installed by the CONTRACTOR at his expense, including the AMR encoder unit. The type of backflow device utilized for potable lines shall be on the Water Department approved list of backflow preventers, Appendix G. All potable water meters 3" or greater shall be purchased by the owner and installed by the CONTRACTOR. The master meter assemblies shall be built in accordance with the design details in Section 3 – Utilities Detail Drawings. The location of all meters shall be clearly shown on the construction plans.
 - b. Non-Potable Irrigation Water Meters: Non-potable water meters provided for service connections to the COUNTY non-potable reclaimed distribution system shall be designed to accept an encoder compatible with the COUNTY Automatic Meter Reading (AMR) system. The COUNTY will install the meter and the AMR encoder unit on 2" and smaller meters. All non-potable water meters 3" or greater shall be purchased by the owner and installed by the CONTRACTOR. The master meter assemblies shall be built in accordance with the design details in Section 3 – Utilities Detail Drawings. The location of all meters shall be clearly shown on the construction plans.
3. Corporation Stops for Service Connections
 - a. Corporation stops (see County Approved Product List, Appendix F) shall meet the requirements of AWWA C800; ends AWWA thread x compression, CTS.
4. Water Service Tubing

- a. Water service connection tubing shall be blue polyethylene municipal service tubing as shown on Utility Detail Drawing W-12.
- b. Polyethylene tubing shall meet the requirements of AWWA Standard C901. Polyethylene tubing shall be 3406 polyethylene.

5. Polyethylene Service Tube Stiffeners

- a. A solid ring, stainless steel insert shall be installed with each and every compression connection made with polyethylene tubing.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install all valves and appurtenances in accordance with manufacturer's instructions and in the locations shown, true to alignment and rigidly supported. Repair any damage to the above items to the satisfaction of the ENGINEER before they are installed.
- B. After installation, test all valves and appurtenances for at least one hour at the working pressure corresponding to the class of pipe, unless a different test pressure is specified. If any joint proves to be defective, repair it to the satisfaction of the ENGINEER.
- C. Install all floor boxes, brackets, extension rods, guides, the various types of operators and appurtenances as shown on the Drawings that are in masonry floors or walls, and install concrete inserts for hangers and supports as soon as forms are erected and before concrete is poured. Before setting these items, check all plans and figures, which have a direct bearing on their location and assure the proper location of these valves and appurtenances during the construction of the structures.
- D. Flanged joints shall be made with stainless steel bolts.
- E. Buried mechanical joints shall be made with COR-TEN bolts.
- F. Prior to assembly of split couplings, thoroughly clean the grooves as well as other parts. The ends of the pipes and outside of the gaskets shall be moderately coated with petroleum jelly, cup grease, soft soap or graphite paste, and the gasket shall be slipped over one pipe end. After the other pipe has been brought to the correct position, center the gasket properly over the pipe ends with the lips against the pipes. The housing sections then shall be placed. After the bolts have been inserted, tighten the nuts until the housing sections are firmly in contact, metal-to-metal, without excessive bolt tension.
- G. Prior to the installation of sleeve-type couplings, thoroughly clean the pipe ends for a distance of 8". Soapy water may be used as a gasket lubricant. A follower

and gasket, in that order, shall be slipped over each pipe to a distance of about 6" from the end, and the middle ring shall be placed on the already laid pipe end until it is properly centered over the joint. Insert the other pipe end into the middle ring and bring to proper position in relation to the pipe already laid. The gaskets and followers shall then be pressed evenly and firmly into the middle ring flanges. After the bolts have been inserted and all nuts have been made up finger-tight, uniformly tighten diametrically opposite nuts progressively all around the joint, preferably by use of a torque wrench of the appropriate size and torque for the bolts.

- H. Carefully inspect each valve, open it wide and then tightly close it and test the various nuts and bolts for tightness. Special care shall be taken to prevent any foreign matter from becoming lodged in the valve seat. Gate valves, unless shown otherwise, shall be set with their stems vertically above the centerline of the pipe. Remove and replace any valve that does not operate correctly.
- I. Carefully center valve boxes over the operating nuts of the valves so as to permit a valve wrench or key to be fitted easily to the operating nut. Valve boxes shall be set to conform to the level of the finished surface and held in position by a ring of concrete placed under the support flange as shown in Section 3, Utility Detail Drawings. The valve box shall not transmit surface loads to the pipe or valve. Exercise care to prevent earth and other material from entering the valve box. Any valve box which is out of alignment or whose top does not conform to the finished ground surface shall be dug and reset. Before final acceptance of the work, adjust all valve boxes to finish grade. Valve extension stems or risers shall not be used.

3.2 AIR RELEASE VALVE INSTALLATION

- A. Prior to pressure testing a pipeline, all air release valve assemblies on that pipeline shall be installed.

3.3 SHOP PAINTING

- A. Ferrous surfaces of valves and appurtenances shall receive a coating of epoxy in accordance with AWWA Standard C550 and meets or exceeds all test requirements including the Food and Drug Administration Document Title 21 of the Federal Regulations on Food Additives, Section 175.000 entitled "Resinous and Polymeric Coating"; Impact Test Requirement in accordance with the ASTM D2794.

END OF SECTION

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Specifications for Rehabilitation of Two Collier County Production Wells: RO-118N & RO-120N



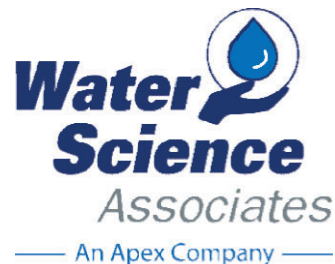
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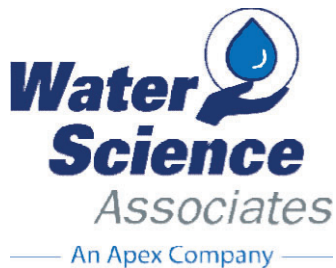


JULY 2024



13620 Metropolis Avenue, Suite 110
Fort Myers, Florida 33912
O 239.204.5300 ♦ F 866.398.2426
www.waterscienceassociates.com

Specifications for Rehabilitation of Two Collier County Production Wells: RO-118N & RO-120N



JULY 2024

W. Kirk Martin, P.G. 0079
Principal Scientist

Andrew McThenia P.G. 2318
Senior Hydrogeologist

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- Table 2. Work sequence referenced to Quote Schedule items.
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- Figure 2. Construction Details of RO-118N and RO-120N
- Figure 3. Temporary HCl Injection Piping Configuration Schematic

1.0 PURPOSE AND SCOPE

The purpose of this document is to provide the technical specifications for testing and rehabilitation treatment of two Collier County Water and Sewer District (CCWSD) public supply wells, RO-118N and RO-120N. The selected wells were previously constructed but were never equipped with the necessary pumping and discharge piping facilities to be operated. Prior to bringing these wells into an operational status, it is necessary to conduct the specified testing and treatment to verify the water quality and maximize the well capacity by acidification treatment using hydrochloric acid (HCl).

The CONTRACTOR will be required to obtain coverage under the Florida Department of Environmental Protection (FDEP) Generic Permit for the Discharge of Groundwater from Dewatering Operations prior to discharging produced ground water from the production wells.

The CONTRACTOR will coordinate with CCWSD operational staff to determine the sequence for well rehabilitation based on the County's operational schedule and system demands. Refer to **Figure 1** for a map showing the locations of the wells to be treated. Refer to **Figure 2** and **Table 1** for construction details of the selected wells.

The products and equipment required for the testing and rehabilitation are listed in Section 2. The technical specifications for well treatments are provided in Section 3.

Table 1. Construction Details for Selected Wells.

Well ID	Well Diameter (inches)	Casing Depth (ft. bls)	Total Depth (ft. bls)	Casing Material	Completion Date
RO-118N	16	465	590	FRP	February 2006
RO-120N	16	427	473	FRP	November 2005

2.0 GENERAL REQUIREMENTS

- 2.1 CONTRACTOR'S LICENSURE REQUIREMENTS:** The CONTRACTOR for this project will provide documentation showing that their firm is licensed with the State of Florida as a Water Well Contractor under Chapter 62-532, F.A.C. to engage in the business of construction, modification, repair, or abandonment of a well.
- 2.2 CONSTRUCTION SCHEDULE:** The CONTRACTOR will submit a detailed schedule prior to the commencement of any sitework. The schedule will include a proposed mobilization, completion, and demobilization date. The CONTRACTOR will schedule all work or tests during daylight hours (7:00 a.m. to 6:00 p.m.) unless prior approval from the ENGINEER and OWNER has been obtained; except for HCl injection which will be allowed during all hours.
- 2.3 WATER SUPPLY:** The CONTRACTOR will provide the OWNER and ENGINEER with a description of his water supply needs at a required pre-construction meeting. The CONTRACTOR will coordinate with the OWNER for access to raw water from the transmission main adjacent to each well site. The CONTRACTOR is responsible for metering the volume of water supplied by the OWNER to the OWNER's satisfaction. The cost of water for this project will be included in the lump sum price for mobilization and site preparation. The CONTRACTOR will obtain any temporary hydrant meters and/or backflow prevention devices that may be required by the OWNER and will pay any deposits and rental as required by the OWNER.
- 2.4 ELECTRICITY:** All electric current required by the CONTRACTOR will be furnished at his own expense. All temporary lines will be furnished, installed, connected, and maintained by the CONTRACTOR in a workmanlike manner satisfactory to the OWNER and ENGINEER and will be removed by the CONTRACTOR in like manner at his expense at the completion of the work. All temporary electrical fixtures, lines, and related equipment and installation will be in accordance with applicable city, county, and state regulations.
- 2.5 EQUIPMENT REQUIREMENTS:** Equipment utilized for this project will be in first-class working order. The CONTRACTOR will use his own equipment, having the minimum capabilities necessary to do the described work. No delays or work stoppages will be tolerated because of equipment failure. Nor will equipment failure be considered a valid reason for extending the length of the contract. The CONTRACTOR will be held responsible, and payment may be withheld for damages to the wells due to any cause of negligence, faulty operation, or equipment failure.
- 2.6 REMEDIAL WORK:** If remedial work proves to be necessary to make the well acceptable to the OWNER to comply with the regulations and/or Specifications because of accident, loss of tools, defective material, or for any other cause, the CONTRACTOR will propose a method of correcting the problem, in writing. Suggested methods will be reviewed and approved by the ENGINEER before work proceeds. Such work will be performed at no additional cost to the OWNER, and it will not extend the length of the contract. The CONTRACTOR is notified that all specifications will be met as designated by the ENGINEER.
- 2.7 DAILY LOG:** The CONTRACTOR will maintain a detailed daily log of the testing and remediation operations. The logs will be on printed forms and will give a brief description of all field activities and pertinent data as may be required by the

ENGINEER. One copy of each daily log will be submitted to the ENGINEER daily.

- 2.8 SITE PREPARATION:** No clearing is expected to be needed for the sites. The CONTRACTOR will take precautions to avoid damage to the OWNER's property. Any damage to public or private property will be repaired or paid for by the CONTRACTOR at no expense to the OWNER. The CONTRACTOR will install "No Trespassing" signage to keep onlookers out of the work area. The OWNER is not responsible for damage of theft to the CONTRACTOR's equipment.
- 2.9 MAINTENANCE OF TRAFFIC:** As applicable, and as directed by the ENGINEER, the CONTRACTOR will file a traffic control plan and obtain approval within the appropriate local, county, or state traffic departments. When work occurs within Department of Transportation rights-of-way or easements, the CONTRACTOR will submit to the ENGINEER, a Maintenance of Traffic Plan that shows the measures for traffic management during the well installation. This Plan will include appropriate signage, barricades and/or temporary striping in accordance with the Florida Department of Transportation, Roadway, and Traffic Design Standards, (Topic #625-010-003-6) and/or the Manual on Uniform Traffic Control Devices (MUTCD), Part VI, Standards and Guides for Traffic Controls for Street and Highway Construction, Maintenance, Utility, and Incident Management Operations.
- 2.10 SAFETY:** The CONTRACTOR is expected to perform the proposed work in a safe manner. If the CONTRACTOR has safety concerns regarding the proposed work, alternative methods may be proposed by the CONTRACTOR in writing prior to commencement of work. Alternative methods must be approved by the ENGINEER before execution. The CONTRACTOR will use every precaution necessary to ensure a safe work area and will comply with all U.S. Occupational Safety and Health Administration (OSHA) and U.S. Environmental Protection Agency (USEPA) regulations regarding the types of work described in this Specifications.
- 2.11 CONTRACTOR SUBMITTALS:** At least 10 days prior to the commencement of work, the CONTRACTOR will provide the ENGINEER the following:
1. Detailed work schedule
 2. FDEP Generic Permit for Discharge of Groundwater
 3. Name and address of any subcontractors used for the job
 4. Detailed drawing of the acidification wellhead
 5. Health and Safety Plan
 6. SDS sheets for HCl, and additives
 7. Manufacturer's specifications and pump curve for temporary submersible test pump
 8. Disinfection and well suppression procedure including chemical SDS sheets for disinfectant.
 9. Details of any proposed containment and sedimentation and erosion controls to be used.
- 2.12 GUARANTEE:** The CONTRACTOR guarantees that the work and services performed under the contract and that all workmanship, materials, equipment furnished, used, or installed in the work will be free from defect and flaws, and will be performed and furnished in strict accordance with the contract documents; that the strength of all parts of all manufactured equipment will be adequate and as specified; and that the performance test requirements of the contract documents will be fulfilled. The CONTRACTOR will repair, correct, or replace all damage to the work resulting from failures covered by the guarantee.

2.13 STANDBY TIME: The OWNER may ask the CONTRACTOR to stop operations so that extra work not included in these Specifications, such as testing or additional data collection, can be performed. The OWNER and ENGINEER will schedule the request, so it causes a minimum of delay. All standby time for which extra payment will be made will be approved by the ENGINEER in writing in advance. The CONTRACTOR will be reimbursed at hourly rates agreed upon with the OWNER in the Task Order.

2.14 REGULATORY REQUIREMENTS: The CONTRACTOR will comply with all requirements and conditions of all permits related to the work of this contract and will comply with the provisions of any permits issued. The CONTRACTOR will be responsible for obtaining any necessary licenses and permits, and for complying with any applicable federal, state, and municipal laws, codes, and regulations, in connection with the execution of the Work. The CONTRACTOR will take proper safety and health precautions to protect the Work, the workers, the public and the property of others. The CONTRACTOR will be required to obtain coverage under the Florida Department of Environmental Protection (FDEP) Generic Permit for the Discharge of Groundwater from Dewatering Operations prior to discharging water from production wells.

2.15 REFERENCE STANDARDS: All design, material and work will be in strict accordance with all applicable governmental, regulatory, and testing organizations including, but not limited to the following:

ANSI – American National Standards Institute
ASTM – American Society of Testing and Materials
AWWA – American Water Works Association
DOH – Department of Health
FDEP – Florida Department of Environmental Protection
FDOT – Florida Department of Transportation
NSF – National Sanitation Foundation
OSHA – Occupational Safety and Health Administration

2.16 MEASUREMENT AND PAY: Measurement of an item of work will be by the unit indicated in the Task Order. Measurement will include all necessary and incidental related work not specified to be included in any other item of work listed in the quote schedule. Unless otherwise stated in individual sections of the Specifications or in the Quote Schedule, no separate payment will be made for any item of Work, materials, parts, equipment, supplies, or related items required to perform and complete the Work. The costs for all such items required will be included in the contract price quote for each item of which it is a part.

Payment will be made at the contract price per unit indicated in the Task Order with total price of the contract being equal to the Total Quote, as specified and as modified, by extending unit prices.

2.17 PROTECTION OF PROPERTY: The CONTRACTOR will take special precautions to reduce to a minimum the nuisances and damage to property which could result from working near a residential area and adjacent to a road. Any damage to public or private property will be immediately repaired or paid for by the CONTRACTOR at no expense to the OWNER. Equipment, tools, and materials will be stored at a location where they will produce a minimum of nuisance. The appropriate warning signs will be posted on the streets and the local authorities will be informed of the location of the construction

site.

2.18 NOISE CONTROL: Noise produced by field operations will be kept to a minimum. The CONTRACTOR will equip all machinery and equipment used for construction with noise devices such as mufflers, muffling sleeves, and spark arrestors or other suitable noise suppressors. Electric power will be used in lieu of internal combustion engine power whenever possible. Air compressors will be of a quiet type such as a “whisperized” compressor. The CONTRACTOR will comply with all applicable federal, state, and Collier County noise pollution control regulations. Noisy equipment will be kept as far as possible from noise sensitive site boundaries. Equipment will be properly maintained to reduce noise from excessive vibration, faulty mufflers, or other sources. No equipment will be left idling unnecessarily.

2.19 SITE RESTORATION AND DEMOBILIZATION: Upon completion of the work, the CONTRACTOR will disassemble all temporary piping and equipment modifications from the site and demobilize. The CONTRACTOR will remove all equipment which is not part of the well and leave the site in a condition acceptable to the OWNER. The CONTRACTOR will broom clean exterior paved surfaces and rake clean other adjacent surfaces of the grounds. The CONTRACTOR will return the Site to its original condition as defined by the ENGINEER.

2.20 SITE PHOTOS/VIDEO: The CONTRACTOR is required to take a digital photographs or video of pre- and post- construction site conditions of the well sites and surrounding areas to allow for clear comparisons of site conditions before and after the work is conducted.

FIGURES



FIGURE 1. MAP SHOWING LOCATIONS OF WELLS TO BE TREATED

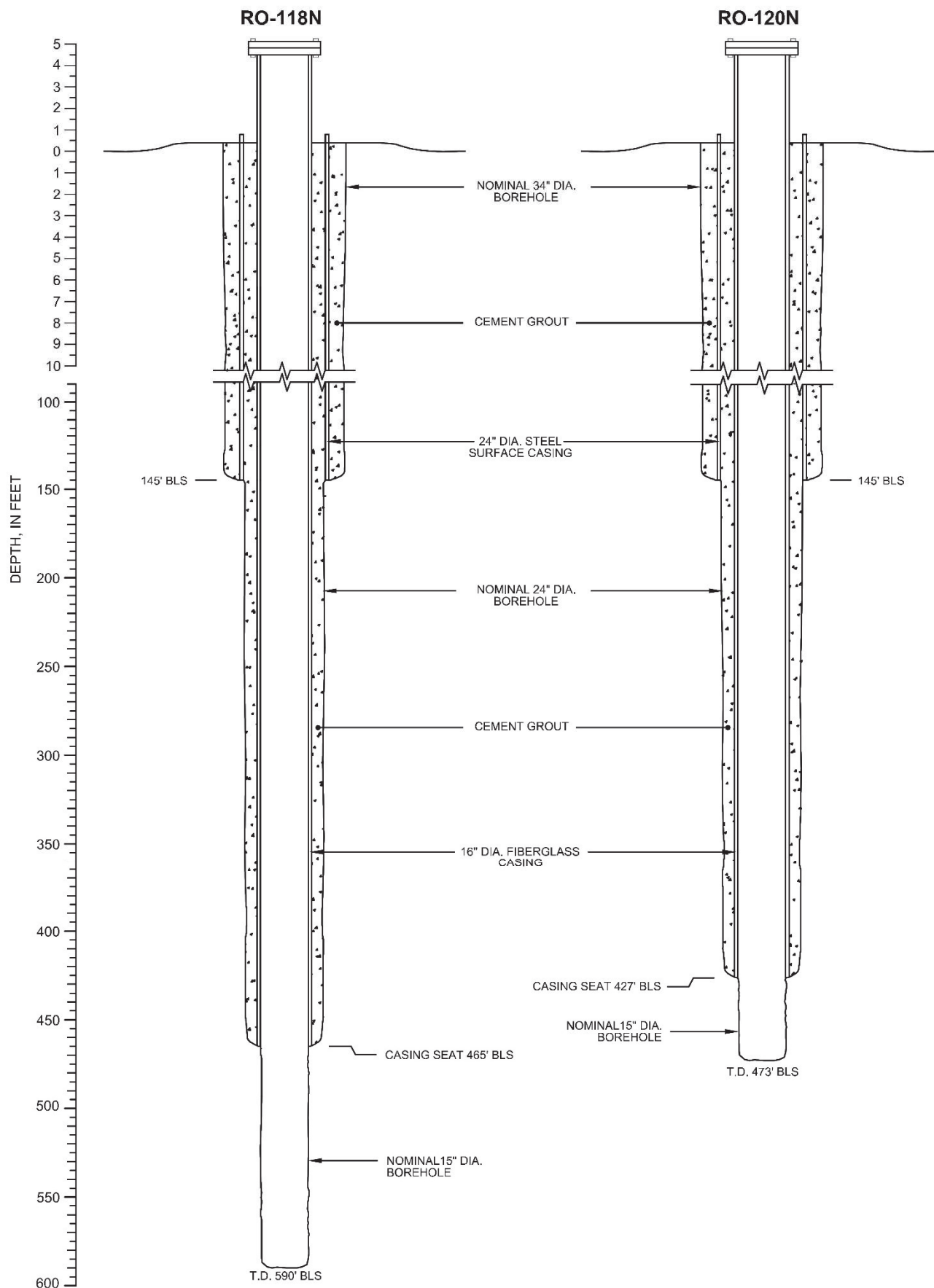


FIGURE 2. CONSTRUCTION DETAILS OF RO-118N AND RO-120N

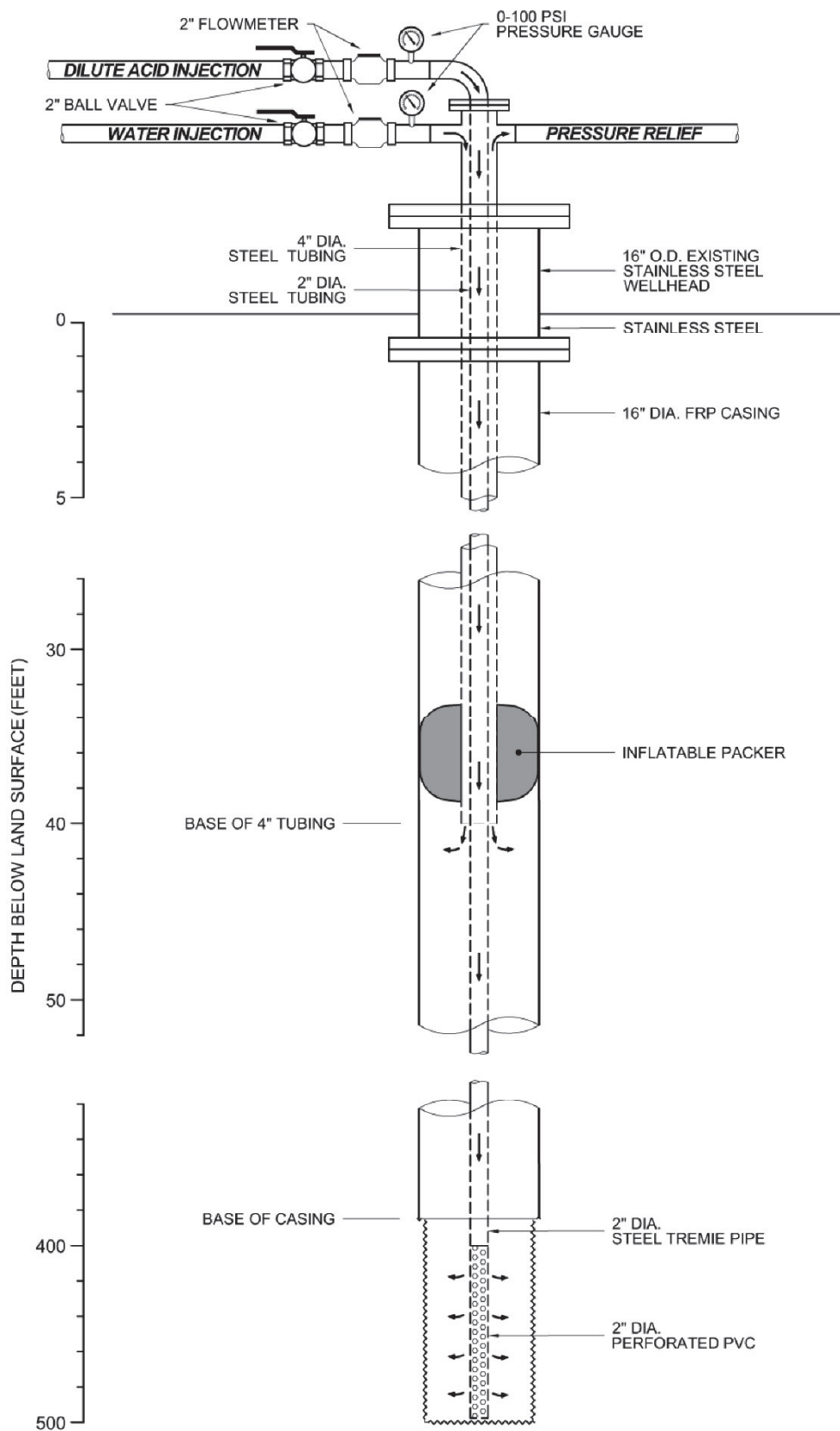


FIGURE 3. TEMPORARY HCL INJECTION PIPING CONFIGURATION SCHEMATIC

3.0 TECHNICAL SPECIFICATIONS FOR WELL ACIDIFICATION

3.1 GENERAL

3.1.1 SCOPE OF WORK: The scope of work includes the following: video survey, capacity testing, rehabilitation, development, sampling, and disinfection of two wells in Collier County's North Reverse Osmosis (NRO) wellfield. Wells RO-118N and RO-120N will be initially inspected with a downhole video survey and capacity tested via step-drawdown method using a temporary test pump. Each well will then be treated with a volume of 6,000 gallons of 32% HCl mixed in-line at 4 gpm with 150,000 gallons of raw water and injection of the mixture at a rate of 100 gpm over a period of 25 hours. Following the acidification, the wells will be developed by airlifting for a period of 16 hours and by high-rate pump development for a period of 16 hours. Following development, a post-treatment step-drawdown test will be conducted, and water samples will be collected from each well and analyzed by a certified laboratory for primary and secondary drinking water standards. After completion of treatment and testing, each well will be disinfected.

The CONTRACTOR will be responsible for providing all equipment needed for well development including an air compressor, temporary submersible pump, motor, generator, discharge piping, totalizer, and flow control. The temporary test pump will have a capacity of up to 700 gallons per minute. The CONTRACTOR will be required to obtain coverage under the Florida Department of Environmental Protection (FDEP) Generic Permit for the Discharge of Groundwater from Dewatering Operations prior to discharging water from the production wells.

3.1.2 WORK SEQUENCE: The specified work sequence is provided in **Table 2**.

Table 2. Work Sequence Summary

Step No.	Task Description
1	Obtain necessary permits. Mobilize equipment and materials to the site.
2	Perform pre-treatment downhole video camera survey
3	Install temporary test pump and perform pre-treatment step-drawdown test
4	Install required temporary wellhead, isolation packer, and tubing, and treat each well using 6000 gallons of HCl as specified
5	Conduct airlift surge development for 16 hours
6	Install temporary test pump and perform post-treatment high-rate pump development for 16 hours. Perform sand content, turbidity, and silt density index testing during pump development.
7	Conduct post-treatment step-drawdown test
8	Collect water samples and provide analysis results for primary and secondary drinking water standards.
9	Disinfect the well as specified
10	Clean and restore site and demobilize

3.2 PRODUCTS AND EQUIPMENT

The CONTRACTOR will provide all the products and equipment required to accomplish the work and all work will be supervised by the ENGINEER. Additional materials may be added to the list below. It is the CONTRACTOR's responsibility to ensure that adequate materials are provided for the successful completion of the work. The following products and equipment will be needed for the project.

- 3.2.1 SALT:** The CONTRACTOR will use only food grade granular sodium chloride which is NSF approved for use with drinking water systems for any necessary flow suppression during the project. The CONTRACTOR will provide the manufacturer's specifications for the salt to the ENGINEER prior to mobilization of the salt to the project site.
- 3.2.2 HYDROCHLORIC ACID:** The acid used for well treatment will be 32% inhibited Hydrochloric Acid (HCl) from a source and carrier approved by the ENGINEER. Certification from the acid supplier will be required to verify materials and acid quantities on the same working day as the acid delivery to the site.
- 3.2.3 HYDROCHLORIC ACID ADDITIVES:** A chelating agent, such as citric acid or Ban-T, will be added to the hydrochloric acid prior to injection into the well. The purpose of the chelating agent is to keep dissolved metal ions such as iron and calcium in solution during the acid treatment process. A mix concentration of 10 pounds dry weight or 1 gallon of liquid per 1,000 gallons of 32% acid will be achieved. Manufacturer's safety data sheets will be submitted to the ENGINEER for approval prior to acid delivery.
- 3.2.4 SODA ASH:** Sodium Carbonate in the form of dry powder will be used, if necessary, as per the manufacturer's instructions to raise the pH of discharged groundwater after acidification using HCl. The pH of water discharged will be no less than 6 pH units. Water will be neutralized in the specified water storage tank using soda ash to a pH of 6 or higher before it is discharged from the tank to ground.
- 3.2.5 TEMPORARY TEST PUMP:** For capacity testing and pump development, CONTRACTOR will provide and utilize a temporary submersible test pump capable of pumping 700 gpm at 100 feet of drawdown. The test pump will be installed on 6-inch diameter riser pipe and set at a depth of 120 feet below top of casing. The contractor will provide a temporary power generator for operation of the test pump.
- 3.2.6 TEMPORARY FLOWMETERS:** The CONTRACTOR will provide and install temporary flowmeters that are capable of instantaneous reading of flow and total gallons pumped. The meters will be new or have a calibration certificate within 60 days prior to the testing. The CONTRACTOR will submit a dated calibration certificate for the proposed flowmeters upon request of the ENGINEER.
- 3.2.7 TEMPORARY PRESSURE GAUGES:** The CONTRACTOR will provide and install temporary pressure gauges that are capable measuring and displaying pressures from 0 to 200 pounds per square inch (psi). A minimum of one pressure gauge on the wellhead and one gauge on the injection line are required.
- 3.2.8 INFLATABLE PACKER:** The inflatable packer to be used will be of sufficient size to fit within the existing 16-inch diameter well casing and will be installed and inflated

with the centerline of the packer at a depth of approximately 40 feet below top of casing (btoc). The packer will be installed on 4-inch diameter tubing and will be inflated to isolate the casing and wellhead above the packer from pressure generated by the acid reaction in the well below the packer.

- 3.2.9 TEMPORARY AIR COMPRESSOR:** For airlift development, the CONTRACTOR will provide and utilize an air compressor which will be capable of discharging air at a rate of 375 cubic feet per minute (cfm) at a pressure of 125 pounds per square inch (psi). Air compressors will be of a quiet type such as a “whisperized” compressor.
- 3.2.10 WATER QUALITY MONITORING METER:** The water quality monitoring instrument will be capable of measuring pH and temperature. The CONTRACTOR will provide a manufacturer’s specification for the instrument upon request to the ENGINEER.
- 3.2.11 WATER LEVEL MONITORING METER:** The water level measuring instrument will include an electronic sensor connected via a cable to a reel which will have both audible and visible indicators that the conductor probe is in contact with water. The instrument will have a minimum of 200 feet of cable which will be permanently marked with depth to water measurements in engineering scale increments of no greater than 0.01 feet.
- 3.2.12 WATER STORAGE TANK:** The CONTRACTOR will provide one or more water storage tanks with a minimum capacity of 10,000 gallons to capture spent acid and its byproducts for neutralization and solids settling prior to disposal.
- 3.2.13 ROSSUM SAND TESTER:** The CONTRACTOR will provide, install, and operate a Rossum Sand Tester or approved equal during the final 6 hours of pump development of each well.
- 3.2.14 TURBIDITY METER:** The CONTRACTOR will provide and operate a turbidity meter during pump development and during step drawdown testing. The meter will be capable of reading turbidity in nephelometric turbidity units (NTUs) in a range between 0 and 100 NTUs. The meter equipment will include factory calibration standards including 0 and 100 NTU samples which will be within the manufacture’s expiration dates.
- 3.2.15 SILT DENSITY INDEX (SDI) TESTER:** The CONTRACTOR will provide, install, and operate a Silt Density Index Tester as manufactured by Millipore or equal during final 6 hours of pump development. The CONTRACTOR will supply the manufacturer’s brand, or equal, of filter membranes with a mean pore size filter of 0.45 microns. The CONTRACTOR will submit the manufacturer’s specifications to the ENGINEER for approval prior to installation of the SDI testing equipment.
- 3.2.16 DISINFECTANT:** The CONTRACTOR will provide and install a disinfectant solution containing either calcium hypochlorite (HTH) or sodium hypochlorite as per specification section **3.3.13 DISINFECTION**. The disinfectant will be NSF approved and will be transported to the project site in the original manufacturer’s containers.
- 3.2.17 FLANGE GASKETS, NUTS, AND BOLTS:** The CONTRACTOR will provide and install new flange gaskets for each flange that is disconnected during the

performance of the work. The CONTRACTOR will store the OWNER's nuts and bolts onsite and will replace any lost or damaged pre-existing nuts and bolts with equivalent 316 stainless steel nuts and bolts.

3.3 EXECUTION

The CONTRACTOR will perform the work in accordance with all applicable worker health and safety procedures. The following methods and procedures are specified to be performed by the CONTRACTOR.

3.3.1 PRE-TREATMENT DOWN-HOLE VIDEO SURVEY: The CONTRACTOR will complete a video survey using a down-hole camera with side looking capability. To achieve good water clarity for the video survey, the CONTRACTOR is required pump or flow the well at a minimum flow rate of 100 gpm for at least 1 hour prior to the camera survey and to maintain the flow during the survey. The record of the video survey will include header information as follows: OWNER name, well ID, and date of survey. The video survey will display depth on the video output and will be recorded on a digital format such as DVD or memory storage device with copies distributed to the OWNER and ENGINEER at the completion of the survey.

3.3.2 PRE-TREATMENT STEP DRAWDOWN TESTING: The CONTRACTOR will install a temporary test pump and discharge piping assembly to conduct a pre-treatment 3-rate step drawdown test. The test will be performed at 50%, 75% and 100% of the estimated maximum capacity of the well and pump. The duration of each step will be 60 minutes. CONTRACTOR will provide and install any fittings necessary to measure the static and pumping water level in the well. The CONTRACTOR will supply and install an inline flowmeter capable of measuring instantaneous flow and providing totalized readings on the discharge line at flow rates up to 1000 gpm. All equipment installed in the well will be disinfected with a chlorine solution prior to installation. Prior to the test, the well may need to be pumped at the maximum capacity for 5 minutes and allowed to fully recover to determine the maximum flow rate of the well. The CONTRACTOR's staff will be present onsite throughout the test to ensure continuous operation of the pump and assist the ENGINEER in taking flow readings from the existing metering system and water level readings using an electronic water level measuring meter (to be provided by the CONTRACTOR).

3.3.3 WELLHEAD PREPARATION:

A schematic showing the typical details of the wellhead, packer, and injection tubing configuration is included as **Figure 3**.

Inflatable Packer The inflatable packer to be used will be of sufficient size to fit within the existing 16-inch diameter casing and be installed and inflated with the centerline of the packer at a depth of approximately 40 feet below top of casing (btoc). The packer is to be installed on 4-inch diameter tubing and will be inflated to isolate the casing and wellhead above the packer from pressure generated by the acid reaction in the well below the packer.

Feed Water: After isolating the raw water piping from the distribution system, install all necessary temporary fittings including flanges, valves, meters, etc. to facilitate the specified flow rate of 100 gpm of raw water from the raw water main to the

wellhead. The temporary piping must include an approved backflow prevention device.

Injection Tubing: The injection tubing for HCl injection include a minimum length of 450 feet of 2-inch diameter steel tubing and will also include one or more sections of perforated 2-inch diameter PVC, with a total length of up to 100 feet, for dispersion of the acid solution over section(s) of the open hole of the well to be determined by the ENGINEER based on the video survey.

Pressure Gauge: A pressure gauge capable of reading from 0 to 100 psig will be attached to the wellhead and injection tubing to monitor wellhead pressure during injection operations.

Wellhead Sealing: Any ports or vents in the wellhead will be sealed by threaded plugs if possible. Any leaks in the wellhead will be sealed using silicon sealant to prevent the escape of any gas or fluid from the wellhead. Excessive pressure is not expected for this process.

3.3.4 HYDROCHLORIC ACID INJECTION: The CONTRACTOR will install temporary piping necessary for blending 32% HCl into the injection feed line in the following specified quantities and rates:

- Each well will be treated with a volume of 6000 gallons of 32% HCl mixed in-line at 4 gpm with 150,000 gallons of raw water and injected at a rate of 100 gpm over a period of 25 hours.
- The prescribed citric acid additive (Section 3.2.3) will be mixed with the concentrated HCl prior to injection. A mix concentration of 10 pounds dry weight or 1 gallon of liquid per 1,000 gallons of 32% acid will be achieved.
- Wellhead pressure will be monitored during the injection process and flow will be adjusted to maintain injection pressure of less than 75 psi.

After completion of the acid injection process, the well will remain sealed in for a period of not less than 12 hours and no greater than 24 hours before initiating purging.

3.3.5 DISCHARGE WATER MANAGMENT: The CONTRACTOR will be responsible for containment of all fluids within the existing stormwater swales and ensuring that produced groundwater does not cause erosion or sedimentation or adversely impact any protected or environmentally sensitive areas. The pH of the spent acid is not expected to be less than 6 standard units; however, if it is less than 6 units, the recovered water will be neutralized using soda ash to a pH of 6 or higher before it can be discharged to the ground. The discharged water from the 4 HCl treated wells will be routed from each well into a minimum 10,000-gallon storage tank for neutralization and setting prior to discharge to ground. Development water is prohibited from direct discharge to any surface water bodies unless previously approved by the OWNER and follows regulatory guidelines. It is suggested that the CONTRACTOR route discharge from the settling tank to a location where the water can be contained on the surface where there is adequate capacity for the water to percolate into the ground. The CONTRACTOR will be responsible for installation of

appropriate erosion and sedimentation control measures such as silt fencing, hay bales, ditch blocks, temporary sediment traps, and/or containment berms. All erosion and sedimentation control measures employed will be installed to the standards set forth by the Florida Stormwater Erosion and Sedimentation Control Inspector's Manual and must be approved by the Engineer.

- 3.3.6 AIRLIFT DEVELOPMENT:** The CONTRACTOR will install a rigid airline with a minimum diameter of 2 inches and develop each well with compressed air released at a depth of 200 feet below pad level. The air compressor used will have a minimum capacity of 375 cubic feet per minute (cfm) at a pressure of 100 pounds per square inch (psi). The temporary well header used for airlifting will not reduce the diameter of the airlift discharge to less than 12-inches so that the airlift discharge remains minimally restricted. The distance from the wellhead to the point of discharge into the water storage tank or to ground will be no greater than 20 feet and there will be an air gap between the top of the storage tank and the discharge line. Perform airlift development with alternating periods of airlifting followed by recovery for a minimum of 16 hours. Each well will be developed until the water is sediment free for a period of one (1) hour.
- 3.3.7 HIGH-RATE PUMP DEVELOPMENT:** The CONTRACTOR will provide and install a temporary test pump and all ancillary equipment including motor, drop pipe, couplings, electric cable, power supply etc. and will perform high-rate pumping development for a minimum of 16 hours. The temporary test pump will be set on 8-inch diameter drop pipe to the same or greater depth as the existing permanent pump installation. The CONTRACTOR will supply a temporary generator and electric controls to power and control the test pump. The CONTRACTOR will alternate between pumping the well at near the maximum safe discharge rate allowed by the pump manufacture and then allow the well to recover before resuming pumping. The CONTRACTOR will supply the necessary testing equipment and will perform sand content, turbidity, and silt density index testing during the final 6 hours of pump development on wells RO-118N and RO-120N.
- 3.3.8 SAND CONTENT TESTING:** The CONTRACTOR will supply and install a temporary Rossum Sand Tester on the discharge piping of the well. The sand tester will be installed at the vertical centerline of the discharge pipe at a location of turbulent flow immediately (within 1 foot) downstream of a 90-degree elbow or other flow restriction. The mounting location and configuration of the sand tester will be approved by the ENGINEER prior to installation. There will be adequate backpressure on the sand content tester to achieve a minimum of ½ gallon per minute flow through the device and there will be a control valve between the tester and the discharge piping. Sand content tests will be conducted on an hourly frequency during the final 6 hours of pumping development on all wells treated.
- 3.3.9 TURBIDITY TESTING:** The CONTRACTOR will provide a calibrated turbidity meter as specified and will collect grab samples for turbidity at ½ hour intervals during the final 6 hours of pump development. The CONTRACTOR will record the turbidity readings for the final 6 hours of high-rate pump development of all wells treated.
- 3.3.10 SILT DENSITY INDEX TESTING:** During pumping development, the CONTRACTOR will install a silt density index tester on the pump discharge piping at an accessible location and according to manufacturer's guidelines. The silt density index tester will be installed at a location with sufficient back pressure

(approximately 30 psi) for the correct operation of the SDI tester. The SDI testing will be as directed by the ENGINEER. SDI testing will be initiated once turbidity levels are below 5 NTUs.

3.3.11 POST-TREATMENT STEP-DRAWDOWN TESTING: After completion of acidification and development, the CONTRACTOR will use a temporary test pump and temporary discharge piping to conduct a pre-treatment 3-rate step drawdown test. The test will be performed at 50%, 75% and 100% of the estimated maximum capacity of the well and pump. The duration of each step will be 60 minutes. The CONTRACTOR will measure the static and pumping water level in the well. The CONTRACTOR will supply and install a temporary inline flowmeter capable of measuring instantaneous flow and providing totalized readings on the discharge line at the specified rates. All instruments and equipment introduced into the well to measure water level will be disinfected with a chlorine solution prior to each use. Prior to the test, the well may need to be pumped at the maximum capacity for 5 minutes and allowed to fully recover to determine the maximum flow rate of the well. The CONTRACTOR's staff will be present onsite throughout the test to ensure continuous operation of the pump and assist the ENGINEER in taking flow readings from the existing metering system and water level readings using an electronic water level measuring meter (to be provided by the CONTRACTOR).

3.3.12 WATER QUALITY SAMPLING At the end of the step-drawdown test, the CONTRACTOR will contract with a laboratory approved by the Florida Department of Health to collect and analyze the required Primary and Secondary drinking water standard samples according to FDEP SOP FS 2200 Groundwater Sampling. The CONTRACTOR will ensure that the laboratory representative performs the required stabilization parameter measurements prior to sampling. The well shall be sampled and analyzed for Primary and Secondary drinking water standards listed in F.A.C 62-550, including the parameters listed in **Table 3**. Additional analyses are required for the following parameters: Alkalinity, Calcium, Manganese, Potassium, Ammonium, Strontium, Carbonate, Bicarbonate, Hydrogen Sulfide, Total Sulfide, and Turbidity.

Table 3. Analyses Required for Primary and Secondary Drinking Water Standards

Primary and Secondary Drinking Water Standards		
Maximum Contaminant Levels for Inorganic Compounds		
Federal Contaminant ID Number	Contaminant	MCL (mg/L)
1074	Antimony	0.006
1005	Arsenic	0.010
1010	Barium	2
1075	Beryllium	0.004
1015	Cadmium	0.005
1020	Chromium	0.1
1024	Cyanide (as free Cyanide)	0.2
1025	Fluoride	4.0
1030	Lead	0.015
1035	Mercury	0.002
1036	Nickel	0.1
1040	Nitrate	10 (as N)
1041	Nitrite	1 (as N)
	Total Nitrate and Nitrite	10 (as N)

1045	Selenium	0.05
1052	Sodium	160
1085	Thallium	0.002
Maximum Contaminant Levels for Volatile Organic Contaminants		
Federal Contaminant ID Number	Contaminant (CAS NUMBER)	MCL (mg/L)
2977	1,1-Dichloroethylene (75-35-4)	0.007
2981	1,1,1-Trichloroethane (71-55-6)	0.2
2985	1,1,2-Trichloroethane (79-00-5)	0.005
2980	1,2-Dichloroethane (107-06-2)	0.003
2983	1,2-Dichloropropane (78-87-5)	0.005
2378	1,2,4-Trichlorobenzene (120-82-1)	0.07
2990	Benzene (71-43-2)	0.001
2982	Carbon tetrachloride (56-23-5)	0.003
2380	cis-1,2-Dichloroethylene (156-59-2)	0.07
2964	Dichloromethane (75-09-2)	0.005
2992	Ethylbenzene (100-41-4)	0.7
2989	Monochlorobenzene (108-90-7)	0.1
2968	o-Dichlorobenzene (95-50-1)	0.6
2969	para-Dichlorobenzene (106-46-7)	0.075
2996	Styrene (100-42-5)	0.1
2987	Tetrachloroethylene (127-18-4)	0.003
2991	Toluene (108-88-3)	1
2979	trans-1,2-Dichloroethylene (156-60-5)	0.1
2984	Trichloroethylene (79-01-6)	0.003
2976	Vinyl chloride (75-01-4)	0.001
2955	Xylenes (total) (1330-20-7)	10
Maximum Contaminant Levels for Synthetic Organic Contaminants		
Federal Contaminant ID Number	Contaminant (CAS NUMBER)	MCL (mg/L)
2063	2,3,7,8-TCDD (Dioxin) (1746-01-6)	3 X 10 ⁻⁸
2105	2,4-D (94-75-7)	0.07
2110	2,4,5-TP (Silvex) (93-72-1)	0.05
2051	Alachlor (15972-60-8)	0.002
2050	Atrazine (1912-24-9)	0.003
2306	Benzo(a)pyrene (50-32-8)	0.0002
2046	Carbofuran (1563-66-2)	0.04
2959	Chlordane (57-74-9)	0.002
2031	Dalapon (75-99-0)	0.2
2035	Di(2-ethylhexyl)adipate (103-23-1)	0.4
2039	Di(2-ethylhexyl)phthalate (117-81-7)	0.006
2931	Dibromochloropropane (DBCP) (96-12-8)	0.0002
2041	Dinoseb (88-85-7)	0.007
2032	Diquat (85-00-7)	0.02
2033	Endothall (145-73-3)	0.1
2005	Endrin (72-20-8)	0.002
2946	Ethylene dibromide (EDB) (106-93-4)	0.00002
2034	Glyphosate (1071-83-6)	0.7
2065	Heptachlor (76-44-8)	0.0004
2067	Heptachlor epoxide (1024-57-3)	0.0002
2274	Hexachlorobenzene (118-74-1)	0.001
2042	Hexachlorocyclopentadiene (77-47-4)	0.05
2010	Lindane (58-89-9)	0.0002

2015	Methoxychlor (72-43-5)	0.04
2036	Oxamyl (vydate) (23135-22-0)	0.2
2326	Pentachlorophenol (87-86-5)	0.001
2040	Picloram (1918-02-1)	0.5
2383	Polychlorinated biphenyls (PCBs)	0.0005
2037	Simazine (122-34-9)	0.004
2020	Toxaphene (8001-35-2)	0.003
Secondary Drinking Water Standards		
Federal Contaminant ID Number	Contaminant	MCL (mg/L)
1002	Aluminum	0.2
1017	Chloride	250
1022	Copper	1
1025	Fluoride	2.0
1028	Iron	0.3
1032	Manganese	0.05
1050	Silver	0.1
1055	Sulfate	250
1095	Zinc	5
1905	Color	15 color units
1920	Odor	3 (threshold odor number)
1925	pH	6.5 - 8.5
1930	Total Dissolved Solids	500
2905	Foaming Agents	0.5
Radionuclides		
Contaminant		MCL
Combined radium226 and radium228		5 pCi/L
Gross alpha particle activity including radium226 but excluding radon and uranium		15 pCi/L
Uranium		30 ug/L

Abbreviations Used: MCL = maximum contaminant level
mg/L = milligrams per liter. pCi/L = picoCuries per liter
MRDL = maximum residual disinfectant level
CAS Number = Chemical Abstract System Number

3.3.13 DISINFECTION: The CONTRACTOR will thoroughly disinfect the well to inactivate any microbiological contaminant that may have been introduced into the well during rehabilitation. The well will be disinfected to remove contamination that may cause well water supply to be unsafe for human consumption, in accordance with Sections 1 through 4. and Section 5.2 of American Water Works Association (AWWA) Standard C654 as incorporated into Rule 62-555.330, FAC. The water in the well casing will be treated with chlorine approved by the state and local regulatory agencies. The quantity of chlorine used for disinfection will be sufficient to produce a minimum of 100 ppm and not more than 200 ppm residual chlorine in the solution when mixed with the total volume of water in the well. The disinfectant will be delivered to the site of the work in original closed containers bearing the original label indicating the percentage of available chlorine. The disinfectant will be furnished or prepared in liquid form and pumped into the well in sufficient volume to assure that the entire cased and open-hole portions of the well come into contact with the disinfection solution. A minimum of two well volumes of chlorine solution will be pumped into the well. An alternative disinfection method may be used with ENGINEER's written approval; however, it is the CONTRACTOR responsibility to

ensure that a uniform concentration of chlorine solution contacts the well casing and open-hole portions of the well and that the well is adequately disinfected to regulatory standards. The chlorine solution will stay in the well for a period of 24 hours after which the well will be pumped free of chlorine as indicated by a negligible chlorine residual, and in preparation for water quality sampling if requested by the ENGINEER. All equipment and material to be installed in the well will be chlorinated/disinfected prior to its installation. The CONTRACTOR will take adequate measures to collect the chlorinated water and dispose of it in a proper manner as per regulatory guidelines without impacts to natural systems. Measures will include, but are not limited to, impoundment of highly chlorinated water or dechlorination before disposal. If bacteriological evaluation shows the presence of coliform after disinfection, then the CONTRACTOR will perform corrective actions as determined by the ENGINEER.

3.3.14 SITE RESTORATION: The site will be restored to its original condition. All expended work materials will be removed from the site by the CONTRACTOR.

