

**BOARD OF COUNTY COMMISSIONERS
PALM BEACH COUNTY, FLORIDA
ENGINEERING AND PUBLIC WORKS
ROADWAY PRODUCTION DIVISION**

**Project Name: Lyons Road North of Lake Worth Drainage District (LWDD)
L-30 Canal to Boynton Beach Boulevard & Lyons Road and Boynton Beach
Boulevard Intersection Improvements**

Project Number: 2018503 & 2020110

Addendum No. 3

Date of Issuance: October 5, 2026

SPECIFICATIONS

Delete	Insert	Add
Sheet A	Sheet A-C	
		SP-42C thru SP-57C
		TSP-1 thru TSP-222

PLANS

Delete	Insert	Add
Signalization Plans Page T-1 (dated 03/09/26)	Signalization Plans Page T-1 (dated 9/18/26)	
Signalization Plans Page T-2 (dated 03/09/26)	Signalization Plans Page T-2 (dated 9/23/26)	
Signalization Plans Page T-5 (dated 03/09/26)	Signalization Plans Page T-5 (dated 9/17/26)	
Signalization Plans Page T-8 (dated 03/09/26)	Signalization Plans Page T-8 (dated 9/23/26)	
		Double Wide Hub Site Field Cabinet Page T-14-C (dated 9/16/26)
		2018503-Utility Relocation Plans Pages UT-01 thru UT- 69 (dated 09/25/26)
		2020110-Utility Relocation Plans Pages UT-01 thru UT- 17 (dated 09/25/26)
2018503 Roadway Plans Pages 1, 2, 13, 37, 38, 82, 84,	2018503 Roadway Plans Pages 1, 2, 13, 37, 38, 82, 84,	

85, 88-95 of 216 (dated 03/09/26)	85, 88-95 of 216 (dated 9/18/26)	
2020110 Roadway Plans Pages 1-3, 9-13, 19-25 of 48 (dated 09/21/26)	2020110 Roadway Plans Pages 1-3, 9-13, 19-25 of 48 (dated 9/18/26)	

REPORTS

Delete	Insert	Add
		GCME, Inc. Geotechnical Report, Mast Arm Structures & Box Culvert Pages 1-27 of 27, (dated 7/08/2021)
		TSFGeo Geotechnical Report, Roadway Pages 1-27 of 27 (dated 11/26/2024)
		TSFGeo Geotechnical Report, Mast Arms Pages 1-13 of 13 (dated 11/26/24)

P-PAGES

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Bid Proposal Form Pages P-1 – P-4	Bid Proposal Form Pages P-1C – P-8C	

It is required that **ADDENDUM NO. 3** be acknowledged in the space provided on the **PROPOSAL FORM**.

Approved By: Kate O. Farrell

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SPECIAL PROVISIONS

RESPONSE TO CONTRACTORS REQUESTS FOR INFORMATION

Wednesday, September 2, 2026 11:24 AM

Bergeron, Inc.

Brian Landis <blandis@bergeroninc.com

QUESTION 1 - ROADWAY LIGHTING, PROJECT 2018503

Reference: 2018503 Lighting Analysis, Sheet 31 (Luminaire Schedule and Calculation Summary); 2018503 Roadway Plans General Note 51; 2018503 Roadway Plans Key Sheet (Contract Plans Components); Proposal Form Item 90.

The 2018503 Lighting Analysis shows 74 new 263-watt LED luminaires (ATB2_P604_R4_3K) at 38-foot mounting height on 8-foot arms, at pole locations stationed from STA 120+14.03 to STA 278+07.65, plus 5 luminaires to be relamped and 3 to be removed. The calculation summary evaluates ten corridor segments against FDOT Corridor Lighting criteria at a 160 mph design wind speed.

The Proposal Form contains one lighting item: Item 90, 715-11-211-L2, "Furnish and Install 263 Watt Cobra Head LED Luminaire," 3 EA. Signalization Sheet T-10 assigns all three of those luminaires to the three mast arms at Lyons Road and Senator Joe Abruzzo Avenue. There are no pay items for light poles, pole foundations, lighting conduit, conductors, load centers, lighting service points, or removals.

We note that 2018503 General Note 51 states: "THE LIGHTING PLANS WERE DEVELOPED WITHOUT SUBSURFACE UTILITY ENGINEERING (SUE) INVESTIGATION OF THE EXISTING UTILITIES. THE CONTRACTOR MUST VERIFY THE LOCATIONS OF EXISTING UTILITIES PRIOR TO INSTALLING LIGHT POLES." We also note that the 2018503 Key Sheet's Contract Plans Components list does not include a Lighting Plans entry, and that 2020110 Sheet L-3 annotates poles at the south end of the corridor as "FPL LIGHT POLE PROPOSED IN FDOT PROJECT 439844-1 - TO REMAIN."

QUESTION: Is the 2018503 corridor lighting system within the scope of this Contract?

RESPONSE: No

QUESTION: If it is, please issue an addendum adding pay items and quantities for light poles, pole foundations, lighting conduit, conductors, service points and load centers, and issue lighting plan sheets containing a Tabulation of Quantities, a Pole Data Table and a wiring and circuit plan. The Lighting Analysis as issued is photometric only and contains no quantities, pole schedule, or service point locations, and cannot be priced from the information provided.

RESPONSE: N/A.

QUESTION: If it is not, please confirm by addendum that the 2018503 corridor lighting is by others and is excluded from this Contract.

RESPONSE: 2018503 Corridor lighting is not a part of this contract.

SPECIAL PROVISIONS

QUESTION: Please also address the two lighting items shown on the 2020110 Lighting Plans Tabulation of Quantities, Sheet L-2 - 715-11-211-L1 (175W LED cobra head, 1 EA) and 715-68000 (Light Pole Complete, RELOCATE, 1 EA) at STA 31+69.64, 77.20' LT - neither of which appears in the Proposal Form.

RESPONSE: See updated P-Pages in the addendum.

SIGNING AND PAVEMENT MARKING

Reference: 2018503 Signing and Pavement Marking Plans, Sheets S-1 through S-38; 2020110 Signing and Pavement Marking Plans, Sheets S-1 through S-9; 2018503 and 2020110 Roadway Plans Key Sheets (Contract Plans Components); General Provisions 102-10 and 102-11.20; Special Provisions Section 15; Proposal Form Items 1-90.

Signing and Pavement Marking Plans are issued for both projects, and their Tabulations of Quantities carry populated Grand Total columns. The combined quantities include approximately 9.458 net miles of 6-inch white solid thermoplastic, 7.070 net miles of 6-inch yellow solid thermoplastic, 6.010 gross miles of 6-inch white skip, 4,816 LF of 12-inch white, 2,920 LF of 24-inch white, 623 LF of 18-inch white, 330 LF of 18-inch yellow, 162 thermoplastic arrows, 53 preformed arrows, 53 preformed messages, 2,777 Type B raised pavement markers, 69 new ground sign assemblies, 15 sign relocations and 49 sign removals.

The Proposal Form contains no 706-series or 711-series pay item. Its only 700-series item is Item 89, 700-5-22, "Internally Illuminated Sign (8') Fluorescent," 3 EA, which the Signalization Plans identify as mast-arm-mounted street name signs.

We note that the 2018503 Roadway Plans Key Sheet lists, under Contract Plans Components, "SIGNING AND PAVEMENT MARKING PLANS (FOR INFORMATION PURPOSE ONLY)," while the 2020110 Key Sheet lists its Signing and Pavement Marking Plans without that qualifier.

QUESTION: Is permanent signing and pavement marking within the scope of this Contract? Please confirm separately for Project 2018503 and Project 2020110, and confirm whether the difference in the two Key Sheet listings is intended.

RESPONSE: No, See updated Key Sheet dated 09/18/2026.

QUESTION: If it is, please issue an addendum adding the 700-, 706- and 711-series pay items and quantities in accordance with the Signing and Pavement Marking Tabulations of Quantities.

RESPONSE: Not Applicable

QUESTION: Please identify the pay item for removal of existing pavement markings located outside the milling limits. General Provisions 102-10 states that black-out shall not be used to obliterate pavement markings and that existing markings which conflict with temporary work zone delineation shall be removed by a method approved by the Engineer, and we find no pay item for that work.

RESPONSE: The proposed permanent pavement markings are within the milling and resurfacing limits, no additional pay items anticipated for the pavement markings located outside the milling limits.

SPECIAL PROVISIONS

QUESTION: If permanent signing and pavement marking is excluded from this Contract, please identify the responsible party and clarify the application of Special Provisions Section 15, which allows 120 additional Contract Calendar Days for "pavement cure and placement of final pavement markings" with liquidated damages attached, and the General Provisions Section 1 definition of Substantial Completion, which requires permanent signing and markings to be complete.

RESPONSE: Permanent Signage and Markings will be installed by Palm Beach County.

2020110 SIGNALIZATION TABULATION OF QUANTITIES

Reference: 2020110 Signalization Plans, Sheet T-3 (Tabulation of Quantities); 2018503 Signalization Plans, Sheet T-2; Proposal Form Items 63 through 90.

QUESTION: The Signalization section of the Proposal Form, Items 63 through 90, corresponds item for item to the Tabulation of Quantities on Sheet T-2 of the 2018503 Signalization Plans. The Tabulation of Quantities on Sheet T-3 of the 2020110 Signalization Plans contains 31 pay items, none of which appear in the Proposal Form. These include:

RESPONSE: See updated P-Pages included in this addendum.

QUESTION: We further note that 2020110 Signalization Sheet T-12 advises of loose to very loose caving sands and cemented sand and limestone lenses, and states that conditions may be difficult or impossible for retaining bentonite or polymer slurry, and that special equipment or procedures may be required. Please confirm whether casing is anticipated for the drilled shaft foundations at Lyons Road and Boynton Beach Boulevard and, if so, the pay item under which it is compensated.

Response: The foundation construction method is included in the pay item 649-2-16-45 & 649-2-20-50.

TRAFFIC CONTROLLER ASSEMBLY AND SIGNAL CABLE

Reference: 2018503 Signalization Plans, Sheet T-5 (Pay Item Notes), Sheet T-8, and General Note 2; Proposal Form Items 65, 66 and 63 through 90.

2018503 Signalization Sheet T-5 includes a pay item note which reads "670-1-110 TRAFFIC CONTROLLER ASSEMBLY IS TYPE 6 W/ ATC CONTROLLER NEMA" (typographical errors are as shown on the sheet).

QUESTION: FDOT pay item 670-1-110 does not appear in the Tabulation of Quantities on Sheet T-2 or anywhere in the Proposal Form.

Response: See updated plans in this addendum.

SPECIAL PROVISIONS

QUESTION: Sheet T-8 locates a Traffic Controller at STA 266+26.50, 53.33' LT at Lyons Road and Senator Joe Abruzzo Avenue, where the plans call for removal of the existing temporary span wire assembly, two existing strain poles, an existing pedestrian pole, and all existing signal cable, and construction of a new permanent three-mast-arm signal.

The only signal cable items in the Proposal Form are Item 65, 632-7-4, "Signal Cable (Adjust)," 1 PI, and Item 66, 632-7-6, "Signal Cable, Remove - In Intersection," 1 PI. There is no 632-7-1 Signal Cable, Furnish and Install item for any of the three signalized intersections in this Contract. Signalization General Note 2 requires the Contractor to submit shop drawings for the "Controller Cabinet and Assembly" and for the "Video Detection System."

QUESTION: Will Palm Beach County Traffic Engineering furnish the traffic controller, cabinet and assembly at Lyons Road and Senator Joe Abruzzo Avenue, or is the Contractor to furnish and install it? If the Contractor is to furnish it, please identify the pay item.

RESPONSE: The controller, cabinet and assembly at Lyons Road and Senator Joe Abruzzo Avenue to remain.

QUESTION: Under what pay item is new signal cable at Lyons Road and Senator Joe Abruzzo Avenue to be paid, including all conductors from the three new mast arms, pedestrian signal heads and detectors to the controller cabinet?

RESPONSE: See updated P-Pages for bid items. 632-7-1-19

QUESTION: Is any new video detection system to be furnished under this Contract? General Note 2 requires a Video Detection System submittal, while the 2020110 plans show only 660-4-60, Vehicle Detection System - Video, Remove, 8 EA.

RESPONSE: No; See updated plans in this addendum.

DRIVEWAY CONSTRUCTION

Reference: Contract Documents Section DE-1 and DE-2 (Right of Entry and Release Agreement for Road and Driveway Construction); 2018503 Roadway Plans General Note 41; Proposal Form Items 40 and 41.

Section DE-1 assigns driveway construction at each abutting property to the Contractor, including obtaining an executed Right of Entry and Release from each property owner, accommodating the owner's selection of circular, "T"-type or other configuration, and providing temporary access and parking during construction. It states that clearing and grubbing, excavation, earthwork, grading, restoration of sodding, landscaping, sprinkler systems and all other work required are included in the square yard price. Section DE-1 further references a "6" base item."

SPECIAL PROVISIONS

QUESTION: Proposal Form Item 41, "Concrete Sidewalk & Driveway (6" Thick)," is 517 SY. Please confirm that 517 SY is the total quantity of driveway reconstruction anticipated project-wide, or provide the driveway locations, dimensions and a revised quantity.

RESPONSE: See P-Pages in this addendum.

UTILITY RELOCATION AND ADJUSTMENT

Reference: 2018503 Roadway Plans General Notes 6 and 10, Sheets 21 through 33 and the Roadway Drainage Structure sheets; 2020110 Roadway Plans General Notes 6 and 26, Sheets 9 through 24; Proposal Form Item 62.

2018503 General Note 10 states "EXISTING UTILITIES ARE TO BE ADJUSTED BY OTHERS UNLESS OTHERWISE NOTED," and 2020110 General Note 6 states substantially the same. However, numerous plan sheets do note otherwise, directing the Contractor to relocate or deepen specific facilities, including callouts reading "RELOCATE 16" DIP WM (PBCWUD) TO AVOID CONFLICT WITH INLET & PIPE," "RELOCATE 6" GM (FPUC)," "RELOCATE COMCAST CABLE," and "BEGIN DEEPENING / END DEEPENING 16" RWM AND 6" GM TO MAKE MIN. 3' COVER." We count more than fifteen such locations across the two plan sets. 2018503 General Note 6 also requires the Contractor to notify the respective utility owners to resolve utility conflicts and "provide utility adjustments, as required."

The Proposal Form contains no utility relocation pay item. The only related item is Item 62, "Support Existing Utilities During Proposed Utilities/Drainage Installation," 700 LF, which is a contingency item released at the direction of the Engineer.

QUESTION: Please confirm which of the relocations and deepenings directed on the plans are to be performed by the utility owner and which by the Contractor, and for any assigned to the Contractor, identify the pay item.

RESPONSE: All Palm Beach County Water Utilities Department work is part of this contract. All other utilities will be adjusted by others.

ADJUST VALVE BOXES

Reference: 2018503 Roadway Plans, Summary of Pay Items, PBCWUD Items, Item 44; 2018503 Roadway Plans General Note 48; 2020110 Roadway Plans, Summary of Pay Items.

The 2018503 Summary of Pay Items includes, under the heading "PBCWUD ITEMS," Item 44, 0425-6, Adjust Valve Boxes, 46 EA. That item does not appear in the Proposal Form. 2018503 General Note 48 states: "CONTRACTOR SHALL ADJUST TOPS OF ALL EXISTING UTILITIES (VALVE BOX, METER BOX, ETC.) TO MATCH PROPOSED GRADES & SLOPES." The note stating that work for Palm Beach County Water Utility facilities shall be completed by the Water Utilities Department separately appears only on the 2020110 plans.

QUESTION: Please confirm whether adjustment of PBCWUD valve boxes, meter boxes and covers within the 2018503 limits is to be performed by PBCWUD separately or by the Contractor, and if by the Contractor, identify the pay item.

RESPONSE: See P-Pages in this addendum.

SPECIAL PROVISIONS

QUESTION: Please confirm that the 16-inch DIP water main relocation shown on 2018503 Signalization Sheet T-8 at Lyons Road and Senator Joe Abruzzo Avenue is by PBCWUD and is excluded from this Contract.

RESPONSE: See P-Pages in this addendum.

MAST ARM AND DRILLED SHAFT DESCRIPTIONS

Reference: Proposal Form Items 74 through 80; 2018503 Signalization Plans Sheets T-2, T-10 and T-11.

Please confirm and correct by addendum the following apparent discrepancies between the Proposal Form and the 2018503 Signalization Plans:

QUESTION: Item 76 reads "Mast Arm Assembly with Street Light, Furnish and Install On Existing Foundation, Single Arm 70' Heavy Duty (A70/S-P5/S/L-Hd)." Sheets T-2, T-10 and T-11 require a 78-foot heavy duty arm on a P6 pole (A78/S/H-P6/S/L-HD) at Structure ID 3, STA 267+32.31. We note T-11 Note 4 states that pole type P5 and larger require a minimum 5.0-foot diameter drilled shaft.

RESPONSE: See revised P-Pages in this addendum.

QUESTION: Item 78 reads "649-2-12-45, Drilled Shaft Foundation Assembly, 12' Deep and 4.5' Diameter, Furnish and Install," quantity 1, unit LF. Sheets T-2 and T-11 require 649-2-18-45, an 18-foot deep by 4.5-foot diameter shaft, at Structure ID 1. Please correct both the depth and the unit of measure; the sibling drilled shaft assembly items are measured EA.

RESPONSE: See revised P-Pages in this addendum.

QUESTION: Item 79 reads "649-2-16-50, Drilled Shaft Foundation Assembly, 16' Deep and 5.0' Diameter." Sheets T-2 and T-11 require 649-2-20-50, a 20-foot deep by 5.0-foot diameter shaft, plus 4 LF of additional depth under Item 80, for a total 24-foot shaft at Structure ID 3.

RESPONSE: See revised P-Pages in this addendum.

QUESTION: Item 80's FDOT item number reads "649-2-16-50-AD" while its description reads "20' Deep and 5.0' Diameter." Please confirm the item number is 649-2-20-50-AD.

RESPONSE: See revised P-Pages in this addendum.

QUESTION: Items 74, 75 and 76 read "Furnish and Install On Existing Foundation," while the plans show new drilled shaft foundations at all three mast arm locations, paid separately under Items 77 through 80. Please confirm that Items 74 through 76 cover the mast arm assembly, pole and hardware only, and that the drilled shaft foundations are paid under the 649-2 series items.

RESPONSE: Drill Shaft foundation is paid for under 649-2 series.

SPECIAL PROVISIONS

ITS HUB CABINET AND ITS SYSTEM INFORMATION

Reference: Proposal Form Item 55 and Pay Item Footnote 2; 2020110 Signalization Plans index.

QUESTION: Proposal Form Item 55 reads "Its Cabinet (Hub) (Install)," 1 EA. Pay Item Footnote 2 states that "All items shall include cost to furnish and install unless otherwise noted." Please confirm whether the hub cabinet is furnished by Palm Beach County for Contractor installation, or is to be furnished and installed by the Contractor.

RESPONSE: Hub Cabinet shall be furnished and installed by contractor.

QUESTION: Please identify the location of the ITS hub cabinet. We are unable to locate it on any issued sheet.

RESPONSE: Refer to PBC Project #, 2020110, Sta. 31+40+/-, 65'+/- RT.

QUESTION: Please identify the tie-in point to the existing Palm Beach County ITS network, the fiber optic splice locations, and the cable assignment schedule. The Proposal Form provides 5 EA of fiber optic splices and 5 EA of splice trays against 19,300 LF of fiber optic cable and three signalized intersections, and no fiber schematic or splice plan has been issued.

RESPONSE: Refer to PBC Project #, 2020110, Sta. 31+40+/-, 68'+/- RT.

QUESTION: Please issue 2020110 Signalization Plans Sheet T-14, "PBC Signal Installation Detail - Communication Conduits, Pull Boxes & Wiring," which is listed in the plan index but is not included in the plan set.

RESPONSE: Sheet T-14-C has been added in this addendum

FOUR-SECTION VEHICULAR SIGNAL QUANTITY

Reference: Proposal Form Item 82; 2018503 Signalization Plans Sheets T-2, T-7 and T-9.

Proposal Form Item 82, 650-1-14, Vehicular Traffic Signal, Furnish and Install, Aluminum, 4 Section, 1 Way, is 2 AS. Sheet T-7 shows 2 AS of four-section one-way signals at Lyons Road and Appalachian Ridge Road, and Sheet T-9 shows 2 AS at Lyons Road and Senator Joe Abruzzo Avenue, for a total of 4 AS, while the Tabulation of Quantities on Sheet T-2 shows 2 AS.

QUESTION: Please confirm the correct quantity for Item 82.

RESPONSE: Confirmed.

FDOT CONSTRUCTION AGREEMENT COMPLETION PERIOD

Paragraph 15 of FDOT Construction Agreement 2025-C-496-00001 states: "All work and construction shall be completed within 365 days of the date of the last signature affixed to this agreement. If construction is not completed within this time, the DEPARTMENT may make a claim on the bond." The Contract Time stated on Proposal page P-6 is 820 Calendar Days, plus 120 additional Calendar Days for final pavement markings.

SPECIAL PROVISIONS

QUESTION: Does paragraph 15 create a completion milestone for the work located within FDOT right-of-way at Boynton Beach Boulevard?

RESPONSE: Comply with FDOT Construction Agreement.

QUESTION: If so, please state the milestone date or the event from which it runs, and the consequences to the Contractor of not meeting it.

RESPONSE: All work within the FDOT right of way to be constructed and approved FDOT Construction Agreement, all other work to adhere to contract.

QUESTION: Please also confirm whether the payment and performance bond payable to FDOT referenced in the Construction Agreement is required of the Contractor, and if so, in what amount.

RESPONSE: Payment and performance bond to FDOT by the contractor is not required with this project.

EARTHWORK, MATERIAL REUSE AND GEOTECHNICAL DATA

Reference: 2018503 Roadway Plans General Notes 24 and 25; 2020110 Roadway Plans General Note 31; Special Provisions Section 29; 2020110 Roadway Plans Sheets GR-1 through GR-3.

QUESTION: The only soil survey included in the Contract Documents, Sheets GR-1 through GR-3, covers Project 2020110. Please confirm whether a geotechnical report exists for Project 2018503, STA 119+21.40 to STA 279+31.10, and if so, make it available to bidders.

RESPONSE: 2018503 project includes three geotechnical reports as follows:

1. Geotechnical Report- Mast Arm Structures & Box Culvert,
2. Geotech Report -Roadway Soil Survey.
3. Geotech Report -Borehole Permeability Tests & Double Ring Infiltration Tests

Provided in this addendum

Wednesday, September 2, 2026 12:40 PM

Johnson Davis

cjohnson@johnsondavis.com

QUESTION: Please have LWDD supply the contractors with size of the pump and or the GPM it needs to move for the Bypass Pump for the L-28 Canal where the 10' x 6' Box Culvert Extension is located.

RESPONSE: Contractor to verify with LWDD for requirements.

QUESTION: There are multiple places on the west side of Lyons Road that call for the 16" DIP Raw Water Main and the 6" Gas Main to get relocated to avoid conflict with the proposed inlets, there are no bid items to perform this work?

RESPONSE: See updated plans in this addendum.

SPECIAL PROVISIONS

QUESTION: Why are you calling for 12" RCP, only one supplier makes it, the pipe should be 12" HDPE to go into the 12" Yard Drains?

RESPONSE: See update P-Pages in this addendum.

Wednesday, September 11, 2026 12:56 PM

Johnson Davis

cjohnson@johnsondavis.com

QUESTION: There is no Inlet, Curb, Type P-1 found on the project?

RESPONSE: See revised P-Pages in this addendum.

QUESTION: The plans show to Adjust Water Valves, there are no items for adjusting Water or FM Valves?

RESPONSE: See revised P-Pages in this addendum.

QUESTION: The plan shows to Adjust FM MH to Grade, again not items to Adjust these Air Release MH's?

RESPONSE: See plans and revised P-Pages in this addendum.

Wednesday, September 11, 2026 1:02 PM

Johnson Davis

cjohnson@johnsondavis.com

QUESTION: On the NW corner of Lyons and Boynton Bch Blvd it calls to relocate an existing Fire Hydrant, no bid item?

RESPONSE: See Water Utility adjustment plans in this Addendum.

Tuesday, September 14, 2026 12:53 PM

Johnson Davis

Chris Johnson, cjohnson@jonsondavis.com

QUESTION: Your bid quantity of 12" pipe is 112 lf. there is only 76 lf. found, please adjust the bid quantity.

RESPONSE: See P- Pages in this addendum.

SPECIAL PROVISIONS

Tuesday, September 15, 2026 12:57 PM
Rosso Site Development
Joe3@rossositedevelopment.com

QUESTION: There are numerous open flumes in the curb. Which bid item should this work be included in?

RESPONSE: Flumes are incidental to pay item Type F Curb & Gutter, L.F.

QUESTION: The plan sheets don't call out the pipe type. The cross sections sheets listed below show 12" and 18" PVC pipe. Which bid item should we include the pvc drainage pipe in?

- Plan Sheet 84, S-8 to S-8A
- Plan Sheet 85, S-9 to S-9A
- Plan Sheet 88, S-15 to S-15A
- Plan Sheet 89, S-18 to S-18A & S-17 to S-17A
- Plan Sheet 90, S-24 to S-24A & S-23 to S-23A
- Plan Sheet 91, S-26 to S-26A & S-25 to S-25A
- Plan Sheet 92, S-28 to S-28A & S-29 to S-29A
- Plan Sheet 93, S-35 to S-35A & S-34 to S-34A
- Plan Sheet 94, all 4 runs of pipe
- Plan Sheet 95, S-40 to S-40A

RESPONSE: See Special Provisions.

QUESTION: The proposed guardrail from station 31+54.68 (69.44' LT) to station 44+54.46 (47.13' LT) has a proposed sidewalk behind it. There is no bid item for the guiderail that needs to be attached to the back of the guardrail. Where should the cost for this be included?

RESPONSE: See updated P-Pages.

QUESTION: Plan Sheet 13. Please confirm that you would like Type B-12.5 Asphalt Base for the curb pad.

RESPONSE: See updated plans in this addendum.

Tuesday, September 15, 2026 11:53 AM
Rosso Site Development
Joe3@rossositedevelopment.com

QUESTION: Station +/- 120+00 to Station 123+00. Have bores been done in this area? During original construction of Lyons Road muck was found in this area and had to be removed for the roadway construction.

RESPONSE: Geotechnical report has been provided with this addendum.

SPECIAL PROVISIONS

QUESTION: There are multiple places on the west side of Lyons that call for the 16" DIP Raw Water Main and or 6" gas main to get relocated to avoid conflict with proposed inlets, but there are no bid items to perform this work? Is this what Bid Item #62 "Support existing utilities during drainage construction" is for? If that is not what that bid item is for can you please clarify the portion of work that this item pertains to?

RESPONSE: Palm Beach County Water Utilities plans have been provided with this addendum. All other utilities to be adjusted by the utility owners.

QUESTION: Station 120+54, 58' LT to Station 127+30, 56' LT. "Begin deepening 16" RWM to make Min. 3' Cover" note. Who is responsible for this work?

RESPONSE: Palm Beach County Water Utilities plans have been provided with this addendum.

QUESTION: Station 126+39, 51' RT. "16" RWM (To be relocated under drainage structure S-2". Please clarify which bid item this cost should be included in? Also please confirm that you want this relocated under the structure.

RESPONSE: Palm Beach County Water Utilities plans have been provided with this addendum.

QUESTION: At the following locations the plans call for the lowering of a 6" GM. Who is responsible for this work?

- Station 120+89, 89' LT to Station 124+68, 34' LT.
- Station 166+48, 63' LT to Station 172+58, 52' LT.

RESPONSE: Adjustments will be made by the owner of the utility line.

QUESTION: There is a gas main valve to be adjusted. There is no valve adjustment item. What bid item should the cost for this work be included in?

- Station 170+71, 44' LT
- Station 129+96, 54' LT.

RESPONSE: Adjustments will be made by the owner of the utility line.

QUESTION: Station 136+21, 54' LT to Station 137+13, 54' LT. The plans call for the lowering of a 6" GM. Who is responsible for this work?

RESPONSE: Adjustments will be made by the owner of the utility line.

QUESTION: Station 137+90, 43' LT. Please clarify what "pavement reconstruction" means and how it differs from the typical section.

RESPONSE: Reconstruct driveway to roadway specifications.

QUESTION: At the locations list below a note states to relocate 16" DIP RWM (PBCWUD) to avoid conflict with inlet. Which bid item should the cost for this work be included in?

- Station 139+27, 57' LT.
- Station 192+71, 53' LT.

RESPONSE: Palm Beach County Water Utilities plans have been provided with this addendum.

SPECIAL PROVISIONS

QUESTION: Station 148+34, 72' LT to Station 150+86, 71' LT. The plans call for the lowering of a 6" GM. Who is responsible for this work?

RESPONSE: Adjustments will be made by the owner of the utility line.

QUESTION: . At the following locations there are two notes about relocating a 6" GM and a 16" DIP RWM to avoid the conflict with S-8A. Which bid item should the cost for this work be included in?

- Station 155+51, 68' LT.
- Station 161+48, 67' LT.
- Station 201+68, 51' LT.
- Station 207+66, 51' LT
- Station 216+67, 53' LT

RESPONSE: Palm Beach County Water Utilities plans have been provided with this addendum.

QUESTION: Station 176+50, 51' LT. Note: "Relocated 6" GM (FPUC) at inlet location. Who is responsible for this work?

RESPONSE: Adjustments will be made by the owner of the utility line.

QUESTION: . Station 186+74, 53' LT. The plans call to relocate a comcast cable and a 6" GM. Who is responsible for this work?

RESPONSE: Adjustments will be made by the owner of the utility line.

QUESTION: Station 205+07, 47' LT. The notes states to "Relocate GM Valve and Adjust to Grade". Who is responsible for this work?

RESPONSE: Adjustments will be made by the owner of the utility line.

QUESTION: Station 209+95, 64' LT & Station 211+06, 72' LT. There are two ped poles and each location that are called out to be relocated. I don't see a line item for relocating them. Which bid item should the cost associated with this work be included?

RESPONSE: See revised P-Pages in this addendum.

QUESTION: Plan Sheet 200, 205, Sta. 251+00 to 257+00 (Plan Sheets 210-211) have no call outs for the trees. Are all of these trees to remain?

RESPONSE: Between Sta. 190 to Sta. 202 and between Sta. 218 to Sta. 230, No tree removal.

QUESTION: There is a substantial amount of small plants that aren't called out to be removed in the islands. Where should this cost be included?

RESPONSE: The small plants will be removed under clearing & grubbing pay item see P-Pages notes.

SPECIAL PROVISIONS

QUESTION: Station 141+50, RT. There is a note here that this approach isn't to be built in this contract. The proposed curb on either side of this approach doesn't line up with the existing curb. Do you want a small radii to tie into the existing curb at this location?

RESPONSE: No

QUESTION: . Station 560+37.64, 39.7' RT. This proposed curb doesn't tie into the existing curb. Is this the intent?

RESPONSE: Yes

Tuesday, September 15, 2026 1:35 PM

All County Paving

rpolselli@allcountypaving.com

QUESTION: Will you be adding a "Concrete Removal" Pay Item?

RESPONSE: No.

QUESTION: Can Limerock be used instead of Asphalt for the Curb Pad?

RESPONSE: Refer to curb pad detail in this addendum.

QUESTION: Will this project be pushed a few weeks since no addenda has been released?

RESPONSE: See addendum Cover Sheet

Tuesday, September 15, 2026 4:55 PM

Ranger Construction

Andrew Maniotis <Andrew.Maniotis@rangerconstruction.com>

QUESTION: The limits of construction and plan sheets for Project Nos. 2018503 and 2020110 appear to overlap or conflict. Does the combined tonnage shown on the bid tabs account for these overlapping limits? Is all overlapping work accounted for properly in the bid quantities?

RESPONSE: Yes

QUESTION: Please confirm that all temporary barrier wall, temporary striping required for traffic shifts, and temporary striping required for the final configuration will be included and paid for under Bid Item No. 2.

RESPONSE: Yes

QUESTION: Please confirm that all sod placed under Bid Item No. 42 is to match the existing conditions and that Bahia sod should not be assumed for all disturbed areas.

RESPONSE: All Sod in disturbed areas shall match existing.

SPECIAL PROVISIONS

Tuesday, September 15, 2026 4:55 PM
Ferreira Construction
Dan Lewis, dewis@ferreiraconstruction.com

QUESTION: The Signalization Conduit Pay Items provided on your Bid Form do not match the conduit requirements shown in your Signalization plans(#1 & 2). There are multiple runs of both trenched and directionally bored conduits do not fit within the item descriptions that you've provided on your Bid Form, and the quantities of the Conduit Items that you have are incorrect. Please advise... there area sets of 2,3,4,6 & 7 conduit runs.

RESPONSE: See updated P-Pages.

Tuesday, September 15, 2026 5:39 PM
FG Construction
Denise Sorrentio, denise@fgconstruction.com

QUESTION: The ERP states dewatering is "not required," yet French drains, canal excavation, and storm pipe all sit below the water table, and no dewatering pay item exists. Please confirm how continuous well-point dewatering is paid, and the SFWMD discharge/turbidity requirements. Borings terminate at ~10 ft and none are on the Boynton Beach Blvd (SR 804) leg where intersection work occurs — request deeper borings and an infiltration test on that leg.

RESPONSE: Any dewatering or other permits sought are incidental to the contract.

QUESTION: The 38-LF 10'×6' RCBC extension is doweled into the existing box inside a live canal (maintained WSEL 14.50) with no cofferdam / dewatering / diversion detail or pay item, no existing-box as-builts, no rip-rap bedding/toe section, and seven mains threaded ~3–4 ft above it. Please provide water-control requirements, existing-box as-builts (to verify dowel embedment), a rip-rap section, barrier-wall removal dimensions, and confirm the box-first utility sequence.

RESPONSE: All requirements required to extend the box culvert shall be included in the box culvert bid item.

QUESTION: General Note 10 states utilities are "adjusted by others," but plan callouts direct the contractor to deepen/support mains, and nearly every inlet calls a relocation of the parallel 16" WM / 6" gas / 16" RWM. Please confirm who performs and pays each inlet-driven relocation and on what schedule; confirm whether item 62 (700 LF utility support, contingency) and the missing conflict-structure item are intended to cover the near-continuous conflicts. Request any SUE / designating depth data.

RESPONSE: Palm Beach County Water Utility adjustment plans are part of this contract and included in this addendum. All other utilities will complete adjustments of their facilities.

SPECIAL PROVISIONS

QUESTION: Roughly 31,000 LF of existing-system pumping / cleaning and box-culvert cleaning are shown only as “SEE SP’S” with contingent quantities, and existing cross-drains under the widened template have no extension or condition detail. Please provide the expected condition of the existing system and confirm cross-drain extension scope and end treatments.

RESPONSE: The contractor shall review the existing condition of the drainage system prior to bidding.

QUESTION: Double-lane closures are night-only across two jurisdictions; officer hours (item 56, 60 HR) and temporary striping / signal / detection appear under-quantified or rolled into lump-sum MOT. Please confirm access-maintenance expectations for the gated-community driveways and the meandering pathway, whether temporary marking / temporary signal / temporary detection is the contractor’s scope, and the FDOT 14-day lane-closure lead for the SR 804 leg.

RESPONSE: Access-maintenance expectations for the gated-community driveways and the meandering pathway, whether temporary marking / temporary signal / temporary detection, and all needed maintenance of traffic items are included in the Maintenance of Traffic pay item.

QUESTION: Multiple mast-arm drilled shafts sit next to mains marked for relocation; several poles are coded both “on existing foundation” and a new drilled shaft; and existing foundations are not confirmed adequate for the new / heavier arms. Please have the EOR confirm foundation scope per pole (existing vs. new), existing-foundation capacity for the proposed loading, and utility-clearance sequencing before mast-arm orders.

RESPONSE: All proposed mast arms will be installed on new foundations.

QUESTION: Both large drilled shafts (to 28 ft, including the 78-ft heavy-duty arm) are designed from one caving-soil boring (loose sand, GW ~5 ft) that ends only ~2 ft below the shaft tip. Please provide a deeper boring at the 78-ft HD pole before fabrication, and confirm the cased / slurry wet-hole construction method.

RESPONSE: It is contractor’s means and methods to perform and install the drill shaft foundation.

QUESTION: The 2018503 lighting deliverable is a photometric analysis only — approximately 57 proposed poles with no pay items, conduit, conductor, service, load-center, or foundation details, several located at canal / box-culvert crossings. Please provide the lighting construction plans and pay-item tabulation, or confirm the discipline is an owner allowance / by-others.

RESPONSE: Lighting is not part of this contract.

QUESTION: Existing travel lanes receive only 1” mill + 1” FC-9.5 (no structural / leveling course), yet must correct an existing VAR 3%–4.5% cross slope and tie to new widening built to design cross slope; the adjacent 2020110 typical explicitly calls milling, resurfacing AND overbuild. Please confirm whether a leveling / overbuild course is intended on the existing lanes, and provide superelevation / cross-slope transition data.

RESPONSE: The leveling/overbuild course is intended to be installed on the existing lanes, see sheet 6 of the plans.

SPECIAL PROVISIONS

QUESTION: Four specimen-grade Southern mahoganies (DBH 15–20”), plus numerous permit-criteria oaks and cabbage palms, plot inside the widening footprint with no mitigation / replacement or relocation table shown; clearing is gated behind a temporary vegetation-barricade permit and inspection. Please provide the PBC tree-permit mitigation / replacement schedule and confirm whether a nesting-bird / gopher-tortoise survey is required.

RESPONSE: See Plans for Tree removal.

QUESTION: The 2018503 signalization and signing / pavement-marking plans are stamped “FOR INFORMATION PURPOSE ONLY,” yet the signal general notes assign the contractor extensive build, coordination, MOT, foundation, and activation duties. Please confirm whether this bid carries construction of the 2018503 signals and markings, or only coordination / MOT.

RESPONSE: Permanent Signs and markings will be installed by Palm Beach County. Signalization is part of this contract.

QUESTION: Please confirm: (a) the governing SBE participation goal — ITB §6.3.1 states both a 12% goal and a mandatory 20% minimum, which is a responsiveness risk; (b) the right-of-way acquisition status and availability date, since widening and turn lanes depend on parcels beyond the existing R/W line; and (c) the exact construction limits and interface responsibility for the developer turn lane at Whitworth South and the Kimley-Horn “Flavor Pict” tie-in that will not be built under this contract.

RESPONSE: A 12% SBE subcontracting participation goal is established for this Contract.

Tuesday, September 17, 2026 8:17 AM
Ferreira Construction
Dan Lewis, dewis@ferreiraconstruction.com

QUESTION: There are (2) sets of Signalization Plans. Signalization Plan Set #2 (Project No. 2018503) does not appear to be quantified within the items and quantities provided on your Bid Form. This error/omission will result in numerous Change Orders that will be very expensive to the project. Please review and revise the Bid Form to include all items shown in both sets of Signalization Plans.

RESPONSE: See Updated P-Pages.

TECHNICAL SPECIFICATIONS

For

LYONS ROAD FROM LWDD L-30 CANAL TO BOYNTON BEACH BOULEVARD/LYONS ROAD AND BOYNTON BEACH BOULEVARD INTERSECTION IMPROVEMENTS

WUD Project No. 24-019

PREPARED FOR

Palm Beach County Water Utilities Department



Prepared By:



MASSE CONSULTING SERVICES, LLC

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September 25, 2026

PBCWUD
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SECTION 01 11 00 – SUMMARY OF WORK

PART 1 -- GENERAL

1.1 THE SUMMARY

A. Construct Work as described in the Contract Documents.

1. Provide the materials, equipment, and incidentals required to make the Project completely and fully operable.
2. Only the materials listed in Palm Beach County Water Utilities Department Engineering Services Division - Approved Materials and Equipment List (Latest Version) are approved for use within the PBCWUD service area, or as specified herein.
3. Provide the labor, equipment, tools, and consumable supplies required for a complete Project.
4. Provide the civil, and all other Work required for a complete and operable Project.
5. Test and place the completed Project in operation.
6. Provide special tools, spare parts, lubricants, supplies, or other materials as indicated in Contract Documents for the operation and maintenance of the Project.
7. Arrange and coordinate with Supplier for deliveries of OWNER purchased products in accordance with construction schedule, coordinate to avoid conflict with work and conditions at the site. Unload the products at the site, and store and protect the products in accordance with the Supplier's instructions.
8. The WORK shall be complete, and all work, materials, and services not expressly indicated or called for in the Contract Documents which may be necessary for the complete and proper construction of the WORK in good faith shall be provided by the CONTRACTOR and coordinated with the ENGINEER as though originally so indicated, at no increase in cost to the OWNER.
9. CONTRACTOR shall comply with all applicable federal, state and local safety regulations, laws and standards, as well as any specific Palm Beach County or Water Utilities Department requirements while completing the work.
10. Except as specifically noted, the CONTRACTOR shall provide and pay for:
 - a. Labor, materials, and equipment.
 - b. Tools, equipment and machinery.
 - c. Water, electricity, and other utilities required to complete the project.

d. Other facilities and services necessary for proper execution and completion of the work.

e. Permits, surveys, and testing.

B. The CONTRACTOR and its SUBCONTRACTORS shall meet the qualification requirements as defined in the front end (Appendix B) specifications.

1.2 DESCRIPTION OF WORK

A. Work is described in general, non-inclusive terms as:

1. The work covered by these specifications consists in general of furnishing all labor, supervision, materials, equipment, supplies, tools and manufactured articles of every kind required to furnish and install potable water mains, wastewater force mains, and related appurtenances for Lyons Road from the LWDD L-30 Canal to Boynton Beach Boulevard. The improvements include water main and force main relocation, demolition and removal of existing water main and force main, relocation of pipes in conflict with PBC road widening and drainage improvement project and all appurtenances as shown in the Drawings and temporary facilities and by-pass pumping to maintain service during construction and complete the work.
2. The CONTRACTOR shall complete all work shown in the Drawings and as indicated in the Technical Specifications and all work and materials shall meet the requirements outlined in these Technical Specifications and the latest edition of the Palm Beach County Water Utilities Department's "Minimum Design and Construction Standards". In case of discrepancies, in or between the drawings and specification, the CONTRACTOR shall include the better quality or greater quantity of work in the Bid.

1.3 CONTRACT METHOD

A. The WORK hereunder will be constructed under a single unit-price contract.

1.4 WORK UNDER OTHER CONTRACTS

A. The following construction work is not included in this Contract, but may impact construction scheduling, testing, and startup:

Owner	Description
Palm Beach County Engineering & Public Works	Road Improvement Projects

B. Obtain clarification from the OWNER in the case of a disagreement between the above list and those specified elsewhere in the Contract Documents.

C. Completion of the Work described in this Contract may impact the construction and testing of the items listed above.

1. Coordinate construction activities through the OWNER.

2. Pay claims for damages which result from the late completion of the Project or any specified Milestones.

1.5 WORK BY OTHERS

- A. Where 2 or more contracts are being performed at one time on the same Site or adjacent land in such manner that work under one contract may interfere with work under another, the OWNER will determine the sequence and order of the Work in either or both contracts. When the Site of one contract is the necessary or convenient means of access for performance of work under another, the OWNER may grant privilege of access or other reasonable privilege to the CONTRACTOR so desiring, to the extent, amount, and in manner and at time that the OWNER may determine. No OWNER determination of method or time or sequence or order of the work or access privilege shall be the basis for a claim for delay or damage except under provisions of the General Conditions for temporary suspensions of the work. The CONTRACTOR shall conduct its operations so as to cause a minimum of interference with the work of such other CONTRACTOR's, and shall cooperate fully with such CONTRACTOR's to allow continued safe access to their respective portions of the Site, as required to perform work under their respective contracts.
- B. Interference With Work On Utilities: The CONTRACTOR shall cooperate fully with all utility forces of the OWNER or forces of other public or private agencies engaged in the relocation, altering, or otherwise rearranging of any facilities which interfere with the progress of the WORK, and shall schedule the WORK so as to minimize interference with said relocation, altering, or other rearranging of facilities.

1.6 WORK SEQUENCE

- A. The CONTRACTOR's attention is directed to the fact that during the period of construction, no interruption in the flow of utilities to be relocate can be accommodated, and the CONTRACTOR shall so schedule its construction operations that no interference with the operation of the system will occur during construction.
- B. Access to the site is limited to the hours as defined in the front end (Div 0) specification.

1.7 CONTRACTOR USE OF SITE

- A. The CONTRACTOR's use of the Site shall be limited to its construction operations, including on-site storage of materials, on-site fabrication facilities, and field offices.
- B. The CONTRACTOR shall not use any of the private properties or any portion of the Site until and authorization from the property owner is granted for any of its construction operations.

1.8 OUTAGE PLAN AND REQUESTS

- A. Unless the Contract Documents indicate otherwise, the CONTRACTOR shall not remove from service, de-energize, or modify settings for any existing pipeline, valve, equipment, structure, road, or any other facility without permission from the ENGINEER.

1. Outages and service connections shall be performed during non-peak times, unless specifically allowed by the OWNER to occur during this time. The maximum duration of any outage may be 2 hours, subject to the OWNER's prior approval.
 - B. Where the WORK requires modifications to existing facilities or construction of new facilities and connection of new facilities to existing facilities, the CONTRACTOR shall submit a detailed outage plan and schedule for the OWNER'S approval a minimum of 7 working days in advance of the time that such outage is planned.
 - C. The outage plan shall be coordinated with the construction schedule and shall meet the restrictions and conditions of the Contract Documents. The outage plan shall describe the CONTRACTOR's method for preventing bypassing of system; the length of time required to complete said operation. All costs for preparing and implementing the outage plans shall be at no increase in cost to the OWNER.
 - D. The ENGINEER shall be notified in writing at least 7 working days in advance of the required outage if the schedule for performing the work has changed or if revisions to the outage plan are required.
 - E. The CONTRACTOR shall provide written confirmation of the shutdown date and time 48 hours prior to the actual shutdown.
- 1.9 OWNER USE OF THE SITE AND OCCUPANCY
- A. The OWNER may utilize all or part of the existing facilities during the entire period of construction for the conduct of the OWNER's normal operations. The CONTRACTOR shall cooperate and coordinate with the ENGINEER to facilitate the OWNER's operations and to minimize interference with the CONTRACTOR's operations at the same time. In any event, the OWNER shall be allowed access to the Site during the period of construction.
 - B. Testing of equipment and appurtenances including specified test periods, training, and startup does not constitute acceptance for operation.
 - C. OWNER may accept the facility for continued use after startup and testing at the option of the Owner. If acceptance is delayed at the option of the OWNER, shut down facilities per approved Operation and Maintenance procedures.
 - D. The execution of bonds indicates the consent of the surety to these provisions for occupancy of the structures and use of equipment.
 - E. Provide an endorsement from the insurance carrier permitting occupancy of the structures and use of equipment during the remaining period of construction.
 - F. Conduct operations to ensure the least inconvenience to the Owner and general public.
- 1.10 CONSTRUCTION OF UTILITIES
- A. Utility companies or their CONTRACTOR's will provide new or enhanced utilities for this project. Coordinate with others performing work associated with this Project.

B. Power and Electrical Services:

1. Pay for temporary power, including but not limited to construction cost, meter connection, fees and permits.
2. CONTRACTOR may use the permanent power source in lieu of temporary power source when permanent power is available at the Site.
 - a. Notify ENGINEER and OWNER to use the permanent power source.
 - b. Arrange with the power utility and pay the charges for connections and monthly charges for use of this power.
3. Pay for the power consumed until the Project has been accepted as substantially complete, unless noted otherwise.
4. The utility company is to provide the electric meter and shall install and connect upon notification of completed work by the CONTRACTOR.
5. Utility pole mounted transformer to be provided and installed to the new overhead lines by the utility company.
6. The utility is to provide power cable from the secondary of the transformer to the overhead.

C. Telephone Services:

1. Telephone Company will provide construction to the point shown on Drawings.
2. Provide conduit, cable, pull boxes, manholes, and other appurtenances for the installation of telephone fiber between the point shown on the drawings and the main telephone terminal board.
3. CONTRACTOR shall make all arrangements for any temporary phone service used by the CONTRACTOR including construction cost, telephones and equipment, connection fees, and permit.
4. CONTRACTOR may use the permanent telephone system when permanent lines are available at the site with the approval of the OWNER.
5. Notify OWNER of intent to use the permanent telephone system.
6. Arrange with Telephone Utility and pay the charges for connections and monthly charges for use of this service.
7. Pay for the service until the project has been accepted as substantially complete. Provide separate service for OWNER, CONTRACTOR, and ENGINEER.

1.11 REQUIREMENTS OF OTHER AGENCIES

- A. When performing Work on facilities owned by agencies other than OWNER, comply with all requirements of such agencies which are more restrictive than those specified herein.

1.12 PROTECTION OF EXISTING STRUCTURES

- A. The CONTRACTOR shall assume full responsibility for the protection of all existing buildings, structures, poles, signs, services to buildings, hydrants, drains, duct banks and electric and telephone cables, whether or not they are shown on the Drawings. The CONTRACTOR shall carefully support and protect all such structures and utilities from injury of any kind. Any damage resulting from the CONTRACTOR's operations shall be repaired by the CONTRACTOR at CONTRACTOR's expense.
- B. The CONTRACTOR shall be responsible for the protection of property, in the areas in the vicinity of the project; and for the protection of his own equipment, supplies, materials and work, against any damage resulting from the elements, such as flooding, by rainstorm, wind damage, or other elemental cause resulting from the project configuration. The CONTRACTOR shall take all precautions against any such damage occurrence, and shall be responsible for damage resulting from same. The CONTRACTOR shall provide adequate drainage facilities, tie-downs, or other protection, throughout the Contract period, for the protection of his, the OWNER's and other properties from such damage.
- C. Protection and temporary removal and replacement of existing structures as described in this Section shall be a part of the Work under the Contract and all costs in connection therewith shall be included in the Bid Price.

1.13 FAMILIARIZATION OF SITE

- A. The CONTRACTOR shall pay attention to the provisions of the Instructions to Bidders. The CONTRACTOR shall check and familiarize himself with the overall general conditions prevailing along the route of construction and at the construction site.
- B. All vertical and horizontal locations for existing above ground & underground structures, utilities, etc. have been shown in the drawings according to the best information available. No attempt has been made to show all below grade utilities not visible from surface features. The CONTRACTOR shall consider all locations approximate in nature. CONTRACTOR shall comply with Florida statute 553.851 regarding notification of utility owners prior to excavation and shall also notify 1-800-432-4770 "Sunshine State One call of Florida, inc." At least forty-eight (48) hours prior to excavating. Evidence of such notice shall be furnished to the owner upon request. It may be necessary for CONTRACTOR to conduct soft/hard digs to confirm location of utilities, cost to conduct soft/hard digs shall be considered incidental.
- C. Prior to the start of construction and/or ordering of any materials or fabricated items, the CONTRACTOR shall confirm, at their own expense, all exact vertical and horizontal locations, and shall be responsible for verifying. If "other" structures, utilities, etc., not shown on the drawings, exist within the area of construction, the CONTRACTOR shall be responsible for providing engineer with "as-built" information and written notification of all conflicts with the proposed construction prior to ordering materials and commencing work

onsite. The CONTRACTOR shall not proceed with any work or ordering of any materials until all conflicts have been resolved.

1.14 PROTECTION AND RESTORATION OF SURVEY MONUMENTS

- A. The CONTRACTOR shall be responsible for protecting and restoring all land and property corners, such as section corners, ¼ section corners, property corners or block control points, and for maintaining all horizontal and vertical control points. All surveying work shall be the responsibility of the CONTRACTOR and shall be performed under the supervision of a Florida Registered Land Surveyor. Survey points that will be destroyed during construction shall be properly referenced and replaced at the CONTRACTOR's expense with permanent monuments approved by the ENGINEER.

1.15 INDEMNIFICATION

- A. To the fullest extent permitted by Laws and Regulations, CONTRACTOR shall indemnify and hold harmless OWNER and ENGINEER, and the officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the performance of the Work, provided that any such claim, cost, loss, or damage is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom but only to the extent caused by any negligent act or omission of CONTRACTOR, any subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work or anyone for whose acts any of them may be liable.
- B. In any and all claims against the OWNER or ENGINEER or any of their respective consultants, agents, officers, directors, partners, or employees by any employee (or the survivor or personal representative of such employee) of CONTRACTOR, any subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph A shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for CONTRACTOR or any such subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit act
- C. The indemnification obligations of CONTRACTOR under Paragraph A shall not extend to the liability of ENGINEER and Engineer's officers, directors, partners, employees, agents, consultants and subcontractors arising out of:
 - 1. The preparation or approval of, or the failure to prepare or approve, maps, Drawings, opinions, reports, surveys, Change Orders, designs, or Specifications; or

2. Giving directions or instructions, or failing to give them, if that is the primary cause of the injury or damage.

1.16 CONTRACTORS LIABILITY INSURANCE

- A. CONTRACTOR shall meet all contract insurance requirements providing coverage for not less than the amount specified in the contract or greater where required by Laws and Regulations including but not limited to providing Comprehensive General Liability Insurance, Umbrella or Excess Liability Insurance, and Contractual Liability Insurance.
- B. Prior to beginning work, CONTRACTOR shall provide the OWNER and ENGINEER with its certificates of Insurance and endorsements naming the OWNER and ENGINEER as additional insurers.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

END OF SECTION

SECTION 01 14 00– WORK RESTRICTIONS

PART 1 -- GENERAL

1.1 THE SUMMARY

- A. WORK shall be scheduled, sequenced, and performed in a manner which minimizes disruption to the public and to the operation and maintenance of existing facilities along the pipeline alignment.
- B. The CONTRACTOR shall incorporate the construction and schedule constraints of this Section in preparing the construction schedules required.

1.2 EXISTING UTILITIES

- A. The WORK shall be executed while the existing utilities remain in operation or by-pass. operation of existing pump stations, watermains, and drainage shall not be jeopardized, nor shall the volume of flow be reduced as a result of the execution of the WORK.
- B. Unless indicated otherwise, temporary pumping, piping, power, lighting, controls, instrumentation, alarms, security devices, and safety devices shall be provided by the CONTRACTOR whenever its activity or interruption due to its activity affects the existing facility.
- C. The construction constraints in this section do not include every item affecting the completion of the work but are intended to describe the sequence of critical events necessary to minimize disruption to flows and to ensure compliance with all pertinent permit requirements. It shall be understood and agreed by the CONTRACTOR that the critical events described are not inclusive and that additional items of WORK not included may be required to minimize disruption and ensure compliance. Deviation from or modification of these suggested sequences is permitted if techniques and methods known to the CONTRACTOR will result in reducing disruption to the facility operation, and if deviation is approved in advance by the ENGINEER.

1.3 BYPASSING

- A. By-passing of untreated or partially treated sewage to surface waters or drainage courses is prohibited during construction. In the event accidental bypassing is caused by the CONTRACTOR's operations, the OWNER shall immediately be entitled to employ others to stop the bypassing and costs incurred therefore will be deducted from the CONTRACTOR's construction progress payments.

1.4 COMPLIANCE WITH NPDES PERMIT

- A. If applicable, the NPDES permit specifies the water quality limits that the plant must meet prior to discharging its effluent. A copy of the NPDES permit shall be available at the site by the CONTRACTOR if required. In scheduling and performing the WORK, the CONTRACTOR shall not, directly or indirectly, prevent any piping system from achieving the discharge requirements. Penalties imposed on the OWNER as a result of any discharge violation caused by the actions of the CONTRACTOR or its employees, or subcontractors shall be borne in full by the CONTRACTOR, including fines, legal fees,

and other expenses to the OWNER resulting directly or indirectly from such discharge violations. The OWNER may recover such sums by deductions from the construction progress payments.

- B. The CONTRACTOR shall take necessary precautions to ensure that no damage occurs to the OWNER'S facilities, including piping, utilities, roads, and structures, that are to remain in operation and are not to be modified or replaced, in accordance with Section 01 76 10 – Protection of Existing Facilities. Any temporary facilities, materials, equipment, and labor required for the project to continue to meet the terms of the NPDES permit during construction shall be provided by the CONTRACTOR as part of the WORK. At the completion of work, such temporary facilities, materials, and equipment shall be removed from the Site as part of the WORK.

1.5 OUTAGE REQUESTS

- A. Modifications to existing facilities, the construction of new facilities, and the connection of new to existing facilities may require the temporary outage or bypass of existing facilities. In such cases, the CONTRACTOR shall coordinate WORK with the OWNER as described below. The CONTRACTOR shall submit a detailed outage plan and time schedule for construction activities which will make it necessary to remove a tank, pipeline, channel, electrical circuit, equipment, structure, road, or other facilities from service.
- B. The outage plans shall be submitted to the OWNER for acceptance a minimum of 7 working days in advance of the time that such outages are required. The outage plans shall be coordinated with the construction schedule and shall meet the restrictions and conditions of this Section. The outage plan shall describe the CONTRACTOR's method for preventing bypassing of pump station; the length of time required to complete the operation; any necessary temporary power or equipment required to maintain service; and the manpower, and equipment which the CONTRACTOR shall provide in order to ensure proper operation of service. Cost for preparing and implementing the outage plans shall be the responsibility of the CONTRACTOR as part of the WORK.
- C. The CONTRACTOR shall not begin any alteration affecting existing facilities until specific written approval has been granted by the OWNER in each case.
- D. The OWNER shall be notified in writing at least 7 working days in advance of the required outage if the schedule for performing the WORK has changed or if revisions to the outage plan are required. The CONTRACTOR shall provide written confirmation of the shutdown date and time 7 business days prior to the actual shutdown. No shutdown will be scheduled or performed on Friday or holiday's.

1.6 TEMPORARY CONNECTIONS

- A. Making connections to existing facilities or other operations that interfere with the operation of the existing equipment shall be thoroughly planned in advance, and required equipment, materials, and labor shall be on hand at the time of undertaking the connections. WORK shall be completed as quickly as possible and with as little delay as possible and shall proceed continuously (24 hours a day and seven days a week) if necessary to complete modifications and/or connections in the minimum time.

- B. The cost of any temporary facilities and night, weekend, or holiday activity and overtime payments required during process interruptions shall be included in the WORK, where and when allowed by the owner.
- C. Temporary facilities and piping shall be located to minimize interference with CONTRACTOR's construction facilities and OWNER's operation and maintenance of the utility system. Unless otherwise indicated, each temporary pipeline shall be of the same size as its connection to the existing or permanent facility at the downstream end of the pipeline. Piping materials shall be suitable for the material being conveyed and be as required in the Contract Specifications.
- D. A plan showing the size and location of the temporary facilities and piping shall be submitted to the OWNER at the same time as the outage plan required under this Section. Costs for design, provision, operation, and removal of temporary facilities and piping shall be part of the WORK.

1.7 CONSTRUCTION SEQUENCING

- A. Construction activities shall be scheduled and sequenced to ensure continuous operation of the existing utility system. The CONTRACTOR's scheduling shall develop construction sequencing so that the WORK will not adversely impact the utility system. The CONTRACTOR shall be responsible for development of the construction sequencing. In implementing the construction sequencing, the CONTRACTOR shall maintain the existing facilities in service until new facilities are constructed and are operational to supplement the existing capacity. When new facilities are operational, the existing facilities may be taken out of service. The following general guidelines shall be used by the CONTRACTOR in planning the sequence of construction.
 - 1. Safe working conditions for personnel shall be maintained during rehabilitation, modification, and demolition WORK. The foregoing includes at least proper trench excavation, the provision of temporary equipment guards, supports, warning signs, walkways, covers over openings, handrailing, and protection of electrical equipment and power supply.
 - 2. Temporary facilities shall be constructed in accordance with applicable codes and regulations to operate safely and properly.
 - 3. Valves to be temporarily shut off during the WORK shall be approved by the owner.

1.8 PERMITS

- A. No work shall commence before all necessary permits have been obtained.
- B. The CONTRACTOR shall keep himself fully informed of all local ordinances, state and federal laws and regulations, and interpretations of these laws, ordinances and regulations by a governmental body or agency, including but not limited to, the Florida Department of Environmental Regulation, the Technical Advisory Group of the Florida Department of Environmental Regulation, the Environmental Protection Agency, and the South Florida Water Management District, which in any manner affect the work herein specified. The CONTRACTOR shall at all times comply with said ordinances, laws and regulations and protect and indemnify the OWNER, the OWNER, and the respective employees, and their

officers and agents against any claim or liability arising from or based on the violation of such laws, ordinances, or regulations. All Design permits and fees have been paid; however, all post-design permits, licenses, and inspection fees necessary for protection and completion of the work for the duration of Construction shall be secured and paid for by the CONTRACTOR unless otherwise specified.

- C. The CONTRACTOR shall abide by the conditions of permits and shall obtain proof of satisfaction of conditions from issuers of permits prior to acceptance of the WORK by the OWNER.

1.9 OPERATION OF EXISTING SYSTEM PROHIBITED

- A. At no time shall the CONTRACTOR close off any lines or open valves or take any other action which would affect the operation of the existing system, except under direction of the OWNER.

1.10 SEQUENCE AND SCHEDULE CONSTRAINTS

- A. General: It is the CONTRACTOR's responsibility to coordinate and plan the construction activities to integrate each schedule constraint into performance of the overall WORK.
- B. The listing of sequence and schedule constraints below does not mean that every constraint or special condition has been identified. The list does not substitute for the CONTRACTOR's coordination and planning for completion of the WORK within the Contract Times.
- C. The following constraints affect the construction sequence and schedule. These constraints must be accommodated to minimize or prevent service interruptions, which must be considered in the construction sequence and schedule.
 - 1. Schools' normal operations (including School Bus Routes within/adjacent to Project Area)
 - 2. Church normal operations
 - 3. Crop Harvesting Season.
 - 4. Access to Hospitals and Fire Stations
 - 5. Public Transportation
 - 6. Solid Waste Collection

1.11 PRODUCTS (NOT USED)

PART 2 -- EXECUTION (NOT USED)

END OF SECTION

SECTION SPEC 01 29 00 – MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.1 THE SUMMARY

- A. Payment for various items of the Schedule of Bid Prices, as further specified herein, shall be made for the items listed in the Schedule of Bid Prices and shall include all compensation to be received by the CONTRACTOR for furnishing all materials, tools, equipment labor, operations and incidentals appurtenant to the items of work so described or as necessary to actually complete the various items of work, all in accordance with the requirements of the Contract Documents, including all appurtenances and temporary services thereto, and including all costs of compliance with the regulations of public agencies having jurisdiction, including the Occupational Safety and Health Administration of the U.S. Department of Labor (OSHA).
- B. The omission of reference to any item in this description shall not alter the intent of the Bid Form or relieve the CONTRACTOR of the necessity of furnishing such as a part of the Contract. No separate payment shall be made for any item that is not specifically set forth in the Schedule of Bid Prices, and all costs therefore shall be included in the prices named in the Schedule of Bid Prices for the various appurtenant items of the Work.
- C. The quantities set forth in the Schedule of Bid Prices are approximate and are given to establish a uniform basis for the comparison of Bids. The OWNER reserves the right to increase or decrease the quantity of any class or portion of the Work during the progress of the construction in accordance with these Specifications.
- D. Unit prices are used as a means of computing final figures for Bid and Contract purposes, for periodic partial payments for Work performed, for determining the value of additions and/or deletions associated with approved Work Authorizations/Supplements/Change Orders to the Contract, and wherever else reasonable.
- E. The quantities shown are approximate and are given only as a basis of calculation upon which the award of the Contract is to be made. The OWNER/ENGINEER does not assume any responsibility for the final quantities, nor shall the CONTRACTOR claim misunderstanding because of such estimate of quantities. The OWNER/ENGINEER may change the quantities or delete items in their entirety to match the project budget. Final payment shall be made only for satisfactorily completed quantity of each item.

1.2 LUMP SUM PAYMENT ITEMS

- A. Measurement for progress payments of lump sum items will be made on the basis of the earned value for each item shown as a percentage of the cost for the lump sum item as listed in the Schedule of Values. The CONTRACTOR shall submit a Schedule of Values to the ENGINEER for approval.
- B. Payment will be made at the lump sum price as named in the Bid Schedule which price

shall constitute full compensation for the complete and proper construction of the Work as shown on the Contract Drawings and specified herein. Payment at Final Completion will be equal to the total lump sum amount for that item.

1.3 UNIT PRICE ITEMS

- A. Payment shall be made for work items described in the Bid Form, as Unit Price items. All related work not specifically listed but required for satisfactory completion of the work shall be included in the work item.

1.4 MAINTENANCE OF TRAFFIC

- A. In the CONTRACTOR'S use of streets and highways, all work to be done shall conform to all Municipal, County, State, and Federal laws and regulations. The CONTRACTOR shall provide, erect, and maintain effective barricades, danger signals, and signs on all affected streets or highways for the protection of the Work and the safety of the public. Maintenance of traffic must conform to the guidelines as shown in the Florida Department of Transportation Roadway and Traffic Design Standards, latest revision, Index Nos. 600 through 660 inclusive. All barricades or obstructions, which encroach on or are adjacent to the public rights – of - way, shall be provided with lights, which shall be illuminated at all times from one hour prior to sunset to one hour after sunrise.
- B. The CONTRACTOR shall conduct the Work to cause minimum disturbance of normal pedestrian and vehicular traffic and is responsible for providing suitable means of access to all public and private properties during all stages of the construction. Other than for an emergency safety condition, the CONTRACTOR must contact the OWNER and the ENGINEER for approval prior to completely blocking off any street to vehicular traffic during construction.
- C. Maintenance of Traffic shall be in accordance with Section 102 of the Florida Department of Transportation Standard Specifications for Road and Bridge Construction, latest edition, except as follows:
 - 1. The CONTRACTOR shall be responsible for preparing a Maintenance of Traffic Plan as stipulated in Article 102-4, but the CONTRACTOR shall only submit the Traffic Plan at the Pre-Construction Conference if requested to do so by the ENGINEER.
- D. Maintenance of Traffic including but not limited to: Submittals of Maintenance of Traffic Plan; barricades; flag persons; sign boards; public notification; and removal of Maintenance of Traffic shall be in accordance with the requirements of the Contract Documents, Technical Specification Section 01 55 26 and all other applicable requirements as mentioned above.

1.5 PAYMENT ITEMS

- A. **Mobilization (Bid Item 1) and Demobilization (Bid Item 2):**

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- a. Mobilization shall include the cost of the preparatory work and operations to mobilize for beginning Work on the Project, including, but not limited to, those operations necessary for the movement of personnel, equipment, materials, supplies and incidentals to the Project site, NPDES permitting for construction sites greater than one acre, for the establishment of temporary offices, buildings, safety equipment and first aid supplies, sanitary and other facilities, as required by these Specifications, State and local laws and regulations, the costs of bonds, insurance and any other pre-construction expense necessary for the start of the Work. Payment for mobilization is limited to 2.5 percent of the value of furnished and installed items. The payment will be made based on the percentage of completion.
- b. Demobilization shall include removal of all construction equipment, materials, and debris from the site of the work and restoration thereof to its preconstruction condition, including repair of all damage caused by the construction. Payment for demobilization is limited to 1.0 percent of the value of furnished and installed items. The payment will be made based on the percentage of completion.

B. Maintenance of Traffic (incl. Pedestrian MOT) (Bid Item 3):

- a. Measurement for payment for maintenance of traffic including but not limited to: Submittals of Maintenance of Traffic Plan; barricades; flag persons; sign boards; public notification; and removal of Maintenance of Traffic will be based upon the horizontal length of the project work limits completed in accordance with the requirements of the Contract Documents.
- b. The payment will be made based on the percentage of completion. Payment shall be in accordance with the Contract Drawings and Specifications when the project is substantially complete.

C. Construction Survey (Bid Item 4):

- a. This item is a lump sum and will not be measured. The limits of the lump sum item extend to the alignment of construction designated on the Contract Drawings.
- b. Payment for Surveying Services will be made to the Contractor to retain a Professional Surveyor Licensed in the State of Florida to perform construction staking including establishing baseline and verification of the connecting stations and offset and notification to the Owner's representative of any discrepancies. Payment will be made for the construction staking and layout information based on the percentage of completion in accordance with the requirements of the Contract Documents.

D. Record Drawings (Bid Item 5)

- a. Measurement for payment shall be based on the project limits of the work completed in accordance with the requirements of the Contract Documents.

- b. Payment for Record Drawings will be made to the CONTRACTOR to retain a Professional Surveyor Licensed in the State of Florida to perform as-built surveying including: signed and sealed record drawings; AUTOCAD Release 2000 record drawings; record drawing mylars; and other items described in Section 01720, Project Record Drawings. Payment for the record drawing information will be made upon completion of all required items in accordance with the requirements of the Contract Documents.
- c. The Contractor to provide a progress record drawings set completed by a Florida licensed surveyor for every monthly application for payment or as needed by the EOR or PBCWUD for the works that have been completed; otherwise, the Owner may withhold the monthly application for payment.
- d. Payment for the record drawings will be processed after drawings are approved by the ENGINEER. No partial payments shall be made for the record drawings.

E. Preconstruction Video Taping (Bid Item 6):

- a. This item is a lump sum and will not be measured. The limits of the lump sum item extend to the alignment of construction designated on the Contract Drawings.
- b. Payment for Pre-construction Audio Video Services will be made to the Contractor to perform videotaping of the route of the project prior to construction. The owner shall make payments upon completion of the videotaping and approval.

F. Density Tests (Bid Item 7); Proctor Tests (Bid Item 8):

- a. Measurement shall be based on the number completed by an approved Testing Laboratory for passing test results. Failing test results shall be paid by the CONTRACTOR without compensation.
- b. Payment shall be in accordance with the Contract Drawings and Specifications.
- c. Unit Price Bid for each test shall include CONTRACTOR'S effort for the continual digital tracking of passing Density tests performed by approximate Station, labelled by Lift/Elevation on a PDF set of the Construction Plans, made available by all parties for reference.
- d. No payment shall be made for Density Tests performed in a frequency that is deemed excessive or unnecessary by the OWNER or ENGINEER.
- e. No payment shall be made until acceptable reports are approved by the OWNER or ENGINEER.

G. Furnish and Install 16" DIP Water Main (Bid Item 9):

- a. Measurement shall be based upon the horizontal length of the pipe between the listed state plane coordinates as shown on the record drawings.
- b. Payment for the water main shall be based on the horizontal distance. The unit bid price per linear foot (LF) of said item shall include all labor, materials, equipment and incidentals necessary to furnish and install DIP water main as shown on the contract drawings, as specified herein and as directed by the Engineer, including but not limited to: the excavation for the pipe trench, de-mucking and clean backfill, disposal of all excess materials, bracing, sheeting, dewatering, furnishing and installation of the DIP pipes, pipe restraints, gaskets, polyethylene encased where required by PBCWUD, pipe marking tapes, connection of existing water meter to new water main including all accessories, backfilling and compaction, pressure testing of the pipe, chlorinating and bacteriological testing, maintaining uninterrupted flow of existing utilities, providing access to driveways and roadways all times, maintaining traffic control, cleaning the site of the work location, and protection of existing utilities, trees, shrubs, and all other work required for the complete furnishing and installation of water main. All work shall be in accordance with the Contract Drawings and Specifications.

H. Furnish and Install 16" DIP Wastewater Force Main (Bid Item 10):

- a. Measurement shall be based upon the horizontal length of the pipe between the listed state plane coordinates as shown on the record drawings.
- b. Force Main shall include protective coating in accordance with the latest PBCWUD Minimum Engineering Standards or approved equal.
- c. Payment for force main shall be the horizontal distance. The unit bid price per linear foot said item shall include all labor, materials, equipment and incidentals necessary to furnish and install force main as shown on the contract drawings, as specified herein and as directed by the Engineer, including but not limited to: the excavation for the pipe trench, de-mucking and clean backfill, disposal of all excess materials, bracing, sheeting, dewatering, furnishing and installation of the pipes, pipe restraints, gaskets, pipe marking tapes, backfilling and compaction, pressure testing of the pipe, maintaining uninterrupted flow of existing utilities, providing access to driveways and roadways all times, maintaining traffic control, cleaning the site of the work location, and protection of existing utilities, trees, shrubs, and all other work required for the complete furnishing and installation of force main. All work shall be in accordance with the Contract Documents and Specifications.

I. Furnish and Install 16” Megalug Mechanical Joint Restraint (Bid Item 11):

- a. Measurement for payment said item will be based upon the actual quantity furnished and installed including the restraining device, bolts, and nuts in accordance with the requirements of the Contract Documents.
- b. Payment for furnishing and installing said item will be made at the unit price named in the Bid Schedule. The unit price shall constitute full compensation for the furnishing and installation of the item as shown on the Contract Drawings and Specifications, and shall include clearing, excavation, dewatering, bedding, testing, backfilling, and grading.

J. Furnish and Install Ductile Iron Fittings for Water Main (Bid Item 12):

- a. Measurement shall be based on the weight of the fittings installed per ton based on manufacture's specifications. The weight of glands, gaskets, nuts, washers, bolts, rods and other accessories will not be measured for payment.
- b. Payment for furnishing and installing said items will be the product of the unit price named in the Bid Form and the weight of the fittings. The unit price for this item shall include, but not be limited to, excavation, dewatering, disposal of excess materials, bracing, sheeting, trench safety, furnishing and installing of ductile iron fittings, bolts, nuts, gaskets, flanges, restraints, markers, backfilling, compaction, thrust restraints, flushing, pressure testing of pipe, disinfection and grading as shown on the Contract Drawings and Specifications.

K. Furnish and Install Ductile Iron Fittings for Wastewater Force Main (Bid Item 13):

- a. Measurement shall be based on the weight of the fittings installed per ton based on manufacture's specifications. The weight of glands, gaskets, nuts, washers, bolts, rods and other accessories will not be measured for payment.
- b. Payment for furnishing and installing said items will be the product of the unit price named in the Bid Form and the weight of the fittings. The unit price for this item shall include, but not be limited to, excavation, dewatering, disposal of excess materials, bracing, sheeting, trench safety, furnishing and installing of ductile iron fittings, bolts, nuts, gaskets, flanges, restraints, markers, backfilling, compaction, thrust restraints, flushing, pressure testing of pipe, and grading as shown on the Contract Drawings and Specifications.

L. Removal and Disposal of Existing 16” DIP Water Main (Bid Item 14):

- a. Measurement shall be based upon the horizontal length of the pipe removed. The limits of the item extend to the removal of said pipe removal and disposal at all locations shown in the Contract Drawings.

- b. The unit bid price per linear foot said item shall include all labor, materials shall include all labor, materials, equipment and incidentals necessary to remove and dispose of the existing water main components, and as directed by the Engineer, including but not limited to: excavation, disposal of all excess materials, bracing, sheeting and dewatering, removal of all directed materials, maintain uninterrupted services of existing utilities, backfilling and compaction, grading, grading and stabilization, sodding, silt fence, turbidity barrier, restoration, plugs installation, providing access to driveways and roadways at all times, maintain traffic control, testing, cleaning the site of the work location and protection of utilities, structures, trees, shrubs and lawns, and all other worked required to complete the removal as shown on the Contract Drawings and Specifications.

M. Removal of Existing 16" PVC Wastewater Force Main (Bid Item 15):

- a. Measurement shall be based upon the horizontal length of the pipe removed. The limits of the item extend to the removal of said pipe removal and disposal at all locations shown in the Contract Drawings.
- a. The unit bid price per linear foot said item shall include all labor, materials shall include all labor, materials, equipment and incidentals necessary to remove and dispose of the existing force main components and appurtenances, all supports, fittings, as specified herein and as directed by the Engineer, including but not limited to: excavation, disposal of all excess materials, bracing, sheeting and dewatering, removal of all directed materials, maintain uninterrupted services of existing utilities, backfilling and compaction, grading, stabilization, sodding, silt fence, turbidity barrier, restoration, plugs installation, providing access to driveways and roadways at all times, maintain traffic control, testing, cleaning the site of the work location and protection of utilities, structures, trees, shrubs and lawns, and all other worked required to complete the removal as shown on the Contract Drawings and Specifications.

N. 16" Diameter Connection to Exist Water Main or Wastewater Force Main include Restraining (Bid Item 16):

- a. Measurement for payment of said item will be based upon the actual quantity furnished and installed (EA), in accordance with the requirements of the Contract Documents. The connection to existing water mains and force main shall be in accordance with the Palm Beach County Water Utilities Department (PBCWUD) Minimum Design and Construction Standards requirements.
- b. Payment for furnishing and installing said item will be the measured quantity at the unit price named in the Bid Schedule. The unit price shall constitute full compensation for the furnishing and installing the item as shown on the Contract Drawings and Specifications, and shall include clearing, excavation, dewatering, bedding, testing, backfilling, and grading.

O. 16" Existing Pipe Bell Joint Restraint Harness (Bid Item 17):

- a. Measurement for payment of said item will be based upon the actual quantity furnished and installed (EA), in accordance with the requirements of the Contract Documents.
- b. Payment for restraining existing water main and force main pipe joints shall be the product of the appropriate size named in the Schedule of Bid Prices.
- c. The Unit Price shall be full compensation to provide all restraining devices, bell joint restraint harness, bolts, nuts, clearing, excavation, dewatering, disposal of excess materials, bracing, sheeting, rock removal, removal and disposal of unsuitable in-situ material, trench safety, testing, bedding, backfilling with suitable native material, compaction, grading and labor for the proper construction of all work as shown on the Contract Drawings and Specifications.

P. 16" Joint Restraint Gasket DIP (Field Lock or Fast Grip) (Bid Item 18)

- a. Measurement for payment of said item will be based upon the actual quantity furnished and installed, in accordance with the requirements of the Contract Documents.
- b. Payment for furnishing and installing said item will be made at the unit price named in the Bid Schedule. The unit price shall constitute full compensation for furnishing and installing the item as shown on the Contract Drawings and Specifications, and shall include clearing, excavation, dewatering, bedding, testing, backfilling and grading.

Q. Sample Point (Bid Item 19):

- a. Measurement for payment of sample points installed shall be based upon the actual quantity furnished and installed (EA), in accordance with the requirements of the Contract Documents.
- b. Payment for furnishing and installing sample points shall be at the unit price indicated for this item in the bid proposal for the actual quantity furnished and installed, in accordance with the requirements of the Contract Drawings and Specifications. Payment shall include the cost of bacteriological testing and removal of the sampling points upon completion of testing.

R. Adjustment of Air Release Valve Manhole (Bid Item 20):

- a. Measurement for payment said item will be based upon the actual number of manhole adjustment (EA), in accordance with the Contract Drawings and Specifications and as directed by the Engineer.

- b. The unit bid price shall consist of furnishing all labor, materials, equipment, tools, supervision, and incidentals necessary to adjust an existing air release valve (ARV) manhole to the proposed or existing finished grade, as shown on the Contract Drawings and as directed by the Engineer. The work shall include, but not limited to: Locating and exposing the existing ARV manhole; Excavating around the existing manhole as necessary; Removing the existing manhole frame and cover; Removing existing adjustment rings, bricks, mortar, concrete, or other materials as necessary to facilitate adjustment; Raising or lowering the manhole frame and cover to the required elevation; Furnishing and installing approved precast concrete adjustment rings/grade rings, brick courses, mortar, or other approved adjustment materials; Reconstructing the manhole neck as required; Resetting the existing frame and cover at the required elevation; Maintaining the structural integrity and watertight condition of the existing ARV manhole; Protecting the existing air release valve, piping, fittings, and appurtenances during construction; Furnishing and installing temporary asphalt or other temporary surface restoration where required; Backfilling and compacting around the adjusted manhole; Performing required density testing; Restoring the surrounding pavement, sidewalk, shoulder, sod, landscaping, or other disturbed areas; Removing and disposing of surplus and unsuitable materials; and All other work necessary to provide a complete and operational ARV manhole adjustment.

S. Valve Box Replacement and Adjustment (Bid Item 21):

- a. Measurement for valve box replacement shall be by actual number of valve box satisfactorily removed and replaced (EA), in accordance with the Palm Beach County Water Utilities Department (PBCWUD) Minimum Design and Construction Standards, applicable standard details, and Approved Materials and Equipment List. The unit price shall include removal and disposal of the existing valve box and lid, excavation, furnishing and installation of the PBCWUD-approved valve box and lid, extensions or adjustment sections as required, adjustment to finished grade, connection/clearance around the existing valve operating mechanism, bedding, backfill, compaction, and all incidental work necessary to complete the installation in accordance with the Contract Drawings and Specifications and as directed by the Engineer. The Contractor shall complete the following:
- b. Raising valve boxes in asphalt - Locate the paved over valve, cut asphalt (small cut), jackhammer down to reveal box upper section, adjust box to proposed street level, backfill with concrete and patch with cold patch material. Raising valve boxes in dirt - Locate the buried valve, dig down to the cover, and apply risers to raise the box to proposed ground level and backfill with compacted soil.
- c. Replacing valve boxes - Cut asphalt, jackhammer, or dig to reveal box upper section, vacuum excavate so that box can be replaced, adjust box over the operating nut, backfill with concrete and patch with cold patch material. Backfill shall be as specified in Section 125 of the latest FDOT Standard Specifications for Road and Bridge Construction, meeting the specific requirements around valve

boxes detailed in Section 125-8.1 and 125-8.2 of the FDOT Standard Specifications to match the proposed roadway grade and slope.

- d. After the surface course has been installed, the top surface of the valve boxes adjusted under the Contract shall be within the following limits: ¼" below the adjacent asphalt surface to zero (0) inches above the adjacent asphalt surface. All valve boxes that do not fall within these limits shall be adjusted to fall within the specified tolerances. No extra payment shall be allowed for this re-adjustment. If approved by PBCWUD representative, it will not be necessary to adjust valve boxes as long as they are within the limits described above. A valve box may have been called out on the plans for adjustment, however, only those that actually require adjustment shall be paid.
- e. If the CONTRACTOR is not going to follow behind the milling machine with the overlay and the street is reopened to local traffic, the CONTRACTOR shall be required to provide fillets around all valve boxes at uneven sections of pavement. Replacing valve boxes in unpaved areas - The Contractor shall install all valve boxes, concrete collars and covers for existing valves on existing mains that are left in place. In addition, the contractor shall have the entire opening around the valve filled in and compacted in accordance with the Contract Drawings and Specifications and as directed by the Engineer.
- f. Payment for furnishing and installing said item will be made at the unit price named in the Bid Schedule. The unit price shall constitute full compensation for the furnishing and installation of the item as shown on the Contract Drawings and Specifications.

T. Furnish and Install Fire Hydrant Assembly (Bid Item 22)

- a. Measurement for payment of fire hydrant assembly shall be by actual number of fire hydrant assembly furnished and installed (EA), in accordance with the requirements of the Contract Documents, Palm Beach County Water Utilities Department (PBCWUD) Minimum Design and Construction Standards, applicable standard details, and Approved Materials and Equipment List, and shall include but not limited to 6" DIP, all mechanical restraint joints, gate valve with box, fire hydrant, concrete collars and bollards for a complete hydrant assembly.
- b. Payment for fire hydrants will be made at the Contract unit price per each for the item, which price shall be full compensation for furnishing, installing, and flow testing the hydrant prior to final completion to determine the fire flow and residual pressures and to report the data on the form supplied by the OWNER, as shown on the Contract Drawings and Specifications.
- c. Payment of fitting for tee or anchor tee shall be under the bid item for ductile iron fittings w/accessories, mega-lugs & accessories on the branch of the tee are included in the cost of the hydrant assembly. (Refer to the latest PBCWUD Minimum Design and Construction Standards).

U. Asphalt Pavement Restoration (Bid Item 23)

- a. Measurement of asphaltic concrete surface course for asphalt roadway restoration will be the actual area of the surface course replaced in square yard, furnished and installed in accordance with the requirements of the Contract Documents.
- b. Payment for open-cut roadway for asphaltic concrete restoration will be the measured quantity at the Contract unit price per square yard with thickness of not less than 2-1/2", which price shall be full compensation for all labor, equipment materials, transportation and necessary preparation including placement and compaction of stabilized sub-grade, placement and compaction of base, tack coat, placement and compaction of surface course, restoring all pavement markings, removal and disposal of existing asphalt including saw cutting and all work as shown on the Contract Drawings and Specifications.

V. Wastewater Force Main Temporary Bypass (16") with 2 Line Stops (Installation and Removal) (Bid Item 24):

- a. This item is a lump sum and will not be measured.
- b. Payment for furnishing and installing the said item will be made at the lump sum named in the Bid Schedule. Payment for this said item will cover the entire duration required to complete the intended work which the bypass is installed for and includes bypass required for all force main installations as shown in the Contract Drawings. The price shall include but not be limited to all by-pass connections, hoses, fittings, plugs, caps, temporary valves, pumps/backup pumps, fuel, permits and all other necessary appurtenances required, two line stops, and any communication devices required such as auto-dialers for pump failure notifications to provide continuous wastewater service. The price shall also include removal of the bypass.

W. Single Line Stop (16") (Bid Items 25):

- a. Measurement and payment shall be based on furnishing, installing, and testing each line stop. Payment will not be made for any failed line stop attempts.
- b. The unit bid price per line stop (EA) shall include all labor, materials, equipment and incidentals necessary to furnish and install line stops for the entire duration needed to complete the intended work which the line stops are installed for as specified herein and as directed by the Engineer, including but not limited to: excavation, disposal of all excess materials, bracing, sheeting and dewatering, furnishing and installation of on the line stops, backfill, maintain uninterrupted flow in existing utilities, location and protection of existing utilities, and all other work required for the complete installation of the line stops including restraining existing pipes if necessary. All line stops shall be installed at locations as directed by the Engineer.

X. Relocation or Adjustment of Existing Fire Hydrant (Bid Item 26):

- a. Measurement for payment of fire hydrant relocation or adjustment shall be based upon the actual quantity of existing fire hydrant adjustment, in accordance with the requirements of the Contract Documents. Any additional pipe, accessories and materials needed to complete the adjustment shall be included and compensated under this bid item.
- b. The unit price shall constitute full compensation for fire hydrant relocation and adjustment as specified in the Contract Documents and Specifications, and as directed by the OWNER or Engineer.

Y. Gate Valve and Box (16") (Bid Item 27):

- a. Measurement for payment for valve with box and concrete collar based upon the actual quantity furnished and installed including all gaskets, bolts, nuts and appurtenances in accordance with the requirements of the Contract Documents.
- b. Payment for furnishing and installing said item will be made at the unit price named in the Bid Schedule. The unit price shall constitute full compensation for furnishing and installing the item as shown on the Contract Drawings and Specifications, and shall include clearing, excavation, dewatering, bedding, testing, backfilling and grading.

Z. Butterfly Valve and Box (16") (Bid Item 28):

- a. Measurement for payment for valve with box and concrete collar will be based upon the actual quantity furnished and installed including all gaskets, bolts, nuts and appurtenances in accordance with the requirements of the Contract Documents.
- b. Payment for furnishing and installing valve with box and concrete collar shall be made at the unit price named in the Bid Schedule. The unit price shall constitute full compensation for furnishing and installing the item as shown on the Contract Drawings and Specifications, and shall include clearing, excavation, dewatering, bedding, testing, backfilling and grading.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 01 29 73– SCHEDULE OF VALUES

PART 1 -- GENERAL

1.1 THE SUMMARY

- A. This Section defines the process whereby the Schedule of Values (lump sum price breakdown) shall be developed and incorporated into the cost loading function of the CPM Schedule in accordance with the requirements of Section 01 32 16 – Construction Progress Schedule.
- B. Upon request of the ENGINEER, the CONTRACTOR shall support the Schedule of Values with data that shall substantiate their correctness.
- C. The Schedule of Values, unless objected to by the ENGINEER, may be used for the lump sum portions of the Work as the basis for Payment Applications.
- D. Monthly progress payment amounts will be determined from the monthly progress updates of the CPM Schedule activities.
- E. Develop the Schedule of Values independent of but simultaneous with the development of the CPM Schedule activities and logic.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. Section 01 11 00 – Summary of Work
- B. Section 01 32 16 – Construction Progress Schedule

1.3 FORM AND CONTENT OF SCHEDULE OF VALUES

- A. The CONTRACTOR shall type Schedule of Values on 8 ½" x 11" or 11" x 17" white paper. The CONTRACTOR's standard forms and automated printout shall be considered for approval by the ENGINEER upon the CONTRACTOR's request. The CONTRACTOR shall identify the Schedule of Values with:
 - 1. Title of Project and Location.
 - 2. ENGINEER and OWNER's Project numbers.
 - 3. Date of Submission.
- B. The Schedule of Values shall list the installed value of the components of the Work in sufficient detail to serve as a basis for computing values for partial payments during construction.
- C. The CONTRACTOR shall identify each line with the numbers and title of the respective major section of the Specifications.
- D. For each major line item, the CONTRACTOR shall list sub-values of major products or operations under the item.

E. For the various portions of the Work:

1. Each item shall include a directly proportional amount of the CONTRACTOR's overhead profit.
2. For items on which partial payments will be requested for stored materials, the Schedule of Values shall conform to the requirements of the General Conditions of these Contract Documents.

F. The sum of each item of the lump sum breakdown shall equal the lump sum in the Proposal. All lump sum values listed in the Schedule of Values plus the sum of the unit price shall equal the Total Contract Price.

1.4 PRELIMINARY SCHEDULE OF VALUES

A. Submit a preliminary Schedule of Values for the major components of the WORK at the Preconstruction Conference in accordance with the requirements of Section 01 11 00 – Summary of Work.

B. At a minimum, submit proposed values for the following major WORK components:

1. Mobilization: 2.5 percent of Contract Price;
2. the total value of electrical WORK;
3. the total value of instrumentation and control WORK;
4. the total value of protective coatings WORK;
5. the total value of yard mechanical WORK inclusive of excavation, pipe installation, testing and backfill of pipe, and all incidental WORK associated with underground pipe installations;
6. the total value of mechanical WORK:
 - a. exclusive of yard mechanical WORK included in Item 5 above, but including piping, valves, equipment, tanks, and appurtenances at new and existing structures;
 - b. break down this total value into separate values for each new and existing structure constructed or modified as a part of the WORK;
7. the total value of structural reinforced concrete WORK:
 - a. inclusive of excavation, dewatering, subgrade preparation, backfill, and incidental WORK for new structures;
 - b. break down this total value shall be broken down into separate values for each new structure constructed as a part of the WORK;
 - c. miscellaneous and minor concrete WORK may be listed as one item in this breakdown;

8. the total value of pre-engineered metal buildings:
 - a. inclusive of architectural WORK, doors, windows and other incidental systems and features;
 - b. break down, this total value shall be broken down into separate values for each pre-engineered metal building;
9. the total value of site civil WORK, inclusive of clearing and grubbing, paving, grading and drainage WORK, and;
10. the total value of other WORK not specifically included in the above items.

C. Review and Revisions

1. The CONTRACTOR and ENGINEER shall meet and jointly review the preliminary Schedule of Values and make any adjustments in value allocations if, in the opinion of the ENGINEER, these are necessary to establish fair and reasonable allocation of values for the major WORK components.
2. Front-end loading will not be accepted.
3. The ENGINEER may require reallocation of major WORK components from items in the above listing if in the opinion of the ENGINEER such reallocation is necessary.
4. This review of the preliminary Schedule of Values and discussion of any necessary revisions shall be completed within 15 Days from the date of Notice to Proceed.

1.5 DETAILED SCHEDULE OF VALUES

- A. Prepare and submit a detailed Schedule of Values to the ENGINEER within 25 Days from the date of Notice to Proceed.
- B. Base the detailed Schedule of Values on the accepted preliminary Schedule of Values for major WORK components.
- C. Because the ultimate requirement is to develop a detailed Schedule of Values sufficient to determine appropriate monthly progress payment amounts through cost loading of the CPM Schedule activities, furnish a sufficiently detailed breakdown in order to meet this requirement.
- D. The ENGINEER will be the sole judge of acceptable numbers, details and description of values established.
- E. If, in the opinion of the ENGINEER, a greater number of Schedule of Values items than proposed is necessary, add the additional items so identified by the ENGINEER.
- F. Submit the minimum detail of breakdown of the major WORK components as follows; furnish greater detail if requested by the ENGINEER:
 1. Mobilization: no breakdown required;

2. Section 01 32 16 – Construction Progress Schedule: break down by submittal;
3. Break down the electrical WORK by structure and yard facilities, as follows:
 - a. Break down structures electrical WORK into conduit and raceway installation, cable and wire installation, electrical equipment installation, terminations, and lighting; and,
 - b. Break down yard facilities electrical WORK by duct bank designation and substations;
4. Break down instrumentation and control WORK by structure;
5. Protective Coating WORK:
 - a. Break down protective coating WORK by structure and yard area;
 - b. Where specific coating WORK at structures or yard areas may be critical to performing the WORK in order to meet milestone and Contract Times, such WORK shall be included as individual pay and Schedule activity items;
6. Yard Piping WORK:
 - a. Break down into individual pipelines running from and to Contract termination points.
 - b. Each pipeline shall be an individual pay item unless otherwise allowed by the ENGINEER.
7. Break down mechanical WORK within each structure in order to identify individual piping systems, equipment installation by equipment name and number, and equipment testing and checkout.
8. Break down concrete structures into excavation, subgrade preparation, and appurtenant pre-foundation WORK, concrete foundation construction, slabs on grade, walls/columns, suspended slabs, stairs, and the like (provide sufficiently detailed breakdown in order to accommodate necessary Schedule detail), hydrostatic structure testing, where required, and backfill.
9. Break down civil site WORK into individual drainage piping, drainage structures, site concrete, paving, excavation cut and fill, removal of existing pipe, clearing and grubbing, and other items determined to be necessary for the establishment of pay and schedule activity items.
10. Break down pre-commissioning and commissioning based on completion milestones for each.
11. Break down other WORK not specifically included in the above items, as necessary for the establishment of pay and schedule activity items.

G. Adjustments and Acceptance

1. The CONTRACTOR and ENGINEER shall meet and jointly review the detailed Schedule of Values within 14 Days from the date of Notice to Proceed, at which time the value allocations and extent of detail shall be reviewed in order to determine if necessary adjustments to the values are required, and to determine if sufficient detail has been proposed in order to allow acceptable cost loading of the CPM Schedule activities.
2. Make necessary adjustments to the value allocation or level of detail, and submit a revised detailed Schedule of Values within 30 Days from the date of Notice to Proceed.
3. Following acceptance of the detailed Schedule of Values, incorporate the values into the cost loading portion of the CPM Schedule.
4. Concurrently develop the CPM activities and logic with the development of the detailed Schedule of Values; however, it shall be necessary to adjust the detailed Schedule of Values to correlate to individual Schedule activities.
5. It is anticipated that instances will occur, due to the independent but simultaneous development of the Schedule of Values and the CPM Schedule activities, where interfacing these 2 documents will require changes to each document.
6. Schedule activities may need to be added to accommodate the detail of the Schedule of Values, and Schedule of Value items may need to be added to accommodate the detail of the CPM Schedule activities.
7. Where such instances arise, propose changes to the Schedule of Values and to the CPM Schedule activities in order to satisfy the CPM Schedule cost loading requirements.

1.6 CROSS-REFERENCE LISTING

- A. To assist in the correlation of the Schedule of Values and the CPM Schedule, provide a cross-reference listing to be furnished in 2 parts:
 1. In the first part, list each scheduled activity with the breakdown of the respective valued items making up the total cost of the activity; and,
 2. In the second part, list the valued item with the respective schedule activity or activities that make up the total indicated cost.
- B. In the case where a number of schedule items make up the total cost for a valued item (shown in the Schedule of Values), indicate the total cost for each Schedule of Value item.
- C. Update and submit these listings in conjunction with the CPM monthly submittals as indicated in Section 01 32 16 – Construction Progress Schedule.
- D. Incorporate approved Change Orders reflected in the CPM Schedule into the Schedule of Values as a single unit identified by the Change Order number.

1.7 CHANGES TO SCHEDULE OF VALUES

- A. Changes to the CPM Schedule which additional activities not included in the original schedule but included in the original WORK (schedule omissions) shall have values assigned as approved by the ENGINEER.
- B. Reduce other activity values in order to provide equal value adjustment increases for added activities, as approved by the ENGINEER.
- C. In the event that the CONTRACTOR and ENGINEER agree to make adjustments to the original Schedule of Values because of inequities discovered in the original accepted detailed Schedule of Values, increases and equal decreases to values for activities may be made.

1.8 LIQUIDATED DAMAGES

- A. See Section 11 of Instruction to Bidders, section 1.6 of the Bid Form and General conditions.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01 33 00 – SUBMITTAL PROCEDURES

PART 1 -- GENERAL

1.1 THE SUMMARY

- A. Submit to the Owner, shop drawings, project data, samples and miscellaneous work-related submittals required by the Specification Sections. Individual submittal requirements are specified in applicable sections of these Contract Documents.
- B. The Owner's review is for general conformance with the design concept and the Contract Documents.
- C. Miscellaneous submittals related directly to the Work (non-administrative) include warranties, guarantees, maintenance agreements, workmanship bonds, project photographs, survey data and reports, physical records, statements of applicability, quality testing and certifying reports, copies of industry standards, record drawings, overrun stock, and similar information, devices and materials applicable to the Work and not defined as shop drawings, product data or samples.
- D. Within 14 Days after the date of commencement as stated in the Notice to Proceed, submit the following items for review:
 - 1. Submittal Schedule
 - a. Submit a preliminary schedule of Shop Drawings, Samples, and proposed Substitutes ("or equal") submittals listed in the Bid.
 - b. Base the schedule of submittals on CONTRACTOR's priority, planned construction sequence and schedule, long-lead items, and size of submittal package.
 - c. Allow time for resubmittals.
 - 2. Submit a list of permits and licenses the CONTRACTOR shall obtain, indicating the agency required to grant the permit and the expected date of submittal for the permit and required date for receipt of the permit.
- E. Related Sections:
 - 1. Section 01 31 13 – Project Coordination
 - 2. Section 01 45 00 – Quality Control
 - 3. Section 01 77 00 – Closeout Procedures
 - 4. Section 01 78 23 – Operation and Maintenance Data

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. Section 01 11 00 – Summary of Work

- B. Section 01 29 73 – Schedule of Values
- C. Section 01 32 16 – Construction Progress Schedule
- D. Section 01 33 23 – Shop Drawings, Product Data, and Samples
- E. Section 01 52 00 – Construction Facilities
- F. Section 01 60 00 – Products Requirements
- G. Palm Beach County Water Utility District (PBCWUD) – Engineering Services Division – Approved Materials List (Latest Revision).
- H. Florida Department of Transportation (FDOT) – Standard Specifications for Road and Bridge Construction

1.3 PRECONSTRUCTION CONFERENCE SUBMITTALS

- A. At the preconstruction conference per Section 01 31 13 – Project Coordination, submit the following items to the ENGINEER for review:
 - 1. CONTRACTOR's organizational chart as it relates to this Project;
 - 2. List of Subcontractors and Suppliers;
 - 3. CONTRACTOR's safety program, including the designated safety representative, requirement for personal protective equipment and safety protocols;
 - 4. A 30-Day plan of operation and a project overview bar chart in accordance with Section 01 32 16 – Construction Progress Schedule;
 - 5. Status of building permits and crossing permits and a list of permits and licenses the CONTRACTOR shall obtain, indicating the agency required to grant the permit, the expected date of submittal for the permit, and required date for receipt of the permit;
 - 6. Requirements for surveying or establishing controls;
 - 7. Status of Storm Water Pollution Prevention Plans, if required;
 - 8. Preliminary submittal schedule per Section 01 33 00 – Submittal Procedures;
 - 9. Preliminary Schedule of Values and anticipated schedule of payments per Section 01 20 00 – Price and Payment Procedures;
 - 10. Letter indicating the agents of authority for the CONTRACTOR and the limit of that authority with respect to the execution of legal documents, contract modifications and payment requests, if required
 - 11. Major equipment deliveries and priorities;
 - 12. Locations, site access and related facilities of the field office required under Section 01 52 00 – Construction Facilities

1.4 CONTRACTOR'S RESPONSIBILITIES

- A. Review documents, shop drawings, product data and samples prior to submission. Make certifications as required by the Contract Documents and as indicated on OWNER provided forms.
- B. Determine and verify:
 - 1. Field measurements.
 - 2. Field construction criteria.
 - 3. Catalog numbers and similar data.
 - 4. Conformance with the Specifications.
- C. Coordinate each submittal with requirements of the Work and of the Contract Documents.
- D. Notify the Owner in writing, at the time of submission, of any deviations in the submittals from the requirements of the Contract Documents.
- E. Begin no fabrication or work requiring approved submittals until return of submittals by the Owner.
- F. Provide a Schedule of Submittals to list the documents that are to be submitted, the dates on which submittals are to be sent to the OWNER for review and proposed dates that submittals must be returned to comply with the project schedule. Use the form provided by the OWNER for this list.
- G. Incorporate the dates for processing submittals into the Progress Schedule required by Section 01 32 16 – Construction Progress Schedule.
 - 1. Provide submittals in accordance with the schedule so construction of the Project is not delayed.
 - 2. Allow a reasonable time for the review of submittals when preparing the Progress Schedule. Assume a 14 day review cycle for each submittal unless a longer period of time is indicated in the Contract Documents or agreed to by OWNER and CONTRACTOR.
 - 3. Schedule submittal to provide all information for interrelated Work at one time.
 - 4. Allow adequate time for processing submittals so construction of the Project is not delayed.

1.5 SHOP DRAWINGS

- A. Wherever called for in the Contract Documents or where required by the OWNER, furnish four copies of Shop Drawings or where required by the CONTRACTOR, furnish three copies of Shop Drawings.

- B. Shop Drawings may include detail design calculations, shop-prepared drawings, fabrication and installation drawings, erection drawings, lists, graphs, catalog sheets, data sheets, and similar items.
- C. Whenever the CONTRACTOR is required to submit design calculations as part of a submittal, such calculations shall bear the signature and seal of an ENGINEER registered in Florida and in the appropriate branch, unless otherwise indicated.
- D. Drawings shall be presented in a clear and thorough manner.
 - 1. Details shall be identified by reference to sheet and detail and schedule as shown on the Contract Documents.
- E. Designate in the construction schedule, or in a separate coordinating schedule, the dates for submission and the dates that reviewed shop drawings, product data and samples are needed.
- F. Transmittal Form
 - 1. Shop Drawing submittals shall be accompanied by the ENGINEER's standard submittal transmittal form, a reproducible copy of which is available from the ENGINEER.
 - 2. A submittal without the form, or where applicable items on the form have not been completed, will be returned for resubmittal.
- G. Organization
 - 1. Use a single submittal transmittal form for each technical specification Section or item or class of material or equipment for which a submittal is required.
 - 2. A single submittal covering multiple Sections will not be accepted, unless the primary specification references other Sections for components: For example, if a pump Section references other Sections for the motor, shop-applied protective coating, anchor bolts, local control panel, and variable frequency drive, a single submittal would be accepted, whereas a single submittal covering vertical turbine pumps and horizontal split-case pumps would not be accepted.
 - 3. On the transmittal form, index the components of the submittal and insert tabs in the submittal to match the components.
 - 4. Relate the submittal components to specification paragraph and subparagraph, Drawing number, detail number, schedule title, room number, or building name, as applicable.
 - 5. Unless otherwise indicated, match terminology and equipment names and numbers used in the submittals with those used in the Contract Documents.

H. Format

1. Minimum sheet size shall be 8-1/2 inches by 11 inches, and maximum sheet size shall be 24 inches by 36 inches.
2. Number every page in a submittal in sequence.
3. Collate and staple or bind, as appropriate, each copy of a submittal; the ENGINEER will not collate sheets or copies.
4. Where product data from a manufacturer is submitted, clearly mark which model is proposed, with complete pertinent data capacities, dimensions, clearances, diagrams, controls, connections, anchorage, and supports.
5. Present a sufficient level of detail for assessment of compliance with the Contract Documents.
6. Numbering
 - a. Assign to each submittal a unique number.
 - b. Number the submittals sequentially, with the submittal numbers clearly noted on the transmittal.
 - c. Assign original submittals a numeric submittal number followed by a letter of the alphabet in order to distinguish between the original submittal and each resubmittal: For example, if submittal "25-A" requires a resubmittal, the first resubmittal will bear the designation "25-B" and the second resubmittal will bear the designation "25-C," and so on.

I. Disorganized submittals that do not meet the requirements of the Contract Documents will be returned without review.

J. ENGINEER's Review

1. Except as otherwise indicated, the ENGINEER will return prints of each submittal to the CONTRACTOR with comments noted thereon, within 15 Days following receipt by the ENGINEER.
2. It is considered reasonable that the CONTRACTOR shall make a complete and acceptable submittal to the ENGINEER by the first resubmittal on an item.
3. The OWNER reserves the right to withhold monies due to the CONTRACTOR to cover additional costs of the ENGINEER's review beyond the first resubmittal.
4. The ENGINEER'S maximum review period for each submittal or resubmittal will be 30 Days; thus, for a submittal that requires 2 resubmittals before it is complete, the maximum review period could be 60 Days.

K. If a submittal is returned to the CONTRACTOR marked "NO EXCEPTIONS TAKEN," formal revision and resubmission will not be required.

L. If a submittal is returned marked "MAKE CORRECTIONS NOTED," the CONTRACTOR shall make the corrections on the submittal, but formal revision and resubmission will not be required.

M. Resubmittals

1. If a submittal is returned marked "AMEND-RESUBMIT," the CONTRACTOR shall revise the submittal and resubmit the required number of copies.
2. Resubmittal of portions of multi-page or multi-drawing submittals will not be accepted: For example, if a Shop Drawing submittal consisting of 10 drawings contains one drawing noted as "AMEND-RESUBMIT," the submittal as a whole is deemed "AMEND-RESUBMIT," and 10 drawings are required to be resubmitted.
3. Every change from a submittal to a resubmittal or from a resubmittal to a subsequent resubmittal shall be identified and flagged on the resubmittal.
4. Make any corrections or changes in the submittals noted by the Owner or the Engineer and resubmit unless otherwise noted.
5. Shop Drawings, Project Data and Product Data:
 - a. Revise initial drawings or data, and resubmit as specified for the initial submittal.
 - b. Indicate any changes which are made other than those requested by the Engineer.
6. The Owner will review one (1) re-submittal for each shop drawing or product data. All costs of reviewing additional re-submittals shall be at the Contractor's expense and shall be reflected in the final Change Order.
7. Samples: Submit new samples as required for initial submittal.

N. Rejected Submittals

1. If a submittal is returned marked "REJECTED-RESUBMIT," it shall mean either that the proposed material or product does not satisfy the specification, the submittal is so incomplete that it cannot be reviewed, or is a substitution request not submitted in accordance with Section 01 25 13 – Product Substitution Procedures.
2. In the first 2 cases, the CONTRACTOR shall prepare a new submittal and shall submit the required number of copies.
3. In the latter case, the CONTRACTOR shall submit the substitution request according to the requirements of Section 01 25 13 – Product Substitution Procedures.
4. The resubmittal of rejected portions of a previous submittal will not be accepted.

O. The fabrication of an item may commence only after the ENGINEER has reviewed the pertinent submittals and returned copies to the CONTRACTOR marked either "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED."

P. Corrections indicated on submittals shall be considered as changes necessary to meet the requirements of the Contract Documents and shall not be taken as changes to the contract requirements.

Q. Review by CONTRACTOR

1. Submittals shall be carefully reviewed by an authorized representative of the CONTRACTOR prior to submission to the ENGINEER.
2. Each submittal shall be dated and signed by the CONTRACTOR as being correct and in strict conformance with the Contract Documents.
3. In the case of Shop Drawings, each sheet shall be so dated and signed.
4. Any deviations from the Contract Documents shall be noted on the transmittal sheet.
5. The ENGINEER will only review submittals that have been so verified by the CONTRACTOR.
6. Non-verified submittals will be returned to the CONTRACTOR without action taken by the ENGINEER, and any delays caused thereby shall be the total responsibility of the CONTRACTOR.

R. Conformance

1. Corrections or comments made on the CONTRACTOR's Shop Drawings during review shall not relieve the CONTRACTOR from compliance with Contract Drawings and Specifications.
2. A lack of comments made on the CONTRACTOR's Shop Drawings during review shall not relieve the CONTRACTOR from compliance with Contract Drawings and Specifications.
3. Review is for conformance to the design concept and general compliance with the Contract Documents only.
4. The CONTRACTOR shall be responsible for confirming and correlating quantities and dimensions, fabrication processes and techniques, coordinating WORK with the trades, and satisfactory and safe performance of the WORK.

S. Selection

1. Unless otherwise indicated, the ENGINEER will select colors and textures from the manufacturer's standard colors and standard materials, products, or equipment lines.

1.6 WARRANTIES

- A. Refer to individual sections of these Specifications for specific general requirements on the submittal of warranties, guarantees, product/workmanship bonds, and maintenance agreements which are uniquely prepared and executed for the project.

1.7 AS-BUILT DRAWINGS

A. On-Site Drawings Set

1. Maintain one set of Drawings at the Site for the preparation of as-built drawings. Label each document "PROJECT RECORD" in neat large printed letters.
2. On this set, mark every project condition, location, configuration, and any other change or deviation which may differ from the Contract Drawings at the time of award, including buried or concealed construction and utility features that are revealed during the course of construction.
3. Give special attention to recording the horizontal and vertical location of buried utilities that differ from the locations indicated, or that were not indicated on the Contract Drawings.
4. Supplement the as-built drawings by any detailed sketches as necessary or as directed, in order to fully indicate the WORK as actually constructed.
5. The as-built drawings are the CONTRACTOR's representation of as-built conditions, shall include revisions made by addenda and change orders, and shall be maintained up-to-date during the progress of the WORK.
6. Use red ink for alterations and notes.
7. Notes shall identify relevant Change Orders by number and date.

B. Submittal

1. Submit paper copies of the as-built drawings on the 20th Day of every third month after the month in which the Notice to Proceed is given, as well as at completion of the WORK.
2. Failure to submit complete as-built drawings on or before the 20th Day will enact the liquidated damages clause for interim record drawing submittals described in Article 3 of the Agreement.

C. Unacceptable Drawings

1. Disorganized or incomplete as-built drawings will not be accepted.
2. The CONTRACTOR shall revise them and resubmit within 10 Days.

D. In the case of those drawings that depict the detail requirement for equipment to be assembled and wired in the factory, such as motor control centers and the like, update the as-built drawings by indicating those portions which are superseded by Change Order drawings or final Shop Drawings, and by including appropriate reference information describing the Change Orders by number and the Shop Drawings by manufacturer, drawing, and revision numbers

E. As-built drawings shall be accessible to the ENGINEER during the construction period.

1.8 RECORD DRAWINGS

A. Final payment will not be acted upon until the record drawings have been completed and delivered to the ENGINEER.

B. Upon substantial completion of the WORK and prior to final acceptance, the CONTRACTOR shall finalize and deliver a complete set of record drawings to the ENGINEER for transmittal to the OWNER, conforming to the construction records of the CONTRACTOR. This set of drawings shall consist of corrected drawings showing the reported location of the WORK. The information submitted by the CONTRACTOR and incorporated by the ENGINEER into the Record Drawings will be assumed to be correct, and the CONTRACTOR shall be responsible for the accuracy of such information, and shall bear the costs resulting from the correction of incorrect data furnished to the ENGINEER and the OWNER.

C. Legibly mark drawings to record actual construction

1. Provide horizontal location of pipes any time the pipe passes a permanent surface reference point. Permanent reference points are as defined herein. Any deviations from the alignment shown on the Contract Drawings must be noted.
2. Provide vertical locations at 100-foot intervals. Vertical location will be depth of cover or pipe elevation, whichever is called for on the drawings.
3. All fittings, including sleeves, valves, and services are to be located by two measurements to permanent surface reference points.
4. Permanent surface reference points are manholes, catch basins, power poles, concrete sidewalk, or concrete curbs. Edge of pavement and road intersections may not be used without the ENGINEER's approval.
5. Field changes of dimension and detail.

D. Legibly mark each Section of the Specifications and Addenda to record:

1. Manufacturer, trade name, catalog number, and supplier of each item actually installed.
2. Changes made by Field Order, Change Order, or Work Directive.

E. Record drawings for **pipelines** shall address the following:

1. The as-built data on submitted plan sheets (line work, numerical data) must be easily legible, accurate and comply with PBCWUD standards (increase the font size and/or use different font style to improve legibility). Separate water and wastewater as-built plans may be required for projects with a high density of data and/or poor legibility.
2. The Contract Drawings shall be used for as-built presentation.
3. Identify street names, addresses, subdivision, homeowner's association contact for each well site.
4. Existing utility easements shall be identified on record drawings with ORB/Page, Plat Book/Page.
5. Complete title block with current file name (including f/k/a, a/k/a, plat name, etc.). Label drawings "Record Drawings" or "as-builts" and show appropriate entries in the revision block.
6. New main valves must be numbered on the appropriate plan sheets.
7. Horizontal as-built data (stations, offsets, distances between fittings, manholes, pull boxes) are to be rounded off to the nearest foot. Elevation data shall be shown to the hundredth of a foot (top of manhole, inverts), or to the tenth of foot for top of pipe elevations. Slopes shall be rounded off to the nearest one-ten thousandth.
8. As-built data must include stations and offsets and top of pipe elevations for all fittings, valves, hydrants, pipe conflicts, and pipe at 100-foot intervals. Horizontal pipe separation at 100-foot intervals is required for parallel piping systems. Show restrained pipe joints. For "wet tap" or "cut-in" connections into existing system, a distance from the point of connection to an existing in-line valve is required.
9. Completed equipment information, OWNER equipment data sheets included in Attachment A to this Specification Section, and all data lists must be submitted as part of the record drawing review.
10. Completed operation and maintenance manuals must be submitted with final record drawings.
11. A final survey as prepared and sealed by a Professional Land Surveyor registered in the State of Florida. Survey results shall include the longitude and latitude of each new well site, vertical elevation of the top of the outer casing, top of well pad elevation, top and bottom elevations of all well vaults, finished grade elevation, and the centerline elevation of the wellhead piping.

12. The CONTRACTOR shall submit record as-built information for each new well and each existing well modified under the Contract. Information to be provided shall include but not be limited to the following: depth and size of each casing, total depth of well casing, total depth of well, screened interval for well, pump set depth, set depth of level transmitter, total number of hours for air development and pumping development, materials of construction, capacity of well, sand content from final well, and silt density index from final well.

F. Computer generated as-built drawings shall be submitted. Data in tabular form will not be accepted. Initially two (2) signed and sealed paper prints are to be submitted for review. Following review by the ENGINEER and OWNER, any comments are to be addressed. On final submission, the following items shall be provided:

1. All proposed data must be crossed out and the computer generated as-built data must be easy to be identified as such, using different font (larger size, thickness, pitch, etc.). Record data identifiers must be added to the legend and shown on each plan/profile sheet.
2. Manufacturers of equipment including but not limited to valves, hydrants, pumps, motors, control panels, backflow preventors, generators, engines, and meters shall be listed on at least one page of the record drawings.
 - a. List of manholes, valves, and hydrants on forms and CD/DVD, as specified by the OWNER. The listing shall match the data shown on record drawings. Sample forms to be completed by the CONTRACTOR are included in Attachment A to this Specification Section.
 - b. Data on CD/DVD shall be in Microsoft Excel format.
3. The electronic drawing files must be AutoCAD format or compatible (DWG file or DXF file) submitted on compact disc or DVD (CD/DVD). All fonts and line types shall be from the standard AutoCAD library or be AutoCAD compatible. Reference files and blocks are to be bound to drawings prior to submittal. Layers and drawings created by turning on and off layers are to be documented and submitted in MS Word or ASCII format. As a minimum requirement, electronic files must include all features that were shown on the Contract Drawings.

G. Information submitted by the CONTRACTOR will be assumed to be correct, and the CONTRACTOR shall be responsible for the accuracy of such information.

1.9 QUALITY CONTROL (QC) SUBMITTALS

A. Quality control submittals are defined as those required by the Specifications to present documentary evidence to the ENGINEER that the CONTRACTOR has satisfied certain requirements of the Contract Documents.

B. Unless otherwise indicated, QC submittals shall be submitted:

1. Before delivery and unloading, for the following types of submittals:
 - a. Manufacturers' installation instructions

- b. Manufacturers' and Installers' experience qualifications
 - c. Ready mix concrete delivery tickets
 - d. Design calculations
 - e. Affidavits and manufacturers' certification of compliance with indicated product requirements
 - f. Laboratory analysis results
 - g. Factory test reports
2. Within 30 Days of the event documented for the following types of submittals:
- a. Manufacturers' field representative certification of proper installation
 - b. Field measurement
 - c. Field test reports
 - d. Receipt of permit
 - e. Receipt of regulatory approval
- C. The ENGINEER will record the date that a QC submittal was received and review it for compliance with submittal requirements, but the review procedures above for Shop Drawings and samples will not apply.
- 1.10 INFORMATIONAL SUBMITTALS
- A. Informational submittals formalize the flow of information between the CONTRACTOR and the ENGINEER.
 - B. Paper and/or electronic forms, if applicable, shall be obtained from the ENGINEER for such purpose.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01 72 00 - PROJECT RECORD DRAWINGS

PART 1 - GENERAL

1.1 THE REQUIREMENT

- A. The CONTRACTOR shall keep and maintain, at the job site, one record copy of all drawings, specifications, addenda, change orders, and other modifications to the Contract, approved shop drawings, and field test records.
- B. The CONTRACTOR shall mark the record drawings to indicate all project conditions, locations, configurations, and any other changes or deviations which may vary from the details represented on the original Contract Drawings, including buried or concealed construction and utility features which are revealed during the course of construction. Special attention shall be given to recording the horizontal and vertical location of all buried utilities that differ from the locations indicated, or which were not indicated on the Contract Drawings. Said record drawings shall be supplemented by any detailed sketches as necessary or directed to indicate, fully, the WORK as actually constructed. These master record drawings of the CONTRACTOR's representation of as-built conditions, including all revisions made necessary by addenda and change orders shall be maintained up-to-date during the progress of the WORK.
- C. Record drawings shall be accessible to the ENGINEER at all times during the construction period.
- D. Periodic payments must be accompanied by an updated copy of the record drawings. Pay Applications submitted without record drawings shall not be proceeded by the ENGINEER, until the drawings are received. The CONTRACTOR shall submit one set of record drawing, 11 x 17 size shall be acceptable.
- E. Final payment will not be acted upon until the CONTRACTOR has prepared and delivered record as-built drawings to the ENGINEER. Said up-to-date record drawings shall be in the form of a set of prints with carefully plotted information overlaid in red.
- F. Upon substantial completion of the WORK and prior to final acceptance, the CONTRACTOR shall finalize and deliver a complete set of record drawings to the ENGINEER for transmittal to the OWNER, conforming to the construction records of the CONTRACTOR. This set of drawings shall consist of corrected drawings showing the reported location of the WORK. The information submitted by the CONTRACTOR and incorporated by the ENGINEER into the Record Drawings will be assumed to be correct, and the CONTRACTOR shall be responsible for the accuracy of such information, and shall bear the costs resulting from the correction of incorrect data furnished to the ENGINEER and the OWNER.

1.2 RELATED REQUIREMENTS

- A. Section 01 33 00: Submittal Procedures
- B. Section 01 77 00: Closeout Procedure.
- C. Latest Palm Beach County Water Utilities Department Minimum Design and Construction Standards for Potable Water, Reclaimed Water and Wastewater systems

1.3 MARKING DEVICES

- A. The CONTRACTOR shall provide felt tip marking pens for recording information in a color code.

1.4 RECORDING

- A. Label each document "PROJECT RECORD" in neat large printed letters.
- B. Record information concurrently with the progress of construction.
- C. Legibly mark drawings to record actual construction
 - 1. Provide horizontal location of pipes any time the pipe passes a permanent surface reference point. Permanent reference points are as defined herein. Any deviations from the alignment shown on the Contract Drawings must be noted.
 - 2. Provide vertical locations at 100-foot intervals. Vertical location will be depth of cover or pipe elevation, whichever is called for on the drawings.
 - 3. All fittings, including sleeves, valves, and services are to be located by two measurements to permanent surface reference points.
 - 4. Permanent surface reference points are manholes, catch basins, power poles, concrete sidewalk, or concrete curbs. Edge of pavement and road intersections may not be used without the ENGINEER's approval.
 - 5. Field changes of dimension and detail.
 - 6. Changes made by Field Order, Change Order, or Construction Change Directive.
 - 7. Details not shown on the original Contract Drawings.
- D. Legibly mark each Section of the Specifications and Addenda to record:
 - 1. Manufacturer, trade name, catalog number, and supplier of each item actually installed.

2. Changes made by Field Order, Change Order, or Work Directive.

1.5 SUBMITTAL

- A. Prior to Substantial Completion, submit Record Documents to the ENGINEER for delivery to the OWNER.
- B. Accompany submittal with a transmittal letter in duplicate, containing:
 1. Date.
 2. Project title and number.
 3. CONTRACTOR's name and address.
 4. Title and number of each record document.
 5. Signature of CONTRACTOR or its authorized representative.
- C. Computer generated as-built drawings shall be submitted. Data in tabular form will not be accepted. Initially two (2) signed and sealed paper prints are to be submitted for review. Following review by the ENGINEER and OWNER, any comments are to be addressed. On final submission, the following items shall be provided:
 1. Two (2) signed and sealed sets of prints (24" x 36")
 2. All proposed data must be crossed out and the computer generated as-built data must be easy to be identified as such, using different font (larger size, thickness, pitch, etc.). Record data identifiers must be added to the legend and shown on each plan/profile sheet.
 3. Manufacturers of equipment including but not limited to valves, hydrants, pumps, motors, control panels, backflow preventors, generators, engines, and meters shall be listed on at least one page of the record drawings.
 - a. List of manholes, valves, and hydrants on forms and computer CD / usb, as specified by the OWNER. The listing shall match the data shown on record drawings. Sample forms to be completed by the CONTRACTOR are included in Attachment A to this Specification Section.
 - b. Data on CD / usb shall be in Microsoft Excel format or alternative program (such as Lotus 1-2-3 (*.wk*), QuattroPro/DOS Files (*.wq*), dBase Files (*.dbf), or Text Files (*.prn; *.txt; *.csv)) that can be imported into Microsoft Excel without loss of data.

4. The electronic drawing files must be AutoCAD format or compatible (DWG file or DXF file) submitted on compact disc (CD). All fonts and line types shall be from the standard AutoCAD library or be AutoCAD compatible. Reference files and blocks are to be bound to drawings prior to submittal. Layers and drawings created by turning on and off layers are to be documented and submitted in MS Word or ASCII format. As a minimum requirement, electronic files must include all features that were shown on the Contract Drawings.
- D. A separate electronic record drawing files require showing only geographically correct locations of main pipes, valves, hydrants, manholes, lift stations, right-of-way lines and property lines.
- E. Submit one (1) print highlighting the part of the system requested for Health Department certifications. Any as-built drawing found to be inaccurate or incomplete will be rejected.
- F. Record drawings for pipelines shall address the following:
1. The as-built data on submitted plan sheets (line work, numerical data) must be easily legible, accurate and comply with PBCWUD standards (increase the font size and/or use different font style to improve legibility). Separate water and wastewater as-built plans may be required for projects with a high density of data and/or poor legibility.
 2. The Contract Drawings shall be used for as-built presentation.
 3. Identify street names, addresses, subdivision, homeowner's association contact for each well site.
 4. Existing utility easements shall be identified on record drawings with ORB/Page, Plat Book/Page.
 5. Complete title block with current file name (including f/k/a, a/k/a, plat name, etc.). Label drawings "Record Drawings" or "as-builts" and show appropriate entries in the revision block.
 6. New valves must be numbered on the appropriate plan sheets.
 7. Horizontal as-built data (stations, offsets, distances between fittings, manholes, pull boxes) are to be rounded off to the nearest foot. Elevation data shall be shown to the hundredth of a foot (top of manhole, inverts), or to the tenth of foot for top of pipe elevations. Slopes shall be rounded off to the nearest one-tenthousandth.
 8. As-built data must include stations and offsets and top of pipe elevations for all fittings, valves, hydrants, pipe conflicts, and pipe at 100-foot intervals. Horizontal pipe separation at 100-foot intervals is required for parallel piping systems. Show restrained pipe joints. For

“wet tap” or “cut-in” connections into existing system, a distance from the point of connection to an existing in-line valve is required.

9. Completed equipment information, OWNER equipment data sheets included in Attachment A to this Specification Section, and all data lists must be submitted as part of the record drawing review.
 10. Completed operation and maintenance manuals must be submitted with final record drawings.
- G. Record drawings for new and rehabilitated production wells shall address the following information:
1. A site sketch shall be prepared for each new well site showing sufficient detail to properly locate the wellhead. The site sketch must indicate the position of the wellhead in the State Planar coordinate system NAD27 and the elevation of the outer casing with reference to feet National Geodetic Vertical Datum.
 2. A final survey as prepared and sealed by a Professional Land Surveyor registered in the State of Florida. Survey results shall include the longitude and latitude of each new well site, vertical elevation of the top of the outer casing, top of well pad elevation, top and bottom elevations of all well vaults, finished grade elevation, and the centerline elevation of the wellhead piping.
 3. The CONTRACTOR shall submit record as-built information for each new well and each existing well modified under the Contract. Information to be provided shall include but not be limited to the following: depth and size of each casing, total depth of well casing, total depth of well, screened interval for well, pump set depth, set depth of level transmitter, total number of hours for air development and pumping development, materials of construction, capacity of well, sand content from final well, and silt density index from final well.
- H. Record drawings for new equipment provided by the CONTRACTOR shall address the following information:
1. Manufacturer, model number, serial numbers for each piece of equipment.
 2. For each new pump: pump type, design capacity and TDH, shutoff head, impeller size, manufacturer's pump curve reference number, horsepower, efficiency, motor speed, discharge pipe size, discharge flange pressure rating, diameter of bowls, number of stages, pump column pipe diameter and length.
 3. For each new flow meter/flow transmitter: flow range, accuracy, turndown ratio, signal interface, materials of construction, and power supply required.

PART 2 – PRODUCTS - Not Used

PART 3 – EXECUTION - Not Used

END OF SECTION

ATTACHMENT A - OWNER'S EQUIPMENT DATA SUBMITTAL REQUIREMENT

The CONTRACTOR is required to submit this data sheet with each piece/unit of mechanical, electrical, or instrumentation equipment provided on this project. Information shall be submitted with the Record Drawings for review and approval by the OWNER.

GENERAL INFORMATION

Installation Date	
Replacement Date	
Deletion Date & Equipment #	/
System	
Equipment Description	
Equipment Location	
Manufacturer	

DESCRIPTION INFORMATION

Tag #		Catalog	
Asset #		Size	
Serial #		Type	
Model #			

REQUIRED INFORMATION

Volts		Discharge Size	
Amps		Packing Type	
Phase		Packing Size	
Heater Size		Body Size	
KVA		Port Size	
KW		PSI Rating	
RPM		Face to Face	
Horse Power		Body Ends	
Insulation			
Enclosure			
Service Factor			
Arrangement			
Frame Size			
Drive Bearing			
Opp Dr Bearing			
Sealed Bearing			
Fuel Capacity			
Oil Filter			
Air filter			
Coolant Filter			
Fuel Filter			
Ratio			
Torque			
Input RPM			
Output RPM			
TDH			
Impeller Dia			
PSI			
No. of Stages			
Suction Size			

The above listed information shall be provided for the following equipment. One sheet shall be completed for each unit/piece listed below. It is the CONTRACTOR's responsibility to coordinate this equipment list with equipment included in the Contract Documents and technical specifications.

ELECTRICAL AND CONTROL PANELS:

Alternator, Circuit Breaker (control, disconnect, emergency, pump or lighting), Control Circuit, Control Panel, Contactor, Insulator, Electrical Panel, Limit Switch, Main Breaker, Power Capacitor, Pressure Switch, Phase Monitor, Soft Start Controller, Timer, Transfer Switch, Transformer (bank, control, lighting, or current), Variable Frequency Drive, Voltage Regulator, etc.

EMERGENCY EQUIPMENT:

Alarm-Horn Lights, Emergency Lights, Emergency Drop Shower, Exit Signs, Eye Wash Station, Fire Alarm System, Fire Extinguisher, SCBA Air Pack, etc.

GENERATORS:

Air Filter, Battery Charger, Battery, Coolant Filter, Day Tank, Engine, Engine Heater, Portable Generator, Stationary Generator, etc.

INSTRUMENTATION:

Alarm Panel, Flow Controller, Flow Indicator, Flow Transmitter, Flow Recorder, Level Controller, Hydrogen Sulfide Detector, Level Indicator, Level Transmitter, etc.

MOTORS (AC or DC):

Blower, Pump, Valve Actuator, Well, etc.

PUMPS:

Submersible, Sump, etc.

TELEMETRY:

Alarms, Battery Backup Power, Controllers, CPU, Fiber Optics, PLC, Radio, Seiscor, Telemetry, UPS, etc.

VALVES:

Air Relief, Back Pressure, Ball, Ball Check, Butterfly, Gate, Plug, Pneumatic, Pressure Reducing, Pressure Relief, Silent Check, Under Flow, etc.

WELLS:

Raw Water, Monitoring Well, etc.

FORM BY : _____ **DATE:** _____

WUD INSPECTOR :

APPLICATOR :

VALVE MFG:

[illegible]

***FEATURE CODE (NAME)**

MH = MANHOLE

FH = FIRE HYDRANT

FLH = FLUSHING HYDRANT

LSGV= LINE STOP GATE VALVE

AFL = AUTOMATIC FLUSHER

ADD "W" FOR WATER, "S" FOR SEWER & "R" FOR RECLAIM TO ALL FEATURE CODES, IE. WFH, WGV, SGV, SMH, RGV OR RFLH

SECTION 01 73 29– CUTTING AND PATCHING

PART 1 -- GENERAL

1.1 THE SUMMARY

A. Section Includes:

1. CONTRACTOR shall be responsible for all cutting, backfill, base replacement, asphalt replacement, milling required to complete the Work. The Contract Plans list cutting and patching of driveways and roadways. The CONTRACTOR shall maintain traffic and comply with the special conditions as shown on the Contract Plans.

B. Related sections:

1. Section 01 11 00 – Summary of Work
2. Section 01 76 10 – Protection of Existing Facilities
3. Section 31 23 33 – Trenching and Backfilling

1.2 PERFORMANCE REQUIREMENTS

- A.** Execute cutting and demolition by methods that will prevent damage to other Work and will provide proper surfaces to receive installation of repairs.
- B.** Perform excavation and backfill by methods that will prevent settlement or damage to other Work.
- C.** Execute fittings and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances and finishes.
- D.** Minimize disruption of vehicular and pedestrian traffic during cutting and patching. If a property has multiple entrances close only one entrance at a time.
- E. Restoration of Pavement:**
1. General: All paved areas including asphaltic concrete berms cut or damaged during construction shall be replaced with similar materials of equal thickness to match the existing adjacent undisturbed areas, except where specific resurfacing requirements have been called for in the Contract Documents or in the requirements of the agency issuing the permit. The pavement restoration requirement to match existing sections shall apply to all components of existing sections, including sub-base, base, and pavement. Temporary and permanent pavement shall conform to the requirements of the affected pavement owner. Pavements which are subject to partial removal shall be neatly saw cut in straight lines.
 2. Temporary Resurfacing: Wherever permanent resurfacing is not possible immediately after completing the work, the CONTRACTOR shall place temporary surfacing promptly after backfilling and shall maintain such surfacing until final restoration of improvements.

3. Permanent Resurfacing: In order to obtain a satisfactory junction with adjacent surfaces, the CONTRACTOR shall saw cut back and trim the edge so as to provide a clean, sound, vertical joint before permanent replacement of an excavated or damaged portion of pavement. Damaged edges of pavement along excavations and elsewhere shall be trimmed back by saw cutting in straight lines. All pavement restoration and other facilities restoration shall be constructed to finish grades compatible with adjacent undisturbed pavement.
4. Restoration of Sidewalks or Private Driveways: Wherever sidewalks or private roads have been removed for purposes of construction, the CONTRACTOR shall place suitable temporary sidewalks or roadways promptly after backfilling and shall maintain them in satisfactory condition for the period of time fixed by the authorities having jurisdiction over the affected portions. If no such period of time is so fixed, the CONTRACTOR shall maintain said temporary sidewalks or roadways until the final restoration thereof has been made.

PART 2 -- PRODUCTS

2.1 MATERIALS

- A. Comply with specifications and standards for each product involved.

PART 3 -- EXECUTION

3.1 INSPECTION

- A. Inspect existing conditions of the Project, including elements subject to damage or to movement during cutting and patching.
- B. After uncovering the Work, inspect conditions affecting installation of products or performance of the Work.
- C. Report unsatisfactory or questionable conditions to the ENGINEER in writing; do not proceed with the Work until the ENGINEER has provided further instructions.

3.2 PREPARATION

- A. Provide adequate temporary support as necessary to assure structural integrity of affected portions of the Work.
- B. Provide devices and methods to protect other portions of the Work from damage.
- C. Provide protection from elements for that portion of the Project which may be exposed by cutting and patching work, and maintain excavations free from water.

END OF SECTION

SECTION 01 74 30 - PRESSURE PIPE TESTING AND DISINFECTION

PART 1 - GENERAL

1.1 THE SUMMARY

- A. The CONTRACTOR shall test potable water/wastewater and disinfect potable water pipelines and appurtenant piping, in accordance with the Contract Documents.
- B. The CONTRACTOR shall be responsible for obtaining permits for discharging excess testing water/wastewater and disinfection water and dechlorination of such water if required to satisfy permit limits.

1.2 CONTRACTOR SUBMITTALS

- A. Furnish submittals in accordance with Section 01 33 00 – Submittal Procedures.
- B. Furnish:
 - 1. A testing plan and schedule, including method for water conveyance, control, disposal, and disinfection shall be submitted in writing for approval.
 - 2. Name of certified bacteriological testing laboratory.
 - 3. Resume of experienced technician, if liquid chlorine is proposed.

PART 2 - PRODUCTS

2.1 MATERIAL REQUIREMENTS

- A. All test equipment, chemicals for chlorination, temporary valves, bulkheads, and other water control equipment, and choice of disinfectant shall be as determined by the CONTRACTOR. No materials shall be used which would be injurious to the WORK for future conveyance of potable water.
- B. Chlorine for disinfection may be in the form of liquid chlorine, sodium hypochlorite solution, or calcium hypochlorite granules or tablets.
 - 1. Liquid chlorine shall be in accordance with the requirements of ANSI/AWWA B301 - Liquid Chlorine, and shall be used only when each of the following conditions are satisfied:
 - a. Appropriate gas flow chlorinators and ejectors are used.
 - b. An experienced technician directly supervises.
 - c. Appropriate safety practices are observed.
 - 2. Sodium and calcium hypochlorite shall be in accordance with ANSI/AWWA B300 - Hypochlorites.
- C. Dechlorination agents may be sodium bisulfate, sodium sulfite, or sodium thiosulfate.

PART 3 - EXECUTION

3.1 GENERAL

- A. Water for testing and disinfecting water pipelines will be furnished by the OWNER; however, the CONTRACTOR shall convey the water from the OWNER-designated source to the points of use.
- B. All pressure pipelines shall be tested; those for potable water shall be disinfected. All chlorinating and testing operations shall be performed in the presence of the ENGINEER.
- C. Disposal of flushing water and water containing chlorine shall be by methods acceptable to the ENGINEER.
- D. Disinfection operations shall be scheduled as late as possible during the Contract Time to maximize the degree of sterility of the facilities at the time the WORK is accepted by the OWNER. Bacteriological testing shall be performed by a certified testing laboratory accepted by the OWNER. Results of the bacteriological testing shall be satisfactory with the State Department of Health or other appropriate regulatory agency.

3.2 HYDROSTATIC TESTING OF PIPELINES

- A. Pipeline 30-inches diameter and larger shall be visually inspected that all debris has been removed prior to flushing.
- B. Prior to hydrostatic testing, pipelines shall be flushed or blown out as appropriate. The CONTRACTOR shall test pipelines in sections. Sections to be tested shall be defined by isolation valves in the pipeline. Where such valves are not present, the CONTRACTOR shall install temporary bulkheads or plugs for the purpose of testing. Sections that do not have isolation valves shall be tested in approximate 2,500 feet segments. Sections that have a zero leakage allowance may be tested as a unit. No section of the pipeline shall be tested until field-placed concrete or mortar has attained an age of 14 Days. The test shall be made by closing valves when available or by placing bulkheads and filling the line slowly with water. The CONTRACTOR shall be responsible for ascertaining that test bulkheads are suitably restrained to resist the thrust of the test pressure without damage to or movement of the adjacent pipe. Unharnessed sleeve-type couplings, expansion joints, or other sliding joints shall be restrained or suitably anchored prior to the test to avoid movement and damage to piping and equipment. Remove or protect any pipeline-mounted devices that may be damaged by the test pressure. The CONTRACTOR shall provide sufficient temporary tapings in the pipelines to allow for trapped air to exit. After completion of the tests, such taps shall be permanently plugged. Care shall be taken that air relief valves are open during filling.
- C. The pipeline shall be filled at a rate which will not cause any surges or exceed the rate at which the air can be released through the release valves at a reasonable velocity. The air within the pipeline shall be allowed to escape completely. The differential pressure across the orifices in the air release valves shall not be allowed to exceed 5 psi at any time during filling. After the pipeline or section thereof has been filled, it shall be allowed to stand under a slight pressure for at least 24 hours to allow the concrete or mortar lining, as applicable, to absorb water and to allow the escape of air from air pockets. During this

period, bulkheads, valves, and connections shall be examined for leaks. If leaks are found, corrective measures satisfactory to the ENGINEER shall be taken.

- D. The hydrostatic test shall consist of holding the indicated test pressure on the pipeline segment for a period of 2 hours for DIP and PVC or 3 hours for HDPE. The test pressure for yard piping shall be measured at the lowest point of the pipeline section being tested. No pressure test will be required for a reservoir overflow line. Visible leaks that appear during testing shall be repaired in a manner acceptable to the ENGINEER. Add water to restore the test pressure if the pressure decreases 5 psi below test pressure during the test period.
- E. The maximum allowable leakage for distribution and transmission pipelines shall be The maximum quantity of make-up water that must be supplied into the tested pipe to maintain pressure within 5 psi of the specified test pressure shall not exceed 50% of the applicable AWWA C-600 Standard. Pipe with welded joints shall have no leakage. Exposed piping shall show no visible leaks and no pressure loss during the test. In the case of pipelines that fail to pass the leakage test, the CONTRACTOR shall determine the cause of the leakage, shall take corrective measures necessary to repair the leaks, and shall again test the pipeline, repeating as necessary until the pipeline passes.

3.3 DISINFECTING PIPELINES

- A. General: Potable water pipelines except those appurtenant to hydraulic structures shall be disinfected in accordance with the requirements of ANSI/AWWA C651 - Disinfecting Water Mains, using the Continuous-Feed Method as modified herein.
- B. Chlorination: A chlorine-water mixture shall be uniformly introduced into the pipeline by means of a solution-feed chlorinating device. The chlorine solution shall be introduced at one end of the pipeline through a tap in such a manner that as the pipeline is filled with water, the dosage applied to the water entering the pipe shall be approximately 50 mg/L. Care shall be taken to prevent the strong chlorine solution in the line being disinfected from flowing back into the line supplying the water.
- C. Retention Period: Chlorinated water shall be retained in the pipeline for at least 24 hours. After the chlorine-treated water has been retained for the required time, the free chlorine residual at the pipeline extremities and at other representative points shall be at least 25 mg/L. If testing does not demonstrate a residual of 25 mg/L or greater, the disinfection procedure above shall be repeated.
- D. Chlorinating Valves: During the process of chlorinating the pipelines, valves and other appurtenances shall be operated from closed to full open to closed while the pipeline is filled with the heavily-chlorinated water.
- E. Sampling Ports: The CONTRACTOR shall provide sampling ports along the pipeline as defined on AWWA C651. Taps may be made at manways and air valves to help facilitate the spacing requirement.
- F. Final Flushing: After the applicable retention period, the heavily chlorinated water shall be flushed from the pipeline until chlorine measurements show that the concentration in the water leaving the pipeline is no higher than that generally prevailing in the system or is acceptable for domestic use. Any release of chlorinated water shall comply with federal,

state, and local regulation and the permits for the project. Chlorinated water shall be treated before discharge.

- G. Bacteriological Testing: After final flushing and before the pipeline is placed in service, a sample, or samples shall be collected from the end of the line, and shall be tested for bacteriological quality in accordance with the requirements of the State Department of Health or other appropriate regulatory agency. For this purpose, the final flushing water shall be left for a period of 24 hours before any sample is collected. If testing does not demonstrate a free chlorine residual after the 24-hour period, the disinfection procedure above shall be repeated. If the initial disinfection treatment fails to produce satisfactory bacteriological test results, the disinfection procedure shall be repeated until acceptable results are obtained.

3.4 CONNECTIONS TO EXISTING SYSTEM

- A. Where connections are to be made to an existing potable water system, the interior surfaces of all pipe and fittings used in making the connections shall be swabbed or sprayed with a one percent hypochlorite solution before installation. Thorough flushing shall be started as soon as the connection is completed and shall be continued until discolored water is eliminated.

END OF SECTION

SECTION 01 76 10 – PROTECTION OF EXISTING FACILITIES

PART 1 -- GENERAL

1.1 THE SUMMARY

- A. The CONTRACTOR shall protect all existing utilities and improvements not designated for removal and shall restore damaged or temporarily relocated utilities and improvements to a condition equal to or better than prior to such damage or temporary relocation, all in accordance with the Contract Documents.
- B. The CONTRACTOR shall verify the exact locations and depths of all existing utilities, and the CONTRACTOR shall make exploratory excavations of all utilities that may interfere with the WORK.
- C. All such exploratory excavations shall be performed as soon as practicable after award of the Contract and a sufficient time in advance of construction to avoid possible delays to the CONTRACTOR's WORK.
- D. When such exploratory excavations show the utility location as shown on the Drawings to be in error, the CONTRACTOR shall notify the ENGINEER.
- E. The number of exploratory excavations required shall be that number which is sufficient to determine the alignment and grade of the utility.
- F. Related Sections:
 - 1. Section 01 11 00 – Summary of Work
 - 2. Section 01 14 00 – Work Restrictions
 - 3. Section 01 73 29 – Cutting and Patching

1.2 RIGHTS-OF-WAY

- A. The CONTRACTOR shall not do any WORK that would affect any oil, gas, sewer, or water pipeline; any telephone, communications cable conduits, or electric transmission line; any fence; or any other structure, nor shall the CONTRACTOR enter upon the rights-of-way involved until notified by the ENGINEER that the OWNER has secured authority from the proper party.
- B. After authority has been obtained, the CONTRACTOR shall give said party due notice of its intention to begin work, if required by said party, and shall remove, shore, support, or otherwise protect such pipeline, transmission line, ditch, fence, or structure, or replace the same.
- C. When two or more contracts are being executed at one time on the same or adjacent land in such manner that work on one Contract may interfere with that on another, the OWNER shall determine the sequence and order of the WORK.
- D. When the limits of one Contract are the necessary or convenient means of access for the execution of another Contract, such access or any other reasonable privilege may be

granted by the OWNER to the CONTRACTOR to the extent, amount, in the manner, and at the times permitted.

- E. No such decision as to the method or time of conducting the WORK or the use of territory shall be made the basis of any claim for the delay or damage, except as provided for temporary suspension of the WORK.

1.3 PROTECTION OF STREET OR ROADWAY MARKERS

- A. The CONTRACTOR shall not destroy, remove, or otherwise disturb any existing survey markers or other existing street or roadway markers without proper authorization.
- B. No pavement breaking or excavation shall be started until all survey or other permanent marker points that will be disturbed by the construction operations have been properly referenced.
- C. All survey markers or points disturbed by the CONTRACTOR shall be accurately restored after all street or roadway re-surfacing has been completed.

1.4 RESTORATION OF PAVEMENT

- A. Restoration of pavement (temporary and permanent resurfacing and sidewalks or private drives) shall be done in accordance with Section – 01 73 29 Cutting and Patching.

1.5 EXISTING UTILITIES AND IMPROVEMENTS

A. General

- 1. The CONTRACTOR shall protect underground utilities and other improvements which may be impaired during construction operations, regardless of whether or not the Utilities are indicated on the Drawings.
- 2. It shall be the CONTRACTOR's responsibility to ascertain the actual location of all existing utilities and other improvements that will be encountered in its construction operations, and to see that such utilities or other improvements are adequately protected from damage due to such operations.
- 3. The CONTRACTOR shall take all possible precautions for the protection of unforeseen utility lines to provide for uninterrupted service and to provide such special protection as may be deemed necessary.
- 4. Except where the Drawings indicate Utilities have been field located during design or certain Utility locations shall be exposed as part of the WORK, the CONTRACTOR shall be responsible for exploratory excavations as it deems necessary to determine the exact locations and depths of Utilities which may interfere with its work. All such exploratory excavations shall be performed as soon as practicable after Notice to Proceed and, in any event, a sufficient time in advance of construction to avoid possible delays to the CONTRACTOR's progress. When such exploratory excavations show the Utility location as shown on the Drawings to be in error, the CONTRACTOR shall so notify the ENGINEER.

5. CONTRACTOR shall pothole all conflicts within the first 30 days of the Contract to avoid delays while installing the pipelines.

B. Utilities to be Moved:

1. In case it may be necessary to move the property of any public utility or franchise holder, such utility company or franchise holder will, upon request of the CONTRACTOR, be notified by the OWNER to move such property within a specified reasonable time.
2. When utility lines that are to be removed are encountered within the area of operations, the CONTRACTOR shall notify the ENGINEER a sufficient time in advance for the necessary measures to be taken to prevent interruption of service.

C. Temporary Removal and/or Relocation:

1. Where the proper completion of the WORK requires the temporary removal, permanent removal, and/or relocation of an existing utility or other improvement which is indicated, the CONTRACTOR shall remove and, without unnecessary delay, temporarily replace or relocate such utility or improvement in a manner satisfactory to the ENGINEER and the OWNER of the facility.
2. In all cases of such temporary removal or relocation, restoration to the former location shall be accomplished by the CONTRACTOR in a manner that will restore or replace the utility or improvement as nearly as possible to its former locations and to as good or better condition than found prior to removal.

D. Owner's Right of Access:

1. The right is reserved to the OWNER and to the owners of public utilities and franchises to enter at any time upon any public street, alley, right-of-way, or easement for the purpose of making changes in their property made necessary by the WORK of this Contract.

E. Underground Utilities Indicated:

1. Existing utility lines that are indicated or the locations of which are made known to the CONTRACTOR prior to excavation and that are to be retained, and all utility lines that are constructed during excavation operations shall be protected from damage during excavation and backfilling and, if damage, shall be immediately repaired or replaced by the CONTRACTOR.

F. Underground Utilities Not Indicated:

1. In the event that the CONTRACTOR damages existing Utility lines that are not indicated or the locations of which are not made known to the CONTRACTOR prior to excavation, a verbal report of such damage shall be made immediately to the damaged Utility Owner and ENGINEER and a written report thereof shall be made promptly thereafter.

2. If directed by the ENGINEER, repairs shall be made by the CONTRACTOR under the provisions for changes and extra work contained in the General Conditions.

G. All costs of locating, repairing damage not due to failure of the CONTRACTOR to exercise reasonable care, and removing or relocating such utility facilities not shown on the Contract Documents with reasonable accuracy, and for equipment on the project which was actually working on that portion of the work which was interrupted or idled by removal or relocation of such utility facilities, and which was necessarily idled during such work will be paid for as extra work in accordance with the provisions for changes and extra work contained in the General Conditions.

H. All repairs to a damaged utility or improvement are subject to inspection and approval by an authorized representative of the utility or improvement owner being concealed by backfill or other work.

1. All oil and gasoline pipelines, power, and telephone or the communication cable ducts, gas mains, water mains, irrigation lines, sewer lines, storm drainage, poles, and overhead power and communication wires and cables encountered along the line of the work shall remain continuously in service during all the operations under the Contract, unless other arrangements satisfactory to the ENGINEER are made with the OWNER(s) of said pipelines, ducts, main, irrigation lines, sewers, storm drains, poles, wires or cables.

2. The CONTRACTOR shall be responsible for and shall repair all damage due to its operations, and the provisions of this Section shall not be abated even in the event such damage occurs after backfilling or is not discovered until after completion of the backfilling.

1.6 TREES WITHIN ROAD RIGHT-OF-WAY AND PROJECT LIMITS

A. General:

1. The CONTRACTOR shall exercise all necessary precautions so as not to damage or destroy any trees or shrubs, including those lying within street right-of-way and project limits, and shall not trim or remove any trees unless such trees have been approved for trimming or removal by the jurisdictional agency or OWNER.

2. All existing trees and shrubs which are damaged during construction shall be trimmed or replaced by the CONTRACTOR or a certified tree company under permit from the jurisdictional agency and/or OWNER.

3. Tree trimming and replacement shall be accomplished in accordance with the following paragraphs.

B. Trimming:

1. Symmetry of the tree shall be preserved; no stubs or splits or torn branches left; clean cuts shall be made close to the trunk or large branch.

2. Spikes shall not be used for climbing live trees.

3. Cuts over 1 1/2 inches in diameter shall be coated with a tree paint product that is waterproof, adhesive, and elastic, and free from kerosenes, coal tar, creosote, or other material injurious to the life of the tree.

C. Replacement:

1. The CONTRACTOR shall immediately notify the jurisdictional agency/or OWNER if any tree is damaged by the CONTRACTOR's operations.
2. If, in the opinion of said agency or the OWNER, the damage is such that replacement is necessary, the CONTRACTOR shall replace the tree at its own expense.
3. The tree shall be of a like size and variety as the tree damaged, or, if of a smaller size, the CONTRACTOR shall pay to the OWNER of said tree a compensatory payment acceptable to the tree owner, subject to the approval of the jurisdictional agency or the OWNER.
4. The size of the trees shall be not less than 1-inch diameter, nor less than six feet (6') in height.

1.7 NOTIFICATION BY THE CONTRACTOR

- A. Prior to any excavation in the vicinity of any existing underground facilities, including all water, sewer, storm drain, gas, petroleum products, or other pipelines; all buried electric power, communications, or television cables; all traffic signal and street lighting facilities; and all roadway and state highway rights-of-way the CONTRACTOR shall notify the respective authorities representing the owners or agencies responsible for such facilities not less than three (3) days nor more than seven (7) days prior to excavation so that a representative of said owners or agencies can be present during such work if they so desire.
- B. The CONTRACTOR shall also notify "SUNSHINE UNDERGROUND UTILITIES NOTIFICATION CENTER" at 1-800-432-4770 at least three (3) days, but not more than ten (10) days prior to such excavation.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

END OF SECTION

SECTION 02 00 00 – EXISTING CONDITIONS

PART 1 -- GENERAL

1.1 GENERAL

- A. The plans depict the approximate locations of existing subsurface utilities.
- B. Related sections:
 - 1. Section 31 23 33 – Trenching and Backfilling

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION

3.1 CONSTRUCTION

- A. Notify the owners of utilities at least 48 hours in advance of conducting construction near these existing utilities.
- B. Locate cables, ducts, conduits, pipelines, casings, etc., in advance of the proposed construction in cooperation with the owners of such utilities.
- C. Notify the ENGINEER of any substantial changes in the vertical or horizontal orientation of existing utilities that would require a deviation in the Contract Documents.
- D. Repair all damage done to existing utilities at no additional expense to the OWNER of the project, or the owner of the utility.

PART 4 -- OBSTACLES:

- 4.1 Obstacles encountered not shown on the Drawings which may cause a revision to final grades may be considered grounds for compensation to the CONTRACTOR on a force account (equipment rental) basis for the time expended to re-perform any WORK necessary. Such compensation will be agreed to by the OWNER prior to proceeding with the modified construction

END OF SECTION

SECTION 02 41 13.23 – UTILITY LINE REMOVAL

PART 1 -- GENERAL

1.1 THE REQUIREMENT

- A. Removal or abandonment of existing utilities and underground structures shall include, but not necessarily be limited to, the removal, salvage, demolition in place, abandonment, or other disposition of existing utilities, underground structures, or other facilities shown on the Plans, encountered in the course of the work, and/or as directed by the Engineer and in accordance with the Contract Documents.
- B. This Section includes abandonment in place of existing sewers, junction structures, manholes, service lines, and force mains. It also includes water lines, fire hydrants, valves and valve boxes. Abandonment using flowable fill will be at the direction of the Owner as field conditions dictate, or as specified on the Drawings.

1.2 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

- A. The following standards are referenced in this specification:
 - 1. ASTM C 150 - Standard Specification for Portland Cement
 - 2. ASTM C 494 - Standard Specification for Chemical Admixtures for Concrete
 - 3. ASTM C 618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
 - 4. ASTM C 937 - Standard Specification for Grout Fluidifier for Preplaced-Aggregate Concrete
 - 5. ASTM C 940 - Standard Test Method for Expansion and Bleeding of Freshly Mixed Grouts for Preplaced-Aggregate Concrete in the Laboratory
 - 6. ASTM C 1017 - Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete
 - 7. ASTM C 1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
- B. The following sections are referenced in this specification:
 - 1. Section 01 33 00 - Submittal Procedures
 - 2. Section 31 23 33 – Trenching and Backfilling
 - 3. Section 32 16 00 – Curbs and Gutters
 - 4. Section 32 16 23 – Sidewalks

5. Section 32 16 33 – Driveways

1.3 CONTRACTOR SUBMITTALS

- A. Conform to requirements of Section 01 33 00 – Submittal Procedures.
- B. Submit product data for proposed plugs for approval.
- C. Flowable fill mix design report:
 - 1. Flowable fill type and production method. Describe if fill will be mixed to final proportions and consistency in batch plant or if constituents will be added in transit mixer at placement location.
 - 2. Use of ballast. Provide percentage of ballast of total placement and size limits for ballast if fill is intended to be used with ballast.
 - 3. Aggregate gradation of fill. Aggregate gradation of mix (excluding ballast) shall be used as pilot curve for quality control during production.
 - 4. Fill mix constituents and proportions including materials by weight and volume, and air content but excluding ballast. Give types and amounts of admixtures including air entrainment or air generating compounds.
 - 5. Fill densities and viscosities, including wet density at point of placement.
 - 6. Initial time of set.
 - 7. Bleeding and shrinkage.
 - 8. Compressive strength.
- D. Technical information for equipment and operational procedures including projected slurry injection rate, grout pressure, method of controlling grout pressure, bulkhead and vent design, and number of stages of grout application.
- E. Experience record for proposed crew, showing minimum of 100 cubic yards of flowable fill placed using proposed or similar equipment and methods.
- F. At least 60 days prior to commencing abandonment activities, submit plan for abandonment, describing proposed grouting sequence, bypass pumping requirements and plugging, if any, and other information pertinent to completion of work.

1.4 QUALITY ASSURANCE

- A. The Engineer will inspect all materials and work to ensure compliance with the Contract Documents.

PART 2 -- PRODUCTS

2.1 FLOWABLE FILL

- A. Design Mix Criteria. Provide design of one or more mixes to meet design criteria and conditions for placement. Present information required by Paragraph 1.05.B in mix design report including following:
1. Cement: ASTM C 150 Type I or II. Volume and weight per cubic yard of fill. Provide minimum cement content of 100 pounds per cubic yard.
 2. Fly ash: ASTM C 618 Class C or F. Volume and weight per cubic yard of fill. Provide minimum Fly ash content of 200 pounds per cubic yard.
 3. Potable water: Volume and weight per cubic yard of fill. Amount of water determined by mix design testing.
 4. Aggregate gradation: 100 percent passing 3/8-inch sieve and not more than 10 percent passing No. 200 sieve. Mix design report shall define pilot gradation based on following sieve sizes 3/8-inch, Nos. 4, 8, 16, 30, 50, 100, and 200. Do not deviate from pilot gradation by more than plus or minus 10 percentage points for any sieve for production material.
 5. Aggregate source material: Screened or crushed aggregate, pit or bank run fine gravels or sand, or crushed concrete. If crushed concrete is used, add at least 30 percent of natural aggregate to provide workability.
 6. Admixtures: Use admixtures meeting ASTM C 494 and ASTM C 1017 as needed to improve pumpability, to control time of set, and reduce bleeding.
 7. Fluidifier: Use fluidifier meeting ASTM C 937 as necessary to hold solid constituents in suspension. Add shrinkage compensator if necessary.
 8. Performance additive: Use flowable fill performance additive, such as Darafill or approved equal, to control fill properties.
- B. Flowable Fill Requirements
1. Unconfined compressive strength: minimum 75 psi and maximum 150 psi at 56 days as determined based on an average of three tests for same placement. Present at least three acceptable strength tests for proposed mix design in mix design report.
 2. Placement characteristics: self-leveling.
 3. Shrinkage characteristics: non-shrink.
 4. Water bleeding for fill to be placed by grouting method in sewers: not to exceed 2 percent according to ASTM C 940.

5. Minimum wet density: 90 pounds per cubic foot.

2.2 BALLAST

- A. Ballast Material: Natural rock or concrete pieces with minimum size equal to at least 10 times maximum aggregate size of flowable fill and maximum size of 24 inches. Maximum dimension shall not be more than 20 percent of minimum dimension of space to be filled.
- B. Ballast Composition: Free of regulated waste material.

2.3 PLUGS

- A. Grout Plugs: Cement-based dry-pack grout conforming to ASTM C 1107, Grade B or C.
- B. Manufactured Plug: Commercially available plug or cap specifically designed and manufactured to be used with pipe being abandoned

PART 3 -- EXECUTION

3.1 CUTTING AND CAPPING OF MAINS

- A. Do not begin cut, plug, and abandonment operations until replacement utility has been constructed and tested, and all service connections have been installed.
- B. Install plug, clamp, and concrete reaction block and make cut at location shown on drawings.
- C. Main to be abandoned shall not be valved off and shall not be cut or plugged other than as shown on drawings.
- D. After main to be abandoned has been cut and capped, check for other sources feeding abandoned pipeline. If sources are found, notify Construction Manager immediately. Cut and cap abandoned main at point of other feed as directed by Construction Manager.
- E. Plug or cap ends or opening in abandoned main in manner approved by Construction Manager. Install concrete around cap and over pipe to ensure its not penetrable by groundwater. Before backfilling of a capped service line is started, the capping must be observed by a representative of the Owner
- F. Removed and dispose of surface identifications such as valve boxes. Valve boxes in improved streets, other than shell, may be filled with concrete after removing cap.
- G. Backfill excavations in accordance with Section 31 23 33 – Trenching and Backfilling.
- H. Repair street surfaces in accordance with Section 32 16 13 – Curbs and Gutters, Section 32 16 23 – Sidewalks, and Section 32 16 33 – Driveways.
- I. Mark location of abandoned sewer laterals on drawings and provide to Owner.

3.2 CUTTING AND CAPPING OF SERVICES

- A. Do not begin cut, plug, and abandonment operations until replacement service, if necessary, has been constructed and tested, and all service connections have been installed.
- B. Service lines shall be cut and capped in two locations. The service line shall be cut and capped as close to the main as practical but no more than 5' from the main unless obstacles exist to prevent the same (pavement, other utilities, etc.). Services shall also be cut and capped 5' from the building envelope.
- C. Before backfilling of a capped service line is started, the capping must be observed by a representative of the Owner.
- D. After service to be abandoned has been cut and capped, check for any other sources feeding abandoned service. When sources are found, notify Construction Manager immediately. Cut and cap abandoned main at point of other feed as directed by Construction Manager.
- E. Plug or cap ends or opening in abandoned service in manner approved by Construction Manager. Install concrete around cap and over pipe to ensure it's not penetrable by groundwater.
- F. Removed and dispose of surface identifications such as cleanouts or meter boxes. Cleanouts in improved streets, shall be filled with concrete.
- G. Backfill excavations in accordance with Section 31 23 33 – Trenching and Backfilling.
- H. Repair paved surfaces in accordance with Section 32 16 13 – Curbs and Gutters, Section 32 16 23 – Sidewalks, and Section 32 16 33 – Driveways.
- I. Mark location of abandoned service on drawings and provide to Owner.

3.3 ABANDONMENT OF FORCE MAINS

- A. Do not begin cut, plug and abandonment operations until replacement force main has been constructed and tested, and all service connections have been installed.
- B. Install plug, clamp, and concrete reaction block and make cut at location shown on drawings.
- C. Main to be abandoned shall not be valved off and shall not be cut or plugged other than as shown on Drawings.
- D. After force main to be abandoned has been cut and plugged, check for other sources feeding abandoned force main. When sources are found, notify Construction Manager immediately. Cut and plug abandoned force main at point of other feed as directed by Construction Manager.

- E. Plug or cap ends or openings in abandoned force main in manner approved by Construction Manager.
- F. Remove and dispose of surface identifications such as valve boxes. Valve boxes in improved streets, other than shell, may be filled with concrete after removing cap.
- G. Backfill excavations in accordance with Section 31 23 33 - Trenching and Backfilling.
- H. Repair street surfaces in accordance with Section 32 16 13 – Curbs and Gutters, Section 32 16 23 – Sidewalks, and Section 32 16 33 – Driveways.

3.4 PREPARATION FOR FLOWABLE FILL

- A. Have fill mix design reports and other submittals required by Section 01 33 00 – Submittal Procedures accepted by the Construction Manager prior to start of placement. Notify the Construction Manager at least 24 hours in advance of grouting with flowable fill.
- B. Select fill placement equipment and follow procedures with sufficient safety and care to avoid damage to existing underground utilities and structures. Operate equipment at pressure that will not distort or imperil portion of work, new or existing.
- C. Clean sewer lines and video with closed circuit television to identify connections, locate obstructions, and assess condition of pipe. Locate previously unidentified connections, which have not been redirected and reconnected as part of this project, and report them to the Construction Manager. During placement of fill, compensate for irregularities in sewer pipe, such as obstructions, open joints, or broken pipe to ensure no voids remain unfilled.
- D. Perform demolition work prior to starting fill placement. Clean placement areas of sewers and manholes of debris that may hinder fill placement. Remove excessive amounts of sludge and other substances that may degrade performance of fill. Do not leave sludge or other debris in place if filling more than 2 percent of placement volume.
- E. Remove free water prior to starting fill placement.

3.5 EQUIPMENT FOR FLOWABLE FILL

- A. Mix flowable fill in automated batch plant and deliver it to site in ready-mix trucks. Performance additives may be added at placement site if required by mix design.
- B. Use concrete or grout pumps capable of continuous delivery at planned placement rate.

3.6 DEMOLITION OF SEWER MANHOLES, PIPELINE STRUCTURES, AND FORCE MAINS PRIOR TO ABANDONMENT

- A. Remove manhole frames and covers and castings from other existing pipeline structures. Deliver castings to nearest maintenance facility for future use. Alternatively, salvaged castings may be used upon approval by the Construction Manager, for constructing new manholes on this project.

- B. Demolish and remove precast concrete adjustment rings and corner section, or brick and mortar corbel and chimney, or other pipeline structure, to minimum depth of 4 feet below finished grade. Structure may be removed to greater depth, but not deeper than 18 inches above crown of abandoned sewer.
- C. When adjacent sewer lines are not to be filled, place temporary plugs in each line connecting to manhole, in preparation for filling manhole.
- D. Excavate overburden from force mains to be abandoned at locations indicated on Drawings, conforming to Section 31 23 33 - Trenching and Backfilling. Cut existing force main, when necessary, to provide an end surface perpendicular to axis of pipe and suitable for plug to be installed. Remove force main piping material remaining outside of segment to be abandoned.

3.7 INSTALLATION OF FLOWABLE FILL

- A. Abandon sewer lines by completely filling sewer line with flowable fill. Abandon manholes and other structures by filling with flowable fill, together with ballast as applicable, within depth of structures left in place.
- B. Place flowable fill to fill volume between manholes. Continuously place flowable fill from manhole to manhole with no intermediate pour points, but not exceeding 500 feet in length.
- C. Have filling operation performed by experienced crews with equipment to monitor density of flowable fill and to control pressure.
- D. Temporarily plug sewer lines which are to remain in operation during pouring/pumping to keep lines free of flowable fill.
- E. Pump flowable fill through bulkheads constructed for placement of two 2-inch PVC pipes or use other suitable construction methods to contain flowable fill in lines to be abandoned. These pipes will act as injection points or vents for placement of flowable fill.
- F. Place flowable fill under pressure flow conditions into properly vented open system until flowable fill emerges from vent pipes. Pump flowable fill with sufficient pressure to overcome friction and to fill sewer from downstream end, to discharge at upstream end.
- G. Inject flowable fill through replaced ballast using grouting equipment and series of grout pipes discharging at bottom of placement, allowing fill to rise through ballast effectively filling all voids. Alternatively, sequentially place individual pieces of ballast at same time as flowable fill is placed. Do not fill with ballast more than 50 percent of volume at any level, to prevent nesting and void formation.
- H. Remediate placement of flowable fill which does not fill voids in sewer, in manhole or other structures, or where voids develop due to excessive shrinkage or bleeding of fill, by using pressure grouting either from inside sewer or from surface.
- I. Plug each end of force main being abandoned.

J. Force main abandonment

1. Clean inside surface of force main at least 12 inches from ends to achieve firm bond and seal grout plug or manufactured plug to pipe surface. Similarly, clean and prepare exterior pipe surface if manufactured cap is to be used.
2. When using grout plug, place temporary plug or bulkhead approximately 12 inches inside pipe. Fill pipe end completely with dry-pack grout mixture.
3. When using manufactured plug or cap, install fitting as recommended by manufacturer's instructions, to form water tight seal.

K. Backfill to surface, above pipe or structures left in place, with flowable fill in restricted areas, compacted bank run sand in unrestricted areas to be paved or select fill in unrestricted areas outside of pavement. Place and compact backfill, other than flowable fill, in compliance with Section 31 23 33 - Trenching and Backfilling.

L. Collect and dispose of excess flowable fill material and other debris as directed by the Construction Manager.

3.8 FIELD QUALITY CONTROL

- A. Provide batch plant tickets for each truck delivery of flowable fill. Note on tickets addition of admixtures at site.
- B. Check flow characteristics and workability of fill as placement proceeds.
- C. Obtain at least three test cylinders for each placement area for determination of 56-day compressive strength and bleeding. Acceptance of placement will be based on average strength of three tests.
- D. Record volume of ballast together with flowable fill placement for same space to demonstrate that voids have been filled.

3.9 PROTECTION OF PERSONS AND PROPERTY

- A. Provide safe working conditions for employees throughout demolition and removal operations in accordance with Section 01 35 53 – Security Procedures. Observe safety requirements for work below grade.
- B. Maintain safe access to adjacent property and buildings. Do not obstruct roadways, sidewalks or passageways adjacent to work.

- END OF SECTION -

SECTION 09 96 00 - PROTECTIVE COATINGS

PART 1 -- GENERAL

1.1 THE SUMMARY

- A. The CONTRACTOR shall provide protective coatings, complete and in place, in accordance with the Contract Documents.
- B. Definitions
 - 1. The term "paint," "coatings," or "finishes" as used herein, shall include surface treatments, emulsions, enamels, paints, epoxy resins, and other protective coatings, excepting galvanizing or anodizing, whether used as a pretreatment, primer, intermediate coat, or finish coat.
 - 2. The term "DFT" means minimum dry film thickness, without any negative tolerance.
- C. The following surfaces shall not be coated:
 - 1. Concrete, unless required by items on the concrete coating schedule below or the Drawings.
 - 2. Stainless steel
 - 3. Machined surfaces
 - 4. Grease fittings
 - 5. Glass
 - 6. Equipment nameplates
 - 7. Platform gratings, stair treads, door thresholds, and other walk surfaces, unless specifically indicated to be coated.
 - 8. Platform gratings, stair treads, door thresholds, and other walk surfaces, unless specifically indicated to be coated.
- D. The coating system schedules summarize the surfaces to be coated, the required surface preparation, and the coating systems to be applied. Coating notes on the Drawings are used to show or extend the limits of coating schedules, to show exceptions to the schedules, or to clarify or show details for application of the coating systems.
- E. Where protective coatings are to be performed by a Subcontractor, the Subcontractor shall possess a valid state license as required for performance of the painting and coating WORK called for in this specification and shall provide 5 references which show that the Subcontractor has previous successful experience with the indicated or comparable coating systems. Include the name, address, and the telephone number for the owner of each installation for which the Subcontractor provided the protective coating.

1.2 CONTRACTOR SUBMITTALS

- A. Furnish submittals in accordance with specifications.
- B. Submittals shall include the following information and be submitted at least 30 Days prior to commencing protective coating WORK:
 - 1. Materials List: Eight copies of a coating materials list showing the manufacturer and the product number, keyed to the coating systems herein. The list shall be submitted prior to or at the time of submitting samples.
 - 2. Manufacturer's Information: For each coating system to be used, the following data:
 - a. Manufacturer's data sheet for each product proposed, including statements on the suitability of the material for the intended use.
 - b. Technical and performance information that demonstrates compliance with the system performance and material requirements.
 - c. Paint manufacturer's instructions and recommendations on surface preparation and application.
 - d. Colors available for each product (where applicable).
 - e. Compatibility of shop and field applied coatings (where applicable).
 - f. Material Safety Data Sheet for each product proposed.
- C. Samples
 - 1. Samples of paint, finishes, and other coating materials shall be submitted on 8-1/2 inch by 11-inch sheet metal. Each sheet shall be completely coated over its entire surface with one protective coating material, type, and color.
 - 2. Two sets of color samples to match each color selected by the ENGINEER from the manufacturer's standard color sheets. If custom mixed colors are indicated, the color samples shall be made using color formulations prepared to match the color samples furnished by the ENGINEER. The color formula shall be shown on the back of each color sample.
 - 3. One 5 pound sample of each abrasive proposed to be used for surface preparation for submerged and severe service coating systems.
- D. Experience Requirements of the Field Applicator:
 - 1. Three references which verify that the coating CONTRACTOR has demonstrated successful application of the specified coating system in the past 3 years. Provide the size (area of coating), time of completion, name, the owner's address and telephone number for each installation referenced.
 - 2. A written statement from the CONTRACTOR stating that they are qualified and experienced in the application of the specified coating systems. The letter shall state the manufacturer and model number of mixing, heating, and pumping equipment to be used to apply the specified coating systems.

3. A written statement from the manufacturer certifying that the coating CONTRACTOR's onsite foreman and each applicator performing WORK on the project has been trained and approved to apply the selected coating system.
4. CONTRACTOR shall provide SSPC QP 1 Certification or the manufacturer's certification of the applicator for the specified coating system.

E. Experience Requirements of the Shop Applicator

1. NACE Coating Inspector Program certification documents for the person responsible for Quality Assurance/Quality Control at the facility. This person will be responsible for submitting inspection reports to the OWNER.
2. A copy of a typical Quality Assurance/Quality Control inspection report containing items listed in 3.18 of this Specification.
3. Three references which verify that the shop painting facility has demonstrated successful application of the specified coating systems in the past 3 years. Provide the structure name and size (area of coating), time of completion, the owner's name, address, and telephone number for each installation referenced.
4. The manufacturer shall provide written certification that the shop painting facility's supervisor and each applicator performing Work on the project have been trained and approved by the manufacturer to apply the selected coating system.
5. The manufacturer shall state whether or not it has verified that the CONTRACTOR is going to use the proper mixing, coating application, heating, and environmental control equipment for the specified coating products. Only heated plural component equipment shall be used for the 100% solids coating application. Equipment shall be capable of performing a ratio test.
6. The Shop Coating Applicator shall provide SSPC QP 3 Certification or the coating manufacturer's certification of the applicator for selected coating system.

1.3 SPECIAL CORRECTION OF DEFECTS REQUIREMENTS

- A. Inspection: An inspection may be conducted during the eleventh month following completion of coating WORK. The CONTRACTOR and a representative of the coating material manufacturer shall attend this inspection. Defective WORK shall be repaired in accordance with these specifications and to the satisfaction of the OWNER. The OWNER may, by written notice to the CONTRACTOR, reschedule the inspection to another date within the one year correction period or may cancel the inspection altogether. The CONTRACTOR is not relieved of its responsibilities to correct defects, whether or not the inspection is conducted.

PART 2 -- PRODUCTS

2.1 GENERAL

- A. Suitability: The CONTRACTOR shall use suitable coating materials as recommended by the manufacturer. Materials shall comply with Volatile Organic Compound (VOC) limits applicable at the Site.
- B. Material Sources: Where manufacturers and product numbers are listed, it is to show the type and quality of coatings that are required. If a named product does not comply

with VOC limits in effect at the time of Bid opening, that product will not be accepted, and the CONTRACTOR shall propose a substitution product of equal quality that does comply. Proposed substitute materials will be considered as indicated below. Coating materials shall be materials that have a record of satisfactory performance in industrial plants, manufacturing facilities, and water and wastewater treatment plants.

- C. Compatibility: In any coating system only compatible materials from a single manufacturer shall be used in the WORK. Particular attention shall be directed to compatibility of primers and finish coats. If necessary, a barrier coat shall be applied between existing prime coat and subsequent field coats to ensure compatibility.
- D. Containers: Coating materials shall be sealed in containers that plainly show the designated name, formula or specification number, batch number, color, date of manufacture, and name of manufacturer, all of which shall be plainly legible at the time of use.
- E. Colors: Colors and shades of colors of coatings shall be as indicated or selected by the ENGINEER. Each coat shall be of a slightly different shade to facilitate inspection of surface coverage of each coat. Finish colors shall be as selected from the manufacturer's standard color samples by the ENGINEER.
- F. Substitute or "Or-Equal" Products
 - 1. To establish equality, the CONTRACTOR shall furnish satisfactory documentation from the manufacturer of the proposed substitute or "or-equal" product that the material meets the indicated requirements and is equivalent or better in the following properties:
 - a. Minimum and maximum recoat times
 - b. Minimum and maximum cure time for immersion
 - c. Abrasion resistance per ASTM D4060 using CS17 Wheel
 - d. Maximum and minimum dry film thickness per coat
 - e. Compatibility with other coatings
 - f. Suitability for the intended service
 - g. Resistance to chemical attack
 - h. Temperature limitations during application and in service
 - i. Type and quality of recommended undercoats and topcoats
 - j. Ease of application
 - k. Ease of repairing damaged areas
 - l. Stability of colors
 - 2. Protective coating materials shall be standard products produced by recognized manufacturers who are regularly engaged in production of such materials for essentially identical service conditions. When requested, the CONTRACTOR shall

provide the ENGINEER with the names of not less than 10 successful applications of the proposed manufacturer's products that comply with these requirements.

3. If a proposed substitution requires changes in the WORK, the CONTRACTOR shall bear such costs involved as part of the WORK.

2.2 INDUSTRIAL COATING SYSTEMS

- A. System 1 – Not Used
- B. System 2 - Not Used
- C. System 3 – Not Used
- D. System 3 (VOC-Limited) – Not Used
- E. System 4 – Not Used
- F. System 4 (VOC-Limited) – Not Used
- G. System 5 – Not Used
- H. System 5 (VOC-Limited) – Not Used
- I. System 6 – Not Used
- J. System 7 – Not Used
- K. System 8 – Not Used
- L. System 8 (VOC-Limited) – Not Used
- M. System 9 – Not Used
- N. System 9 (VOC-Limited) – Not Used
- O. System 10 – Not Used
- P. System 11 - Not Used

Q. System 12 – Not Used

R. System 12 (VOC-Limited) – Not Used

2.3 SUBMERGED AND SEVERE SERVICE COATING SYSTEMS

A. System 100 - Amine Cured Epoxy

1. Material

Type	high build, amine cure epoxy
VOC content, g/L max	220
Demonstrated suitable for	steel, long term immersion in water and wastewater, resistant to corrosion, chemical fumes, good color retention
Certification	NSF 61 if in contact with potable water

2. Application and manufacturers

Products (3 coats or more)	Total System DFT
PPG- Amercoat 133	15 to 17 mils For non-submerged valves and other equipment, DFT = 10 to 12 mils
Carboline Carboguard 891HS	
International Bar-Rust 233H	
Tnemec Epoxoline Series L69	
Sherwin Williams Macropoxy 646 PW	

B. System 101 - (Not used)

C. System 102 – Not Used

D. System 102 (VOC-Limited) - Polyamide Epoxy

1. Materials

Type	high build polyamide cure epoxy
VOC content, max, g/L	250
Demonstrated suitable for	long term immersion in water and wastewater, resistant to corrosion and chemical fumes, good color retention

Certification	NSF 61 if in contact with potable water
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2. Application and manufacturers

Products (3 coats or more)	Total System DFT
Devoe Bar-Rust 233H	12 - 18 mils
Tnemec L140F	
PPG- Amerlock 400/2	
Carboguard 61	
Sherwin Williams Macropoxy 646 PW for water and Dura-Plate 235 for wastewater	

E. System 103 - Not Used

F. System 104 - Not Used

G. System 105 – Not Used

H. System 105 (VOC-Limited) – Not Used

I. System 106 - Fusion Bonded Epoxy

1. Material

Type	100 percent solids fusion bond epoxy
Demonstrated suitable for	fluidized bed or electrostatic spray application, recommended for pumps, valves, pipe appurtenances, tanks, pipe hangers, flow meters, and hydrants
Certification requirement	NSF 61

2. Application in accordance with AWWA C213 and the following:

Product	Surface and DFT
3M Scotchkote 134 or 206N	Valves 12-mils
	All others 16-mils

J. System 107 – Not Used

- K. System 108 – Not Used
- L. System 109 – Not Used
- M. System 110 - Not Used
- N. System 111 – Not Used

2.4 SPECIAL COATING SYSTEMS

- A. **System 200 - PVC Tape:** Prior to wrapping the pipe with PVC tape, the pipe and fittings first shall be primed using a primer recommended by the PVC tape manufacturer. After being primed, the pipe shall be wrapped with a 20-mil adhesive PVC tape, half-lapped, to a total thickness of 40 mils.
- B. **System 201 - Rich Portland Cement Mortar:** Rich portland cement mortar coating shall have a minimum thickness of 1/8-inch, followed by enclosure in an 8-mil thick polyethylene sheet with all joints and edges lapped and sealed with tape.
- C. System 202 - (Not used)
- D. System 203 Not Used
- E. System 204 – Not Used
- F. **System 205 - Polyethylene Encasement:** Application of polyethylene encasement shall be in accordance with ANSI/AWWA C105 using Method C.
- G. **System 206 - Cement Mortar Coating:** A 1-1/2-inch minimum thickness mortar coating reinforced with 3/4-inch galvanized welded wire fabric shall be provided. The cement mortar shall contain no less than one part Type V cement to 3 parts sand. The cement mortar shall be cured by a curing compound meeting the requirements of "Liquid Membrane Forming Compounds for Curing Concrete," ASTM C 309, Type II, white pigmented, or by enclosure in an 8-mil thick polyethylene sheet with all edges and joints lapped by at least 6-inches.
- H. System 207 - Not Used
- I. System 208 – Not Used
- J. System 209 - Not Used
- K. System 210 – Not Used

PART 3 -- EXECUTION

3.1 MANUFACTURER'S SERVICES

- A. The CONTRACTOR shall require the protective coating manufacturer to furnish a qualified technical representative to visit the Site for technical support as may be necessary to resolve field problems.

3.2 WORKMANSHIP

- A. Skilled craftsmen and experienced supervision shall be used on coating WORK.
- B. Coating shall be done in a workmanlike manner so as to produce an even film of uniform thickness. Edges, corners, crevices, and joints shall receive special attention to insure thorough surface preparation. The finished surfaces shall be free from runs, drops, ridges, waves, laps, brush marks, and variations in color, texture, and finish. The hiding shall be so complete that the addition of another coat would not increase the hiding. Special attention shall be given so that edges, corners, crevices, welds, and similar areas receive a film thickness equivalent to adjacent areas, and installations shall be protected by the use of drop cloths or other precautionary measures.
- C. Damage to other surfaces resulting from the WORK shall be cleaned, repaired, and refinished to original condition.

3.3 STORAGE, MIXING, AND THINNING OF MATERIALS

- A. Manufacturer's Recommendations: Unless otherwise indicated, the coating manufacturer's printed recommendations and instructions for thinning, mixing, handling, applying, and protecting its coating materials, for preparation of surfaces for coating, and for other procedures relative to coating shall be strictly observed.
- B. Coating materials shall be used within the manufacturer's recommended shelf life.
- C. Storage and Mixing: Coating materials shall be stored under the conditions recommended by the Product Data Sheets, and shall be thoroughly stirred, strained, and kept at a uniform consistency during application. Coatings from different manufacturers shall not be mixed together.

3.4 PREPARATION FOR COATING

- A. General: Surfaces to receive protective coatings shall be prepared as indicated prior to application of coatings. The CONTRACTOR shall examine surfaces to be coated and shall correct surface defects before application of any coating material. Marred or abraded spots on shop-primed and on factory-finished surfaces shall receive touch-up restoration prior to any field coating application. Surfaces to be coated shall be dry and free of visible dust.
- B. Protection of Surfaces Not to be Coated: Surfaces that are not to receive protective coatings shall be protected during surface preparation, cleaning, and coating operations.
- C. Hardware, lighting fixtures, switch plates, machined surfaces, couplings, shafts, bearings, nameplates on machinery, and other surfaces not to be painted shall be removed, masked, or otherwise protected. Drop cloths shall be provided to prevent coating materials from falling on or marring adjacent surfaces. The working parts of mechanical and electrical equipment shall be protected from damage during surface preparation and coating operations. Openings in motors shall be masked to prevent entry of coating or other materials.
- D. Care shall be exercised not to damage adjacent WORK during blasting operations. Spraying shall be conducted under carefully controlled conditions. The CONTRACTOR shall be fully responsible for and shall promptly repair any and all damage to adjacent WORK or adjoining property occurring from blasting or coating operations.

- E. Protection of Painted Surfaces: Cleaning and coating shall be coordinated so that dust and other contaminants from the preparation process will not fall on wet, newly-coated surfaces.

3.5 ENVIRONMENTAL REQUIREMENTS

- A. No coating work shall be performed under the following conditions:
 - 1. Surface or ambient temperatures exceed the manufacturer's recommended maximum or minimum allowable.
 - 2. Dust or smoke laden atmosphere.
 - 3. Damp or humid conditions, where the relative humidity is above the manufacturer's maximum allowable.
 - 4. Substrate and ambient temperatures are less than 5°F above the dew point and are decreasing. Dew point shall be measured by use of an instrument such as a Sling Psychrometer in conjunction with U.S. Department of Commerce, Weather Bureau psychrometric tables. Elcometer 319 Dew Point meter or equal may also be used.
 - 5. Ambient temperature that is expected to drop below 50°F or less than 5°F above the dew point within 8 hours after application of coating.

3.6 SURFACE PREPARATION STANDARDS

- A. The following referenced surface preparation specifications of the Steel Structures Painting Council shall form a part of this specification:
 - 1. Solvent Cleaning (SSPC SP 1): Removal of oil, grease, soil, salts, and other soluble contaminants by cleaning with solvent, vapor, alkali, emulsion, or steam.
 - 2. Hand Tool Cleaning (SSPC SP 2): Removal of loose rust, loose mill scale, loose paint, and other loose detrimental foreign matter, by hand chipping, scraping, sanding, and wire brushing.
 - 3. Power Tool Cleaning (SSPC SP 3): Removal of loose rust, loose mill scale, loose paint, and other loose detrimental foreign matter, by power tool chipping, descaling, sanding, wire brushing, and grinding.
 - 4. White Metal Blast Cleaning (SSPC SP 5/NACE 1): Removal of all visible rust, oil, grease, soil, dust, mill scale, paint, oxides, corrosion products and foreign matter by blast cleaning.
 - 5. Commercial Blast Cleaning (SSPC SP 6/NACE 3): Removal of all visible oil, grease, soil, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except that staining shall be limited to no more than 33 percent of each square inch of surface area.
 - 6. Brush-Off Blast Cleaning (SSPC SP 7/NACE 4): Removal of all visible oil, grease, soil, dust, loose mill scale, loose rust, and loose paint.
 - 7. Near-White Blast Cleaning (SSPC SP 10/NACE 2): Removal of all visible oil, grease, soil, dust, mill scale, rust, paint, oxides, corrosion products, and other

foreign matter, except that staining shall be limited to no more than 5 percent of each square inch of surface area.

8. Power Tool Cleaning to Bare Metal (SSPC 11) When viewed without magnification, the surface shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter. Slight residues of rust and paint may be left in the lower portion of pits if the original surface is pitted. The surface profile shall not be less than 1 mil (25 microns).
9. Surface Preparation of Concrete (SSPC-SP 13/NACE 6): Removal of protrusions, laitance and efflorescence, existing coatings, form-release agents, and surface contamination by detergent or steam cleaning, abrasive blasting, water jetting, or impact or power tool methods as appropriate for the condition of the surface and the requirements of the coating system.

3.7 FERROUS METAL SURFACE PREPARATION (UNGALVANIZED)

- A. The minimum abrasive blasting surface preparation shall be as indicated in the coating system schedules included at the end of this Section. Where there is a conflict between these requirements and the coating manufacturer's printed recommendations for the intended service, the higher degree of cleaning shall apply.
- B. The Shop Painting Facility shall use a minimum blast material mixture of 75% grit and 25% shot material to achieve the proper surface profile.
- C. The Field Coating Applicator shall abrasive blast the shop coated surfaces per SSPC SP 7/NACE 4. The previously shop-painted surfaces shall be abraded prior to the application of the final coats. Special attention shall be given to uncoated steel weld joints, coating holdbacks, and bare metal.
- D. Grease, oil, and welding fluxes shall be removed by wiping with MEK or naphtha cleaning or with trisodium phosphate detergent per SSPC SP 1.
- E. All sharp edges shall be rounded or chamfered and all burrs, rust, scale, welding slag, and spatter shall be removed and the surface prepared by SSPC SP 2 hand tool cleaning, and SSPC SP 3 power tool cleaning.
- F. The Contractor shall test the surfaces for soluble salts with the use of Chlor*Test as manufactured by Chlor*Rid International or approved equivalent. Any blasted surfaces shall be tested and shall have a maximum concentration of 5 micrograms per square centimeter ($\mu\text{g}/\text{cm}^2$). A test shall be conducted for every 100 square feet (ft^2) of surface area to be coated at locations determined by the Inspector.
- G. If the soluble salt test indicates chloride concentrations greater than those outlined in these Specifications, the Contractor shall use Chlor*Rid, as manufactured by Chlor*Rid International, in the water source during Water Cleaning to remove the salts from the substrate. A substrate's surface preparation will be accepted once the soluble salt concentration is below the amounts outlined in these Specifications.
- H. The type and size of abrasive shall be selected to produce a surface profile that meets the coating manufacturer's recommendation for the particular coating and service conditions. Abrasive shall not be reused unless an automated blasting system is used for surfaces that will be in non-submerged service. For automated blasting systems, clean oil-free abrasives shall be maintained. The abrasive mix shall include at least 50 percent grit.

- I. The CONTRACTOR shall comply with the applicable federal, state, and local air pollution control regulations for blast cleaning.
- J. Compressed air for air blast cleaning shall be supplied at adequate pressure from well-maintained compressors equipped with oil and moisture separators that remove at least 95 percent of the contaminants.
- K. Surfaces shall be cleaned of dust and residual particles of the cleaning operation by dry air blast cleaning, vacuuming, or another approved method prior to painting.
- L. Enclosed areas and other areas where dust settling is a problem shall be vacuum-cleaned and wiped with a tack cloth.
- M. Damaged or defective coating shall be removed by the blast cleaning to meet the clean surface requirements before recoating.
- N. If the required abrasive blast cleaning will damage adjacent WORK, the area to be cleaned is less than 100 square feet, and the coated surface will not be submerged in service, then SSPC SP 2 or SSPC SP 3 may be used.
- O. Shop-applied coatings of unknown composition shall be completely removed before the indicated coatings are applied. Valves, castings, ductile or cast iron pipe, and fabricated pipe or equipment shall be examined for the presence of shop-applied temporary coatings. Temporary coatings shall be completely removed by solvent cleaning per SSPC SP 1 before the abrasive blast cleaning has been started.
- P. Shop primed equipment shall be solvent-cleaned in the field before finish coats are applied.

3.8 SHOP COATING REQUIREMENTS

- A. Unless otherwise indicated, items of equipment or parts of equipment which are not submerged in service shall be shop-primed and then finish-coated in the field after installation with the indicated or selected color. The methods, materials, application equipment, and other details of shop painting shall comply with this Section. If the shop primer requires top coating within a specific period of time, the equipment shall be finish-coated in the shop and then be touched up after installation.
- B. Items of equipment or parts and surfaces of equipment which are submerged or inside an enclosed hydraulic structure when in service, with the exception of pumps and valves, shall have surface preparation and coating performed in the field.
- C. Shop primed surfaces which are to be incorporated in the work shall be prepared in the field by cleaning all surfaces as necessary in accordance with SSPC SP 1 and SP 2. Damaged shop coating shall be cleaned in accordance with SSPC SP 3, Power Tool Cleaning, and recoated with the primer specified.
- D. For every 500 square feet, or less, of steel surface blasted, the surface profile shall be tested with the use of Press-o-Film as manufactured by Testex, or other RP0287 approved equal, at locations to be determined by the Inspector. The replica tape thickness shall be measured using a dial micrometer manufactured by Testex, or other ASTM D4417 Type C approved equal. For each test area, one replica tape test shall be performed. For each test area, the three replica tape thickness values shall be recorded and must be within 10% of the coating manufacturer's recommended profile. If the surface profile does not meet the manufacturer's recommended profile, two additional

tests will be performed within a 12-inch diameter of the initial test. If the values are not satisfactory, the Contractor shall reblast the affected areas.

- E. The interior surfaces of steel water reservoirs, except for Paragraph A surfaces, shall have surface preparation and coating WORK performed in the field.
- F. For certain pieces of equipment it may be undesirable or impractical to apply finish coatings in the field. Such equipment may include engine generator sets, equipment such as electrical control panels, switchgear or main control boards, submerged parts of pumps, ferrous metal passages in valves, or other items where it is not possible to obtain the indicated quality in the field. Such equipment shall be primed and finish-coated in the shop and touched up in the field with the identical material after installation. The CONTRACTOR shall require the manufacturer of each such piece of equipment to certify as part of its Shop Drawings that the surface preparation is in accordance with these specifications. The coating material data sheet shall be submitted with the Shop Drawings for the equipment.
- G. For certain small pieces of equipment the manufacturer may have a standard coating system that is suitable for the intended service conditions. In such cases, the final determination of suitability will be made during review of the Shop Drawing submittals. Equipment of this type generally includes only indoor equipment such as instruments, small compressors, and chemical metering pumps.
- H. Shop-painted surfaces shall be protected during shipment and handling by suitable provisions including padding, blocking, and the use of canvas or nylon slings. Primed surfaces shall not be exposed to the weather for more than 2 months before being top coated or less time if recommended by the coating manufacturer.
- I. Damage to shop-applied coatings shall be repaired in accordance with this Section and the coating manufacturer's printed instructions.
- J. The CONTRACTOR shall make certain that the shop primers and field topcoats are compatible and meet the requirements of this Section. Copies of applicable coating manufacturer's data sheets shall be submitted with equipment Shop Drawings.

3.9 APPLICATION OF COATINGS

- A. The application of protective coatings to steel substrates shall be in accordance with SSPC PA1 - Paint Application Specification No. 1.
- B. Cleaned surfaces and each coat shall be inspected prior to applying each succeeding coat. The CONTRACTOR shall schedule such inspection with the ENGINEER in advance.
- C. Blast cleaned ferrous metal surfaces shall be painted before any rusting or other deterioration of the surface occurs. Blast cleaning shall be limited to only those surfaces that can be coated in the same day.
- D. Coatings shall be applied in accordance with the manufacturer's instructions and recommendations and this Section, whichever has the most stringent requirements.
- E. Special attention shall be given to edges, angles, weld seams, flanges, nuts and bolts, and other places where insufficient film thicknesses are likely to be present. CONTRACTOR shall use an independent stripe coat per SSPC PA Guide 11 for these

areas. Particular care shall be used to ensure that the specified coverage is secured on the edges and corners of all surfaces.

- F. Special attention shall be given to materials that will be joined so closely that proper surface preparation and application are not possible. Such contact surfaces shall be coated prior to assembly or installation.
- G. Finish coats, including touch-up and damage repair coats shall be applied in a manner that will present a uniform texture and color matched appearance.
- H. Coatings shall not be applied under the following conditions:
 - 1. Temperatures exceeding the manufacturer's recommended maximum and minimum allowable.
 - 2. Concrete surfaces will be in direct sunlight during application or within 3 hours after application.
 - 3. Dust or smoke laden atmosphere.
 - 4. Damp or humid weather.
 - 5. Substrate or air temperature is less than 5 degrees F above the dew point.
 - 6. Air temperature is expected to drop below 40 degrees F or less than 5 degrees F above the dew point within 8 hours after application of coating.
 - 7. Wind conditions are not calm.
- I. Dew point shall be determined by use of a sling psychrometer in conjunction with U.S. Dept. of Commerce, Weather Bureau psychrometric tables.
- J. Unburied steel piping shall be abrasive blast cleaned and primed before installation.
- K. Finish coats shall be applied after concrete, masonry, and equipment installation is complete, and the working areas are clean and dust free.

3.10 CURING OF COATINGS

- A. The CONTRACTOR shall maintain curing conditions in accordance with the conditions recommended by the coating material manufacturer or by this Section, whichever is the most stringent, prior to placing the completed coating system into service.
- B. In the case of enclosed areas, forced air ventilation, using heated air if necessary, may be required until the coatings have fully cured.

3.11 IDENTIFICATION OF PIPING

- A. Identification of piping shall be in accordance with Section 43 10 51 - Piping Identification.

- B. Every valve or connection, where it may be possible for a worker to be exposed to a hazardous substance, shall be labeled per OSHA Occupational Safety and Health Standards 29CFR1910.1200.

3.12 SHOP AND FIELD INSPECTION AND TESTING

- A. General: The CONTRACTOR shall give the ENGINEER a minimum of 3 Days advance notice of the start of any field surface preparation or coating application, and a minimum of 7 Days advance notice of the start of any surface preparation activity in the shop.
- B. Such WORK shall be performed only in the presence of the ENGINEER, unless the ENGINEER has granted prior approval to perform such WORK in its absence.
- C. Inspection by the ENGINEER, or the waiver of inspection of any particular portion of the WORK, shall not relieve the CONTRACTOR of its responsibility to perform the WORK in accordance with these Specifications.
- D. Scaffolding shall be erected and moved to locations where requested by the ENGINEER to facilitate inspection. Additional illumination shall be furnished on areas to be inspected.
- E. Inspection Devices: The CONTRACTOR shall furnish inspection devices in good working condition for the detection of holidays and measurement of dry film thicknesses of coatings. Dry-film thickness gauges shall be made available for the ENGINEER's use while coating is being done, until final acceptance of such coatings. The CONTRACTOR shall furnish the services of a trained operator of the holiday detection devices until the final acceptance of such coatings. Holiday detection devices shall be operated only in the presence of the ENGINEER.
- F. Holiday Testing: The CONTRACTOR shall test for continuity all coated ferrous surfaces inside a steel reservoir, other surfaces that will be submerged in water or other liquids, surfaces that are enclosed in a vapor space in such structures, and surfaces coated with any of the submerged and severe service coating systems. Areas that contain discontinuities shall be marked and repaired or recoated in accordance with the coating manufacturer's printed instructions and then be retested.
 - 1. Coatings with thickness exceeding 20-mils total DFT: Pulse-type holiday detector such as **Tinker & Rasor Model AP-W, D.E. Stearns Co. Model 14/20**, or equal shall be used. The unit shall be adjusted to operate at the voltage required to cause a spark jump across an air gap equal to twice the required coating thickness.
 - 2. Coatings with thickness of 20-mils or less total DFT: **Tinker & Rasor Model M1** non-destructive type holiday detector, **K-D Bird Dog**, or equal shall be used. The unit shall operate at less than 75 volts. For thicknesses between 10- and 20-mils, a non-sudsing type wetting agent, such as **Kodak Photo-Flo** or equal, shall be added to the water prior to wetting the detector sponge.
- G. Film Thickness Testing: On ferrous metals, the dry film coating thickness shall be measured in accordance with the SSPC Paint Application Specification No. 2 using a magnetic type dry film thickness gauge such as **Mikrotest Model FM, Elcometer Model 111/1EZ**, or equal. Each coat shall be tested for the correct thickness. No measurements shall be made until at least 8 hours after application of the coating. On non-ferrous metals and other substrates, the coating thicknesses shall be measured at the time of application using a wet film gauge.

- H. Surface Preparation: Confirm proper surface profile with Testex Press-O-Film replica tape in accordance with NACE RP0287-02.

3.13 Coating System Schedule, Ferrous Metal - Not Galvanized

	Item	Surface Prep.	System No.
FM-1	All surfaces indoors and outdoors, exposed or covered, except those included below.	Commercial blast cleaning SSPC SP 6/NACE 3	(1) alkyd enamel
FM-1	All surfaces indoors and outdoors, exposed or covered, except those included below.	Commercial blast cleaning SSPC SP 6/NACE 3	(4) epoxy/ polyurethane
FM-1	All surfaces indoors and outdoors, exposed or covered, except those included below.	Near white metal blast cleaning SSPC SP 10/NACE 2	(5) inorganic zinc/epoxy/polyurethane
FM-1	All surfaces indoors and outdoors, exposed or covered, except those included below.	Manufacturer recommendation	(7) acrylic latex
FM-2	Surfaces in chlorination room, chlorine storage room.	Commercial blast cleaning SSPC SP 6/NACE 3	(100) amine cure epoxy
FM-3	Surfaces of equipment and ferrous surfaces submerged or intermittently submerged in potable water, utility water, and wastewater including all surfaces lower than 2 feet above high water level in hydraulic structures, and all surfaces inside enclosed hydraulic structures and vents (excluding shop-coated valves, couplings, pumps).	White metal blast cleaning SSPC SP 5/NACE 1	(100) amine cure epoxy
FM-4	Surfaces exposed to high temperature (between 150 and 600 degrees F).	Near white metal blast cleaning SSPC SP 10/NACE 2	(6) inorganic zinc, water-based
FM-5	Surfaces exposed to high temperature (between 600 and 1000 degrees F).	Near white metal blast cleaning SSPC SP 10/NACE 2	(3) aluminum silicone
FM-6	Buried small steel pipe.	Removal of dirt, grease, oil	(200) PVC tape
FM-7	Where indicated, ferrous surfaces in water passages of all valves 2-inch size and larger, exterior surfaces of submerged valves.	White metal blast cleaning SSPC SP 5/NACE 1	(102) polyamide epoxy
FM-8	Where indicated, ferrous surfaces in water passages	White metal blast cleaning SSPC SP	(100) amine cure epoxy

	and submerged surfaces of all pumps which have discharge size of 4 inches or larger.	5/NACE 1	
FM-9	Ferrous surfaces of sleeve couplings.	Solvent cleaning SSPC SP 1, followed by white metal blast cleaning SSPC-SP 10/NACE 2	(106) fusion bond epoxy
FM-10	All ferrous surfaces of sluice gates, flap gates, and shear gates, including wall thimbles.	White metal blast cleaning SSPC SP 5/NACE 1	(102) polyamide epoxy
FM-11	Buried surfaces that are not indicated to be coated elsewhere.	Near white metal blast cleaning SSPC SP 10/NACE 2	(100) amine cure epoxy
FM-12	Interior surfaces of all chemical tanks, including tank nozzles, manholes, nozzle necks, flange faces.	White metal blast cleaning SSPC SP 5/NACE 1	(107) chemical-resistant sheet lining
FM-13	External surfaces of buried steel tanks.	White Metal blast cleaning SSPC SP 5/NACE 1	(100) amine cure epoxy
FM-16	Surfaces of indoor equipment, not submerged	Commercial blast cleaning SSPC SP 6/NACE 3	(8) epoxy, equipment
FM-18	Buried pipe couplings, valves, fittings, and flanged joints (where piping is plastic).	Removal of dirt, grease, oil	(201) rich portland cement mortar
FM-19	Buried pipe couplings, valves, and flanged joints (where piping is ductile or cast iron, not tape-coated), including factory-coated surfaces.	As specified by reference specification	(205) polyethylene encasement
FM-20	Buried pipe couplings, valves, and flanged joints (where piping is mortar-coated steel or reinforced concrete), including factory-coated surfaces.	Removal of dirt, grease, oil	(206) cement mortar coating

3.14 COATING SYSTEM SCHEDULE, NON-FERROUS METAL, PLASTIC, FIBER GLASS

- A. Where isolated non-ferrous parts are associated with equipment or piping, the CONTRACTOR shall use the coating system for the adjacent connected surfaces. Do not coat handrails, gratings, frames or hatches. Only primers recommended by the coating manufacturer shall be used.

	Item	Surface Prep.	System No.
NFS-1	All exposed surfaces, indoors and outdoors, except those included below.	Solvent cleaned SSPC SP 1	(4) epoxy/polyurethane
NFS-2	Chlorination room, chlorine storage room.	Solvent cleaned SSPC SP 1	(100) amine cure epoxy
NFS-3	Aluminum surfaces in contact with concrete, or with any other metal except galvanized ferrous metal.	Solvent cleaned SSPC	(208) aluminum metal isolation
NFS-4	Polyvinyl chloride plastic piping, indoors and outdoors, or in structures, not submerged.	Solvent cleaned SSPC	(7) acrylic latex
NFS-5	Fiber glass surfaces.	Per paragraph 3.10	(12) polyurethane, fiber glass
NFS-6	Buried non-ferrous metal pipe.	Removal of dirt, grease, oil	(200) PVC tape

END OF SECTION

SECTION 31 23 00– EXCAVATION AND FILL

PART 1 -- GENERAL

1.1 THE SUMMARY

- A. The CONTRACTOR shall perform all earthwork indicated and required for construction of the WORK, complete and in place, in accordance with the Contract Documents.

1.2 CONTRACTOR SUBMITTALS

- A. The CONTRACTOR shall submit samples of all materials proposed to be used in the work in accordance with the requirements in Section 01 33 00 – Submittal Procedures. Sample sizes shall be as determined by the testing laboratory.

PART 2 -- PRODUCTS

2.1 SUITABLE FILL AND BACKFILL MATERIAL REQUIREMENTS

- A. **General:** Fill, backfill, and embankment materials shall be suitable selected or processed clean, fine earth, rock, or sand, free from grass, roots, brush, or other vegetation.
- B. Fill and backfill materials to be placed within 6 inches of any structure or pipe shall be free of rocks or unbroken masses of earth materials having a maximum dimension larger than 3 inches.
- C. **Suitable Materials:** Materials not defined as unsuitable below are defined as suitable materials and may be used in fills, backfilling, and embankment construction subject to the indicated limitations. In addition, when acceptable to the ENGINEER, some of the material listed as unsuitable may be used when thoroughly mixed with suitable material to form a stable composite.
- D. Suitable materials may be obtained from on-site excavations, may be processed on-site materials, or may be imported. If imported materials are required to meet the quantity requirements of the project, the CONTRACTOR shall provide the imported materials at no additional expense to the OWNER, unless a unit price item is included for imported materials in the bidding schedule.
- E. The following types of suitable materials are defined:
 - 1. Type A (three-quarters inch minus granular backfill): Crushed rock or gravel, and sand with the gradation requirements below. The material shall have a minimum sand equivalent value of 28 and a minimum R-value of 78. If the sand equivalent value exceeds 35 the R-value requirement is waived.

<u>Sieve Size</u>	<u>Percentage Passing</u>
3/4-inch	100
No. 4	30 - 50
No. 200	0 – 10

2. Type B (Class I crushed stone): Manufactured angular, crushed stone, crushed rock, or crushed slag with the following gradation requirements. The material shall have a minimum sand equivalent value of 75.

<u>Sieve Size</u>	<u>Percentage Passing</u>
3/4-inch	100
No. 4	30 - 50
No. 200	0 - 5

3. Type C (sand backfill): Sand with 100 percent passing a 3/8-inch sieve, at least 90 percent passing a Number 4 sieve, and a sand equivalent value not less than 30.
4. Type D: Not used.
5. Type E (pea gravel backfill): Crushed rock or gravel with 100 percent passing a 1/2-inch sieve and not more than 10 percent passing a Number 4 sieve.
6. Type F (coarse drainrock): Crushed rock or gravel meeting the following gradation requirements:

<u>Sieve Size</u>	<u>Percentage Passing</u>
2-inch	100
1-1/2-inch	90 - 100
1-inch	20 - 55
3/4-inch	0 - 15
No. 200	0 - 3

7. Type G (aggregate base): Crushed rock aggregate base material of such nature that it can be compacted readily by watering and rolling to form a firm, stable base for pavements. At the option of the CONTRACTOR, the grading for either the 1-1/2-inch maximum size or 3/4-inch maximum size gradation shall be used. The sand equivalent value shall be not less than 22, and the material shall meet the following gradation requirements:

<u>Sieve Size</u>	<u>Percentage Passing</u>	
	<u>1-1/2-inch Max. Gradation</u>	<u>3/4-inch Max. Gradation</u>
2-inch	100	-
1-1/2-inch	90 - 100	-
1-inch	-	100
3/4-inch	50 - 85	90 - 100
No. 4	25 - 45	35 - 55
No. 30	10 - 25	10 - 30
No. 200	2 - 9	2 - 9

8. Type H (graded drainrock): Drainrock shall be crushed rock or gravel, durable and free from slaking or decomposition under the action of alternate wetting or drying. The material shall be uniformly graded and shall meet the following gradation requirements:

<u>Sieve Size</u>	<u>Percentage Passing</u>
1-inch	100
3/4-inch	90 - 100
3/8-inch	40 - 100
No. 4	25 - 40
No. 8	18 - 33
No. 30	5 - 15
No. 50	0 - 7
No. 200	0 - 3

The drainrock shall have a sand equivalent value not less than 75. The finish graded surface of the drainrock immediately beneath hydraulic structures shall be stabilized to provide a firm, smooth surface upon which to construct reinforced concrete floor slabs. The CONTRACTOR shall use, at its option, one of the asphalt types listed below:

	<u>Type 1</u>	<u>Type 2</u>	<u>Type 3</u>
Designation	SC-800	SC-250	RS-1
Spray Temperature (°F)	175-255	165-200	70-120
Coverage (gal/sq yd)	0.50	0.50	0.50

If the surface remains tacky, sufficient sand shall be applied to absorb the excess asphalt.

9. Type I: Any other suitable material as defined herein.
10. Type J (cement-treated backfill): Material which consists of Type H material, or any mixture of Types B, C, G, and H materials which has been cement-treated so that the cement content of the material is not less than 5 percent by weight when tested in accordance with ASTM D 2901 - Test Method for Cement Content of Freshly Mixed Soil Cement. The ultimate compressive strength at 28 days shall be not less than 400 psi when tested in accordance with ASTM D 1633 - Test Method for Compressive Strength of Molded Soil - Cement Cylinders.
11. Type K (topsoil): Stockpiled topsoil material obtained at the site by removing soil to a depth not exceeding 2 feet. Removal of the topsoil shall be done after the area has been stripped of vegetation and debris.
12. Type L (controlled low strength material): Controlled low strength material, if required, shall be in accordance with Section 33 23 23.33 Flowable Fill.
13. Type M (aggregate subbase): Crushed rock aggregate subbase material that can be compacted readily by watering and rolling to form a firm stable base. The sand equivalent value shall be not less than 18 and the material shall meet the following gradation requirements:

<u>Sieve Size</u>	<u>Percentage Passing</u>
3-inch	100
2-1/2 inch	87 - 100
No. 4	35 - 95
No. 200	0 - 29

14. Type N (trench plug): Low permeable fill material, a non-dispersible clay material having a minimum plasticity index of 10.

2.2 UNSUITABLE MATERIAL

- A. Unsuitable materials include the materials listed below.
 1. Soils which, when classified under ASTM D 2487, fall in the classifications of Pt, OH, CH, MH, or OL.
 2. Soils which cannot be compacted sufficiently to achieve the density specified for the intended use.
 3. Materials that contain hazardous or designated waste materials including petroleum hydrocarbons, pesticides, heavy metals, and any material which may be classified as hazardous or toxic according to applicable regulations.
 4. Soils that contain greater concentrations of chloride or sulfate ions, or have a soil resistivity or pH less than the existing on-site soils.
 5. Topsoil, except as allowed below.

2.3 USE OF FILL, BACKFILL, AND EMBANKMENT MATERIAL TYPES

- A. The CONTRACTOR shall use the types of materials as designated herein for all required fill, backfill, and embankment construction hereunder.
- B. Where these Specifications conflict with the requirements of any local agency having jurisdiction or with the requirements of a pipe material manufacturer, the ENGINEER shall be immediately notified. In case of conflict between types of pipe embedment backfills, the CONTRACTOR shall use the agency specified backfill material if that material provides a greater degree of structural support to the pipe, as determined by the ENGINEER. In case of conflict between types of trench or final backfill types, the CONTRACTOR shall use the agency-specified backfill material if that material provides the greater in-place density after compaction.
- C. Fill and backfill types shall be used in accordance with the following provisions:
 1. Embankment fills shall be constructed of Type I material, as defined herein, or any mixture of Type I and Type A through Type H materials.
 2. Pipe zone backfill, as defined under "Pipe and Utility Trench Backfill" below, shall consist of the following materials for each pipe material listed below.
 - a. Mortar coated pipe, concrete pipe, and uncoated ductile iron pipe shall be provided Type A or B pipe bedding and embedment backfill material.
 - b. Coal tar enamel coated pipe, polyethylene encased pipe, tape wrapped pipe, and other non-mortar coated pipe shall be backfilled with Type C bedding and embedment zone backfill material.

- c. Plastic pipe and vitrified clay pipe shall be backfilled with Type B bedding and embedment zone backfill material. Vitrified clay pipe shall be backfilled with Type B material to the top of the pipe zone.
 - d. Where pipelines are installed on grades exceeding 4 percent, and where backfill materials are graded such that there is less than 10 percent passing a Number 4 sieve, trench plugs of Type J, L, or N material shall be provided at maximum intervals of 200 feet unless indicated otherwise
- 3. Trench zone backfill for pipelines as defined under "Pipe and Utility Trench Backfill" shall be Type I backfill material or any of Types A through H backfill materials or any mixture thereof, except:
 - a. Type K material may be used for trench zone backfill in agricultural areas unless otherwise shown or specified.
- 4. Final backfill material for pipelines under paved areas, as defined under "Pipe and Utility Trench Backfill" shall be Type G backfill material. Final backfill under areas not paved shall be the same material as that used for trench backfill, except that Type K material shall be used for final backfill in agricultural areas unless otherwise indicated.
- 5. Trench backfill and final backfill for pipelines under structures shall be the same material as used in the pipe zone, except where concrete encasement is required by the Contract Documents.
- 6. Aggregate base materials under pavements shall be Type G material constructed to the thicknesses indicated. Aggregate subbase shall be Type M material.
- 7. Backfill around structures shall be Type I material, or Types A through Type H materials, or any mixture thereof, except as shown.
- 8. Backfill used to replace pipeline trench over-excavation shall be a layer of Type F material with a 6-inch top filter layer of Type E material or filter fabric to prevent migration of fines for wet trench conditions or the same material as used for the pipe zone backfill if the trench conditions are not wet.
- 9. The top 6 inches of fill on reservoir roofs, embankment fills around hydraulic structures, and all other embankment fills shall consist of Type K material, topsoil.
- 10. Filter fabric shall be **Mirafi 140 N, Mirafi 700X**, or approved equal.

2.4 MATERIALS TESTING

- A. All soils testing of samples submitted by the CONTRACTOR will be done by a testing laboratory of the CONTRACTOR'S choice approved by the OWNER at the CONTRACTOR'S expense. At its discretion, the ENGINEER may request that the CONTRACTOR supply samples for testing of any material used in the work.
- B. Particle size analysis of soils and aggregates will be performed using ASTM D 422 - Method for Particle-Size Analysis of Soils.

- C. Determination of sand equivalent value will be performed using ASTM D 2419 - Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
- D. **Unified Soil Classification System:** References in this Section to soil classification types and standards shall have the meanings and definitions indicated in ASTM D 2487 - Classification of Soils for Engineering Purposes. The CONTRACTOR shall be bound by all applicable provisions of said ASTM D 2487 in the interpretation of soil classifications.
- E. The testing for chloride, sulfate, resistivity, and pH will be done in accordance with accepted State laboratory standards and procedures.

PART 3 -- EXECUTION

3.1 EXCAVATION - GENERAL

- A. **General:** Except when specifically provided to the contrary, excavation shall include the removal of all materials of whatever nature encountered, including all obstructions of any nature that would interfere with the proper execution and completion of the WORK. The removal of said materials shall conform to the lines and grades indicated or ordered. Unless otherwise indicated, the entire construction site shall be stripped of all vegetation and debris, and such material shall be removed from the site prior to performing any excavation or placing any fill. The CONTRACTOR shall furnish, place, and maintain all supports and shoring that may be required for the sides of the excavations. Excavations shall be sloped or otherwise supported in a safe manner in accordance with applicable State safety requirements and the requirements of OSHA Safety and Health Standards for Construction (29CFR1926).

3.2 REMOVAL AND EXCLUSION OF WATER

- A. The CONTRACTOR shall remove and exclude water, including stormwater, groundwater, irrigation water, and wastewater, from all excavations. Dewatering wells, wellpoints, sump pumps, or other means shall be used to remove water and continuously maintain groundwater at a level at least two feet below the bottom of excavations before the excavation work begins at each location. Water shall be removed and excluded until backfilling is complete and all field soils testing has been completed.
- B. The CONTRACTOR shall dispose of water from the WORK in a suitable manner without damage to adjacent property. CONTRACTOR shall be responsible for obtaining any permits that may be necessary to dispose of water. No water shall be drained into work built or under construction without prior consent of the ENGINEER. Water shall be filtered using an approved method to remove sand and fine-sized soil particles before disposal into any drainage system.

3.3 STRUCTURE, ROADWAY, AND EMBANKMENT EXCAVATION

- A. **Excavation Beneath Structures and Embankments:** Except where otherwise indicated for a particular structure or ordered by the ENGINEER, excavation shall be carried to the grade of the bottom of the footing or slab. Where indicated or ordered, areas beneath structures or fills shall be over-excavated. The subgrade areas beneath embankments shall be excavated to remove not less than the top 6 inches of native material and where such subgrade is sloped, the native material shall be benched. When such over-excavation is indicated, both

over-excavation and subsequent backfill to the required grade shall be performed by the CONTRACTOR. When such over-excavation is not indicated but is ordered by the ENGINEER, such over-excavation and any resulting backfill will be paid for under a separate unit price bid item if such bid item has been established; otherwise payment will be made in accordance with a negotiated price. After the required excavation or over-excavation has been completed, the exposed surface shall be scarified to a depth of six inches, brought to optimum moisture content, and rolled with heavy compaction equipment to obtain 95 percent of maximum density.

- B. **Excavation Beneath Paved Areas:** Excavation under areas to be paved shall extend to the bottom of the aggregate base or sub-base, if such base is called for; otherwise it shall extend to the paving thickness. After the required excavation has been completed, the top twelve inches of exposed surface shall be scarified, brought to optimum moisture content, and rolled with heavy compaction equipment to obtain 95 percent of maximum density. The finished subgrade shall be even, self-draining, and in conformance with the slope of the finished pavement. Areas that could accumulate standing water shall be re-graded to provide a self-draining subgrade.
- C. **Notification of ENGINEER:** The CONTRACTOR shall notify the ENGINEER at least 3 days in advance of completion of any structure excavation and shall allow the ENGINEER a review period of at least one day before the exposed foundation is scarified and compacted or is covered with backfill or with any construction materials.

3.4 PIPELINE AND UTILITY TRENCH EXCAVATION

- A. **General:** Unless otherwise indicated or ordered, excavation for pipelines and utilities shall be open-cut trenches with widths as indicated.
- B. **Trench Bottom:** Except when pipe bedding is required, the bottom of the trench shall be excavated uniformly to the grade of the bottom of the pipe bedding. Excavations for pipe bells and welding shall be made as required.
- C. **Open Trench:** The maximum amount of open trench permitted in any one location shall be 500 feet, or the length necessary to accommodate the amount of pipe installed in a single day, whichever is greater. All trenches shall be fully backfilled at the end of each day or, in lieu thereof, shall be covered by heavy steel plates adequately braced and capable of supporting vehicular traffic in those locations where it is impractical to backfill at the end of each day. The above requirements for backfilling or use of steel plate will be waived in cases where the trench is located further than 100 feet from any travelled roadway or occupied structure. In such cases, however, barricades and warning lights meeting safety requirements shall be provided and maintained.
- D. **Trench Over-Excavation:** Where trenches are indicated to be over-excavated, excavation shall be to the depth indicated, and backfill shall be installed to the grade of the bottom of the pipe bedding.
- E. **Over-Excavation:** When ordered by the ENGINEER, whether indicated on the Drawings or not, trenches shall be over-excavated beyond the depth and/or width shown. Such over-excavation shall be to the dimensions ordered. The trench shall then be backfilled to the grade of the bottom of the pipe bedding. Over-excavation less than 6 inches below the limits on the Drawings shall be done at no increase in cost to the OWNER. When the over-

excavation ordered by the ENGINEER is 6 inches or greater below the limits shown, or wider, additional payment will be made to the CONTRACTOR. Said additional payment will be made under separate unit price bid items for over-excavation if such bid items have been established; otherwise payment will be made in accordance with a negotiated price.

- F. Where pipelines are to be installed in embankments, fills, or structure backfills, the fill shall be constructed to a level at least one foot above the top of the pipe before the trench is excavated.
- G. If a moveable trench shield is used during excavation operations, the trench width shall be wider than the shield so that the shield is free to be lifted and then moved horizontally without binding against the trench sidewalls. If the trench walls cave in or slough, the trench shall be excavated as an open excavation with sloped sidewalls or with trench shoring, as indicated and as required by the pipe structural design.

3.5 OVER-EXCAVATION NOT ORDERED OR INDICATED

- A. Any over-excavation carried below the grade ordered or indicated, shall be backfilled to the required grade with the indicated material and compaction. Such work shall be performed by the CONTRACTOR at no additional cost to the OWNER.

3.6 EXCAVATION IN LAWN AREAS

- A. Where excavation occurs in lawn areas, the sod shall be carefully removed. Excavated material shall be placed in a manner not to damage any additional lawn area as necessary. Immediately after completion of backfilling and testing of the pipeline, new sod shall be placed and lightly rolled in a manner so to restore the lawn as near as possible to its original condition. CONTRACTOR shall provide new sod in kind.

3.7 EXCAVATION IN VICINITY OF TREES

- A. Except where trees are indicated to be removed, trees shall be protected from injury during construction operations. No tree roots over 2 inches in diameter shall be cut without express permission of the ENGINEER. Trees shall be supported during excavation by any means previously reviewed by the ENGINEER.

3.8 EXPLOSIVES AND BLASTING

- A. Blasting is not permitted.

3.9 DISPOSAL OF EXCESS EXCAVATED MATERIAL

- A. The CONTRACTOR shall remove and dispose of all excess excavated material at a site selected by the CONTRACTOR and reviewed by the ENGINEER.
- B. The CONTRACTOR shall obtain all required permits, landowner and agency approvals for disposal of excess material, and pay all costs associated with the removal and disposal.

3.10 BACKFILL - GENERAL

- A. Backfill shall not be dropped directly upon any structure or pipe. Backfill shall not be placed around or upon any structure until the concrete has attained sufficient strength to withstand the loads imposed. Backfill around water retaining structures shall not be placed until the structures have been tested, and the structures shall be full of water while backfill is being placed.
- B. Except for drainrock materials being placed in over-excavated areas or trenches, backfill shall be placed after all water is removed from the excavation, and the trench sidewalls and bottom have been dried to a moisture content suitable for compaction.
- C. If a moveable trench shield is used during excavation, pipe installation, and backfill operations, the shield shall be moved by lifting the shield free of the trench bottom or backfill and then moving the shield horizontally. The CONTRACTOR shall not drag trench shields along the trench causing damage or displacement to the trench sidewalls, the pipe, or the bedding and backfill.
- D. Immediately prior to placement of backfill materials, the bottoms and sidewalls of trenches and structure excavations shall have all loose sloughing, or caving soil and rock materials removed. Trench sidewalls shall consist of excavated surfaces that are in a relatively undisturbed condition before placement of backfill materials.

3.11 PLACING AND SPREADING OF BACKFILL MATERIALS

- A. Backfill materials shall be placed and spread evenly in layers not exceeding 18 inches. When compaction is achieved using mechanical equipment, the layers shall be evenly spread so that when compacted each layer shall not exceed 6 inches in thickness.
- B. During spreading, each layer shall be thoroughly mixed as necessary to promote uniformity of material in each layer. Pipe zone backfill materials shall be manually spread around the pipe so that when compacted the pipe zone backfill will provide uniform bearing and side support.
- C. Where the backfill material moisture content is below the optimum moisture content, water shall be added before or during spreading until the proper moisture content is achieved.
- D. Where the backfill material moisture content is too high to permit the specified degree of compaction the material shall be dried until the moisture content is satisfactory.

3.12 COMPACTION OF FILL, BACKFILL, AND EMBANKMENT MATERIALS

- A. Each layer of Types A, B, C, G, H, I, and K backfill materials as defined herein, where the material is graded such that at least 10 percent passes a No. 4 sieve, shall be mechanically compacted to the indicated percentage of density. Equipment that is consistently capable of achieving the required degree of compaction shall be used and each layer shall be compacted over its entire area while the material is at the required moisture content.
- B. Each layer of Type E, F, and J backfill materials shall be compacted by means of at least 2 passes from a flat plate vibratory compactor. When such materials are used for pipe zone

backfill, vibratory compaction shall be used at the top of the pipe zone or at vertical intervals of 24 inches, whichever is the least distance from the subgrade.

- C. Flooding, ponding, or jetting shall not be used for fill on roofs, backfill around structures, backfill around reservoir walls, for final backfill materials, or aggregate base materials.
- D. Equipment weighing more than 10,000 pounds shall not be used closer to walls than a horizontal distance equal to the depth of the fill at that time. Hand operated power compaction equipment shall be used where use of heavier equipment is impractical or restricted due to weight limitations.
- E. Backfill around and over pipelines that is mechanically compacted shall be compacted using light, hand operated, vibratory compactors and rollers. After completion of at least two feet of compacted backfill over the top of pipeline, compaction equipment weighing no more than 8,000 pounds may be used to complete the trench backfill.
- F. **Compaction Requirements:** The following compaction test requirements shall be in accordance with ASTM D 1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 10 lb Rammer and 18-in. Drop for Type A, B, C, G, H, I, K, M, and N materials and in accordance with ASTM D 4253 - Test Methods for Maximum Index Density of Soils Using a Vibratory Table, and D 4254 - Test Methods for Maximum Index Density of Soils and Calculation of Relative Density, for Type B, E, F, and J materials. Where agency or utility company requirements govern, the highest compaction standards shall apply.

<u>Location or Use of Fill</u>	<u>Percentage of Maximum Density</u>	<u>Percentage of Relative Density</u>
Pipe embedment backfill for flexible pipe	95	70
Pipe bedding and over-excavated zones under bedding for flexible pipe, including trench plugs	95	70
Pipe embedment backfill for rigid pipe	90	55
Pipe zone backfill portion above embedment for rigid pipe	95	70
Pipe bedding and over-excavated zones under bedding for rigid pipe	95	70
Final backfill, beneath paved areas or Structures	98	70
Final backfill, not beneath paved areas or structures	90	55
Trench zone backfill, beneath paved areas and structures, including trench plugs	98	70

Trench zone backfill, not beneath paved areas or structures, including trench plugs	95	70
Embankments and fills	90	55
Embankments and fills beneath paved areas or structures	98	70
Topsoil (Type K material)	80	N/A
Aggregate base or subbase (Type G or M material)	95	N/A

3.13 PIPE AND UTILITY TRENCH BACKFILL

A. Pipe Zone Backfill

1. The pipe zone is defined as that portion of the vertical trench cross-section lying between a plane 6 inches below the bottom surface of the pipe and a plane at a point 6 inches above the top surface of the pipe. The bedding is defined as that portion of pipe zone backfill material between the trench subgrade and the bottom of the pipe. The embedment is defined as that portion of the pipe zone backfill material between the bedding and a level line as indicated.
2. After compacting the bedding the CONTRACTOR shall perform a final trim using a stringline for establishing grade, such that each pipe section when first laid will be continually in contact with the bedding along the extreme bottom of the pipe. Excavation for pipe bells and welding shall be made as required.
3. The pipe zone shall be backfilled with the indicated backfill material. The CONTRACTOR shall exercise care to prevent damage to the pipeline coating, cathodic bonds, and the pipe itself during the installation and backfill operations.
4. If a moveable trench shield is used during backfill operations the shield shall be lifted to a location above each layer of backfill material prior to compaction of the layer. The CONTRACTOR shall not displace the pipe or backfill while the shield is being moved.

- B. Trench Zone Backfill: After the pipe zone backfills have been placed, backfilling of the trench zone may proceed. The trench zone is defined as that portion of the vertical trench cross-section lying between a plane 6 inches above the top surface of the pipe and a plane at a point 18 inches below the finished surface grade, or if the trench is under pavement, 18 inches below the roadway subgrade.

- C. Final Backfill: Final backfill is all backfill in the trench cross-sectional area within 18 inches of finished grade, or if the trench is under pavement, all backfill within 18 inches of the roadway subgrade.

3.14 FILL AND EMBANKMENT CONSTRUCTION

- A. The area where a fill or embankment is to be constructed shall be cleared of all vegetation, roots and foreign material. Following this, the surface shall be moistened, scarified to a depth of 6 inches, and rolled or otherwise mechanically compacted. Embankment and fill material shall be placed and spread evenly in approximately horizontal layers. Each layer shall be moistened or aerated, as necessary. Unless otherwise approved by the ENGINEER, each layer shall not exceed 6 inches of compacted thickness. The embankment, fill, and the scarified layer of underlying ground shall be compacted to 95 percent of maximum density.
- B. When an embankment or fill is to be made and compacted against hillsides or fill slopes steeper than 4:1, the slopes of hillsides or fills shall be horizontally benched to key the embankment or fill to the underlying ground. A minimum of 12 inches normal to the slope of the hillside or fill shall be removed and re-compacted as the embankment or fill is brought up in layers. Material thus cut shall be re-compacted along with the new material at no additional cost to the OWNER. Hillside or fill slopes 4:1 or flatter shall be prepared in accordance with Paragraph A, above.
- C. Where embankment or structure fills are constructed over pipelines, the first 4 feet of fill over the pipe shall be constructed using light placement and compaction equipment that does not damage the pipe. Heavy construction equipment shall maintain a minimum distance from the edge of the trench equal to the depth of the trench until at least 4 feet of fill over the pipe has been completed.

3.15 FIELD TESTING

- A. **General:** All field soils testing will be done by a testing laboratory of the CONTRACTOR's choice approved by the OWNER at the CONTRACTOR's expense.
- B. Where soil material is required to be compacted to a percentage of maximum density, the maximum density at optimum moisture content will be determined in accordance with Method C of ASTM D 1557. Where cohesionless, free draining soil material is required to be compacted to a percentage of relative density, the calculation of relative density will be determined in accordance with STM D 4253 and D 4254. Field density in-place tests will be performed in accordance with ASTM D 1556 - Test Method for Density of Soil in Place by the Sand-Cone Method, ASTM D 2922 - Test Methods for Density of Soil and Soil-Aggregate in Place By Nuclear Methods (Shallow Depth), or by such other means acceptable to the ENGINEER.
- C. In case the test of the fill or backfill show non-compliance with the required density, the CONTRACTOR shall accomplish such remedy as may be required to insure compliance. Subsequent testing to show compliance shall be by a testing laboratory approved by the OWNER and shall be at no additional cost to the OWNER.

END OF SECTION

SECTION 31 23 19 – DEWATERING

PART 1 -- GENERAL

1.1 THE SUMMARY

- A. The WORK covered by this Section consists of furnishing all permits, labor, equipment, appliances and materials, and performing all operations required for dewatering excavations as required to ensure that all work is performed in the dry. The contract plans may include specific requirements limiting the controlling dewatering near areas of known contamination by VOC's and VOH's.
- B. The CONTRACTOR shall not discharge water from dewatering operations in any manner that will:
 - 1. Adversely affect the water quality of adjoining water bodies.
 - 2. Violate Federal, State, or local laws and regulations.
 - 3. Allow discharge to flow onto private property.
 - 4. Hamper the movement of traffic.
 - 5. Damage portions of the WORK previously constructed.
- C. Related sections:
 - 1. Section 31 23 33 – Trenching and Backfilling.

1.2 CONTRACTOR SUBMITTALS

- A. Furnish submittals in accordance with Section 01 33 00 – Submittal Procedures.
- B. Prior to commencement of excavation, the CONTRACTOR shall submit a detailed plan and operation schedule for dewatering of excavations. The detailed plan shall include mitigation measures to prevent settlement of nearby structures and a contingency plan for restoring nearby structures if settlement is observed as a result of the CONTRACTOR's dewatering operations. The CONTRACTOR may be required to demonstrate the system proposed and to verify that adequate equipment, personnel, and materials are provided to dewater the excavations at all locations and times. The CONTRACTOR's dewatering plan is subject to review by the ENGINEER.

1.3 QUALITY ASSURANCE

- A. It shall be the sole responsibility of the CONTRACTOR to control the rate and effect of the dewatering in such a manner as to avoid all objectionable settlement and subsidence.
- B. All dewatering operations shall be adequate to assure the integrity of the finished project and shall be the responsibility of the CONTRACTOR.
- C. All structures or facilities that are located within the radius of influence of the CONTRACTOR's dewatering operation shall have reference points established and

observed at frequent intervals to detect any settlement which may develop. The responsibility for conducting the dewatering operation in a manner which will protect adjacent structures and facilities rests solely with the CONTRACTOR. The CONTRACTOR shall survey, record and report the reference points on a daily basis, and submit the written log to the ENGINEER at the completion of construction. The ENGINEER shall be immediately notified should any sign of settlement is observed. The cost of repairing any damage to adjacent structures and restoration of facilities shall be the responsibility of the CONTRACTOR.

PART 2 -- PRODUCTS

2.1 EQUIPMENT

- A. Dewatering, where required, may include the use of well points, sump pumps, temporary pipelines for water disposal, rock or gravel placement, and other means. Standby pumping equipment shall be maintained on the Site.

PART 3 -- EXECUTION

3.1 DELIVERY, STORAGE AND HANDLING

- A. The CONTRACTOR's proposed method for dewatering pipe trenches shall be reviewed by the ENGINEER prior to instituting any such operations. Methods may include wellpoints, sump pumps, bedding rock or other methods approved by the ENGINEER. If a dewater sock method is used, the sock must be grouted in place when work is complete. Wellpoint holes must be grouted or sand wash backfilled.
- B. The CONTRACTOR shall provide all labor, materials, tools and equipment necessary to properly control the quality of the discharge from dewatering operations. The CONTRACTOR shall comply with all applicable laws, rules and regulations governing the discharge of water from dewatering operations. The CONTRACTOR shall have on hand, at all times, sufficient pumping equipment and machinery in good working condition and shall have available, at all times, competent workmen for the operation of the pumping equipment. Adequate standby equipment shall be kept available at all times to insure efficient dewatering and maintenance of dewatering operation during power failure.
- C. All dewatering shall be accomplished by the use of sanded well points and other techniques deemed necessary by the CONTRACTOR to properly dewater the trench excavations. Well points shall be adequately spaced to provide the necessary dewatering and shall be sandpacked and/or other means used to prevent pumping of fine sands or silts from the subsurface. A continual check by the CONTRACTOR shall be maintained to ensure that the subsurface soil is not being removed by the dewatering operation.
- A. Dewatering for structures and pipelines shall commence when groundwater is first encountered, and shall be continuous until such times as water can be allowed to rise in accordance with the provisions of this Section or other requirements.
- B. At all times, site grading shall promote drainage. Surface runoff shall be diverted from excavations. Water entering the excavation from surface runoff shall be collected in shallow ditches around the perimeter of the excavation, drained to sumps, and be pumped or drained by gravity from the excavation to maintain a bottom free from standing water.

- C. Dewatering shall at all times be conducted in such a manner as to preserve the undisturbed bearing capacity of the subgrade soils at proposed bottom of excavation.
- D. If foundation soils are disturbed or loosened by the upward seepage of water or an uncontrolled flow of water, the affected areas shall be excavated and replaced with drain rock.
- E. The CONTRACTOR shall maintain the water level below the bottom of excavation in all work areas where groundwater occurs during excavation construction, backfilling, and up to acceptance.
- F. Flotation shall be prevented by the CONTRACTOR by maintaining a positive and continuous removal of water. The CONTRACTOR shall be fully responsible and liable for all damages which may result from failure to adequately keep excavations dewatered.
- G. Upon removal of the wellpoints, the CONTRACTOR must protect the holes and fill with flowable fill within 24 hours. Flowable fill for backfill of wellpoints shall not be measured for payment and shall not be included in the cost of installing the pipe.
- H. The CONTRACTOR is responsible for controlling the bacteriological quality of well point discharges into existing bodies of water. The maximum allowable level for fecal coliform in the wellpoint discharge is a mean MPN of 14 per 100 ML with not more than ten percent (10%) of the samples exceeding an MPN of 43 per 100 ML.
- I. The CONTRACTOR shall dispose of water from the WORK in a suitable manner without damage to adjacent property. CONTRACTOR shall be responsible for obtaining any permits that may be necessary to dispose of water. No water shall be drained into work built or under construction without prior consent of the ENGINEER. Water shall be filtered using an approved method to remove sand and fine-sized soil particles before disposal into any drainage system.
- J. The release of groundwater to its static level shall be performed in such a manner as to maintain the undisturbed state of the natural foundation soils, prevent disturbance of compacted backfill and prevent flotation or movement of structures, pipelines, and sewers.
- K. Dewatering of trenches and other excavations shall be considered as incidental to the construction of the WORK and all costs thereof shall be included in the various contract prices in the Bid Forms, unless a separate bid item has been established for dewatering.

END OF SECTION

SECTION 31 23 23.33– FLOWABLE FILL

GENERAL

1.1 THE SUMMARY

- A. The CONTRACTOR shall provide Controlled Low Strength Material (CLSM), complete and in place, in accordance with the Contract Documents.
- B. CLSM shall be placed where indicated and may be used, if the ENGINEER approves, for the following purposes:
 - 1. Normal CLSM with high slump, non-segregating consistency that readily flows and fills voids and difficult to reach places: pipe zone fill, trench zone fill, pipe abandonment, structure backfill, and structure cavity fill.
 - 2. Foundation CLSM is used where higher early strengths are required and future excavation is not likely to be required.

1.2 DEFINITIONS

- A. Flowable Fill: is defined as Controlled Low Strength Material or CLSM.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. Furnish submittals in accordance with Section 01 33 00 – Submittal Procedures.
- B. FDOT Standard Specifications for Road and Bridge Construction - Section 121

1.4 CONTRACTOR SUBMITTALS:

- A. CLSM mix designs which show the proportions and gradations of materials proposed for each type of CLSM indicated. Each mix design shall be accompanied by independent laboratory test results of the indicated properties.
- B. If the CONTRACTOR proposes to provide lower strength CLSM with aggregates that do not conform to ASTM C 33 - Concrete Aggregate, Shop Drawings shall include a testing program that will be used to control the variability of the aggregates. The testing program shall be acceptable to the ENGINEER.

1.5 QUALITY ASSURANCE

- A. Testing will be performed by a testing laboratory selected by CONTRACTOR, except as otherwise indicated in the Contract Documents.
- B. If tests of the CLSM show non-compliance with the specifications, the CONTRACTOR shall make changes as may be required to achieve compliance. Performing and paying for subsequent testing to show compliance shall be the CONTRACTOR's responsibility.
- C. Correlation Tests

1. The CONTRACTOR shall perform a field correlation test for each mix of CLSM used in pipe zone, trench zone, or backfill used in amounts greater than 100 cubic yards or when CLSM is required to support traffic or other live loads on the fill less than 7 days after placing CLSM.
2. Laboratory and field tests shall be performed on samples taken from the same CLSM batch mix. Tests shall be performed by a laboratory at the CONTRACTOR's expense.
3. Testing shall be performed once each 24 hours for 2 days and once per week thereafter until the CLSM mix reaches the maximum design strength.
 - a. Compression testing shall be in accordance with ASTM D 4832 - Preparation and Testing of Soil-Cement Slurry Test Cylinders.
 - b. Setting test shall be in accordance with ASTM C 403 - Time of Setting of Concrete Mixtures by Penetration Resistance.
 - c. Density tests shall be in accordance with ASTM C 138 - Unit Weight, Yield and Air Content (Gravimetric) of Concrete.

PART 2 -- PRODUCTS

2.1 CONTROLLED LOW STRENGTH MATERIAL

- A. CLSM shall be a mixture of cement, pozzolan, coarse and fine aggregate, admixtures, and water, mixed in accordance with ASTM C 94 - Ready Mixed Concrete.
- B. Composition: The following parameters shall be within the indicated limits and as necessary to produce the indicated compressive strengths.
 1. Mix proportions as necessary.
 2. Entrained air content shall be between 5 percent minimum and 35 percent maximum.
 3. Water reducing agent content as necessary.
- C. Properties
 1. Density shall be between 100 PCF minimum and 145 PCF maximum.
 2. Slump shall be as required by the CONTRACTOR's methods, but shall not promote segregation nor shall slump exceed 9 inches.
 3. Compressive strength at 28 Days:
 - a. Normal CLSM: Between 100 psi minimum and 300 psi maximum. Unless specifically indicated otherwise, CLSM shall be Normal CLSM.
 - b. Foundation CLSM: 1,000 psi minimum.

2.2 CEMENT

- A. Cement shall be Type I or II in accordance with ASTM C 150 - Portland Cement.

2.3 POZZOLAN

- A. Pozzolan shall be Type F or C in accordance with ASTM C 618 - Flyash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete. Pozzolon content, by weight, in Normal CLSM shall not be greater than cement content.

2.4 AGGREGATE

- A. Aggregate shall consist of a well graded mixture of crushed rock, soil, or sand, with a nominal maximum size of 3/8-inch. One hundred percent shall pass the 1/2-inch sieve; no more than 30 percent shall be retained on the 3/8-inch sieve; and no more than 12 percent shall pass the number 200 sieve. If more than 5 percent of the aggregate passes the number 200 sieve, the material passing the number 200 sieve shall have a plasticity index of less than 0.73 (liquid limit-20), when tested in accordance with ASTM D 4318 - Liquid Limit, Plastic Limit, and Plasticity Index of Soils. Aggregate shall be free from organic matter and shall not contain more alkali, sulfates, or salts than the native materials at the Site.

2.5 ADMIXTURES

- A. Air entraining admixtures shall be in accordance with ASTM C 260 - Air-Entraining Admixtures for Concrete.
- B. Water reducing admixtures shall be in accordance with ASTM C 494 - Chemical Admixtures for Concrete.

2.6 WATER

- A. Water shall be potable, clean, and free from objectionable quantities of silt, organic matter, alkali, salt, and other impurities.

PART 3 -- EXECUTION

3.1 PREPARATION

- A. Subgrade and compacted fill to receive CLSM shall be prepared according to Section 31 23 00 – Excavation and Fill.

3.2 BATCHING, MIXING AND DELIVERY

- A. Batching, mixing, and delivery of CLSM shall conform to ASTM C 94. CLSM shall be mixed at a batch plant acceptable to the ENGINEER and shall be delivered in standard transit mix trucks.

3.3 PLACEMENT

- A. CLSM shall be placed by tailgate discharge, conveyor belts, pumped, or other means. CLSM shall be directed in place by vibrator, shovel, or rod to fill crevices and pockets. Avoid over-consolidation which causes separation of aggregate sizes.
- B. CLSM shall be continuously placed against fresh material unless otherwise approved by the ENGINEER. When new material is placed against existing CLSM, the placement area shall be free from loose and foreign material. The surface of the existing material shall be soaked a minimum of one hour before placement of fresh material but no standing water shall be allowed when placement begins.
- C. Temperature of the CLSM shall be between 50 and 90 degrees F, when placed. CLSM shall not be placed when the air temperature is below 40 degrees F. No CLSM shall be placed against frozen subgrade or other materials having temperature less than 32 degrees F.

3.4 FINISHING

- A. The finish surface shall be smooth and to the grade indicated or directed by the ENGINEER. Surfaces shall be free from fins, bulges, ridges, offsets, and honeycombing. Finishing by wood float, steel trowel, or similar methods is not required.

3.5 CURING

- A. CLSM shall be kept damp for a minimum of 7 Days or until final backfill is placed.

3.6 PROTECTION

- A. CLSM shall be protected from freezing for 72 hours after placement.
- B. No fill or loading shall be placed on CLSM until probe penetration resistance, as measured in accordance with ASTM C 803 - Standard Test Method for Penetration Resistance of Hardened Concrete, meets the design strength.
- C. CLSM shall be protected from running water, rain, and other damage until the material has been accepted and final fill completed.

END OF SECTION

SECTION 31 23 33 – TRENCHING AND BACKFILLING

PART 1 -- GENERAL

1.1 THE SUMMARY

- A. Furnish labor, materials and equipment to excavate for all underground piping and conduit.
- B. Place and compact granular bedding and fill over pipelines and conduits.
- C. Dewater excavations as required to maintain dry conditions.
- D. In order to avoid existing operational utilities, it may be necessary for pipe to be laid up to twelve inches deeper than the cover specified. At such time the CONTRACTOR is not allowed extra compensation for additional excavation involved, whether the utilities were indicated on the Contract Drawings or not.
- E. Density tests for determination of the specified compaction shall be made by a testing laboratory approved by the ENGINEER.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. Section 33 05 23.16 – Utility Pipe Jacking
- B. Section 31 23 19 – Dewatering
- C. Section 31 20 00 – Earth Moving
- D. Section 31 23 00 – Excavation and Fill

1.3 QUALITY ASSURANCE

- A. Testing of compacted fill materials is required in accordance with these specifications.
- B. If results of tests taken during the progress of the work indicate compacted materials do not meet specified requirements, such defective work will be removed, replaced and re-tested as directed by the ENGINEER and at the CONTRACTOR's sole expense.
- C. Compacted fill is to be tested before proceeding with the placement of surface materials.

1.4 PROTECTION

- A. Protect trees, hedges, shrubs, and lawn areas to receive plantings, rock out-croppings and other features remaining as part of the final landscaping.
- B. Protect survey bench marks and existing structures, roads, sidewalks, paving and curbs against damage from vehicular or foot traffic. Install and maintain proper bridging, planking and to provide access to buildings. Maintain access to streets and driveways.
- C. Protect excavations by shoring, bracing, sheet piling underpinning, or by other methods, as required to prevent cave-ins or loose soil from falling into excavations.

- D. Underpin or otherwise support adjacent structures which may be damaged by excavation work. This includes other utilities.
- E. Notify the ENGINEER of any unexpected sub-surface conditions. Discontinue work in the area until the ENGINEER provides notification to resume work.

PART 2 -- PRODUCTS

2.1 BEDDING AND FILL MATERIALS

- A. Bedding Materials: Provide granular material, 100% passing a No. 4 sieve, free of organic matter and compacted to 95% density. Use a minimum of six inches of bedding material as measured from the bottom of the pipe bell to natural earth. Bedding material shall support the pipe as shown in the details of the Contract Drawings.
- B. Selected Backfill: After pipe joints have been inspected and given preliminary approval by the ENGINEER, and sufficient time has elapsed for setting of joints, if necessary, backfilling shall be performed, together with tamping, until fill is placed to an elevation at least one foot above the top of the pipe bell. During this initial stage of backfilling, approved granular materials or loose free soil from lumps, clods or stones shall be deposited in layers approximately six inches thick and compacted by manually operated machine tampers actuated by compressed air, or by other suitable means. Tampers and machines shall be suitable for the work and subject to approval by the ENGINEER prior to use.
- C. Backfill Material: Furnish excavated material, free from roots and rocks larger than 3-1/2 inches in size and building debris.
- D. Fill Under Landscaped Areas: Provide material free from alkalis, salts and petroleum products. Use sub-soil excavated from the site only if it conforms to the specified requirements.

PART 3 -- EXECUTION

3.1 PREPARATION AND LAYOUT

- A. Establish the limits of excavations by area and elevation. Identify datum elevation.
- B. Set lines and levels. Maintain survey benchmarks, monuments and other reference points.
- C. Clear the site of all trees, shrubs, paving and objectionable material which interfere with the prosecution of the Work. Vegetation not interfering with the construction shall be protected from damage.

3.2 UTILITIES

- A. Before starting excavation operations, establish the location and extent of underground utilities existing in the area of work.
- B. Notify the ENGINEER if utility lines which are in the way of the excavation are uncovered.
- C. Protect active utility services uncovered by the excavation.

- D. Remove abandoned utility lines from areas of excavation. Cap, plug or seal such lines as directed by the ENGINEER and identify at grade.
- E. Accurately locate and record the location of abandoned utility lines and active utility lines that are re-routed, re-located or extended on Project Record Documents.
- F. Accurately locate and record the location on Project Record Documents of active utility lines whose locations are not accurately reflected on the Contract Drawings.

3.3 TRENCHING

- A. Ensure that trenching does not interfere with normal 45 degree bearing splay of any building foundation.
- B. Excavate in accordance with lines and grades shown on the Contract Drawings or specified in these Specifications.
- C. Cut trenches sufficiently wide to enable safe and proper installation of pipe and to allow for thorough inspection. Trim and shape the trench bottom and leave it free of irregularities, lumps and projections. Excavate whatever substances are encountered to the dimensions and depths specified or shown on the Contract Drawings.
- D. Do not disturb soil within the branch spread of existing trees or shrubs that are to remain. If it is necessary to excavate through roots, perform work by hand and cut roots with a sharp axe.
- E. When complete, notify the ENGINEER for inspection of excavations. Correct unauthorized excavations as directed, at no cost to the OWNER.
- F. Where encountered in the trench bed, rock shall be excavated to a depth of 1/2 of the pipe diameter, but in no case less than 6" below the bottom of the pipe. All undercut trench excavations shall be backfilled and tamped with suitable materials.
- G. Unsuitable materials encountered at or below the excavation depth specified or shown on the Contract Drawings shall be removed and replaced to a depth of six inches below the excavation depth and replaced with suitable material.
- H. Keep pipe laying operations as close to the excavation operation as possible.
- I. All trench excavations shall comply with OSHA Standards.
- J. The CONTRACTOR shall provide all trench and structural bracing, sheeting or shoring necessary to construct and protect the excavation, existing utilities, structures and private property as required. Sheeting shall be removed or cut off by the CONTRACTOR during backfilling.

3.4 DEWATERING

- A. Keep trenches dry. Provide necessary dewatering equipment including wellpoints, pumps, piping and temporary drains.

- B. Do not discharge drainage water into municipal sewers without municipal approval. Ensure water does not contain unacceptable levels of suspended solids.
- C. Direct surface drainage away from excavated areas in such a manner as to not create a nuisance to adjacent property or public thoroughfares.
- D. Control the grading in and adjacent to excavations to prevent water from running into excavated areas or onto adjacent properties or into public thoroughfares.
- E. Direct surface drainage away from excavated areas in such a manner as to not create a nuisance to adjacent property or public thoroughfares.

3.5 BACKFILLING

- A. Do not start backfilling until piping has been inspected by the ENGINEER.
- B. Maintain trenches free of debris, wood, rocks over 3-1/2 inches in diameter and water.
- C. Backfill as early as possible after pipe installation to allow maximum time for natural settlement and compaction. Backfill on both sides of the pipe simultaneously.
- D. After backfill has reached a point one foot above the top of the pipe, a variation in the procedure of the placement and amount of compaction of fill may be permitted by the ENGINEER, depending upon the location of the work and the danger from subsequent settlement, as follows:
 - 1. For backfilling in unimproved areas (along utility easements and beyond the edge of driveways and graveled parking areas) from an elevation of one foot above the top of pipe to the surface of the ground, backfill may be deposited by equipment. Depositing in layers or tamping will not be required. Sufficient surplus excavated material shall be neatly rounded over the trench to compensate for settlement. All surplus excavated materials beyond that required above shall be disposed of by the CONTRACTOR.
 - 2. For backfilling beneath driveways and parking areas, alleys and streets where non-rigid type surfacing is to be replaced (including dirt, gravel or cinder driveways and alleys):
 - a. Backfill material shall be carefully deposited in uniform layers not to exceed six inches in thickness and each layer shall be compacted to 98% of maximum density in accordance with AASHTO T-180 with manually operated machine tampers.
 - b. Excavated material may not be compacted by the water jetting method.
 - c. In lieu of the foregoing compaction method, the backfill material and procedure used may be as specified under Method 3, below.
 - 3. For backfilling across and beneath driveways, sidewalks, parking areas or streets where a rigid type paving is to be replaced (i.e., concrete, asphaltic concrete and brick or block surfaces):

- a. All backfill material shall be approved granular material of high weight and density. The material shall be carefully deposited in uniform layers not to exceed six inches in thickness (loose measure) and each layer shall be compacted to a density of at least 100% of the maximum density as determined by AASHTO Method T-99, by ramming or tamping with tools approved by the ENGINEER in a manner that does not disturb the pipe. Where necessary, granular base material of the type and thickness specified shall be used for the last layer prior to surfacing.

END OF SECTION

SECTION 33 01 12 – SEWER FLOW CONTROL

PART 1 -- GENERAL

1.1 THE SUMMARY

- A. The objective of flow bypass and/or diversion pumping (SEWER FLOW CONTROL) is to:
 - 1. Maintain an efficient and uninterrupted level of service to wastewater collection system users while maintenance or construction operations (including rehabilitation, repair or replacement) are facilitated on the segment or segments being bypassed and/or from which flow is being diverted within the wastewater collection system.
 - 2. Ensure all levels of sewage flow are continuously and effectively handled around the segment or segments of sewer being bypassed and/or from which flow is being diverted.
- B. Related sections:
 - 1. Section 31 23 33 – Trenching and Backfilling
 - 2. Section 33 01 30.61 – Sewer and Pipe Joint Sealing
 - 3. Section 33 01 30.41 – Cleaning of Sewers
 - 4. Section 33 01 30.16 – TV Inspection of Gravity Pipelines
 - 5. Section 33 01 30.72 – Relining Sewers
 - 6. Section 33 01 30.71 – Rehabilitation of Sewer Utilities

1.2 PERFORMANCE REQUIREMENTS

- A. It is essential to the operation of the existing sewerage system that there is no interruption in the flow of sewage throughout the duration of the project. To this end, the CONTRACTOR shall provide, maintain and operate all temporary facilities such as dams, plugs, pumping equipment (both primary and back-up units as required), conduits, all necessary power, and all other labor and equipment necessary to intercept the sewage flow before it reaches the point where it would interfere with his/her WORK, carry it past his/her WORK, and return it to the existing sewer downstream of his/her WORK.
- B. The design, installation and operation of the temporary pumping system shall be the CONTRACTOR's responsibility. The bypass system shall be the CONTRACTOR's responsibility. The bypass system shall meet the requirements of all codes and regulatory agencies having jurisdiction.
- C. The CONTRACTOR shall provide all necessary means to safely convey the sewage past the WORK area.
- D. The CONTRACTOR shall maintain sewer flow around the work area in a manner that will not cause surcharging sewers or damage to sewers, and that will protect public and private property from damage and flooding.

- E. The CONTRACTOR shall protect water resources wetlands and other natural resources.
- F. In the event of a bypass failure, the CONTRACTOR shall be responsible for all necessary corrective action, as approved by the OWNER, to complete the original assignment.
- G. The CONTRACTOR shall be solely responsible for planning and executing sewer flow control, bypass and diversion pumping operations. The CONTRACTOR shall be entirely liable for damages to private or public property that may result from his operations and for all cleanup, disinfection, damages, and resultant fines in the event of spillage, flooding or overflow.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION

3.1 CONSTRUCTION

- A. All WORK and testing shall comply with the applicable Federal codes, including Federal Occupational Safety and Health Act of 1970 and the Construction Safety Act of 1969, as amended, and applicable State and local codes and standards; and to the extent applicable with the requirements of the Underwriter's Laboratories, Inc. and the National Electric Code.
- B. If during normal rehabilitation work on manholes and sewers, where flow control devices, including flow bypass and diversion pumping, have not been deployed, wastewater flow depth exceeds the workable levels, rehabilitation work shall be immediately discontinued. Rehabilitation works shall only resume, at no extra cost to the OWNER when minimum flow levels prevail.
- C. During all bypass-pumping or other flow control operations, the CONTRACTOR shall prevent mains, manholes, and all local sewer lines from damage inflicted by any equipment. The CONTRACTOR shall be responsible for all physical damage to mains, manholes, and all local sewer lines caused by human or mechanical failure.
- D. The CONTRACTOR shall coordinate with the OWNER as necessary to determine and effect optimum working arrangements.
- E. The CONTRACTOR shall immediately cease bypass and/or diversion pumping when so ordered by the OWNER.
- F. The CONTRACTOR shall notify the OWNER 48 hours prior to commencing actual flow bypass and/or diversion pumping operations. The CONTRACTOR flow control proposal shall be agreed to by the OWNER before the CONTRACTOR shall be allowed to commence sewerage bypass pumping and/or diversion.

3.2 FIELD QUALITY CONTROL

- A. During flow bypass and/or diversion pumping, the CONTRACTOR is prohibited from allowing any sewage to be dumped, or spilled in or onto the ground or any area outside of the existing wastewater collection system. In addition, due care and attention shall be given to prevent vehicular or pump fuel or lubrication oil to be leaked.

- B. When flow bypass and diversion pumping operations are complete, the residual contents of sewage in piping shall be drained into the existing sewer prior to disassembly.
- C. It shall be the responsibility of the CONTRACTOR to schedule and perform his/her work in a manner that does not cause or contribute to incidence of overflows or spills of sewage from the sewer system.
- D. In the event that the CONTRACTOR work activities contribute to overflows or spills the CONTRACTOR shall immediately take appropriate action to contain and stop the overflow, clean up the spillage, disinfect the area affected by the spill, and notify the OWNER in a timely manner.
- E. CONTRACTOR will indemnify and hold harmless the OWNER for any fines or third-party claims for personal or property damage arising out of a spill or overflow that is fully or partially the responsibility of the CONTRACTOR, including the legal, engineering and administrative expenses of the OWNER in defending such fines and claims.

END OF SECTION

SECTION 40 05 00 – PIPING, GENERAL

PART 1 -- GENERAL

1.1 THE REQUIREMENT

- A. Provide the piping systems indicated, complete and operable, in accordance with the Contract Documents.
- B. The provisions of this Section shall apply to piping sections in Divisions 33
- C. The Drawings define the general layout, configuration, routing, method of support, pipe size, and pipe type.
- D. The Drawings are not pipe construction or fabrication drawings. CONTRACTOR shall prepare pipe spooling and fabrication drawings and shall submit to the ENGINEER for review.
- E. Where pipe supports and spacing are indicated on the Drawings and are referenced to a Standard Detail, the CONTRACTOR shall use that Detail.
- F. Where pipe supports are not indicated on the Drawings, it is the CONTRACTOR'S responsibility to develop the details necessary to design and construct mechanical piping systems to accommodate the specific equipment provided, and to provide spacers, adapters, and connectors for a complete and functional system.

1.2 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

- A. AISI C 1012 Carbon Steel
- B. ANSI/ASME B1.1 Unified Inch Screw Threads, (UN and UNR Thread Form).
- C. ANSI/ASME B1.20.1 Pipe Threads, General Purpose (inch).
- D. ASCE 7-05 Minimum Design Loads for Buildings and Other Structures
- E. ASME B16.5 Pipe Flanges and Flanged Fittings, Steel Nickel Alloy and other Special Alloys.
- F. ASME B 31 Standards for Pressure Piping
- G. ASME Section 9 Boiler and Pressure Vessel Code
- H. ASTM A 36 Standard Specification for Carbon Structural Steel
- I. ASTM A 108 Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
- J. ASTM A 167 Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
- K. ASTM A 193 Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications

L. ASTM A 194	Standard Specification for Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both
M. ASTM A 240	Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
N. ASTM A 276	Standard Specification for Stainless Steel Bars and Shapes
O. ASTM A 307	Specification for Carbon Steel Bolts and Studs, 6,000 psi Tensile.
P. ASTM A 325	Specification for High-Strength Bolts for Structural Steel Joints.
Q. ASTM F 436	Standard Specification for Hardened Steel Washers
R. ASTM F 467	Standard Specification for Nonferrous Nuts for General Use
S. ASTM F 468	Standard Specification for Nonferrous Bolts, Hex Cap Screws, Socket Head Cap Screws, and Studs for General Use
T. ASTM A 512	Standard Specification for Cold-Drawn Buttweld Carbon Steel Mechanical Tubing
U. ASTM A 513	Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing
V. ASTM A 563	Standard Specification for Carbon and Alloy Steel Nuts
W. ASTM A 576	Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality
X. ASTM D 792	Test Methods for Specific Gravity and Density of Plastics by Displacement.
Y. ASTM F 844	Standard Specification for Washers, Steel, Plain (Flat), Unhardened for General Use
Z. AWS D1.1	Structural Welding Code
AA. AWWA M 11	Steel Pipe – A Guide for Design and Installation
BB. AWWA C 115	Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges
CC. AWWA C 207	Steel Pipe Flanges for Water Works Service, Sizes 4 in through 144 in.
DD. AWWA C 209	Standard for Cold-Applied Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines

EE. AWWA C 219

Standard for Bolted Sleeve-Type Couplings for Plain-End Pipe.

FF. AWWA C 606

Grooved and Shouldered Joints.

1.3 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. Shop Drawings: Shop Drawings shall contain the following information:

1. Drawings: Layout drawings including necessary dimensions, details, pipe joints, fittings, specials, bolts and nuts, gaskets, valves, appurtenances, anchors, guides, design calculations, and material lists. Pipe spooling and fabrication drawings shall indicate spacers, adapters, connectors, fittings, and pipe supports to accommodate the equipment and valves in a complete and functional system.
2. Pipe Supports: Submit pipe support fabrication drawings including calculations signed by a Registered Engineer in accordance with Section 40 05 07 – Pipe Supports.
3. Grooved joint couplings and fittings shall be shown on drawings and product submittals, and shall be specifically identified with the applicable style or series designation.
4. Thermoplastic Pipe Joints: Submit solvent cement manufacturer's catalog indicating that the recommended product is suitable for each fluid service application.
5. Gasket Material: Submit gasket manufacturer's catalog indicating that the recommended product is suitable for each fluid service application.
6. Seals and Seating Materials: Submit elastomer material and manufacturer's catalog indicating that the recommended product is suitable for each fluid service application.
7. Modular Seals for Pipe: Manufacturer's catalog sheet showing materials and installation procedures.

C. Samples

1. Performing and paying for sampling and testing as necessary for certifications are the CONTRACTOR'S responsibility.

D. Certifications

1. Necessary certificates, test reports, and affidavits of compliance shall be obtained by the CONTRACTOR.
2. A certification from the pipe fabricator that each pipe will be manufactured subject to the fabricator's or a recognized Quality Control Program. An outline of the program shall be submitted to the ENGINEER for review prior to the manufacture of any pipe.

1.4 MATERIAL DELIVERY, STORAGE, AND PROTECTION

A. Piping materials, fittings, valves, and accessories shall be delivered in a clean and undamaged condition and stored off the ground for protection against oxidation caused by ground contact.

- B. Defective or damaged materials shall be replaced with new materials.

PART 2 -- PRODUCTS

2.1 GENERAL

A. Extent of Work

1. Pipes, fittings, and appurtenances shall be provided in accordance with the requirements of the applicable Sections of Divisions 33 and as indicated.
2. Materials in contact with potable water shall be listed as compliant with NSF Standard 61.
3. All materials, fittings and appurtenances intended for use in pressure pipe systems shall be designed and constructed for a minimum working pressure of 150 psi unless the specific application dictates a higher working pressure.
4. All dead ends (temporary and permanent) shall be mechanically restrained (plug is required). Thrust block restraint is not allowed.

B. Piping Supports

1. Pipes shall be adequately supported, restrained, and anchored in accordance with Section 40 05 07 – Pipe Supports, and as indicated.
2. Piping support lateral and vertical seismic forces shall be sized in accordance with design parameters indicated in Structural sheet GS-1 – General Structural Notes– Design Criteria– Seismic Loads and data per ASCE 7-05, Table 13.6-1 Seismic Coefficients for Mechanical and Electrical Components.

C. Lining

1. Application, thickness, and curing of pipe lining shall be in accordance with the applicable Sections of Division 33, unless otherwise indicated.

D. Coating

1. Application, thickness, and curing of coating on buried pipe shall be in accordance with the applicable Sections of Division 33, unless otherwise indicated.
2. Pipes shall be coated in accordance with Section 09 96 00 – Protective Coating.

E. Pressure Rating

1. Piping systems shall be designed for the maximum expected pressure as defined in Section 01 74 30 – Pressure Pipe Testing and Disinfection, or as indicated on the Piping Schedule, whichever is greater.

F. Grooved Piping Systems

1. Piping systems with grooved joints and fittings may be provided in lieu of screwed, flanged, welded, or mechanical joint systems for steel and ductile iron yard piping. (All piping above and below ground within the property limits of treatment plants, pump stations, and similar installations). All grooved couplings on buried piping must be bonded. To assure uniform and compatible piping components, all grooved fittings, couplings, and valves shall be from the same manufacturer. The CONTRACTOR

shall make the coupling manufacturer responsible for the selection of the correct style of coupling and gasket for each individual location.

G. Inspection

1. Pipe shall be subject to inspection at the place of manufacture.
2. During the manufacture, the ENGINEER shall be given access to areas where manufacturing is in progress and shall be permitted to make inspections necessary to confirm compliance with requirements.

H. Tests

1. Except where otherwise indicated, materials used in the manufacture of the pipe shall be tested in accordance with the applicable specifications and standards.
2. The CONTRACTOR shall be responsible for performing material tests at no additional cost to the OWNER.

I. Welding Requirements

1. Qualification of welding procedures used to fabricate pipe shall be in accordance with the provisions of AWS D1.1 - Structural Welding Code or the ASME Boiler and Pressure Vessel Code, Section 9, whichever is applicable.
2. Welding procedures shall be submitted for the ENGINEER's review.

J. Welder Qualifications

1. Welding shall be performed by skilled welders and welding operators who have adequate experience in the methods and materials to be used.
2. Welders shall be qualified under the provisions of AWS D1.1 or the ASME Boiler and Pressure Vessel Code, Section 9, whichever is applicable.
3. Machines and electrodes similar to those used in the WORK shall be used in qualification tests.
4. Qualification testing of welders and materials used during testing is part of the WORK.

K. DIP and PVC Transition

1. Transitions between DIP and PVC that are not specified or required by the construction plans or details are not permitted. PVC SDR-35 sewer pipe/ductile iron pipe adapters shall be used for DIP and PVC transition on all new constructions. Heavy duty stainless steel flexible couplings are acceptable for transition joints with existing facilities only.

L. Tapping:

1. Existing mains may be tapped as long as the tapping line is smaller than the tapped line. No size-on-size taps are permitted. Equal size lines branch-offs shall require that a tee be cut in. A ductile iron mechanical joint tapping sleeve is required for all taps unless the tapping line is half the diameter or less of the line to be tapped. A stainless steel tapping sleeve is permissible in those cases. Use of a stainless steel sleeve is also permissible on all size taps on existing SDR-26 and SDR-21 PVC

pipe only. Cut-in tee construction may be specified, depending on the circumstances and sizes involved.

2. Tapping Sleeves and Tapping Valves

- a. Provide ductile iron, mechanical joint x flanged outlet tapping sleeves. Factory epoxy coated steel tapping sleeves are permissible on existing SDR-26 and SDR-21 PVC pipe only.
- b. Provide as a tapping valve a mechanical joint x flanged outlet, iron body, resilient seat gate valve, conforming to those described in these Specifications.
- c. Pressure test the tapping sleeve and valve at 150 psi for one hour. The OWNER and the ENGINEER (if applicable) must be given not less than 48 hours advance notice of the test and must be present to witness the test.
- d. The pipe coupon will be carefully preserved and turned over to the OWNER.
- e. Provide double strap tapping saddles with AWWA threads and ball valve corp stop with operating nut gate valve for 1-1/2" and 2" taps.
- f. Provide double strap tapping saddle with AWWA threads and corporation stop with AWWA inlet threads for taps 1" and smaller.
- g. All taps must be not less than 18" from a fitting or bell.
- h. The tapping line must be smaller than the tapped line, except as approved by the OWNER and the ENGINEER.
- i. A ductile iron tapping sleeve is required for all taps unless the tapping line is less than 1/2 the diameter of the line to be tapped. A steel tapping sleeve is permissible in those cases.
- j. Cut-in tee construction may be required by the OWNER depending on the circumstances and sizes involved.

3. Tapping Saddles

- a. Tapping saddles shall be used for all taps three inches in diameter or less.
- b. Tapping saddles shall be the double-strap, steel-constructed type conforming to AWWA C-800 requirements.
- c. Saddles shall be brass with stainless steel hardware with extra wide bearing surfaces furnished with a flanged or NPT threaded outlet.
- d. Saddles shall be rated for 150 psi working pressure and shall be furnished with extra thick and wide neoprene gasket.
- e. Service saddles shall be as manufactured by **Clow** or approved equal.

2.2 PIPE FLANGES

A. General

- B. Flanges shall be provided with flat faces and shall be attached with bolt holes straddling the vertical axis of the pipe unless otherwise indicated.

- C. Flange faces shall be perpendicular to the axis of the adjoining pipe.
- D. Flanges for miscellaneous small diameter pipes shall be in accordance with the standards indicated for these pipes.
- E. Pressure Ratings
 - 1. 150 psig or less: Flanges shall conform to either AWWA C207 - Steel Pipe Flanges for Waterworks Service--Sizes 4 In. Through 144 In., Class D, or ASME B16.5 - Pipe Flanges and Flanged Fittings, 150 lb. class. For ozone and oxygen piping, use weld-neck flanges.
 - 2. 150 psig to 275 psig: Flanges shall conform to either AWWA C207 Class E or Class F, or ASME B16.5 150 lb. class.
 - 3. 275 psig to 500 psig: Flanges shall conform to ASME B16.5, 300 lb. class.
 - 4. Selection Based on Test Pressure
 - a. Do not expose AWWA flanges to test pressures greater than 125 percent of rated capacity.
 - b. For higher test pressures, the next higher rated AWWA flange or an ANSI-rated flange shall be selected.
- F. Blind Flanges
 - 1. Provide blind flanges in accordance with AWWA C207, or as indicated for miscellaneous small pipes.
 - 2. Blind flanges for pipe sizes 12-inches and greater shall be provided with lifting eyes in the form of welded or screwed eye bolts.
- G. Flange Coating
 - 1. Machined faces of metal blind flanges and pipe flanges shall be coated with a temporary rust-inhibitive coating to protect the metal until the installation is completed.
- H. Flange Fasteners
 - 1. Unless otherwise shown on the drawings, or indicated in the applicable Sections of Divisions 33, Bolts and nuts shall conform to the following requirements;
 - a. Threads shall be in accordance with ANSI/ASME B1.1, Class 2, UNC for bolt diameters 1" and smaller and UN8 for bolt diameters greater than 1".
 - b. Bolts shall have heavy hexagon heads and heavy hexagon nuts. Length of studs shall provide a projection of not less than 0.25 inch and no more than 0.5 inch through the nut when it is drawn tight.
 - c. Thread studs on flange connections are not permitted except where space restrictions preclude the use of standard bolts.
 - d. Through bolt holes shall be drilled in accordance with the applicable flange standard.

- e. All bolts fastening metallic flanges shall be provided with plain washers installed under the nut. Washer materials shall be of the same material as the bolt. If the through bolt holes are drilled larger than the applicable standard by 1/8 inch in diameter or more, bolts shall be also installed with a plain washer under the bolt head as well.
- f. All bolts fastening non-metallic flanges shall be provided with plain washers installed under both the bolt head and nut. Washer materials shall be of the same material as the bolt.
- g. Anti-seize compound shall be used on carbon steel fasteners, and shall be **Husk-ITT, Husky 2000; or approved equal.**
- h. Anti-galling compound used for stainless steel fasteners in LOX, nitrogen injection, oxygen, ozone process/off-gas/vent and ozone contactor maintenance air service shall be **Dupont "Krytox"; or approved equal.**
- i. Anti-galling compound used for stainless steel fasteners for all other services shall be certified for potable water use and shall be **Husk-ITT, Lube O'seal; Hercules, Real-Tuff; La Co, Slic-Tite; or approved equal.**

2. Fastener Material Group Numbering System

- a. Flange fasteners shall conform to the following material standards and shall be categorized within the Fastener Material Schedule Groups as indicated:
 - 1) Material Group C1 (Carbon steel) = ASTM A307 Grade B bolts, ASTM A563 Grade B nuts.
 - 2) Material Group C2 (Carbon steel) = ASTM A193 Grade B7 bolts, ASTM A194 Grade 2H nuts.
 - 3) Material Group S1 (316 SS) = ASTM A193, Grade B8M bolts, ASTM A194 Grade 8M nuts.
 - 4) Material Group S2 (304 SS) = ASTM A193, Grade B8 bolts, ASTM A194 Grade 8F nuts.
 - 5) Washers for carbon steel fasteners, if applicable, shall be provided with hardened steel conforming to ASTM F436.
 - 6) Washers for stainless steel fasteners, if applicable, shall conform to ASTM F844, material ASTM A167, Type 316 or ASTM A276, Type 316.

3. Fastener Material Group Numbers used in Non-Corrosive Service Applications

- a. Flanges per AWWA C207 steel flanges.
 - 1) Class B and D flanges – Material Group C1
 - 2) Class E and F flanges. – Material Group C2
- b. AWWA C115 Ductile Iron Flanges - Material Group C1
- c. ASME B31 group piping flanges – Material Group C2
- d. Non-metallic pipe flanges - Material Group S1

- e. Stainless steel pipe flanges and all others not listed above - Material Group S1
 - f. Where mating flanges are of different flange material standards and the specified Fastener Material Groups are in conflict, then fasteners of the higher grade shall be utilized unless otherwise indicated. For the purpose of this requirement, the Material Groups in order of decreasing grade shall be S1, S2, C2 and C1.
 - g. Where gaskets of Teflon or Viton-A are required, fasteners of Material Group C2 shall be utilized for all flange standards in lieu of those listed above.
4. Fastener Material Group Numbers used in Corrosive Service Applications
- 1) Corrosive service shall be as defined in accordance with Section 05 50 00 Miscellaneous Metalwork.
 - 2) All Flange fasteners shall be of Material Group S1 unless S2 is otherwise indicated.

I. Insulating Flanges

- 1. Insulated flanges shall be provided with bolt holes 1/4-inch diameter greater than the bolt diameter.

J. Insulating Flange Sets

- 1. Insulating flange sets shall be furnished on all piping connections where two dissimilar metals are to be connected in order to prevent corrosion. Each insulating flange set shall consist of an insulating gasket, insulating sleeves and washers, and a steel washer.
- 2. Insulating sleeves and washers shall be one piece when flange bolt diameter is 1-1/2 inch or smaller and shall be made of acetyl resin.
- 3. For bolt diameters larger than 1-1/2 inches, insulating sleeves and washers shall be 2-piece and shall be made of polyethylene or phenolic material.
- 4. Steel washers shall be in conformance with ASTM A 325 - Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
- 5. Insulating flange sets materials used for fluids other than general water and wastewater shall be made of materials compatible with the fluid services.
- 6. Insulating gaskets shall be full-face.

K. Insulating Flange Manufacturer, or Approved Equal

- 1. **JM Red Devil, Type E**
- 2. **Maloney Pipeline Products Co.**
- 3. **PSI Products, Inc. (Garlock Pipeline Technologies)**

L. Flange Gaskets

- 1. Gaskets for flanged joints used in general water and wastewater service shall be full-faced type, with material and thickness in accordance with AWWA C207, suitable for temperatures to 700 degrees F, a pH of one to 11, and pressures to 1000 psig.

2. Blind flanges shall be provided with gaskets covering the entire inside face of the blind flange and shall be cemented to the blind flange.
3. Ring gaskets will not be accepted unless otherwise indicated.
1. Flanged gaskets shall be **Toroseal** gaskets as manufactured by American Pipe or **Flange-Tyte** gaskets as manufactured by US pipe.
2. Gaskets for flanged joints used in water with chloramines shall be Teflon material, NSF 61 approved, **Garlock, Gylon Style 3505, John Crane, or approved equal.**
3. Gaskets for flanged joints used in water with ozone shall be Teflon material, NSF 61 approved, **Garlock, Gylon, Style 3504, John Crane, or approved equal.** Contractor shall furnish high strength bolts in accordance with ASTM A325 at all locations where flanges are provided for water with dissolved ozone residual.
4. Gaskets for flanges for PVC and CPVC piping used in general water and wastewater service shall be NSF 61 approved, full-faced, 1/8-inch thick, and made of fluoroelastomer having a durometer hardness of 50 to 70. Gaskets for pipe sizes up to 24-inch and 150 psi shall be **Garlock Style XP, John Crane, or approved equal.**
5. When the mating flange has a raised face, provide stainless steel flat ring gasket filler between the PVC flange and gasket and the adjacent flange.
6. Gaskets for flanged joints used in chemicals, hot air, ozone gas, solvents, hydrocarbons, steam, chlorine and other fluids shall be made of materials compatible with the service, pressure, and temperature. Consult gasket Manufacturer for recommended gasket material.

2.3 THREADED INSULATING CONNECTIONS

A. General

1. Threaded insulating bushings, unions, or couplings, as appropriate, shall be furnished for joining threaded pipes of dissimilar metals and for piping systems where corrosion control and cathodic protection are involved.

B. Materials

1. Threaded insulating connections shall be constructed of nylon, Teflon, polycarbonate, polyethylene, or other non-conductive materials, and shall have ratings and properties to suit the service and loading conditions.

2.4 MECHANICAL-TYPE COUPLINGS (GROOVED OR BANDED PIPE)

A. General

1. Provide cast mechanical-type couplings where indicated, conforming to the requirements of AWWA C606 - Grooved and Shouldered Joints.
2. Bolts and nuts shall conform to the requirements of Section 05 50 00 – Miscellaneous Metalwork.
3. Elastomers for seal materials shall be compatible with the piping service and fluid utilized, in accordance with the coupling manufacturer's recommendations. Where couplings are used in water containing dissolved ozone residual or chloramines, seal material shall be Viton-A.

4. Grooved or banded piping shall conform to the coupling manufacturer's recommendations to suit the highest expected pressure.
 - a. If grooved connections are used, the remaining thickness of pipe material after grooving shall be adequate to carry the load imparted to the joint. Joints for thin wall pipes shall be banded or welded
 - b. Method of connection for metallic pipes using rolled pipe ends shall not be acceptable.
 - c. Couplings for PVC pipe shall be furnished with radius cut or standard roll grooved pipe ends.
 5. In order to avoid excessive load on equipment caused by pipe movement due to steady state or transient pressure conditions, equipment connections with mechanical-type couplings shall be provided with rigid grooved couplings or flexible type coupling with harness in sizes where rigid type couplings are not available, unless thrust restraint is provided by other means.
 6. Mechanical type couplings shall be electrically bonded.
 7. The CONTRACTOR shall have the coupling manufacturer's service representative verify the correct choice and application of couplings and gaskets, and the workmanship, to assure a correct installation.
 8. In order to assure uniform and compatible piping components, grooved fittings, couplings, and valves shall be furnished by the same manufacturer as the coupling.
 9. Grooving tools shall be from the same manufacturer as the grooved components.
- B. Steel Pipe Couplings Manufacturer, or approved equal
1. **Victaulic Style 41 or 44** (banded, flexible)
 2. **Victaulic Style 177 / 77 / W77** (grooved, flexible or rigid)
 3. **Victaulic Style 107H / 07 / W07 or HP-70** (grooved, rigid)
- C. Ductile Iron Pipe Couplings Manufacturer, or approved equal
1. **Victaulic Style 31** (flexible or rigid grooving)
- Note: Ductile iron pipe couplings shall be provided with flush seal gaskets.
- D. PVC Pipe Couplings Manufacturer, or approved equal
1. **North American Specialty Products**
 2. **Victaulic Aquamine Products, Series 2900**

2.5 SLEEVE-SPLIT TYPE COUPLINGS

- A. General
1. Provide sleeve-split type couplings where indicated.
- B. Construction

1. Couplings shall be of the split-type, consisting of one- or 2-piece housing, gasket assembly, bolts and nuts, and end rings.
2. The double arch cross section that closes around the pipe ends shall be smooth in order to allow for expansion or contraction requirements.
3. The pipe ends with steel end rings affixed shall provide restraint requirements.
4. As the coupling closes, it shall confine the elastomeric gasket beneath the arches of the sleeve to create a radial seal.
5. The axial seal shall squeeze the closure plates as the bolts pull the coupling snug around the pipe.
6. Elastomers for seal materials shall be compatible with the piping service, in accordance with the coupling manufacturer's recommendations. Where couplings are used in water containing dissolved ozone residual or chloramines, seal material shall be Viton-A.
7. The coupling shall permit angular pipe deflection, flexibility, contraction and expansion, as designed by the manufacturer.
8. The coupling housing shall be designed for internal pressure and external loads as determined by the design procedures of AWWA M-11.
9. The coupling shell thickness of the steel coupling shall be calculated using the formula:

$$T = PwDy / 2Fs$$

Where:

T = steel coupling thickness, in.

Dy = pipe outside diameter, in.

Pw = Design working pressure, psi

Fs = 50 percent of minimum yield point of steel, psi

10. Coupling design calculations shall be stamped and signed by a registered engineer and shall be included in the Shop Drawing submittal for couplings.
11. The sealing members shall be comprised of 2 O-ring gaskets and an elastomer sealing pad bonded to sealing plate.
12. Internal pressure shall not be required to make the seal.

C. Materials

1. Unless otherwise indicated, the coupling housing material shall be the same material as the piping.
2. Couplings
 - a. Carbon steel couplings shall be fabricated from ASTM A 36.

- b. Stainless steel couplings shall be fabricated from ASTM A 240, Type - 304, 304L, 316, or 316L.
- 3. Restraint End Rings
 - a. Carbon steel end rings shall conform to ASTM A 108 Grade 1018.
 - b. Stainless steel end rings shall conform to ASTM A 276 Type - 316L.
- 4. Bolts and nuts shall be in conformance with the requirements of Section 05 50 00 – Miscellaneous Metalwork.
- 5. Carbon steel couplings shall be fusion bond epoxy-coated inside and outside of the coupling in accordance with the requirements of Section 09 96 00 – Protective Coating.
- 6. Wrapping
 - a. Couplings installed underground shall be provided with **Depend-O-Wrap tape or approved equal**.
 - b. The application of wrapping material shall be in conformance with AWWA C209.

D. Pipe Preparation

- 1. Ends of pipes shall be prepared for the flexible split sleeve type couplings inspected and approved by the coupling manufacturer.
- 2. The pipe outside diameter and roundness tolerances shall comply with tolerances listed in AWWA C219.
- 3. Plain ends for use with couplings shall be smooth and round for a distance of 12 inches from the end of the pipe.
- 4. End Rings
 - a. Provide end rings with couplings when restraint is required.
 - b. Carbon steel end rings shall be constructed of ASTM A 108 Grade 1018.
 - c. Stainless steel end rings shall conform to ASTM A 276 Type - 316L.
- 5. Where the split-type coupling is used to take up thermal expansion or contraction (**Depend-O-Lok F X E or approved equal**) at the pipe joint, one end ring shall be fixed to one end of the pipe in order to keep the coupling in the proper location.
- 6. Fully-Restrained Joints
 - a. Where the split-type coupling is used for a fully-restrained pipe joint (**Depend-O-Lok F X F or approved equal**) at the pipe joint, one end ring shall be welded to each of the pipe ends to fit beneath the coupling and shall be protected by the coating.
 - b. Welding design and specification shall be in conformance with the coupling manufacturer's recommendations.

E. Sleeve-Split Type Couplings Manufacturer, or approved Equal

1. **Victaulic**

2.6 SLEEVE-TYPE COUPLINGS

A. General

1. Provide sleeve-type couplings where indicated.
2. The CONTRACTOR will not be allowed to substitute any other type of coupling in lieu of sleeve coupling unless approved by the ENGINEER.

B. Construction

1. Sleeve couplings shall be in accordance with AWWA C219 - Standard for Bolted Sleeve-Type Couplings for Plain-End Pipe.
2. Couplings shall be constructed of steel with steel bolts, without pipe stop.
3. Couplings shall be of sizes to fit the indicated pipe and fittings.
4. The middle ring shall be not less than 1/4-inch thick or at least the same wall thickness as the pipe to which the coupling is connected.
5. If the strength of the middle ring material is less than the strength of the pipe material, the thickness of the middle ring shall be increased to have the same strength as the pipe.
6. The coupling shall be either 5 or 7 inches long for sizes up to and including 30-inch and 10 inches long for sizes greater than 30-inch, for standard steel couplings, and 16 inches long for long-sleeve couplings.
7. The followers shall be single-piece contoured mill sections welded and cold-expanded as required for the middle rings and of sufficient strength to accommodate the number of bolts necessary to obtain adequate gasket pressures without excessive rolling.
8. The shape of the follower shall be of such design as to provide positive confinement of the gasket.
9. Bolts and nuts shall be in accordance with the requirements of Section 05 50 00 – Miscellaneous Metalwork.
10. Buried sleeve-type couplings shall be epoxy-coated at the factory as indicated.

C. Pipe Preparation

1. Where indicated, prepare the ends of the pipe for flexible steel couplings.
2. Plain ends for use with couplings shall be smooth and round for a distance of 12 inches from the ends of the pipe, with an outside diameter not more than 1/64 inch smaller than the nominal outside diameter of the pipe.
3. The middle ring shall be tested by cold-expanding a minimum of one percent beyond the yield point, in order to proof-test the weld to the strength of the parent metal.
4. The weld of the middle ring shall be subjected to air test for porosity.

D. Seals

1. Seal elastomer materials for couplings shall be selected to be compatible with the fluid service, pressure and temperature. They shall be composed of elastomeric-compound material that will not deteriorate from age or exposure to air under normal storage or use conditions.
2. Where couplings are used in water containing ozone or chloramines, seal material shall be Viton-A.
3. Where couplings are used for fluids which are not compatible with rubber materials, the elastomeric seal material shall be compatible with the piping service and fluid utilized.

E. Piping Connection to Equipment

1. Where couplings are shown to connect piping to mechanical equipment such as pumps, compressors, and blowers, the piping shall be aligned with the equipment point of connection and shall be perpendicular to the axis of the flange or fitting for which the piping is to be connected.
2. The piping shall not impose excessive stress to the equipment connection to cause misalignment of the equipment.
3. The CONTRACTOR shall assign the responsibility to the equipment manufacturer to review the piping connection to the equipment and submit any modifications to the ENGINEER for review.

F. Insulating Sleeve Couplings

1. Where insulating couplings are required, both ends of the coupling shall be provided with a wedge-shaped gasket which assembles over a sleeve of an insulating compound material compatible with the fluid service in order to obtain insulation of coupling metal parts from the pipe.

G. Restrained Joints

1. Sleeve-type couplings on pressure lines shall be harnessed unless thrust restraint is provided by other means.
2. Harnesses shall be designed by the pipe manufacturer in accordance with AWWA Manual M11, or as indicated.
3. Harness sets shall be designed for the maximum test pressure of the pipe in which they are installed.
4. Where harness sets are installed near the suction and discharge of the pump, harness bolts shall have zero elongation in order to prevent misalignment of the pump imparted by the thrust within the piping system.

H. Sleeve-Type Couplings Manufacturer, or approved Equal

1. **Dresser, Style 38**
2. **Ford Meter Box Co., Inc., Style FC1 or FC3**
3. **Smith-Blair, Style 411**

2.7 FLEXIBLE SLEEVE TYPE COUPLINGS FOR DIFFERING PIPE MATERIALS/DIAMETERS IN BURIED APPLICATIONS

- A. Flexible sleeve type couplings to connect different pipe types shall be of corrosion resistant rubber or PVC with Type 316 stainless steel clamp bands; Flexible sleeve type couplings shall be as manufactured by **Fernco, Mission Rubber Company, Inc., Calder**, or approved equal. All couplings shall conform to ASTM 425 and installed per manufacturers requirements.

2.8 FLANGED COUPLING ADAPTERS AND DISMANTLING JOINTS

- A. Provide couplings where indicated.
- B. The CONTRACTOR will not be allowed to substitute any other type of coupling in lieu of the couplings as specified herein unless approved by the ENGINEER.
- C. The coupling shall be rated as indicated.
- D. Construction
 - 1. Coupling bodies shall be fabricated from steel, ASTM A 512 - Cold-Drawn butt-weld Carbon Steel Mechanical Tubing or A 513 - Electric-Resistance Welded Carbon and Alloy Steel Mechanical Tubing with steel bolts, without pipe stop.
 - 2. Provide flanges in conformance with AWWA C207.
 - 3. Couplings shall be of sizes to fit the indicated pipe and fittings.
 - 4. The body shall be not less than 1/4 inch thick or at least the same wall thickness as the pipe to which the coupling is connected.
 - 5. If the strength of the body material is less than the strength of the pipe material, the thickness of the middle ring shall be increased to have the same strength as the pipe.
 - 6. The follower flange shall be fabricated from steel, ASTM A 576 - Steel Bars, Carbon, Hot Wrought, Special Quality or AISI C1012.
 - 7. The shape of the follower shall be of such design as to provide positive confinement of the gasket.
 - 8. Bolts and nuts shall be in accordance with the requirements of Section 05 50 00 – Miscellaneous Metalwork.
 - 9. Buried couplings shall be epoxy-coated at the factory as indicated.
- E. Seals
 - 1. Seal elastomer materials for couplings shall be selected to be compatible with the fluid service, pressure and temperature. They shall be composed of elastomeric-compound material that will not deteriorate from age or exposure to air under normal storage or use conditions.
 - 2. Where couplings are used in water containing ozone or chloramines, seal material shall be Viton-A.

3. Where couplings are used for fluids which are not compatible with rubber materials, the elastomeric seal material shall be compatible with the piping service and fluid utilized.

F. Piping Connections to Equipment

1. Where couplings are shown to connect piping to mechanical equipment such as pumps, compressors, and blowers, the piping shall be aligned with the equipment point of connection and shall be perpendicular to the axis of the flange or fitting for which the piping is to be connected.
2. The piping shall not impose excessive stress to the equipment connection to cause misalignment of the equipment.
3. The CONTRACTOR shall assign the responsibility to the equipment manufacturer to review the piping connection to the equipment and submit any modifications to the ENGINEER for review.

G. Restrained Joints on flanged coupling adapters

1. Flanged coupling adapters on pressure lines shall be harnessed unless thrust restraint is provided by other means.
2. Harnesses shall be designed by the pipe manufacturer in accordance with AWWA Manual M11, or as indicated.
3. Harness sets shall be designed for the maximum test pressure of the pipe in which they are installed.
4. Where harness sets are installed near the suction and discharge of the pump, harness bolts shall have zero elongation in order to prevent misalignment of the pump imparted by the thrust within the piping system.
5. Other means of restraining the coupling such as set screws will not be accepted.

H. Flanged Couplings Adapter Manufacturer, or approved equal

1. **Smith-Blair, Model 913**
2. **Dresser, Model 128-W**
3. **JCM, Model 303**

I. Dismantling Joints Manufacturer, or approved equal

1. **Smith-Blair, Model 975**
2. **Dresser, Model 131**
3. **JCM, Model 309**

2.9 FLEXIBLE CONNECTORS

A. Low-Temperature

1. Flexible connectors shall be installed in piping connections to engines, blowers, compressors, and other vibrating equipment, and where indicated.

2. Flexible connectors for service temperatures up to 180 degrees F shall be flanged-reinforced neoprene or butyl spools, rated for a working pressure of 40 to 150 psig, or reinforced flanged duck and rubber, as best suited for the application.
3. Flexible connectors for service temperatures above 180 degrees F shall be flanged, braided stainless steel spools with inner, annular, corrugated stainless steel hose, rated for a minimum 150-psig working pressure, unless otherwise indicated.
4. The connectors shall be a minimum of 9 inches long and provided with face-to-face flanges, unless otherwise indicated.
5. The final material selection shall be approved by the manufacturer.
6. The CONTRACTOR shall submit manufacturer's Shop Drawings and calculations.

B. High-Temperature

1. Install flexible connectors in engine exhaust piping and where indicated.
2. Connectors shall be sufficient to compensate for thermal expansion and contraction and to isolate vibration between the engine and the exhaust piping system.
3. Connectors shall be stainless steel bellows-type, flanged, and rated for minimum 150 psig, 2000 degrees F.

C. Flexible Connections for Chemical Tanks

1. Flexible connectors for chemical tanks shall be constructed of molded PTFE with at least two convolutions and flanged joints. Flanges shall be ductile iron with Type 316 stainless steel bolts and nuts.
2. Flexible connector shall be **Proco Series 442 molded expansion joint, or approved equal.**

2.10 EXPANSION JOINTS

- A. Piping subject to expansion and contraction shall be provided with sufficient means to compensate for such movement without exertion of undue forces to equipment or structures, accomplished with expansion loops, bellow-type expansion joints, or sliding-type expansion joints.
- B. Expansion joints shall be provided with flanged ends and constructed of stainless steel, Monel, rubber, or other materials best suited for each individual service. Where expansion joints are used in water containing dissolved ozone residual or chloramines, provide Type 316 stainless steel material expansion joints.
- C. Where bellows-type expansion joints are mounted near the suction nozzle of the pump, stainless steel internal liner shall be provided to minimize turbulence as the flow passes through the arches of the bellows.
- D. CONTRACTOR shall submit detailed calculations and manufacturer's Shop Drawings of proposed expansion joints, piping layouts, and anchors and guides, including information on materials, temperature, and pressure ratings.

2.11 PIPE THREADS

- A. Pipe threads shall be in conformance with ASME B1.20.1 - Pipe Threads, General Purpose (inch), and be made up with Teflon tape unless otherwise indicated.

2.12 PIPE INSULATION

- A. Hot and cold liquid piping, flues, and engine exhaust piping shall be insulated as indicated and in accordance with the requirements of Section 43 10 70 – Pipe, Ductwork, and Equipment Insulation.
- B. No unprotected hot piping shall be within reach of operating personnel or other persons.
- C. Pre-insulated pipe for underground service shall be in accordance with the requirements of Section 43 10 68 – Pre-Insulated Pipe.

2.13 MODULAR MECHANICAL SEALS FOR PIPING PENETRATIONS

- A. Where indicated and where required in order to prevent flow of water or air, the passages of piping through wall sleeves and cored openings shall be sealed with modular interlocking link mechanical closures.
- B. Individual links shall be constructed of EPDM rubber, be suitable for temperatures between minus 40 and plus 250 degrees F, and be shaped to fill the annular space between the outside of the pipe and the inside of the wall sleeve or cored opening.
- C. Assemble the links using Type 316 stainless steel bolts and nuts to form a continuous rubber belt around the pipe.
- D. Pressure plates under each bolt and nut shall be fabricated of a corrosion-resistant composite material.
- E. After the seal assembly is positioned in the sleeve, tighten the bolts against the pressure plates to expand the rubber links and form the watertight seal.
- F. Sizing and installation of sleeves and assemblies shall be in accordance with the manufacturer's recommendations.
- G. Modular Mechanical Seals Manufacturer, or approved equal

- 1. **Thunderline Corporation, Link-Seal**

- 2. **Proco, Pen-Seal**

2.14 SAMPLE POINTS (WATER TRANSMISSION MAINS)

- A. Install sample taps required to take all necessary water samples at points designated on the Contract Drawings.
- B. Provide 3/4" type "K" copper tubing or schedule 40 PVC for all in-line sample points.
- C. The CONTRACTOR will make arrangements for a certified laboratory to take all water samples required for bacteriological tests.
- D. Water main being tested must remain under line pressure throughout the test and until such time as regulatory agency approval to place the main in service has been received by the OWNER.

- E. Following the receipt of regulatory agency approval, the CONTRACTOR will remove all sample point tubing and install a brass plug on all sample point corporation stops.

2.15 AIR AND GAS TRAPS

- A. Air and gas pipes shall slope to low points and shall be provided with drip legs, shut-off valves, strainers, and traps.
- B. Pipe the traps to the nearest drain.
- C. Air and gas traps shall be not less than 150-lb iron body float-type, with a copper or stainless steel float.
- D. Bracket, lever, and pins shall be constructed of stainless steel.
- E. Drain traps shall be provided with threaded connections.
- F. Air and Gas Traps Manufacturer, or approved equal
 - 1. **Armstrong International, Inc.**
 - 2. **Spirax Sarco, Inc.**

2.16 GLASS LINING

- A. General
 - 1. Ductile iron or steel pipe and fittings shall be glass-lined where indicated.
 - 2. The glass lining shall be suitable for handling sewage, primary sludge, digested sludge, and scum.
 - 3. The lining shall be smooth, continuous, and suitable for prevention of grease and foam build-up.
 - 4. The glass lining shall be capable of withstanding thermal shock of 350 degrees F (from 430 degrees F to 80 degrees F) without crazing, blistering, or spalling.
- B. The glass lining shall consist of a vitreous material to meet or exceed the following criteria:
 - 1. unaffected by scraping with a sharp knife, simulating the effects of rodding;
 - 2. unaffected by the continuous application of live steam from a steam generator, immediately followed by a cold water quench;
 - 3. unaffected by an 8-percent sulfuric acid solution at 148 degrees F for a 10-minute period;
 - 4. a minimum thickness of 10 mils by micro test;
 - 5. spark-tested to be free of pinholes;
 - 6. a hardness of 5 to 6 Mohs; and,
 - 7. a density of 2.5 to 3.0 g/cu cm, measured by ASTM D 792 - Test Method for Specific Gravity (Relative Density) and Density of Plastics by Displacement.

C. Application

1. Cast or ductile iron pipes and fittings shall be bored or machined smooth in order to remove voids or protrusions.
2. Steel pipe shall be seamless pipe, with internal fitting welds ground smooth, slag holes ground out, re-welded, and ground smooth.
3. Interior surfaces shall be grit-blasted to white metal, and lining shall be fused onto chemically clean metal at above 1400 degrees F.
4. Welded flanges shall be factory-installed before lining.
5. Screwed flanges or cast and ductile iron pipes shall be installed after lining.
6. Pieces shall be sealed and tested prior to shipment.
7. Finish shall be subject to the ENGINEER'S approval.

D. Manufacturer, or approved equal

1. **The Pfaudler Co, Inc.**
2. **A.O. Smith Corp.**
3. **Waterworks, Mfg. Co.**

PART 3 -- EXECUTION

3.1 GENERAL

- A. Install piping, fittings, and appurtenances in accordance with the requirements of applicable Sections of Divisions 33.
- B. Proprietary manufactured couplings shall be installed in accordance with the coupling manufacturer's recommendation.
- C. Care shall be taken to insure that piping flanges, mechanical-type couplings, sleeve-type couplings, flexible connectors, and expansion joints are properly installed as follows:
 1. Gasket surfaces shall be carefully cleaned and inspected prior to making up the connection.
 2. Each gasket shall be centered properly on the contact surfaces.
 3. Connections shall be installed to prevent inducing stress to the piping system or the equipment to which the piping is connected.
 4. Contact surfaces for flanges, couplings, and piping ends shall be aligned parallel, concentric, and square to each axis at the piping connections.
 5. Flange Bolts
 - a. Flange bolts shall be initially hand-tightened with the piping connections properly aligned.

- b. Bolts shall be tightened with a torque wrench in a staggered sequence to the recommended torque for the bolt material per AWWA M-11.
- 6. Harness, Thrust Restraint, and Tie Rod Bolts
 - a. Harness, thrust restraint, and tie rod bolts used for sleeve couplings, flange coupling adapters, or flexible joints shall be tightened gradually and equally at diametrically opposite sides until snug, in order to prevent misalignment and to insure that all studs carry equal loads.
 - b. In order to prevent induced stress or misalignment, do not over-torque connections to adjoining pump or equipment.
- 7. Groove ends shall be clean and free from indentations, projections, and roll marks in the area from the pipe end to the groove.
- 8. After installation, joints shall meet the indicated leakage rate.
- 9. Flanges shall not be deformed nor cracked.

D. Lined Piping Systems

- 1. The lining manufacturer shall take full responsibility for the complete, final product and its application.
- 2. Pipe ends and joints of lined pipes at screwed flanges shall be epoxy-coated in order to assure continuous protection.

E. Core Drilling

- 1. Where core drilling is required for pipes passing through existing concrete, core drilling locations shall be determined by radiograph of concrete construction in order to avoid damage to embedded raceways and reinforcing bars.

F. Cleanup

- 1. After completion of the WORK, cuttings, joining and wrapping materials, and other scattered debris shall be removed from the Site.
- 2. The entire piping system shall be handed over in a clean and functional condition.

3.2 SERVICES OF MANUFACTURER

- A. Where the assistance of a manufacturer's service representative is advisable, in order to obtain perfect pipe joints, supports, or special connections, the CONTRACTOR shall furnish such assistance at no additional cost to the OWNER.

- END OF SECTION -

SECTION 33 05 02 – PIPING IDENTIFICATION

PART 1 -- GENERAL

1.1 THE REQUIREMENT

- A. The CONTRACTOR shall provide identification for exposed piping and valves, complete and in place, in accordance with the Contract Documents.
- B. The requirements of Section 01 33 00 –Submittal Procedures apply to this Section.
- C. The requirements of Section 09 96 00 – Protective Coatings apply to this Section.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. Commercial Standards

ANSI A13.1 Scheme for the Identification of Piping Systems

Ten States Standards Recommended Standards for Water Works

1.3 CONTRACTOR SUBMITTALS

- A. Furnish submittals in accordance with Section 01 33 00 - Submittal Procedures.
- B. The CONTRACTOR shall submit to ENGINEER, for approval, a list of suggested wording for all valve tags prior to fabrication.
- C. Samples
 - 1. One sample of each type of identification device to be used in work.

PART 2 -- PRODUCTS

2.1 IDENTIFICATION OF PIPING

- A. Except as indicated below for very short pipe lengths, identify exposed piping larger than 2-inches nominal size for the pipe contents and direction of flow.
 - 1. Marker Type
 - a. Snap Around: Vinyl or polyester sheet with UV- resistant ink, preshaped and sized to tightly curl around the pipe and remain in position.
 - b. Adhesive: Vinyl or polyester sheet with UV- resistant ink, shaped similar to pipe curvature and coated with pressure sensitive adhesive.
 - c. Stencil: Lettering painted directly on surface of pipe inside color coded marker area.
 - 2. Marker Area: Sized per pipe size according to ANSI A13.1; color from the table below.
 - 3. Lettering: Sized per pipe size according to ANSI A13.1; color from the table below.
 - 4. Arrows: at least 2 arrows at each marker area, showing direction of flow.

- B. Pipe 2-inches and smaller shall be identified by plastic plates made from laminated 3 layer plastic with engraved black letters on white background.
- C. Identification of all exposed pipe shall be accomplished by color-coding with bands and by lettering as specified in Part 3 of this Section, and in Section 09 96 00 – Protective Coating.
- D. Pipe identification shall be as manufactured by **Brady, Seton**, or approved equal.

2.2 EXISTING IDENTIFICATION SYSTEMS

- A. In installations where existing piping identification systems have been established, the CONTRACTOR shall follow the existing system. Where existing identification systems are incomplete, utilize the existing system as far as practical and supplement with the indicated system. The objective is to fully identify all new piping, valves, and appurtenances to the level specified herein.

2.3 IDENTIFICATION OF VALVES AND SHORT PIPE LENGTHS

- A. Identifying devices for valves and the sections of pipe that are too short to be identified with markers and arrows shall be identified with metal or plastic tags.
- B. Metal tags shall be stainless steel with embossed lettering. Plastic tags shall be solid black plastic laminate with white embossed letters. Tags shall be designed to be firmly attached to the valves or short pipes or to the structure immediately adjacent to such valves or short pipes.
- C. Wording on the valve tags shall describe the exact function of each valve, e.g., "POTABLE WATER," "RAW WATER", etc.

PART 3 -- EXECUTION

3.1 GENERAL

- A. Markers and identification tags shall be installed in accordance with the manufacturer's printed instructions, and shall be neat and uniform in appearance. Tags and markers shall be readily visible from all normal working locations.

3.2 VALVE TAGS

- A. Valve tags shall be permanently attached to the valve or structure by means of 2 stainless steel bolts or screws.

3.3 MARKER LOCATIONS AND PIPE IDENTIFICATION

- A. Each pipe shall be marked at:
 - 1. Intervals of 20-feet in straight runs.
 - 2. At least once in every room.
 - 3. Within 2-feet of turns, elbows, and valves.
 - 4. On the upstream side of tees, branches, and other distribution points.
 - 5. On both sides of walls and floors through which the piping passes.

6. Sections of pipe that are too short to be identified with color bands, lettered labels, and directional arrows shall be tagged and identified similar to valves.

B. Pipe identification shall consists of four elements (i.e., two color bands, a lettered label, and a directional label). The bands shall be arranged so that the lettered label and the directional arrow is places between the two bands.

3.4 IDENTIFICATION COLORS

A. Conform to the following color codes.

Color Schedule				
Pipe Contents		Pipe Color	Marker Color	Letter Color
Abbreviation	Identification			
REW	Reclaimed water		Pantone Purple (522C)	white
RW	Raw water		green	white
SS	Sanitary sewer		yellow	black
UW	Utility water (non-potable water)		yellow	black

- END OF SECTION -

Part 1 GENERAL

1.01 THE SUMMARY

- A. Furnish all labor, materials, equipment and incidentals required to complete and make ready for operation wet taps and line stops for DIP/CIP/PVC pipe and associated valve installations as specified herein.
- B. Only the materials listed in Palm Beach County Water Utilities Department Engineering Services Division - Approved Materials and Equipment List (Latest Version) are approved for use within the PBCWUD service area, or as specified herein.
- C. The equipment shall include, but is not limited to, the following:
 - 1. Butterfly Valves
 - 2. Valve Operator Accessories
 - 3. Tapping Sleeves and Valves
 - 4. Valve Boxes
 - 5. Line Stops

1.02 CONTRACTOR SUBMITTALS

- A. Submit to the Engineer within seven (7) days prior to mobilization a list of materials to be furnished, the names of the suppliers and the date of delivery of materials to the site, except for emergency work.
- B. Complete shop drawings of all valves and appurtenances shall be submitted to the Engineer for approval in accordance with Section 01 33 00 of these Specifications. Clearly indicate make, model, location, type, size and pressure rating.

1.03 Quality Assurance

The manufacturer shall provide written certification to the Engineer that all equipment furnished complies with all applicable requirements of these Specifications.

Part 2 PRODUCTS

2.01 GENERAL

- A. Provide valves of same manufacturer throughout where possible.
- B. Provide valves with manufacturer's name and pressure rating clearly marked on the outside of the valve body.
- C. All exposed bolts, nuts, and washers for buried or submerged valves shall be stainless steel. All exposed nuts, bolts, springs, washers, and miscellaneous hardware shall be zinc plated in accordance with ASTM B 633, Type II unless specified otherwise.

2.02 Shop Painting

- A. All exterior ferrous metal surfaces of exposed or submerged valves and appurtenances shall receive a coating of rust-inhibitive primer compatible with the finish paint specified in Section 09 96 01 of these Specifications. The exterior of all buried valves shall have a factory applied, two coat coal tar epoxy coating system. The coal tar epoxy shall be Tnemec Tneme-Tar 46-413, Indurall Ruffstuff 2100 Coal Tar Epoxy or KopCoat Bitumastic No. 300-M. Each coating shall have a dry film thickness of 8-10 mils.
- B. All interior ferrous metal surfaces of valves, except for finished or bearing surfaces, and appurtenances shall be provided with two coat, interior epoxy coating conforming to the requirements of AWWA C550 and NSF 61. The coating shall be equal to Tnemec Series 20 Pota Pox, Valspar Series 78 Hi-Build Epoxy, or KopCoat Hi-Gard Epoxy. The coating system shall have a dry film thickness of 4 - 6 mils.

2.02 Butterfly Valves

- A. Butterfly valves shall be resilient seated, short body design, and shall be designed, manufactured, and tested in accordance with all requirements of AWWA C504, and as modified below. Valves shall be designed for a rated working pressure of 250 psi. Class B, AWWA C504 Section 5.2 testing requirements are modified as follows:
 - 1. the leakage test shall be performed at a pressure of 150 psi;
 - 2. the hydrostatic test shall be performed at a pressure of 250 psi; and
 - 3. proof of design tests shall be performed and certification of such proof of design test shall be provided to the Engineer.
- B. Valve bodies shall be ductile iron conforming to ASTM A 536, Grade 65-45-12 or ASTM A 126, Grade B cast iron. Shafts and shaft hardware shall be ASTM A 564, Type 630 stainless steel, machined and polished. Valve discs shall be ductile iron, ASTM A 536, Grade 65-45-12. The resilient valve seat shall be located either on the valve disc or in the valve body and shall be fully field adjustable and field replaceable.
- C. Valves shall be installed with the valve shafts horizontal. Valves and actuators shall have seals on all shafts and gaskets on valve actuator covers to prevent the entry of water. Actuator mounting brackets shall be totally enclosed and shall have gasket

seals.

D. Actuators

1. Valves shall be equipped with traveling nut, self-locking type actuators designed, manufactured and tested in accordance with AWWA C504. Actuators shall be capable of holding the disc in any position between full open and full closed without any movement or fluttering of the disc.
2. Actuators shall be furnished with fully adjustable mechanical stop-limiting devices. Actuators that utilize the sides of the actuator housing to limit disc travel are unacceptable.
3. Valve actuators shall be capable of withstanding a minimum of 450 foot pounds of input torque in either the open or closed position without damage.

E. Operators: Valves for buried service shall have a 2-inch square operating nut and shall be equipped with a valve box and stem extension, as required. Valves shall open left and have vee ring stem seals.

F. Valve ends shall be mechanical joint type, except where flanged or restrained joint ends are shown. Flange joints shall meet the requirements of ANSI B16.1, Class 125.

G. Butterfly valves shall be from approved material list.

2.03 GATE VALVES

- A. Valves shall be double-disc type conforming to the requirements of AWWA C500. Valves shall be designed for horizontal installation with tracks and rollers, bypass valves, and bevel gear type operator. Valves shall be rated for 250 psi working pressure.
- B. Valve ends shall be mechanical joint type except where flanged or restrained joint ends are shown. Flanged joints shall meet the requirements of ANSI B16.1, Class 125.
- C. Buried valves shall be equipped with valve boxes unless access to the operator is provided by a manhole.
- D. Manually operated valves, including geared valves, shall be non-rising stem type having O-ring seals.
- F. Valves shall have 2-inch square operating nuts, be non-rising stem type and shall open left.

2.04 TAPPING SLEEVES AND VALVES

Tapping sleeves shall be cast or ductile iron of the split-sleeve, mechanical joint type. The Contractor shall be responsible for determining the outside diameter of the pipe to be connected to prior to ordering the sleeve. Valves shall be gate valves furnished in

accordance with the specifications shown above, with flanged connection to the tapping sleeve and mechanical joint connection to the branch pipe. The tapping sleeve and valve shall be supplied by the valve manufacturer. Tapping sleeves shall be from approved material list.

2.05 VALVE BOXES (VB) AND EXTENSION STEMS

- A. All valves shall be equipped with valve boxes. The valve boxes shall be cast iron two-piece screw type with drop covers. Valve boxes shall have a 5.25-inch inside diameter. Valve box covers shall weigh a minimum of 13 pounds. The valve boxes shall be adjustable to 6-inches up or down from the nominal required cover over the pipe. Valve boxes shall be of sufficient length that bottom flange of the lower belled portion of the box is below the valve operating nut. Ductile or cast iron extensions shall be provided as necessary. Covers shall have "WATER VALVE" or "WATER" cast into them. Valve boxes shall be manufactured in the United States. A cast-in-place concrete collar shall be provided around the valve box.
- B. All valves shall be furnished with extension stems, as necessary, to bring the operating nut to within 30-inches of the top of the valve box. Connection to the valve shall be with a wrench nut coupling and a set screw to secure the coupling to the valve's operating nut. The coupling and square wrench nut shall be welded to the extension stem. Extension stems shall be equal to Mueller A-26441 or M & H Valve Style 3801.

2.06 LINE STOPS

- A. Line stops shall be manufactured by JCM or approved equal. Line stops shall be temporary. ¹The 30-inch line stop shall provide a minimum 16-inch bypass. The 8-inch line stop shall provide no bypass.
- B. Description: The Line Stopping procedure is a means of temporarily plugging a pressurized pipe without disrupting pressure or service upstream of the Line Stop. A Pressure tap is first made into the main, allowing insertion of the Line Stop plugging device into the main under pressure.
- C. Line Stop Fittings and Accessories: Fitting shall be full encirclement type, split tee. It shall consist of two halves: (1) an upper line stop flange saddle half. The interior of the saddle plate adjacent to and concentric with the O.D. of the nozzle shall be grooved to retain a gasket which shall seal the saddle plate to the exterior of the main. This gasket shall constitute the only seal between the main and the fitting. (2) A lower bottom solid half with bolting arrangement for fastening to upper half.
 - 1. Line Stop Flange: The outlet of each fitting shall be machined from a 150 lb forged steel flange (ASTM A181 or A105) or from pressure vessel quality steel plate (ASTM A285, Grade C); flat faced and drilled per ANSO B16.5. Suitable independently operated locking devices shall be provided in the periphery of the flange to secure the completion plug.
 - 2. Line Stop Nozzle: The nozzle, which lies between the saddle and the flange shall be fabricated from steel pipe (ASTM A234). After welding and stress relief,

the nozzle shall be accurately machine bored to receive and lock a suitable completion plug.

3. Completion Plug: The completion plug shall be machined from a stress relieved carbon steel weldment. It shall contain two (2) circumferential grooves: one to receive the locking devices from the Line Stop flange, and the second to contain a compressible "O" ring to seal pressure tight against the bore of the flange.
4. Blind Flange: Each Line Stop fitting shall be closed with a blind flange that is compatible with the line stop flange.
5. Saddle Alignment Marking: Each saddle half shall be matched and marked with serial numbers, to insure proper alignment in the field.
6. The Manufacture will exercise extreme care to insure that weldments are of adequate strength, properly shaped, securely reinforced, and free from distortion that could stress the ductile iron main during installation, pressure tapping, or Line Stopping operations. All steel shall meet the requirements of ASTM A36, as a minimum. All weldments shall be braced and stress relieved.
7. Gaskets: Shall be molded from elastomer compounds that resist compression setting and are compatible with water in the 32 to 140 degree Fahrenheit temperature range.
8. Upper Line Stop Flange Saddle: Shall consist of saddle plate, a Line Stop flange, and a Line Stop nozzle.
 - a. Saddle plate shall be of a minimum of 0.375-inches in thickness. It shall be shaped to be concentric to the outside of the ductile iron main.
 - b. A Line Stop nozzle for the 0.375-inches minimum wall thickness shall be securely welded to the saddle plate.
 - c. The Line Stop flange shall be securely welded to the nozzle. After welding, the assembly shall be braced, stress relieved, and bored to receive the completion plug.
 - d. Bolt, nut, and washer assemblies shall be furnished to draw the upper and lower saddles together for sealing. Bolting brackets shall be gusseted.
9. Lower Saddle Plate: Saddle plate shall be of a minimum 0.375" thickness and shall be shaped to be concentric to the outside of the ductile main. Gusseted bolting brackets shall match upper half.
10. Coating: After fitting has been stress relieved and machined, the exterior and unmachined interior surfaces shall be sandblasted and coated with coal tar epoxy to a final minimum cured thickness of 0.020".
11. Drilling Equipment shall be in good condition and equipped with power drive to insure smooth cutting and to minimize shock and vibration. Cutting equipment

shall be carbide tipped and capable of being replaced without removal from the jobsite.

12. Hydra Stop Machinery: The line stop equipment shall consist of a full size, solid plugging head attached to a carrier body. The body is advanced and retracted from the main by means of a linear actuator. When retracted, the plugging head and carrier are housed in an adapter, bolted pressure tight between the tapping valve and the actuator.
 - a. Plugging Head: The plugging head shall be full size and articulated with a carrier body. When completely seated the head shall lie in a perpendicular plan to the bore of the main.
 - b. Sealing Element: The element shall be monolithically molded from a suitable polyurethane compound or other acceptable method as determined by the Owner. The element shall be flat in a plane perpendicular to the flow in the main and shaped so that upstream water pressure shall increase contact between the periphery of the seal and the interior of the main.
 - c. Deposits in Bore of Main: The plugging head shall be designed to break and dislodge tuberculation and other deposits in the bore of the main which might interfere with a satisfactory Line Stop

Part 3 EXECUTION

3.01 INSTALLATION

- A. All valves and appurtenances shall be installed in the locations shown on the Drawings, true to alignment and properly supported. Any damage to the above items shall be repaired to the satisfaction of the Engineer before they are installed.
- B. Buried flanged or mechanical joints shall be made with cadmium plated bolts. All exposed bolts shall be made with cadmium plated bolts. All exposed bolts and nuts shall be heavily coated with two coats of bituminous paint.
- C. Prior to assembly of split couplings, the grooves as well as other parts shall be thoroughly cleaned. 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, the gasket shall be centered properly over the pipe ends with the lips against the pipes. The housing sections shall then be placed. After the bolts have been inserted, the nuts shall be tightened until the housing sections are firmly in contact without excessive bolt tension.

3.02 FIELD PAINTING

All metal valves and appurtenances specified herein and exposed to view shall be

surface prepared and painted as part of the work in Section 09 96 01 of these Specifications.

3.03 INSPECTION AND TESTING

Following installation, operating tests will be performed to demonstrate to the Engineer that all equipment and accessories will function in a satisfactory manner. The Contractor shall make, at Contractor's own expense, all necessary changes, modifications and/or adjustments required to ensure satisfactory operation.

3.04 LINE STOP INSTALLATION

- A. The existing mains, upstream and downstream of the Line Stops, cannot be shut down or taken out of service (not including the sections between the line stops). To insure that the entire operation shall be accomplished without interruption of service or flow, or the reduction of pressure, the installation shall be accomplished by Contractor personnel skilled and experienced in the procedures specific to Line Stops of this size.
- B. Drain Nozzles: At Owner's direction, Contractor shall provide drain pressure taps between Line Stops. These pressure connections will allow quick determination of shutdown adequacy.
 - 1. In order to remove a Line Stop plugging head, equalization will be required.
 - 2. Contractor shall have the option of recovering the drain valves by using Line Stop-type tapping nozzles with completion plugs, or abandoning the valves by leaving them attached to the nozzles. In either case, the outlet of each nozzle or valve shall be sealed with a blind flange, mechanical joint plug, or a screwed pipe cap.
- C. Extent of shutdowns: Shutdowns will be accomplished by using Line Stops. Because of possible internal corrosion and deposits in mains, "bottle tight" shutdowns may not occur. A satisfactory shutdown is one which allows the work to be accomplished using drainage pumps to dewater excavations.
- D. Preliminary Field inspection of mains:
 - 1. It is necessary to know the exact main O.D., ovality, and bore diameter before Line Stop fittings and plugging head sealing elements can be manufactured.
 - 2. Prior to ordering material, Contractor shall excavate at each proposed locations, and caliper the header O.D. along at least four (4) diameters to determine ovality.
 - 3. Contractor shall determine main wall thickness, uniformity, and structural integrity by means of ultrasonic testing. Data shall be taken to determine extent of internal deposits, tuberculation, etc.

- a. If Owner determines that the Contractor's data are not adequate, the Owner may direct the Contractor to make one or more pressure taps on the main to obtain test pipe coupons for the Owner's evaluation.
 - b. Minimum size of test coupon shall be determined by WUD Engineer.
- 4. If in the Owner's opinion, the proposed location is unsatisfactory; he will direct excavation at another site. Excavating, dewatering, inspections, backfill, and restoration will be separate pay items.
- E. Installation of Line Stop fittings: Contractor shall power wire brush and grind the exterior of the main to remove any debris, corrosion deposits, or other surface irregularities that might interfere with proper seating and sealing of each Line Stop fitting against each main. Any structural defects in the main, service connections, appurtenances, adjacent utilities, etc., that could interfere with the Line Stop installation shall be immediately reported to Owner.
 - 1. Inspection: Contractor shall fit upper and lower saddle plate assemblies to the main, thoroughly checking for proper fit to the main.
 - 2. Assembly to Main: Under no circumstances shall the Contractor attempt to force, reshape, or bend saddle plates by excessive tightening of saddle studs while Line Stop fitting is assembled around the main.
 - a. Any retrofitting shall be accomplished with the fitting removed from the main.
 - b. Any damage to fitting, accessories, or main shall be repaired at the Contractor's expense to the satisfaction of Owner.
- F. Completion: Final closure shall be accomplished by insertion of a completion plug.
 - 1. The test of the completion plug sealing shall be accomplished through bleed-off in the machine housing.
 - 2. The temporary valve shall be removed and the installation of the blind flange shall be complete.
 - 3. The Contractor shall coat the entire assembly with a coal tar epoxy to a final minimum cured thickness of 0.02-inches.

END OF SECTION

SECTION 33 26 40 - VALVES AND APPURTENANCES

PART 1 - GENERAL

1.1 WORK INCLUDED

- | | |
|--|----------------------------|
| A. Gate Valves. | S. Valve Connections. |
| B. Knife Gate Valves. | T. Valve Operators. |
| C. Plug Valves. | U. Automatic Pinch Valves. |
| D. Corporation and Curb Stops. | V. Drain Valves. |
| E. Sampling Cocks and Hose Bibs. | W. Strainers. |
| F. Globe or Angle Valves. | X. Backflow Preventers. |
| G. Air Release Valves. | Y. Ball Valves. |
| H. Air-Vacuum Valves. | Z. Solenoid Valves. |
| I. Tapping Sleeves and Valves. | AA. Shear Gate Valves. |
| J. Tapping Saddles. | BB. Flap Valves. |
| K. Dresser Type Couplings. | CC. Surge Relief Valves. |
| L. Valve Boxes. | DD. Extension Stems. |
| M. Check Valves. | EE. Gauge Cocks. |
| N. Butterfly Valves. | FF. Needle Valves. |
| O. Air and Vacuum Valves. | GG. Diaphragm Valves. |
| P. Guage Cocks. | HH. Floor Stands. |
| Q. Back Pressure Sustaining Valves. | |
| R. Pressure Reducing Regulator Valves. | |

1.2 RELATED WORK

- A. Section 02610: Pipe and Fittings.

1.3 REFERENCES

- A. AWWA - American Water Works Association.
- B. ASTM - American Society for Testing and Materials.

C. FS - Federal Specification.

1.4 CONTRACTOR SUBMITTALS

- A. Submit copies of valve ordering schedule for approval before ordering valves.
- B. Submit detailed Shop Drawings in accordance with Section 01 33 00. Clearly indicate the make, model, location, type, size and pressure rating.
- C. Certified copies of reports covering proof of design testing.
- D. Submit manufacturer supplied operation and maintenance instructions for each type of valve larger than 4" in diameter.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Provide valves and operators of same manufacturer throughout, where possible.
- B. Provide valves with manufacturer's name and pressure rating clearly marked on the outside of the body.
- C. Acceptable Manufacturer's as noted herein. Substitutions in accordance with Section 01630.

2.2 VALVE CONNECTIONS

- A. Provide valves suitable to connect to adjoining piping as specified for pipe joints. Use pipe size valves.
- B. Thread pipe sizes 2-1/2 inches and smaller.
- C. Flange and/or mechanical joint ends for pipe sizes three inches (3") and larger.

2.3 GATE VALVES

- A. Gate valves three inches (3") and larger in size shall be of the non-rising stem type and shall conform to AWWA C500, latest revision, and Federal Specification WW-V-58B for Class I, Type I, with handwheel or wrench nut, extension stems and other appurtenances as required. Valves shall be rated for 150 psi working pressure.
 - 1. Shall open counter-clockwise.
 - 2. Shall be iron body, fully bronze mounted, double disk, parallel seat; non-rising stem valves with O-ring seals and with end connections as called for in the Contract Drawings.

3. Shall be as manufactured by Mueller, American, Kennedy, M&H, Clow, Nappco Daigle, Waterous, and U.S. Pipe.

B. Gate valves smaller than three inches (3") shall be 125 lb. bronze body, double disc, rising stem, solid wedge, inside screw, screwed bonnet, 150 pound S.P., 300 W.O.G. with stuffing boxes capable of being repacked under pressure when the valve is fully open. Valves shall conform to the requirements of Federal Specification WW-V-54 for Class B, Type II. The valves shall be as manufactured by Crane Co., Walworth Co., Lunkenhelmer Co., or approved equal.

C. Quick-opening valves shall be iron body, fully bronze mounted, double disk, parallel seat, sliding stem gate valves with quick-opening type operators. The valves shall be as manufactured by Iowa Valve Co., M&H Valve and Fittings Co., Crane Co., or approved equal.

D. Where required, gate valves shall be provided with a box cast in the slab and a cover. The box cover shall be for the valve stem and nut. The floor box and cover shall be equal to those manufactured by Rodney Hunt Machine Company, or approved equal.

E. Valves for buried service shall be non-rising stem type and valves above grade and valves for interior service shall be outside screw and yoke (OS&Y) type. Valves above grade shall be provided with handwheels and shall open counter-clockwise.

F. Valves below grade shall be iron body, resilient seat, non-rising stem conforming to AWWA C509, with double O-ring stem seal. Valve ends shall be flanged, mechanical joint, or "ring-tite" joint as required for the type of pipe used, and provided with two inch (2") square operating nuts, extension stems and valve boxes.

2.4 CHECK VALVES

A. Check valves smaller than three inches (3"):

1. Unless otherwise indicated, check valves less than three inches (3") in size shall be standard, all-bronze, horizontal or vertical-swing check valves, with screwed ends.

B. Check valves three inches (3") and larger:

1. Check valves three inches (3") and larger shall be swing check type with outside lever and weight.

2. Check valves shall have Class 125 flanged ends faced and drilled in accordance with ANSI Standard.

3. Check valves shall have cast iron bodies, with the following components of stainless steel:

a. Body ring.

b. Disc ring.

c. Clapper hinge shaft.

d. Hinge shaft key.

e. Clapper spacers.

- f. Disc stud.
 - g. Disc stud nut and bushing.
 - h. Disc retaining washer and cotter pin.
- 4. The hinge pin shall extend outside the cast iron body through lubricated stainless steel bushings and outside packed glands on each side of the valve.
 - 5. Each bushing shall be provided with a buttonhead grease fitting.
 - 6. Stainless steel shall be at least 18-8 nickel-chromium content.
 - 7. Check valves shall be tested at the factory and shall be drip tight under a hydrostatic pressure of 200 psi applied to the downstream side of the disc. A certified test report shall be furnished with each valve.

C. PVC and CPVC Check Valves:

- 1. Valves shall be swing type check or ball type check manufactured from PVC or CPVC compounds.
- 2. PVC check valves shall be provided on PVC and fiberglass piping.
- 3. CPVC check valves shall be provided on CPVC piping.
- 4. Swing type check valves shall be provided on piping three inches (3") in diameter and larger and furnished with teflon seats, teflon seals and flanged end connections.
- 5. Ball type check valves shall be provided on piping less than three inches (3") in diameter and furnished with Viton seats, Viton seals and threaded ends.
- 6. Check valves shall be as manufactured by Asahi/America, or approved equal.

D. Slanting Disc Check Valves:

- 1. Check valves on the discharge side of pumps shall be slanting disc type.
- 2. The body shall be heavy two piece cast iron, not fabricated steel.
- 3. The two body halves and body seat shall be O-ring sealed and bolted together in a manner to sandwich the body seat on a 55 degree angle.
- 4. Each body half must have an access covered hole for internal inspection and each body half and disc fully machined to accept attachment of a top mounted oil dash pot.
- 5. The seat ring and disc ring must be of the design that permits replaceability in the field without need for special tools or machining. The pivot pins in the body and the bushings, in the disc lugs, must be stainless steel, but of different hardnesses to prevent galling. The bushings shall be press fit to prevent wear.
- 6. An indicator shall be provided to show the position of the disc.

7. The area throughout the valve body must be equal to the full pipe area. The area through the seat section shall be 40% larger than the inlet and outlet of the valve to achieve lowest head loss.

8. Valve materials shall be certified conforming to the following ASTM specifications:

Bodies	Cast Iron	ASTM A126 Gr. B
Disc (2" thru 10")	Bronze	ASTM B584 C83700
Disc (12" & Larger)	Ductile Iron	ASTM A536
Seat Ring & Disc Ring	Bronze	ASTM A271 C92200
Pivot Pins (2" thru 10")	Aluminum Bronze	ASTM B150 Alloy 2
Pivot Pins (12" & Larger)	Stainless Steel	ASTM A582 T303
Pivot Pin Bushings	Stainless Steel	ASTM A269 T304
Exterior Paint	Phenolic Primer	FDA Approved for
Red Oxide	Potable Water	
Contact		

9. Each valve shall have a top mounted oil dashpot to control opening and closing cycles of the valve in order to prevent surge and water hammer.

10. The dashpot must have two (2) control flow rates, each rate infinitely and independently adjustable:

a. 90% rapid rate.

b. 10% slow rate during shut-down and start-up.

11. The dashpot must be a self contained oil system, separate and independent from the water line media. The oil reservoir for closing cycle shall be open to atmosphere with an air breather cap to prevent dust and other media from contaminating the oil.

12. The oil reservoir for opening cycle must be hermetically sealed to contain pressure if necessary (air over oil) and be equipped with a pressure gauge and pneumatic air valve.

13. Slanting disc valves shall be as manufactured by APCO Series 800, or by Valve Primer Corporation, or approved equal.

2.5 BUTTERFLY VALVES

A. Provide Class 150 A mechanical joint butterfly valves conforming to the latest edition of AWWA C-504, suitable for buried service, for all valves larger than 12" (except tapping valves).

B. Furnish butterfly valves with "O" ring shaft seals and cast iron body and disc.

C. Valves shall be Class 150 B for valves with nominal pipe sizes twenty inches (20") and smaller.

D. Valves shall be Class 75 B for valves with nominal pipe sizes twenty-four inches (24") and larger.

E. Actual port diameter shall not be less than one inch (1") smaller than the nominal pipe size to which it is attached.

F. Valves shall be equipped with adjustable mechanical stop limiting devices in the operator to prevent over travel of the valve disc in the open and closed position. Disc position stops located in the valve body are not acceptable.

G. Valve bodies shall be constructed of ASTM A126 Class B cast iron and shall have two (2) integrally cast trunnions for shaft bearings.

H. Valve discs shall operate through a 90-1/4 degree angle from full closed to full open position.

I. Valve discs shall be alloy cast iron ASTM A436 Type 1, or ASTM A48, or ASTM A126 for valves on lines of nominal pipe sizes of twenty inches (20") and smaller.

J. Valve discs shall be ASTM A48 cast iron or ASTM A536 ductile iron for valves on lines of nominal pipe sizes of twenty-four inches (24") or larger.

K. Valve discs shall also be provided with a type 316 stainless steel seating edge for ASTM A48, A126 or A536 cast iron discs, and shall not have any hollow chambers which can entrap water.

L. Valve shafts shall be type 316 stainless steel. Shaft diameter shall meet minimum requirements established by AWWA Standard C504 for Class 150 B.

M. Valve shafts shall be one (1) piece for valves with nominal pipe sizes twenty inches (20") and smaller.

N. Valve shafts shall be two (2) piece for valves with nominal pipe sizes twenty-four inches (24") and larger.

O. Valve seats shall have the bond with the valve body tested with a seventy-five pound (75 lb.) pull in accordance with test procedures ASTM D-429 method B for valves with nominal pipe sizes twenty inches (20") and smaller.

P. For valves twenty-four inches (24") and larger, seats shall be retained in the body by mechanical means without retaining rings, segments, screws or hardware of any kind in the flow streams.

Q. Valve seats shall be field adjustable around the full circumference of the valve body without interruption for valves with nominal pipe sizes twenty-four inches (24") and larger.

R. Valve seats shall be replaceable without dismantling the operator, disc or shaft and without removing the valve from the line. The manufacturer shall certify that the valve seat is field replaceable as specified for valves with nominal pipe sizes twenty-four inches (24") and larger.

S. Valve bearings shall be sleeve type bearings, and shall be 100% nylon or teflon for valves with nominal pipe sizes twenty inches (20") and smaller.

T. Valve bearings shall be teflon lining with fiberglass backing for valves with nominal pipe sizes twenty-four inches (24") and larger. Valve bearings shall be self lubricating and bearing loads shall not exceed 20% of the compressible strength of the bearing or shaft material.

U. Valve shaft seals shall be self compensating split V-type, and shall be adjustable and replaceable without removing the operator and/or the shaft.

V. Valve shaft seals shall be the same elastomer as specified for the valve seats for the intended service.

W. Manual operators shall conform to AWWA C504, except where modified or supplemented herein, and shall be of the worm gear or traveling nut type and shall be self-locking to prevent the valve disc from creeping or fluttering when in any intermediate position between open and closed.

X. Manual operators shall be totally enclosed and permanently lubricated, and shall have a gear ratio and handwheel diameter designed to produce an output torque equivalent to the maximum valve shaft torque required to operate the valve under actual line pressures, velocities and flow direction with a minimum pull of forty pounds (40 lbs.) on the handwheel. The manufacturer shall submit calculations verifying compliance with this standard.

Y. For buried service, valves shall be totally enclosed, fully gasketed, grease packed and shall be designed to operate indefinitely when submerged under twenty feet (20') of water. Buried service operators shall be provided with a valve extension stem, AWWA Standard operating nut and valve box. The extension stem for buried service shall be sufficiently long to extend to within twelve inches (12") of the ground surface. Where required, valves shall be furnished with extension bonnets.

Z. Laying length of all classes shall be Table 2, short body.

AA. Valves shall be rated at 150 psi working pressure.

BB. Valves shall be the manually operated type opening counterclockwise.

CC. Valves shall be as manufactured by Mueller Linesal, Kennedy, Clow, U.S. Pipe, American/Darling, Pratt, or Dresser.

DD. PVC Butterfly Valves:

1. Shall be manufactured from PVC compounds and provided on PVC and fiberglass piping as indicated.
2. Valves shall be wafer style with PVDF disc, Teflon or Viton seal and 316 stainless steel shaft.
3. Valves shall be as manufactured by G.F. Plastics Type 367, Asahi/America Type 75, or approved equal.

2.6 PLUG VALVES

A. Plug valves shall be of the bi-directional, non-lubricated, eccentric type with a balanced resilient faced plug suitable for service in sewage and sludge piping. Acceptable manufacturers shall be DeZurik Corporation, Sartell, Minn., Series 100; Keystone/Drum-Owen Valve Co., Lehigh Valley, PA, Ballcentric, or approved equal.

B. Valve construction shall require the opening movement of the valve to cause the plug to rise off the seat contact rather than sliding from its seat. Valve bodies shall be of ASTM-A126 Class B cast iron in compliance with ANSI/AWWA Standard C504 and AWWA/ANSI Standard C507. Valve bonnets shall be bolted.

C. Valves three inches (3") and larger shall have seats of a welded-in overlay of not less than 90 percent pure nickel. Valves less than three inches shall have plastic or epoxy covered seats.

D. Port areas shall be unobstructed when open and have smoothly shaped waterways. Valves 4" and smaller shall have a port area capable of passing a spherical solid having a diameter not less than 100% of the nominal pipe diameter. Valves 6" and larger shall have a port area capable of passing a spherical solid having a diameter not less than 87% of the nominal pipe diameter.

E. Plug valves less than three inches (3") shall have screwed ends. Plug valves three inches and larger shall have:

1. Flanged ends, faced and drilled in accordance with the 125 pound ANSI Standard B16.1.

2. Mechanical joint ends in accordance with ANSI/AWWA C111/A21.11.

F. Resilient plug facings shall be ASTM A126 Grade B cast iron with neoprene on a single-piece plug. The plug shall be of sufficient construction so that no strengthening member is required opposite the plug face.

G. Valves shall be furnished with permanently lubricated stainless steel or oil-impregnated bronze upper and lower stem bushings in accordance with ANSI/AWWA C-507.

H. Shaft seals or packing shall be self-adjusting or adjustable and replaceable without removing the valves from service or interrupting service with flow in either direction in accordance with ANSI/AWWA C-507.

I. Valve pressure ratings shall be as follows and shall be established by hydrostatic tests as specified by ANSI Standard B16.1. Pressure ratings shall be 175 psi for valves up to 12 inches, 150 psi in sizes 14 through 54 inches. Valves shall be capable of providing drip-tight shutoff to the full valve rating with the pressure in either direction.

J. Valves shall be provided with limit stops and rotate 90 degrees from fully open to fully closed and shall be capable of providing shut-off up to the full test pressure of 150 psi for all valve sizes. Valve operators shall be as specified herein.

K. Valve seats shall be corrosion resistant consisting of a welded-in overlay of 90% pure nickel.

L. Valve bearings shall be replaceable type 316 series stainless steel for both the upper and lower journals.

M. Shaft seals shall be multiple ring V-type Buna-N packing. The stuffing box shall be designed to allow the packing to be adjusted and replaced when the valve is in service.

N. Valves on interior and exposed piping shall have flanged end connections conforming to ANSI B16.1 Class 125. Valves shall have the standard face to face dimensions of AWWA gate valves for nominal pipe sizes of three inches (3") to twelve inches (12") with flanged end connections.

O. Valves for exterior buried service shall have mechanical joint bells conforming to AWWA C111.

P. Interior coating shall be in accordance with Section 09900 - Painting - Wastewater Systems.

Q. All nuts, bolts, springs, washers, etc. shall be type 316 stainless steel.

R. Interior and exposed service with nominal pipe sizes eight inches (8") and larger shall be provided with totally enclosed worm gear actuators. The actuators shall be properly sized to suit the maximum differential across the valve.

S. For buried or submerged service, valves shall be provided with an AWWA operating nut. Valves with nominal pipe sizes eight inches and larger shall have permanently lubricated totally enclosed worm gear actuators with permanently lubricated bronze bearings, and shall be designed to handle the seating and unseating torque at the specified handwheel pull for applications with the maximum pressure differential in either direction.

T. Manual actuators for buried service shall be provided with AWWA operating nut and a completely enclosed mounting bracket and actuator cover and extension stem sufficiently long to extend within twelve inches (12") of the ground surface and shall be housed in a valve box and cover.

U. Valves may be used in testing portions of piping systems in accordance with Section 01670 - Testing Piping Systems, with the full test pressure on either side.

2.7 VALVE OPERATORS

A. Valve operators shall be sized for operation at the pressure and flow conditions as indicated hereinafter.

B. Valves eight inches (8") and larger shall have gear operators. All gearing shall be enclosed in a cast-iron housing and be suitable for running in a lubricant with seals provided on all shafts and gaskets on the valve and actuator covers to prevent entry of dirt and water.

C. Manual operators shall be of the totally enclosed worm gear type in accordance with ANSI/AWWA C-504.

1. Actuators shall be properly designed and sized to handle the seating and unseating torque at the specified handwheel pull for applications with the maximum pressure differential across either direction of the valve. Design conditions shall be:

- a. Design Velocity: 15 fps.

- b. Design Pressure Differential: 150 psig.

2. Gear actuators shall have permanently lubricated bronze bearings.

3. Actuators shall be equipped with a handwheel for interior and exposed service and an AWWA operating nut for buried or submerged service.

4. Actuators shall clearly indicate the valve position with an adjustable stop to set closing.

D. A suitable wrench shall be provided for each six (6) wrench operated valves. Wrenches shall be of suitable size and sufficient length for easy operation of the valves at their rated working pressure. A suitable lever shall be provided for each lever operated valve with suitable method for securing the lever to the valve stem.

E. Valve boxes shall be as specified in Item 2.32.

F. Floor stands shall be as specified in Item

2.8 CORPORATION AND CURB STOPS

A. Corporation cocks for connection to cast-iron, ductile iron or steel piping shall be all brass or bronze suitable for 150 psi operating pressure and similar to Mueller Co. H-9969 or equal by Clow Corp., Ford, or Grand Co., and shall be of sizes required and/or noted on the Contract Drawings.

B. Corporation stops shall be "O" ring sealed, balance pressure, plug type valves having a full open unobstructed flow way.

C. Corporation stops shall be suitable for buried service and shall have threaded inlet and outlet connections unless otherwise indicated.

2.9 AUTOMATIC PINCH VALVES

Not Used.

2.10 SAMPLING COCKS AND HOSE BIBBS

A. Potable Water System:

1. Hose bibs shall be 3/4" brass, rough chrome plated, with vacuum breaker and loose key stop. Hose bibs shall be Chicago No. 998, Sloan, or approved equal.
2. Provide permanent, plastic or brass name tags located above the hose bibs which state "POTABLE WATER". Letters on the tags shall be not less than 3/4" high.

B. Reuse Water System:

1. Hose bibs shall be 1" bronze body angle valves with screwed inlet, hose outlet, quick connect coupling, cap and chain.
2. Hose bibs shall have a minimum 200 psi non-shock, cold water pressure rating.
3. Hose bibs shall be No. 117 as manufactured by Crane Co., Walworth, or approved equal.
4. Provide permanent, plastic or brass name tags located above the hose bibs which state "REUSE WATER - DO NOT DRINK". Letters on the tags shall be not less than 3/4" high.

2.11 GLOBE OR ANGLE VALVES

A. Valves less than three inches (3") shall be bronze body, stem and bonnet, steel disc and seat ring type having screwed ends and designed for a minimum 300 psi cold water non-shock

service. Valves shall be No. 14-1/2 P as manufactured by Crane Co., Mueller Co., or approved equal.

B. Valves three inches (3") and larger shall be iron body and bonnet with bronze stem, disc and trim. Valves shall be of the O.S. & Y type, renewable composition disc, with flanged ends. Valves shall be designed for a minimum 200 psi cold water non-shock service. Valves shall be No. 351 as manufactured by Crane Co., Powell Valves, or approved equal.

2.12 DRAIN VALVES

Not Used.

2.13 STRAINERS

A. Strainers shall be Y-Pattern bronze or iron body, with threaded end connections, and shall be provided with a cylindrical 20 mesh monel screen.

B. Strainers shall be rated for 200 psi cold water pressure and shall be Model No. 988 1/2 by Crane Co., No. 3699 1/2 by Walworth, or approved equal.

2.14 BACKFLOW PREVENTORS

A. Reduced pressure backflow preventers shall be of the size indicated on the Contract Drawings and shall contain two (2) spring loaded vertical check valves and one (1) spring loaded, diaphragm actuated, differential pressure relief valve.

B. The unit shall include tightly closing shutoff valves located at each end of the device and shall be fitted with properly located test cocks.

C. Operation shall be completely automatic. All parts must be removable or replaceable without removal of the unit from the line.

D. All materials shall be protected against corrosion.

E. One (1) fully stocked device repair kit shall be provided to the Owner for each size, type and model of backflow device installed.

2.15 BALL VALVES

A. Bronze Ball Valves:

1. Ball valves for all service unless otherwise indicated shall be bronze with screwed or flanged ends as appropriate.

2. Valves shall have Teflon ball seats and Viton stem and body seals.

3. Valves shall be supplied with manual levers or "T" handles.

B. Ball Valves for PVC Pipe:

1. Ball valves shall be manufactured from PVC or CPVC compounds and shall have viton or Teflon seals and "O"-ring seals to suit the intended chemical service requirements.
2. PVC valves shall be provided on PVC and fiberglass piping.
3. CPVC valves shall be provided on CPVC piping.
4. Valves shall be full port type with flanged or threaded union ends.

C. Ball Valves for Stainless Steel Pipe:

1. Ball valves shall be 316 stainless steel body, with 316 stainless steel ball and stem, Teflon seats and seals, threaded ends, lever operated and 150 Class.
2. Valves used as moisture drain valves shall be installed at low points of the line and at plugged or capped ends for draining piping.

D. Ball Valves for Hydrogen Peroxide Service:

1. Valves shall be two-way or three-way type constructed of B-356 cast aluminum with Teflon seat and seals, of the full bore type, stainless steel trim, lever operated, specifically designed for hydrogen peroxide duty.
2. Valves shall be type AK44-33TT (screwed ends) or AK150F44-36TT (flanged) as manufactured by Jamesbury Corporation or similar units of equal quality by Wooster Corporation or Whitey. Screwed or flanged end connections shall be provided as indicated.

E. Ball Valves for Pressurized Chlorine Gas and Liquid Chlorine Lines:

1. Valves shall be designed for the intended service and shall meet all requirements of the Chlorine Institute and these Specifications.
2. Valves shall have a cast steel body, Monel or Hastelloy "C" ball and stem, Teflon seats, with manual lever operator and shall be provided with threaded end connections.
3. Valves shall be rated at 300 pounds ANSI for pressures of minus 30 inches W.C. to 300 psig and temperatures of minus 20 degrees to 300 degrees Fahrenheit.
4. Valve sizes shall be as shown on the Contract Drawings and shall be Jamesbury "Double Seal" Series 3000 Ball Valves, or equivalent models as manufactured by Whitey, Hills McCanna, or WKM.

2.16 SOLENOID VALVES

- A. Solenoid valves shall be 2 way or 3 way as required, with a NEMA 4X water-tight, dust-tight, corrosion resistant enclosure.
- B. Valves shall be of the type that are normally closed, energized to open, closed on failure, and can be opened manually on failure.
- C. Plunger assembly and tube shall be 316 stainless steel.

- D. Disc shall be Viton or Teflon.
- E. Valves shall have a molded epoxy resin, Class B temperature range coil for continuous duty, and a NEMA 4X water-tight coil housing.
- F. Valves shall be suitable for operation on a 120 volt, 60 hertz power supply or 24 volt DC power supply.
- G. Valves shall be as manufactured by Automatic Switch Co., Magnatrol Corp., or approved equal.

2.17 BACK PRESSURE SUSTAINING VALVES

A. Back Pressure Sustaining Valves less than three inches (3"):

1. Valves shall maintain constant upstream pressure by passing or relieving excess pressure, and shall maintain close pressure limits without causing surges.
2. Valves shall be a direct acting, adjustable, spring-loaded, diaphragm valve, designed to permit flow when controlling pressure exceeds the spring setting.
3. Valves shall be bronze body with stainless steel diaphragm and all stainless steel trim, with plugged outlet and a pressure adjustment range of 40-200 psi.
4. Valves shall be as manufactured by Cash-Acme Type FR, or approved equal.

B. Back Pressure Sustaining Valves three inches (3") and Larger:

1. Valves shall be designed to protect the pressure integrity of the upstream pressure system by only opening when the upstream pressure exceeds an adjustable pilot setting.
2. Valves shall modulate as required to maintain a pre-set pressure on the upstream side of the valve. If upstream pressure drops below the valve setting, the valve shall close.
3. Valves shall be designed such as turning clockwise on the sustaining pilot handwheel will increase the setting and turning counter-clockwise will decrease the setting.
4. Needle valves shall be furnished to provide independent and adjustable control of the main valve opening and closing speed.
5. The valve shall be shipped completely piped and ready for installation.
6. The main valve shall operate on the differential piston principle such that the area on the underside of the piston is no less than the pipe area, and the area on the upper surface of the piston is of greater area than the underside of the piston.
7. The valve piston shall be guided on its outside diameter by long stroke stationary Vee ports which shall be downstream of the seating surface to minimize the consequences of throttling. Throttling shall be done by the valve Vee ports and not the valve seating surfaces.
8. The valve shall be capable of operating in any position and shall incorporate only one flanges cover at the valve top from which all internal parts shall be accessible. There shall

be no stems, stem guides, or spokes within the waterway. There shall be no springs to assist the valve operation.

9. The valve body shall be of cast iron ASTM A126 with flanges conforming to the latest ANSI Standards. The valve shall be extra heavy construction throughout.

10. The valve interior trim shall be bronze B-62 as well as the main valve operation.

11. The valve seals shall be easily renewable while no diaphragm shall be permitted within the main valve body.

12. All controls and piping shall be of non-corrosive construction.

13. A visual valve position indicator shall be provided for observing the valve position at any time

14. Valves shall be as manufactured by Golden-Anderson Industries Figure 6700-DR, Clayton, or approved equal.

2.18 KNIFE GATE VALVES

A. Valves shall be of the bonnetless non-rising stem wafer knife gate type with face flange connections.

B. Flanges shall be drilled to the ANSI B16.1 125 pound standard.

C. W.O.G. valve rating shall be 125 psi non-shock pressure.

D. Valves shall provide bubble-tight shutoff against a 30 psi downstream pressure.

E. Valve body and all wetted parts shall be 304 stainless steel with carbon steel flanges.

F. Valves shall be provided with resilient neoprene D-shape O-ring in the seat for bubble-tight shutoff in both directions.

G. The stainless steel gate shall have a square bottom with a knife edge.

H. Both sides of the gate shall be finish ground.

I. The valve stem shall be stainless steel and shall have double pitch threads.

J. Valve packing shall be multiple layers of square, braided flax and shall be impregnated with marine or petroleum base lubricants.

K. The packing gland shall be plastic coated.

L. The valve body port shall be no less than 95% of the nominal pipe diameter.

M. The valve body shall be complete with two (2) flush ports consisting of not less than 1-1/2" diameter pipe taps.

N. Valves shall be as manufactured by Fabri-Valve, DeZurik, or approved equal.

2.19 SHEAR GATE VALVES

Not Used.

2.20 FLAP VALVES (Circular)

- A. Flap valves shall be flanged framed with bolt holes and bolt patterns conforming to ANSI B16.1, Class 125, and ASTM A126 B cast iron with bronze trim.
- B. Valve seats shall be bronze placed in detailed grooves and machines for maximum water tightness.
- C. Valves shall have ASTM B584 high tensile bronze hinge arms which shall have two pivot points and shall have silicon bronze, ASTM B98 or type 316 stainless steel hinge pins which shall be designed in double shear.
- D. The lower hinge pivot point shall have an adjustment to limit rotation and the upper pivot point shall be capable of adjusting the valve sensitivity.
- E. Valves shall be supplied with lubrication fittings at each pivot. Lubricant lines shall be supplied to the surface for easy access.
- F. Valves shall be mounted to standard flange or to a cast iron wall thimble as recommended by the manufacturer.
- G. Valves shall be series FV-AC as manufactured by Rodney Hunt Co., Clow, or approved equal.

2.21 PRESSURE RATINGS

- A. Unless otherwise indicated, use valves suitable for 125 minimum psig WSP and 450 degrees F., and 200 psig and 250 degrees F.

2.22 SURGE RELIEF VALVES

Not Used.

2.23 EXTENSION STEMS

- A. Extension stems shall be provided and installed on all valves in buried locations and where indicated on the Contract Drawings.
- B. Extension stems shall be fabricated from solid steel shafting capable of withstanding the torque imposed, but not smaller than 1.25 inches in diameter.
- C. Stem couplings shall be keyed and of approved design and construction.

D. Extension stems for buried valves shall extend to within six inches (6") of the surface of the ground. Each extension stem shall be connected to the valve operator with a suitable universal joint type of coupling. All connections shall be pinned.

E. Each extension stem shall be provided with spacers which will center the stem in a valve box having an inside diameter of six inches (6"), and shall be equipped with a standard AWWA wrench nut as described in AWWA C500, except where handwheels are indicated on the Contract Drawings.

F. A position indicator shall be provided with each buried valve which shows the valve position, number of turns to go from full open to full closed, and type and size of valve. The entire unit shall be constructed of non-corrosive materials.

2.24 AIR RELEASE VALVES

A. Air release/vacuum valves shall be 2" minimum, shall have a cast iron body, cover and baffle, stainless steel float and lever pins, bronze water diffuser, Buna-N or Viton seat and stainless steel trim. Valves shall be provided with a vacuum check to prevent air from re-entering the line. The fittings shall be threaded.

B. Valves shall be specifically designed for use on sewage force mains and properly coated for contact with hydrogen sulfide and its byproducts.

C. Valves shall allow unrestricted venting on the re-entry of air through it.

D. The valve inlet and outlet shall be 2" NPT.

E. The valve shall be designed and equipped for flushing and include inlet and outlet blow-off valves, isolation drain, flushing water valves, and quick disconnect couplings.

F. Air release valves shall be Model 445 by APCO Valve & Primer Corporation, Schaumbert, Illinois, or approved equal.

2.25 AIR-VACUUM RELEASE VALVES

A. Valves shall be furnished with 2" screwed inlet and outlet fittings, a 1/4" orifice.

B. Valves shall incorporate two (2) stainless steel floats directly connected by a stainless steel float guide, to maintain an air gap between the bottom concave float and top shut-off float. The air gap shall retard waste solids from fouling or clogging the top shut-off float.

C. The internal baffle shall be fitted with a guide bushing and act to protect the shut-off float from direct airflow. The baffle shall retain the 45 degree Durometer Buna-N seat in place, without distortion, for tight shut-off.

D. All internals shall be easily removable through the top cover without removing the main valve from the line.

E. The complete valve shall withstand 500 psi test pressure.

F. Furnish inlet and blowoff valves, quick disconnect couplings, and a minimum five foot (5') length of 2" diameter hose for flushing.

G. Valve body, cover and baffle shall be constructed of cast iron conforming to ASTM A126, Grade B.

H. The upper float, lower float, stem, and guide bushing shall be stainless steel conforming to ASTM A240.

I. The valve seat shall be of Buna-N nitrile rubber.

J. Exterior paint shall be a phenolic red oxide primer that is FDA approved for use in potable water systems.

2.26 AIR AND VACUUM VALVES

A. Slow closing air and vacuum valves shall be three (3) valves furnished assembled and tested as a single unit.

B. Valves shall have a stainless steel float guided at each end with stainless steel stems. The stems shall be guided through stainless steel bushings inside the body and cover. The seat must be Buna-N fastened to the cover with stainless steel shoulder screws without distortion to allow drip tight closure.

C. The cover shall have a male lip to fit the female body register for positive float guide direction into the seat. Cover outlets shall be flanged.

D. The surge check valve shall be a normally open spring loaded valve consisting of a body, seat and plug bolted to the inlet of the air and vacuum valve.

E. The surge check shall operate on the interphase between the kinetic energy and the relative velocity flows of air and water, allowing air to pass through, but water shall close the surge check, reducing the rate of water flow by means of throttling orifices in the plug to prevent shock closure of the air and vacuum valve. The surge check orifices must be adjustable type to suit operating conditions in the field.

F. The inlet isolation butterfly valve shall be wafer (compact) style constructed to AWWA Standards with hand level and variable position locking device. The seat is to be freely interchangeable from the body without need for special tools or skills. The seat must be Buna-N, molded with a steel flanged insert for high strength and tight seating. The disc must pivot eccentrically from closed position to clear center valve area.

G. Valves shall be flow tested in the field, substantiated by test data to show reduction of surge pressure in the valve.

H. Air & vacuum valve and air release valve cover and body, surge check body, and butterfly valve body shall be cast iron conforming to ASTM A126, Grade B.

I. Floats and springs shall be Stainless Steel conforming to ASTM A240.

J. Surge check seat and disc shall be bronze conforming to ASTM B584.

K. Air release valve needle shall be Buna-N.

L. Air & vacuum valve seat shall be Buna-N (4" through 12") conforming to ASTM A240.

- M. Leverage assembly shall be Delrin conforming to ASTM A270.
- N. Butterfly valve shaft shall be stainless steel conforming to ASTM A270.
- O. Exterior paint shall be phenolic primer red oxide, FDA approved for contact with potable water.
- P. Air and vacuum valves shall be as manufactured by APCO Series 1300, Valve and Primer, or approved equal.

2.27 GAUGE COCKS

- A. Gauge cocks shall be screwed, all bronze, tee handle, as manufactured by Crane Co., Model No. 712 or 744, or approved equal.

2.28 NEEDLE VALVES

- A. Needle valves shall be bronze, rising bronze stem, Class 200, globe style needle valve with threaded end connections.
- B. Valves shall conform to Federal Specifications WW-V-51, Class C, Type 1 (Globe) for nominal pipe sizes up to one inch (1").
- C. Needle valves shall be Model No. 88 as manufactured by Crane Co., Model No. 180 by Powell, Model No. 120 by Walworth, or approved equal.

2.29 DIAPHRAGM VALVES

- A. Diaphragm valves shall be manufactured from PVC and shall be provided on PVC and fiberglass piping as indicated.
- B. Valves shall be weir type with Teflon diaphragm and seals, handwheel operator, and flanged or threaded end connections to suit the piping.
- C. Valves shall be as manufactured by Assahi/America, G.F. Plastics, or approved equal.

2.30 PRESSURE REDUCING REGULATOR VALVES

- A. Less than three inches (3"):
 - 1. Valves shall be direct acting, adjustable, spring-loaded, normally open diaphragm valves, which close when downstream pressure exceeds the spring setting.
 - 2. Valve body and cover shall be bronze with reinforced Buna-N diaphragm, Buna-N seat, and bronze piston and cylinder. Valves shall have screwed ends.
 - 3. The outlet pressure range of the valve shall be adjustable between 10 and 30 psi.
 - 4. Valves shall be as manufactured by Cash-Acme Type B, or approved equal.

B. Three inches (3") and larger:

Not used.

2.31 DRESSER TYPE COUPLINGS

A. Couplings shall be as manufactured by the Dresser Manufacturing Division, or approved equal, and of a style as specified on the Contract Drawings.

B. The couplings shall be placed to evenly cover the ends of the pipe and tightened without damage to the gaskets or pipe coating. The nuts on all bolts shall be started and tightened evenly around the entire circumference of the pipe. No one nut shall be tightened more than 1/4 turn tighter than the remainder of the nuts on the coupling. A 1/4 inch space shall be left between the ends of the pipe.

2.32 VALVE BOXES

A. All buried valves shall be provided with valve boxes as indicated on the Contract Drawings, with a minimum thickness of 1/2" and constructed so that the removable cover will not be thrown out by travel over it.

B. Valve boxes shall be of sufficient length to operate all valves buried in the ground.

C. Valve boxes shall be the telescope extension type with not less than a five-inch (5") diameter shaft and with cast iron covers marked "SEWER". Boxes shall Model No. F-2452 as manufactured by James B. Clow & Sons, Mueller, or approved equal.

D. The valve boxes and valve box covers shall be of sound close grained cast iron, free from flaws and defects, and built strong and rugged enough to withstand the shock of street traffic.

E. Two (2) valve operating wrenches shall be supplied in 4-foot lengths with handles. Valve wrenches shall be model No. F2520 as manufactured by James B. Clow & Sons, Mueller Co., or approved equal.

2.33 TAPPING VALVES AND SLEEVES

A. Tapping valves and sleeves shall be used for all taps four-inches (4") in diameter or greater.

B. Sleeves shall be the mechanical joint type constructed from cast iron with a recessed flat face flange to accept the tapping valve.

C. Gaskets shall be neoprene or other materials compatible with potable water.

D. Valves shall conform to all the applicable requirements of AWWA C-500 and shall be rated for a minimum of 150 psi.

E. Tapping valves shall be the non-rising stem type designed for buried service in accordance with paragraph 2.03.

F. Sleeves and valves shall be as manufactured by Dresser or approved equal.

2.34 TAPPING SADDLES

- A. Tapping saddles shall be used for all taps three inches (3") in diameter or less.
- B. Tapping saddles shall be the double-strap, steel-constructed type conforming to AWWA C-800 requirements.
- C. Saddles shall be brass with stainless steel hardware with extra wide bearing surfaces furnished with a flanged or NPT threaded outlet.
- D. Saddles shall be rated for 150 psi working pressure and shall be furnished with extra thick and wide neoprene gasket.
- E. Service saddles shall be as manufactured by Clow or approved equal.

2.35 FLOOR STANDS

- A. Shall be cast iron, non-rising stem type with lockable handwheel operator, valve position indicator and steel extension stem.
- B. The handwheel shall be lockable in the full closed position.
- C. The floor stand shall be furnished with an armored padlock and six (6) keys. Locks shall be as manufactured by Master, Schlage, or approved equal.
- D. Floor stands shall be standard pattern type as manufactured by Clow Corporation, or approved equal.

PART 3 - EXECUTION

3.1 GENERAL

- A. The Contractor shall furnish and install in the appropriate locations as shown on the Contract Drawings, all valves and special fittings as specified.
- B. Where required for satisfactory operation of valves or gates, extension stems, stem guides, valve boxes, floor boxes and other valve appurtenances shall be provided.
- C. Extension stems shall be complete with guide bearings, wrench nut, and tee handle wrench.
- D. All valve stems where packing is specified shall be packed with material properly selected for the service intended.
- E. Valves shall be suitable for safe working pressure as required in each application. Manufacturer's name and service and pressure marking shall be cast into the body.
- F. Valves shall be constructed for not less than 125 pounds per square inch working pressure, (200 pound cold water, oil or gas, non-shock, except as otherwise specified), and shall be so

designed and installed that they can be packed under pressure. Shut-off valves shall be gate valves, except where other type valves are specifically indicated or specified.

F. All valves shall be manually opened and closed before installation to check their operation, and the interior of the valve shall be cleaned.

G. Valves shall be placed in the positions indicated on the Contract Drawings. Joints shall be made as directed under the piping specifications.

3.2 INSTALLATION

A. Install valves with stems upright or horizontal, not inverted.

B. Use plug valves for wastewater unless otherwise noted.

C. Install valves so that they are easily accessible for operation, visual inspection and preventative maintenance.

D. Buried valves shall be firmly set on a foundation or footing of solid concrete, not less than eight inches (8") nor less than one cubic foot (1 cu. ft.) in volume, which shall have been placed on firmly compacted ground.

E. All buried valves shall be provided with valve boxes. The riser shall rest on the valve and be adjusted so that the cover may be set flush with existing sidewalk, bike path, paved streets, unpaved streets, driveways, road right-of-way, etc. The valve box shall be set to allow equal movement above and below finished grade when located in utility easements not subject to street traffic. The riser shall be centered over the valve. The entire assembly shall be plumb.

F. All valves shall be tested at the same test pressure as the line in which they are installed. Any leakage or "sweating" of joints shall be stopped and all joints shall be water tight with no visible leaks.

END OF SECTION

SECTION 33 26 60 -WATER TRANSMISSION SYSTEM

PART 1 -- GENERAL

1.1 THE SUMMARY

- A. The work covered by this section consists of providing all labor, equipment, materials, and performing all construction required to install the various piping, valves, fittings and accessories for potable water distribution mains as specified and shown on the Contract Drawings.
- B. RELATED SECTIONS
 - 1. Section 01 11 00 -Summary of Work.
 - 2. Section 01 33 00 – Submittal Procedures
 - 3. Section 01 74 30 -Pressure Pipe Testing and Disinfection.
 - 4. Section 01 72 00 -Project Record Drawings.
 - 5. Section 01 76 10 -Protection of Existing Facilities.
 - 6. Section 31 23 33 -Trenching and Backfilling.

1.2 CONTRACTOR SUBMITTALS

- A. Submittals for the various types of pipe, fittings and restrained joints.
- B. Catalog cuts and shop drawings for all valves and valve boxes.
- C. Record drawings in accordance with Section 01 72 00 – Project Record Drawings.
- D. The manufacturer will furnish a sworn affidavit that the pipe, fittings and lining furnished under the Contract comply with all applicable provisions of the ANSI and/or AWWA Standards.
- E. Reports of pressure tests, leakage tests and bacteriological clearance tests in accordance with Section 01670 - Testing Piping Systems.
- F. Shop drawing submittals for materials listed as approved in the Water Utilities Department "Manual of Minimum Engineering and Construction Standards" are not required if the Contractor submits a signed "shop specification" form attached hereto.

1.3 JOB CONDITIONS

- A. The Contractor will submit plans and schedules for approval by the Owner before any shutdown or any interruption in service takes place or any large flows and volumes of water are used for flushing or disinfection.
- B. Design criteria for all pipe and fittings: 150 psi test pressure, ANSI laying condition Type 4, trench width of 2 feet plus the pipe diameter.

- C. Pipe and fittings shall be marked with the diameter, date of manufacture, and the name or trademark of the manufacturer.

PART 2 -- PRODUCTS

2.1 DUCTILE IRON PIPE (D.I.P.)

- A. Ductile Iron Pipe shall be in accordance with Section 33 26 10 -Ductile Iron Pipe and Fittings

2.2 POLYVINYLCHLORIDE (PVC)

- A. PVC Pipe shall be in accordance with Section 33 26 14 -Polyvinylchloride (PVC) Pressure Pipe

2.3 RESTRAINED JOINTS

- A. Provide ductile iron Class 350 restrained joint pipe. Where the drawings do not specify a type of restrained joint, but require a specified length of restraining, ductile iron retainer glands may be used.

2.4 FITTINGS

- A. All fittings shall be ductile iron, cement lined with a bituminous seal coat, mechanical joint, Class 250 conforming to ANSI A21.10 and AWWA C-104/110/111.
- B. Joints for fittings 24" in diameter and under shall be restrained mechanical joint, except above ground fittings which shall be flanged.
- C. Joints for fittings 16" in diameter and smaller shall be restrained type in accordance with the schedule shown on the Contract Drawings.

2.5 GATE VALVES

- A. Provide mechanical joint, iron body, resilient seat gate valves conforming to the latest edition of AWWA C-509, for all valves smaller than 12".
- B. Gate valves smaller than 4" shall conform to federal specifications W W-V-54D, Type 1, Class A, 125 psi steam pressure rating.
- C. Furnish non-rising stem gate valves, with parallel seats, interior parts coated with thermo-setting epoxy, and mechanical joint ends.
- D. Gate valves are to open left (counter-clockwise) with a 2-inch square operating nut. Unless otherwise shown, valves are to be set with their stems vertically above the centerline of the pipe.
- E. Gate valves are to be carefully inspected, opened wide, then tightly closed, and all the nuts and bolts thereon tested for tightness.
- F. Any gate valve that does not operate correctly will be removed and replaced at the Contractor's expense.
- G. Valve operating nuts are to be brought within 30" of finished grade.

- H. Special care shall be taken by the Contractor to prevent joint material, stones, or other substances from becoming lodged in the valve seat.
- I. Gate valves shall be tied to mains with tie rods or anchor tees.

2.6 BUTTERFLY VALVES

- A. Provide Class 150A mechanical joint butterfly valves conforming to the latest edition of AWWA C-504, suitable for buried service, for all valves 12" and larger (except tapping valves).
- B. Furnish butterfly valves with "O" ring shaft seals and cast iron body and disc.
- C. Butterfly valves shall be tied to mains with tie rods or anchor tees.
- D. Laying length of all classes shall be Table 2, short body.
- E. Actual port diameter shall not be less than one inch (1") smaller than the nominal pipe size to which it is attached.
- F. Valves shall be equipped with adjustable mechanical stop limiting devices in the operator to prevent over travel of the valve disc in the open and closed position. Disc position stops located in the valve body are not acceptable.
- G. Valve bodies shall be constructed of ASTM A126 Class B cast iron and shall have two (2) integrally cast trunnions for shaft bearings.
- H. Valve discs shall operate through a 90-1/4 degree angle from full closed to full open position.
- I. Valve discs shall be alloy cast iron ASTM A436 Type 1, or ASTM A48, or ASTM A126 for valves on lines of nominal pipe sizes of twenty inches (20") and smaller.
- J. Valve discs shall be ASTM A48 cast iron or ASTM A536 ductile iron for valves on lines of nominal pipe sizes of twenty-four inches (24") or larger.
- K. Valve discs shall also be provided with a type 316 stainless steel seating edge for ASTM A48, A126 or A536 cast iron discs, and shall not have any hollow chambers which can entrap water.
- L. Valve shafts shall be type 316 stainless steel. Shaft diameter shall meet minimum requirements established by AWWA Standard C504.
- M. Valve shafts shall be one (1) piece for valves with nominal pipe sizes twenty inches (20") and smaller.
- N. Valve shafts shall be two (2) piece for valves with nominal pipe sizes twenty-four inches (24") and larger.
- O. Valve seats shall have the bond with the valve body tested with a seventy-five pound (75 lb.) pull in accordance with test procedures ASTM D-429 method B for valves with nominal pipe sizes twenty inches (20") and smaller.
- P. For valves twenty-four inches (24") and larger, seats shall be retained in the body by mechanical means without retaining rings, segments, screws or hardware of any kind in the flow streams.

- Q. Valve seats shall be field adjustable around the full circumference of the valve body without interruption for valves with nominal pipe sizes twenty-four inches (24") and larger.
- R. Valve seats shall be replaceable without dismantling the operator, disc or shaft and without removing the valve from the line. The manufacturer shall certify that the valve seat is field replaceable as specified for valves with nominal pipe sizes twenty-four inches (24") and larger.
- S. Valve bearings shall be sleeve type bearings, and shall be 100% nylon or teflon for valves with nominal pipe sizes twenty inches (20") and smaller.
- T. Valve bearings shall be teflon lining with fiberglass backing for valves with nominal pipe sizes twenty-four inches (24") and larger. Valve bearings shall be self lubricating and bearing loads shall not exceed 20% of the compressible strength of the bearing or shaft material.
- U. Valve shaft seals shall be self compensating split V-type, and shall be adjustable and replaceable without removing the operator and/or the shaft.
- V. Valve shaft seals shall be the same elastomer as specified for the valve seats for the intended service.
- W. Manual operators shall conform to AWWA C504, except where modified or supplemented herein, and shall be of the worm gear or traveling nut type and shall be self-locking to prevent the valve disc from creeping or fluttering when in any intermediate position between open and closed.
- X. Manual operators shall be totally enclosed and permanently lubricated, and shall have a gear ratio and hand-wheel diameter designed to produce an output torque equivalent to the maximum valve shaft torque required to operate the valve under actual line pressures, velocities and flow direction with a minimum pull of forty pounds (40 lbs.) on the hand-wheel. The manufacturer shall submit calculations verifying compliance with this standard.
- Y. For buried service, valves shall be totally enclosed, fully gasketed, grease packed and shall be designed to operate indefinitely when submerged under twenty feet (20') of water. Buried service operators shall be provided with a valve extension stem, AWWA Standard operating nut and valve box. The extension stem for buried service shall be sufficiently long to extend to within twelve inches (12") of the ground surface. Where required, valves shall be furnished with extension bonnets.
- Z. Laying length of all classes shall be Table 2, short body.
- AA. Valves shall be rated at not less than a 150 psi working pressure.
- BB. Valves shall be the manually operated type opening counterclockwise.
- CC. Valves shall be as manufactured by Mueller Linesal, Keystone, M & H, American/Darling, Pratt, Dezurik BAW, Dresser #1450, Clow, or U.S. Pipe

2.7 TAPPING SLEEVES AND TAPPING VALVES

- A. Provide ductile iron, mechanical joint tapping sleeves. Factory epoxy coated steel tapping sleeves are permissible on existing SDR-26 and SDR-21 PVC pipe only.
- B. Provide as a tapping valve a mechanical joint, iron body, resilient seat gate valve, conforming to those described in these Specifications.

- C. Pressure test the tapping sleeve and valve at 150 psi for one (1) hour. The Owner and the Engineer (if applicable) must be given not less than 48 hours advance notice of the test and must be present to witness the test.
- D. The pipe coupon will be carefully preserved and turned over to the Owner.
- E. Provide double strap tapping saddles with AWWA threads and ball valve curb stop with operating nut gate valve for 1-1/2" and 2" taps.
- F. Provide double strap tapping saddle with AWWA threads and corporation stop with AWWA inlet threads for taps 1" and smaller.
- G. All taps must be not less than 18" from a fitting or bell.
- H. The tapping line must be smaller than the tapped line, except as approved by the Owner and the Engineer.
- I. A ductile iron tapping sleeve is required for all taps unless the tapping line is less than 1/2 the diameter of the line to be tapped. A steel tapping sleeve is permissible in those cases.
- J. Cut-in tee construction may be required by the Owner depending on the circumstances and sizes involved.

2.8 VALVE BOXES

- A. Provide cast iron valve boxes with screw type riser sections and a minimum inside shaft diameter of 5-1/4" for all valves 4" and larger installed underground.
- B. Furnish valve box lids with a 1-1/2" deep skirt and the word "water" cast in the top.
- C. Valve boxes are to be adjustable to fit the depth of earth cover over the valve and be designed and installed to prevent the transmission of surface loads directly to the valve or piping. Extensions shall be provided as required to meet grade.
- D. Valve boxes are to be carefully centered over the valve-operating nut so as to permit a valve key to be easily fitted to the operating nut.
- E. Valve box tops are to be set flush with finished grade, with allowance made for the settlement of surrounding backfill or surface. In paved areas, the top of the cover shall be set flush with the finished paving.
- F. Valves lying outside of paved areas shall be provided with an eight inch (8") thick concrete collar surrounding the top of the valve box.

2.9 AIR RELEASE VALVE

- A. Air release valves shall be of the manual type unless otherwise specified.
- B. Air release valves shall have cast iron bodies and stainless steel floats.

2.10 SAMPLE POINTS

- A. Install sample taps required to take all necessary water samples at points designated on the Contract Drawings.

- B. Provide 3/4" type "K" copper tubing or schedule 40 PVC for all in-line sample points.
 - C. The Contractor will make arrangements for a certified laboratory to take all water samples required for bacteriological tests.
 - D. Water main being tested must remain under line pressure throughout the test and until such time as regulatory agency approval to place the main in service has been received by the Owner.
 - E. Following the receipt of regulatory agency approval, the Contractor will remove all sample point tubing and install a brass plug on all sample point corporation stops.
- 2.11 METER BOXES/VAULTS AND YOKES – NOT USED
- 2.12 BACKFLOW PREVENTION DEVICES – NOT USED.
- 2.13 WATER SERVICE LINE – NOT USED.
- 2.14 TRANSITION COUPLINGS
- A. Heavy duty flexible couplings are acceptable for transition joints with existing facilities only.
 - B. Couplings must have stainless steel clamps only and be manufactured by Fernco, or approved equal.

PART 3 -- EXECUTION

3.1 MARKING BY MANUFACTURER

- A. Provide pipe with special markings indicating the weight, class of pipe, casting period, manufacturer's mark and the year the pipe was produced.

3.2 TESTING

- A. All tests are to be made in the presence of the Owner and the Engineer (if applicable), unless waived in writing.
- B. Notify the Owner not less than 48 hours prior to performing a test.

3.3 INSTALLATION

- A. All work must conform to the latest revision of AWWA C-600.
- B. A pre-construction meeting must be held prior to beginning any work. All necessary permits must be obtained and presented at the pre-construction meeting.
- C. The Owner and the Engineer (if applicable) must be given not less than 72 hours notice prior to beginning construction.
- D. Avoid causing damage when loading and unloading pipe, fittings, valves and accessories.
- E. Place pipe and fittings along the route of construction with spigots pointing in the direction of flow and situated to cause the least interference with pedestrian and vehicular traffic. Pipe shall be handled by mechanical equipment.

- F. Clean and inspect all pipe to insure that no dirt or foreign material are in the finished line.
- G. Groundwater and trench water are to be kept out of the pipe and the pipe kept closed with a test plug when work is not in progress.
- H. Trenches are to be dewatered and the cost thereof included in the price for installing the water line. All pipes shall be laid in trenches having a dry and stable bottom.
- I. Pipe is to be laid to line and grade with valves and hydrant stems plumb. Minimum cover is 36" for pipes 12" and larger and 30" for pipes 10" and smaller, unless otherwise noted on the plans.
- J. Deflections from a straight line or grade made necessary by field conditions are not to exceed the manufacturer's recommendations. If the specified alignment requires deflection in excess of that recommended by the manufacturer, provide fittings in accordance with these Specifications.
- K. Commence laying of the water line immediately after the excavation is started and keep pipe laying closely behind the trenching.
- L. Excavation may be stopped when, in the opinion of the Engineer, the trench is open too far in advance of the pipe laying operation. Pipe shall be fully supported along its entire length. Backfill shall be free of boulders and debris. Sharp or rocky material encountered in the base shall be replaced with proper bedding.
- M. Damaged or unsound pipe or fittings will be removed and replaced by the Contractor at no additional cost to the Owner.
- N. Remove from the pipe all lumps, blister, excess coating material and oil prior to jointing of the pipe.
- O. Water lines are to be thrust blocked or restrained to prevent movement of lines under pressure. Provide thrust blocks, anchor blocks, or restrained joints at all bends, tees, crosses, wyes, plugs and behind all main line taps.
- P. Provide support thrust blocks or restrained joints (megalugs or approved equal) at all main line valves, hydrant valves, tapping valves and tapping sleeves.
- Q. All joints are to be watertight. Leaks or defects will be repaired immediately.
- R. Pipe which has been disturbed after being laid will be taken up, the joints cleaned, and the pipe properly re-laid. Superfluous material inside the pipe must be flushed or removed by means of an approved follower or scraper after joints are made.
- S. Install fittings and pipe joints in strict accordance with the manufacturer's specifications and recommendations.
- T. Place EMS magnetic markers horizontally 12" above all bends and changes in alignment.
- U. Unanticipated conflicts with other underground utilities must be immediately brought to the attention of the Owner and the Engineer (if applicable). Resolution of each conflict must receive prior approval from the Owner and the Engineer.
- V. Any proposed deviations from the Contract Drawings must be approved by the Engineer and the Owner.

- W. Maintain 10' horizontal separation (centerline of pipe to centerline of pipe) from sanitary sewer mains and 5' horizontal separation (outside of pipe to outside of pipe) from drainage pipes. Where 10' separation cannot be maintained between sanitary sewers and water mains, a lesser separation may be permitted provided restrained joint ductile iron pipe is used. Maintain 15' horizontal separation from buildings, top of bank of lakes and canals, and other structures, unless otherwise approved by the Owner.
- X. Maintain 18" vertical separation (centerline of pipe to centerline of pipe) between all pipes, if possible. Where 18" separation cannot be maintained between gravity sewers and water mains, a 6" separation may be permitted provided D.I.P. is used.
- Y. Ductile Iron Pipe is required in the following circumstances:
1. Water mains 16" in diameter or larger.
 2. Water mains smaller than 6".
 3. Within 10' of gravity or pressure sewage pipes.
 4. Within 10' of storm sewers and exfiltration trenches.
 5. Within 15' of building structures.(near side of concrete footing).
 6. Within 15' of the top of canal and lake banks.
 7. Crossings under any wastewater, reclaimed water, and storm drainage pipes with no joints within 10' of the crossing.
 8. Crossings over wastewater, reclaimed water, and storm drainage pipes with less than 18" vertical separation with no joints within 10' of each other.
 9. Jack and bores (mechanical joint with MEGALUGS or equal).
 10. Within the right-of-way of major roads as determined by the Owner and as shown on the Contract Drawings.
 11. Under existing or proposed paved areas, including bicycle paths, sidewalks and parking areas.
- Z. Water mains shall not be laid in fuel contaminated areas.
- AA. Unnecessary transitions between ductile iron pipe and PVC pipe that are not specified or required by the Contract Drawings are not permitted.

3.4 MISCELLANEOUS INSTALLATION CONDITIONS

- A. New connections to existing mains are to be made using proper specials and fittings to suit the actual conditions.
- B. Verify all pipe dimensions before ordering special fittings and couplings.
- C. Locate existing in-line fittings and valves prior to starting trench work on a line to be connected to an existing fitting or valve.
- D. Line tie-ins are to be done on a date and at a time approved by the Owner.

- E. All connections to existing mains shall be made under the direct supervision of the Owner. Valves on existing mains shall be operated only by the Owner's personnel.
- F. If service must be cut off to existing customers, the Owner must receive four (4) days prior notice to make necessary notifications. The Contractor may be required to assist the Owner in making notifications.
- G. In the event of cutting off service to existing customers, the Contractor shall be ready to proceed with as much material pre-assembled as possible at the site to minimize the length of service interruption. Such connections may be required to be made at night to minimize the effects on existing customers. The Owner will postpone a service cut-off if the Contractor is not ready to proceed on schedule.
- H. Local chlorination will be required for all pipe and fittings used to complete connections with potable water.

3.5 FIELD INSPECTION OF SYSTEM

- A. Furnish and install temporary testing plugs or caps for the water line, all necessary pressure pumps, hose, pipe connections, meters, gauges and other similar equipment for conducting pressure and leakage tests and flushing of the new water lines.
- B. Perform tests between valves and in sections not exceeding 1,500 lineal feet in length. Use potable water from a source approved for use by the Owner.
- C. Mains tested shall either be physically separated from existing potable water lines or isolated from existing lines by a double valve arrangement.
- D. Maintain a water line pressure of at least 150 psi for a period of not less than two (2) hours. All joints, fittings and thrust blocks must be exposed during the pressure test.
- E. The maximum quantity of water that must be supplied into the tested pipe to maintain pressure within 5 psi of the specified test pressure shall not exceed 50% of the applicable AWWA C-600 Standard.
- F. Uncover and repair leaks evident at the surface regardless of the total leakage indicated by the test. Remove all pipe, valves, fittings and other materials found defective under the test at no additional expense to the Owner. Tests will be repeated until leakage has been reduced below the allowable amount.
- G. The Contractor is responsible for the ultimate tightness of the water line within the preceding requirements. Necessary modifications to the foregoing procedure are subject to prior approval by the Engineer and the Owner.
- H. Inspections will be scheduled for regular working hours only, except for nights when service interruptions are involved. Inspections will not be scheduled for weekends or holidays.
- I. Inspectors will make routine passes on call to inspect such items as thrust blocks, material on-site and clearances between conflicting lines.
- J. Scheduled inspections are required for jack and bores, pipe slippage through jack and bore casings, main line taps, pressure and leakage tests, flushing of sections of completed mains and any time an existing facility of the Owner is to be connected to.

3.6 THRUST BLOCKS

- A. Brace all fittings, hydrants, and plugs with concrete thrust blocks of adequate size placed between the fittings and the side of the trench in accordance with the details shown in the Contract Drawings.
- B. Fittings, hydrant bases, and plugs are not to be encased in concrete.
- C. Thrust blocks are to remain uncovered until inspected and approved by the Owner.
- D. At all thrust blocks, visqueen protection of plugs and bolts shall be provided.

3.7 CONCRETE

- A. Provide ready-mixed concrete for thrust blocks, encasements, and protective slabs having a 28-day compressive strength not less than 2,500 psi.

3.8 FINAL CONNECTION

- A. No connection of the new water main to an existing water main in service shall be made until all tests, including but not limited to pressure, leakage, and bacteriological clearance tests, have been completed and are approved. Thorough flushing of the new water main must also be completed.

3.9 RESTORATION AND CLEAN-UP

- A. All areas disturbed by the Work shall be immediately cleaned and restored in to its original condition or better by the Contractor at no cost to the Owner.

END OF SECTION

SECTION 33 95 45 – DUCTILE IRON PRESSURE PIPE AND FITTINGS

PART 1 -- GENERAL

1.1 THE SUMMARY

- A. The WORK covered by this section and the related sections following consists of providing all labor, equipment, material and supplies and performing all operations required to install ductile iron piping and fittings, complete, with appurtenances for pressure systems (e.g., lift stations, potable water and force mains), as specified and shown on the contract drawings
- B. Related sections:
 - 1. Section 01 11 00 – Summary of Work
 - 2. Section 01 33 00 – Submittals Procedures
 - 3. Section 01 74 30 – Pressure Pipe Testing and Disinfection
 - 4. Section 03 30 00 – Cast-in-Place Concrete
 - 5. Section 31 23 00 – Excavation and Fill
 - 6. Section 31 23 13 – Subgrade Preparation
 - 7. Section 31 23 19 - Dewatering
 - 8. Section 31 23 33 – Trenching and Backfilling
 - 9. Section 33 26 60 – Water Transmission Systems

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. AWWA C105 Polyethylene Encasement for Ductile-Iron Pipe Systems
- B. AWWA C110 Ductile-Iron and Gray-Iron Fittings, 3-in through 48-in for Water
- C. AWWA C111 Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
- D. AWWA C115 Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges
- E. AWWA C116 Protective Fusion-Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings for Water Supply Service.
- F. AWWA C150 Thickness Design of Ductile-Iron Pipe
- G. AWWA C151 Ductile-Iron Pipe, Centrifugally Cast for Water
- H. AWWA C153 Ductile-Iron Compact Fittings. for Water Service
- I. AWWA C600 Installation of Ductile Iron Water Mains and Their Appurtenances

J. AWWA C606 Grooved and Shouldered Joints

1.3 CONTRACTOR SUBMITTALS

A. Furnish Submittals in accordance with Section 01 33 00 – Submittal Procedures and the following supplemental requirements:

B. Shop Drawings

1. Certified dimensional drawings of valves, fittings, and appurtenances.
2. For pipe 24-inches diameter and larger, line layout and marking diagrams which indicate the specific number of each fitting and the location and the direction of each fitting in the completed line. In addition, the line layouts shall include: the pipe station and invert elevation at changes in grade or horizontal alignment; elements of curves and bends, both in horizontal and vertical alignment; and the limits of each reach of restrained joints, or of concrete encasement.

C. **Certifications:** Certified affidavit of compliance for pipe and other products or materials furnished under this Section and as specified in the referenced standards and the following supplemental requirements:

1. Physical and chemical properties.
2. Hydrostatic test reports.

D. The CONTRACTOR shall be responsible for performing and paying for sampling and testing as necessary for the certifications.

E. QUALITY ASSURANCE

1. Where local building and/or plumbing codes conflict with the use of any material, pipe, or type of fittings, or where the local code is more restrictive or specific than this Specification, the material, pipe or type of fitting producing a better quality or greater quality product and not prohibited by the code shall be utilized.
2. To aid in the proper performance and inspection of the subaqueous work, the Contractor shall furnish the services of competent and registered commercial divers and helpers complete with equipment in such numbers as may be necessary.
3. The Contractor shall at any time permit the Engineer access to the site and provide all equipment and necessary assistance for making subaqueous inspections, including the services of a diver to accompany and assist the Engineer on such inspections.
4. Diving equipment and procedures shall conform with the Bureau of Ship's Diving Manuals NAVSHIPS 0994-001-9010 Occupational Safety and Health Act (OSHA) and all regulations pertaining to underwater construction.
5. The Contractor shall provide or make arrangements for air re-filling facilities and other auxiliary equipment and shall arrange for any emergency facilities needed.

6. **Tests:** Except as modified herein, materials used in the manufacture of the pipe shall be tested in accordance with the requirements of the referenced standards as applicable.
7. The CONTRACTOR shall perform said material tests as part of the WORK. The ENGINEER shall have the right to witness testing conducted by the CONTRACTOR; provided, that the CONTRACTOR's schedule is not delayed for the convenience of the ENGINEER.
8. 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 OWNER. The additional samples shall be furnished as a part of the WORK.
9. **Inspection:** Pipe shall be subject to inspection at the place of manufacture in accordance with the provisions of the referenced standards, as supplemented by the requirements herein. The CONTRACTOR shall notify the ENGINEER in writing of the manufacturing starting date not less than 14 Days prior to the start of any phase of the pipe manufacture.
10. During the manufacture of the pipe, the ENGINEER shall be given access to areas where manufacturing is in process and shall be permitted to make inspections necessary to confirm compliance with the Specifications.
11. Three certified records of the tests made by the manufacturer or by a reliable commercial laboratory shall be submitted with each shipment of pipe of any type used for force mains.

1.4 WORK INCLUDED

- A. In general, the Work under this Section shall include but is not limited to furnishing and installing the following:
 1. Raw Water Transmission Main:
 - a. Flanged ductile iron pipe and fittings with an interior cement mortar lining for use on aerial crossings.
 - b. Ductile iron restrained mechanical joint pipe and fittings with an interior cement mortar lining for use on subaqueous crossings.
 - c. Ductile iron restrained mechanical joint pipe and fittings with an interior cement mortar lining for use on road crossings.
 - d. Ductile iron push-on pipe with an interior cement mortar lining.
 - e. Ductile iron restrained mechanical joint pipe and fittings with an interior cement mortar lining.
 2. Potable Water Transmission and distribution Main:
 - a. Flanged ductile iron pipe and fittings with an interior cement mortar lining for use on aerial crossings.

- b. Ductile iron restrained mechanical joint pipe and fittings with an interior cement mortar lining for use on subaqueous crossings.
 - c. Ductile iron restrained mechanical joint pipe and fittings with an interior cement mortar lining for use on road crossings.
 - d. Ductile iron push-on pipe with an interior cement mortar lining.
 - e. Ductile iron restrained mechanical joint pipe and fittings with an interior cement mortar lining.
- 3. Domestic Wastewater Force Main:
 - a. Flanged ductile iron pipe and fittings with an interior ceramic epoxy coating for use on aerial crossings.
 - b. Ductile iron restrained mechanical joint pipe and fittings with an interior ceramic epoxy coating for use on subaqueous crossings.
 - c. Ductile iron restrained mechanical joint pipe and fittings with an interior ceramic epoxy coating for use on road crossings.
 - d. Ductile iron push-on pipe with an interior ceramic epoxy coating.
 - e. Ductile iron restrained mechanical joint pipe and fittings with an interior ceramic epoxy coating.
- 4. Membrane Concentrate Force Main: (Not used.)
- B. The Work shall also include the furnishing of all labor, materials, equipment including buoys, sounding equipment, lights, transportation, and performing all operations necessary for the proper construction of the project in accordance with these Specifications and as shown on the Contract Drawings.
- C. Where the term "subaqueous work" is used herein or where "subaqueous" is referred to, this shall be understood to mean work under water using equipment and methods that are accepted practice for such work.
- D. Where the term "aerial crossing" is used herein, this shall be understood to mean work over water using equipment and methods that are accepted practice for such work.
- E. Where the term "road crossing" is used herein, this shall be understood to mean work under or across an existing paved roadway or thoroughfare using equipment and methods that are accepted practice for such work.

PART 2 -- PRODUCTS

2.1 GENERAL EQUIPMENT REQUIREMENTS

- A. Lined and polyethylene-wrapped ductile iron pipe shall conform to AWWA C151 and C105, subject to the supplemental requirements in this Section. The pipe shall be of the diameter and class indicated, shall be provided complete with rubber gaskets, specials, and fittings as required under the Contract Documents.
- B. **Markings:** The CONTRACTOR shall legibly mark specials 24-inches diameter and larger in accordance with the laying schedule and marking diagram. Each fitting shall be marked at each end with top field centerline.
- C. **Handling and Storage:** The pipe shall be handled as a minimum at the 1/3 points by use of wide slings, padded cradles, or other devices designed and constructed to prevent damage to the pipe coating/exterior. The use of chains, hooks, or other equipment that might injure the pipe coating/exterior will not be permitted. Stockpiled pipe shall be supported on padded skids, sand or earth berms free of rock exceeding 3-inches diameter, sand bags, or suitable means so that the coating will not be damaged. The pipe shall not be rolled and shall be secured to prevent accidental rolling
- D. **Laying Lengths:** Nominal 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.
- F. **Closures and Correction Pieces:** Closures and correction pieces shall be provided 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 on the Drawings. The locations of correction pieces and closure assemblies are indicated. Any change in location or number of said items shall only be as accepted by the ENGINEER.

2.2 MATERIALS

A. Ductile Iron Pipe:

- 1. Ductile Iron Pipe shall be centrifugally cast in metal or sand lined molds conforming to ANSI/AWWA C151 A21.51, latest revision. Minimum pressure class as per ANSI/AWWA C150/A21.50, shall be as follows:

Pipe Size	Rated Working Pressure (psi)	Rated Working Plus Surge Pressure (psi)
3" and 4"	350	500
6" to 18"	350	500
20"	300	450
24"	250	400
≥30"	200	350

- a. All ductile iron pressure pipe shall be manufactured to withstand an additional 100 psi surge allowance over and above the rated water working pressure specified herein.

- b. All piping shall be factory pressure tested, including end connections and weld-on outlets.
2. Minimum Special Thickness Class 53 is required for all flanged pipe.
3. All ductile iron pipe and fittings installed for potable water transmission mains and/or raw water transmission main shall be furnished with an interior cement mortar lining per AWWA C-104 A21.50. All flanges shall be made of ductile iron. Flanged piping shall use Toroseal gaskets or approved equal.
4. All ductile iron pipe and fittings installed for domestic wastewater force mains shall be furnished with an interior ceramic epoxy coating.
5. Types of Joints:
 - a. Push-On Joint - ANSI/AWWA C111 A21.11.
 - b. Flanged Joint - ANSI/AWWA C110 A21.10 or C115 A21.15.
 - c. Restrained Mechanical Joints - ANSI/AWWA Standard C111/A21.11 using T-head bolts, coupling nuts and threaded studs.

B. Polyethylene Encasement Material:

1. Ductile Iron Pipe furnished and installed under this Contract shall be polyethylene encased in the areas shown on the Contract Drawings and in the field as directed by the Engineer. The Contractor shall supply all encasement materials.
2. The material shall be extruded tube form, flat sheets of high quality virgin polyethylene, 8 mils thick, pigmented with 2.0% to 2.5% of well dispersed carbon black with stabilizers. Minimum tensile strength will be 500 volts per mil thickness.
3. A plastic adhesive tape approximately two inches wide will be used to close seams and overlaps. The tape must bond securely under water to polyethylene and metal surfaces. Approved types are Polyken No. 900 Polyethylene, Scotchrap No. 50 Polyvinyl, or equal. The tape material and installation procedures shall conform to ASTM A674.

2.3 FITTINGS

- A. Ductile Iron Fittings shall be as shown on the Contract Drawings and shall conform to the following:**
1. Mechanical Joint and Flanged Fittings - ANSI/AWWA C110 A21.10, AWWA C-153, and ANSI/AWWA C111 A21.11.
 2. Ductile Iron Fittings shall be centrifugally cast in metal or sand lined molds and conform to ANSI/AWWA C151 A21.51, latest revision. Minimum pressure rating shall be as follows:

Fitting Size	Rated Working Pressure (psi)	Rated Working Plus Surge Pressure (psi)
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3" to 20"	350	500
24"	250	400
≥ 30"	200	350

All ductile iron fittings shall be manufactured to withstand an additional 100 psi surge allowance over and above the rated water working pressure specified herein.

- B. Welded-on outlets may be used in place of reducing tees and reducing crosses, if the nominal outlet diameter is not more than 2 DIP sizes less than the nominal pipe diameter. If welded-on outlets are used, show and note on the line laying drawings and submit with shop drawings for the Engineer's approval prior to fabrication.

2.4 RESTRAINED JOINTS

- A. Mechanical joint restraint shall be incorporated in the design of the follower gland and shall include a restraining mechanism which, when actuated, imparts multiple wedging action against the pipe, increasing its resistance as the pressure increases.
- B. Lengths of pipe restraint specified on the drawings are approximations only. Actual lengths of restrained joint pipe required for installation shall be based on the calculation specified herein. The Contractor and the pipe manufacturer shall coordinate to ensure that adequate lengths of joint restraint are called out on the line laying schedule.
- C. Flexibility of the joint shall be maintained after burial. Glands shall be manufactured of ductile iron conforming to ASTM A 536-80.
- D. Restraining devices shall be of ductile iron heat treated to a minimum hardness of 370 BHN. Dimensions of the gland shall be such that it can be used with the standardized mechanical joint bell and tee-head bolts conforming to ANSI/AWWA A21.11 and ANSI/AWWA C153/A21.53 (latest revision).
- E. Twist-off nuts shall be used to insure proper actuating of the restraining devices.
- F. The mechanical joint restraint device shall have a water working pressure of at least 250 psi with a minimum safety factor of 2:1.

2.5 CERAMIC EPOXY COATING

- A. The interior of all domestic wastewater force main ductile iron pipe and fittings shall be furnished with a factory applied ceramic epoxy coating.
- B. Condition of the Pipe Prior to Surface Preparation:
 - 1. All pipe and fittings shall be delivered to the application facility without asphalt, cement mortar lining, or any other coating or lining on the interior surface.
- C. Coating Material:
 - 1. The material shall be an amine cured novalac epoxy containing at least 20% by volume of ceramic quartz pigment.

2. Coating shall be "Protecto 401 Ceramic Epoxy", "Linerguard 100", or PERMITE 9043 type 2", no equal.

D. Coating Application:

1. Coating shall be applied by a competent firm with a successful history of applying coatings to the interior of pipe and fittings.
2. Prior to abrasive blasting, the entire area to receive the protective compound shall be inspected for oil, grease, etc. Any areas where oil, grease, or any substance which can be removed by solvent is present shall be solvent cleaned using the guidelines outlined in DIPRA-1 Solvent Cleaning.
3. After the surface has been solvent cleaned, all areas to receive the protective compounds shall be abrasive blasted using compressed air nozzles with sand or grit abrasive media. The entire surface to be lined shall be struck with the blast media so that all rust, loose oxides, etc., are removed from the surface.
4. Only slight stains and tightly adhering annealing oxide may be left on the surface. Any area where rust reappears before lining must be re-blasted.
5. Within eight hours after completion of surface preparation, the interior of the pipe and fittings shall receive 40 mils nominal dry film thickness of Protecto 401. No coating shall take place when the substrate or ambient temperature is below 40° F. The surface must be dry and dust free.
6. If flange pipe or fittings are included in the project the coating shall not be applied on the face of the flange.
7. The gasket area and spigot end up to six inches back from the end of the spigot end must be coated with 6 mils nominal, 10 mils maximum Protecto Joint Compound. The joint compound shall be applied by brush to ensure coverage. Care shall be taken to ensure that the joint compound is smooth without excess buildup in the gasket seat or on the spigot ends. Coating of the gasket seat and spigot ends shall be done after application of the pipe coating.
8. The number of coats applied to achieve 40 mils nominal DFT shall be as recommended by the coating manufacturer. In no case shall the material be applied above the DFT per coat recommended by the coating manufacturer in printed literature. The maximum or minimum time between coats shall be as recommended by the coating material manufacturer. No material shall be used for coating that is not indefinitely re-coatable with itself without roughening of the surface.
9. Procedures for sealing cut ends and repairing field damaged areas of interior coated pipe and fittings shall be in accordance with the coating manufacturers procedures and recommendations.
10. Protecto Joint Compound shall be used for touch-up or repair in accordance with the coating manufacturer's recommendations.

E. Inspection and Certification:

1. Coating shall be checked for thickness using a magnetic film thickness gauge. The thickness testing shall be done using the method outlined in SSPC-PA-2 Film Thickness Rating.
2. The interior coating of all pipe and fittings shall be tested for pinholes with a non-destructive 2,500 volt test. Any defects found shall be repaired prior to shipment.
3. Each pipe joint and fitting shall be marked with the date of application of the coating system along with its numerical sequence of application on that date and records maintained by the applicator of his work.
4. The pipe or fitting manufacturer shall supply a certification attesting to the fact that the applicator met the requirements of this specification, and that the material used was as specified.

F. Handling:

1. Interior coated pipe and fittings shall be handled only from the outside. No forks, chains, straps or hooks shall be placed inside the pipe and fittings for lifting, positioning, or laying.

2.6 POLYETHYLENE LINING

NOT USED.

2.7 MANUFACTURERS

- A. Refer to the Palm Beach County Water Utilities Department Engineering Services Division – Approved Materials and Equipment List (Latest Version)

PART 3 -- EXECUTION

3.1 GENERAL

- A. Pipe must be delivered to the job site by means which will adequately support it, and not subject it to undue stresses. Pipe shall be unloaded carefully and strung or stored as close to the final point of placement as practical.
- B. Utmost care shall be exercised in loading and placing of all pipe, fittings, valves, etc., in order to avoid shock and/or damage. Lifting shall be by hoist or skids when hand lifting is not feasible. Dropping will not be permitted. Pipe handled on skidways must not be skidded or rolled against pipe already on the ground.
- C. Any pipe, special casting, or other appurtenances broken or damaged after delivery to the site shall be replaced by the Contractor at its own expense. All pipes and special castings shall be carefully examined for defects, and no pipe or special casting shall be laid which is known to be defective. If any such pipe or special casting shall be discovered to be defective after being laid, it shall be removed and replaced with a sound casting by the Contractor at its own expense.

3.2 PREPARATION

- A. The layout of some of the piping systems shown on the Contract Drawings is diagrammatic, but shall be followed as closely as the work will permit.
- B. Clean off scale and dirt both inside and outside before assembly. Remove welding slag or other foreign material from piping.
- C. Before running lines, the Contractor shall carefully verify the location, depth, type of joint needed, and size of pipe to which connection is proposed. The Contractor shall then assure itself that the lines can be run as contemplated without interfering with footings, walls, other piping, fixtures, etc. Any necessary deviations shall be referred to the Engineer for final adjustment before lines are run.
- D. All lengths of pipe shall be dimensioned accurately to measurements established at the site, and shall be worked into place without springing or forcing. Cut sections of pipe shall be reamed to remove all burrs.
- E. The Contractor shall cut all pipe and drill all holes that may be necessary, whenever and wherever so required. This work shall be done in a thorough and workmanlike manner.
- F. All field-cut or drilled pipe shall be hermetically sealed along the cut edge and for a distance of six inches inside and outside of the pipe with at least 15 mils of coal tar epoxy such as Koppers Bitumastic 300M or equal applied in no less than two coats, each coat having a different color.
- G. Changes in direction, unless otherwise noted on the Contract Drawings or approved by the Engineer, shall be made with restrained mechanical joint fittings. The bending of pipe is strictly prohibited.
- H. Any transition from one pipe size to another shall be made with a reducing fitting. Reducing bushings are prohibited except where specifically called for on the Contract Drawings.
- I. Deflection of piping at joints is permitted. The maximum allowable deflection shall be 50% of the maximum allowable deflection recommended by the pipe manufacturer.

3.3 INSTALLATION OF PIPING

- A. Lines, Grades, Stakes and Templates:
 - 1. The Contractor shall, at its own expense, furnish all stakes, templates, patterns, platforms, and labor required in the layout of any part of the Work.
 - 2. The line and grade of all piping, as well as the location of all appurtenances, will be as shown on the Contract Drawings, or as directed by the Engineer.
 - 3. The Contractor shall give the Engineer a minimum of 48 hours notice for any engineering or inspection necessary to continue or complete the Work.
 - 4. The Contractor shall establish all limit marks and bench marks reasonably necessary for the execution of the Work. The locations of all such marks so established shall be

indicated and identified on the project record drawings as maintained by the Contractor.

B. Excavation:

1. The Contractor shall perform all excavation required for the installation of all parts of the project. All excavation shall be in strict accordance with the requirements of Section 31 23 00.
2. The excavation of the trench shall not advance more than 100 feet ahead of the completed pipe work except where in the opinion of the Engineer it is necessary to drain wet ground, or for other reasons as approved by the Engineer.
3. All excavations shall be made by open cut except as shown on the Contract Drawings. The sides of the trench shall be kept as nearly vertical as possible, especially from the trench floor to a level of one foot above the top of the pipe. Trench bottoms shall not be less than 16 inches wider nor more than 24 inches wider than the outside diameter of the pipe laid therein, and shall be excavated true to line, so that a clear space of not less than eight inches nor more than twelve inches in width is provided on each side of the pipe.
4. The bottom of trenches shall be accurately graded to provide uniform bearing and support for each section of pipe on undisturbed soil at every point along its entire length, except for portions of the pipe sections where it is necessary to excavate for bell holes. Bell holes shall be excavated only to an extent sufficient to permit accurate work in the making of the joints and to ensure that the pipe, for a maximum of its length, will rest upon the prepared bottom of the trench.
5. Excavation carried beyond or below grades specified by the Engineer shall be backfilled at the Contractor's expense with earth, sand, or gravel as directed by the Engineer, and shall be thoroughly tamped.
6. The materials excavated shall be deposited on the sides of the trenches and beyond the reach of slides, with the banks trimmed up so as little inconvenience as possible is made to public travel or occupants of adjoining property.
7. Sidewalks, roads, streets, and pavements shall not be obstructed by excavated materials, except as authorized by the Engineer. In this case, adequate temporary provisions will be made for a satisfactory temporary passage of pedestrians and vehicles.
8. Adequate bridging and planked crossings must be provided and maintained across all open trenches for pedestrians and vehicles. Barriers, lights, flares and any other necessary warning devices shall be provided and maintained by the Contractor at trenches, excavations and embankments, at no additional compensation.
9. In case it is necessary to place excavated material adjacent to buildings, the Contractor shall erect barriers to keep the earth at least four feet from the front of such buildings. In case earth is deposited on grass plots, the Contractor shall remove it carefully when backfilling so as to not destroy the grass. All shade trees, shrubs, etc., along the line of construction shall be reasonably protected.

10. The Contractor shall, without additional expense, provide suitable temporary channels for any water that may flow along or across the site of the Work.
11. Where the bottom of the trench is found to consist of material which is unstable to such a degree that, in the opinion of the Engineer, it cannot be removed and shaped to adequately support the pipe, the trench bottom shall be stabilized by the Contractor to the satisfaction of the Engineer, without extra compensation.
12. The Contractor shall excavate the trench for subaqueous crossings to the elevations and typical sections shown on the Contract Drawings:
 - a. Trench bottoms shall be excavated to the bottom grade at which the pipe is to be laid, plus over dig as necessary. Excavation in water shall be made from equipment by use of approved methods. The trench will remain open until the pipe can be properly laid.
 - b. Excavated material shall be stored in such a manner as not to interfere with the progress of the Work. Excavated material may be used to refill the trench, subject to the requirements outlined herein.
 - c. Excess materials shall be spread over the top of the trench to bring areas to final finished grade. If additional material is required, the Contractor will furnish acceptable material from other sources.
 - d. All unsuitable material will be stock-piled and disposed of by the Contractor in a manner meeting the approval of the Engineer.
 - e. The Contractor shall anticipate that the work will be performed under the vigilance and periodic inspection of the Lake Worth Drainage District (LWDD), the Palm Beach County Public Health Unit (PBCPHU), the Palm Beach County Department of Engineering and Public Works, the Florida Department of Transportation (FDOT), and the Florida Department of Environmental Protection (FDEP), and shall be assumed to have acquainted himself not only with the conditions of their permits and/or approvals, but with the laws, statutes and regulations pertaining to this and similar work, with particular regard to allowable levels of turbidity in adjacent waters, disposal of normal and excess excavation, ecological aspect, and restoration.
 - f. Upon completion of the Work, all trenches shall have been backfilled to a level equal to the original contour of the site before the start of construction and at least three feet above the top of the new pipeline. Backfilling shall be accomplished as the Work progresses.

C. Pipe Clearances in Rock:

1. Ledge rock, boulders and large stones shall be removed to provide a clearance of at least six inches below and on each side of all pipe, valves and fittings. Before the pipe is laid, all irregularities of the rock are to be filled with earth or sand well rammed into place and the bottom of the trench brought to proper grade.

2. The specified minimum clearances are the minimum clear distances which will be permitted between any part of the pipe and appurtenances being laid and any part, projection, or point of such rock, boulder or stone.

D. Blasting:

1. Blasting for rock excavation will not be permitted.

E. Bracing and Shoring:

1. The Contractor shall do all bracing, sheeting and shoring necessary to perform and protect all excavations as required for safety and as otherwise directed by the Engineer.

F. Dewatering:

1. The Contractor shall at all times during construction of the Work, provide and maintain ample means and devices with which to promptly and efficiently remove and properly dispose of all water entering trenches and excavations and keep said excavations dry until the structures to be built thereon are completed.
2. No pipe joints shall be made in water, nor shall water be allowed to rise over masonry or mortar until the concrete or mortar has set for at least 24 hours. Dewatering operations shall be in strict accordance with the requirements of Section 31 23 19.

G. Bedding and Base Fill:

1. After pipe joints have been inspected and given preliminary approval, and sufficient time has elapsed for setting of joints, backfilling shall be performed by hand, together with tamping, until fill has progressed to an elevation at least one foot above the top of the pipe.
2. During this initial stage of backfilling, approved granular materials or loose soil free from lumps, organic materials or stones shall be deposited in layers six inches thick and compacted by hand, or with manually operated machine tampers actuated by compressed air or other suitable means. Tamps and machines shall be suitable for the Work.
3. It is the intention of these Specifications to lay the subaqueous crossing pipe on a sand or crushed gravel foundation. Should rock be encountered above the trench bottom it shall be excavated to a depth of twelve inches under the pipe to allow for placing sand or crushed gravel bedding material.
4. In no case shall the gradient or alignment of any aerial, subaqueous, or road crossing be changed from that indicated on the Contract Drawings without the permission of the Engineer.

H. Backfilling:

1. The Contractor shall perform all backfilling that may be required for the installation of any and all parts of the Project. Backfilling shall be performed in accordance with Section 31 23 33.

2. After the pipe is laid as specified herein, the trench shall be backfilled with selected fine materials from the excavation or borrow.

I. Clean-Up:

1. The Contractor shall clean up and legally dispose of all trash, wood forms and other debris and restore the job site to a condition acceptable to the Owner.
2. Excess excavated material within the FDOT right-of-ways shall be hauled to a located designated by the Engineer, within 20 miles. The Contractor shall include in the cost of the pipe installation removal and disposal of all excess excavated material.
3. Pipe laying operations shall not be permitted to extend excessive distances ahead of clean-up. Unless otherwise directed by the Engineer, clean-up activities shall not lag behind pipe installation by more than 500 feet.

J. Tees, Crosses, Bends, Plugs, Caps, Blind Flanges, Etc.:

1. Standard plugs shall be inserted into the bells of all dead end pipes, tees or crosses; spigot ends shall be capped; flanged ends shall have suitable blind flanges.
2. All tees, crosses, bends, plugs, and other fittings shall be mechanically restrained in accordance with the pipe manufacturers design manual for restrained joints.
3. In addition to full mechanical restraint, concrete reaction or thrust blocks may be used for supplemental restraint at all tees, crosses, plugs, caps, and at bends deflecting 11-1/4 degrees or more.
4. Concrete reaction or thrust blocks shall have a 28-day compressive strength of not less than 2,500 psi. The concrete mix shall consist of one part cement, two parts sand and five parts stone or gravel, by weight.
5. Concrete reaction or thrust blocks are to be poured between undisturbed solid ground and the fitting. The concrete will be so placed that pipe joints and fitting joints will be accessible for repair.

K. Temporary Plugging:

1. Piping shall be temporarily plugged at the end of each day's work. Plugging shall be adequate to prevent the entry of animals into the pipe or the entrance or insertion of deleterious materials. Plugs installed for pressure testing shall be fully secured and blocked to withstand the test pressure.
2. Where plugging is required because of contract division or phasing for later connection, the ends of such lines shall be equipped with a permanent type plug or

blind flange. Installation or removal of such plugging shall be considered incidental to the Work.

L. Flanged Joints:

1. Care shall be taken in bolting flanged joints that there is no restraint on the opposite end of the that would prevent pressure from being evenly and uniformly applied on the gasket.
2. Bolts shall be gradually tightened, each in turn, at a uniform rate of gasket compression around the entire flange.

M. Pipe Laying in Cinders:

1. Where pipe must be laid through cinder fill, garbage dumps, slag piles, or where harmful corrosive conditions exist in the soil, notify the Engineer immediately.
2. At the Engineer's direction, encase the pipe in accordance with subsection 2.1.C of these specifications and backfill with sand, limestone, or shell material.

N. Subaqueous Crossing:

1. Subaqueous piping shall be placed by suitable means to the line and grade shown on the profile. The actual work of laying the pipe shall be accomplished by experienced personnel well qualified in this type of work.
2. Sand bags may be used to support the pipe in the ditch but no pipe shall be laid on blocks. Before backfilling, the barrel of the pipe shall be firmly supported along its entire length by the sand or crushed bedding.
3. The Engineer shall approve each section of pipe installed prior to and after placing backfill. Such approval shall not relieve the Contractor of the responsibility of re-excavating for and repairing any leaks discovered when the hydrostatic pressure test is applied.
4. Precautions shall be taken during installation to prevent silt and other foreign matter from entering the pipeline. Sheet piling may be required where the trench is in muck.
5. Before assembling the pipe all lumps, blisters and excess coal tar coating shall be removed from the mating ends of each pipe, and both bell and spigot ends shall be wire-brushed and wiped clean and dry.
6. The method of assembly of the locked joint type of fittings and the ball type joints shall be in accordance with these Specifications and the Manufacturer's recommendations and standards.
7. Where required, the Contractor shall use a non-toxic type lubricant for assembly of rubber gasket joints in accordance with the manufacturer's recommendations.

O. Turbidity Control:

1. The Contractor shall take adequate precautions to minimize siltation and bank erosion in waterways.

2. The Contractor must control turbidity on subaqueous and aerial crossing work so that it does not exceed established background turbidity by more than 50 Jackson Turbidity Units (JTU's) at a distance greater than 100 feet from the point of work.
3. This shall be done by the use of four turbidity screens suspended by floats or other methods approved by the Engineer. The turbidity screens shall be spaced twenty-five feet apart, with two screens on each side of the crossing.

P. Conformity with Permits and Regulations:

1. The subaqueous and aerial construction is licensed under formal permits issued by the Lake Worth Drainage District and the State of Florida Department of Environmental Regulation. Permits shall be obtained by the Owner with copies provided to the Contractor.
2. The Contractor shall comply with all regulations, conditions and other requirements promulgated under these permits or by other governmental agencies having jurisdiction.

Q. Crossing Signs:

1. The Contractor shall install a sign at each location where the pipeline crosses the shoreline.
2. The sign shall be 3/32 inches thick aluminum and shall conform to Sections 700-1 through 700-7 of the F.D.O.T. Specifications, latest revision. The signs shall be painted with baked enamel.
3. All sign dimensions and design shall be in accordance with the U.S. Department of Transportation, Federal Highway Administration Manual of Uniform Traffic Control Devices and as specified on the Contract Drawings.
4. All sign installations shall conform to the F.D.O.T. Specifications, Section 700-8 and 700-9, and as approved by the Engineer.

R. Restrained Joints:

1. Restrained joints shall be provided as shown on the Contract Drawings.
2. Restrained joint fittings shall be constructed using a PBCWUD approved field installed joint restraint system capable of holding against line pressures up to the rated water working pressure as specified below (with a 2:1 safety factor):

Nominal Pipe Size	Rated Working Pressure (psi)	Rated Working Plus Surge Pressure (psi)
3" to 20"	350	500
24"	250	400
≥ 30"	200	350

3. The minimum number of restrained joints required for resisting forces at fittings and changes in direction of pipe is shown on the Contract plans. The pipe manufacturer

will verify that the length of restraint indicated on the plans is adequate. The parameters that shall be used to verify the minimum length of restraint will be calculated based on "Thrust Restrain Design for Ductile Iron Pipe", developed by "The Ductile Iron Pipe Research Association", program version 3.2 (7/27/99) with cover according to profile, laying condition type 5, soil designation as sand-silt and safety factor 1.5 design pressure of 150 psi.

3.4 PIPELINE TESTING

- A. All pipe shall be hydrostatically tested in accordance with Section 01670.
- B. Before testing, all parts of the pipeline must be backfilled and braced sufficiently to prevent movement under pressure. If concrete thrust blocks are used, ample curing time must be provided prior to pressure testing to allow time for concrete to gain strength. Test ends shall be capped and braced to withstand the thrust developed under test pressure.
- C. All sections of lines must be thoroughly flushed and filled with clean water obtained from an approved source. Air shall be vented from all high points in the pipeline before conducting pressure and leakage tests. Prior to beginning testing, the temperature of the pipeline and of the test water shall be allowed to equalize.
- D. All pipelines shall be disinfected and bacteriologically cleared to potable water main standards of the Palm Beach County Public Health Unit (PBCPHU) and the State of Florida Department of Environmental Protection (FDEP).

3.5 PIPELINE CLEANING

- A. The entire length of pipeline shall be cleaned and flushed.
- B. Potable water supplied by the Owner shall be used for flushing the pipeline.

3.6 DISINFECTION

- A. Disinfection of the pipeline shall be accomplished after successful pressure testing in accordance with Section 01 74 30 and cleaning in accordance with Section 01 74 40.
- B. The disinfecting agent shall be liquid chlorine or sodium hypochlorite solution. Dry hypochlorite, similar or equal to "HTH" may also be used.
- C. The piping shall be disinfected by the introduction of a disinfecting agent into potable water being pumped into the system, in such a manner that the entire system is filled with water containing a minimum chlorine concentration of 50 PPM throughout the pipeline.
- D. The disinfected water will be allowed to remain in the pipeline for a minimum contact period of eight hours before the system is flushed. After the disinfecting agent has been permitted to remain for the specified contact period, the pipeline and valves will be thoroughly flushed with potable water until the residual chlorine concentration is less than 3.0 mg/l.
- E. After the system has been disinfected and flushed as specified herein, samples of water will be taken from the sample points specified on the Contract Drawings, collected in suitable sterilized containers, and forwarded to an independent testing laboratory for bacterial examination.

- F. If the analyzed samples show the presence of coliform bacteria, the disinfection procedure will be repeated by the Contractor until tests indicate the absence of coliforms.
- G. Two consecutive daily samples shall be satisfactorily tested before the system is placed into service. The Contractor is responsible for collection of samples and paying for tests.

END OF SECTION

SECTION 43 30 00 – VALVES GENERAL

PART 1 -- GENERAL

1.1 THE REQUIREMENT

- A. Provide valves, actuators, and appurtenances, complete and operable, as indicated in accordance with the Contract Documents.
- B. The requirements of Section 46 00 00 – Equipment General Provisions, apply to the WORK of this Section.
- C. The provisions of this Section shall apply to all valves and valve actuators except where otherwise indicated.
- D. Valves and actuators in particular locations may require a combination of units, sensors, limit switches, and controls, as indicated.
- E. Support
 - 1. Where a valve is to be supported by means other than the piping to which it is attached, obtain from the valve manufacturer a design for its support and foundation that satisfies the criteria in Section 46 00 00 – Equipment General Provisions.
 - 2. Submit the support design, including drawings and calculations sealed by an engineer, with the Shop Drawings.
- F. Unit Responsibility
 - 1. The CONTRACTOR shall assign a single manufacturer to be responsible for the supply, coordination of design, assembly, testing, and furnishing of each valve; however, the CONTRACTOR shall be responsible to the OWNER for compliance with the requirements of each valve Section. Unless indicated otherwise, the responsible manufacturer shall be the manufacturer of the valve.
- G. Single Manufacturer
 - 1. Where 2 or more valves of the same type and size are required, the valves shall be furnished by the same manufacturer.

1.2 CONTRACTOR SUBMITTALS

- A. Furnish submittals in accordance with the requirements of Section 01 33 00 – Submittal Procedures.
- B. Furnish the following information on Shop Drawings:
 - 1. Valve name, size, Cv factor, pressure rating, identification number (if any), and specification section number;
 - 2. Complete information on the valve actuator, hydraulic power units (HPU), pneumatic air supply system including size, manufacturer, model number, limit switches, and mounting;
 - 3. Cavitation limits for control valves;

4. Assembly drawings showing part nomenclature, materials, dimensions, weights, and relationships of valve handles, hand wheels, position indicators, limit switches, integral control systems, needle valves, and control systems;
 5. Data in accordance with Section 40 05 93 – Common Motor Requirements for Process Equipment, for electric motor-actuated valves;
 6. Complete wiring diagrams and control system schematics; and,
 7. A valve-labeling schedule, listing the valves to be furnished with stainless steel tags, indicating in each case the valve location and the proposed wording for the label.
- C. Furnish a technical manual containing the required information for each valve, as indicated.
- D. Furnish a spare parts list, containing the required information for each valve assembly, as indicated.
- E. Factory Test Data
1. Where indicated, submit signed, dated, and certified factory test data for each valve requiring certification, before shipping the valve.
 2. Furnish a certification of quality and test results for factory-applied coatings.
- F. Field Test Data
1. Submit signed, dated, and certified field test data for each valve.

PART 2 -- PRODUCTS

2.1 PRODUCTS

- A. General
1. Provide valves and gates of new and current manufacture.
 2. Provide valves 6-inch and larger with actuators with position indicators.
 3. Buried valves shall be provided with valve boxes and covers containing position indicators and valve extensions. Manual shut-off valves mounted higher than 7-feet above working level shall be provided with chain actuators.
 4. Unless otherwise indicated, provide valve actuators in accordance with Section 43 30 12 – Valve and Gate Actuators.
 5. All materials, fittings and appurtenances intended for use in pressure pipe systems shall be designed and constructed for a minimum working pressure of 150 psi unless the specific application dictates a higher working pressure.
- B. Protective Coating
1. Coat the exterior surfaces of valves and the wet interior surfaces of ferrous valves of sizes 2-inch and larger in accordance with the requirements of Section 09 96 00 – Protective Coatings.

2. The valve manufacturer shall certify in writing that the required coating has been applied and tested in the manufacturing plant prior to shipment, in accordance with the indicated requirements.
3. Do not coat the machined flange faces of valves except where such flanges are not adjoining a mating flange as shown in the Contract Documents. Apply rust inhibitor coating on machined surfaces of the flange prior to shipment.

C. Valve Labeling

1. Except when such requirement is waived by the ENGINEER in writing, provide a label on shut-off valves and control valves except for hose bibbs and chlorine cylinder valves.
2. Furnish a label composed of 1/16-inch plastic or stainless steel, a minimum of 2 inches by 4 inches in size, as indicated in Section 40 50 02 – Piping Identification, and permanently attached to the valve or on the wall adjacent to the valve as directed by the ENGINEER.

D. Valve Testing

1. As a minimum, unless otherwise indicated or recommended by the reference standards, test valves 3 inches in diameter and smaller in accordance with the manufacturer's standard procedure.
2. Factory-test valves 4 inches in diameter and larger as follows:
 - a. Hydrostatic Testing
 - 1) Subject valve bodies to an internal hydrostatic pressure equivalent to twice the water-rated pressure of the valve.
 - 2) Metallic valves rating pressures shall be based at 100 degrees F.
 - 3) Plastic valves rating pressures shall be based at 73 degrees F, or at a higher temperature according to material type.
 - 4) During the hydrostatic test, there shall be no visible leakage through the valve body, end joints, or shaft seals, nor shall parts of the valve be permanently deformed.
 - 5) Allow test duration of at least 10 minutes, in order to allow visual examination for leakage.
 - b. Seat Testing
 - 1) Test the valves for leaks in the closed position, with the pressure differential across the seat equal to the water rated pressure of the valve.
 - 2) Provide test duration of at least 10 minutes, in order to allow visual examination for leakage.
 - 3) The leakage rate shall be the more stringent of the following:
 - a) As recommended by the reference standard for that type of valve; or

- b) Leakage past the closed valve not to exceed one fluid ounce per hour per inch diameter for metal seated valves, and drop-tight for resilient seated valves.

c. Performance Testing

- 1) Shop-operate the valves from the fully-closed to the fully-open position, and reverse under no-flow conditions in order to demonstrate that the valve assembly operates properly.

E. Certification

1. Prior to shipment of valves with sizes larger than 12-inches in diameter, submit certified, notarized copies of the hydrostatic factory tests, showing compliance with the applicable standards of AWWA, ANSI, or ASTM.

F. Valve Markings

1. Permanently mark valve bodies in accordance with MSS SP25 - Standard Marking Systems for Valves, Fittings, Flanges, and Unions.

2.2 MATERIALS

A. General

1. Provide materials suitable for the intended application.
2. Provide materials in contact with potable water listed as compliant with NSF Standard 61.
3. Ensure that materials not indicated are of high-grade standard commercial quality, free from defects and imperfections that might affect the serviceability of the product for the purpose for which it is intended.
4. Unless otherwise indicated, provide valve and actuator bodies conforming to the following requirements:
 - a. Cast Iron: Close-grained gray cast iron, conforming to ASTM A 48 - Gray Iron Castings, Class 30, or to ASTM A 126 - Gray Iron Castings for Valves, Flanges, and Pipe Fittings
 - b. Ductile Iron: ASTM A 536 - Ductile Iron Castings, or to ASTM A 395 - Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures
 - c. Bronze: ASTM B 62 - Composition Bronze or Ounce Metal Castings, and valve stems not subject to dezincification shall conform to ASTM B 584 - Copper Alloy Sand Castings for General Applications. Bronze materials in contact with potable water service shall be free of lead content meeting the Lead Reduction Act.
 - d. Steel: ASTM A 216 - Steel Castings, Carbon Suitable for Fusion Welding for High-Temperature Service, or to ASTM A 515 - Pressure Vessel Plates, Carbon Steel, for Intermediate- and Higher-Temperature Service

- e. Stainless Steel: Stainless steel valve and operator bodies and trim shall conform to ASTM A 351 - Steel Castings, Austenitic, for High-Temperature Service, Grade CF8M, or shall be Type 316 stainless steel
- f. PVC: Polyvinyl chloride materials for valve body, flanges, and cover shall conform to Cell Classification 12454
- g. CPVC: Chlorinated Poly Vinyl Chloride materials for valve body, flanges, and cover shall conform to Cell Classification 23447
- h. Elastomeric materials used for seat, seals and O-rings shall be compatible with temperature, pressures and fluid or gas service.
- i. NSF Standard 61: Materials shall be listed for use in contact with potable water.

2.3 VALVE CONSTRUCTION

A. Bodies

- 1. Provide valve bodies that are cast, molded (in the case of plastic valves), forged, or welded, of the materials indicated, and with smooth interior passages.
- 2. Provide wall thicknesses uniform and in agreement with the applicable standards for each type of valve, without casting defects, pinholes, and other defects that could weaken the body.
- 3. Perform welds on welded bodies by certified welders and ground welds smooth.
- 4. Provide valve ends as indicated, and rated for the maximum temperature and pressure to which the valve will be subjected.

B. Valve End Connections

- 1. Unless otherwise indicated, valves 2-1/2 inches in diameter and smaller may be provided with threaded end connections.
- 2. Provide valves 3 inches in diameter and larger with flanged end connections.
- 3. Flanges, bolts and gaskets shall be as specified in Section 43 05 00 - Piping, General.

C. Bonnets

- 1. Connect valve bonnets to the body by clamping, screwing, or flanging.
- 2. Provide bonnets of the same material, temperature, and pressure rating as the body.
- 3. Make provisions for the stem seal with the necessary glands, packing nuts, and yokes.

D. Stems

1. Provide valve stems of the materials indicated, or, if not indicated, of the best commercially-available material for the specific service, with adjustable stem packing, O-rings, chevron V-type packing, or other suitable seal. Bronze materials in contact with potable water shall be NSF 61 approved and free of lead. Elastomeric materials shall be compatible with fluid service.
2. Where subject to dezincification, bronze valve stems shall conform to ASTM B 62.
3. Where dezincification is not a problem, bronze conforming to ASTM B 584 may be used, except that the zinc content shall not exceed 16 percent.

E. Stem Guides

1. Provide stem guides spaced with an L/R ratio not to exceed 200:1. Submit calculations for L/R ratios and guide spacing to the ENGINEER for review.
2. Stem guides shall have slotted holes and shall be adjustable in two directions.
3. Construct submerged stem guides from Type 304 stainless steel.

F. Internal Parts

1. Provide internal parts and valve trim as indicated for each individual valve.
2. Where not indicated, construct valve trim from Type 316 stainless steel or other material best-suited for the intended service.

G. Nuts and Bolts

1. Unless otherwise indicated, provide nuts and bolts on valve flanges and supports in accordance with the requirements of Section 05 50 00 – Miscellaneous Metalwork and Section 43 05 00 – Piping, General.

2.4 VALVE ACTUATORS

- A. Valve actuators shall be as indicated and as specified in Section 43 30 12 – Valve and Gate Actuators

2.5 VALVE ACCESSORIES

- A. Provide valves complete with the accessories required to provide a functional system.

2.6 SPARE PARTS

- A. Furnish the required spare parts, suitably packaged and labeled with the valve name, location, and identification number.
- B. Furnish the name, address, and telephone number of the nearest distributor for the spare parts of each valve.
- C. Spare parts are intended for use by the OWNER, after expiration of the correction of defects period.

2.7 MANUFACTURERS

- A. Valve manufacturers shall have a successful record of not less than 5 years in the manufacture of the indicated valves.

2.8 VALVE BOXES

- A. All buried valves shall be provided with valve boxes as indicated on the Contract Drawings, with a minimum thickness of 1/2" and constructed so that the removable cover will not be thrown out by travel over it.
- B. Valve boxes shall be of sufficient length to operate all valves buried in the ground.
- C. Valve boxes shall be the telescope extension type with not less than a five-inch (5") diameter shaft and with cast iron covers marked "SEWER". Boxes shall be Model No. 6850 as manufactured by Tyler Union, or approved equal.
- D. The valve boxes and valve box covers shall be of sound close grained cast iron, free from flaws and defects, and built strong and rugged enough to withstand the shock of street traffic.
- E. Two (2) valve operating wrenches shall be supplied in 4-foot lengths with handles. Valve wrenches shall be Model No. 144908 (UP Code) as manufactured by Tyler Union, or approved equal.

2.9 EXTENSION STEMS

- A. Extension stems shall be provided and installed on all valves in buried locations and where indicated on the Contract Drawings.
- B. Extension stems shall be fabricated from solid steel shafting capable of withstanding the torque imposed, but not smaller than 1.25 inches in diameter.
- C. Stem couplings shall be keyed and of approved design and construction.
- D. Extension stems for buried valves shall extend to within six inches (6") of the surface of the ground. Each extension stem shall be connected to the valve operator with a suitable universal joint type of coupling. All connections shall be pinned.
- E. Each extension stem shall be provided with spacers which will center the stem in a valve box having an inside diameter of six inches (6"), and shall be equipped with a standard AWWA wrench nut as described in AWWA C500, except where handwheels are indicated on the Contract Drawings.
- F. A position indicator shall be provided with each buried valve which shows the valve position, number of turns to go from full open to full closed, and type and size of valve. The entire unit shall be constructed of non-corrosive materials.

PART 3 -- EXECUTION

3.1 VALVE INSTALLATION AND TRIAL OPERATION

- A. General
 - 1. Install valves, actuating units, stem extensions, valve boxes, and accessories in accordance with the manufacturer's written instructions and as indicated.

2. Adequately brace gates in order to prevent warpage and bending under the intended use.
3. Firmly support valves in order to avoid undue stresses on the pipe.
4. Where required for satisfactory operation of valves or gates, extension stems, stem guides, valve boxes, floor boxes and other valve appurtenances shall be provided.
5. Extension stems shall be complete with guide bearings, wrench nut, and tee handle wrench.
6. All valve stems where packing is specified shall be packed with material properly selected for the service intended.
7. .
8. All valves shall be manually opened and closed before installation to check their operation, and the interior of the valve shall be cleaned.

B. Installation

1. Install valves with stems upright or horizontal, not inverted.
2. Use plug valves for wastewater unless otherwise noted.
3. Install valves so that they are easily accessible for operation, visual inspection and preventative maintenance.
4. Buried valves shall be firmly set on a foundation or footing of solid concrete, not less than eight inches (8") nor less than one cubic foot (1 cu. ft.) in volume, which shall have been placed on firmly compacted ground.
5. All buried valves shall be provided with valve boxes. The riser shall rest on the valve and be adjusted so that the cover may be set flush with existing sidewalk, bike path, paved streets, unpaved streets, driveways, road right-of-way, etc. The valve box shall be set to allow equal movement above and below finished grade when located in utility easements not subject to street traffic. The riser shall be centered over the valve. The entire assembly shall be plumb.
6. Valves located on branching pipe shall be tied to mains with tie rods or anchor tees.

C. Access

1. Install valves in a manner to provide easy access for actuation, removal, and maintenance, and to avoid interference between valve actuators and structural members, handrails, and other equipment.

D. Valve Accessories

1. Where combinations of valves, sensors, switches, and controls are indicated, properly assemble and install such items such that systems are compatible and operating properly.
2. Clearly note the relationship between interrelated items on Shop Drawing submittals.

E. Trial Operation

1. After installation, schedule trial operation witnessed by the ENGINEER and the OWNER representative.
2. All valves shall be cleaned thoroughly of all foreign materials and final adjustments made. The valves shall then be operated through one complete cycle from a fully closed position to a fully open position and back to a fully closed position to verify that the assembly is functional.
3. For control valves that operate in multiple operating scenarios, the CONTRACTOR shall simulate all operational scenarios including the hydraulic power units, pilot control system or pneumatic air supply system to demonstrate compliance to the specifications.
4. A field leakage test meeting the maximum allowable specified requirement shall be conducted.
5. Test certificate shall be signed by the valve manufacturer and the CONTRACTOR and shall be submitted to the ENGINEER.

- END OF SECTION -

SECTION 43 30 22 – GATE VALVES

PART 1 -- GENERAL

1.1 THE REQUIREMENT

- A. The CONTRACTOR shall provide gate valves and appurtenances, complete and operable, in accordance with the Contract Documents.
- B. The requirements of Section 43 30 00 – Valves General apply to this Section.
- C. The requirements of Section 43 30 12 – Valve and Gate Actuators apply to this Section.

1.2 CONTRACTOR SUBMITTALS

- A. Furnish submittals in accordance with Section 43 30 00 – Valves General.
- B. Gate valves shall have undergone a proof-of-design test to demonstrate that the valve components operate at the service flow, pressure, temperature, and fluid conditions, free from binding, excessive noise, and premature failures. Proof-of-design test results shall be available to the ENGINEER on request. The proof-of-design test shall be conducted in accordance with the applicable provisions of AWWA C509.

PART 2 -- PRODUCTS

2.1 GENERAL

- A. Buried valves shall be of the inside screw, non-rising stem type. The valve actuators shall be as indicated, with counter-clockwise opening stems, in accordance with Section 43 30 12 – Valve and Gate Actuators.
- B. Gate valves 18-inches and larger shall be provided with a bypass line and isolation valve.

2.2 KNIFE-GATE VALVES (2- TO 96-INCH)

- A. Construction: Knife-gate valves shall be of the flanged or wafer design, with raised face and resilient seats for positive seating. Wetted parts shall be constructed of Type 316 stainless steel, and the gates shall be finish-ground on both sides to prevent packing or seat damage. Valves 2- to 12-inches in size shall be furnished with cast stainless steel bodies; valves 14-inches and larger shall have semi-steel bodies with stainless steel linings. The valve stem shall be of stainless steel with a long life packing. The stainless steel gate shall have a square bottom with a knife edge. The valve body port shall be no less than 95% of the nominal pipe diameter.
- B. Flush Ports: The valve body shall be complete with two flush ports consisting of not less than 1-1/2" diameter pipe taps.
- C. The valves shall be rated for tight shut-off at the following pressures:
 - 1. Valve sizes 4- to 12-inches 150 psi (bi-directional)
 - 2. Valve sizes larger than 12-inches 50 psi
- D. Actuators: Actuators shall be provided in accordance with Section 43 30 12 – Valve and Gate Actuators.

E. Manufacturers, or approved equal

1. **DeZURIK Water Controls Corporation**

2. **Fabri-Valves**

2.3 RESILIENT-SEATED GATE VALVES

A. **General:** Resilient-seated gate valves may be provided in lieu of metal-seated double-disc or solid-disc gate valves, at the discretion of the ENGINEER.

B. **Construction:** Resilient-seated gate valves shall conform to ANSI/AWWA C 509 - Resilient-Seated Gate Valves for Water and Sewerage Systems. The valves shall be suitable for a design working water pressure of 200 psig, with flanged, bell and spigot, or mechanical joint ends. The valve body, bonnet, and disc shall be of cast iron or ductile iron and the disc or body shall be rubber-coated. Body and bonnet wall thickness shall be equal to or greater than the minimum wall thickness as listed in Table 2 of ANSI/AWWA C509. The stem, stem nuts, glands, and bushings shall be of bronze, with the stem seal per ANSI/AWWA C 509.

C. **Pressure Ratings:**

1. AWWA C509 valves that are 3, 4, 6, 8, and 12 inches in size shall be rated for 200 psig minimum design working water pressure, and valves 16 and larger shall be rated for 150 psig minimum design working water pressure.

D. **Protective Coating:** Valves shall be factory coated in accordance with Section 09 96 00 - Protective Coatings. The CONTRACTOR shall submit a test report from a coating inspector that the coating is holiday-free. The CONTRACTOR shall be aware that it may retain the services of a third party coating applicator to achieve the holiday-free requirement.

E. **Actuators:** Unless otherwise indicated, resilient-seated gate valves shall have manual actuators in accordance with Section 43 30 12 – Valve and Gate Actuators.

F. Manufacturers, or approved equal

1. **Mueller Valve 2360**

2. **American 2500 (MM,FF)**

3. **Kennedy Ken-Seal II**

4. **M & H Valve 4067**

5. **Clow Valve F-6100, F-6102**

6. **US Pipe**

2.4 GATE VALVES (SMALLER THAN 3-INCHES)

A. **Construction:** Gate valves smaller than 3-inches, for general purpose use, shall be non-rising stem, heavy-duty type for industrial service, with screwed or soldered ends to match the piping. The bodies shall have union bonnets of bronze conforming to ASTM B 62 - Composition Bronze or Ounce Metal Castings. The stems shall be of bronze conforming

to ASTM B 62, or ASTM B 371 - Copper-Zinc-Silicon Alloy Rod. The solid wedges shall be of bronze conforming to ASTM B 62. The valves shall have malleable iron hand wheels unless otherwise indicated, and stem seals shall be of Teflon-impregnated or other acceptable non-asbestos packing. Valves shall have a pressure rating of minimum 125 psi steam and 200 psi cold-water, unless otherwise indicated.

B. Manufacturers, or approved equal

1. **Mueller Valve**
2. **American**
3. **Kennedy Valve**
4. **M & H Valve**
5. **Clow Valve**
6. **US Pipe**

PART 3 -- EXECUTION

3.1 GENERAL

- A. Gate valves shall be installed in accordance with the provisions of Section 43 30 00 – Valves, General. Care shall be taken that valves in plastic lines are well supported at each end of the valve.

END OF SECTION

SECTION 46 00 00 - EQUIPMENT GENERAL PROVISIONS

PART 1 -- GENERAL

1.1 THE SUMMARY

- A. The CONTRACTOR shall provide equipment and appurtenant WORK, complete and operable, in accordance with the Contract Documents.
- B. The provisions of this Section shall apply to equipment throughout the Contract except where otherwise indicated.
- C. All component and support systems of the equipment shall be designed and manufactured to withstand all forces such as internal or external, static, wind, dynamic and seismic loads in order for the equipment to last throughout its expected life without premature failure.
- D. Equipment Arrangement: Unless specifically indicated otherwise, the arrangement of equipment indicated is based upon information available from manufacturers at the time of design and is not intended to show exact dimensions particular to a specific manufacturer. Some aspects of the Drawings are diagrammatic and some features of the illustrated equipment arrangement may require revision by the CONTRACTOR to meet the actual equipment requirements proposed by the CONTRACTOR. Structural supports, foundations, piping and valve connections, and electrical and instrumentation connections indicated may have to be altered by the CONTRACTOR to accommodate the equipment provided. No additional payment will be made to the CONTRACTOR for such revisions and alterations. Substantiating calculations and drawings shall be submitted prior to beginning the fabrication of equipment.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. Equipment shall be in accordance with the following standards, as applicable and as indicated in each equipment specification:
 - 1. American Society for Testing and Materials (ASTM).
 - 2. American National Standards Institute (ANSI).
 - 3. American Society of Mechanical Engineers (ASME).
 - 4. American Water Works Association (AWWA).
 - 5. American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE).
 - 6. American Welding Society (AWS).
 - 7. National Fire Protection Association (NFPA).
 - 8. Federal Specifications (FS).
 - 9. National Electrical Manufacturers Association (NEMA).
 - 10. Manufacturer's published recommendations and specifications.

11. Occupational Safety and Health Administration (OSHA).

12. Hydraulic Institute (HI)

B. The following standards are referenced in this Section:

ASME B16.1	Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800
ASME B16.5	Pipe Flanges and Flanged Fittings, Steel, Nickel Alloy and other Special Alloys
ASME B46.1	Surface Texture
ANSI S12.6	Method for the Measurement of the Real-Ear Attenuation of Hearing Protectors
ASME B1.20.1	General Purpose Pipe Threads (Inch)
ASME B31.1	Power Piping
ASME B31.3	Process Piping
AWWA C206	Field Welding of Steel Water Pipe
AWWA C207	Steel Pipe Flanges for Waterworks Service - Sizes 4 In. Through 144 In. (100 mm through 3,600 mm)
AWWA D100	Welded Steel Tanks for Water Storage
ASTM A 48	Gray Iron Castings
ASTM A 108	Steel Bars, Carbon, Cold-Finished, Standard Quality

1.3 CONTRACTOR SUBMITTALS

- A. Furnish submittals in accordance with Section 01 33 00 - Submittal Procedures.
- B. Shop Drawings: Furnish complete drawings and technical information for equipment, piping, valves, and controls. Where indicated or required by the ENGINEER, Shop Drawings shall include clear, concise calculations showing equipment anchorage forces and the capacities of the anchorage elements proposed by the CONTRACTOR.
- C. Spare Parts List: The CONTRACTOR shall obtain from the manufacturer and submit as part of Shop Drawings a list of suggested spare parts for each piece of equipment. CONTRACTOR shall also furnish the name, address, and telephone number of the nearest distributor for each piece of equipment.

1.4 QUALITY ASSURANCE

- A. Costs: Responsibility shall be the CONTRACTOR'S for performing and paying the costs of inspection, startup, testing, adjustment, and instruction services performed by factory representatives. The OWNER will pay for costs of power and water. If available, the OWNER'S operating personnel will provide assistance in the field testing.

- B. Inspection: The CONTRACTOR shall inform the local authorities, such as building and plumbing inspectors, fire marshal, OSHA inspectors, and others, to witness required tests for piping, plumbing, fire protection systems, pressure vessels, safety systems, cranes, and related items to obtain required permits and certificates, and shall pay inspection fees.
- C. Quality and Tolerances: Tolerances and clearances shall be as shown on the Shop Drawings and shall be closely adhered to.
1. Machine WORK shall be of high-grade workmanship and finish, with due consideration to the special nature or function of the parts. Members without machined or milled ends and which are to be framed to other steel parts of the structure may have a variation in the detailed length of not greater than 1/16-inch for members 30-feet or less in length, and not greater than 1/8-inch for members over 30-feet in length.
 2. Castings shall be homogeneous and free from non-metallic inclusions and defects. Surfaces of castings which are not machined shall be cleaned to remove foundry irregularities. Casting defects not exceeding 12.5 percent of the total thickness and where defects will not affect the strength and serviceability of the casting may be repaired by approved welding procedures. The ENGINEER shall be notified of larger defects. No repair welding of such defects shall be carried out without the ENGINEER'S written approval. If the removal of metal for repair reduces the stress resisting cross-section of the casting by more than 25 percent or to such an extent that the computed stress in the remaining metal exceeds the allowable stress by more than 25 percent, then the casting may be rejected. Costs of casting new material shall be the CONTRACTOR'S responsibility as part of the WORK.
 3. Materials shall meet the physical and mechanical properties in accordance with the reference standards.
- D. Machine Finish: The type of finish shall be the most suitable for the application as recommended by the equipment manufacturer in micro-inches in accordance with ANSI B46.1. In the absence of manufacturer's recommendations, the following surface finishes shall be used:
1. Surface roughness not greater than 63 micro-inches shall be required for surfaces in sliding contact.
 2. Surface roughness not greater than 250 micro-inches shall be required for surfaces in contact where a tight joint is not required.
 3. Rough finish not greater than 500 micro-inches shall be required for other machined surfaces.
 4. Contact surfaces of shafts and stems which pass through stuffing boxes and contact surfaces of bearings shall be finished to not greater than 32 micro-inches.
- E. Manufacturer's Experience: Equipment manufacturer shall have a record of proven experience of at least 5 years of successful, troublefree operation in similar applications and size equal or larger than the equipment in this Contract. Where indicated in each individual equipment specifications, the CONTRACTOR shall submit this experience record to the ENGINEER for approval.

PART 2 -- PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. Noise Level: When the equipment is in operation, no single piece of equipment shall exceed the OSHA noise level requirement of 105 dBA for one hour exposure per day.
- B. High Noise Level Location: The CONTRACTOR shall provide one personal hearing protection station at each location defined as follows:
1. Outdoor Location: Any single equipment item or any group of equipment items that produce noise exceeding OSHA noise level requirements for a 2 hour exposure. Where such equipment is separated by a distance of more than 20-feet, measured between edges of footings, the area for each group of equipment shall be provided with a separate hearing protection station.
 2. Indoor Location
 - a. Any single equipment item or any group of equipment items located within a single room not normally occupied, that produces noise exceeding OSHA noise level requirements for a 2 hour exposure.
 - b. Any single equipment item or any group of equipment items located within a single room normally occupied by workers that produces noise exceeding OSHA noise level requirements for an 8 hour exposure.
- C. Personal Hearing Protection: The CONTRACTOR shall furnish 3 pairs of high attenuation hearing protectors in the original unopened packaging. The ear protectors shall be capable of meeting the requirements of ANSI S12.6 and shall produce a noise level reduction of 25 dBA at a frequency of 500 Hz. The hearing protectors shall have fluid filled ear cushions and an adjustable, padded headband. The protectors shall be stored in a weatherproof, labeled, steel cabinet, provided at an approved location near the noise producing equipment.
- D. Drive Trains and Service Factors: Service factors shall be applied in the selection or design of mechanical power transmission components. Components of drive train assemblies between the prime mover and the driven equipment shall be designed and rated to deliver the maximum peak or starting torque (whichever is the greatest), speed, and horsepower. Applicable service factors shall be considered, such as mechanical (type of prime mover), load class, start frequency, ventilation, ambient temperature, and fan factors. Drive train components include couplings, shafts, gears and gear drives, drive chains, sprockets, and V-belt drives. Unless otherwise indicated, the following load classifications shall apply in determining service factors:

Type of Equipment	Service Factor	Load Classification
Blowers		
centrifugal or vane	1.0	Uniform
lobe	1.25	Moderate Shock
Centrifugal Fans	1.0	Uniform
Reciprocating Air Compressors		
multi-cylinder	2.0	Heavy Shock
single-cylinder	2.0	Heavy Shock

Pumps		
centrifugal or rotary	1.0	Uniform
reciprocating	1.8	Moderate Shock
progressing cavity	1.0	Uniform
Mixers		
constant density	1.0	Uniform
variable density	1.25	Moderate Shock
rapid mixer	1.25	Moderate Shock
flocculator	1.25	Moderate Shock
sludge mixer	2.5	Moderate Shock
surface aerator	2.5	Heavy Shock
Clarifiers	1.0	Uniform
Sludge Thickeners	1.25	Moderate Shock
Vacuum Filters	1.25	Moderate Shock
Dewatering Screws	1.25	Moderate Shock
Grit Handling Equipment	1.25	Moderate Shock
Mechanical Bar Screens	1.0	Uniform
Scum Breakers	1.25	Moderate Shock
Cranes or Hoists	1.25	Moderate Shock

E. Mechanical Service Factors

	Mechanical Service Factors	
	Electric Motor	Internal Combustion Engine
Uniform	1.25	1.50
Moderate Shock	1.50	1.75
Heavy Shock	2.00	2.25

- F. For thermal rating adjustments such as start frequency, ambient temperature, and hourly duty cycle factor, ventilation factor, and fan factor, refer to gear manufacturer sizing information.
- G. For service factors of electric motors, see Section 26 05 10 - Electric Motors.
- H. Where load classifications are not indicated, the equipment manufacturer's recommendations for service factors shall be utilized.
- I. Welding: Unless otherwise indicated, welding shall conform to the following:
1. Latest revision of AWWA D100.
 2. Latest revision of AWWA C206.

3. Composite fabricated steel assemblies that are to be erected or installed inside a hydraulic structure, including any fixed or movable structural components of mechanical equipment, shall have continuous seal welds to prevent corrosion of hard-to-coat metallic surfaces.
 4. Welding shall be by the metal-arc method or gas-shielded arc method as described in the American Welding Society's "Welding Handbook" as supplemented by other pertinent standards of the AWS. Qualification of welders shall be in accordance with the AWS Standards.
 5. In assembly and during welding, the component parts shall be adequately clamped, supported, and restrained to minimize distortion and for control of dimensions. Weld reinforcement shall be as specified by the AWS code. Upon completion of welding, weld splatter, flux, slag, and burrs left by attachments shall be removed. Welds shall be repaired to produce a workmanlike appearance with uniform weld contours and dimensions. Sharp corners of material that are to be painted or coated shall be ground to a minimum of 1/32-inch on the flat.
- J. Protective Coating: Equipment shall be painted or coated in accordance with Section 09 96 00 – Protective Coatings, unless otherwise indicated. Non-ferrous metal and corrosion-resisting steel surfaces shall be coated with grease or lubricating oil. Coated surfaces shall be protected from abrasion or other damage during handling, testing, storing, assembly, and shipping.
- K. Potable Water Contact: Materials immersed in or exposed to potable water shall be made of materials or coated compliant with NSF Standard 61. Bronze alloy materials in contact with potable water shall be constructed of zero-lead materials or materials whose lead content do not exceed the weighted average criteria as required by the Lead Reduction Act. Equipment manufacturer shall submit to the ENGINEER a certification of compliance with the requirement of NSF Standard 61 and the Lead Reduction Act.
- L. Protection of Equipment: Machined and coated surfaces shall be protected by rust inhibitor material prior to shipment. Equipment shall be boxed, crated, or otherwise protected from damage and moisture during shipment, handling, and storage. Equipment shall be protected from exposure to corrosive fumes and shall be kept thoroughly dry. Equipment with anti-friction bearings or sleeve bearings shall be protected from being damaged due to jarring motion during shipment. Pumps, motors, drives, electrical equipment, and other equipment having anti-friction or sleeve bearings shall be stored in weathertight storage facilities prior to installation. For extended storage periods, plastic equipment wrappers should be avoided to prevent accumulation of condensate in gears and bearings. In addition, motor space heaters shall be energized and shafts shall be rotated per manufacturer's recommendation. Equipment delivered to the Site with rust or corroded parts shall be rejected. If equipment develops defects during storage, it shall be disassembled, cleaned, recoated, or otherwise corrected to restore it to original condition.
- M. Identification of Equipment Items
1. At the time of shipping, each item of equipment shall have a legible identifying mark corresponding to the equipment number in the Contract Documents for the particular item.
 2. After installation, each item of equipment shall be given permanent identification.

- a. Pumps, compressors, and blowers of 150 horsepower or less shall receive acrylic plastic nametags.
 - b. Pumps, compressors, and blowers larger than 150 horsepower shall receive stainless steel plate nametags.
- N. Vibration Isolators: Air compressors, blowers, engines, inline fans shall be provided with restrained spring-type vibration isolators or pads per manufacturer's written recommendations. Vibration isolations shall be provided with seismic restraint.
- O. Equipment Maximum Allowable Vibration Level: Unless otherwise indicated, maximum allowable vibration level shall be in accordance with the acceptance criteria recommended by the reference Standard for that particular type of equipment
- P. Shop Fabrication: Shop fabrication shall be performed in accordance with the Contract Documents and the ENGINEER reviewed Shop Drawings.
- Q. Controls: Equipment and system controls shall be in accordance with Division 40..

2.2 EQUIPMENT SUPPORTS AND FOUNDATIONS

- A. Equipment Supports: Equipment components and supports, anchors, and seismic restrainers shall be adequately designed for static, dynamic, wind, and seismic loads. The design horizontal seismic force shall be the greatest of the following design criteria:
 - 1. Design criteria as required by the governing building code, or
 - 2. 10 percent of the total static weight of the equipment.
- B. Submit design calculations for equipment supports, anchors, and seismic restrainers signed and sealed by an engineer registered in the State wherein the project is to be built. Calculations shall account for forces and distribution of forces on supporting structures resulting from normal operation, normal operation plus seismic loadings, and normal operation plus wind loadings.
 - 1. Wall-mounted equipment weighing more than 250 pounds or which is within 18-inches above the floor shall be provided with fabricated steel supports. Pedestals shall be of welded steel. If the supported equipment is a panel or cabinet or is enclosed with removable sides, the pedestal shall match the supported equipment in appearance and dimensions.
 - 2. Seismic requirements: Freestanding and wall-hung equipment shall be anchored in place by methods that satisfy the building code. Calculations shall be performed and signed and stamped for equipment weighing more than 400 pounds. Calculations shall analyze lateral and overturning forces and shall include a factor of safety against overturning equal to 1.5. Calculations shall include the distribution of forces imposed on the supporting structure and anchors, verifying that each anchor can develop the required resistance forces.
 - 3. Wind requirements: Exterior freestanding equipment shall be anchored in place by methods that satisfy the building code. Calculations shall be performed and signed and stamped, analyzing lateral and overturning forces and shall include a factor of safety against overturning equal to 1.5. Calculations shall include the distribution of forces imposed on the supporting structure and anchors, verifying that each anchor can develop the required resistance forces.

4. Anchors: Anchor bolts shall be in accordance with Section 05 50 00 – Metal Fabrications. CONTRACTOR shall determine the size, type, capacity, location, and other placement requirements of anchorage elements. Anchoring methods and leveling criteria in the manufacturer's literature shall be followed. Submit methods and criteria with the Shop Drawings.
5. Equipment Foundations: Unless otherwise indicated, mechanical equipment, tanks, control cabinets, enclosures, and related equipment shall be mounted on minimum 3.5-inch high concrete bases. Unless otherwise indicated on the Drawings, pumps, blowers, compressors and engine driven equipment shall be provided with a concrete foundation with a total weight equal to at least five times the weight of the equipment. Concrete foundations shall be isolated from the building floor in order to prevent transfer of vibration from the equipment to the building structure. The CONTRACTOR through the equipment manufacturer shall verify the size and weight of equipment foundation to insure compatibility with equipment.
6. Equipment Grout: Mechanical equipment installed on top of concrete foundations or bases shall be provided with non-shrink concrete or epoxy grout as indicated and as specified in Section 03 60 00 - Grouting. Grout shall be applied between the base plate and the concrete foundation or base in accordance with the grout manufacturer's recommendation. Grout shall be free of void space.

2.3 PIPING CONNECTIONS

- A. Flanges and Pipe Threads: Flanges on equipment and appurtenances shall conform to ASME B16.1, Class 125, or B16.5, Class 150, unless otherwise indicated. Pipe threads shall be in accordance with ASME B1.20.1 and Section 40 05 00 – Piping, General.
- B. Flexible Connectors: Flexible connectors shall be installed in piping connections to engines, blowers, compressors, and other vibrating equipment and in piping systems in accordance with the requirements of Section 40 05 00 – Piping, General. Flexible connectors shall be harnessed or otherwise anchored to prevent separation of the pipe where required by the installation.
- C. Insulating Connections: Insulating bushings, unions, couplings, or flanges, as appropriate, shall be used in accordance with the requirements of the specifications.

2.4 NAMEPLATES

- A. Equipment nameplates of stainless steel shall be engraved or stamped and fastened to the equipment in an accessible location with No. 4 or larger oval head stainless steel screws or drive pins. Nameplates shall contain the manufacturer's name, model, serial number, size, characteristics, and appropriate data describing the machine performance ratings.

2.5 TOOLS AND SPARE PARTS

- A. Tools: The CONTRACTOR shall furnish one complete set of special wrenches and other special tools necessary for the assembly, adjustment, and dismantling of the equipment. Tools shall be of best quality hardened steel forgings with bright finish. Wrench heads shall have work faces dressed to fit nuts. Tools shall be suitable for professional work and manufactured by Snap On, Crescent, Stanley, or approved equal. The set of tools shall be neatly mounted in a labeled toolbox of suitable design provided with a hinged cover.

- B. Spare parts shall be furnished as indicated in the individual equipment sections. Spare parts shall be suitably packaged in a metal box and labeled with equipment numbers by means of stainless steel or solid plastic nametags attached to the box.

2.6 EQUIPMENT LUBRICANTS

- A. The CONTRACTOR shall provide lubricants for equipment during shipping, storage, and prior to testing, in accordance with the manufacturer's recommendations. Lubricants that could come in contact with potable water shall be food grade lubricants. After successful initial testing, final testing, and satisfactory completion startup testing per Section 01 75 00 – Starting and Adjusting, the CONTRACTOR shall conduct one complete lubricant change on equipment. In addition, the CONTRACTOR shall be responsible for the proper disposal of used lubricants. The OWNER will then be responsible for subsequent lubricant changes

2.7 SAFETY EQUIPMENT

- A. Where work areas are located within a flammable or toxic gas environment, suitable gas detection, ventilating, and oxygen deficiency equipment shall be provided. Workers shall be equipped with approved breathing apparatus.

PART 3 -- EXECUTION

3.1 SERVICES OF MANUFACTURER

- A. Installation Supervision, Inspection, Startup, and Field Adjustment: An authorized, experienced, and competent service representative of the manufacturer shall visit the Site to perform the following:
 - 1. Supervision of the installation of the equipment
 - 2. Inspection, checking, and adjusting the equipment and approving its installation
 - 3. Startup and field testing for proper operation, efficiency, and capacity
 - 4. Performing field adjustments during the test period to ensure that the equipment installation and operation comply with requirements
 - 5. Certify in writing that the equipment and controls have been properly installed, aligned, lubricated, adjusted, and readied for operation.

3.2 INSTALLATION

- A. General: Equipment shall be installed in accordance with the manufacturer's written recommendations.
- B. Alignment: Equipment shall be field tested to verify proper alignment.

3.3 PACKAGED EQUIPMENT

- A. When any system is furnished as pre-packaged equipment, the CONTRACTOR shall coordinate space and structural requirements, clearances, utility connections, signals, and outputs with Subcontractors to avoid later change orders.

- B. If the packaged system has any additional features (as safety interlocks, etc.) other than required by the Contract Documents, the CONTRACTOR shall coordinate such features with the ENGINEER and provide material and labor necessary for a complete installation as required by the manufacturer.

3.4 FIELD ASSEMBLY

- A. Studs, cap screws, bolt and nuts used in field assembly shall be coated with Never Seize compound or equal.

3.5 WELDING

- A. Welds shall be cleaned of weld-slag, splatter, etc. to provide a smooth surface.

3.6 FIELD TESTS

- A. Where indicated by the individual equipment sections, equipment shall be field tested after installation to demonstrate satisfactory operation without excessive noise, vibration, or overheating of bearings or motor.
- B. The following field testing shall be conducted:
 - 1. Start equipment, check, and operate the equipment over its entire operating range. Vibration level shall be within the amplitude limits as indicated or as recommended by the reference applicable standards.
 - 2. Obtain concurrent readings of motor voltage, amperage, capacity, vibration, and bearing temperatures.
 - 3. Operate equipment indicated in Section 01 75 00 – Starting and Adjusting.
- C. The ENGINEER shall witness field-testing. The CONTRACTOR shall notify the ENGINEER of the test schedule 72 hours in advance.
- D. In the event that any equipment fails to meet the test requirements, the equipment shall be modified and retested until it satisfies the requirement.

END OF SECTION