Lenoir City Utilities Board

Standard Sewer Specifications

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LCUB
Going the Extra Mile

Prepared By:

ARDURRA

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Typical Details

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SECTION 01050
FIELD ENGINEERING

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. Contractor shall provide field engineering services and establish grades, lines, and levels, by use of recognized engineering survey practices.

B. The Owner will provide reference point information (if available) that was used as a part of the design. This information will be listed on the Plans. Additional field surveys needed to establish or re-establish reference points for construction is the responsibility of the Contractor and will be considered a part of laying out the Work.

PART 2 PRODUCTS

A. Not Applicable

PART 3 EXECUTION

3.01 INSPECTION

A. Verify locations of survey control points prior to starting work. Promptly notify Owner of any discrepancies discovered.

3.02 SURVEY REFERENCE POINTS

A. Protect survey control points prior to starting site work; preserve permanent reference points during construction. Make no changes without prior written notice to Owner.

B. Promptly report to Owner the loss or destruction of any reference point or relocation required because of changes in grades or other reasons. Replace dislocated survey control points based on original survey control.

C. The Contractor shall preserve all USGS, TVA, State of Tennessee, and private markers; do not remove or disturb any such markers without prior approval from the Owner. Any removal and replacement of such markers shall be at the expense of the Contractor. The re-establishment of these markers shall be performed by a surveyor licensed by the State of Tennessee, with a letter indicating the completion of work.

3.03 STAKING

A. The Contractor shall be responsible for staking the project and preparing cut sheets as needed.

End of Section

SECTION 01090
STANDARDS

PART 1 GENERAL

1.01 Meet the requirements and recommendations of all Standards, Institutes, Associations, etc., referred to throughout these documents and specifications as if they were fully reproduced herein. Unless otherwise noted, the latest editions shall apply.

1.02 ABBREVIATIONS

AAMA	Architectural Aluminum Manufacturers' Association
AASHTO	American Association of State Highway and Transportation Officials
ABMA	American Boiler Manufacturers' Association
ACI	American Concrete Institute
AFBMA	Anti-Friction Bearing Manufacturers' Association
AGA	American Gas Association
AGC	Association of General Contractors
AGMA	American Gear Manufacturers' Association
AIA	American Institute of Architects
AIEE	American Institute of Electrical Engineers
AIMA	Acoustical and Insulating Materials Association
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
AMCA	Air Moving and Conditioning Association
ANSI	American National Standards Institute
APA	American Plywood Association
API	American Petroleum Institute
ARI	Air Conditioning and Refrigeration Institute
ASA	American Standards Association
ASAE	American Society of Automotive Engineers
ASC	Association of Specialty Contractors
ASCII	American Standard Code for Information Interchange
ASHRAE	American Society of Heating, Refrigerating, and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWI	Architectural Woodwork Institute
AWPB	American Wood Preservers Bureau
AWPI	American Wood Preservers Institute
AWS	American Welding Society
AWWA	American Water Works Association
BIA	Brick Institute of America
CMAA	Crane Manufacturer's Association of America
CRSI	Concrete Reinforcing Steel Institute
CS	Commercial Standards
CSI	Construction Specifications Institute

EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FGMA	Flat Glass Marketing Association
FM	Associated Factory Mutual Laboratories
FS	Federal Specifications
IEEE	Institute of Electrical and Electronic Engineers
IRI	Industrial Risk Insurors
ISA	Instrument Society of America
JIC	Joint Industrial Council
MBMA	Metal Building Manufacturers' Association
MMA	Monorail Manufacturers' Association
NAAMM	National Association of Architectural Metal Manufacturers
NBS	National Bureau of Standards
NEC	National Electrical Code
NEMA	National Electrical Manufacturers' Association
NFPA	National Fire Protection Association or National Forest Products Association
NKCA	National Kitchen Cabinet Association
NPT	National Pipe Thread
NRCA	National Roofing Contractors' Association
NSF	National Sanitation Foundation
NSWMA	National Solid Waste Manufacturers' Association
NWMA	National Woodwork Manufacturing Association
OSHA	Occupational Safety and Health Administration
PPI	Plastics Pipe Institute
RIS	Redwood Inspection Service
SAE	Society of Automotive Engineers
SBCC	Standard Building Code Congress
SDI	Steel Deck Institute
SJI	Steel Joist Institute
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association
SPII	Southern Pine Inspection Institute
SSBC	Southern Standard Building Code
SSPC	Steel Structures Painting Council
TCA	Tile Council of America
TDOT	Tennessee Department of Transportation
TIMA	Thermal Insulation Manufacturers' Association
UL	Underwriters' Laboratories
USG	United States Gypsum
WCLIB	West Coast Lumber Inspection Bureau
WWPA	Western Wood Products Association

PART 2 PRODUCTS

A. Not Applicable

PART 3 EXECUTION

A. Not Applicable

End of Section

SECTION 01302
SUBMITTALS AND SUBSTITUTIONS

PART 1 GENERAL

1.01 SUMMARY

A. Work Included

1. Wherever possible throughout the contract documents, the minimum acceptable quality of workmanship and materials has been defined by a manufacturer's name and catalogue number, reference to recognized industry and government standards, or description of required attributes and performance.
2. To ensure that the specified products are furnished and installed in accordance with the design intent, procedures have been established for advance submittal of design data and for their review by the Engineer.
3. Make all submittals required by the Contract Documents, and revise and resubmit as necessary to establish compliance with the specified requirements.

B. Related Work Described Elsewhere

1. Individual requirements for submittals are described in other pertinent sections of these specifications.

1.02 SUBMITTALS

A. Identification of Submittals

1. General: Consecutively number all submittals.
2. Internal Identification: On at least the first page of each copy of each submittal, clearly indicate the submittal number in which the item was included.
3. Resubmittals: When material is resubmitted for any reason, transmit under a new letter of transmittal utilizing the original submittal number followed by an A, B, C, etc., depending on the number of resubmittals of the original submittal required.

B. Shop Drawings and Coordination of Drawings

1. Deliver or mail all submittals to:

Lenoir City Utilities Board
7698 Creekwood Park Boulevard
Lenoir City, Tennessee 37772
Attention: Water & Wastewater Department
Telephone: 844.687.5282

2. Before issuance of Certificate of Payment for Final Payment, deliver to the Design Engineer:

a. Waivers of Lien
b. Affidavit of payment of debts and claims
c. Consent of surety company to final payment
d. Written guarantees and warranties
e. Marked-up record set of drawings showing every alteration or change from the original drawings and specifications
f. All certificates of compliance, as a condition of acceptance of the work.

3. Make submittals in strict accordance with the provisions of this section.

C. Required Submittals

1. Precast Concrete Manhole Components (not fabrication sheets – see part D.)
2. Manhole Steps
3. Manhole Joint Rope, Wrap, and Primer Sealer
4. Manhole Frame and Cover
5. Manhole Riser Rings
6. Pipe
7. Protecto 401 Lining (for ductile iron pipe)
8. Neoprene Pipe-to-Manhole Connectors
9. Sewer Fittings (for services and force mains)
10. Tracer Wire and Connectors
11. Detection Tape
12. Sewage Air Release/Vacuum Valves
13. Plug Valves
14. LPS Ball Valve/Check Valve Assembly
15. Service Boxes

D. Precast Manhole Fabrication Drawings will not be reviewed by LCUB. It is the Contractor's responsibility to verify how the manhole precast company fabricates the manholes according to the plans and specifications.

1.03 QUALITY ASSURANCE

A. Coordination of Submittals:

1. Prior to each submittal, carefully review and coordinate all aspects of each item being submitted, and verify that each item and the submittal for it conforms in all respects with the requirements of the bidding instruments.

2. Shop drawings and submittals shall bear the stamp of approval of the Contractor as evidence that this coordination has been performed.

1.04 SUBMITTAL SCHEDULE

A. Timing of Submittals:

1. General: Make all submittals far enough in advance of scheduled dates for installation to provide all time required for reviews, for securing necessary approvals, for possible revisions and resubmittals, and for placing orders and securing delivery. Submit shop drawings in accordance with the approved schedule of shop drawing submittals.

2. Engineer's Review Time: In scheduling, allow at least 20 calendar days for review by the Engineer following his receipt of the submittal.

3. Delays: Delays caused by tardiness in receipt of submittals will not be an acceptable basis for extension of the contract completion date.

1.05 SUBSTITUTIONS

A. Approval Required

1. The contract is based on the standards of quality established in the contract documents.
2. All products proposed for use, including those specified by required attributes and performance shall require approval by the Engineer before being incorporated into the work.
3. Do not substitute materials, equipment, or methods unless such substitution has been specifically approved for this work by the Engineer.

B. "Or Equal"

1. Where the phrase "or equal", "or approved equal", or “approved substitute” occurs in the contract documents do not assume that materials, equipment, or methods will be approved as equal unless the item has been specifically approved for this work by the Engineer.
2. The decision of the Engineer shall be final.
3. See pertinent portions of the contract documents for additional information relating to substitutions.
4. Where equipment, materials, or methods do not specify "or equal", "or approved equal", or “approved substitute”, substitutions may be submitted by the Contractor in accordance with this section.

PART 2 PRODUCTS

A. Not Applicable

PART 3 EXECUTION

A. Not Applicable

End of Section

SECTION 01310
PROGRESS SCHEDULES

PART 1 GENERAL

1.01 SUBMITTALS

A. Informational Submittals:

1. Preliminary Progress Schedule: Submit at least 7 days prior to preconstruction conference.
2. Detailed Progress Schedule:

    a. Submit initial Detailed Progress Schedule within 30 days after Effective Date of the Agreement.
    b. Submit an Updated Progress Schedule at each update, in accordance with Section 1.03 Detailed Progress Schedule.

3. Submit with Each Progress Schedule Submission:

    a. Contractor's certification that Progress Schedule submission is actual schedule being utilized for execution of the Work.
    b. Progress Schedule: One legible copy.
    c. Narrative Progress Report: Same number of copies as specified for Progress Schedule.

4. Prior to final payment, submit a final Updated Progress Schedule.

1.02 PRELIMINARY PROGRESS SCHEDULE

A. In addition to basic requirements outlined in General Conditions, show a detailed schedule, beginning with Notice to Proceed, for minimum duration of 90 days, and a summary of balance of Project through Final Completion.

B. Show activities including, but not limited to, the following:

1. Notice to Proceed.
2. Permits.
3. Submittals, with review time. Contractor may use Schedule of Submittals specified in Section 01302, Submittals and Substitutions.
4. Early procurement activities for long lead equipment and materials.
5. Initial Site work.
6. Earthwork.
7. Specified Work sequences and construction constraints.
8. Contract Milestone and Completion Dates.
9. Major structural, mechanical, equipment, electrical, architectural, and instrumentation and control Work.
10. System startup summary.

11. Project close-out summary.
12. Demobilization summary.

C. Update Preliminary Progress Schedule monthly; as part of progress payment process. Failure to do so may result in the Owner withholding all or part of the monthly progress payment until the Preliminary Progress Schedule is updated in a manner acceptable to Engineer.

D. Format: In accordance with Article Progress Schedule—Bar Chart.

1.03 DETAILED PROGRESS SCHEDULE

A. In addition to requirements of General Conditions, submit Detailed Progress Schedule beginning with Notice to Proceed and continuing through Final Completion.

B. Show the duration and sequences of activities required for complete performance of the Work reflecting means and methods chosen by Contractor.

C. When accepted by Engineer, Detailed Progress Schedule will replace Preliminary Progress Schedule and become Baseline Schedule. Subsequent revisions will be considered as Updated Progress Schedules.

D. Format: In accordance with Article Progress Schedule—Bar Chart.

E. Update monthly to reflect actual progress and occurrences to date, including weather delays.

1.04 PROGRESS SCHEDULE—BAR CHART

A. General: Comprehensive bar chart schedule, generally as outlined in Associated General Contractors of America (AGC) 580, "Construction Project Planning and Scheduling Guidelines." If a conflict occurs between the AGC publication and this Specification, this Specification shall govern.

B. Format:

1. Unless otherwise approved, white paper, 11-inch by 17-inch sheet size.
2. Title Block: Show name of project and Owner, date submitted, revision or update number, and name of scheduler.
3. Identify horizontally, across the top of the schedule, the time frame by year, month, and day.
4. Identify each activity with a unique number and a brief description of the Work associated with that activity.
5. Legend: Describe standard and special symbols used.

C. Contents: Identify, in chronological order, those activities reasonably required to complete the Work, including as applicable, but not limited to:

1. Obtaining permits, submittals for early product procurement, and long lead time items.

2. Mobilization and other preliminary activities.
3. Initial Site work.
4. Specified Work sequences, constraints, and Milestones, including Substantial Completion date(s).
5. Subcontract Work.
6. Major equipment design, fabrication, factory testing, and delivery dates.
7. Delivery dates for Owner-furnished products, as specified in the Summary of Work.
8. Sitework.
9. Concrete Work.
10. Structural Work.
11. Asphalt Work.
12. Facilities retirement Work.
13. Gravity Sewer Testing activities.
14. Water Line Disinfection and Testing Activities.
15. Project closeout and cleanup.
16. Demobilization.

1.05 PROGRESS OF THE WORK

A. Updated Progress Schedule shall reflect:

1. Progress of Work to within 5 working days prior to submission.
2. Approved changes in Work scope and activities modified since submission.
3. Delays in Submittals or resubmittals, deliveries, or Work.
4. Adjusted or modified sequences of Work.
5. Other identifiable changes.
6. Revised projections of progress and completion.
7. Report of changed logic.

B. Produce detailed subschedules during Project, upon request of Owner or Engineer, to further define critical portions of the Work such as facility shutdowns.

C. If Contractor fails to complete activity by its latest scheduled completion date and this Failure is anticipated to extend Contract Times (or Milestones), Contractor shall, within 7 days of such failure, submit a written statement as to how Contractor intends to correct nonperformance and return to acceptable current Progress Schedule. Actions by Contractor to complete the Work within Contract Times (or Milestones) will not be justification for adjustment to Contract Price or Contract Times.

D. Owner may order Contractor to increase plant, equipment, labor force or working hours if Contractor fails to:

1. Complete a Milestone activity by its completion date.
2. Satisfactorily execute Work as necessary to prevent delay to overall completion of Project, at no additional cost to Owner.

1.06 NARRATIVE PROGRESS REPORT

A. Format:

1. Organize same as Progress Schedule.
2. Identify, on a cover letter, reporting period, date submitted, and name of author of report.

B. Contents:

1. Number of days worked over the period, work force on hand, construction equipment on hand (including utility vehicles such as pickup trucks, maintenance vehicles, stake trucks).
2. General progress of Work, including a listing of activities started and completed over the reporting period, mobilization/demobilization of subcontractors, and major milestones achieved.
3. Contractor's plan for management of Site (e.g., lay down and staging areas, construction traffic), utilization of construction equipment, buildup of trade labor, and identification of potential Contract changes.
4. Identification of new activities and sequences as a result of executed Contract changes.
5. Documentation of weather conditions over the reporting period, and any resulting impacts to the work.
6. Description of actual or potential delays, including related causes, and the steps taken or anticipated to mitigate their impact.
7. Changes to activity logic.
8. Changes to the critical path.
9. Identification of, and accompanying reason for, any activities added or deleted since the last report.
10. Steps taken to recover the schedule from Contractor-caused delays.

1.07 SCHEDULE ACCEPTANCE

A. Engineer's acceptance will demonstrate agreement that:

1. Proposed schedule is accepted with respect to:

a. Contract Times, including Final Completion and all intermediate Milestones are within the specified times.
b. Specified Work sequences and constraints are shown as specified.
c. Specified Owner-furnished Equipment or Material arrival dates, or range of dates, are included.
d. Access restrictions are accurately reflected**.**
e. Startup and testing times are as specified.
f. Submittal review times are as specified.
g. Startup testing duration is as specified and timing is acceptable.

2. In all other respects, Engineer's acceptance of Contractor's schedule indicates that, in Engineer's judgment, schedule represents reasonable plan for constructing Project in accordance with the Contract Documents. Engineer's review will not make any change in Contract requirements. Lack of comment on any aspect of schedule that is not in accordance with the Contract Documents will not thereby indicate acceptance of that change, unless Contractor has explicitly called the nonconformance to Engineer's attention in submittal. Schedule remains Contractor's responsibility and Contractor retains responsibility for performing all activities, for activity durations, and for activity sequences required to construct Project in accordance with the Contract Documents.

B. Unacceptable Preliminary Progress Schedule:

1. Make requested corrections; resubmit within 10 days.
2. Until acceptable to Engineer as Baseline Progress Schedule, continue review and revision process, during which time Contractor shall update schedule on a monthly basis to reflect actual progress and occurrences to date.

C. Unacceptable Detailed Progress Schedule:

1. Make requested corrections; resubmit within 10 days.
2. Until acceptable to Engineer as Baseline Progress Schedule, continue review and revision process.

D. Narrative Report: All changes to activity duration and sequences, including addition or deletion of activities subsequent to Engineer's acceptance of Baseline Progress Schedule, shall be delineated in Narrative Report current with proposed Updated Progress Schedule.

PART 2 PRODUCTS

A. Not Applicable

PART 3 EXECUTION

A. Not Applicable

End of Section

SECTION 01400
QUALITY CONTROL

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. General Quality Control.

1. Maintain quality control over suppliers, manufacturers, products, services, site conditions, and workmanship to produce work of specified quality.

B. Workmanship.

1. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.
2. Perform work by persons qualified to produce workmanship of specified quality.
3. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking.

C. Manufacturers' Instructions.

1. Comply with instructions in full detail, including each step in sequence. Should instructions conflict with contract documents, request clarification from Engineer before proceeding.

D. Manufacturers' Certificates.

1. When required by individual specifications section, submit manufacturers' certificate, in duplicate, that products meet or exceed specified requirements.

E. Manufacturers' Field Services.

1. When specified in respective specification sections, require supplier or manufacturer to provide qualified personnel to observe field conditions; conditions of surfaces and installation; quality of workmanship; start-up of equipment; test, adjust, and balance of equipment; and as applicable, to make appropriate recommendations.
2. A representative shall submit a written report to Owner listing observations and recommendations.

F. Testing Laboratory Services.

1. Owner shall employ and pay for services of an Independent Testing Laboratory to perform inspections, tests, and other services required by individual specification sections.

2. Services will be performed in accordance with requirements of governing authorities and with specified standards.
3. Reports will be submitted to Owner in duplicate giving observations and results of tests, indicating compliance or non-compliance with specified standards and with contract documents.
4. Contractor shall cooperate with testing laboratory personnel; furnish tools, samples of materials, design mix, equipment, storage, and assistance as requested.

    a. Notify Owner and testing laboratory 24 hours prior to expected time for operations requiring testing services.
    b. Make arrangements with testing laboratory and pay for additional samples and tests for Contractors' convenience.

PART 2 PRODUCTS

A. Not Applicable

PART 3 EXECUTION

A. Not Applicable

End of Section

SECTION 01500
CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. Sanitary Facilities

B. Electricity, Lighting

C. Water

D. Barriers

E. Security

F. Temporary Controls

G. Protection of Installed Work

H. Water Control

I. Cleaning During Construction

J. Field Offices and Sheds

K. Removal of Construction Facilities and Temporary Controls

1.02 RELATED REQUIREMENTS

A. Summary of Work: Abandoned materials, storage, and Contractor's use of premises.

B. Section 01710 - Cleaning.

C. Owner's facilities can not be used by any of the contractor's or subcontractor's employees.

1.03 SANITARY FACILITIES

A. Provide and maintain required temporary facilities and enclosures for job personnel that:

1. Are weather tight, clean, and sanitary.
2. Are provided with either natural light and ventilation or artificial light and mechanical ventilation.
3. Are provided with toilet tissue in a suitable holder.
4. Comply with applicable legal and health requirements.

B. Remove temporary toilet facilities when work is complete.

1.04 ELECTRICITY, LIGHTING

A. Connect to existing service, provide branch wiring and distribution boxes located to allow service and lighting by means of construction-type power cords.

1. Make arrangements for and install the poles, wiring, switches, outlets, and other electrical equipment necessary.
2. Pay for current used during construction period.

B. Provide lighting for construction operations.

C. Existing and permanent lighting may be used during construction. Maintain lighting and make routine repairs. Replace all lamps of all light fixtures used during construction at final inspection and give used lamps to the Owner for stock.

D. Remove temporary electrical equipment when construction is completed.

1.05 WATER

A. Provide service required for construction operations. Extend branch piping with outlets located so that water is available by use of hoses. Connect to existing facilities; extend branch piping with outlets located so that water is available by use of hoses.

1. Contractor to contact LCUB for hydrant meter/backflow preventer. Contractor is responsible for payment/deposit for required equipment and cost of water used at the current cost per gallon in accordance with LCUB's current rates.
2. Make arrangements for and install the piping and equipment necessary.

B. Remove temporary water facilities when construction is completed unless otherwise directed by Owner. Water will be provided by the Owner for standard, reasonable, project-related use only.

1.06 SECURITY

A. Provide security and facilities to protect Work, existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft.

B. Coordinate with Owner's security program.

1.07 TEMPORARY CONTROLS

A. Coordinate, schedule, and perform work to cause the least practical interference with the public, fire protection service, public utility service, and Owner's operations. Coordinate all connections, cut-ins, alterations, or other interruption with designated representative of the Owner or utility service. Notify the representative 48 hours in advance and cooperate with him in minimizing the interruptions.

B. Comply with the local requirements of EPA, the health department, or other regulatory requirement for construction operations relating to noise, pest, rodent, dust, and pollution controls.

1.08 CLEANING DURING CONSTRUCTION

A. Construction cleaning shall be as specified in Section 01710.

1.09 REMOVAL OF CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

A. Remove temporary materials, equipment, services, and construction prior to Substantial Completion inspection.

B. Clean and repair damage caused by installation or use of temporary facilities. Remove underground installations to a depth of 2 feet; grade site as indicated. Restore existing facilities used during construction to specified, or to original, condition.

1.10 PAYMENT

A. No separate payment will be made for the materials, work, equipment, labor, etc., required herein for Construction Facilities and Temporary Controls. Include the costs thereof in the various lump sum prices on the Bid Form.

PART 2 PRODUCTS

A. Not Applicable

PART 3 EXECUTION

A. Not Applicable

End of Section

SECTION 01560
EROSION AND POLLUTION CONTROL

PART 1 GENERAL

1.01 SUMMARY

A. This work shall consist of erosion control on all cut and fill operations, excavation, backfill, or other construction activities within the limits of the construction site, within any temporary or permanent easements, and within any borrow site used during the period of construction. The protection of these sites shall continue throughout the construction period regardless of weather conditions.

B. While formally identified as erosion control activities, this work encompasses that necessary to ensure that construction activities do not temporarily or permanently harm the waters of the State of Tennessee, nor properties of the Owner, nor adjoining owners.

C. These activities, over which neither the Owner nor the Engineer has control during the bidding process, are related to the means and methods the Contractor uses to pursue the work and as such cannot be predicted in advance. For this reason, the Contractor must be solely responsible for conforming to related local, State, and Federal requirements.

D. Any fines levied by the Federal, State, and/or local governments for non-conformance with their respective regulations related to erosion and pollution control shall be paid for by the Contractor.

PART 2 PRODUCTS

2.01 MATERIALS

A. Materials, installation, and maintenance of erosion and pollution control structures shall be in accordance with the Drawings and the "Tennessee Erosion and Sediment Control Handbook" (Tennessee Department of Environment and Conservation, latest edition).

PART 3 EXECUTION

3.01 GENERAL

A. The temporary erosion and pollution control provisions shown on the drawings are considered the minimum necessary, with the final design, implementation, and maintenance being the responsibility of the Contractor.

B. The Contractor shall prepare a Stormwater Pollution Prevention Plan (SWPPP) and submit or amend the project Notice of Intent (NOI) to include their project specific activities.

C. Install temporary sediment traps where appropriate. Construct and maintain in accordance with the requirements of Tennessee Erosion and Sediment Control Handbook. Muddy water collected in sediment traps shall be held until it is at least as clear as the upstream water before it is discharged to surface waters. Discharge through a pipe or lined channel so that the discharge does not cause erosion and sedimentation.

D. Install temporary diversion berms or diversion channels as necessary to divert storm water from running onto the disturbed areas and to divert runoff from disturbed areas to the temporary sediment traps.

E. Apply temporary seeding whenever grading operations are temporarily halted for over 14 days and final grading of exposed surfaces is to be completed within one year. Apply temporary seeding to soil stockpiles.

F. The Contractor is responsible for the installation and maintenance of site construction pollution prevention controls throughout the life of the project.

End of Section

SECTION 01570
WORK ZONE TRAFFIC CONTROL

PART 1 GENERAL

1.01 SUMMARY

A. The Work to be performed shall consist of providing, installing, maintaining, relocating, and removing temporary traffic control devices and services as ordered by the traffic control plan (TCP) and as required for the control and protection of public traffic through the Project work zone.

B. Notification of the Work commence date and application for permission from the governing body having jurisdiction over the right-of-way is the responsibility of the Contractor.

C. The Work to be performed under this Section will conform to Part VI of the Manual on Uniform Traffic Control Devices (MUTCD) and shall be subject to local codes, policies, and regulations of the agency having jurisdiction over the area where the Work is performed.

PART 2 PRODUCTS

2.01 MATERIALS AND/OR PROCUCTS

A. All signage, channeling devices, arrow displays, lighting devices, and other traffic control devices shall conform to the design requirements contained in the MUTCD which specifically govern such features as size, contrast, colors, shape, composition, use of symbols, etc. Use of “home made” or contractor-fabricated devices are prohibited.

PART 3 EXECUTION

3.01 TRAFFIC CONTROL PLAN (TCP)

A. The Contractor shall submit the TCP along with a request for approval noting the date of proposed construction and the duration to the agency having jurisdiction.

B. The Contractor shall obtain any and all necessary permits required for performance and execution of the TCP in coordination with the appropriate agencies.

C. The Contractor shall install and maintain temporary traffic control devices adjacent to and within the Project work zone in accordance with the approved TCP and the MUTCD. Installation of the traffic control devices shall proceed in accordance with MUTCD phasing and shall be performed prior to the start of construction operations.

3.02 TRAFFIC CONTROL DEVICES (TCD)

A. Furnish and place Traffic Control Devices before the start of construction operations.

B. Install only those Traffic Control Devices needed for each stage or phase of construction as required by the TCP and the MUTCD.

C. Relocate temporary or permanent Traffic Control Devices as required by the phasing of the Work. Remove devices that no longer apply to the Work in progress. Temporarily cover signs when they are not applicable to current conditions.

D. Immediately clean, service, or replace any Traffic Control Device that is defaced, damaged, or when its retro reflectivity is reduced by 50% due to fading, dirt, etc. Keep all temporary Traffic Control Devices clean and serviceable.

E. If required by the Work in progress maintain Traffic Control Devices 24 hours a day with adequate barricades, lights, arrows, etc. to protect the public from traffic hazards and accidents.

F. Use flares and/or lights during times of low visibility to delineate traffic lanes and to guide traffic.

G. Remove all temporary Traffic Control Devices upon completion of the Work and repair all damage caused by their installation.

3.03 CONSTRUCTION PARKING CONTROL

A. Control parking of construction personnel's vehicles and construction equipment to prevent interference with public traffic and public access to private drives, parking areas, sidewalks, residences, etc.

B. Prevent parking on or adjacent to side streets or in non-designated areas. The Contractor at his expense will repair vehicle damage caused by the Contractor or his personnel to residential or private property.

C. Schedule and coordinate delivery and off-loading of materials so as to not interfere with traffic outside of the Contractor's designated work zone or storage yard.

3.04 FLAGMEN

A. When the TCP requires provide flagmen or traffic control officers who are trained and equipped in accordance with the requirements of Part VI of the MUTCD.

B. Flaggers shall use Type III or Type IV retro reflective Stop/Slow paddles. Use of flags is prohibited unless it is an emergency situation in low-speed, low-volume locations which can best be controlled by a single flagger.

C. The flagger or traffic control officer shall wear a retro reflective vest at all times during traffic control operations.

End of Section

SECTION 01600
MATERIAL AND EQUIPMENT

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. Products.

B. Transportation and Handling.

C. Storage and Protection.

D. Product Options.

E. Products List.

F. Substitutions.

G. Systems Demonstration.

1.02 QUALITY ASSURANCE

A. Approval Required

1. The contract is based on the standards of quality established in the contract documents.
2. All products proposed for use, including those specified by required attributes and performance, shall require approval by the Owner before being incorporated into the work.
3. Do not substitute materials, equipment, or methods unless such substitution has been specifically approved for this work by the Owner.

1.03 PRODUCTS

A. Products include material, equipment, and systems.

B. Comply with specifications and referenced standards as minimum requirements.

C. Components required to be supplied in quantity within a specification section shall be the same and shall be interchangeable.

D. All Materials shall be Manufactured in the USA unless otherwise approved by LCUB.

1.04 TRANSPORTATION AND HANDLING

A. Transport products by methods to avoid product damage; deliver in undamaged condition in manufacturer's unopened containers or packaging, dry.

B. Provide equipment and personnel to handle products by methods to prevent soiling or damage.

C. Promptly inspect shipments to assure that products comply with requirements, quantities are correct, and products are undamaged.

1.05 STORAGE AND PROTECTION

A. Store products in accordance with manufacturer's instructions, with seals and labels intact and legible. Store sensitive products in weather-tight enclosures; maintain within temperature and humidity ranges required by manufacturer's instructions. Store mechanical and electrical equipment in a controlled environment as recommended by the manufacturer.

B. For exterior storage of fabricated products, place on sloped supports above ground. Cover products subject to deterioration with impervious sheet covering; provide ventilation to avoid condensation.

C. Store loose granular materials on solid surfaces in a well-drained area; prevent mixing with foreign matter.

D. Arrange storage to provide access for inspection. Periodically inspect to assure products are undamaged, and are maintained under required conditions.

1.06 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Any product meeting those standards.

B. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not specifically named.

C. Products Specified by Naming Several Manufacturers: Products of named manufacturers meeting specifications: No options, no substitutions allowed.

D. Products Specified by Naming Only One Manufacturer: No options, no substitutions allowed.

1.07 PRODUCTS LIST

A. Under provisions of Section 01302-Submittals and Substitutions, submit complete list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.

1.08 SUBSTITUTIONS

A. During bidding period, the Owner will govern times for submitting requests for substitutions under requirements specified in this section.

B. Concurrent with submission of product list, the Owner will consider requests from Contractor for substitutions. Subsequently, substitutions will be considered only when a product

becomes unavailable due to no fault of Contractor. Confirmation of unavailable products must be in writing and certified by the manufacturer that the product is no longer available.

C. Submit separate request for each substitution. Document each request with complete data substantiating compliance of proposed substitution with contract documents.

D. Request for substitution constitutes a representation that Contractor:

1. Has investigated proposed product and determined that it meets or exceeds, in all respects, specified product.
2. Will provide the same warranty for substitution as for specified product.
3. Will coordinate installation and make other changes which may be required for work to be complete in all respects.
4. Waives claims for additional costs which may subsequently become apparent.

E. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals. Separate written request, must be submitted for any proposed substitutions or deviation from the contract documents.

F. Owner will determine acceptability of proposed substitution, and the Engineer will notify Contractor of acceptance or rejection in writing within a reasonable time.

G. Substitute products shall not be ordered or installed without written acceptance.

H. Only one request for substitution will be considered for each product. When substitution is not accepted, provide specified product.

I. Engineer will determine acceptability of substitutions.

1.09 SUBMITTAL PROCEDURES

A. Engineer will review Contractor's requests for substitutions with reasonable promptness.

B. During the bidding period, Engineer will record acceptable substitutions in Addenda.

C. Upon proper submission, Engineer will notify Contractor, in writing, of decision to accept or reject requested substitution within 15 days.

D. For accepted products, submit shop drawings, product data, and samples under provisions of Section 01302 - Submittals and Substitutions.

1.10 SYSTEMS DEMONSTRATION

A. Prior to final inspection, demonstrate operation of each system to the Owner.

B. Instruct Owner's personnel in operation, adjustment, and maintenance of equipment and systems, using the operation and maintenance data as the basis of instruction.

PART 2 PRODUCTS

A. Not Applicable

PART 3 EXECUTION

A. Not Applicable

End of Section

SECTION 01700
CONTRACT CLOSEOUT

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. Closeout Procedures
B. Final Cleaning
C. Project Record Documents
D. Operation and Maintenance Data
E. Warranties and Bonds
F. Spare Parts and Maintenance Materials

1.02 RELATED REQUIREMENTS

A. General Conditions: Fiscal provisions, legal submittals, and other administrative requirements.

1.03 CLOSEOUT PROCEDURES

A. Comply with procedures stated in General Conditions of the contract and procedures specified in this section for issuance of Certificate of Final Completion.

B. Owner will occupy designated portion of Project for the purpose of conduct of business, under provision stated in Certificate of Substantial Completion.

C. When Contractor considers work has reached final completion, submit written certification that work is complete in accordance with contract documents and ready for Engineer observation.

1.04 FINAL COMPLETION

A. The final inspection at the job site will be done by the Engineer once the following items are received from the General Contractor:

1. Notification to Engineer that work is complete and ready for final inspection.

B. Should Engineer inspection find work incomplete, he will promptly notify Contractor in writing listing observed deficiencies.

C. Contractor shall remedy deficiencies and send a second certification of final completion.

D. When Engineer finds work is complete, he will consider closeout submittals.

1.05 STATEMENT OF ADJUSTMENT OF ACCOUNTS

A. Submit final statement reflecting adjustments to Contract Sum indicating:

1. Original Contract Sum
2. Previous Change Orders
3. Changes Under Unit Prices
4. Deductions for Uncorrected Work
5. Deductions for Liquidated Damages
6. Other Adjustments to Contract Sum
7. Total Contract Sum as Adjusted
8. Previous Payments
9. Sum Remaining Due

B. Engineer will issue a final Change Order reflecting approved adjustments to Contract Sum not previously made by change orders.

1.06 APPLICATION FOR FINAL PAYMENT

A. Submit application for final payment in accordance with provisions of Conditions of the contract.

PART 2 PRODUCTS

A. Not Applicable

PART 3 EXECUTION

A. Not Applicable

End of Section

SECTION 01710
CLEANING

PART 1 GENERAL

1.01 DESCRIPTION

A. Work Included: Throughout the construction period, maintain the site in a standard of cleanliness as described in this section.

1. Site generated debris will be cleaned and removed daily. No debris or waste will be allowed to be buried on-site including along sewer line.

B. Related Work Described Elsewhere: In addition to standards described in this section, comply with all requirements for cleaning up as described in various other sections of these specifications.

1.02 QUALITY ASSURANCE

A. Inspection: Conduct inspection daily, and more often if necessary, to verify that requirements for cleanliness are being met.

B. Codes and Standards: In addition to the standards described in this section, comply with all pertinent requirements of government agencies having jurisdiction.

PART 2 PRODUCTS

2.01 CLEANING MATERIALS AND EQUIPMENT

A. Provide all required personnel, equipment, and materials needed to maintain the specified standard of cleanliness.

PART 3 EXECUTION

3.01 PROGRESS CLEANING

A. General:

1. Retain all stored items in an orderly arrangement allowing maximum access, not impeding drainage or traffic, and providing the required protection of materials.
2. Do not allow the accumulation of scrap, debris, waste material, and other items not required for the construction of this work.
3. At least twice each month, and more often if necessary, completely remove all scrap, debris, and waste material from the job site.
4. Provide adequate storage for all items awaiting removal from the job site, observing all requirements for fire protection and protection of the ecology.

B. Site:

1. Daily, and more often if necessary, inspect the site and pick up all scrap, debris, and waste material. Remove all such items to the place designated for their storage.
2. Weekly, and more often if necessary, inspect all arrangements of materials stored on the site. Restack, tidy, or otherwise service all arrangements to meet the requirements of paragraph 3.01.A.1, above.
3. Maintain the site in a neat and orderly condition at all times.

3.02 FINAL CLEANING

A. Definition: Except as otherwise specifically provided, "clean" (for the purpose of all paragraphs under paragraph 3.02) shall be interpreted as meaning the level of cleanliness generally provided by skilled cleaners using commercial quality building maintenance equipment and materials.

B. General: Prior to the completion of the work, remove from the job site all tools, surplus materials, equipment, scrap, debris, and waste. Conduct final progress cleaning as described under paragraph 3.01, above.

C. Site: Unless otherwise specifically directed by the Owner, broom clean all paved areas on the site and all public paved areas directly adjacent to the site. Completely remove all resultant debris.

D. Timing: Schedule final cleaning as approved by the Owner to accept a completely clean project.

End of Section

SECTION 01720
PROJECT RECORD DOCUMENTS

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. Maintenance of Record Documents and Samples.

B. Submittal of Record Documents and Samples.

1.02 RELATED REQUIREMENTS

A. General Conditions: Documents at the site.

B. Section 01302 - Submittals and Substitutions: Shop drawings, product data, and samples.

C. Individual Specifications Sections: Manufacturer's certificates and certificates of inspection.

1.03 MAINTENANCE OF DOCUMENTS AND SAMPLES

A. In addition to requirements in General Conditions, maintain at the site for OWNER one record copy of:

1. Contract Drawings.
2. Specifications.
3. Addenda.
4. Change Orders and other modifications to the Contract.
5. Reviewed shop drawings, product data, and samples.
6. Field test records.
7. Inspection certificates.
8. Manufacturer's certificates.
9. Verified GIS Data Collected by LCUB-approved staff.

B. Maintain Record Documents in a clean, dry, and legible condition. Do not use Record Documents for construction purposes.

C. Keep Record Documents and samples available for inspection by OWNER.

1.04 RECORDING

A. Record information concurrently with construction progress. Do not conceal any work until required information is recorded by CONTRACTOR and verified by OWNER.

B. Contract Drawings and Shop Drawings: Legibly mark each item to record actual construction, including:

1. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
2. Field changes of dimension and detail.
3. Changes made by modifications.
4. Details not on original contract drawings.
5. References to related shop drawings and modifications.

C. Specifications: Legibly mark each item to record actual construction, including:

1. Manufacturer, trade name, and catalog number of each product actually installed, particularly optional items and substitute items.
2. Changes made by addenda and modifications.

1.05 SUBMITTALS

A. At Contract closeout, deliver contractor red-line drawings, Record Documents and samples to OWNER.

B. Transmit with cover letter in duplicate, listing:

1. Date.
2. Project title and number.
3. Contractor's name, address, and telephone number.
4. Number and title of each Record Document.
5. Signature of Contractor or authorized representative.

PART 2 PRODUCTS

A. Not Applicable

PART 3 EXECUTION

A. Not Applicable

End of Section

SECTION 02110
CLEARING AND GRUBBING

PART 1 GENERAL

1.01 SUMMARY

A. This work consists of clearing, grubbing, removing, and disposing of all debris and of all vegetation that are within the designated construction areas, except for such objects that the Owner designates to remain. The work shall also include preserving and protecting from injury or defacement all vegetation and objects designated to remain.

PART 2 PRODUCTS

A. Not Applicable.

PART 3 EXECUTION

3.01 GENERAL

A. Clear the entire construction area of all weeds, brush, briars, bushes, trees, stumps, and other protruding obstructions not designated to remain.

B. Perform all clearing and grubbing operations in accordance with the applicable provisions for erosion control as shown on the drawings. The Contractor is responsible for locating disposal sites and for obtaining all related permits from site property owner and any agency having jurisdiction.

C. The Contractor is solely responsible for the removal, hauling, and disposal of waste material. Completely dispose of all materials resulting from clearing and grubbing off the site, all at the Contractor's expense. The Owner shall not be liable for the improper disposal of waste material.

D. Secure in writing any approval from a property Owner desiring disposal of debris on their private property.

End of Section

SECTION 02221
UNCLASSIFIED EXCAVATION FOR UTILITIES

PART 1 GENERAL

1.01 SUMMARY

A. All excavation for this project is considered UNCLASSIFIED.

B. The work called for by this section shall consist of clearing and grubbing, loosening, loading, removing, and disposing of, in the specified manner, all wet and dry materials (including rock) encountered that must be removed for construction purposes; furnishing, placing, and maintaining all sheeting, shoring, bracing, and timbering necessary for the proper protection and safety of the work, the workmen, the public, and adjacent property and improvements; the dewatering of trenches and other excavations; the preparation of satisfactory pipe beds; the backfilling and tamping of trenches, foundations, and other structures; the preparation of fills and embankments; the removal of unsuitable material from outside the normal limits of excavation and, where ordered by the Owner, their replacement with suitable materials; and all other grading or excavation work incidental to or necessary for the work. This work shall be performed as specified below.

1.02 RELATED SECTIONS

A. Section 02110 – Clearing and Grubbing

B. Section 02611 – Trenching, Backfilling, and Compacting

C. Section 02930 - Seeding

PART 2 PRODUCTS

A. Not Applicable

PART 3 EXECUTION

3.01 PREPARATION OF THE SITE

A. Before starting construction, remove from the work site all vegetable growth (except as hereinafter excluded), debris, and/or other objectionable matter as well as any buildings and/or other structures that the drawings and/or the Owner specifically indicate are to be removed. Dispose of this refuse material in a manner acceptable to the Owner.

B. In certain areas it may be desirable for existing trees, shrubs, or other vegetation on the site to be preserved for the permanent landscape. Such vegetation may be shown on the drawings, specifically listed in the specifications, marked on the site, or identified by the Owner. In no case damage or remove such growth without written permission from the Owner.

C. If the area to be excavated is occupied by trees, brush, or other vegetable growth, clear such growth and grub the excavated area, and remove all large roots to a depth of not less than 2

feet below the bottom of the proposed construction. Dispose of the growth removed in a manner satisfactory to the Owner. Fill all holes or cavities created during this work that extend below the subgrade elevation with suitable material and compact to the same density as the surrounding material.

D. Trees, cultivated shrubs, etc., that are situated within public rights-of-way and/or construction easements through private property but not directly within the excavation area shall remain undisturbed unless it is necessary to remove them so that the work can be performed safely and unless their removal is specifically ordered by the Owner. Take special precautions to protect and preserve such growth throughout all stages of the construction.

E. Preparation of the site shall be considered an integral part of the excavation and one for which no separate payment shall be allowed.

3.02 UNSUITABLE MATERIALS

A. Wherever muck, quicksand, soft clay, swampy ground, or other material unsuitable for foundations, subgrade, pipe laying, or backfilling is encountered, remove it and continue excavation until suitable material is encountered. The material removed shall be disposed of in the manner described below. Then refill the areas excavated for this reason with 1- to 2-inch sized crushed stone up to the level of the lines, grades, and/or cross sections shown on the drawings. The top 6 inches of this refill shall be Class A, Grade D aggregate crushed stone for bedding.

3.03 ROCKS AND BOULDERS

A. Should rock be encountered in the excavation, remove it by mechanical methods (no blasting is allowed).

B. Excavate rock over the horizontal limits of excavation and to a depth of not less than 6 inches below the outside bottom of pipe up to 30 inches in diameter and not less than 12 inches below the outside bottom of larger pipes if rock extends to such depth. Then backfill the space below grade with Class A, Grade D aggregate or other approved material, tamp to the proper grade, and make ready for construction. For monolithic concrete sewers or culverts and for structures, excavate rock to the outside bottom of the structure or sewer.

3.04 DISPOSAL OF MATERIALS

A. Whenever practicable, all materials removed by excavation that are suitable for backfilling pipe trenches or for other purposes shown on the drawings or directed by the Owner shall be used for these purposes. Any materials not so used shall be considered waste materials and disposed of at the Contractor's expense.

B. Waste materials may be deposited in spoil areas at locations approved by the Owner. Do not leave in unsightly piles but instead spread in uniform layers, neatly level, and shape to drain. Seed as specified in Section 02930 - Seeding.

C. Once any part of the work is completed, properly dispose of all surplus or unused materials (including waste materials) left within the construction limits of that work. Leave the surface of the work in a neat, workmanlike condition, as described below.

D. The disposal of waste materials shall be considered an integral part of the excavation work and one for which no separate payment shall be allowed.

3.05 EXCAVATION FOR TRENCHES, MANHOLES, AND STRUCTURES

A. Unclassified excavation for pipelines shall consist of the excavation necessary for the construction of water, sewer, and other pipes and their appurtenances (including manholes, inlets, outlets, headwalls, collars, concrete saddles, and pipe protection) that are called for by the drawings. It shall include clearing and grubbing where necessary, backfilling and tamping pipe trenches and around structures, and disposing of waste materials; all of which shall conform to the applicable provisions set forth elsewhere in these specifications.

B. The Contractor may, if he chooses, use a motor-powered trenching machine. If he does; however, he shall be fully responsible for the preservation or repair of existing utilities.

C. Unless the construction of lines by tunneling, jacking, or boring is called for by the drawings or specifically authorized by the Owner, make excavation for pipelines in open cut and true to the lines and grades shown on the drawings or established by the Owner on the ground. Cut the banks of trenches between vertical parallel planes equidistant from the pipe centerline. The horizontal distance between the vertical planes (or, if sheeting is used, between the inside faces of that sheeting) shall vary with the size of the pipe to be installed, but shall not be more than the distance specified in Section 02611 Part 3.02 E. 2. When approved in writing by the Owner, the banks of trenches from the ground surface down to a depth not closer than 1 foot above the top of the pipe may be excavated to nonvertical and nonparallel planes, provided the excavation below that depth is made with vertical and parallel sides equidistant from the pipe centerline in accordance with the width requirements outlined above. Any cut made in excess of the maximum width shall be at the expense of the Contractor and may be cause for the Owner to require that stronger pipe and/or a higher class of bedding be used at no cost to the Owner.

D. For rigid pipe, shape the bottom of all trenches to provide uniform bearing for the bottom of the pipe barrel. Pipe bedding shall be thoroughly and completely tamped before backfilling. Bedding for DIP used shall consist of 6-inch envelope of Class A, Grade D aggregate up to the centerline of the pipe. Pipe bedding shall be thoroughly and completely tamped before backfilling.

E. Excavate bell holes for bell and spigot pipe at proper intervals so that the barrel of the pipe will rest for its entire length upon the bottom of the trench. Bell holes shall be large enough to permit proper jointing of the pipe. Do not excavate bell holes more than two joints ahead of pipe laying.

F. Excavation for manholes, inlets, and other incidental structures shall not be greater in horizontal area than that required to allow a 2-foot clearance between the outer surface of the structure and the walls of the adjacent excavation or of the sheeting used to protect it. The bottom of the excavation shall be true to the required shape and elevation shown on the

drawings. No earth backfilling will be permitted under manholes, inlets, headwalls, or similar structures. Should the Contractor excavate below the elevations shown or specified, he shall, at his own expense, fill the void with either concrete or granular material approved by the Engineer.

G. Do not excavate pipe trenches more than 200 feet ahead of the pipe laying. Perform all work so as to cause the least possible inconvenience to the public. Construct temporary bridges or crossings when and where the Owner deems necessary to maintain vehicular or pedestrian traffic.

H. In all cases where materials are deposited along open trenches, place them so that in the event of rain or surcharge loading from such deposits no damage will result to the work and/or to adjacent property.

I. Excavation for manholes and other structures may be performed with nonvertical banks except beneath pavements or adjoining existing improvements. Do not permit the horizontal area of the excavation to exceed that required to allow a 2-foot clearance between the outer surface of the structure and the banks of the excavation or the sheeting used to protect the embankments. The bottom of the excavation shall be true to the required shape and elevation shown on the drawings.

3.06 THE DEWATERING OF EXCAVATION

A. Provide and keep in operation enough suitable pumping equipment whenever necessary or whenever directed to do so by the Engineer. Give special attention to excavations for those structures that, prior to proper backfilling, are subject to flotation from hydrostatic uplift.

B. All water pump or drained from the work shall be disposed of in a manner satisfactory to the Engineer without damage to adjacent property or other areas.

C. If necessary, due to the volume of water containing sediment, or due to the location of pumping activities, construct a sediment trap (structure) to pump ground water into until sediment is no longer being removed with the water. Sediment shall not be discharged to the waters of the State.

3.07 BORROW EXCAVATION

A. Whenever the backfill of excavated areas of the placement of embankments requires more material that is available from authorized excavations or whenever backfill material from such excavations is unsuitable, then obtain additional materials from other sources. This may require the opening of borrow pits at points accessible to the work. In such cases, make suitable arrangements with the property owner and pay all incidental costs, including any royalties, for the use of the borrowed material. Before a borrow pit is opened, the quality and suitability of its material shall be approved by the Engineer. All state and local regulation concerning borrow pits, drainage, and erosion control shall be strictly followed.

B. Excavate borrow pits in such a way that the remaining surfaces and slopes are reasonably smooth and that adequate drainage is provided over the entire area. Construct drainage ditches wherever necessary to provide outlets for water to the nearest natural channel, thus preventing

the formation of pools in the pit area. Leave the sides of borrow pit cuts at a maximum slope of 2:1 unless otherwise directed by the Engineer.

C. Properly clear and grub borrow pits. Remove all objectionable matter from the borrow pit material before placing it in the backfill.

D. The taking of materials from borrow pits for use in the construction of backfill, fills, or embankments shall be considered an incidental part of the work. No separate payment shall be made for this.

3.08 BACKFILLING

A. Begin backfilling after the line construction is completed and then inspected and approved by the Engineer. On each side of the line, from the top of the bedding material as specified in Paragraph B., the backfill material shall consist either of fine, loose earth like sandy soil or loam or of granular material that is free from clods, vegetable matter, debris, stone, and/or other objectionable materials and that has a size of no more than 2 inches. Place this backfill simultaneously on either side of the pipe in even layers that before compaction are no more than 6-inches deep. Thoroughly and completely tamp each layer into place before placing additional layers. Backfill shall, at locations beneath concrete and asphalt driveways, roadways, sidewalks, parking areas, etc. or within three feet of pavement, consist of No. 57 crushed stone aggregate. Use of aggregate backfill shall be at the direction of the Engineer.

B. For all site piping used, install No. 57 crushed stone bedding in a 6-inch envelope on all sides of the pipe to be compacted as outlined in Paragraph A. Then add the remaining backfill as described in the previous paragraph.

C. At locations beneath or closely adjacent to pavement or at locations of improvements subject to damage by displacement, tamp and thoroughly compact the backfill in layers that, before compaction, are 6 inches deep. In other areas, the backfill for the upper portion of the trenches may be placed without tamping but shall be compacted to a density equivalent to that of adjacent earth material as determined by laboratory tests. Use special care to prevent the operation of backfilling equipment from causing any damage to the pipe.

D. If earth material for backfill is, in the opinion of the Engineer, too dry to allow thorough compaction, then add enough water so that the backfill can be properly compacted. Do not place earth material that the Engineer considers too wet or otherwise unsuitable.

E. Wherever excavation has been made within easements across private property, the top 1 foot of backfill material shall consist of fine loose earth free from large clods, vegetable matter, debris, stone, and/or other objectionable materials. Top soil shall be placed a minimum of 6 inches on top of this backfill material.

F. Wherever trenches have been cut across or along existing pavement, temporarily pave the backfill of such trenches by placing Class A, Grade D crushed stone as the top 12 inches of the backfill. Maintain this temporary pavement either until the permanent pavement is restored or until the project is accepted by the Owner. On heavy-traveled roadways, cold mix or leveling course binder 2 inches thick shall be installed and maintained until permanent pavement is installed.

G. Conduct backfilling around manholes, inlets, outfalls, and/or structures in the same manner as specified above for pipelines except that even greater care is necessary to prevent damage to the utility structure.

H. Wherever pipes have diameters of 15 inches or less, do not use power-operated tampers to tamp that portion of the backfill around the pipe within 1 foot above the pipe.

I. Perform backfilling so as not to disturb or damage any pipe and/or structure against which the backfill is being placed. If any pipe or structure is damaged and/or displaced during backfilling, open up the backfill and make whatever repairs are necessary, whenever directed to do so by the Engineer.

J. Backfilling and clean-up operations shall closely follow pipe laying. Failure to comply with this provision will result in the Owner's requiring that the Contractor's other activities be suspended until backfilling and clean-up operations catch up with pipe laying.

K. Compaction Requirements: Under buildings and two times the depth of pipe beyond, and under roads and two times the depth beyond the shoulder, compact to 100-percent of the standard proctor density at 2% less than the optimal moisture content as determined by AASHTO T99 Method D.

3.09 MAINTENANCE

A. Seed and mulch and maintain in good condition all excavated areas, trenches, fills, embankments, and channels until final acceptance by the Engineer.

B. Maintain trench backfill at the approximate level of the original ground surface by periodically adding backfill material wherever necessary and whenever directed to do so by the Engineer. Continue such maintenance until final acceptance of the project or until the Engineer issues a written release.

3.10 SLOPES

A. Neatly trim all open cut slopes and finish to conform either with the slope lines shown on the drawings or the directions of the Engineer. Leave the finished surfaces of bottom and sides in reasonably smooth and uniform planes like those normally obtainable with hand tools, though the Contractor will not be required to use hand methods if he is able to obtain the required degree of evenness with mechanical equipment. Conduct grading operations so that material is not removed or loosened beyond the required slope.

End of Section

SECTION 02415
HORIZONTAL DIRECTIONAL DRILLING AND BORING

PART 1 GENERAL

1.01 DESCRIPTION

A. This section covers the work necessary for installation of pipelines by directionally controlled horizontal drilling or boring equipment.

1.02 SCOPE OF WORK

A. Fabricate, directionally drill or bore and install the pipeline to the approximate lines and grades shown on the project plans.

B. Pressure test the pipeline section before installation; Pressure test the pipeline section after installation.

C. Clean up all affected sites, and restore all areas to pre-construction or better condition.

D. The CONTRACTOR shall deliver the pipeline to OWNER in a clean and operable condition. The pipe shall be internally cleaned with a suitable type pig cleaner as approved by OWNER. The cleaning must be conducted with an OWNER approved pig. All water must be removed from the pipeline as required by OWNER.

1.03 SUBMITTALS

A. The CONTRACTOR shall prepare a schedule for the work and submit it to OWNER for approval. The schedule shall include all major tasks to be performed including the following:

1. Rig mobilization and setup
2. Pipe assembly
3. Pilot hole drilling
4. Pre-reaming
5. Pretesting and pigging pipe before installation
6. Pipe pulling
7. Testing and pigging pipe after installation
8. Restoration and demobilization

B. At least 10 days prior to mobilization of equipment, the CONTRACTOR shall submit a detailed installation plan to OWNER for review and approval. This plan must also include a detailed description as to contingencies for potential fissures of drilling fluid.

C. The CONTRACTOR will supply Material Safety Data Sheets (MSDS) for all material used in making up drilling fluids. The drilling fluid composition must meet all federal, state, and local laws and environmental regulations governing the use, handling, storage, and disposal of such material.

1.04 PERMITS

A. The CONTRACTOR shall maintain and operate all construction equipment and perform all work within designated easements, temporary construction easements, working areas, public rights-of-way, and access roads.

B. The CONTRACTOR shall be responsible for obtaining all permits and regulatory authorizations for activities off of the defined easements and working areas, including any permits required for mobilizing materials and equipment and disposal of drilling fluids and industrial debris. The CONTRACTOR will be responsible for paying all fines that may be imposed due to illegal discharge.

PART 2 PRODUCTS

2.01 GENERAL

A. The CONTRACTOR shall provide all materials, equipment and labor for completing the drill/bore and for adequate protection of the work.

2.02 EQUIPMENT AND MATERIALS TO BE FURNISHED BY CONTRACTOR

A. The CONTRACTOR shall furnish all equipment and material required to complete the Scope of Work which shall include but not be limited to the following:

1. Drilling equipment
2. Water pumps, hoses, fittings, storage tanks, filters, hay bales, and silt fencing (as required)
3. Drilling fluids containment, collection, cleaning and disposal equipment, and material
4. Fuel and lubricant
5. Bentonite and related mixing equipment
6. All welding equipment and materials as required
7. All hydrostatic and pneumatic testing equipment and materials
8. Sidebooms, cranes, backhoes, trucks and other equipment and materials necessary to load and unload pipe and to support and smoothly transition the pipe while being pulled into the reamed hole
9. All equipment and materials necessary to restore project areas to pre-existing condition or better

PART 3 EXECUTION

3.01 INSTALLATION

A. General: The CONTRACTOR shall install the section of the pipeline by the horizontally dilled or bored, directionally controlled method of construction. This method shall consist of the drilling of a pilot hole within the designed tolerances for radius requirements, followed by enlargement of the hole to accommodate the product line.

B. Instrumentation: The CONTRACTOR will at all times provide and maintain instrumentation which will accurately locate the pilot hole position relative to ground surface. Drill fluid flow

rate and pressure must also be monitored. CONTRACTOR shall maintain and provide to OWNER, upon request, access to the data generated by the downhole survey tools.

C. Tolerances:

1. Pipe installed by horizontal directional drilling or boring must be located as shown on the project drawings. The CONTRACTOR shall employ experienced personnel to operate the directional drilling or boring equipment and the monitoring and steering equipment. At the completion of the pilot hole, the CONTRACTOR shall provide OWNER with the coordinates of the pilot hole as specified.

2. A smoothly drilled pilot hole shall follow the design centerline of the pipe profile and alignment described on the project drawings.

3. The pilot hole (Borehole Entry Point) shall penetrate the ground surface at the approximate location shown on the project drawings.

4. The course of the pilot hole must stay within the given right-of-way at all points along the drilled route.

5. The CONTRACTOR shall have accurate working gauges, which register tensile force being used to pull the pipeline back through the reamed borehole. It is the CONTRACTOR's responsibility to prepare the reamed out hole such that pulling back operations do not exceed the tensile strength of the pipe. The CONTRACTOR shall provide estimated calculations for the pulling loads and allowable loads before pull back operations begin. If during the pipeline pulling process this force reaches 75% of the allowable load for the pipeline, the project inspector must be notified immediately. Logs must be kept intact referencing all forces exerted on the pipeline during the project.

6. The CONTRACTOR shall provide adequate supports along the stringing area to protect the pipe and allow free movement of the pipeline during pullback.

7. During pullback operations, CONTRACTOR shall monitor roller operation and use sidebooms if required to assist movement of the pipe. Situations which could cause damage to the pipe material shall be corrected immediately. Damaged pipe shall be repaired to the satisfaction of the OWNER or replaced by the CONTRACTOR before pulling operations resume.

3.02 DRILLING MUD AND CUTTINGS

A. The Horizontal Directional Drilling or Boring operation is to be operated in a manner to eliminate the discharge of water, drilling mud and cuttings to water and land areas involved during the construction process. CONTRACTOR shall immediately contain and clean up any inadvertent returns.

B. Disposal of drilling fluids shall be the responsibility of the CONTRACTOR and shall be conducted in compliance with all relative environmental regulations, easement and workspace agreements and permit requirements. All costs related to disposal shall be the responsibility of the CONTRACTOR.

C. Transportation, makeup, and Material Safety Data Sheets (MSDS) for drilling fluids shall be provided to OWNER.

D. Water supply is the CONTRACTOR's responsibility, whether purchased locally or hauled in.

E. Drilling fluids must be free of all additives that will adversely affect the environment.

3.03 REAM AND PULL BACK

A. Pre-reaming: Pre-reaming operations shall be conducted at the discretion of the horizontal directional drilling or boring CONTRACTOR. All provisions of this specification relating to simultaneous reaming and pulling back operations shall pertain to pre-reaming operations.

B. Pulling loads: CONTRACTOR shall be responsible for determining safe pulling loads required for proper installation. Such loads shall be minimized as required to prevent failure of the pipeline during installation.

C. Torsional Stress: A properly sized and fully operational swivel will be installed between the reaming assembly at the end of the drill pipe, and the pipeline to restrict torsional stress from being transmitted to the pipeline.

D. CONTRACTOR may opt to fill the pipeline with water (ballasting) as installation proceeds to help prevent buckling and reduce buoyancy. The CONTACTOR must completely clean and dry the pipeline after installation.

E. Pull Section Support: The pull section shall be supported as it proceeds during pull back so that it moves freely and the pipe material is not damaged.

3.04 CLEANUP, REPAIRS AND RESTORATION

A. The CONTRACTOR is responsible for leaving all areas affected by construction actives in a condition equal to or better than the condition before construction.

B. The CONTRACTOR shall restore area around entry and exit pits as soon as work is completed. Fill to previous existing ground elevation and grade any areas where settlement occurs due to subsidence. Seed and straw as directed in Section 02930, Seeding.

End of Section

SECTION 02444
GALVANIZED CHAIN LINK FENCING

PART 1 GENERAL

1.01 SUMMARY

A. Submit complete specifications and shop drawings for OWNER'S approval.

B. Fencing and all accessories shall be produced by a single manufacturer. Submit copies of the manufacturer's technical data, layout and installation instructions per Section 01302.

C. Refer to other Sections for work related to that specified under this heading.

PART 2 PRODUCTS

2.01 POSTS, RAILS, AND BRACES

A. All structural and roll formed shapes shall conform to the provisions of ASTM A123 for galvanized coating.

B. All tubular members shall comply with the provisions of ASTM A120, Schedule 40, for weight and coating or be high strength triple coated steel in accordance with ASTM A569.

C. End, Corner, and Pull Post: For fence up to and including 12 feet 0 inches in height, 3-1/2 inches by 3-1/2 inches roll formed corner section shall have a minimum bending strength of 452 pounds (2.875 inches outside diameter, Schedule 40 pipe with a minimum bending strength of 381 pounds at 6 feet).

D. Line Posts (10 feet 0 inches Maximum Spacing):

1. Fabric Up To 8 feet 0 inches in Height: C-section, standard roll formed, 1.875 inches by 1.625 inches with a minimum bending strength of 245 pounds (1.90 inches outside diameter, Schedule 40 or high strength pipe with a minimum bending strength of 117 pounds)
2. Fabric Over 8 feet 0 inches in Height: C-section, heavy roll formed, 2.25 inches by 1.70 inches with a minimum bending strength of 314 pounds (2.375 inches outside diameter, Schedule 40 pipe with a minimum bending strength of 201 pounds)

E. Gate Posts:

1. Gate Leaves Up To and Including 6 feet 0 inches Wide: 3-1/2 inches by 3-1/2 inches roll formed section (2.875 inches outside diameter, Schedule 40 or high strength steel pipe)

2. Gate Leaves Over 6 feet 0 inches and Up To and Including 13 feet 0 inches Wide: 4 inches outside diameter, Schedule 40 pipe or high strength steel pipe
3. Gate Leaves Over 13 feet 0 inches and Up To and Including 18 feet 0 inches Wide: 6-5/8 inches outside diameter, Schedule 40 pipe or high strength steel pipe
4. Gate Leaves Over 18 feet 0 inches Wide: 8-5/8 inches outside diameter, Schedule 40 pipe or high strength steel pipe

F. Top Rail:

1. The top rail shall be a 1.625 inches by 1.25 inches roll formed section with a minimum bending strength of 192 pounds (1.660 inches outside diameter, Schedule 40 pipe with a minimum bending strength of 202 pounds at 10 feet).
2. Furnish in the manufacturer's standard lengths of approximately 21 feet 0 inches, with couplings approximately 6 inches long for each joint. One coupling in each five shall have an expansion spring. Provide means for attaching top rails securely to each gate, corner, pull, and end posts. The top rail shall form a continuous brace from end to end to each run of fence.

G. Tension Wire: 7 gage galvanized or aluminum coated coil spring wire

H. Post Bracing Assembly: to match top rail. Brace rail assembly shall be complete with a 3/8 inch diameter rod and adjustable take-up.

2.02 CHAIN LINK FABRIC

A. The fabric shall consist of one piece fabric widths for fences up to 12 feet 0 inches - 2 inches mesh, 9 gage or 11 gage, as indicated on the drawings.

B. Selvage Edges: Fabric in heights 60 inches and less shall be knuckled at both selvages. Fabric 72 inches and more shall be knuckled at the bottom selvage and be twisted and barbed at the top.

C. Finishes: heavy galvanized, 2.0 ounces of zinc per square foot, complying with ASTM A392, Class II, or aluminum coated with 0.40 ounces of aluminum per square foot, complying with ASTM A491, Class II

2.03 ACCESSORIES

A. All accessories, except tie wires and barbed wire, shall be galvanized to comply with ASTM A153.

B. Barbed Wire Supporting Arms: heavy pressed steel, complete with provisions for anchorage to tubular end, corner, and pull posts attaching 3 rows of barbed wire to each arm. Barbed wire arms are not required on roll formed terminal posts. Single arms shall be integral with a post top weather cap. Intermediate arms shall have a hole for the passage of the top rail. Arms shall be capable of withstanding, without failure, 250 pounds downward pull at outermost end of arm.

C. Barbed Wire: 2 strand, 12-1/2 gage wire with 14 gage, 4 point round barbs spaced approximately 5 inches on center, with finishes as follows:

1. Galvanized: ASTM A121, Class 3
2. Aluminized: ASTM A585, Class 2

D. Post Tops: pressed steel or malleable iron (designed as a weathertight closure cap for tubular posts). Where top rail is used, provide tops to permit the passage of the top rail.

E. Stretcher Bars (for tubular end, corner, pull, or gate posts only): one-piece lengths equal to the full height of the fabric, with a minimum cross section of 3/16 inch by 3/4 inch. Provide one stretcher bar for each gate and end post and two for each corner and pull post.

F. Stretcher Bar Bands: heavy pressed steel spaced not over 15 inches on center to secure stretcher bars to tubular end, corner pull, and gate post

G. Wire Ties: For tying fabric to line posts, use 11 gage steel wire clips for C-section posts and a minimum 9 gage aluminum wire ties for tubular posts, spaced 14 inches on center. For tying fabric to rails and braces, use 9 gage aluminum wire ties spaced 24 inches on center. For tying fabric to tension wire, use 11 gage hog rings spaced 24 inches on center.

2.04 GATES

A. Fabricate gate perimeter frames of 1.90 inches outside diameter tubular members galvanized in accordance with ASTM A120. Provide additional horizontal and vertical members to ensure proper gate operation and to allow for attachment of fabric, hardware, and accessories.

B. Assemble gate frames by welding or fittings and rivets for rigid connections. Use same fabric as for fence, unless otherwise indicated. Install fabric with stretcher bars at vertical edges, and tie at top and bottom edges. Attach stretcher bars to gate frame at not more than 15 inches on center. Attach hardware with rivets or by other means that will provide security against removal or breakage.

C. Provide diagonal cross bracing that consists of 3/8 inch diameter adjustable length truss rods on gates where necessary to provide frame rigidity without sag or twist.

D. Gate Hardware: Provide the following hardware and accessories, with a heavy galvanized finish, for each gate:

1. Hinges: pressed steel or malleable iron to suit gate size, nonlift-off type, offset to permit 180 degrees gate opening. Provide one pair of hinges for each leaf.
2. Latch: forked type or plunger bar type to permit operation from either side of the gate. Provide padlock eye as an integral part of the latch.
3. Keeper: Provide a keeper for all vehicle gates that automatically engages the gate leaf and holds it in the open position until manually released.

4. Double Gates: Provide gate stops for all double gates consisting of mushroom type or flush plate with anchors. Set in concrete to engage the center drop rod or plunger bar. Provide locking device and padlock eyes as an integral part of the latch, with one padlock for locking both gate leaves.
5. Sliding Gates: Provide the manufacturer's standard heavy duty track, ball bearing hanger sheaves, overhead framing and supports, guides, stays, bracing, and accessories, as required.

PART 3 EXECUTION

3.01 INSTALLATION

A. The packing for all products shall be Level C.

B. SET ALL POSTS IN A 3,000 PSI CONCRETE FOOTING. Trowel smooth the top of each footing at a 20 degrees angle from the post to the surrounding ground so as to shed water away from the post. The post shall extend to the full depth of the footing. The diameter and depth of footings for various fence heights shall be as specified on the drawings.

C. INSTALL ALL FENCING TO THE LIMITS SHOWN ON THE DRAWINGS. Install end or corner posts at any break in the alignment greater than 20 degrees. Install intermediate posts between end or corner posts, spaced equally at a maximum of 10 feet center to center. Install end, corner, or gate posts on both sides of a gate. Only one end or corner post shall be installed at the junction of different heights of fence and shall be consistent with the largest post required at the junction. Install gates to allow a clear and level swing in either direction to their maximum limit. Set all posts with a vertical tolerance of less than 1 inch in 10 feet as measured with a plumb bob.

D. All corner, terminal, and gate posts for fence 6 feet and higher shall have a midrail and 3/8 round adjustable truss rod to the next post.

E. All gates shall have a full wraparound hinge system with a positive latch with provision for a padlock. Gates 5 feet and under shall have a self-closing mechanism.

F. All fence shall have a bottom tension wire attached to the fabric and posts.

End of Section

SECTION 02532
SANITARY SEWERS AND APPURTENANCES (GRAVITY)

PART 1 GENERAL

1.01 WORK INCLUDED

A. Furnishing and installation of sanitary sewerage systems.

1.02 RELATED SECTIONS

A. Section 01500 - Construction Facilities and Temporary Controls

B. Section 01560 - Erosion and Pollution Control

C. Section 01710 - Cleaning

D. Section 02110 – Clearing and Grubbing

E. Section 02542 – Sewer Flow Control

F. Section 02611 – Trenching, Backfilling, and Compacting

G. Section 02612 – Finish Grading

1.03 SUBMITTALS

A. Submittals shall be submitted as specified in Section 01302, Submittals and Substitutions promptly and in accordance with approved schedule, in such a sequence that no delay to the work, or to the work of other Contractors is caused.

B. Product data shall be submitted as required.

C. Submit certification signed by manufacturer and Contractor that pipe, fittings, manholes, castings, and appurtenances meet specification requirements.

D. Submit six (6) copies of required documents.

1.04 QUALITY ASSURANCE

A. The Contractor shall install and test lines, fittings, valves and appurtenances in accordance with regulations issued by the Tennessee Department of Environment and Conservation and the Owner.

B. The Contractor shall disinfect all potable water lines, fittings, valves and appurtenances in accordance with regulations issued by the Tennessee Department of Environment and Conservation.

C. Adequate numbers of skilled workmen, who are thoroughly trained and experienced in the

necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work in this section shall be used.

D. Use equipment adequate in size, capacity and numbers to accomplish the work in a timely manner.

E. PVC piping shall be stored to protect from long term exposure to direct sun light and shall be stacked in suitable support systems to prevent buckling and deformation.

F. Immediately prior to lowering pipe or fittings into the trench, each length of pipe and each component shall have the interior and mating surfaces cleaned of all dirt and foreign material.

G. Carefully examine each pipe and fitting for cracks and other defects while suspended above the trench immediately before installation.

1.05 REFERENCES

A. ASTM A48 - Gray Iron Casting

B. ASTM C76 - Reinforced Concrete Culvert, Storm Drain, and sewer pipe

C. ASTM C425 - Compression Joints for Vitrified Clay Pipe and Fittings

D. ASTM C443 - Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets

E. ASTM C478 - Pre-Cast Reinforced Concrete Manhole Sections

F. ASTM C890 - Standard Practice for Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures.

G. ASTM C891 - Standard Practice for Installation of Underground Precast Concrete Utility Structures.

H. ASTM C923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals.

I. ASTM D3034 - Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings

J. ASTM D3212 - Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals

K. AWWA C111 - Rubber Gasket Joints for Cast-Iron and Ductile-Iron Pressure Pipe and Fittings

L. AWWA C151 - Ductile-Iron Pipe Centrifugally Cast, in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.

M. ASTM D-1248 - High Density Polyethylene Pipe

N. National Precast Concrete Association: Quality Control Manual for Precast Concrete Plants.

1.06 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Product Delivery, Storage and handling shall be in strict accordance with the manufacturer's recommendations using the best available methods to prevent damage to materials and components.

B. All material shall be stored to protect from long term exposure to direct sun light and shall be stacked in suitable support systems to prevent buckling and deformation.

C. Protect ductile iron pipe from damage to coating and lining.

D. All types of pipe shall be handled using canvas or nylon slings. If a forklift is to come in direct contact with HDPE pipe, the forks shall be padded. HDPE pipe shall be stored in a manner, which minimizes crushing or bending. HDPE pipe should lay flat and be stacked no higher than 84 inches. HDPE pipe coils shall not be stored in a vertical position. HDPE pipe shall be transported and stored so that it does not come in contact with debris or materials that could cause damage to the pipe.

E. Limit stacking of pipe to a height that will not cause deformation of bottom layers of pipes under anticipated temperature conditions. Space supports at widths as not to allow deformation of pipe at point of contact with support or between supports.

F. Interior of pipe and fittings shall be cleaned of dirt and other foreign material immediately prior to lowering into the trench.

G. Carefully examine each pipe and fitting for cracks and other defects while suspended above the trench immediately before installation.

1.07 JOB CONDITIONS

A. All Work in streets and roadways shall be conducted in strict accordance with provisions of Section 01570, Work Zone Traffic Control.

B. Whenever pipe laying is not actively in progress, open ends of all installed pipe and fittings shall be fitted with a watertight plug.

C. Separation of Sewers and Water Mains:

1. Parallel Installation of Sewers and Water Mains

   a. Whenever possible the sewer shall be installed at least 10 feet horizontally from water mains, the distance measured from edge to edge.

   b. If local conditions prevent a horizontal separation of 10 feet, the sewer shall be installed in a separate trench so that the top of the sewer pipe is at least 18 inches below the bottom of the water main.

   c. If neither of these conditions can be met the sewer shall be constructed of push-on or mechanical joint ductile-iron pipe, and the pipe pressure tested to assure watertightness prior to backfilling.

2. Crossing of Sewers and Water Mains:

a. Whenever possible the sewer main shall be installed below the water main so that the minimum distance between the outside of the sewer pipe and the outside of the water pipe is at least 18 inches. The crossing shall be arranged so that the sewer joints will be equidistant and as far as possible from the water main joints.

b. If local conditions prevent this separation, the sewer shall be constructed of push-on or mechanical joint ductile-iron pipe, and the pipe pressure tested to assure watertightness prior to backfilling.

c. Where the water main crosses under a sewer, adequate structural support shall be provided for the sewer to prevent damage to the water main.

D. Sewage flow must be maintained in the existing sewers. Whenever pipe laying progresses to a point where this flow must be interrupted, the Contractor shall plug the sewer upstream of the construction and provide pump bypassing to the downstream manhole in accordance with Section 02542, Sewer Flow Control. All downstream pipes, manholes and appurtenances must be tested and determined to be acceptable to the Owner and the Engineer to receive sewage flow. Bypassing of raw sewage to the surface will not be permitted. Contractor shall notify the Owner, his field representative and/or other appropriate authorities and receive written permission prior to proceeding with bypassing. When working in areas where interruption of sewer flow may occur, the Contractor shall have at the site the necessary pumps, lines and all other equipment in readiness to provide pump bypassing.

E. Contractor shall provide screen or other means approved by the Owner's representative to minimize gravel, mud, and other construction debris from entering sanitary sewer system. Screen shall be checked, maintained, and cleaned by Contractor daily, and shall be located closely downstream of the current construction activities under the direction of the Owner's representative. Relocate screen as necessary with construction activities.

F. Contractor shall plan his Work and arrange his Work schedules to minimize the length of time sewer service is interrupted.

PART 2 PRODUCTS

2.01 POLYVINYL CHLORIDE PIPE AND FITTINGS FOR GRAVITY SEWERS

A. Manufactured from virgin, National Sanitation Foundation (NSF) approved resin conforming to ASTM D-1784.

B. Unless otherwise specified, all PVC pipe and fittings shall conform to ASTM D-3034 and have a Standard Dimension Ratio (SDR) of 35.

C. The gaskets used for joining PVC sewer pipe shall conform to ASTM F-477.

D. All PVC gravity sewer pipe shall be clearly marked with the manufacturer's name, nominal diameter, SDR, ASTM D-3034, and NSF approval seal.

E. Gravity sewers greater than 12-inches in diameter shall be ductile iron pipe. Gravity sewers 12-inches or less in diameter shall be either ductile iron pipe or PVC.

2.02 DUCTILE IRON PIPE AND FITTINGS

A. Pipe:

1. Manufactured in accordance with ANSI A-21.50 (AWWA C-151) and ANSI A-21.10 (AWWA C-110).

2. A cement lining meeting the requirements of ANSI 21.4 (AWWA C-104).

3. A minimum of 1 mil thick bituminous coating on the outside surface.

4. Clearly marked with manufacturer's name, D.I. or Ductile, weight, class or nominal thickness, and casting period.

5. Ductile iron pipe shall be Class 350 for pipe sizes 3-inch through 12-inch and Class 250 for pipe sizes 14-inch and larger.

6. Unless otherwise specified or shown on the Contract Documents, provide Ceramic Epoxy Lining for ductile iron pipe as follows:

a) 40-mils dry film thickness lining, consisting of amine cured novalac epoxy containing at least 20 percent by volume quartz pigment manufactured under the name of Protecto 401 or approved equal.

b) Line interior of bell and exterior of spigot in joint sealing areas with 6 mils to 10 mils of specified lining.

B. Fittings.

1. Fittings 4"-24": Pressure rated at 350 psi.

2. Fittings 30"-36: Pressure rated at 250 psi.

3. Joints meeting the requirements of ANSI A-21.11 (AWWA C-111).

4. If specified or required by Owner, ceramic epoxy lining in accordance with 2.02 A. 6. above.

2.03 CONCRETE MATERIALS

A. Standard Cement Concrete mix with a minimum 28-day compressive strength of 2,500 psi.

2.04 CASTING FOR FRAME AND COVERS

A. Gray iron, Class 30 unless otherwise specified, meeting AASHTO M-108.

B. Cleaned and coated with bituminous paint that will produce an acceptable finish that is not

affected by exposure to hot or cold weather.

C. Rings and covers for use on watertight manholes shall be machined smooth uniform bearing that will provide a watertight seal.

D. Frame and cover shall be capable of supporting 16,000 pounds wheel load, combined weight shall be as shown in the Project Details.

E. Cover shall have concealed pickhole.

F. The words SANITARY SEWER shall be cast into the cover.

G. Horizontal and vertical mating surfaces shall be machined.

2.05 PRECAST MANHOLES

A. AASHTO M-199 SR or ASTM C-478.

B. Openings shall be provided for the required number and size pipes and shall be marked to insure installation at proper locations.

C. Lift loops shall be ASTM A416 steel strand. Lifting loops made from deformed bars are not allowed.

D. Flexible Joint Sealant Roping and Sealant Sheets (joint seals) shall be butyl rubber based conforming to Federal Specification SS-S-210A, AASHTO M-198, Type B - Butyl Rubber and as follows: maximum of 1% volatile matter and suitable for application temperatures between 10 and 100 degrees F. Material shall be RV-30 as manufactured by RuVan Inc., ConSeal CS-212, or approved equal, with a minimum cross section of 1-¼ inches for roping and sheets with minimum dimensions of 1/8 inch thick by 12 inches wide.

E. Epoxy Gels for interior patching of wall penetrations when used as approved by the Engineer shall be a 2-component, solvent-free, moisture-insensitive, high modulus, high-strength, structural epoxy paste adhesive meeting ASTM C-881, Type I and II, Grade 3, Class B and C, Epoxy Resin Adhesive.

F. Precast Component Fabrication and Manufacture shall be as described in the following paragraph:

1. Precast Manufacturing shall be in conformance with ASTM C478. Wall and inside slab finishes resulting from casting against forms standard for the industry shall be acceptable. Exterior slab surfaces shall have a float finish. Small surface holes, normal color variations, normal form joint marks, and minor depressions, chips and spalls will be tolerated Dimensional tolerances shall be those set forth in the appropriate References and specified below.

2. Joint Surfaces between Bases, Risers and Cones shall be manufactured to the joint surface design and tolerance requirements of ASTM C361. The maximum slope of the vertical surface shall be 2 degrees. The maximum annular space at the base of the joint shall be 0.10 inch. The minimum height of the joint shall be 4 inches.

3. Lift Inserts and Holes shall be sized for a precision fit with the lift devices, shall comply with OSHA 1926.704, and shall not penetrate through the manhole wall.

4. Step Holes: Step holes shall be cast or drilled in the Bases, Risers and cones to provide a uniform step spacing of 16 inches. Cast step holes shall be tapered to match the taper of the steps.

G. Precast Base Sections shall be cast monolithically without construction joints or with an approved galvanized or PVC waterstop in the cold joint between the base slab and the walls. The bottom step in base sections shall be a maximum of 26 inches from the top of the base slab. The width of the base extensions on Extended Base Manholes shall be no less than the base slab thickness.

H. Precast Riser Sections shall have a minimum lay length of 16 inches.

I. Precast Concentric and Eccentric Cone Sections shall have an inside diameter at the top of 27 inches. The width of the top ledge shall be no less than the wall thickness required for the cone section. Concentric cones shall be used only for Shallow Manholes.

J. Precast Transition Cone Sections shall provide an eccentric transition from 60 inch and larger manholes to 48-inch diameter risers, cones and flat slab top sections. The minimum slope angle for the cone wall shall be 45 degrees.

K. Precast Transition Top Sections shall provide an eccentric transition from 60-inch and larger manholes to 48-inch diameter risers, cones and flat slab top sections. Transition Top sections shall be furnished with vents as shown on the manhole details. The maximum amount of fill over the transition top section shall be 20 feet. Transition Tops shall not be used in areas subject to vehicle traffic.

L. Precast Flat Slab Top Sections shall have an inside diameter at the top of 27 inches and shall be designed for HS-20 traffic loadings as defined in ASTM C890. Items to be cast into Special Flat Slab Tops shall be sized to fit within the manhole ID and the top and bottom surfaces.

M. Standard Manhole Adjustment Rings (EPP) are specified in paragraph 2.10. Precast Grade Rings used to adjust ring and covers to finished grade will only be allowed in special circumstances and upon receiving prior approval from The Owner or Owner's Representative. No more than 11 vertical inches of grade rings will be allowed per manhole. Grade Rings shall conform to ASTM C478 and shall be no less than 4 inches in height.

N. Precast Inverts shall meet the following requirements.

1. Pipe openings shall provide clearance for pipe projecting a minimum of 2 inches inside the manhole. The height of the transition from the pipe opening to the invert trough shall be equal to ½ of the Opening ID minus Pipe ID, plus or minus ¼-inch. The crown of small I.D. pipe shall be no lower than the crown of the outlet pipe. When the fall between the inlet and the outlet holes is greater than 4 inches, the inlet end of the trough shall be below the inlet pipe invert and aligned horizontally within 1 inch.

2. Invert Troughs shall be formed and finished to provide a consistent slope from the pipe outlet to the inlets up to 4 inches of fall. The minimum fall shall be 1 inch. The

minimum outside bending radius from influent to effluent shall be 1.5 times the pipe I.D. A ½-inch radius shall be provided at the intersection of 2 or more channels. The minimum concrete thickness from the bottom of the trough to the bottom of the base shall be 7 inches.

3. Invert Benches shall have a float finish with a uniform 2-½ inch slope, plus or minus 1 inch, from the high point at the manhole wall to the low point at edge of invert trough. A ¼- inch radius shall be provided at the edge of the bench and trough.

4. Depressions, high spots, voids, chips, or fractured over ¼-inch in diameter or depth shall be filled with a sand cement paste and finished to a texture reasonably consistent with that of the formed surface.

O. Precast Components and grade rings shall be sealed around the external perimeter as follows:

1. External Seals shall consist of a polyethylene backed flat butyl rubber sheet no less than 1/8-inch thick and 12 inches wide centered on the outside perimeter of the joint. Material to be RV-40-PW (or approved equal) as manufactured by RuVan, Inc.

2. Internal Seals shall consist of a plastic backed butyl rubber rope no less than 14 feet long and having a cross-sectional area no less than the annular space times the height of the joint or 1¼ inches, whichever is greater.

P. Lifting devices for handling Precast Components shall be provided by the Precast Manufacturer and shall comply with OSHA Standard 1926.704.

Q. New “wet-cast” manholes shall have a waterproofing protection admixture added during the batching process. Admixture shall be XYPEX ADMIX C-1000R or approved equal and admixture dosage shall be in strict accordance with written manufacturer’s recommendations.

R. Coatings

1. The exterior surface of all new "dry-cast" manholes shall be coated with a minimum of one (1) coat of specified material. The coating shall be applied by the manhole manufacturer, and applied and cured in strict accordance with the coating manufacturer's requirements.

2. Coating and sealing material shall be:

- DRYCON Water proofing/sealer (grey in color) as manufactured by IPA Systems, Inc.

- PRECO Waterproofing/sealer (grey in color) as manufactured by FOSROC PRECO Industries, Ltd.

3. Coating is not required for manholes which are manufactured utilizing the "wet-cast" method.

S. All precast components shall be manufactured at a plant certified by the National Pre-cast Concrete Association’s Plant Certification Program prior to and during the production of products for this project.

T. Manhole Liner: For manholes receiving flow from low pressure sewer and force mains (and one manhole downstream), provide aromatic polyrea coating as manufactured by "OBIC" or approved equal. Application to be provided by a Manufacturer-Certified Contractor.

2.06 MANHOLE STEPS

A. Steps shall be provided in Bases, Risers, Cones, Transition Cones, and Transition Top sections aligned vertically on 16-inch centers. Steps shall be secured to the wall with a compression fit in tapered holes or cast in place. Steps shall not be vibrated or driven into freshly cast concrete or grouted in place. The steps shall be Copolymer Polypropylene Plastic reinforced with a ½" diameter grade 60 bar and have serrated tread and tall end lugs. Step pullout strength shall be 2000 lbs. minimum when tested according to ASTM C497.

2.07 PIPE ENTRANCE COUPLINGS FOR MANHOLES

A. Pipe to Manhole Connectors shall conform to ASTM C923, and to ASTM C-425 for Pipe Diameters 12 inches and smaller. The location of the pipe connectors shall vary from the location shown on the Project Plans no more than ½ inch vertically and 5 degrees horizontally. Provide for control of the OD to within the tolerances of the connector on flexible pipes larger than 12 inches.

B. Rigid cement or synthetic type grouts are not acceptable as a seal between the manhole and entry pipe.

C. The manhole entrance coupling with the entry pipe shall be fitted with a Pipe to Manhole Connector, "A-Lok" or approved equal.

D. Other specially designed flexible products such as "KOR-N-SEAL" may be approved for use in adding a pipe entrance to an installed manhole and for other uses where available and where materials meet the requirements of ASTM C-425.

E. All PVC/HDPE pipe connections to existing brick manholes shall be made with GPK PVC Manhole Adapters (also known as “sand collars”) with an external abrasive silica layer or approved equal.

2.08 INSIDE DROP ASSEMBLY (REHABILITATED MANHOLES)

A. The drop bowl assembly shall be hand fabricated from marine grade fiberglass, and shall be Reliner “A” Drop Bowl or approved equal.

B. Drop pipe shall be 6-inch SDR 35 PVC pipe for 8-inch gravity sewer. Refer to Standard Detail for additional drop pipe size requirements.

C. Flexible connector to connect drop bowl to drop pipe shall be Fernco Series 1056 or approved equal.

D. Clamping brackets for securing 6-inch drop pipe to manhole shall be 304 stainless steel. All fasteners shall be 18-8 stainless steel in accordance with manufacturer’s recommendations.

2.09 PIPE REPAIR COUPLINGS

A. Flexible Couplings:

1. Designed to join sewer pipes of the same or different material or sizes. Flexible couplings shall fit over the end of plain end or spigot pipe to form a positive seal against infiltration and exfiltration in non-pressure applications. Flexible couplings shall flex with normal earth movement to maintain integrity of seal. Use of flexible couplings shall be at the OWNER's discretion.

2. For repairing PVC pipe, coupling shall be manufactured from elastomeric polyvinyl chloride (PVC) which is unaffected by soil conditions and resistant to chemical, ultraviolet rays, and normal sewer gases. The PVC material shall contain bactericide and fungicide to inhibit growth of bacteria and fungus. The PVC material shall be 55 minimum to 65 maximum Shore A durometer hardness. Couplings shall conform to the applicable parts of ASTM C443, ASTM C425, ASTM C564, and ASTM D1869.

3. For repairing materials other than PCV pipe and/or different pipe materials, flexible coupling shall be 5000 Series Strong Back RC coupling as manufactured by Fernco, or approved equal, and shall be supplied with a 0.012-inch stainless steel shield and molded-in bushing, and two corrosion resistant Series 316 stainless steel clamps, which when tightened to 60 inch-pounds torque, seal the joint.

4. Approved and listed by all of the following code agencies: SBCCI (Southern Building Code Congress International, Inc.), BOCA (Building Officials & Code Administrators International, Inc.), IAPMO (International Association of Plumbing and Mechanical Officials), and CSA (Canadian Standards Association).

B. HDPE Couplings: Electro-fusion couplings meeting the same requirements as HDPE pipe.

2.10 MANHOLE GRADE ADJUSTING RINGS

A. Grade Adjustment Rings shall be manufactured from Expanded Polypropylene (EPP), black 5000 series meeting ASTM D3575 and ASTM D4819-13. The rings shall be manufactured using a high compression molding process to produce a finished density of 120 g/l (7.5 pcf) and shall be PRO-RING™ by "Cretex Specialty Products" or approved equal.

B. Design Requirements: The grade adjustment rings shall be designed to allow final adjustment of the frame and cover to the grade established by the Owner or on the project drawings. Also, the rings shall be designed to accommodate flat or sloping surfaces to within approximately ¼-inch to ½-inch of the specified final elevation. The grade adjustment system shall have a minimum fifty-year design life.

C. Performance Requirements: The grade adjustment rings shall be capable of supporting the minimum requirements of AASHTO M-306, H-25 and HS-25, be UV stable and be resistant to chemicals and corrosion commonly associated with the sanitary sewer environment.

D. "Grade" adjustment rings may contain either an upper and lower keyway (tongue and groove) for vertical alignment and/or an adhesive trench on the underside with a flat top.

E. "Finish" or "Flat" rings may have either a keyway (groove) on the underside for vertical alignment and/or an adhesive trench with a flat upper surface. These rings shall be available in heights (thicknesses) which will allow final adjustment of the frame and cover to within ¼-inch to ½-inch of the specified final elevation.

F. "Angle" rings may have either an upper and lower keyway (tongue and groove) for vertical alignment and/or an adhesive trench on the underside. When required, the "Angle" ring or rings shall allow final adjustment of the frame and cover to within ¼-inch to ½-inch of the specified final elevation.

G. Adhesive/Sealant: Any adhesive or sealant used for watertight installation of the manhole grade adjustment rings shall be M-1 Structural Adhesive/Sealant or approved equal meeting the following specifications:

1. ASTM C-920, Type S, Grade NS, Class 25, Uses NT, T, M, G, A, and O
2. Federal Specification TT-S-00230-C, Type II, Class A
3. Corps of Engineers CRD-C-541, Type II, Class A
4. Canadian Standards Board CAN 19, 13-M82
5. AAMA 802.3-08 Type II, AAMA 803.3-08 Type I, and AAMA 805.2-08 Group C

H. Repair Mortar, if required, shall be a one component, quick set, high strength, non-shrink, polymer modified cementitious patching mortar, which has been formulated for vertical or overhead use meeting the requirements of ASTM C-109 for Compressive Strength, C-348 and C-78 for Flexural Strength and C-882 for Slant Shear Bond Strength. Repair mortar shall not contain any chlorides, gypsums, plasters, iron particles, aluminum powder or gas-forming agents, nor shall it promote the corrosion of any steel that it may come in contact with. Repair mortar shall be Octocrete as manufactured by "IPA Systems" or approved equal.

I. Cementitious Grout, if required, shall be a pre-mixed, non-metallic, high strength, non-shrink grout which meets the requirements of ASTM C-191 and C-827 as well as CRD-C-588 and C-621. When mixed to a mortar or "plastic" consistency, it shall have a minimum one-day and 28-day compressive strength of 6,000 and 9,000 psi respectively. Cementitious grout shall be PennGrout as manufactured by "IPA Systems" or approved equal.

PART 3 EXECUTION

3.01 PREPARATION

A. Install barriers, signs and other devices to identify and protect areas the construction site and all adjacent areas.

B. Protect and maintain all benchmarks and other survey points.

C. Protect and maintain all pipe, manholes and other material and equipment not scheduled for replacement, and/or all pipe and equipment scheduled for operation during the construction period of the new components. Repair or replacement of all damaged items shall be at the Contractors expense.

D. Prior to laying pipe, prepare a suitable bedding according to Section 02221, Unclassified Excavation for Utilities.

E. Before placing pipe in the trench, field inspect for cracks or other defect; remove defective pipe from the construction site.

F. The interior of each joint of the pipe shall be cleaned to remove all undesirable material.

G. Prepare and clean the spigot and the bell end of the pipe and remove undesirable material from the gasket and gasket recess.

H. Establish line and grade for pipe and appurtenances. Verify location and elevation of other utilities and manholes for gravity sewers.

3.02 INSTALLATION OF GRAVITY SANITARY SEWERS

A. Sewers shall be installed in locations to provide a minimum of 18 inches of clearance (horizontally and vertically) between all other existing utilities (refer to paragraph 1.07, Part C. for installation near water mains).

B. Lay pipe true to the lines and grades from the grade and alignment stakes, or equally usable references.

1. Lasers shall be used to install sewer lines and type and procedures shall be approved by the Owner. Reference points for both line and grade shall be set at each manhole. Check for pipe alignment and grade after each joint has been installed. Measure for grade at pipe invert; not at top of pipe.

2. Set offset hubs at such distance from centerline of excavation as is suitable for the excavating method and machinery used.

3. Check invert elevation at each installed manhole with survey-grade equipment acceptable to owner before proceeding with installation of next pipe segment.

C. Gravity sewers 12-inches or less in diameter shall be either ductile iron pipe or PVC (SDR 35). Ductile Iron Pipe shall be used for trench depths of 12 feet or greater (No Exceptions). Gravity sewers greater than 12-inches in diameter shall be Class 150 ductile iron pipe.

D. Lay pipe progressively up grade, with bell upstream, in such a manner as to form close, concentric joints with smooth bottom inverts. Joining of all pipe shall be in accordance with manufacturer's specifications.

E. Bed each pipe section and provide Check Dams in accordance with the Standard Details and Specifications.

F. Unless otherwise specified, provide all gravity sewer lines with a minimum of 4 feet of cover in roadways and 2-1/2 feet of cover in open areas, unless ductile iron pipe or concrete encasement is used.

G. Do not allow walking on complete pipelines until backfill has been placed to a depth of at least

6 inches above the crown of the pipe.

H. Keep the interior of the pipe free of all unsuitable material, and upon completion of a section between any two manholes it shall be possible to view a complete circle of light when looking through the pipe.

I. When pipe laying ceases, close the open ends of the pipe with a suitable plug to prevent the entrance of foreign materials.

J. Couplings and adapters used for joining dissimilar gravity pipe materials, for repairing and rejoining sections of gravity sewer, and for connecting the first full joint of pipe to a short stub through a manhole wall shall meet the requirements of ASTM C-425. (See Standard Details).

K. All couplings and adapters for gravity sewer pipe shall be of rubber, plastic and metallic materials that will not react chemically or biologically with municipal wastewaters or aggressive elements in the soil and conform to ASTM - 425, Section 5.

L. All gravity sewers, including DIP, shall be installed with a 12-gauge tracer wire throughout the entire system, including service laterals to the cleanout. Wire shall be installed with (directly beneath or beside of) the sewer main. Keep wire as continuous as possible. Where connections are needed, strip wire back approximately 1-inch and connect with waterproof direct-bury lug with dual conductor slots (DryConn #90120 or approved equal). Wrap connection well on each side connection with electrical tape. When installation is complete, the entire system must be tested for continuity in the presence of a LCUB inspector. LCUB will require re-excavation and improvement to areas that do not trace well and/or show low or poor continuity. Tracer wire shall be high-strength copper clad steel conductor that is specifically made for underground utility locating purposes, and shall be #12 AWG HS-CCS HDPE 30 mil as manufactured by "Copperhead Industries, LLC" or approved equal, and shall be insulated with a 30 mil, high density, high molecular weight polyethylene green insulation and rated for direct burial use at 30 volts. Heavier wire may be required for directional drilling and pipe bursting.

3.03 INSTALLATION: SEWER MANHOLES - GENERAL

A. Unless otherwise specified, all manholes shall have inside diameter of not less than 48 inches and a vertical wall height of not less than 2.5 feet.

B. The clear opening into the manhole shall be not less than 27 inches.

C. Backfill manholes in the same manner as specified for pipelines.

3.04 INSTALLATION: STANDARD PRECAST CONCRETE MANHOLES

A. Manhole shall be installed in accordance with ASTM C-478.

B. Excavate to the required depth and remove materials that are unstable or unsuitable for a good foundation. Prepare a level, compacted foundation extending a minimum of 6 inches beyond the manhole base. Add 6-inches (minimum) bedding material in accordance with 2.01 A. Bedding material shall be shaped and compacted utilizing a vibratory compacter in order to firmly integrate the bedding material into the subgrade resulting in a firm, unyielding, consolidated bedding surface.

C. When wet or unconsolidated material occurs or when over excavation of the base occurs, provide a subbase with a minimum of 12 inches of Class I, granular material, well compacted with mechanical tamping equipment.

D. Set base plumb and level, aligning manhole invert with pipe invert.

E. Secure Pipe Connectors to Pipe according to the written Connector Manufacturer's instructions. When pipe stub outs are installed, provide restraint from vertical and longitudinal movements before backfill.

F. Inlets and outlets from each manhole shall be finished smooth and flush with the sides of manholes walls so as not to obstruct the flow of liquid through the manhole.

G. Thoroughly clean bells and spigots to remove dirt and other foreign materials that may prevent sealing. Unroll the Butyl Sealant rope directly against base of spigot. Leave protective wrapper attached until sealant is entirely unrolled against spigot. Do not stretch. Overlap from side to side, not top to bottom and remove protective wrapper.

H. Set risers and cones so that steps align, taking particular care to clean, prepare and seal joints.

I. After joining manhole sections and setting adjustment rings, apply the primer sealer and the butyl sealant sheet around the outside perimeter of the joint as shown in the Standard Details.

J. Lift Holes leaving less than 2 inches of wall thickness shall be plugged from the outside using a sand cement mortar, then covered with butyl sealant sheet. Should Lift Holes penetrate the wall they shall be additionally sealed with an interior application of an epoxy gel ¾-inch thick extending 2 inches beyond the penetration.

K. Perform the final finishing to the manhole interior by filling all chips or fractures greater than ½- inch in length, width, or depth and depressions more than ¼ inch deep in inverts with an approved hydraulic cement. Do not fill the joints between the precast concrete sections with cementitious material. Clean the interior of the manhole, removing all dirt, spills or other foreign matter.

3.05 INSTALLATION: MANHOLE GRADE ADJUSTMENT RINGS

A. Installation and surface preparation shall be in accordance with the grade adjustment ring manufacturer's written instructions.

B. The joint between the first grade ring and top of the manhole shall be sealed using an adhesive/sealant meeting the requirements of Paragraph 2.10 G.

C. If the top of the manhole is not level or is irregular, then a non-shrink repair mortar meeting the requirements of Paragraph 2.10 H. or non-shrink cementitious grout meeting the requirements of Paragraph 2.10 I. shall be used. A bed of the specified mortar or grout shall be placed on the top surface of the manhole structure and then the first grade ring shall be embedded and leveled into the bed of material.

D. The remaining joints between all manhole adjustment rings and frame and cover shall be sealed using an adhesive/sealant meeting the requirements of Paragraph 2.10 G.

E. No other materials shall be used in the construction of the grade adjustment area beyond those specified above. Prohibited materials include, but are not limited to, wood or wood shims of any kind, concrete, brick, block, stones, etc.

F. The use of any heat shrinkable chimney seals shall only be permitted with Owner's written approval.

3.06 INSTALLATION: MANHOLE RINGS AND COVERS

A. Seal and anchor manhole rings in place with butyl sealant rope and sealant sheets and bolts in accordance with the Standard Details.

B. The bearing surfaces between cast rings and covers shall be machined, fitted together, and match marked to prevent rocking.

C. All castings shall be of the types, dimensions, and weights as shown in the Project Details and shall be free of faults, cracks, blow-holes, or other defects.

D. Set the manhole frames to the required elevation using no more than 11 inches of grade adjustment rings, sealing all joints between cone, adjusting rings, and manhole frame.

E. Standard manholes frames set above grade and all water tight frames shall be held in place by four (4) threaded anchors. Anchors shall consist of:

1. Four (4) ¾ inch diameter by 8-inch long stainless steel all-thread rod.

2. Set all-thread rod into ¾ inch holes 6 inches deep into the precast manhole with approved two (2) component epoxy anchor bolt setting compound.

3. Secure ring with stainless steel washers and nuts after setting compound has cured.

3.07 INSTALLATION: DROP MANHOLE ASSEMBLIES

A. Drop manhole assemblies shall be constructed as outlined on the Project Details and in the Contract Documents.

B. The material used in the outside drop pipe construction shall be Protecto 401 lined Ductile Iron Pipe and Class B concrete.

C. Inside drop bowl assembly shall be installed with stainless steel fasteners in accordance with the written manufacturer's recommendations.

D. Abandonment of existing drop assembly shall be incidental to the cost of inside drop assembly. The abandonment procedure shall be as follows:

1. Remove flow from subject line segment by plugging, by-pass pumping, or other methods approved by Owner and Engineer.

2. Plug existing incoming sanitary sewer (lower pipe) from inside manhole with concrete or grout plug.

3. Fill existing vertical outside drop pipe to within 6 inches of top with crushed stone.

4. Cap off remaining 6 inches of existing drop pipe with concrete or grout plug. Provide smooth finish to match invert of existing incoming sanitary sewer.

E. For inside drop assembly installations where incoming sanitary sewer is being lined, contractor to extend liner pipe a maximum of 2 inches into manhole and cut a "V" shaped notch at bottom edge of incoming pipe in accordance with drip bowl manufacturer's written recommendations.

3.08 INSTALLATION: SERVICE CONNECTIONS

A. Use in-line factory made sanitary tee fittings for all service connections on new sewer mains up to 15-inches in diameter. Where a service saddle is required in making service connections to existing sewers or new sewers 16 inches or larger in diameter, a Romac Industries, Inc. Style "CB" Sewer Saddle shall be used.

B. Wherever existing sewer services are encountered, temporary measures shall be employed to keep sewer services available. The installation of service connections shall follow immediately or be concurrent with the construction of the main sewer. This requirement shall apply particularly where traveled streets are involved so that the said streets will only be closed once during the construction period. This method of construction will permit more advantageous handling of backfilling and street paving replacement, and will also avoid possible damage to the main sewer by subsequent exposure for connection of the service lines.

C. All service laterals shall be 6-inch diameter to the property line and/or edge of easement installed at a minimum of 1% slope, unless field verified by Engineer. A 6"x4" eccentric increaser coupling (with taper) as manufactured by Royal Building Products/Plastic Trends (part number G616-4 or approved equal), installed after the cleanout shall be used for single family residential connection.

D. The service lateral shall be terminated at the end of the cleanout with a plug for future services.

E. Service laterals that originate on the sewer main shall be of the same material as the main at that location on the main unless otherwise approve by Owner. Ductile Iron service laterals shall be Class 350.

F. The service lateral shall not protrude into the sewer main.

G. Service lateral cleanouts shall be a 2-way cleanout as manufactured by Royal Building Products/Plastic Trends (G1006), or approved equal, and extend 3 feet above finished grade to mark sewer service connections until building connection is made. Cleanouts installed and reconnected to existing services shall be installed at finish/existing grade.

H. Any sanitary sewer services which are over 12 feet in depth shall require water line and/or mechanical joint quality pipe.

I. Reconnect existing service connections, including those that are intended to serve unoccupied or abandoned buildings or vacant lots, unless directed otherwise by the Owner or Engineer.

For service line pipe connections beyond the cleanout, use flexible coupling as specified in paragraph 2.09 A. 3. for connecting PVC pipe to dissimilar materials, or use a standard Fernco coupling with concrete cradles. Knock-on Repair Couplings are acceptable for connecting new PVC to existing PVC pipe.

J. Crushed stone bedding and haunching shall be placed in accordance with the Standard Details.

K. Initial and final backfill and surface restoration shall be completed as referenced and specified in Section 02221, Unclassified Excavation for Utilities, and other appropriate sections.

L. Contractor shall install tracer wire along the service line from the main to the cleanout in accordance with Section 02532 3.02 L.

M. Contractor shall provide service tee-wye locations, including size, manhole reach, lot or building number, stationing from nearest downstream manhole, right or left side connection (looking upstream), invert of the sewer main at tee-wye location and depth of cleanout in a tabular form.

N. Sewer Lateral Discharge (Main Floor Elevation) shall be a minimum of 6 inches above the top of the lowest of the two adjacent manholes.

O. The tapping of service connections into manholes will not be permitted.

3.09 ABANDON EXISTING MANHOLE PROCEDURE

A. The Contractor shall:

1. If manhole has salvageable cast iron frame and cover, remove cast iron frame and cover and deliver to LCUB or as directed by Engineer.

2. Permanently plug all incoming and outgoing pipes from inside manhole in accordance with the typical pipe plug detail.

3. Collapse manhole into itself to an elevation not less than 36 inches below finished grade.

4. Fill manhole with T.D.O.T. No. 2 stone within 12 inches (+/-) of the top (after manhole has been collapsed).

5. Use compacted T.D.O.T. base grading "D" to cap remaining excavation over existing manhole.

6. Backfill to finished grade with suitable soil material for manholes in non-paved areas, or backfill to required sub-grade with compacted T.D.O.T. base grading "D" for paved areas.

3.10 FIELD TEST - INITIAL PROOF TESTING OF SANITARY SEWERS

A. It is the intent to specify a "test as you go" procedure in order to establish confidence in the installation and avoid the necessary delay of final acceptance.

B. Before a reach of pipeline is approved for payment, successfully proof test that reach for grade, alignment, cleanliness, and leakage.

C. In the event that four or more reaches fail to satisfactorily pass proof testing procedures, cease pipe laying until deficiencies are identified and corrected.

D. The basis for grade, alignment and cleanliness testing will be visual inspection. Leakage testing will be by means of low pressure air or exfiltration or infiltration as deemed acceptable by the Engineer.

E. Proof test flexible pipeline installation for deflection by pulling a "go no-go" test mandrel through the line after the initial backfill is complete to avoid unnecessary dig-ups.

3.11 FIELD TEST - FINAL GRAVITY SEWER TESTING

A. Before the Work is accepted and before any house services are connected, a final testing procedure is to be followed.

B. Perform a visual inspection when groundwater levels are above the pipeline if possible. All visible leaks shall be repaired.

C. The standard leak test for all gravity sewers shall be a low pressure air exfiltration test. Other exfiltration tests, if approved by the Engineer, will be conducted in accordance with ASTM C-828 or latest revision.

D. If flexible pipe is used, pull an approved “go no-go” deflection mandrel of 95/100 pipe diameter through all reaches of gravity sewer main. This test shall be conducted no sooner than 24 hours after completion of backfilling of the tested reach. No sections will be accepted that exhibit a deflection of more than 5%.

3.12 LOW PRESSURE AIR EXFILTRATION TEST - GRAVITY SEWERS

A. Calculate the pressure drop as the number of minutes for the air pressure to drop from a stabilized pressure of 4.0 to 3.0 PSIG.

B. Times for mixed pipe sized of varying lengths should be calculated as described in ASTM, C828-76T using formula $t = K\,d/q$ ($q = .0020$).

C. Lengths of sections under test shall not exceed 500 linear feet.

D. Gravity sewer line testing shall include service laterals.

E. The following items are for one pipe size only:

AIR TEST TABLE
SPECIFICATION TABLE (MIN:SEC) REQUIRED WHEN TESTING ONE PIPE DIAMETER ONLY
PIPE DIAMETER, INCHES

FT.	4	6	8	10	12	15	18	21	24	27	38	33	36	39	42
25	0:04	0:10	0:18	0:28	0:40	1:02	1:29	2:01	2:38	3:20	4:08	4:59	5:56	6:58	8:05
50	0:09	0:20	0:35	0:55	1:19	2:04	2:58	4:03	5:17	6:41	8:15	9:59	11:53	13:57	16:10
75	0:13	0:30	0:53	1:23	1:59	3:06	4:27	6:04	7:55	10:01	12:23	14:58	17:00	18:25	19:50
100	0:18	0:40	1:10	1:50	2:38	4:08	5:56	8:05	10:34	12:45	14:10	15:35			
125	0:22	0:50	1:28	2:18	3:18	5:09	7:26	9:55	11:20				20:25	19:58	23:06
150	0:26	0:59	1:46	2:45	3:58	6:11	8:30			13:24	16:32	17:09	23:49	23:57	27:43
175	0:31	1:09	2:03	3:13	4:37	7:05			12:06	15:19	18:54	20:01	27:13	27:57	32:20
200	0:35	1:19	2:21	3:40	5:17			10:25	13:36	17:13	21:16	22:52	30:37	31:56	36:58
225	0:40	1:29	2:38	4:08	5:40		8:31	11:35	15:07	19:08	23:38	25:44	34:01	35:56	41:35
250	0:44	1:39	2:56	4:35			9:24	12:441	16:38	21:03	25:59	28:35	37:25	39:56	46:12
275	0:48	1:49	3:14	4:43		8:16	10:12	3:53	18:09	22:58	28:21	31:27	40:49	43:55	50:49
300	0:53	1:59	3:31		6:03	9:27	11:54	16:12	21:10	26:47	33:05	34:16	47:38	47:55	55:26
350	1:02	2:19	3:47		6:48	10:38	13:36	18:31	24:12	30:37	37:48	40:01	54:26	55:54	64:41
400	1:10	2:38			7:34	11:49	15:19	20:50	27:13	34:27	42:32	45:44	61:14	63:53	73:55
450	1:19	2:50		5:14	8:19	13:00	17:01	23:09	30:14	38:16	47:15	51:27	68:02	71:52	83:10
500	1:28			5:45	9:04	14:11	18:43	25:28	33:16	42:06	51:59	57:10	74:51	49:51	92:24
550	1:37		4:02	6:17	9:50	15:21	20:25	27:47	36:17	45:56	56:42	62:53	81:39	87:50	101:38
600	1:46	2:50	4:22	6:48			22:07	30:06	39:19	49:45	61:26	68:36	88:27	95:49	110:53
650	1:54											74:19		103:48	120:07

3.12 FIELD TEST - PRECAST MANHOLES

A. Manholes shall be physically and vacuum tested to assure compliance with the Contract Documents and the desired workmanship of the finished work has been achieved.

B. Manhole Vacuum Test:

1. Backfill shall be placed around the base of the manhole to a depth of 1 foot over the top of the sewer pipe before the vacuum test is performed.

2. The maximum vacuum applied to a manhole shall be 12 inches of mercury (Hg).

3. All manholes shall be subject to a vacuum test of a minimum of 10 inches Hg prior to acceptance by the Owner. The test shall be considered acceptable if the vacuum drops no more than 1 inch within the time specified in the following table:

Manhole I.D. (inches)	**48**	**60**	**72**	**84**	**96**	**120**
Test Time for up to 8 feet in depth (seconds)	**60**	**70**	**80**	**90**	**100**	**120**
Additional Test Time for each 4 Foot Added Depth (Seconds)	**10**	**15**	**20**	**30**	**40**	**60**

4. Testing Sequence:

a. All manholes shall be physically and vacuum tested. Manholes failing the test shall be repaired by the Contractor, and retested.

b. Manholes failing the vacuum test two (2) times may, at the discretion of the Owner, be allow to be hydrostatically tested by an exfiltration test in accordance with 3.12 C. for acceptance.

c. The OWNER may require complete replacement of any manhole failing three (3) leak tests. Replacement shall be at no cost to the OWNER.

5. The CONTRACTOR shall furnish all necessary equipment and personnel to conduct the tests in the presence of the ENGINEER.

6. Costs for initial testings shall be included within and incidental to the Contract Unit Price for manhole construction or rehabilitating.

7. Repairing, retesting, pressure grouting and/or replacement of defective manholes shall be at the sole cost and responsibility of the CONTRACTOR, and shall be pursued in a timely manner to prevent disruption to the Project and/or sewer services.

8. Manholes moved, disturbed, displaced and/or damaged in any way during the finishing and/or backfilling operation subsequent to successful testing shall be retested for acceptance as specified above, at the CONTRACTOR's expense.

C. Hydrostatic Testing:

1. Hydrostatic (exfiltration) testing allowed only if vacuum testing has failed two (2) times and only at the discretion of the Owner or Owner's Representative.

2. Plug inlets and outlets and fill manhole with water to level/height determined by Owner or Owner's Representative.

3. Manhole shall be filled 24 hours prior to time of testing to allow normal absorption into manhole walls to occur.

4. After soak period, add additional water as required to fill manhole to original water level/height as determined by Owner or Owner's Representative.

5. Test period shall be conducted for a minimum of four hours.

6. Leakage in manhole shall not exceed 0.1 gallon per hour per foot of head above invert.

7. Contractor shall repair or replace (as directed by Owner's Representative) manholes that do not meet leakage test requirements, or do not meet specified requirements from visual inspection at no cost to the Owner.

3.13 FIELD TEST – POST CONSTRUCTION CCTV

A. Closed Circuit TV Inspections (CCTV's) shall be performed for all new gravity sewer lines in accordance with Section 02541, Sewer Line Television Inspection.

End of Section

SECTION 02534
WASTEWATER FORCE MAIN

PART 1 GENERAL

1.01 SCOPE

A. The Work to be performed shall consist of the installation of wastewater force mains according to the Specifications and the Standard Drawings herein.

B. CONTRACTOR shall be responsible for safely storing materials needed for the Work until they have been incorporated into the completed Project. CONTRACTOR shall keep the interiors of all pipes, fittings, and other accessories free from dirt and foreign matter at all times.

1.02 DEFINITIONS

A. DR: Standard Dimension Ratio.

B. HDPE: High-density polyethylene pipe.

C. Pipe Stiffness Classification: Referred to as SN.

D. Pressure Class: Referred to as PN.

1.03 SUBMITTALS

A. Action Submittals:

1. Information on gasket polymer properties.

2. Tee fabrication details.

3. Application methods, application requirements, and chemical resistance data for coating and lining products.

4. Joint and fitting restraints.

B. Informational Submittals:

1. Certificates:

A. Manufacturer's Certificate of Compliance for each type of pipe showing that the products furnished meet requirements of this section.
B. Certification of Calibration: Approved testing laboratory certificate if pressure gauge for hydrostatic test has been previously used. If pressure gauge is new, no certificate is required.
C. Certified statement from manufacturer of gaskets, setting forth that basic polymer used in gaskets and test results of physical properties of compound are in accordance with AWWA C900 or AWWA C905 for PVC pipe and AWWA C111

for Ductile Iron Pipe.

2. Manufacturer's Written In Plant Quality Control Program: Quality control procedures and materials testing to be used throughout manufacturing process. Submit prior to manufacture of any pipe for this Project.

3. Test or historical performance data to verify joint design meets requirements of these Specifications.

4. Provide pipe test results with delivery of pipe. Do not deliver pipe not meeting test requirements to Site.

5. Manufacturer's written recommendations for pipe handling and installation.

6. PVC and HDPE pipe deflection test results.

7. Field Leakage Testing Plan: Submit at least 15 days in advance of the testing and include at least the following:

   a. Testing dates.
   b. Piping systems and sections to be tested.
   c. Test type.
   d. Method of isolation.
   e. Method of conveying water from source to system being tested.
   f. Calculation of maximum allowable leakage for piping section(s) to be tested.
   g. Method for disposal of test water, if applicable.

PART 2 PRODUCTS

2.01 PIPE

A. Materials will be visually inspected by OWNER at the Site for conformance to the Specifications. At OWNER's discretion, CONTRACTOR may be required to supply certified mill tests, samples, or other suitable form of verification that the material meets the required specifications.

1. Ductile Iron Pipe and fittings may be used for force mains 8 inches and larger:

   a. Made of good quality ductile iron in conformance with latest revision of AWWA/ANSI C151/A21.51. The pipe shall be push-on joint with a minimum pressure class of 150 psi, thickness design according to AWWA/ANSI C150/A21.58, ceramic epoxy lined and coated outside with an asphaltic coating. Ductile iron pipe and fittings shall conform to the requirements of the Materials Specifications herein.

   b. Ceramic Epoxy Lining:

      1. 40 mil nominal lining consisting of amine cured novolac epoxy containing a minimum of 20 percent by volume quart pigment manufactured under the

name of Protecto 401 by the Vulcan Group.

2. Line interior of bell and exterior of spigot in joint sealing areas with 6 to 10 mils of specified lining.

3. Surface Preparation: SP10 near white abrasive blast.

4. Pinhole Detection: 2,500 volts minimum over 100 percent of lined surfaces.

2. HDPE pipe and fittings may be used for force mains:

a. Pipe Larger than 4 inches: Minimum DR 17, meeting requirements of AWWA C906, ASTM F714, and ASTM D3035.

b. Pipe 4 inches and smaller: Minimum DR 11, meeting requirements of AWWA C906, ASTM F714, and ASTM D3035.

c. HDPE pipe shall have a co-extruded green cover or extruded green stripes designating use for sanitary sewer. Color print lines are not an acceptable method for designation of sewer mains. Pipe with extruded green stripes shall have a minimum of three equally spaced stripes. Pipe shall have a heat indented print line containing the information required in ASTM D 3035.

d. Pipe Manufacturers:

1. Performance Pipe.
2. Rinker Polypipe.
3. Uponor North America.
4. ARNCO, Elyria, OH.

e. Fittings:

1. Fittings shall be molded. Fabricated fittings are not acceptable, unless approved in writing by OWNER. Butt fusion fittings shall comply with ASTM D3261 requirements.

2. Butt heat fusion or electrofusion fittings.

3. Install butt fusion fittings with butt fusion welding, as specified in Paragraph 3.02, Pipe Joining.

4. Electrofusion joint fittings shall have ISO 9001 and NSF 61 certification.

5. Manufacturers:

i. Central Plastics Company; Central Electrofusion System.

ii. IPEX, inc.; Friatec

3. Polyvinyl Chloride (PVC) pipe and fittings may be used for force mains:

a. Smaller than 4-inch in diameter; PVC conforming to the requirement of ASTM D2241. Class 200 SDR21, minimum, or as shown on the drawings.

b. 4-inches and larger in diameter; PVC conforming to requirements of AWWA C900 or AWWA C905. Outside diameter shall conform to ductile iron pipe sizes. DR21, minimum or as shown on the drawings.

c. Fittings shall be ductile iron in accordance with paragraph 2.01 A. 1.

2.02 THRUST BLOCKS

A. Concrete thrust blocks shall meet the requirements of Section 03300 – CAST-IN-PLACE CONCRETE, and shall be placed in accordance with the typical details shown in the Contract Drawings.

2.03 RETAINER GLANDS

A. Retainer glands for ductile iron fittings used when installing ductile iron pipe shall be Romac Industries, Inc. GripRing Pipe Restraint, Megalug Series 1100, as manufactured by EBAA Iron, Sigma One-Lok series SLDE, or approved equal.

B. Retainer glands for ductile iron fittings used when connection to existing PVC pipe shall be Romac Industries, Inc. GripRing Pipe Restraint, Megalug Series 2000PV, as manufactured by EBAA Iron, Sigma One-Lok series SLCE or approved equal.

C. Restraint for HDPE shall be M.J. Adapters by Central Plastics or Performance Pipe, AquaGrip by Mueller or approved equal.

D. Restrained joint system for push-on joint pipe shall be U.S. Pipe: Field Lok®/TR Flex® or approved equal.

2.04 PLUG VALVES

A. Eccentric Plug Valve 3-inch to 12-inch:

1. Non-lubricated type rated 175 psig CWP, drip-tight shutoff with pressure from either direction, cast iron body, exposed service flanged ends per ASME B16.1 or grooved ends in accordance with AWWA C606 for rigid joints, buried service mechanical joint ends, unless otherwise shown.

2. Plug cast iron with round or rectangular port of no less than 80 percent of connecting pipe area and coated with Buna N, seats welded nickel, stem bearings lubricated stainless steel or bronze, stem seal multiple V rings, or U cups with O rings of nitrile rubber, grit seals on both upper and lower bearings.

3. For buried service, provide external epoxy coating.

4. Operators:

a. 3 inch to 4-inch Valves: Wrench lever manual.

b. 6 inch to 12-inch Valves: Totally enclosed, geared, manual operator with handwheel, 2-inch nut, or chain wheel. Size operator for 1.5 times the maximum operating shutoff pressure differential for direct and reverse pressure, whichever is higher. For buried service, provide completely sealed operator filled with heavy lubricant and 2-inch nut.

5. Manufacturers and Products:

a. Pratt; Ballcentric.
b. DeZurik; Style PEC.
c. Milliken; Millcentric Series 600.

6. Valve Boxes: These shall be standard cast iron three-piece 5-¼-inch inside shaft diameter screw adjustable type, each consisting of a cover marked SEWER, and upper telescoping section, and a lower section. Where necessary to provide extra depth, provide cast iron extension pieces as required.

7. Provide a valve box over the operating stem of each underground valve. Set and support each valve box so that no stress shock can be transmitted to the valve, with the box centered and plumb over the valve wrench nut. Set each valve box top in a concrete slab 18-inch square and 6-inch thick, flush with finished grade.

B. Manual Operators:

1. General:

a. For AWWA valves, operator force not to exceed the requirements of the applicable valve standard. For non-AWWA valves, operator force not to exceed applicable industry standard or 80 pounds, whichever is less, under any operating condition, including initial breakaway. Provide gear reduction operator when force exceeds requirements.
b. Operator self-locking type or equipped with self-locking device.
c. Position indicator on quarter-turn valves.
d. Worm and gear operators one-piece design worm-gears of gear bronze material. Worm hardened alloy steel with thread ground and polished. Traveling nut type operators threader steel reach rods with internally threaded bronze or ductile iron nut. Refer to paragraph 2.04 A.1.d.2) for buried service.

2. Exposed Operator:

a. Galvanized and painted handwheels.
b. Cranks on gear type operators.
c. Chain wheel operator with tiebacks, extension stem, floor stands, and other accessories to permit operation from normal operation level.
d. Valve handles to take a padlock, and wheels a chain and padlock.

2.05 SWING CHECK VALVES

A. Valves shall conform to AWWA Section C508.

B. Swing check valves shall be iron body, bronze mounted, with seat rings, faces, with outside lever and spring and hinge pins suitable for operation in horizontal or vertical lines.

C. A removable cover shall be provided for the removal of internal parts without necessitating the removal of the valve from the line. The high point of the valve shall be tapped and equipped with a plug. When shown on the Contract Drawings, a valve or curb cock for the removal of air shall be provided. All check valves shall be of (mechanical joint) or (ANSI 125 or 250#) drilled and faced as shown on the Contract Drawings.

2.06 AIR-RELEASE, AIR/VACUUM AND COMBINATION AIR VALVES

A. All valves shall conform to AWWA C519.

B. Air valves shall be as manufactured by A.R.I. or approved equal and shall be furnished and installed as shown on the Contract Documents, or in the Project Details. Yard installations shall be located and/or approved by the Engineer prior to installation.

C. Unless otherwise noted on the Contract Drawings, the Air-Release, Air/Vacuum Valves shall be:

1. Air Release Valves for Sewage: 2-inch Model S-025 SARV with 1/8 inch NPT outlet.
2. Air/Vacuum Valves for sewage; 2-inch Model D-025 SAVV with 1-1/2 inch NPT outlet.

PART 3 EXECUTION

3.01 INSTALLATION OF FORCE MAINS

A. Force mains shall be installed at the lines and grades required by Drawings. All fittings shall be at the required locations, and the spigots well centered in the bells.

B. All PVC, Ductile Iron and HDPE pipe shall be installed with a 12 gauge copper wire for tracing purposes as specified in Section 02532, Paragraph 3.02 L.

C. Unless otherwise indicated by the Drawings, all force mains shall have at least 36 inches of cover. The pipe shall slope continuously between high and low points to eliminate the formation of air pockets. The pipe shall have a minimum of 60 inches of cover at the high points. OWNER shall approve any exceptions.

D. CONTRACTOR shall provide and use tools and facilities that are satisfactory and that will allow the Work to be done in a safe and convenient manner. Suitable equipment shall be used to lower all pipe and fittings into the trench one piece at a time. Each piece shall be lowered carefully so that neither it nor any protective coating or lining it may have will be damaged. Under no circumstances shall force main materials be dumped or dropped.

E. Pipes and fittings shall not be lowered into the trench until they have been swabbed to remove any mud, debris, etc., which may have accumulated within them. After the pipe has been lowered, all unnecessary materials shall be removed from it. Before any pipe is laid, the outside of its spigot end and the inside of its bell shall be cleaned and left dry and oil-free.

F. Every precaution shall be taken to keep foreign material from getting into the pipe while it is

being installed. No debris, tools, clothing, or other materials shall be placed in the pipe during laying operations.

G. After a length of pipe has been placed in the trench, the spigot end shall be centered in the bell of the adjacent pipe, and then inserted to the depth specified by the manufacturer.

H. Bell holes shall be big enough so that there is ample room for the pipe joints to be properly made. Between bell holes, the bottom of the trench shall be carefully graded so that the pipe barrel will rest on a solid foundation for its entire length.

I. Whenever pipe laying is not in progress, the open ends of the pipe shall be closed either with a watertight plug or by other means approved by OWNER.

J. Pipe shall be cut such that fittings can be inserted in a workmanlike manner and without any damage to the pipe. The manufacturer's recommendations shall be followed concerning how to cut and machine the ends of the pipe in order to leave a smooth end at right angles to the pipe's axis. A carborundum saw shall be used for ductile iron pipe, PVC and HDPE pipe. OWNER may consider other methods for 12-inch diameter and larger pipe. HDPE pipe shall be joined in accordance with Paragraph 3.02, HDPE Pipe Joining.

K. Pipe shall be installed with the bell ends facing in the direction of laying unless otherwise directed by OWNER.

L. Wherever pipe must be deflected from a straight line (in either the vertical or horizontal plane) in order to avoid obstructions, or wherever long radius curves are permitted, the amount of deflection shall not exceed that necessary for the joint to be satisfactorily made, nor more than 75 percent of that recommended by the pipe manufacturer, and shall be approved by OWNER. Bend fittings shall only be used when the pipe deflections are inadequate, according to manufacturer's recommendations, or as directed by OWNER. Pipe bending of PVC pipe shall not be allowed; fittings or joint deflections shall be utilized.

M. No pipe shall be installed in water or when it is OWNER's opinion that trench conditions are unsuitable. If crushed stone is used to improve trench conditions or as backfill for bedding the pipe, its use is considered incidental to the Project.

N. Joint restraints shall be installed wherever the force main changes direction (at tees and bends), at dead ends, or at any other point recommended by the manufacturer or required by OWNER. Joint restraints shall be considered an integral part of the force main work.

O. All pipe shall be jointed in the exact manner specified by the manufacturer of the pipe and jointing materials.

P. Air valves shall be located at all high points on the pipeline as shown on the Drawings or as directed by OWNER.

Q. Force main outlets shall be installed in manholes as shown on the Standard Detail. Force mains 2 inches and smaller may be tied directly into a manhole as approved by OWNER at a minimum depth of 3 feet.

3.02 HDPE PIPE JOINING

A. Assemble and join at the Site using the butt-fusion method to provide a leak-proof joint. Threaded or solvent-cement joints and connections are not permitted.

B. All equipment and procedures used for pipe joining shall be in strict compliance with ASTM D2657 and with the manufacturer's recommendations.

C. Fusion shall be performed by technicians certified by manufacturer of pipe fusion equipment.

D. Prior to pipe installation, two trial fusion welds shall be performed, and reviewed and approved by the OWNER. Full penetration welds shall provide homogeneous material across the cross section of weld. Fusion machine employed for trial welds shall be same machine utilized for project installation.

E. The butt-fused joint shall be true alignment and shall have uniform rollback beads resulting from the use of proper temperature and pressure. The joint shall be allowed adequate cooling time before removal of pressure. Excessive interior bead depth is cause to have the joint cut out and replaced.

F. The fused joint shall be watertight and shall have tensile strength equal to or greater than that of the pipe.

G. All joints shall be subject to acceptance by the OWNER prior to insertion.

H. The CONTRACTOR shall cut out and replace defective joints at no additional cost to the OWNER.

I. Any section of the pipe with a gash, blister, abrasion, nick, scar, or other deleterious fault greater in depth than ten percent of the wall thickness (ASTM 585), shall not be used and shall be removed from the Site. However, a defective area of the pipe may be cut out and the joint fused in accordance with the procedures stated above.

J. Any section of the pipe having other defects such as concentrated ridges, discoloration, excessive spot roughness, pitting, variable wall thickness or any other defect of manufacturing or handling as determined by the OWNER shall be discarded and not used.

K. All connections shall be in conformance with the manufacturer's installation procedures.

L. Do not allow walking on complete pipelines until backfill has been placed to a depth of at least 6 inches above the crown of the pipe.

3.04 HYDROSTATIC PRESSURE TEST – DUCTILE IRON and PVC

A. All testing shall be scheduled with the Owner and Owner's Representative (RPR) at least 48 hours in advance.

B. Mains and services shall be pressure tested as a complete system or as directed by the Owner. Make approved necessary taps in piping prior to testing.

C. All newly installed and backfilled pipe shall be subjected to a leakage test, conducted in the presence of OWNER or Owner's Representative (RPR).

D. Conduct Hydrostatic Pressure Test on buried piping after trench has been completely backfilled and compacted. Testing may be performed prior to placement of concrete or asphalt surface restoration as approved by Owner or RPR.

E. Contractor shall install temporary thrust blocking and/or other restraint as necessary to prevent movement of pipe. Thrust blocking shall cure for 5 days prior to pressure tests. Restrained length calculations shall be prepared and stamped by a Professional Engineer, licensed in Tennessee.

F. Remove or isolate appurtenant instruments or devices that could be damaged by pressure testing.

G. Each valved section of pipe shall be slowly filled with water (0.25 feet per second based on full area of pipe). Expel air from piping system during filling. A test pressure equal to 1.5 times the normal working pressure shall be applied for a minimum of 2 hours (maximum of 4 hours). Test pressure shall be based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge. A pump shall be connected to the pipe in a manner satisfactory to the Owner.

H. Minimum test pressure at the high point of each test segment must be equal to or greater than 1.25 times the working pressure at the high point elevation.

I. The hydrostatic pressure test shall be conducted by measuring, through a calibrated meter, the amount of water, which enters the test section under 1.5 times or normal working pressure for a period of at least 2 hours. No installation will be accepted until the hydrostatic testing leakage is zero. Should tests disclose leakage, the Contractor, at his expense, shall locate and repair defective joints and/or other defects until the leakage is zero.

J. Cracked or defective pipes, fittings, valves, or hydrants discovered in consequence of this hydrostatic pressure test shall be replaced with sound material in the manner specified at no cost to the Owner. The test shall be repeated until the results are satisfactory to the Owner.

K. Test results shall be recorded including date, name of Contractor, name and signature of Contractor's employee responsible for testing, name and signature of RPR, test pressure, and test duration. A recording chart shall be used to document the results of the test if requested by the Owner.

L. Before applying the specified test pressure, all air shall be expelled from the pipe. If taps are not available at the high places, the necessary taps shall be made by the Contractor at the points of highest elevation before testing, and air release valves shall be installed by the Contractor after the test has been completed.

3.05 HYDROSTATIC PRESSURE TEST – HDPE

A. All requirements of Paragraph 3.04 also apply to HDPE.

B. Hydrostatic pressure test shall be conducted following manufacturer and accepted industry recommendations.

C. Monitored make-up water test shall consist of an initial expansion and test phase. During the initial expansion phase, the test section is pressurized to the test pressure and sufficient make-up water is added each hour for three hours to return to the test pressure.

D. After the initial expansion phase, about four hours after pressurization, the test phase begins. The test phase lasts two hours and no make-up water should have to be added during this phase in order to achieve the required zero leakage.

E. The total test time including initial pressurization, initial expansion and time at test pressure shall not exceed eight hours. If the pressure test is not completed within 8 hours, the test section shall be depressurized, and allowed to relax for at least 8 hours before reapplying the test pressure.

3.05 CLEANUP

A. After completing each section of the force main, all debris and construction materials shall be removed from the Site and disposed of in compliance with all applicable laws and regulations and with Section 01710, Cleaning. Then the surface shall be graded and smoothed on both sides of the line. The entire area shall be left clean and in a condition satisfactory to OWNER. CONTRACTOR shall keep cleanup operations as close to active pipe laying activities as practical, generally following by less than 300 feet, or as approved by OWNER.

End of Section

SECTION 02536
LOW PRESSURE SEWER MAINS AND LATERALS

PART 1 GENERAL

1.01 SUMMARY

A. This section is intended to provide criteria for the design, material requirements, construction, and testing of low pressure sewer (LPS) systems. This section established standards for sewer mains and private service lines for new LPS systems.

B. CONTRACTOR shall be responsible for safely storing materials needed for the work until they have been incorporated into the completed project. CONTRACTOR shall keep the interiors of all pipes, fittings, and other accessories free from dirt and foreign matter at all times.

C. Materials will be visually inspected by OWNER at the site for conformance to the specifications. At OWNER's discretion, CONTRACTOR may be required to supply certified mill tests, samples, or other suitable form of verification that the material meets the required specifications.

1.02 REFERENCES

A. American Water Works Association (AWWA):
1. C110, Ductile-Iron and Gray-Iron Fittings.
2. C153, Ductile-Iron Compact Fittings, for Water Service.
3. C605, Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water.
4. C900, Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4-inch through 12-inch for Water Transmission and Distribution.
5. C905, Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14-inch through 48-inch for Water Transmission and Distribution.
6. C906, Polyethylene (PE) Pressure Pipe and Fittings, 4-inch through 63-inch, for Water Distribution and Transmission.
7. C907, Injection-Molded Polyvinyl Chloride (PVC) Pressure Fittings, 4-inch through 12-inch, for Water Distribution.
8. Manual M55, PE Pipe – Design and Installation.

B. ASTM International (ASTM):
1. A193/A194M, Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High Temperature or High Pressure Service and other Special Purpose Applications.
2. A194/A194M, Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.
3. A240/A240M, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
4. A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
5. A536, Standard Specifications for Ductile Iron Castings.
6. A563, Standard Specification for Carbon and Alloy Steel Nuts.

7. D638, Standard Test Method for Tensile Properties of Plastics.
8. D3350, Standard Specification for Polyethylene Plastic Pipe and Fittings Materials.
9. D2241, Standard Specification for Polyvinyl Chloride (PVC) Pressure-Rated Pipe (SDR Series).
10. D2321, Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and other Gravity-Flow Applications.
11. D2466, Standard Specification for Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40.
12. D2467, Standard Specification for Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80.
13. D2672, Standard Specification for Joints for IPS PVC Pipe Using Solvent Cement.
14. D2855, Standard Practice for Making Solvent-Cemented Joints with Polyvinyl Chloride (PVC) Pipe and Fittings.
15. D3139, Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
16. F714, Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.
17. F2164, Standard Practice for Field Leak Testing of Polyethylene (PE) Pressure Piping Systems Using Hydrostatic Pressure.
18. F2620, Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings.

C. Code of Federal (CFR): Title 49 Part 192.285, Plastic Pipe: Qualifying Persons to Make Joints.

D. NSF International (NSF): 61, Drinking Water System Components – Health Effects.

E. Plastic pipe Institute (PPI):
1. Handbook of Polyethylene Pipe.
2. Technical Note 38, Bolt Torque for Polyethylene Flanged Joints.
3. TR-33, Generic Butt Fusion Joining Procedure for Field Joining Polyethylene Pipe.

1.03 SUBMITTALS

A. Design Requirements
1. The Owner shall require a Deign Report, prepared by a Tennessee-licensed Professional Engineer, detailing the basis of design for the low pressure sewage system. The Design Report shall include at a minimum:
   a. Number of housing units, as well as any other structure(s) producing wastewater.
   b. Per capita demand (gallons/capita/day) for each unit type.
   c. Calculated Design Volumes, as the sum total of property units and their respective per capita demands.
   d. Percentage of units contributing wastewater flow at an instantaneous time.
   e. Estimated flows and respective velocities for each sewer main.
   f. Range of elevations in the sewer basin, and the resultant pressures in the force main sewer.
   g. Identification of future phases that would result in increased flow being contributed to any sewer mains. If applicable, estimate the future flows and velocities as a result of future developmental phases.
   h. Main diameter shall be the largest size that supports 2 feet-per-second velocity at design flow.

i. Design calculations shall be prepared using Environment One's "LPS Design Assistant", latest version, for the Owner's review and approval.

B. Action Submittals
1. Shop Drawings
a. Catalog information confirming pipe, fittings, and other materials conform to requirements of this section.
b. Drawings of specific connection details.

C. Information Submittals
1. As required for Section 02634 Wastewater Force Main.

1.04 QUALITY ASSURANCE

A. HDPE Pipe
1. Manufacturer Qualifications, Delivery, Shipping, and Storage shall be consistent with requirements identified in Section 02634 Wastewater Force Main.
2. For Public Main Line installation, persons fusing HDPE pipe shall have 2 years of experience with fusing HDPE pipe and shall have received a minimum of 8 hours of training for fusing HDPE Pipe from pipe supplier or fusing equipment supplier. Training course certification shall be updated annually.
3. For Private Service Line installation, from service junction box to grinder pump, persons fusing HDPE pipe shall have received a minimum of 8 hours of training for fusing HDPE Pipe from pipe supplier or fusing equipment supplier. Training course certification shall be updated annually.
a. Private Service Line work shall be warrantied by Contractor for one (1) year following date of acceptance by Owner.

1.05 CONNECTION TO EXISTING SYSTEM

A. HDPE Pipe
1. Connection of New HDPE to Existing HDPE Pipe
a. Shall comply with manufacturer or distributor recommendations based on PPE TR-33 and Site Conditions.
2. Connection of New HDPE to Existing PVC Pipe
a. Engineer shall Detail Construction materials and methodology for Owner's review and approval.

PART 2 PRODUCTS

2.01 MATERIALS

A. Pipe and Fittings
1. Minimum pipe size for low pressure sewer mains shall be 2-inch diameter.
2. HDPE
a. Pipe, Joints, Fittings, and appurtenances shall be supplied in accordance with Section 02534 Wastewater Force Main.
b. Pipe 4-inch and smaller shall be IPS.

c. HDPE pipe shall have a co-extruded green cover or extruded green stripes designating use for sanitary sewer. Color print lines are not an acceptable method for designation of low pressure sewer mains. Pipe with extruded green stripes shall have a minimum of three equally spaced stripes. Pipe shall have a heat indented print line containing the information required in ASTM D 3035.

3. PVC
   a. PVC Pipe and Fittings are not allowed for LPS use.

B. Tracer Wire
1. Tracer wire installation shall be required for all force main sewer mains and force main services lines.
2. Contractor shall provide and install tracer wire in accordance with Section 02532, Paragraph 3.02 L.

C. Air Valves
1. Air valves shall be located at all high points on the pipe line in accordance with the drawings of as required by Owner.
2. Provide air valves in accordance with Section 02534 Wastewater Force Main and Standard Details.

D. Isolation Valves
1. HDPE Main: 3-inch and smaller
   a. HDPE Ball Valve – SDR11, full-port body, with Butt-Fusion flanges. Components shall include a polyethylene PE4710 body, polypropylene ball, EPDM seat, neoprene seal, and polypropylene adapter.
2. HDPE Main: 4-inch and larger
   a. Plug Valve – Eccentric plug valve with cast iron body conforming to AWWA C504 wall thickness with Class 125 mechanical joint ends. Valve shall have corrosion resistant nickel seat, self-adjusting stem seal per AWWA C504, bearings of Type 316 stainless steel, and adjustable open/close travel stops. Valve shall be full-port. Plug shall be supported on integral trunnions and be abrasion resistant. Acceptable manufacturer shall be DeZurik or Owner-approved equal.
   b. Contactor shall provide mechanical joint adapters to facilitate connection to HDPE pipe. Adapter shall be PE4710 and bear same pressure rating as pipe. Accessories shall include metal insert, metal gland, gasket, bolts, and nuts.

E. Restraint
1. HDPE
   a. Thrust/restraint blocks shall be installed in locations shown on the Plans or in accordance with the pipe manufacturer's recommendations or as required by Owner. Thrust/restraint blocks shall be considered an integral part of the low-pressure sewer main installation. HDPE pipe shall be properly restrained in accordance with the manufacturer's recommendations to resist the longitudinal forces in the pipe due to thermal expansion. Contractor shall install restraint devices in accordance with LCUB requirements necessary to properly secure the pipe.
   b. Provide thrust restraint blocking in accordance with the Standard Details.

F. Flushing Assembly
1. Provide end-of-line flushing assembly at the upstream end of each sewer force main alignment, and as directed by Owner.
2. Install flushing assembly in accordance with the Standard Details.

G. Service Connections
1. Connection to Existing Main
   a. 1-1/4-inch Tapping Saddle with dual stainless steel straps shall be installed to facilitate connection of service line. Connection shall utilize a stainless steel nipple and stainless steel ball valve. Service saddle shall conform to AWWA Standard C800.
      1) Acceptable saddle shall be Romac 202NH with IP Threaded Outlet, or Owner-approved equal.
2. Connection to New Main
   a. Install fusible, molded HDPE tee (PE4710, SDR11), with 1-1/4-inch branch.
3. Between the Force Main Sewer and the service junction box, the Low Pressure Sewer service connection shall utilize 1-1/4-inch diameter HDPE service pipe (PE4710 material, SDR11) meeting requirements identified in Section 02534 Wastewater Force Main.
4. At the service junction box, install a 1-1/4-inch ball valve and 1-1/4-inch check valve assembly. Appurtenances shall be full port and 200 psi rated. Ball valve and check valve shall utilize compression fittings and be compatible with HDPE pipe (PE4710, SDR11, IPS).
   a. Acceptable model for the ball valve/check valve assembly shall The Lateral Connection (Part #GR1125) or Owner approved equal.
5. Service Junction Box shall be placed at the property line, and shall contain the ball valve, check valve assembly, and looped tracer wire. Junction box shall be polyethylene body with snap-lock green lid. Minimum box dimensions shall be 13-inch x 18-inch with 12-inch depth.
   a. Acceptable model shall be Highline Model 194102 with Green Snap-lock lid Model 173137.
6. On the "private" side of the service junction box, the Low Pressure Sewer service connection shall utilize 1-1/4-inch diameter HDPE service pipe (PE4710 material, SDR11 rated) meeting requirements identified in Section 02534 Wastewater Force Main. Marking tape and tracer wire shall be required in accordance with Section 02532, Paragraph 3.02 L.
7. Service lines under roadway, sidewalk, or driveway shall be encased in 2-inch (minimum) Schedule 40 PVC pipe.

H. Grinder Pump, Control Panel, and Basin
1. As required and specified in Section 02537 Residential Grinder Pump Stations.

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

A. Consistent with that required under Section 01400.

3.02 SEPARATION BETWEEN WATER AND SEWER

A. Sewers shall be designed with a 10-foot horizontal separation from any existing or proposed water main. If this is not practical, the sewer may be placed closer than 10 feet to a water main, provided it is laid in a separate trench and the elevation of the top of the sewer is at least 18 inches below the bottom of the water main, or as directed by OWNER.

B. Where a sewer crosses under a water main, the top of the sewer shall be at least 18 inches below the bottom of the water main. If the elevation of the sewer cannot be varied to meet the above requirements, the water main shall be relocated to provide this separation, or the water main shall be reconstructed with ductile iron pipe for a distance of 10 feet on each side of the sewer with a full pipe section of the water main centered over the sewer, or as directed by OWNER.

3.03 INSTALLATION

A. HDPE Collection System
   1. Install HDPE force main, fittings, valves, and restraint as required in Section 02534 Wastewater Force Main.
   2. Provide testing as required in Section 02534 Wastewater Force Main.

B. Connection to System
   1. Service Lines
      a. Pressure service line, grinder station, and gravity service line shall be inspected, tested, and accepted by Owner prior to backfilling the service lines or grinder pump basin. Contractor shall coordinate with Owner based on requirements set forth in the Specifications and Owner's Development Agreement.

End of Section

SECTION 02537
RESIDENTIAL GRINDER PUMP STATIONS

PART 1 GENERAL

1.01 GENERAL DESCRIPTION

A. The MANUFACTURER shall furnish complete factory-built and tested grinder pump unit(s), each consisting of a grinder pump core suitably mounted on an integral stand of stainless steel, tank, electrical quick disconnect (NEMA 6P), pump removal harness, discharge assembly/shut-off valve, anti-siphon valve/check valve assembly, electrical alarm assembly and all necessary internal wiring and controls. For ease of serviceability, all pump motor/grinder units shall be of like type and horsepower throughout the system.

1.02 SUBMITTALS

A. After receipt of notice to proceed, the MANUFACTURER shall furnish one electronic set (PDF format) of shop drawings detailing the equipment to be furnished including dimensional data and materials of construction. The ENGINEER shall promptly review this data and return as accepted, or with requested modifications. Upon receipt of accepted shop drawings, the MANUFACTURER shall proceed immediately with fabrication of the equipment.

1.03 MANUFACTURER

A. Grinder pump stations, complete with all appurtenances, form an integral system, and as such, shall be supplied by one grinder pump station manufacturer. The CONTRACTOR shall be responsible for the satisfactory operation of the entire system. The equipment specified shall be a product of a company experienced in the design and manufacture of grinder pumps for specific use in low pressure sewage systems. The company shall submit detailed installation and user instructions for its product.

B. The MANUFACTURER of the grinder pump station shall be Environment One Corporation.

1.04 OPERATING CONDITIONS

A. The pumps shall be capable of delivering 15 GPM against a rated total dynamic head of 0 feet (0 PSIG), 11 GPM against a rated total dynamic head of 92 feet (40 PSIG), and 7.8 GPM against a rated total dynamic head of 185 feet (80 PSIG). The pump(s) must also be capable of operating at negative total dynamic head without overloading the motor(s). Under no conditions shall in-line piping or valving be allowed to create a false apparent head.

1.05 WARRANTY

A. The grinder pump MANUFACTURER shall provide a part(s) and labor warranty on the complete station and accessories, including, but not limited to, the panel for a period of 60 months after notice of OWNER'S acceptance, but no greater than 66 months after receipt of shipment. Any manufacturing defects found during the warranty period will be reported to the MANUFACTURER by the OWNER and will be corrected by the MANUFACTURER at no cost to the OWNER.

PART 2 PRODUCTS

2.01 PUMP

A. The pump shall be a custom designed, integral, vertical rotor, motor driven, solids handling pump of the progressing cavity type with a single mechanical seal. Double radial O-ring seals are required at all casting joints to minimize corrosion and create a protective barrier. All pump castings shall be cast iron, fully epoxy coated to 8-10 mil Nominal dry thickness, wet applied. The rotor shall be through-hardened, highly polished, precipitation hardened stainless steel. The stator shall be of a specifically compounded ethylene propylene synthetic elastomer. This material shall be suitable for domestic wastewater service. Its physical properties shall include high tear and abrasion resistance, grease resistance, water and detergent resistance, temperature stability, excellent aging properties, and outstanding wear resistance. Buna-N is not acceptable as a stator material because it does not exhibit the properties as outlined above and required for wastewater service.

2.02 GRINDER

A. The grinder shall be placed immediately below the pumping elements and shall be direct- driven by a single, one-piece motor shaft. The grinder impeller (cutter wheel) assembly shall be securely fastened to the pump motor shaft by means of a threaded connection attaching the grinder impeller to the motor shaft. Attachment by means of pins or keys will not be acceptable. The grinder impeller shall be a one-piece, 4140 cutter wheel of the rotating type with inductively hardened cutter teeth. The cutter teeth shall be inductively hardened to Rockwell 50 - 60c for abrasion resistance. The shredder ring shall be of the stationary type and the material shall be white cast iron. The teeth shall be ground into the material to achieve effective grinding. The shredder ring shall have a staggered tooth pattern with only one edge engaged at a time, maximizing the cutting torque.

B. This assembly shall be dynamically balanced and operate without objectionable noise or vibration over the entire range of recommended operating pressures. The grinder shall be constructed so as to minimize clogging and jamming under all normal operating conditions including starting. Sufficient vortex action shall be created to scour the tank free of deposits or sludge banks which would impair the operation of the pump. These requirements shall be accomplished by the following, in conjunction with the pump:

1. The grinder shall be positioned in such a way that solids are fed in an upward flow direction.
2. The maximum flow rate through the cutting mechanism must not exceed 4 feet per second.
3. The inlet shroud shall have a diameter of no less than 5 inches.
4. The impeller mechanism must rotate at a nominal speed of no greater than 1800 rpm.

C. The grinder shall be capable of reducing all components in normal domestic sewage to finely-divided particles which will pass freely through the passages of the pump and the 1-1/4-inch diameter discharge piping.

2.03 ELECTRIC MOTOR

A. As a maximum, the motor shall be a 1 HP, 1725 RPM, 240 Volt 60 Hertz, 1 Phase, capacitor start, ball bearing, air-cooled induction type with Class F installation, low starting current not to exceed 30 amperes and high starting torque of 8.4 foot pounds. The motor shall be press-fit into the casting for better heat transfer and longer winding life. Inherent protection against running overloads or locked rotor conditions for the pump motor shall be provided by the use of an automatic-reset, integral thermal overload protector incorporated into the motor. This motor protector combination shall have been specifically investigated and listed by Underwriters Laboratories, Inc., for the application. The wet portion of the motor armature must be 300 Series stainless.

2.04 MECHANICAL SEAL

A. The pump/core shall be provided with a mechanical shaft seal to prevent leakage between the motor and pump. The seal shall have a stationary ceramic seat and carbon rotating surface with faces precision lapped and held in position by a stainless steel spring.

2.05 TANK

A. High Density Polyethylene Construction (HDPE). The tank shall be a wetwell design made of high density polyethylene of a grade selected for environmental stress cracking resistance. Corrugated sections are to be made of a double wall construction with the internal wall being generally smooth to promote scouring. Corrugations of the outside wall are to be of a minimum amplitude of 1-1/2-inch to provide necessary transverse stiffness. Any incidental sections of a single wall construction are to be a minimum 0.250 inch thick. All seams created during tank construction are to be thermally welded and factory tested for leak tightness. Tank wall and bottom must withstand the pressure exerted by saturated soil loading at maximum burial depth. All station components must function normally when exposed to maximum external soil and hydrostatic pressure.

B. The tank shall be furnished with one EPDM grommet fitting to accept a 4.50-inch OD

(4-inch DWV or SCH 40) inlet pipe.

C. The tank shall include a lockable cover assembly providing low profile mounting and watertight capability. The cover shall be high density polyethylene, green in color, with a load rating of 150 lbs per square foot. The cover assembly shall also include an integral 2-inch vent to prevent sewage gases from accumulating in the tank. The accessway design and construction shall facilitate field adjustment of station height in increments of 3 inches or less without the use of any adhesives or sealants requiring cure time before installation can be completed.

D. The power and control cable shall connect to the pump by means of the provided NEMA 6P Electrical Quick Disconnect (EQD) and shall enter the tank through a factory installed watertight strain relief connector. An electrical junction box shall not be permitted in the tank.

E. Tank heights shall be as shown on the Standard Drawings.

F. The station shall have all necessary penetrations factory sealed and tested. No field penetrations shall be acceptable.

G. The pump/core shall be provided with a mechanical shaft seal to prevent leakage between the motor and pump. The seal shall have a stationary ceramic seat and carbon rotating surface with faces precision lapped and held in position by a stainless steel spring.

2.06 DISCHARGE HOSE AND DISCONNECT/VALVE

A. All discharge piping shall be constructed of 304 stainless steel. The discharge shall terminate outside the accessway bulkhead with a stainless steel 1-1/4-inch female NPT fitting to facilitate connection to service force main. The discharge piping shall include a stainless steel ball valve rated for 235-psi WOG. The bulkhead penetration shall be factory installed and warrantied by the manufacturer to be watertight.

2.07 ELECTRIC QUICK DISCONNECT

A. The grinder pump core shall include a factory-installed NEMA 6P electrical quick disconnect (EQD) for all power and control functions. The EQD will be supplied with 32 feet, 25 feet of useable, electrical supply cable (ESC) to connect to the alarm panel. The EQD shall require no tools for assembly, seal against water before the electrical connection is made, and include radial seals to assure a watertight seal regardless of tightening torque. Plug-type connections of the power cable onto the pump housing will not be acceptable. Junction boxes are not acceptable. The EQD shall be so designed to be conducive to field wiring as required.

2.08 CHECK VALVE

A. The pump discharge shall be equipped with a factory installed, gravity operated,

flapper- type integral check valve built into the discharge piping. The check valve will provide a full-ported passageway when open, and shall introduce a friction loss of less than 6 inches of water at maximum rated flow. Moving parts will be made of a 300 Series stainless steel and fabric reinforced synthetic elastomer to ensure corrosion resistance, dimensional stability, and fatigue strength. A nonmetallic hinge shall be an integral part of the flapper assembly providing a maximum degree of freedom to assure seating even at a very low back-pressure. The valve body shall be an injection molded part made of an engineered thermoplastic resin. The valve shall be rated for continuous operating pressure of 235 psi.

2.09 ANTI-SIPHON VALVE

A. The pump discharge shall be equipped with a factory-installed, gravity-operated, flapper- type integral anti-siphon valve built into the discharge piping. Moving parts will be made of 300 Series stainless steel and fabric-reinforced synthetic elastomer to ensure corrosion resistance, dimensional stability, and fatigue strength. A nonmetallic hinge shall be an integral part of the flapper assembly, providing a maximum degree of freedom to ensure proper operation even at a very low pressure. The valve body shall be injection-molded from an engineered thermoplastic resin. Holes or ports in the discharge piping are not accepted. The anti-siphon port diameter shall be no less than 60% of the inside diameter of the pump discharge piping.

2.10 CORE UNIT

A. The grinder pump station shall have an easily removable core assembly containing pump, motor, grinder, all motor controls, check valve, anti-siphon valve, electrical quick disconnect and wiring. The watertight integrity of the core unit shall be established by a 100% factory test at a minimum of 5 PSIG.

2.11 CONTROLS

A. All necessary motor starting controls shall be located in the cast iron enclosure of the core unit secured by stainless steel fasteners. Wastewater level sensing controls shall be housed in a separate enclosure from motor starting controls. Level sensor housing must be sealed via a radial type seal; solvents or glues are not acceptable. Level sensing control housing must be integrally attached to pump assembly so that it may be removed from the station with the pump and in such a way as to minimize the potential for the accumulation of grease and debris accumulation, etc. Level sensing housing must be a high-impact thermoplastic copolymer over-molded with a thermoplastic elastomer.

B. Non-fouling wastewater level controls for controlling pump operation shall be accomplished by monitoring the pressure changes in an integral air column connected to a pressure switch. The air column shall be integrally molded from a thermoplastic elastomer suitable for use in wastewater and with excellent impact resistance. The air column shall have only a single connection between the water level being monitored and the pressure switch. Any connections are to be radial sealed with redundant O-rings. The level detection device shall have no moving parts in direct contact with the

wastewater and shall be integral to the pump core assembly in a single, readily-exchanged unit. Depressing the push to run button must operate the pump even with the level sensor housing removed from the pump.

C. All fasteners throughout the assembly shall be 300 Series stainless steel. High-level sensing will be accomplished in the manner detailed above by a separate air column sensor and pressure switch of the same type. Closure of the high-level sensing device will energize an alarm circuit as well as a redundant pump-on circuit. For increased reliability, pump ON/OFF and high-level alarm functions shall not be controlled by the same switch. Float switches of any kind, including float trees, will not be accepted due to the periodic need to maintain (rinsing, cleaning) such devices and their tendency to malfunction because of incorrect wiring, tangling, grease buildup, and mechanical cord fatigue. To assure reliable operation of the pressure switches, each core shall be equipped with a factory installed equalizer diaphragm that compensates for any atmospheric pressure or temperature changes. Tube or piping runs outside of the station tank or into tank-mounted junction boxes providing pressure switch equalization will not be permitted due to their susceptibility to condensation, kinking, pinching, and insect infestation. The grinder pump will be furnished with a 6 conductor 14-gauge, type SJOW cable, pre-wired and watertight to meet UL requirements with a FACTORY INSTALLED NEMA 6P EQD half attached to it.

2.12 ALARM PANEL

A. Each grinder pump station shall include a NEMA 4X, UL-listed alarm panel suitable for wall or pole mounting. The NEMA 4X enclosure shall be manufactured of thermoplastic polyester to ensure corrosion resistance. The enclosure shall include a hinged, lockable cover with padlock, preventing access to electrical components, and creating a secured safety front to allow access only to authorized personnel.

B. The alarm panel shall contain one 15-amp, double-pole circuit breaker for the pump core's power circuit and one 15-amp single-pole circuit breaker for the alarm circuit. The panel shall contain a push-to-run feature, an internal run indicator, and a complete alarm circuit. All circuit boards in the alarm panel are to be protected with a conformal coating on both sides and the AC power circuit shall include an auto resetting fuse.

C. The alarm panel shall include the following features: external audible and visual alarm; push-to-run switch; push-to-silence switch; redundant pump start; and high level alarm capability. The alarm sequence is to be as follows when the pump and alarm breakers are on:

1. When liquid level in the sewage wet-well rises above the alarm level, the contacts on the alarm pressure switch activate, audible and visual alarms are activated, and the redundant pump starting system is energized.
2. The audible alarm may be silenced by means of the externally mounted, push-to- silence button.
3. Visual alarm remains illuminated until the sewage level in the wet-well drops below the "off' setting of the alarm pressure switch.

D. The visual alarm lamp shall be inside a red, oblong lens at least 3.75-inch L x 2.38-inch W x 1.5-inch H. Visual alarm shall be mounted to the top of the enclosure in such a manner as to maintain NEMA 4X rating. The audible alarm shall be externally mounted on the bottom of the enclosure, capable of 93 dB @ 2 feet. The audible alarm shall be capable of being deactivated by depressing a push-type switch that is encapsulated in a weatherproof silicone boot and mounted on the bottom of the enclosure (push-to-silence button).

E. The entire alarm panel, as manufactured and including any of the following options shall be listed by Underwriters Laboratories, Inc.

F. Panel shall be modified to include E-One's "Sentry Simplex Protect" features, including:
   1. Low Voltage (Brownout) Protection -A lockout cycle will prevent the motor from operating and will illuminate an LED if:
      a. The incoming AC Mains voltage drops below a predetermined minimum, typically 12% of nameplate (211 volts for a 240 volt system) for 2 to 3 seconds, regardless of whether the motor is running.
      b. the lockout cycle will end if the incoming AC Mains voltage returns to a predetermined value, typically 10% of nameplate (216 volts for a 240 volt system).
   2. The system continues to retest the voltage every second indefinitely. If the lockout cycle has been initiated and the voltage comes back above the predetermined starting voltage, the system will function normally. The LED remains illuminated during a Brownout condition and remains latched until the pump breaker is turned off and then on again (reset). The audible and visual alarm will not be activated unless there is a high wastewater level in the tank.
   3. Run Dry Protection - A 20-minute lockout cycle will prevent the motor from operating and will illuminate an LED when the wastewater level in the tank is below the pump inlet level. The condition is rechecked every 20 minutes. If the lockout cycle has been initiated and the condition is satisfied, the pump is not allowed to cycle normally but the LED remains latched. The LED will remain latched until the pump breaker is turned off and then on again (reset). If the condition is not satisfied after 3 consecutive attempts, the visual alarm will be activated until the pump breaker is turned off and on (reset) or until there is one cycle of normal operation. If a high level condition is presented at any time, a pump run cycle will be activated.
   4. High System Pressure Protection - A 20-minute lockout cycle will prevent the motor from operating and will illuminate an LED when the pressure in the discharge line is atypically high (closed valve or abnormal line plug). The condition is rechecked every 20 minutes. If the condition is satisfied, the pump is allowed to cycle normally but the LED remains latched. If the condition is not satisfied after 3 consecutive attempts, the pump is locked out indefinitely until the condition is removed and power is reset. The LED will remain latched until the pump breaker is turned off and then on again (reset). The audible and visual alarm will be activated.
   5. In all of the above cases, if more than one error condition is presented, the LED

depicting the most recent error condition will be displayed.

6. Other features shall include:
   a. Alarm Activated Dry Contacts - Normally open relay contact closes upon alarm activation.
   b. Alarm Activated Contacts for Remote Indoor Alarm Module - Will work with or without power to the alarm panel and is designed to work with E/One's Remote Sentry
   c. Includes Inner Door Dead Front
   d. Separate LED's for each condition

2.13 SERVICEABILITY

A. The grinder pump core, including level sensor assembly, shall have two lifting hooks complete with lift-out harness connected to its top housing to facilitate easy core removal when necessary. The level sensor assembly must be easily removed from the pump assembly for service or replacement. All mechanical and electrical connections must provide easy disconnect capability for core unit removal and installation. Each EQD half must include a water-tight cover to protect the internal electrical pins while the EQD is unplugged. A pump push-to-run feature will be provided for field trouble shooting. The push-to-run feature must operate the pump even if the level sensor assembly has been removed from the pump assembly. All motor control components shall be mounted on a readily replaceable bracket for ease of field service.

2.14 OSHA CONFINED SPACE

A. All maintenance tasks for the grinder pump station must be possible without entry into the grinder pump station (as per OSHA 1910.146 Permit-required confined spaces). *"Entry means the action by which a person passes through an opening into a permit-required confined space. Entry includes ensuing work activities in that space and is considered to have occurred as soon as any part of the entrant's body breaks the plane of an opening into the space."*

2.15 SAFETY

A. The grinder pump shall be free from electrical and fire hazards as required in a residential environment. As evidence of compliance with this requirement, the completely assembled and wired grinder pump station shall be listed by Underwriters Laboratories, Inc., to be safe and appropriate for the intended use.

B. The grinder pump shall meet accepted standards for plumbing equipment for use in or near residences, shall be free from noise, odor, or health hazards, and shall have been tested by an independent laboratory to certify its capability to perform as specified in either individual or low pressure sewer system applications. As evidence of compliance with this requirement, the grinder pump shall bear the seal of NSF International.

PART 3 EXECUTION

3.01 FACTORY TEST

A. Each grinder pump shall be submerged and operated for 1.5 minutes (minimum). Included in this procedure will be the testing of all ancillary components such as, the anti-siphon valve, check valve, discharge assembly and each unit's dedicated level controls and motor controls. All factory tests shall incorporate each of the above listed items. Actual appurtenances and controls which will be installed in the field shall be particular to the tested pump only. Certified test results shall be available, upon request, showing the operation of each grinder pump at two different points on its curve. Additional validation tests include: integral level control performance, continuity to ground and acoustic tests of the rotating components.

B. All HDPE basins shall be factory leak tested to assure the integrity of all joints, seams and penetrations. All necessary penetrations such as inlets, discharge fittings and cable connectors shall be included in this test along with their respective sealing means (grommets, gaskets etc.).

3.02 DELIVERY

A. All grinder pump core units, including level controls, will be delivered to the job site 100 percent completely assembled, including testing, ready for installation. Grinder pump cores will be shipped separately from the tanks. Installing the cores and discharge piping/hose into the tanks is the only assembly step required and allowed due to the workmanship issues associated with other on-site assembly. Grinder pump cores must be boxed for ease of handling.

3.03 INSTALLATION

A. Earth excavation and backfill are specified under Division 2 Specifications but are also to be done as a part of the work under this section, including any necessary sheeting and bracing.

B. The CONTRACTOR shall be responsible for handling ground water to provide a firm, dry subgrade for the structure, and shall guard against flotation or other damage resulting from general water or flooding.

C. The grinder pump stations shall not be set into the excavation until the installation procedures and excavation have been approved by the LCUB Resident Project Representative (RPR).

D. Remove packing material. User instructions MUST be given to the OWNER. Hardware supplied with the unit, if required, will be used at installation. The basin will be supplied with a standard 4-inch inlet grommet (4.50-inch OD) for connecting the incoming sewer line. Appropriate inlet piping must be used. The basin may not be dropped, rolled or laid on its side for any reason.

E. Installation shall be accomplished so that 1-inch to 4-inch of accessway, below the bottom of the lid, extends above the finished grade line. The finished grade shall slope away from the unit. The diameter of the excavated hole must be large enough to allow for the concrete anchor.

F. A 6-inch (minimum) layer of naturally rounded aggregate, clean and free flowing, with particle size of not less than 1/8-inch or more than ¾-inch shall be used as bedding material under each unit.

G. A concrete anti-flotation collar, as detailed on the drawings, and sized according to the manufacturer's instructions, shall be required and shall be pre-cast to the grinder pump or poured in place. Each grinder pump station with its pre-cast anti-flotation collar shall have a minimum of three lifting eyes for loading and unloading purposes.

H. If the concrete is poured in place, the unit shall be leveled, and filled with water, to the bottom of the inlet, to help prevent the unit from shifting while the concrete is being poured. The concrete must be manually vibrated to ensure there are no voids. If it is necessary to pour the concrete to a level higher than the inlet piping, an 8-inch sleeve is required over the inlet prior to the concrete being poured.

I. The CONTRACTOR will provide and install a 4-foot piece of 4-inch SCH 40 PVC pipe with water tight cap, to stub-out the inlet for the property owners' installation contractor, as depicted on the LCUB Standard Details and manufacturer's installation guide. Installation shall include tracer wire, consistent with the requirements identified in Section 02534 Wastewater Force Main.

J. The CONTRACTOR shall provide full depth stone backfill from the excavation limits to the bottom of the inlet piping and around the basin.

K. The electrical enclosure shall be furnished, installed and wired to the grinder pump station by the CONTRACTOR. An alarm device is required on every installation, there shall be NOEXCEPTIONS.

L. The CONTRACTOR shall mount the alarm device in a conspicuous location, as per national and local codes. The alarm panel will be connected to the grinder pump station by a length of 6-conductor type TC cable as shown on the contract drawings. The power and alarm circuits must be on separate power circuits. The grinder pump stations will be provided with 32 feet of useable, electrical supply cable to connect the station to the alarm panel. This cable shall be supplied with a FACTORY INSTALLED EQD half to connect to the mating EQD half on the core.

3.04 BACKFILL REQUIREMENTS

A. Proper backfill is essential to the long-term reliability of any underground structure. Several methods of backfill are available to produce favorable results with different native

soil conditions. The most highly recommended method of backfilling is to surround the unit to grade using Class I or Class II backfill material as defined in ASTM 2321. Class lA and Class lB are recommended where frost heave is a concern; Class lB is a better choice when the native soil is sand or if a high, fluctuating water table is expected. Class 1, angular crushed stone, offers an added benefit in that it doesn't need to be compacted.

B. Class II, naturally rounded stone, may require more compactive effort, or tamping, to achieve the proper density. If the native soil condition consists of clean compactible soil, with less than 12% fines, free of ice, rocks, roots and organic material, it may be an acceptable backfill. Soil must be compacted in lifts not to exceed one foot to reach a final Proctor Density of not less than 90%. Heavy, non-compactible clays and silts are not suitable.

C. Another option is the use of a flowable fill (i.e., low slump concrete). This is particularly attractive when installing grinder pump stations in augured holes where tight clearances make it difficult to assure proper backfilling and compaction with dry materials. Flowable fills should not be dropped more than four feet from the discharge to the bottom of the hole to avoid separation of the constituent materials.

D. Backfill of clean, native earth, free of rocks, roots, and foreign objects, shall be thoroughly compacted in lifts not exceeding 12-inches to a final Proctor Density of not less than 85%. Improper backfilling may result in damaged accessways. The grinder pump station shall be installed at a minimum depth from grade to the top of the 1 ¼-inch discharge line, to assure maximum frost protection. The finish grade line shall be 1-inch to 4-inch below the bottom of the lid, and final grade shall slope away from the grinder pump station.

E. All restoration will be the responsibility of the CONTRACTOR. Per unit costs for this item shall be included in the CONTRACTOR'S bid price for the individual grinder pump station. The properties shall be restored to their original condition in all respects, including, but not limited to, curb and sidewalk replacement, landscaping, loaming and seeding, and restoration of the traveled ways, as directed by the ENGINEER.

3.05 START-UP AND FIELD TESTING

A. The OWNER shall inspect the placement and installation of the basin and service line as required by this Section.

B. The OWNER shall inspect the placement and wiring of each station, perform field tests as specified herein, and evaluate the installed equipment before the stations are accepted by the OWNER. The pump shall not be installed until the basin and service lines have been accepted, and water and electric service are active.

C. All equipment and materials necessary to perform testing shall be the responsibility of the CONTRACTOR. This includes, as a minimum, electrical service connection per OWNER requirements, water service, and opening of all valves in the system. These steps shall be completed prior to the LCUB's RPR arriving on site.

D. The services of LCUB's RPR are required foreach installation.

E. Upon completion of the installation, the LCUB RPR will perform the following test on each station:
   1. Make certain the discharge shut-off valve in the station is fully open.
   2. Turn ON the alarm power circuit and verify the alarm is functioning properly.
   3. Turn ON the pump power circuit. Initiate the pump operation to verify automatic "on/off' controls are operative. The pump should immediately turn ON.
   4. Consult the Manufacturer's Service Manual for detailed start-up procedures.

F. Upon completion of the start-up and testing, the OWNER shall issue acceptance to the CONTRACTOR and/or property owner. Final acceptance of the system will not occur until authorization forms have been received for each pump station installed and any installation deficiencies corrected.

End of Section

SECTION 02540
SEWER CLEANING

PART 1 GENERAL

1.01 WORK INCLUDED

A. This section covers the Cleaning of sewers to remove all debris, solids, sand, grease, grit, roots, etc. from the sewers and manholes to improve pipe flow, facilitate television inspection for sewer evaluation, for proper application of root control chemical, or as required for other specified rehabilitation.

B. The Work covered by this section includes furnishing all labor, equipment, and materials required to clean and inspect sanitary sewer lines as specified.

1.02 SUBMITTALS

A. Action Submittals: Catalog and manufacturer's data sheets for cleaning equipment.

B. Informational Submittals:

1. Sample of the finished picture from the picture capture system.
2. Equipment manufacturer's operational manual and guidelines.
3. Liquid Waste Manifest.

PART 2 PRODUCTS

2.01 EQUIPMENT

A. Sewer Television Equipment shall be in compliance with Section 02541, Sewer Line Television Inspection.

B. Hydraulically-Propelled Equipment: The equipment used shall be of a movable dam type and be constructed in such a way that a portion of the dam may be collapsed at any time during the cleaning operation to protect against flooding of the sewer. The movable dam shall be equal in diameter to the pipe being cleaned and shall provide a flexible scraper around the outer periphery to insure removal of grease. If sewer cleaning balls or other equipment, which cannot be collapsed, is used, special precautions to prevent flooding of the sewers and public or private property shall be taken.

C. Cleaning:

1. All high-velocity sewer cleaning equipment shall be constructed for ease and safety of operation. The equipment shall have a selection of two or more high-velocity nozzles. The nozzles shall be capable of producing a scouring action from 15 to 45 degrees in all size lines designated to be cleaned. Equipment shall also include a high-velocity gun for washing and scouring manhole walls and floor and produce at least 2,000 psi pressure. The gun shall be capable of producing flows from a fine spray to a solid stream.

2. Sewer line cleaning equipment shall be a combination of high-velocity (hydro-cleaning) jet and vacuum system, truck-mounted for mobility and ease of operation. The hydro-cleaning equipment for sewer lines shall include a minimum 1,000-gallon water storage tank, auxiliary engines and pumps, and include a minimum of 600 feet of 1-1/4-inch I.D. high-pressure hose on a power driven hose reel. Pump nozzle combinations shall be capable of producing water flow rates up to 120 gpm, and a minimum of 60 gpm at a working pressure up to 2,000 psi. The vacuum system shall be a positive displacement blower with a minimum of 4,200 cfm at 15 inches of mercury. OWNER must approve any variations to this pumping rate, in advance.

3. A working pressure gauge shall be used on the discharge of all high-pressure water pumps.

4. CONTRACTOR shall use in addition to conventional nozzles, a nozzle which directs the cleaning force to the bottom of the pipe for sewers 18-inch and larger.

D. Heavy Cleaning: Bucket machines shall be in pairs with sufficient power to perform the work in an efficient manner. Machines shall be belt operated or have an overload device. Machines with direct drive that could cause damage to the pipe will not be allowed. A power rodding machine shall be either a sectional or continuous rod type capable of holding a minimum of 750 feet of rod. The rod shall be specifically heat-treated steel. To ensure safe operation, the machine shall be fully enclosed and have an automatic safety clutch or relief valve.

PART 3 EXECUTION

3.01 GENERAL

A. Prior to the start of any Work under this Project, CONTRACTOR shall make available to OWNER all equipment that is to be utilized in the execution of this contract. OWNER will hold a preconstruction conference at which the sequence of work, methods, inspection, and monitoring requirements and debris disposal shall be discussed.

B. When sewer flow depth is greater than 25 percent, flow depth shall be decreased by plugging or bypass pumping. Plugs shall be designed to pass any desired portion of sewage flow. If bypass pumping is required, CONTRACTOR shall provide all necessary equipment, manpower, and expertise. CONTRACTOR shall be responsible for all damage to public or private property resulting from these operations.

C. Designated sanitary sewers and manholes shall be cleaned using mechanical hydraulically propelled or high velocity sewer cleaning equipment. The cleaning process shall remove all grease, roots, sand, silt, solids, rags, debris, etc. from each sewer segment, including the manhole(s).

D. Selection of cleaning equipment and the method for cleaning shall be based on the condition of the sanitary sewer mains at the time Work commences and will be subject to OWNER's approval.

E. All cleaning equipment and devices shall be operated by experienced personnel.

F. Satisfactory precautions shall be taken to protect the sanitary sewer mains and manholes from damage that might be inflicted by the improper use of the cleaning process or equipment. Any damage done to a sewer by CONTRACTOR shall be repaired by the CONTRACTOR at no additional cost to and to the satisfaction of the OWNER.

G. Cleaning shall also include the initial manhole wall washing by high-pressure water jet.

H. CONTRACTOR, when instructed by OWNER, will be required to demonstrate the performance capabilities of the cleaning equipment proposed for use on the Project. If the results obtained by the proposed sanitary sewer cleaning equipment or attachments are not satisfactory, CONTRACTOR shall use different equipment/attachments, as required, to meet Specifications. More than one type of equipment/attachments may be required at a location.

I. When hydraulic or high velocity cleaning equipment is used, a suitable sand trap, weir, dam, or suction shall be constructed in the downstream manhole in such a manner that all the solids and debris are trapped for removal.

J. If water backups a lateral and enters a building or residence during cleaning, the CONTRACTOR shall notify the OWNER of the occurrence. It is the CONTRACTOR's responsibility to clean any backups which occur. If prior knowledge of backups is available, the CONTRACTOR shall take measures to prevent another backup from occurring (i.e., plugging the lateral) before cleaning.

K. Cleaning operations shall be performed with the flow direction of the sewer, that is, from the upstream manhole towards the downstream manhole. Any damage that occurs from sewer backups resulting from cleaning activities shall be the Contractor's responsibility and shall be repaired/resolved at the Contractor's expense.

3.02 HYDRAULIC CLEANING

A. Prior to televising, CONTRACTOR shall thoroughly clean the pipelines of debris, grease, roots, sediment, broken pipe, or other obstructions that could retard the movement of the television camera. Precautions shall be taken to protect the sewer lines being cleaned from damage by the cleaning equipment.

B. Hydraulically propelled devices, which require a head of water to operate, must utilize a collapsible dam. The dam must be easily collapsible to prevent damage to the sewer, property, etc.

C. When using hydraulically propelled devices, precautions shall be taken to insure that the water pressure created does not cause damage or flooding to public or private property.

D. CONTRACTOR shall not increase the hydraulic gradient of the sanitary sewers beyond the elevation that could cause overflow of sewage into area waterways or into structures.

3.03 HIGH-VELOCITY CLEANING

A. CONTRACTOR shall operate the equipment so that the pressurized nozzle continues to move at all times.

B. The pressure nozzle shall be turned off or water pressure be reduced anytime the hose is held or delayed in order to prevent damage to the line. In heavy debris the step cleaning method should be used.

3.04 MECHANICAL CLEANING

A. Mechanical cleaning, in addition to normal cleaning when required by ENGINEER, shall be approved equipment and accessories driven by power winching devices.

B. All equipment and devices shall be operated by experienced operators in an effort to prevent pipe damage during the cleaning process.

C. Buckets, scrappers, scooters, porcupines, kites, heavy duty brushes, metal pigs and other debris removing equipment/accessories shall be used as appropriate and necessary in the field, in conjunction with the approved power machine(s).

D. The use of cleaning devices such as rods, metal pigs, porcupines, root saws, snakes, scooters, sewer balls, kites and other approved equipment, in conjunction with hand winching device, and/or, gas, electric rod propelled devices, shall be considered normal cleaning equipment.

3.05 WATER USAGE

A. Any and all OWNER water used by CONTRACTOR shall be from a metered supply with an approved backflow device to protect the water supply. All metered water shall be paid for by CONTRACTOR to OWNER through the regular billing system.

B. CONTRACTOR shall be responsible for obtaining transient water meter(s) from OWNER, which shall be installed on the trucks or at fire hydrant(s). All related charges for the set-up shall be considered incidental to the cleaning of the existing sanitary sewer mains.

C. CONTRACTOR shall be responsible for preventing contamination of the potable water system. CONTRACTOR when drawing water from a public hydrant shall use a backflow preventer and/or an eighteen (18) inch air gap.

D. No fire hydrant shall be obstructed or used when there is a fire in the area.

E. It shall be CONTRACTOR's responsibility to obtain approval to use OWNER'S fire hydrants.

F. CONTRACTOR shall remove the water meter(s)/piping etc. from all fire hydrants at the end of each working day.

3.06 REMOVAL AND DISPOSAL OF DEBRIS

A. All materials removed from the sewer lines during cleaning operations shall be trapped and removed from the system at the downstream manhole of the section being cleaned. All materials shall be disposed of in compliance with all applicable laws and regulations and in a manner approved by OWNER.

B. Passing of debris from upstream manhole section to downstream manhole section will not be allowed.

C. All debris from the manholes shall be loaded into an enclosed container that is permitted by OWNER and the Tennessee Department of Environment and Conservation (TDEC) for liquid waste hauling.

D. All solids or semi-solids resulting from the cleaning operations shall be removed from the site at the end of each workday and disposed of at a landfill at the Contractor's expense.

E. CONTRACTOR shall pay landfill-tipping fee and is responsible for all permits required.

F. CONTRACTOR shall not be allowed to accumulate debris, and/or liquid waste, sludge, etc. on the site except in totally enclosed containers approved by ENGINEER.

G. All waste shall be hauled to the disposal site by a transporter, which is arranged for by CONTRACTOR and holds a valid Liquid Waste Transporter Permit.

H. CONTRACTOR shall submit and maintain a "Liquid Waste Manifest" as per OWNER and TDEC requirements. OWNER'S and TDEC's copies of the completed manifest shall be sent to ENGINEER within 24 hours after the disposal of the waste materials.

I. Under no circumstances shall sewage or solids removed in the cleaning process be dumped onto streets or into ditches, catch basins, storm drains, sanitary sewer manholes, cleanouts, or dumps.

End of Section

SECTION 02541
SEWER LINE TELEVISION INSPECTION

PART 1 GENERAL

1.01 WORK INCLUDED

A. The Work covered by this section includes furnishing all labor, equipment, and materials required to clean and inspect the designated sanitary sewer lines specified.

B. Closed-circuit television inspection of sanitary sewers as follows:
1. TV inspection on all lines proposed for rehabilitation, including root control chemical application, under this Contract, shall be performed where no videotape of the sewer is available from OWNER.
2. TV inspection of line segments specified for chemical root removal, shall be required to confirm cleaning and location of service connections. TV inspection shall also be required to confirm the need for mechanical root removal and to determine its location**.**
3. CONTRACTOR shall use the Television Inspection Form and Rehabilitation Tables approved by OWNER prior to beginning of any inspection.
4. Digital videos, data, photos shall be delivered to the OWNER with an external hard drive which will be returned to the CONTRACTOR.

1.02 SUBMITTALS

A. Action Submittals: Catalog and manufacturer's data sheets for television equipment.

B. Informational Submittals:
1. References: Contact names and telephone numbers.
2. List of staff and equipment to be used on Project.
3. Crew chief qualifications.
4. Traffic control plan.
5. Look-ahead inspection schedules, minimum of 7 days in advance of the Work.
6. Initial first days' CCTV digital videos and inspection logs within 24 hours of start of CCTV inspection.
7. Certification that staff to be used for the Work is properly trained in confined space entry and hazardous atmospheres.
8. Training and inspection plan, 7 days prior to manual inspection.
9. Final report.

1.03 QUALITY ASSURANCE

A. Qualifications:
1. CONTRACTOR: Performed work successfully for at least three other projects, within last 5 years, with pipe lengths and pipe diameters similar to this Project.
2. Crew Chief: Minimum of 5 years' experience on projects similar to this Project and experienced using proposed equipment for this Project.

B. Pre-startup Meeting: At least 5 days prior to beginning CCTV inspection work, schedule with OWNER to review proposed sewer flow bypassing plan, traffic control plans, and inspection

methods.

C. Submit digital videos, photos and logs for quality review and comment to OWNER within 24 hours after the first days' work is completed. Submit tapes and logs on a routine basis within 7 days after completing each tape. Picture quality and definition shall be to the satisfaction of OWNER. Inspection equipment that fails to produce satisfactory inspection quality shall be removed.

1.03 NOTIFICATIONS

A. Notify OWNER:
   1. A minimum of 5 days prior to the anticipated commencement of inspections in any one area and 24 hours in advance of actual start.
   2. When obstruction, restricting flow in pipeline, is discovered.
   3. If depth of flow in pipeline exceeds 33 percent of pipe diameter.
   4. If conditions for CCTV inspection are found to be unsafe or impractical.
   5. Pipe configuration in field is different than shown on maps. Notification shall include diagram clearly indicating location of structure in relation to immediately adjacent structures.

PART 2 PRODUCTS

2.01 TELEVISION INSPECTION EQUIPMENT

A. CONTRACTOR shall provide a mobile vehicle with video monitoring equipment specifically compatible with the camera equipment being used. The equipment shall include dual video recorders, dual monitors, and picture capture capability. The vehicle shall be large enough to accommodate at least three people at any time for viewing of the monitor. OWNER shall have unrestricted access to observe the television screen and all other operations at all times.

B. The basic equipment for use in cleaning and inspection operations shall consist of hydraulically propelled or mechanical cleaning equipment and a self-propelled full color television inspection camera with footage meter, pan, and tilt functions.

C. The television camera used for the inspection shall be one specifically designed and constructed for such inspection. Lighting for the camera shall be suitable to allow a clear color picture of the entire periphery of the pipe. The camera shall be capable of a 360-degree viewing area. The camera, television monitor, and other components of the video system shall be capable of producing a minimum 500-line resolution picture. Backup camera shall be available on the Project Site. The camera shall be operative in 100 percent humidity conditions. Camera shall be operative in a hazardous and corrosive environment.

D. The camera, television monitor, and other components of the video system shall be capable of producing picture quality to the satisfaction of OWNER.

E. The television inspection equipment shall have an accurate footage counter that shall display on the monitor the exact distance of the camera from the centerline of the starting manhole.

PART 3 EXECUTION

3.01 PREPARATION

A. Prior to televising, CONTRACTOR shall thoroughly clean the pipelines of debris, grease, roots, sediment, broken pipe, or other obstructions that could retard the movement of the television camera. Precautions shall be taken to protect the sewer lines being cleaned from damage by the cleaning equipment.

B. Immediately after cleaning, the sewer line section shall be visually inspected by means of closed-circuit television to determine the condition of the line and to locate existing service connections. The inspection will be done one manhole section at a time and the flow in the section being inspected will be suitably controlled as specified. (See Section 02542, Sewer Flow Control).

C. All internal pipe damage shall be photographed in color by CONTRACTOR utilizing picture capture equipment, and shall be clearly labeled as to date, each number, footage, and type of defect. The photographs shall be the property of OWNER.

3.02 TELEVISION INSPECTION

A. The camera shall be moved through the line in either direction at a moderate rate, stopping when necessary to permit proper documentation of the sewer line section condition. In no case will the television camera be pulled at a speed greater than 30 feet per minute. Manual winches, power winches, TV cable, and powered rewinds or other devices that do not obstruct the camera view or interfere with proper documentation of the sewer conditions shall be used to move the camera through the sewer line.

B. When manually operated winches are used to pull the television camera through the line, telephones or other suitable means of communication shall be set up between the two manholes of the section being inspected to ensure good communications between members of the crew.

C. The importance of accurate distance measurements is emphasized. Measurement for location of defects shall be above ground by means of a meter device. Marking on the cable, or the like, which would require interpolation for depth of manhole, will not be allowed. Accuracy of the distance meter shall be checked by use of a walking meter, roll-a-tape, or other suitable device, and the accuracy shall be satisfactory to OWNER.

D. The camera height shall be adjusted such that the camera lens is always centered in the pipe being televised.

E. Lighting system shall be adequate for quality pictures. A reflector in front of the camera may be required to enhance lighting in black pipe.

3.03 PASSAGE OF TV CAMERA

A. There may be occasions during the TV inspection of a sewer line section, when the camera will be unable to pass an obstruction even though flow is continuing. CONTRACTOR shall televise the line section from the other direction in order to obtain a “full” video of this line section.

Whenever such condition arises, OWNER shall be notified to determine if a point repair is necessary. No additional payment shall be made for reverse set-ups required due to an obstruction.

B. TV videos shall be submitted in one continuous section from manhole to manhole, and not in broken pieces, unless specifically approved by OWNER.

C. When the camera is being pulled from the "other end" and a second repair location is encountered away from the first repair/obstruction location, OWNER shall be notified and allowed to review the TV DVD at the Site in a timely manner. Obtain OWNER's permission to make the two point repairs. No downtime shall be allowed.

D. If the two point repairs are allowed and completed, CONTRACTOR shall again proceed to re-televise the sewer line section. Generally, up to 20 feet of the line from each of the ends of the two point repairs may be lamped or physically inspected at the Site, to verify the condition of the line without further TV.

E. OWNER makes no guarantee that all of the sanitary sewer mains proposed to be TV inspected after the cleaning, are clear for the passage of the camera set-up. The equipment, tools and method(s) used for securing the passage of the camera are to be at the discretion of CONTRACTOR, with the approval of OWNER. The decision to repair or not to repair a location shall always be made by OWNER.

F. If cleaning of an entire section cannot be successfully performed from one manhole, the equipment shall be reset on the other manhole and cleaning again attempted. If again, successful cleaning cannot be performed or the equipment fails to traverse the entire pipeline section, it will be assumed a major blockage exists and the cleaning effort shall be terminated only at the direction of OWNER.

G. During all sewer-cleaning operations, satisfactory precautions shall be taken to protect the sewer lines from damage that might be inflicted by the improper use of cleaning equipment. Whenever hydraulically-propelled cleaning tools, which depend on water pressure to provide their cleaning force or any tools which retard the flow of water in the sewer line are used, precautions shall be taken to ensure that the water pressure created does not cause any damage to or flooding of public or private property being serve by the sewer section involved.

H. Roots shall be removed in the sections where root intrusion is a problem. Special precautions should be exercised during the cleaning operation to assure complete removal of visible roots from the joint area. Any visible roots that may impact rehabilitation efforts shall be removed. Procedures may include the use of mechanical devices such as rodding machines, expanding root cutters and porcupines, and hydraulic procedures such as high-pressure jet cleaners.

I. To aid in the removal of roots and at the option of CONTRACTOR, sewer sections that have root intrusion may be treated with a OWNER -approved herbicide. The application of the herbicide to the roots shall be done in strict accordance with the manufacturer's recommendations and specifications in such a manner to preclude any damage to the surrounding vegetation. CONTRACTOR shall replace any damaged vegetation so designated by OWNER, at no additional cost to OWNER. All safety precautions as recommended by the manufacturer shall be strictly adhered to concerning handling and application of the herbicide.

J. CONTRACTOR, after cleaning a section of pipe, shall utilize the television camera to inspect the main. No line shall be considered cleaned until OWNER approves.

K. The television camera shall be moved through the line in either direction at a uniform rate, stopping when necessary to insure proper documentation of the sewer's condition, but in no case shall the television camera travel at a speed greater than 30 feet per minute.

L. The television camera shall travel through the lines using its own power. The pictures taken of the entire inside periphery of the pipe shall be clear and visible. Picture quality and definition shall be to the satisfaction of OWNER, and if unsatisfactory, the equipment shall be removed and no payment made for the unsatisfactory inspection.

M. At all service laterals the camera shall be stopped and panned to such an angle that an internal view of the service lateral is available to determine if the lateral is active or dead or plugged. Where other pipe deficiencies are noted, the camera shall be stopped to observe the condition, record information and take photographs. Any service lateral or deficiency observed in the sewer line shall be photographed and described on the photograph.

3.04 FLOW CONTROL

A. TV inspection shall be done one sewer line section at a time, and the flow in the section being televised shall be suitably controlled. The depth of wastewater flow shall not exceed that shown below:

6″ – 10″ Pipe: 20% of pipe's diameter

12″ -24″ Pipe: 25% of pipe's diameter

Over 24″ Pipe: 30% of pipe's diameter

B. When the depth of flow in the section being worked is above the maximum allowable for the television inspection, the flow shall be reduced to allowable levels by performing the inspection during minimum flow hours, with diversion pumping or by pulling camera with swab or a high velocity jet nozzle, as approved by OWNER.

C. No separate payment shall be made for sewer flow control.

D. CONTRACTOR shall not be allowed to float the camera unless permitted by OWNER.

E. When flow in a sewer line is plugged, blocked, or bypassed; sufficient precautions must be taken to protect the sewer lines from damage that might result from sewer surcharging. Further, precautions must be taken to insure that sewer flow control operations do not cause flooding or damage to public or private property being served by the sewers involved.

3.05 DOCUMENTATION

A. CONTRACTOR shall submit in electronic format digital videos, photos, and evaluation reports, to OWNER for review. OWNER's review and comment period may require up to 10 working days from the date of submittal.

B. The digital video shall be recorded at Standard Play and each digital video segment information

entered in the software as required under Article Basic Module (1) – Survey/Logging Report.

C. If digital videos are of such poor quality that OWNER is unable to evaluate the condition of the sanitary sewer main, locate the sewer service connections, or verify the cleaning CONTRACTOR shall be required to re-televise the sanitary sewer and provide new digital videos of good quality, at no additional cost to OWNER.

D. All digital videos will become the property of OWNER.

E. Payment deduction of $50 per digital video shall apply for poor and unacceptable quality digital videos or for portions of sewer not televised. Camera distortions, inadequate lighting, dirty lens or blurred/hazy picture will be cause for rejection of the Work.

3.06 BASIC MODULE (1) – SURVEY/LOGGING REPORT

A. The software's core module shall be capable of providing complete survey reports and be PACP (Pipeline Assessment and Certification Program) certified by NASSCO. The software shall be the latest version of Subcam.

B. There shall be PACP Complaint codes pre-programmed and grouped by PACP Groups.

C. The software shall be capable of customization with the ability to modify or add to the pipeline condition and group them for ease of use.

D. The footage reading from the camera equipment shall be automatically entered into the Survey Log through RS232 cable and shall directly correspond to the noted defect location throughout the pipe graphic and tabular reports generated.

E. The inspection and reporting software program shall be menu-driven and shall have a complete on-screen help file.

F. Drop-down boxes shall be utilized to quickly reference common information such as defects, pipe materials, survey purpose, locations, pipe usage, etc.

G. The browser screen shall allow quick viewing of:

1. Sequential survey/segment as setup number (automatic input by software).
2. User-selected categories.
3. Up-stream and down-stream manhole numbers.
4. Street name.
5. Pipe segment details.
6. Drainage basin number.

H. All relevant pipe segment information shall be entered prior to the actual survey. The below listed minimum pipe details must be supplied in the software for proper system management. The graphic and tabular survey reports generated shall include the following information:

1. Pipe diameter.
2. Starting manhole number.
3. Ending manhole number.

4. Starting manhole depth.
5. Ending manhole depth.
6. Direction of survey.
7. Pre-clean (y/n).
8. Total surveyed length.
9. Pipe material.
10. Pipe section length.
11. Pipe shape.
12. Road name.
13. Address or place name.
14. Work Order number.
15. Video CD number.
16. Engineering drawing number.
17. Purpose of survey.
18. Pipe age (year of construction).
19. Inspection of survey date.

I. The CCTV software shall maintain a database of underground pipe and manhole assets. The database(s) shall have structure similar to the one referencing pipe usage (i.e., sanitary storm drainage, etc.) sections (i.e., projects, areas, or quadrants). Surveys shall include a method of pipe segment numbering and a chronological survey set-up numbering system.

J. The basic module database shall have the means to sort in ascending and descending order according to date, pipe segment, reference number, road name, manhole number(s), observed footage, pipe materials, pipe diameters, work order numbers, etc. A filtering system shall also be made available.

K. The basic module software shall have search capabilities in order to find information about past surveys located in the database(s).

L. A summary paragraph shall be made available for a conclusive pipe segment assessment.

M. The graphical reports shall print in color for quick glance referencing of the defect category. The color-coding scheme shall allow for quick reference as to the quality of service, structural, hydraulic, and constructional defects within a particular survey.

N. A scoring system incorporated in the software will assist the user/management personnel in making proper assessment of pipe conditions. Scoring is to be based upon defect severity entered by the operator.

O. An inspection “health check” feature shall be incorporated to insure that the information has been correctly entered. The health check allows for verification of essential information to complete a survey. This feature can be implemented individually or on a total selection basis.

P. A Site sketch feature shall also be supplied so that a drawing or sketch shall indicate special details or locations about a particular set-up Site.

Q. The software shall also have the capability to import and export survey results in a variety of

industry standard formats.

3.07 BASIC MODULE (1) – SUMMARY REPORTING

A. Summary reports compiling data from multiple inspections shall be available. Such reports shall indicate individual survey results in tabular from and list (sort) surveys based on a user-defined description field.

B. Defect report shall be programmable to list specific defects observed with corresponding footage, starting and ending manhole number, structural pipe defects (i.e., cracks, offsets, defective laterals, collapsed pipe, etc.) and service-oriented defects (i.e., roots, grease, obstructions, infiltration, etc.).

C. A drainage schedule report shall include starting and ending manhole numbers, depths, pipe material, total survey length, and pipe diameter.

D. The grading scores report shall summarize the manhole numbers, pipe material, pipe diameter, and the grade scores for each survey with totals.

E. Service and structural aspect scoring reports are to list the pipe segment, reference number, total observed length, number of defects, and total score with reference to the condition of the total pipe, average of the pipe, total defects, and average of defects.

F. Section summary reports are to be made available so that all surveys within a section are listed showing purpose of inspection, date, work order numbers, manholes, road names, and total lengths.

G. All software shall be compatible with OWNER's current system.

3.08 EVALUATION REPORTS

A. Each video shall be accompanied by a TV inspection report, which shall be a written/narrated log of all pipe defects, sags, service connection locations and conditions, etc., recorded on a footage basis. Report shall be provided in an electronic (computer usable) format that is transferable to a Microsoft Access database.

B. The pipe defects shall include separate codes for the following: Radial Cracks, Longitudinal Cracks, Misaligned Joints, Broken Joints, Root Intrusion, Laterals, and Infiltration. The size/length of the defect shall be reported. The beginning of all sags of the pipe, the length that is underwater as well as where the camera pulls out of the sag shall be reported. The clock position of each service connection and the condition shall be reported. The condition of each service connection will include the distance protruding when appropriate and the type. All other information required for analysis such as degrees of deterioration, deformation or collapsed pipe shall be reported. All reports and/or submittals shall adhere to Pipeline Assessment Certification Program (PACP) Standards.

C. This log shall also identify the section being televised, flow and camera direction, type of pipe, pipe condition, weather conditions, type of surface cover, or any other information required by

OWNER.

D. OWNER may provide CONTRACTOR a log form that utilizes codes for the above-mentioned defects.

E. At the end of the Project CONTRACTOR shall provide a summary listing of all videos provided under this Project.

End of Section

SECTION 02542
SEWER FLOW CONTROL

PART 1 GENERAL

1.01 WORK INCLUDED

A. Sewer flow control required to conduct the sewer line replacement, television inspection, sewer line testing, chemical root control application, and sewer line sealing operations effectively. In general, flow control will be required when sewer line flows are greater than 1/3 of the pipe diameter.

1.02 PERFORMANCE REQUIREMENTS

A. It is essential to the operation of the existing sewerage system that there be no interruption in the flow of sewage throughout the duration of the project. To this end, CONTRACTOR shall provide, maintain and operate all temporary facilities such as dams, plugs, pumping equipment (both primary and back-up units as necessary to intercept the sewage flow before it reaches the point where it would interfere with his work, carry it past his work and return it to the existing sewer downstream of his work.

1.03 FIELD QUALITY CONTROL AND MAINTENANCE

A. Test:
CONTRACTOR shall perform leakage and pressure tests of the bypass pumping discharge piping using clean water prior to actual operation. ENGINEER will be given 24 hours notice prior to testing.

B. Inspection:
CONTRACTOR shall inspect bypass-pumping system every two hours to ensure that the system is working correctly.

C. Maintenance Service:
CONTRACTOR shall insure that the temporary pumping system is properly maintained and a responsible operator shall be on hand at all times when pumps are operating.

PART 2 PRODUCTS

A. Not Applicable.

PART 3 EXECUTION

3.01 PLUGGING OR BLOCKING

A. Insert a sewer line plug into the line at a manhole upstream from the line segment that is to be inspected, tested, and sealed. The plug shall be designed so that a portion of the sewage flow can be released. During the inspection portion of the operation, shut off or substantially reduce flows so that the pipe can be properly inspected. During the sewer line testing and/or sealing,

restore flows to normal, or no more than 1/3 of the pipe diameter.

3.02 BYPASS PUMPING

A. When bypass pumping is required to ensure the completion of the replacement, inspection, testing, and sealing work, furnish pumping equipment, conduit, etc. Conduct pumping operations from manhole to manhole, and discharge no flow on the surface or in natural waterways. Any and all sanitary sewer overflows shall be reported to OWNER.

B. Bypassing Sewage: When required for acceptable completion of an insertion process, CONTRACTOR shall provide for continuous sewage flow around the section(s) of pipe designated for the insertion of liners. For lines 18-inch in diameter and larger, CONTRACTOR shall submit a bypass-pumping plan to ENGINEER.

3.03 LIABILITY

A. CONTRACTOR shall be responsible for damages to private or public property that may result from his sewer flow control operations. CONTRACTOR shall be responsible for any violations of laws, regulations or permits and shall indemnify and hold OWNER harmless for any and all damages, including but not limited to, fines and penalties that arise from such violations.

End of Section

SECTION 02545
BORING AND CASING FOR UTILITY LINES

PART 1 GENERAL

1.01 SUMMARY

A. The work to be performed hereunder shall consist of the installation of a casing pipe for the purpose of installing a water or sewer line as shown on the Drawings or as called for in these specifications. It shall include the excavation of a boring pit, auger boring between the points specified on the Drawings, furnishing and installing of the carrier pipe, and disposing of the excavated materials in the manner herein provided.

B. The Owner will provide the necessary control points required by the Contractor for this construction. The Contractor will provide the detailed layout required to keep the tunnel or bore on grade.

PART 2 PRODUCTS

2.01 CASING PIPE

A. The casing pipe shall be of steel meeting the latest approved American Railway Engineering Association "Specifications for Pipelines for Carrying Flammable and Nonflammable Substances." The steel casing pipe shall have a minimum yield strength of 35,000 psi and shall have the minimum wall thickness shown in the following table:

	(For Highway H20 Loading)		**(For Railroad E72 Loading)**	
Carrier Pipe (inches)	Casing Pipe (inches)	Nominal Thickness (inches)	Casing Pipe (inches)	Nominal Thickness (inches)
2	6	0.250	8	0.250
4	8	0.250	10	0.250
6	12	0.250	14	0.250
8	16	0.250	18	0.281
12	20	0.281	24	0.375
16	24	0.375	30	0.500
20	30	0.500	30	0.500
24	36	0.500	36	0.625
30	42	0.500	42	0.625
36	48	0.625	48	0.750
42	54	0.625	54	0.875
48	60	0.750	60	0.875

2.02 CARRIER PIPE

A. The carrier pipe shall meet the standards specified in Section 02532, Sanitary Sewers and Appurtenances (Gravity), Section 02534, Wastewater Force Mains, and Section 02510, Water

Distribution Lines, Valves, and Appurtenances. Use Field-Lok gaskets for all carrier pipe joints.

PART 3 EXECUTION

3.01 BORING

A. The boring shall be accomplished by means of auguring to the size, line, and grade shown on the Drawings.

3.02 INSTALLATION OF CASING PIPE

A. Jack the steel casing pipe into place as the boring proceeds. Weld sections of casing pipe together to provide watertight joints.

B. Do not remove unacceptable casing without prior approval from the Engineer. If the removal of casing pipe is permitted, make proper provisions to prevent caving in of the earth surrounding the casing.

3.03 INSTALLATION OF CARRIER PIPE

A. The carrier pipe(s) shall be furnished by the Contractor. Upon acceptance of the casing, install the carrier pipe in the casing by jacking it through the casing. Spacers shall be used within the casing pipe. Casing Spacers shall be bolt style with a shell made in two sections of heavy T-304 Stainless Steel. Connecting flanges shall be ribbed for extra strength. The shell shall be lined with a PVC liner .090″ minimum thickness with 85-90 durometer. All nuts and bolts are to be 18-8 stainless steel. Runners shall be made of ultra high molecular weight polymer with inherent high abrasion resistance and a low coefficient of friction. Runners shall be supported by risers made of heavy 304 Stainless Steel. The supports shall be mig welded to the shell and all welds shall be passivated. The height of the supports and runners combined shall be sufficient to keep the carrier pipe at least 0.75″ from the casing pipe wall at all times. A minimum of three spacers shall be placed on each joint of pipe. Casing spacers shall be made by Cascade Waterworks Mgf. Co. or Pipeline Seal and Insulator, Inc., Model S 12G-2. Each end of the casing pipe shall be sealed with a wrap-around end seal. (See Standard Drawing 1024).

3.04 TUNNELING ALTERNATIVE

A. In the event boring and jacking is impossible because of pipe size, rock, or other factors and the highway department or railroad will not permit open cutting, make crossings by tunneling using liner plates. Conduct tunneling operations as approved by the railroad or highway department. If voids are caused by the tunneling operations, fill by pressure grouting or by other approved methods that will provide proper support.

B. Galvanized Plates

1. After the plates are formed to shape, the plates shall be galvanized on both sides by the hot dip process. A coating of prime western spelter, or equal, shall be applied at

the rate of not less than 2 ounces per square foot of double exposed surface. If the average spelter coating as determined from the required samples is less than the amount specified above, or if any 1 specimen shows a deficiency of 0.2 ounce, the lot shall be rejected. Spelter coating shall be of first class commercial quality free from injurious defects such as blister, flux, and uncoated spots.

2. The outside of the plates shall be given a bituminous coating meeting the AASHO M-190 specifications for bituminous protected corrugated metal pipe.

C. Design and Construction

1. Construct the tunnel by the tunnel method, and completely line on the inside with structural steel liner plates meeting all requirements specified hereinafter. The dimensions of the tunnel shall be as shown on the Drawings.

2. The tunneling operation is to commence from a pit that is a minimum of 12 feet long and 4 feet wider than the diameter of the tunnel, bottom to grade, and sheeted and shored, if necessary. Furnish line and grade stakes.

3. All excavation for the entire length of the tunnel shall be done by tunneling, and the work may be done from either or both ends of the conduit. Trim the periphery of the tunnel smooth to fit the outside of the steel liner plate as nearly as is practical, and fill all space outside of the steel liner plate with a sand cement grout mixture.

4. Install the steel liner plates immediately after the excavated material has been removed. Do not remove material more than 24 inches ahead of the installed liner plates.

5. Provide all necessary bracing, bulkheads, and/or shields to ensure complete safety to all traffic at all times during the progress of the work, and perform the work in such a manner as to not interfere with normal traffic over the work.

6. The steel lining shall consist of plates 16 inches wide, and each circumferential ring shall be composed of the number and length plates necessary to complete the required diameter.

7. The inside diameter of the completed ring shall be of a minimum size as called for as a casing pipe in Paragraph 2.1A, and no part of the plate or reinforcing ribs will be allowed to extend inside this net diameter.

8. The strength of the tunnel lining will be determined by its section modulus. In no case shall it be less than 0.0590 inch cubed per inch of plate width based on the average for 1 ring of plates. Thickness of the metal for these steel plates shall be not less than 10 gauge, allowing for standard mill tolerances. The tunnel strength shall be equal to AASHO railroad E80 loading at the depth of cover obtaining.

9. All plates shall be punched for bolting on both longitudinal and circumferential seams and shall be fabricated so as to permit complete erection from the inside of the tunnel. The longitudinal seam shall be of the lap type with offset equal to gauge of metal for

the full width of the plate, including flanges, and shall have staggered bolt construction fabricated so as to allow the cross section of the plate to be continuous through the seam. All plates shall be of uniform fabrication, and those intended for 1 size tunnel shall be interchangeable.

10. The material used for the construction of these plates shall be new and unused and suitable for the purpose intended. Workmanship shall be first class in every respect.

11. Install the carrier pipe to the line and grade shown on the Drawings. The carrier pipe shall be adequately blocked inside the tunnel so that no part of the carrier pipe touches the tunnel liner. The blocking shall be such that the carrier pipe cannot move horizontally or vertically. The blocking shall be installed within one foot on each side of the bell of the carrier pipe and at the center of each joint. The main portion of the support shall be stainless steel with a PVC liner between the support and the carrier pipe. Detailed plans and specifications shall be submitted showing the proposed bracing and support of the carrier pipe inside the tunnel. Each end of the tunnel liner shall be plugged with brick and mortar.

12. All tunnel liners shall have one 2 inch grout coupling in every ring. Grout back of the rings as required.

PART 4 GUARANTEE OF WORK

4.01 SUMMARY

A. Guarantee a usable completed casing or tunnel between the points specified and to the line and grade specified. The allowable tolerance at the downstream end point of the bore shall be such that the invert of the carrier pipe may be positioned within a vertical area limited on the top by an elevation no higher than the elevation shown on the Drawings and on the bottom by an elevation no lower than the existing inlet pipe invert.

B. The allowable tolerance at the upstream end point of the bore shall be such that the invert of the carrier pipe may be positioned at the elevation shown on the Drawings.

End of Section

SECTION 02575
PAVEMENT REPAIR

PART 1 GENERAL

1.01 SUMMARY

A. The work specified by this section shall consist of repairing or replacing all damaged pavement, whether public or private. Dirt shoulders, roads, streets, drives, and walks are to be restored to their original condition as an incidental part of the installation of utilities. Repair damaged base on either side of a trench wherever necessary. Trim the oxidation surface to neat lines outside of the trench wall and repave the entire area as specified below and as shown on the drawings or on the standard drawings.

B. Both these specifications and the drawings make reference to the current edition of the standard specifications of the Tennessee Department of Transportation (TDOT). Even though the weather limitations, construction methods, and materials specifications contained in the TDOT specifications may not be explicitly repeated in these specifications, they shall, wherever applicable to the work called for by this section, be considered as implied and therefore adhered to. However, the various subsections "Basis for Payment" contained in the TDOT specifications shall not be considered applicable. Refer to other sections for work related to that covered by this section.

C. All pavement repair work must meet the requirements of the Loudon County Highway Department, Lenoir City Street Department, and/or all other local agencies having jurisdiction over the roadway being repaired. Where Loudon County Highway Department and/or Lenoir City Street Department requirements differ from the specifications herein, the more stringent of the two shall be used.

PART 2 PRODUCTS

A. Mineral Aggregate Base: Type A Base, Grading D crushed stone (TDOT Specification Section 303);

B. Bituminous Prime Coats: cutback asphalt, Grade RC-250, or material emulsified asphalt, Grade AE-P (TDOT Specification Section 402);

C. Aggregate For Cover Material: Size 7, 8 or 78 (TDOT Specification Section 402) ;

D. Tack Coat: Grade AE-3 (TDOT Specification Section 403);

E. Bituminous Plant Mix Base (Hot Mix): Grading A, B, B (modified), or C, AS or CW, as directed by the Engineer (TDOT Specification Section 307);

F. Asphaltic Concrete Surface: Grading D or E as specified (TDOT Specification Section 411).

PART 3 EXECUTION

3.01 SUBGRADE

A. Before any base material is installed, compact the subgrade of the area to be paved to 95 percent of optimum density as determined by ASTM D698 (Standard Proctor).

B. The backfill material shall contain no topsoil or organic matter. For all areas where subgrade has been prepared, test for uniformity of support by driving a loaded dump truck at a speed of 2 to 3 mph over the entire surface. Make further improvements on all areas that show a deflection of 1 inch or more. When completed, the finished subgrade shall be hard, smooth, stable, and constructed in reasonably close conformance with the lines and grades that existed prior to beginning construction.

C. When a base course is compacted, cut back the surface course of the existing pavement a minimum of 1 foot beyond the limit of the joint between the old and new base course or as shown on the standard drawings. Take special care to ensure good compaction of the new base course at the joint. Apply and compact the surface to conform to the existing pavement so that it will have no surface irregularity.

3.02 BASE

A. Install a mineral aggregate base of the type specified above in accordance with TDOT specifications. The maximum compacted thickness of any one layer shall be 6 inches and the total thickness of the base shall be that indicated by the standard drawings or as shown on the plans.

3.03 SEAL COAT SURFACE

A. Uniformly apply a bituminous prime coat of either emulsified asphalt, Grade AE-P, or cutback asphalt, Grade RC-250, over the entire width of the area to be surfaced at a rate of 0.3 gallons/square yard. Immediately after application, uniformly cover the entire area with Size 7 crushed stone chips at a rate of 12 pounds/square yard.

B. Pavement repairs/replacements shall be thermally bonded with existing asphalt edges.

3.04 ASPHALTIC CONCRETE BINDER

A. Apply a bituminous prime coat of emulsified asphalt, Grade AE-P, or cutback asphalt, Grade RC-250, at a rate of 0.38 to 0.42 gallons/square yard. Take care to prevent the bituminous material's splashing on exposed faces of curbs and gutters, walls, walks, trees, etc. If such splashing does occur, remove it immediately. After the prime coat has been properly cured, apply an asphaltic concrete binder to the thickness shown on the standard drawings or the plans.

B. Carefully place the material to avoid segregation of the mix. Broadcasting of the material will not be permitted. Remove any lumps that do not readily break down.

3.05 ASPHALTIC CONCRETE SURFACE

A. If the asphaltic concrete surface course is to be placed directly on the mineral aggregate base, place a bituminous prime coat as described above. If, however, the surface course is to be placed on a binder course, then apply a bituminous tack coat of the sort specified above under PRODUCTS at a rate of 0.05 to 0.10 gallons/square yard. Take care to prevent the bituminous material's splashing on exposed faces of curbs, gutters, walls, walks, trees, etc. If such splashing does occur, remove it immediately. After the prime or tack coat has been properly cured, apply the asphaltic concrete to the thickness shown on the drawings or standard drawings. Apply the surface course as described above for the binder course.

3.06 SMOOTHNESS

A. The finished surfaces shall conform to the lines and grades that existed prior to construction. No deviations, variations, or irregularities exceeding 1/4 inch in any direction when tested with a 12-foot straightedge will be permitted in the finished work, nor will any depressions that will not drain. Correct all such defects.

3.07 SAMPLING AND TESTING

A. Submit to the Owner test reports made by an independent testing laboratory on the crushed stone aggregate, bituminous materials, and asphaltic concrete design mixes, and obtain his approval of these reports before starting paving operations.

B. Tests shall be made on the completed elements of the pavement to ascertain the compacted thickness of the base and surface courses. If sections with deficient thicknesses are found, the full section for a reasonable distance on each side of the deficiency shall be refused. Remove and reinstall all such sections. Patch all test holes in connection with thickness tests.

C. When making surface tests, furnish one man to mark all surface defects for corrections.

End of Section

SECTION 02611
TRENCHING, BACKFILLING, AND COMPACTING

PART 1 GENERAL

1.01 RELATED WORK

A. Section 01050 – Field Engineering

B. Section 01560 – Erosion and Pollution Control

C. Section 01570 – Work Zone Traffic Control

D. Section 01720 – Project Record Documents

E. Section 02150 – Water Distribution Lines, Valves and Appurtenances

F. Section 02221 – Unclassified Excavation for Utilities

G. Section 02311 – Control Blasting

H. Section 02532 – Sanitary Sewers and Appurtenances (Gravity)

I. Section 02534 – Wastewater Force Mains

J. Section 02536 Low Pressure Sewer Mains and Laterals

K. Section 02930 – Seeding

1.02 JOB CONDITIONS

A. Provide for uninterrupted surface water flow during the work. Provide means whereby storm water can be uninterrupted in existing gutters and surface drains, or temporary drains.

B. All pipe shall be installed in a dry trench. No extra compensation shall be allowed for trench dewatering.

C. Immediately notify the Engineer of any unexpected subsurface or other unforeseen conditions. Discontinue work in area until Engineer provides notification to resume work.

D. Existing utilities, poles, service lines, fences, structures, trees, shrubs, or other improvements encountered during the construction, whether above or below ground, shall be protected by the Contractor. Any item damaged or removed by the Contractor shall be repaired or replaced at the Contractor's expense to at least its original condition and to the satisfaction of the Owner. It shall be the Contractor's responsibility to locate any existing utilities in the path of construction.

E. Adjacent structures which may be damaged by excavation work shall be underpinned or supported by other means.

F. Excavations shall be protected by shoring, bracing, sheet piling, underpinning, or other

methods required to prevent cave in or loose dirt from falling into excavation.

1.03 PERMITS

A. Permits shall be obtained from authorities having jurisdiction prior to any explosives being brought to the site. The Contractor shall be responsible for providing such insurance that is required to hold the Owner harmless from any claims that may arise due to blasting operations at the site. The minimum insurance requirement will be that which is outlined in the General Conditions.

B. All conditions set forth in the Corps of Engineers 404 Permit and Tennessee Valley Authority 26A Permit (if applicable) shall be strictly adhered to. The Owner shall obtain the appropriate permit.

1.04 QUALITY ASSURANCE

A. Adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for the proper performance of the work in this section shall be used.

B. Equipment adequate in size, capacity, and numbers to accomplish the work in a timely manner shall be used.

PART 2 PRODUCTS

2.01 SANITARY SEWERS

A. BEDDING MATERIAL

1. Angular gravel, crushed gravel, or crushed limestone meeting the following gradation requirements set forth in ASTM 33 shall be used:

SIEVE SIZE	PERCENT PASSING
1"	100
3/4"	90 - 100
1/2"	20 - 55
3/8"	0 - 15
#4	0 - 5

2. Shall be used for bedding, haunching, and initial backfill of PVC pipe.
3. Shall be used for bedding and haunching of Ductile Iron Pipe.
4. Frozen materials shall not be used.

B. BACKFILL MATERIALS

1. Material excavated from the trench, free from large stones (any dimension greater than

two (2") inches), clods, debris, or frozen lumps shall be used:

a. For final backfill of PVC pipe.
b. For initial and final backfill of Ductile Iron Pipe.

C. CRUSHED STONE BACKFILL MATERIAL: UNDER ROADS OR AREAS TO BE PAVED

1. Shall be used for final backfill for all pipe under roads and in areas indicated as future roads on the drawings.
2. Material shall be approved by the Engineer.

2.02 WATER LINES

A. BEDDING MATERIALS

1. Angular gravel, crushed gravel, or crushed limestone, meeting the following gradation requirements set forth in ASTM 33:

SIEVE SIZE	PERCENT PASSING
1"	100
3/4"	90 - 100
1/2"	20 - 55
3/8"	0 - 15
#4	0 - 5

a. Shall be used for bedding, haunching, and initial backfill of PVC and HDPE pipe.
b. Shall be used for bedding and haunching of Ductile Iron Pipe.

2. Suitable materials excavated from the trench, free from large stones (any dimension greater than two inches), clods, debris, or frozen lumps may be used for bedding and haunching of water lines outside of paved areas with approval of Owner or Engineer.

B. BACKFILL MATERIALS

1. Material excavated from the trench, free from large stones (any dimension greater than two (2") inches), clods, debris, or frozen lumps shall be used:

a. For final backfill of PVC and HDPE pipe outside of paved areas.
b. For initial and final backfill of Ductile Iron Pipe outside of paved areas.

2. Borrow materials previously approved by the Engineer may be used for backfill material if suitable material is not available from trench.

3. Frozen materials shall not be used.

C. CRUSHED STONE MATERIAL SHALL BE USED AS FOLLOWS:

1. On road crossings where open cut crossings are made, crushed stone shall be used for bedding, haunching, and backfill. (See Standard Details).

2. In areas where rock excavation is required for installation of pipe, crushed stone shall be used for bedding, haunching, and initial backfill.

3. In other areas as directed by the Owner or Engineer and not otherwise required by the Contract Documents, crushed stone shall be replaced at a cost per ton previously agreed by the Owner and Contractor. The quantity of excavation work anticipated to be placed with crushed stone shall be mutually agreed to by the Contractor and the Engineer before excavation.

D. TOPSOIL

1. The final six inches of trench in non-paved areas shall be backfilled with topsoil and finished with crown. See Section 02612, Finish Grading for topsoil specification.

PART 3 EXECUTION

3.01 PREPARATION

A. Line and grade for trench shall be established.

B. Location of all underground utilities, existing and proposed shall be located.

C. Location of existing sewer laterals, manholes and service connections shall be located prior to commencement of trenching.

D. Location of existing water services, meters, and appurtenances shall be located prior to commencement of trenching.

3.02 PERFORMANCE

A. All earthwork and trenching operations shall comply with the requirements of OSHA Construction Standards for the construction industry (29 CFR part 1926).

B. Unless otherwise shown on the drawings or required by the specifications or authorized by the Engineer, all work shall be done in open, vertical trenches. Any sheeting driven below the level of the top of the pipe shall not be disturbed or removed. The responsibility for assessing the need for sheeting and analyzing the stresses induced shall be the total responsibility of the Contractor.

1. Trench sheeting left in place shall be backfilled to a level of 12 inches above the top of the pipe. It shall then be cut off and the upper portion removed.
2. Sheeting for structures shall be left in place until backfill has been brought to a level of 12 inches above the top of the bottom footing. It shall then be cut off and removed.

C. Clearing, including removal of surfacing and pavement, shall be done as necessary to carry on the construction in the proper manner. Material shall be removed only to minimum width necessary to allow adequate construction area. Concrete and asphalt shall be saw cut.

D. Trenches shall be excavated to such depth as required by the drawings. Trenches for sewer lines shall be excavated to such depth as required to provide a minimum of 30 inches cover in all directions from the pipe wall, unless otherwise indicated.

E. Trench Width:

1. Minimum Trench Width

   a. Outside Diameter Less than 4-inches: trench 4-inches greater on each side of the pipe.
   b. Outside Diameter 4-inches to 12-inches: trench 6-inches greater on each side of the pipe.
   c. Outside Diameter 12-inches to 24-inches: trench 8-inches greater on each side of the pipe.

2. Maximum Trench Width shall not be greater than the minimum trench width plus 8-inches nor greater than the minimum width required in order to insert the smallest trench box appropriate for the pipe installation.

F. If rock is encountered in the trench, it shall be excavated in a manner approved by the Owner and as specified below:

1. No separate payment for trench rock excavation will be made. Trench excavation shall be considered unclassified.
2. Trench shall be undercut one foot where rock is in the trench and backfilled with crushed stone.
3. Drilling and blasting operations shall be conducted with due regard for the safety of persons and property in the vicinity and in strict conformity with requirements of all ordinances, laws, and regulations governing blasting and the use of explosives. Rock excavation near existing pipelines or other structures shall be conducted with the utmost of care to avoid damage.
4. All drilling, blasting, and use of explosives shall be in strict accordance with OSHA standards for the construction industry (29 CFR part 1926).

G. Excavated material suitable for backfilling shall be stockpiled no closer than 2 feet from the edge of the trench and shall not obstruct crosswalks, sidewalks, or street intersections, and shall not cause unreasonable interference with travel on the streets by occupants of adjacent property. Gutters and other drainage facilities shall not be obstructed. Free access shall also be maintained to fire hydrants, mailboxes, sewer and water manholes, gas meters, or other municipal facilities.

3.03 BEDDING, HAUNCHING, AND BACKFILLING

A. Pipe shall be installed as shown on the drawings.

B. Bedding shall be shaped and compacted utilizing a vibratory compacter in order to firmly integrate the bedding material into the subgrade resulting in a firm, unyielding, consolidated bedding surface to provide uniform bearing of the pipe. Bell holes shall be excavated to allow for unobstructed assembly of the joint. Bell holes shall be made as small as practical. After the joint has been made, bell holes shall be filled with bedding material.

C. After pipe is jointed and aligned, haunching material shall be installed and compacted to 60 percent relative density, ASTM D2049. Ensure material is worked under the haunch of the pipe to provide adequate side support. Precautions shall be taken to prevent movement of the pipe during placement and compaction of haunching material.

D. Initial backfill shall be hand placed and compacted to provide cover over the pipe as detailed. Pipe shall be protected from large particles of backfill material.

E. Balance of backfill shall be placed by a method which will not damage or displace the pipe, nor cause bridging action in the trench. Backfill material shall be compacted with earthmoving equipment as material is placed so that excessive settlement of the trench material will not occur. Material shall be neatly mounded over the trench. Trench and settled areas shall be maintained as they occur. Finish grade shall be completed to eliminate uneven areas.

F. Where pavement is to be placed over the backfilled trench as indicated on the drawings, the backfill shall be crushed stone under the full trench depth. Under future roads, compaction will be required up to within one foot of existing grade with remaining one foot backfill as per paragraph 3.03. E. above.

G. See Section 02221, Unclassified Excavation for Utilities for additional requirements.

3.04 CREEK AND DITCH CROSSINGS

A. Construct pipe encasement as shown on typical details. Concrete shall be placed in the dry. Concrete: ASTM C94, 2500 psi, at twenty-eight (28) days.

B. Construction methods that will minimize siltation and erosion shall be utilized.

C. All backfill shall be granular material as specified for embedment material or crusher run stone.

D. Clean up, grading, seeding, and other restoration work shall begin immediately and exposed areas shall not remain unprotected for more than seven (7) days.

3.05 TEST FOR DISPLACEMENT OF SEWERS

A. A check of sewer pipe shall be made to determine whether displacement has occurred after the trench has been backfilled to above the pipe and has been compacted as specified.

B. A light shall be flashed between manholes or between locations of manholes with a flash light or sun reflecting mirror.

C. If the pipe line shows poor alignment, displaced pipes, or any other defects, defects shall be corrected to the specified conditions at no additional cost to the Owner.

3.06 TESTING OF BACKFILL

A. A testing laboratory or the Owner shall verify compaction of the bedding and haunching material after placement and compaction.

End of Section

SECTION 02612
FINISH GRADING

PART 1 GENERAL

1.01 RELATED WORK

A. Section 02221: Unclassified Excavation for Utilities

B. Section 02611: Trenching, Backfilling, and Compacting

C. Detailed Specification Sections

1.02 SITE COMPACTION TESTING

A. Testing of compacted fill materials shall be performed by an independent testing laboratory appointed and paid for in accordance with Detailed Specification Section.

B. When work of this section or portions of work are completed, notify the testing laboratory to perform density tests. Do not proceed with additional portions of work until results have been verified.

C. If, during progress work, tests indicate that compacted materials do not meet specified requirements, remove defective work, replace, and retest at no cost to Owner.

1.03 SAMPLES

A. Submit minimum ten (10 lb.) pound samples of each type of excavated fill material to be used. Forward samples to testing laboratory, packed tightly in containers to prevent contamination.

B. If recent test results are available for fill materials to be used, disregard sample submission and submit such test results to the testing laboratory for approval. Such test results are to clearly indicate types of materials and composition, hardness, compactability, and suitability for proposed usage.

1.04 PROTECTION

A. Prevent damage to existing fencing, trees, landscaping, natural features, benchmarks, pavement, utility lines, and structures. Correct damage at no cost to the Owner.

PART 2 PRODUCTS

2.01 MATERIALS

A. Topsoil: Friable loam free from subsoil, roots, grass, excessive amount of weeds, stones and foreign matter; acidity range (pH) of 5.5 to 17.5; containing a minimum of four (4%) percent and a maximum of twenty-five (25%) percent organic matter. Use topsoil stockpiled on site if conforming to these requirements.

PART 3 EXECUTION

3.01 SUB-SOIL PREPARATION

A. Rough grade sub-soil systematically to allow for a maximum amount of natural settlement and compaction. Eliminate uneven areas and low spots. Remove debris, roots, branches, stones, and etc., in excess of three (3") inches in size. Remove sub-soil which has been contaminated with petroleum products.

B. Cut out areas, to sub-grade elevation, which has been contaminated with petroleum products.

C. Bring sub-soil to required levels, profiles, and contours. Make changes in grade gradual. Blend slopes into level areas.

D. Slope grade away from building minimum two (2") inches in ten (10') feet unless indicated otherwise on drawings.

E. Cultivate sub-grade to a depth of three (3") inches where topsoil is to be placed. Repeat cultivation in areas where equipment used for hauling and spreading topsoil has compacted sub-soil.

F. Compact sub-soil to the following:

1. Under Topsoil: 85 percent modified Proctor, ASTM D1557.
2. Under Streets, Drives, and Parking Areas: 95 percent modified Proctor ASTM D1557.
3. Under Walks: 85 percent modified Proctor, ASTM D1557.

3.02 PLACING TOPSOIL

A. Place topsoil in areas where seeding and planting is to be performed. Place to the following minimum depths, up to finished grade elevations.

1. Six (6") inches for seeded areas.
2. Twenty-four (24") inches for shrub beds.

B. Use topsoil in relatively dry state. Place during dry weather.

C. Fine grade topsoil eliminating rough and low areas to ensure positive drainage. Maintain levels, profiles, and contours of sub-grades.

D. Remove stone, roots, grass, weeds, debris, and other foreign material while spreading.

E. Manually spread topsoil around trees, plants, and buildings to prevent damage which may be caused by grading equipment.

F. Lightly compact placed topsoil.

3.03 SURPLUS MATERIAL

A. Remove surplus sub-soil and topsoil from site.

B. Leave stockpile areas and entire job site clean and raked, ready to receive landscaping.

End of Section

SECTION 02930
SEEDING

PART 1 GENERAL

1.01 SUMMARY

A. This work shall consist of supplying and placing soil additives, seed, and mulch as specified on prepared ground in accordance with the Plans and these Specifications. All non-construction areas that show signs of excessive erosion and all newly graded earthen areas that are not to be paved, stabilized, or sodded, shall be seeded unless otherwise indicated on the Plans or as directed by the Engineer.

1.02 RELATED SECTIONS

A. Section 02221 – Unclassified Excavation for Utilities

PART 2 PRODUCTS

2.01 MATERIALS

A. Grass Seed: Use a drought tolerant hybrid Kentucky 31 Fescue (Jaguar, Lancer, Rebel II, Falcon II, etc.). Supplement with an annual rye or other appropriate mixture to assure stabilization during the winter season. Furnish seed in new bags or bags that are sound and not mended; no "below standard" seed accepted.

B. Fertilizer: Use a slow-release starter fertilizer in standard containers that are clearly marked with name, weight, and guaranteed analysis of the contents and that ensure proper protection in transportation and handling; and in compliance with all local, state, and federal fertilizer laws.

C. Lime: Use lime containing a minimum of 85% calcium carbonate and magnesium carbonate, 85% of which passes a No. 10 mesh sieve.

D. Mulch: Stalks of rye, oats, wheat, or other approved grain crops properly cured prior to baling, air dried, and reasonably free of noxious weeds and weed seeds or other material detrimental to plant growth.

PART 3 EXECUTION

3.01 GENERAL

A. Before starting seeding operations on any area, final dressing and placing of topsoil shall have been completed in accordance with the applicable Specifications. Seed, fertilize, lime, and mulch within 30 days of attainment of finish grade.

B. Apply temporary seeding whenever grading operations are temporarily halted for over 14 days and final grading of exposed surfaces is to be completed within one year. Also apply temporary seeding to soil stockpiles.

3.02 PREPARATION

A. Each area to be seeded shall be scarified, disked, harrowed, raked or otherwise worked until it has been loosened and pulverized to a depth of not less than 2 inches and brought to the lines and grades indicated on the Plans or directed by the Engineer. This operation shall be performed only when the soil is in a tillable and workable condition.

B. Apply fertilizer at the rate of 1 pound of nitrogen per 1,000 square feet, and lime at the rate of 50 pounds per 1,000 square feet, shall be uniformly incorporated in the soil for a depth of approximately 1inch. Fertilizer need not be incorporated in the soil as specified above when mixed with seed in water and applied with power sprayer equipment. Do not apply lime without a soil test.

3.03 SEEDING

A. Seed shall be sown as soon as preparation of the seed bed has been completed. It shall be sown uniformly by means of a rotary seeder, hydraulic equipment, or other satisfactory means. Seed shall be sown at the rate of 6 to 8 pounds per 1,000 square feet.

B. No seeding shall be done during windy weather or when the ground surface is frozen, wet or otherwise non-tillable.

C. When seeding during February 1 through April 1 and October 1 through November 30, add an additional 3 pounds per 1000 square feet of annual rye grass. No seeding shall be performed during December and January unless otherwise permitted.

3.04 MULCHING

A. When the mulching material is hay or straw, it shall be spread evenly over the seeded area at an approximate rate of 2 bales (100 pounds minimum) per 1,000 square feet for straw and 150 pounds per 1,000 square feet for hay immediately following the seeding operations. The Engineer depending on the texture and condition of the mulch material and the characteristics of the area seeded may vary this rate.

3.05 MAINTANENCE

A. All seeded areas shall be cared for properly to the Engineer's satisfaction until acceptance of the work. Areas, which have been previously seeded and mulched in accordance with this Section, but which, have been damaged or failed to successfully establish an acceptable stand of grasses shall be repaired as directed by the Engineer. All material and labor required to repair seeded areas made necessary by negligence on a part of the Contractor will be furnished by the Contractor at no cost.

B. If within 60 days of the planting less than 50% is successful, rework the ground, re-fertilize, reseed, and re-mulch.

3.06 CLEANUP AND PROTECTION

A. After the completion of seeding, the area shall be cleaned of all rubbish, excess material, and any other items that will mar the appearance of the projects as in accordance with the General Specifications.

End of Section

SECTION 03303
CONCRETE FOR UTILITIES

PART 1 GENERAL

1.01 SUMMARY

A. This item shall include furnishing and installing concrete blocking, cradles, anchors, caps, pipe protection, and/or encasement at the locations shown on the drawings and/or as directed by the Owner.

B. Submit concrete mix design, including all add mixtures with past strength data for review per the requirements of Section 01302, Submittals and Substitutions.

PART 2 PRODUCTS

A. Not Applicable.

PART 3 EXECUTION

3.01 SUMMARY

A. Concrete work shall conform to ACI 301-72 (as revised), as modified by the supplemental requirements listed below.

1. Strength: The strength of concrete shall be 4,000 psi unless otherwise shown on the drawings.

2. Durability: All concrete exposed to weather shall be air entrained.

3. Slump: Concrete shall be proportional and produced to have a slump of 3-inches with a 1-inch tolerance.

4. Admixtures: Air entrainment, mandatory for concrete exposed to weather, may be used. A water reducing admixture [retarding (normal or accelerating) depending on placing temperature] may be used if approved by the Owner.

5. Reinforcing Steel: Yield strength of reinforcing steel shall be 60,000 psi.

End of Section

SECTION 11235
SUBMERSIBLE PUMP STATION

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. This section includes specifications for dry pit submersible non-clog pumps. Pumps shall be manufactured by Flygt or Owner and Engineer approved equal.

B. This work shall consist of providing and installing a wastewater pump system consisting of two (2) submersible non-clog wastewater pumps and PLC based control panel with variable frequency drives, along with all accessories and, at the location shown on the Drawings and for the service and design condition specified herein.

Motor HP	____
Power	460V, 3 phase, 60 Hz (typical)
Motor Type	Closed coupled, Inverter Duty, 1.15 Service factor
Power Cable	100 feet (sized according to NEC and ICEA standards and shall also meet P-MSHA approval)
Multi-Conductor Cable	100 feet

C. Pump characteristics at _____ rpm:

Operating Point No. 1 (single pump operation at 60 Hz):

Pump Rate	____ gpm
Total Head	____ feet
Minimum Efficiency	____%
Shutoff Head	____ feet
Discharge	____-inch

Operating Point No. 2 (single pump operation at 50 Hz):

Pump Rate	____ gpm
Total Head	____ feet
Minimum Efficiency	____%
Shutoff Head	____ feet
Discharge	____-inch

D. All pumps along with Motor Control and SCADA Panel (MCSP) shall be furnished by a single supplier.

E. Pumps shall operate at the operating condition shown without any detrimental effect on pump wearing parts, cavitations, or excessive noise and vibration. Vibration shall not exceed five mils measured at the lower bearing of the vertical motor. Noise shall never exceed 100 db as measured by ASNI S14. The pumps shall not overload their electric motors beyond their nominal horsepower under the specified operating condition.

F. The pumps and motors will be covered by a five (5) year non-prorated limited warranty. The warranty includes, without limitation, normal wear and tear of wear rings, impellers,

volutes, and other consumable parts. The warranty period shall begin upon startup and acceptance by the Owner.

1.02 QUALITY ASSURANCE

A. Equipment installation shall be in compliance with applicable codes and standards of authorities having jurisdiction.

B. Pumps shall be factory tested prior to shipment. Factory testing shall be witnessed by the Owner and the Engineer.

C. Submit certified pump curves at the completion of manufacturer testing.

PART 2 PRODUCTS

Any substitution for the specified brand name product should be offered with supporting documentation regarding it being equal or superior to the specified brand name to the Engineer 10 business days before the Bid Opening. The Engineer then has 5 business days to determine if the requested substitution is equal to the specified name brand. The Engineer's decision is final on this matter.

2.01 PUMP DESIGN CONFIGURATIONS (Wet pit installation)

A. Pump shall be capable of operating in a continuous non submerged condition in vertical position in a dry pit installation and permanently connected to inlet and outlet pipes. Pump shall be of submersible construction and will continue to operate satisfactorily should the dry pit be subjected to flooding.

The pump shall be supplied with a mating cast iron 6-inch discharge connection. The pump(s) shall be automatically and firmly connected to the discharge connection, guided by no less than two guide bars extending from the top of the station to the discharge connection. There shall be no need for personnel to enter the wet-well. Sealing of the pumping unit to the discharge connection shall be accomplished by a machined metal-to-metal watertight contact. Sealing of the discharge interface with a diaphragm, O-ring or profile gasket will not be acceptable. No portion of the pump shall bear directly on the sump floor. Each pump shall be fitted with thirty feet of stainless steel lifting chain. The working load of the lifting system shall be 50% greater than the pump unit weight.

B. PUMP CONSTRUCTION: Major pump components shall be of grey cast iron, ASTM A-48, Class 35B, with smooth surfaces devoid of blow holes or other irregularities. The lifting handle shall be of stainless steel. All exposed nuts or bolts shall be of stainless steel construction. All metal surfaces coming into contact with the pumpage, other than stainless steel or brass, shall be protected by a factory applied spray coating of acrylic dispersion zinc phosphate primer with a polyester resin paint finish on the exterior of the pump.

C. Sealing design shall incorporate metal-to-metal contact between machined surfaces. Critical mating surfaces where watertight sealing is required shall be machined and fitted with

Nitrile rubber O-rings. Fittings will be the result of controlled compression of rubber O-rings in two planes and O-ring contact of four sides without the requirement of a specific torque limit. Rectangular cross sectioned gaskets requiring specific torque limits to achieve compression shall not be considered as adequate or equal. No secondary sealing compounds, elliptical O-rings, grease or other devices shall be used.

D. COOLING SYSTEM: Each unit shall be provided with an integral motor cooling system. A stainless steel motor cooling jacket shall encircle the stator housing, providing for dissipation of motor heat regardless of the type of pump installation. An impeller, integral to the cooling system and driven by the pump shaft, shall provide the necessary circulation of the cooling liquid through the jacket. The cooling liquid shall pass about the stator housing in the closed loop system in turbulent flow providing for superior heat transfer. The cooling system shall have one fill port and one drain port integral to the cooling jacket. The cooling system shall provide for continuous pump operation in liquid or ambient temperatures of up to 104°F (40°C). Operational restrictions at temperatures below 104°F are not acceptable. Fans, blowers or auxiliary cooling systems that are mounted external to the pump motor are not acceptable.

E. CABLE ENTRY SEAL: The cable entry seal design shall preclude specific torque requirements to insure a watertight and submersible seal. The cable entry shall consist of dual cylindrical elastomer grommets, flanked by washers, all having a close tolerance fit against the cable outside diameter and the entry inside diameter. The grommets shall be compressed by the cable entry unit, thus providing a strain relief function. The assembly shall provide ease of changing the cable when necessary using the same entry seal. The cable entry junction chamber and motor shall be sealed from each other, which shall isolate the stator housing from foreign material gaining access through the pump top. Epoxies, silicones, or other secondary sealing systems shall not be considered acceptable.

Cable leads that enter at the top of the motor shall be double sealed as it enters the motor in such a manner that cable-wicking will not occur. This sealing system shall consist of a rubber grommet followed by epoxy that is high in adhesive qualities and has a low coefficient of expansion. Each cable wire is to have a small section of insulation removed to establish a window area of bare wire and each wire is to be untwisted and surrounded by epoxy potting material. A cable strain relief mechanism shall be an integral part of this sealing system. Cable sealing system shall be capable of withstanding an external pressure test of 1200 psi as well as a cable assembly pull test as required by Underwriters Laboratory. Cable sizing shall conform to NEC specifications and be UL Listed.

F. MOTOR: The pump motor shall be a NEMA B design, induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber. The stator windings shall be insulated with moisture resistant Class H insulation rated for 180°C (356°F). The stator shall be insulated by the trickle impregnation method using Class H monomer-free polyester resin resulting in a winding fill factor of at least 95%. The motor shall be inverter duty rated in accordance with NEMA MG1, Part 31. The stator shall be heat-shrink fitted into the cast iron stator housing. The use of multiple step dip and bake-type stator insulation process is not acceptable. The use of pins, bolts, screws or other fastening devices used to locate or hold the stator and that penetrate the stator housing are not acceptable. The motor shall be designed for continuous duty while handling pumped media of up to 104°F. The motor shall be capable of no less than 30 evenly spaced starts per hour. The rotor bars and

short circuit rings shall be made of aluminum. Three thermal switches shall be embedded in the stator end coils, one per phase winding, to monitor the stator temperature. These thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to the motor control panel.

The junction chamber shall be sealed off from the stator housing and shall contain a terminal board for connection of power and pilot sensor cables using threaded compression type terminals. The use of wire nuts or crimp-type connectors is not acceptable. The motor and the pump shall be produced by the same manufacturer.

G. The motor service factor (combined effect of voltage, frequency and specific gravity) shall be 1.15. The motor shall have a voltage tolerance of +/- 10%. The motor shall be designed for continuous operation in up to a 40°C ambient and shall have a NEMA Class B maximum operating temperature rise of 80°C. A motor performance chart shall be provided upon request exhibiting curves for motor torque, current, power factor, input/output kW and efficiency. The chart shall also include data on motor starting and no-load characteristics.

H. Motor horsepower shall be sufficient so that the pump is non-overloading throughout its entire performance curve, from shut-off to run-out. The motor and cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet or greater.

I. The power cable shall be sized according to the NEC and ICEA standards and shall be of sufficient length to reach the junction box without the need of any splices. The power cable shall be of a shielded design in which an overall tinned copper shield is included and each individual phase conductor is shielded with an aluminum coated foil wrap. The outer jacket of the cable shall be oil resistant chlorinated polyethylene rubber. The cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet or greater.

J. BEARINGS: The integral pump/motor shaft shall rotate on two bearings. The motor bearings shall be sealed and permanently grease lubricated with high temperature grease. The upper motor bearing shall be a two row angular contact ball bearing. The lower bearing shall be a two row angular contact ball bearing to handle the thrust and radial forces. The minimum L10 bearing life shall be 50,000 hours at any usable portion of the pump curve.

K. MECHANICAL SEALS: Each pump shall be provided with a positively driven dual, tandem mechanical shaft seal system consisting of two seal sets, each having an independent spring. The lower primary seal, located between the pump and seal chamber, shall contain one stationary and one positively driven rotating corrosion and abrasion resistant tungsten-carbide ring. The upper secondary seal, located between the seal chamber and the seal inspection chamber shall be a leakage-free seal. The upper seal shall contain one stationary and one positively driven rotating corrosion and abrasion resistant tungsten-carbide seal ring. The rotating seal ring shall have small back-swept grooves laser inscribed upon its face to act as a pump as it rotates, returning any fluid that should enter the dry motor chamber back into the lubricant chamber. All seal rings shall be individual solid sintered rings. Each seal interface shall be held in place by its own spring system. The seals shall not depend upon direction of rotation for sealing. Mounting of the lower seal on the impeller hub is

not acceptable. Shaft seals without positively driven rotating members or conventional double mechanical seals containing either a common single or double spring acting between the upper and lower seal faces are not acceptable. The seal springs shall be isolated from the pumped media to prevent materials from packing around them, limiting their performance.
Each pump shall be provided with a lubricant chamber for the shaft sealing system. The lubricant chamber shall be designed to prevent overfilling and shall provide capacity for lubricant expansion. The seal lubricant chamber shall have one drain and one inspection plug that are accessible from the exterior of the motor unit. The seal system shall not rely upon the pumped media for lubrication.

The area about the exterior of the lower mechanical seal in the cast iron housing shall have cast in an integral concentric spiral groove. This groove shall protect the seals by causing abrasive particulate entering the seal cavity to be forced out away from the seal due to centrifugal action.

A separate seal leakage chamber shall be provided so that any leakage that may occur past the upper, secondary mechanical seal will be captured prior to entry into the motor stator housing. Such seal leakage shall not contaminate the motor lower bearing. The leakage chamber shall be equipped with a float type switch that will signal if the chamber should reach 50% capacity. Seal lubricant shall be non-hazardous.

L. PUMP SHAFT: The pump and motor shaft shall be a single piece unit. The pump shaft is an extension of the motor shaft. Shafts using mechanical couplings shall not be acceptable. The shaft shall be stainless steel – ASTM/AISI 431. Shaft sleeves will not be acceptable.

M. IMPELLER: The impeller shall be of ASTM A-48, Class 35B grey iron, dynamically balanced, semi-open, multi-vane, back swept, screw-shaped, non-clog design. The impeller leading edges shall be mechanically self-cleaned automatically upon each rotation as they pass across a spiral groove located on the volute suction. The leading edges of the impeller shall be hardened to Rc 45 and shall be capable of handling 3-inch diameter solids, fibrous materials, heavy sludge and other matter normally found in wastewater. The screw shape of the impeller inlet shall provide an inducing effect for the handling of up to 5% sludge and rag-laden wastewater. The impeller to volute clearance shall be readily adjustable by the means of a single trim screw. The impeller shall be locked to the shaft, held by an impeller bolt and shall be coated with alkyd resin primer.

N. VOLUTE / SUCTION COVER: The pump volute shall be a single piece grey cast iron, ASTM A-48, Class 35B, non-concentric design with smooth passages of sufficient size to pass any solids that may enter the impeller. Minimum inlet and discharge size shall be as specified. The volute shall have a replaceable suction cover insert ring in which are cast spiral-shaped, sharp-edged groove(s). The spiral groove(s) shall provide trash release pathways and sharp edge(s) across which each impeller vane leading edge shall cross during rotation so to remain unobstructed. The insert ring shall be of ASTM A-48, Class 35B grey iron and provide effective sealing between the multi-vane semi-open impeller and the volute housing.

O. PROTECTION: Each pump motor stator shall incorporate three thermal switches, one per stator phase winding and be connected in series, to monitor the temperature of the motor.

Should the thermal switches open, the motor shall stop and activate an alarm. A float switch shall be installed in the seal leakage chamber and will activate if leakage into the chamber reaches 50% chamber capacity, signaling the need to schedule an inspection.

The thermal switches and float switch shall be connected to a MPE Brand Pump Monitor Relay Model #PMR2 w/ 0.1 micro-farad 1000V capacitor (pins 5 & 7). Pump Monitor Relay unit shall be designed to be mounted in the MCSP.

P. The solid-state pump memory unit, three thermal switches, two FLS switches, PT-100 stator temperature monitor and the lower bearing PT-100 temperature monitor shall all be connected to a monitoring unit. The monitoring unit shall be designed to be mounted in the control panel and shall come with an Operator Panel that is dead-front panel mounted. The Operator Panel shall have soft-touch operator keys and provide local indication of the status of the alarms within the connected pump unit by means of an LCD screen read-out. Local monitoring unit system change shall be made by use of the soft-touch keypad or local connection by means of a laptop computer. Remote indication of pump unit status shall be possible with connection to customer PLC or via LAN.

Q. A certified factory hydrostatic and performance test shall be performed on each pump assembly in accordance with Hydraulic Institute Standards, latest edition. Tests shall be sufficient to determine the curves of head, input horsepower, and efficiency relative to capacity from shutoff to 150% of design. Flow. A minimum of six points, including shutoff, shall be taken for each test. At least one point of the six shall be taken as near as possible to each specified condition.

Results of the performance tests shall be certified by a Registered Professional Engineer and submitted for approval before final shipment.

R. All pumping equipment, motors, etc., shall be painted with a prime coat in the shop by the manufacturer in accordance with the manufacturer's standard procedure and using the manufacturer's standard protective coating. Ferrous surfaces obviously not to be painted shall be given a shop coat of grease or other suitable rust-resistant coating. Final coating shall be field applied by Contractor. Surface preparation, number of coats, and application thickness of each coat shall be as recommended by the paint supplier. Paint type shall be compatible with primer and shall be as manufactured by TNEMEC Co. Color shall be selected by Owner.

2.02 CONTROL SYSTEM

A. A complete Control system shall be provided including: Detailed design, testing, documenting, calibrating, adjusting, and placing into operation a functional system with associated instrumentation to monitor and control the process. Provide a Control Panel with a PLC and necessary I/O modules, an Operator Interface Terminal for monitoring and adjusting setpoints, and manual control functions. All components and assembly shall meet the requirements of this specification section along with that of 11306 and Division 26 in its entirety.

B. Operation & Maintenance Manuals shall be provided with the system:

1. Component Manufacturer's O&M Manuals: Include manuals to cover installation, operations, maintenance, troubleshooting, and calibration.

2. Operating instructions shall incorporate a functional description of the entire system, including the system schematics that reflect "as-built" modifications.

3. Provide system architecture diagram showing network communications.

4. Panel equipment, field devices, and instruments data sheets, including complete "bill of materials" of PLC's, RTU's, control panel devices, computers, printers, software, field equipment, etc.

5. Instrument Calibration Worksheets showing actual calibration procedures performed with reading and results signed and dated by the Service Technician or Engineer.

6. Soft copy of PLC programs in ladder format with descriptive documentation and explanation for each rung. Provide program in format ready for download to PLC. Also provide either a .pdf file copy of the program or hard-copy printout for viewing without need to use configuration software.

7. USB Flash Drive containing final PLC and OIT (Operator Interface Terminal) programs. PLC and OIT programs shall not be encrypted, locked or password protected without consent from LCUB.

8. Point lists for all PLC inputs/outputs. Identify point number (tag), point description, point type, range in engineering units (if analog point), PLC number, rack and slot number, and point address.

9. The complete O&M shall be provided on Compact Disk in PDF file format. The CD shall have all drawings, Equipment Data Sheets, software or equipment manufacturers O&M literature, etc.

C. All instrumentation supplied shall be calibrated to the specified ranges and requirements of the project. Documentation in the form of an Instrument Calibration Worksheet shall be provided to prove the actual calibration of all instrumentation. All instrument data shall be included on the worksheet including but not limited to make, model, tag, zero, span, range, service, process, calibration procedures with actual readings and results. Worksheet shall be signed and dated by the service technician or engineer that performed the calibration.

D. Control Panel General Requirements:

1. All equipment and materials shall be new, unused and proven by previous use of similar products to be completely suitable for the service intended.

2. All of the equipment shall be the manufacturer's latest and proven design. Specifications and drawings call attention to certain features but do not necessarily cover all details for the design of the System.

3. All mounted instruments shall be properly supported front and rear. Instruments deeper than 15-inch shall have rear supports.

4. Design panels for single point 480 volt a.c. power feed with main circuit breaker disconnect. Step-down control voltage transformer rated for at least 110% of anticipated load for control power shall be provided as part of the control power. Where practical, mount transformer in separate compartment in order to isolate 480 volt power from lower voltage components.

5. The enclosure shall be a NEMA 4X rated enclosure manufactured from 316 stainless steel. See 11306 for further requirements.

6. Provide an active tracking filter to protect the PLC from noise and low energy transients. Design basis is Islatrol/IC + or approved equal. See 11306 for TVSS requirements.

7. Panel wiring for all 4-20mA analog input signals shall be two-conductor, shielded cable with drain. Cable and connectors shall be Belden No. 8760, UL Style 2092, 18 AWG minimum, or equal. Single conductor control wires shall be tinned copper with 600V insulation, 16 gauge. Internal panel wires shall be type MTW. Color coding of wiring shall be as follows:

   a. 120 vac control power red
   b. 120 vac from remote source (if used) – yellow
   c. Neutral· white
   d. Ground Green
   e. Isolate Ground (if used) Green w/Yellow stripe
   f. 24 vdc + Blue
   g. 24 vdc- Blue w/White Stripe

8. PVC wiring duct shall be provided as required and shall have removable nonslip covers. Wiring duct shall contain 50% spare space. Wiring duct must be mounted with machine grade screws. Plastic and/or aluminum rivets are not acceptable. For consistency and standardization, wiring duct shall be by Panduit Corporation, no exceptions, and color gray. All wiring in control enclosures not in wiring duct shall be bound with continuous type spiral windings or neatly bound with tie wraps not less than two inches apart consistently and shall not allow the shown wires to cross each other within the bundle.

9. All equipment mounted within the PLC/RTU enclosure shall be mounted on the enclosure back panel, neatly organized, labeled with a tag as shown on engineer-approved control panel drawings and shall be in accordance with the manufacturer's recommendations.

10. All field wiring shall be mounted either at the bottom or side of the enclosure back panel, depending on where the conduits penetrate the enclosure. All labels shall be printed slip-on labels. Hand written or wrap-on labels are not permitted.

11. The field wiring terminals and panel wires shall be clearly labeled, identified and shown on the panel drawings.

12. Jumpers between adjacent terminal blocks shall be tinned copper jumper bars supplied by the terminal block manufacturer.

13. Interconnection drawings shall be provided along with wire numbers, terminal numbers, equipment tag numbers and panel physical layout drawings.

14. All systems and individual components, whether panel or field mounted units, that are located in different areas of the plant, one inside building to device outside of building, shall be protected from voltage and/or current surges.

15. Provide surge protectors for 480VAC or 208VAC power, see 11306.

16. Provide surge protectors for analog 4-20mA signals as Surge Cop, Model SCSP30VDC-20mA, Citel, Model DLA-24D3 or equal by Innovative Technologies or Transtector. Units shall be DIN rail mounted.

17. Control and instrumentation power supplies shall be adequately sized, see 11306.

18. The input and output of each separate DC power supply shall be individually fused with easily accessible DIN-rail mounted fused switch. Provide separate fused disconnects or circuit breakers for each PLC, OIT, each DC power supply, etc. Fuse holders shall provide blown fuse indication.

19. All power supplies shall be DIN Rail mounted and shall have screw terminals for all connections. Solder type connections will not be allowed. All screw terminal connections shall be finger safe.

20. All pushbuttons, selector switches, and pilot light units shall be heavy duty, 30.5mm, NEMA type 4/4X, see 11306.

21. Terminal strips shall be mounted using DIN rails. Terminal strips shall be as manufactured by Wiedmueller, Phoenix, Entrelec, or approved equal.

22. All digital inputs and outputs, including spares, shall be isolated from field wiring through terminal strips. Interposing relays or isolated I/O shall be provided for circuits interfacing with remote power sources. Provide a minimum of 20% spare terminal strip points and 10% spare I/O.

23. All mechanical control relays shall be DIN rail mounted. Minimum contact rating for mechanical control relays shall be 10 Amps at 250 VAC. All control and auxiliary relays shall have indicating LED's.

24. For all field instrumentation located outdoors, provide surge protection at the device in a NEMA 4X enclosure. Surge protector shall be Citel, Model DS240S-120/G. Units shall be DIN rail mounted with status LED.

25. For all 4-20mA loop powered field instrumentation located outdoors, provide surge protection at the device. Surge protector shall be direct conduit mount style by Citel, Model TSP15M-P-D3 or TSP15M-S-D3. If the above model numbers cannot be suitably installed on the instrument, Citel Model DLA-24D3 may be used if housed in a NEMA 4X enclosure. Units shall be DIN rail mounted.

26. For all 4-20mA 4-wire (120VAC powered) field instrumentation located outdoors, provide surge protection at the device. Surge protector shall be Citel Model CAD-120-X24-I.

27. Provide Control Panel fabricated in a UL508A and UL698A facility with UL-508A certification. STACON Company of Apopka, FL is an example of an approved fabrication facility.

28. Control enclosures shall be NEMA 4X. Provide units as freestanding or wall mounted according to drawings and based on physical limitations and requirements of the equipment located therein.

29. Mount process indicators and Operator Interface Terminals (OIT) at eye level, 60" from floor to centerline of instrument.

E. H-O-A switch for each drive in the "HAND" position, the drive shall be controlled by the manual speed potentiometer on the drive door, H-O-A switch in "AUTOMATIC", the drive shall start from the PLC and automatic pump controller and its speed shall be adjustable preset controlled by the PLC via the HMI Screen and remote SCADA in the future.

F. The pump controller shall function as a duplex system. Operation of the pumps will be staged in a lead, lag, and standby sequence. See 11306 for detailed requirements of the Primary and Secondary controllers. The

G. A microprocessor-based secondary (back-up) automatic pump and alarm control system shall be provided, see 11306.

H. The MCSP shall communicate back to the existing system wide SCADA system by way of a Cellular Modem connected to the PLC, see 11306.

I. The system shall incorporate UL 508 Industrial Control Panel approved elements as required of all components of these project panels and be furnished with all necessary hardware and software to accomplish level-responsive pump and alarm operation with software specifically suited to this project.

J. All the discrete I/O circuitry of the computer-based system shall be built to the IEEE 472 (1974) Surge Withstand Capability Standards. The automatic pump and alarm

control system computer shall be the standard product of the control system manufacturer and specifically suited for this type of industrial control panel service. All job connections shall be a UL recognized clamp type barriered screw terminals accepting up to two AWG 14 conductors per terminal.

K. The variable frequency drive equipment shall be programmed to respond to variations in the wet well level in a manner wherein the hydraulic requirement will be accommodated in the pumping program using simple menu-related operator interface routines that operate such that the next load turned on is always the one that has had the longest opportunity to rest since its last operation. Drives shall be similar and equal to Square-D/Schneider Altivar 630 Series with By-pass contactor. The by-pass contactor shall have a drive/off/bypass switch. Pump shall run in automatic mode via either primary or secondary controller in either drive or bypass mode. However, unit can only be placed in bypass mode manually using switch at the control panel by local operator after receiving drive fault signal via SCADA system. The drive/off/by-pass switch shall have contact closure inputs to the PLC to provide the status of the switch to PLC and SCADA system.

L. The level control system shall operate as follows:

1. The level in the wet well shall be sensed by one (1) liquid level sensor with a 2nd liquid level sensor back-up system. The back-up liquid level sensor will turn the lead pump on if the primary sensor has failed. If the PLC has failed, the alarm will activate. If the PLC is operable and the secondary sensor is activated, then the alarm shall activate.

2. When the pumps are in the automatic mode, the lead pump will begin operating when the water level in the wet well reaches the lead pump on level. When the wet well continues to rise to a field determined water level, the lag pump will come on and 2 pumps shall run simultaneously. If the wet well continues to rise to a field determined level with 2 pumps on, a high water alarm will be activated. Likewise, if the level of the wetwell begins to fall to a field determined level, then both operating pumps shall shut off. As the cycle begins again, the pump that has not been utilized for the longest time shall start (as lead pump) in the next sequence. This staging on and off functions of the pumping units will be determined through adjustable parameters, with regard to level, set into the PLC. If level in the wet well continues to rise, a high level alarm shall be activated to signal a high wet well status. The speed of the motors will be pre-set on the HMI Screen through the PLC when in automatic mode, or by the remote SCADA system in the future.

3. The back-up liquid level sensor system shall not take over control of pump operation while the primary liquid level sensor is confirmed to be operating properly. However, the Low Level Alarm will always interrupt the operation of the pumps. If the high level alarm is activated while the PLC is operating properly, an alarm only shall be activated.

4. Provide level probes for both Primary and Secondary (back-up), see 11306 for part numbers. Field verify length of level probes and probe cable prior to ordering. The back-up probe shall connect directly to the back-up controller.

M. The equipment listed below is a guide and does not relieve the supplier from supplying a system that will function as required and described later in this specification.

1. Breaker handles shall be provided to allow operation of breakers without entering the compartment. All control switches, indicator pilot lights, elapsed time meters and other operational devices shall be mounted on the external surface of the dead front. The dead front door shall open a minimum of 150 degrees to allow access to equipment for maintenance.

2. The back plate shall be manufactured of 12 gauge sheet steel and be finished with a primer coat and two (2) coats of baked on white enamel. All hardware mounted to the subpanel shall be accomplished with machine thread tapped holes. Sheet metal screws are not acceptable. All devices shall be permanently identified with engraved name tags.

N. The panel power distribution shall include all necessary components and be completely wired with stranded copper conductors rated at 90 degrees C. All conductor terminations shall be as recommended by the device manufacturer.

1. All circuit breakers shall be heavy duty thermal magnetic or motor circuit protectors similar and equal to Square D type FAL. Each motor breaker shall be adequately sized to meet the pump motor operating characteristics and shall have a minimum interrupting capacity of 65,000 amps at 480 VAC.

2. Circuit breakers shall be indicating type, providing "on-off-trip" positions of the operating handle. When the breaker is tripped automatically, the handle shall assume a middle position indicating "trip".

3. Thermal magnetic breakers shall be quick-make and quick break on manual and automatic operation and have inverse time characteristics secured through the use of bimetallic tripping elements supplemented by a magnetic trip.

4. Breakers shall be designed so that an overload on one pole automatically trips and opens all legs. Field installed handle ties shall not be acceptable.

5. Output waveform for VFDs will be sine-coded pulse width modulation with adjustable full-time current limit of 60% to 120% of maximum continuous output current.

6. Instantaneous over current output protection of 250% of rated output current, over temperature, overvoltage, under voltage, ground fault and shoot through protection shall be provided. A phase monitor relay shall also

be provided for phase loss protection. See 11306 for more detailed requirements.

7. Diagnostic LEDs shall be provided to assist in determining any fault condition that may occur.

8. Acceleration and deceleration for drives shall be adjustable from 6 to 75 seconds. Adjustable overload protection of 0% to 100% of maximum continuous output current shall be provided.

9. Control transformers shall be provided to provide the 120 VAC and/or 24 VAC for control circuits. Transformers shall be fused on the primary and secondary circuits. The secondaries shall be grounded. Provide a UPS unit integral to the MCSP for all control circuit components, see 11306.

10. The alarm horn and light shall be a weatherproof-shatterproof LED red light to indicate alarm conditions. The alarm light shall be turned on by the alarm level and shall flash. See 11306 for more information.

11. Provide an internal work-light with switch, cabinet heater, and ventilation fan or air conditioner (VFD Enclosure) for thermal management with thermostatic control designed for ambient temperature range from -5^0 F to 100^0 F.

O. Level Control Interface (OIT Touchscreen):

1. An operator interface shall be provided to allow work station performance loading with capabilities such as menus, data entry, data displays, security passwords, bar graphs and interactive alarms.

2. The operator interface display shall be a 10.4-inch color touch screen display and provides the interface with the PLC system through direct communications and allows for operator modification of the configuration of the control system through a keypad entry system. The interface shall be compatible and interface with PLC. The interface with the PLC system shall be through an ethernet communication port, RS-485/422, or a PLC data communications module. The programmable menu screen will allow the operator quick access to any portion of the control system, and display by process graphical display and engineering units such items as pump operational status of the motors, drives, wetwell level, any alarms, and other key items such as input voltage, output current, drive temperature, ambient temperature, power factor, watts, run times, faults, alarms, and other such data shown on the contract drawings. The software program shall be based on operator selection and specification and shall not require training in programming. See 11306 for OIT (HMI) Control Touchscreen part numbers. Furnish with protective metal door for exterior application in the front of the MCSP. Provide interconnection cable to the PLC.

3. The operation of the control system shall assure that a pump will be available in the case of a pump failure. The control system shall recognize the failure and automatically switch to an available unit which will operate at a preset field established speed.

4. The controls shall be designed to maintain two (2) pump operations but shall sequence through the pumps to equalize the operation time of both pump units.

P. An 8-Port unmanaged Ethernet switch shall be provided for network connections. Ethernet switch shall be N-Tron 108TX or equal.

2.03 PUMP ACCESSORIES

A. Air and Vacuum Valves: A combination air and vacuum valve of ample capacity shall be furnished connected to the top of the pump column on the discharge head. The valve shall be a 2-inch D-025 sewage air vacuum valve (with vacuum guard) as manufactured by A.R.I., or equal, and shall be capable of eliminating all the column air on starting without undue velocity and shall not stick when the pump is shut down.

B. Pressure Gauges: Provide a pressure gauge on the discharge pipe, calibrated in pressure (psi) from 0 to 120 psi in accordance with the pressure sensor detail in the project plans. The gauge shall be Ashcroft, 4.5-inch face.

C. All accessories shall be supported so that no noticeable vibration will exist when the pumps are running.

2.04 PUMP COATINGS

A. All pumping equipment, motors, etc., shall be painted with a prime coat in the shop by the manufacturer in accordance with the manufacturer's standard procedure and using the manufacturer's standard protective coating. Ferrous surfaces obviously not to be painted shall be given a shop coat of grease or other suitable rust-resistant coating. Final coating shall be field applied by Contractor. Surface preparation, number of coats, and application thickness of each coat shall be as recommended by the paint supplier. Paint type shall be compatible with primer and shall be as manufactured by TNEMEC Co. Color shall be selected by Owner.

2.05 SPARE PARTS

A. The manufacturer shall furnish one set of the following spare parts:

1. Mechanical seals or seal repair kit with all seal faces and O-rings
2. Upper and lower bearing set
3. O-ring set

PART 3 EXECUTION

3.01 GENERAL

A. The wastewater pump system shall be manufactured and tested in accordance with the best applicable trade practices and in compliance with state, OSHA, and other governing code requirements.

3.02 TESTING

A. The timing and schedule for testing shall be coordinated with and dependent upon the Installation Contractor's schedule for construction of the wastewater pump system.

B. Factory Testing: All major system components shall be factory tested for compliance with the construction and functional requirements specified herein, and a certification of the results of these tests shall be submitted to the Engineer.

C. Functional Testing:

1. Prior to start-up, all equipment described herein shall be inspected for proper alignment, proper connection, and satisfactory performance of all components by means of a functional test conducted by the manufacturer's representative and as approved by the Engineer.
2. Functional testing shall demonstrate that the pump system and related control system operates in accordance with the specifications including all start-up, operating, monitoring, and shutdown functions.
3. If, in the opinion of the Engineer, the system meets the requirements specified herein, the system will be classed as conforming for purposes of advancing to the performance test phase. If, in the opinion of the Engineer, the functional test results do not meet the requirements specified herein, the system will be classed as nonconforming.
4. In the case of a non-conforming system, project advancement to the performance test phase will not commence until the Contractor has made, at no additional cost to the Owner, such adjustments, changes, and/or additions as are necessary to correct the system and retest it as specified above and, in the opinion of the Engineer, the system has conformed to these Specifications.
5. Submit Manufacturer’s Certificate of Proper Installation in accordance with section 01640, Manufacturer’s Services.

3.03 PERFORMANCE TESTING

A. The equipment manufacturer shall conduct a performance test to demonstrate that the installed equipment can meet the specified performance requirements. The test shall occur as soon as possible after successful equipment start-up.

B. The pump manufacturer's representative shall operate the equipment during the test. The Owner shall furnish personnel to assist in the test.

C. If, in the opinion of the Engineer, the performance test is successful and meets the requirements specified herein, the Engineer will recommend to the Owner, by letter, the acceptance of the wastewater pump system.

D. Should the wastewater pump system be unable to achieve the performance specified, the Contractor shall perform whatever equipment modifications he deems necessary such that the equipment can achieve the performance specified. All modifications shall be reviewed by the Engineer. The Contractor shall pay review costs at the Engineer's standard billing rate. Following completion of the equipment modifications, the performance test shall be run again in its entirety.

E. The field tests shall determine the head, discharge flow and overall efficiency characteristics of each pumping unit and in addition, shall demonstrate that under all conditions of operation each unit:

1. Has not been damaged by transportation or installation.
2. Has been properly installed.
3. Has no mechanical defect.
4. Is in proper alignment.
5. Has been properly connected.
6. Is free of overheating of any parts.
7. Is free of all-objectionable vibration and noise.
8. Is free of overloading of any parts.

3.04 MANUFACTURER'S SERVICES

A. A manufacturer's representative for the equipment specified herein shall be present at the Job Site and/or classroom designated by the Owner for the minimum person-days listed for the services hereunder for each of the separate facility locations, travel time excluded. The manufacturer shall also be present for the entire performance testing of the pump system, as specified earlier in this Section.
1. Three person-days for installation assistance and Manufacturer's Certificate of Proper Installation and ready for start-up.
2. Three person-days for start-up functional and performance testing.
3. Two person-days for job-site training of Owner's personnel.

B. Training above shall include a complete review of the wastewater pump system and how it functions, a mechanical review of the equipment, instruction in proper operation and maintenance, and a review of the instrumentation system operation and maintenance with an emphasis on the PLC. Training will be videotaped by the Owner. Training shall be presented in a format that is conducive to video recording.

C. The periods slated above are minimums only and the manufacturer is required to be onsite for all of the functions listed above to the extent that is required to complete those functions to the satisfaction of the Owner and Engineer. If through no fault of the manufacturer's equipment, additional service, if requested, shall be available.

End of Section

SECTION 11306
LIFT STATION CONTROL SPECIFICATION

PART 1 GENERAL

1.01 INTENT OF SPECIFICATION

A. It is the intent of this specification that LCUB receives a high quality control panel for all of the lift stations in its collection system. These specifications are intended to standardize all new and future upgraded stations to have the same components and operational structure. This will ensure that all maintenance personnel are familiar with the operation and maintenance of the control panels. Spare parts inventory will also be kept to a minimum and in better control. The Square-D line of components was selected for several reasons but primarily for reliability, and multiple source procurement.

1.02 REFERENCES

A. Section 11235 – Submersible Pumps

1.03 MANUFACTOR'S QUALIFICATIONS

A. The manufacturer shall have at least 10 years of experience in the construction of control equipment in the municipal water and wastewater industry.

B. Control system manufacturer shall be a UL508A and UL698A certified facility and the industrial control panels shall be listed and serialized. The use of only UL listed components in a panel will not be considered equal to an acceptable listed facility. STACON Company of Apopka, FL is an example of an approved fabrication facility.

C. The control system manufacturer shall be a high level member of Schneider Electric Solutions Partner Program to attest to their experience, quality and position in the market.

D. PLC, HMI, and Cellular Modem programing shall be provided by the Owner or their designee. All programming shall be compatible and consistent with all of the existing control panels in the collection system and shall operate as required to interface with the existing SCADA System. The Motor Control and SCADA Panel (MCSP) shall be provided as part of the Division 11235 Submersible Pump Station package.

1.04 SUBMITTALS

A. Complete electronic submittals shall be provided for each control panel for review and approval prior to fabrication. The submittal package shall include complete wiring diagrams, scaled layout drawings of the sub-panel and inner doors (when applicable), complete bill of materials and component data sheets. The wiring diagrams shall include terminal strip layouts to assist the installer with field device connections including torque requirements per manufacturer's recommendations. Contact usage of control devices such as controller and relays shall be identified by the components coil and identified as either normally open or normally closed. The schematics must contain all markings required by the UL508A standard and functional descriptions of the devices. All ladder rungs shall be numbered in the left margin of 11-inch x 8.5-inch pages or 17-inch x 11inch pages. As-

built schematics must be laminated and permanently fastened to the inside of the panel door.

1.05 MANUFACTURER'S TESTING PROCEDURES

A. The manufacturer must apply a systematic and documented testing procedure to each and every panel manufactured in their facilities. Evidence of such testing shall be available to the customer upon request and it shall include all test steps and identification of testing and inspecting personnel.

1.06 WARRANTY

A. The control system warranty shall be for a period of 1 year from commissioning date of the equipment. Warranty excludes incidental or consequential damages and surge/transient damages. The warranty is effective against all defects in workmanship and/or defective components. The warranty is limited to replacement or repair of the defective equipment.

PART 2 PRODUCTS

Any substitution for the specified brand name product should be offered with supporting documentation regarding it being equal or superior to the specified brand name to the Engineer 10 business days before the Bid Opening. The Engineer then has 5 business days to determine if the requested substitution is equal to the specified name brand. The Engineer's decision is final on this matter.

2.01 ENCLOSURE

A. The MCSP enclosure shall be a NEMA 4X rated enclosure manufactured from 316 stainless steel with white polyester powder coating applied by the enclosure manufacturer. The enclosure shall be a minimum depth of 12 inches sized adequately to house all of the components. The door gasket shall be formed-in-place rubber composition and shall assure a positive weatherproof seal. The door shall open a minimum of 180 degrees. Vent Hoods (required for outdoor installations only) mounted on the external surface of the enclosure shall maintain the NEMA rating on the enclosure. Enclosures installed indoors may be equipped with louvers in lieu of vent hoods. Manufacturer is Hoffman or approved equal. Additional vent hoods are not required if filter fans with an integral NEMA 4X rating are used. Manufacturer is ICEqube Series FPW or equal.

B. A polished inner aluminum dead front door shall be mounted on a continuous aluminum aircraft type hinge and shall contain cutouts for the protrusion of the control breakers and provide protection of personnel from internal live voltages. All control switches, pilot indicator lights, elapsed time meters, duplex receptacle and other operational devices shall be mounted on the external surface of the dead front. The dead front door shall open a minimum of 150 degrees to allow for access to the equipment for maintenance. A ¾-inch break shall be formed around the perimeter of the dead front to provide rigidity. Painted steel or other materials are not acceptable.

C. The back plate shall be manufactured of 12 gauge sheet steel and be finished with a primer coat and two (2) coats of baked on white enamel. All hardware mounted to the sub-panel

shall be accomplished with machine thread tapped holes. Sheet metal screws are not acceptable. All devices shall be permanently identified with engraved legends.

2.02 INCOMING POWER (MAIN/AUXILIARY BREAKER)

A. A properly sized service entrance main breaker shall be supplied in its own section for the incoming power supply.

B. Both the main breaker and the auxiliary breaker (required where a generator is not provided) will be Square D Type H or Type J Frame 611 Series heavy duty breakers.

C. Where more than one connection is required on load side of breakers, Square D, Class 611 power distribution connectors of the proper size will used on the load side lugs.

2.03 SURGE PROTECTION

A. Surge Protection 208V and 480V

1. Three phase surge protection shall be accomplished by using a Citel DS74US-120Y/G or DS74US-277Y/G (voltage dependent), DIN rail mountable SPD Surge Protector or approved equal.
2. The surge protector shall be properly mounted onto the back panel.
3. Surge protector remote signaling contact shall be wired to the PLC.

2.04 ALARM SYSTEM (120 VAC ALARM)

A. An alarm system shall be installed that will provide visual indication of an alarm condition. The visual device will only activate on a high or low level wet well level; all other alarms will be viewed on control panel display screen. Devices shall be:
   1. 160,000 candle power strobe light with red prismatic lens to be located to the side of the building near the main doorway and visible from passing traffic.

B. The alarm system shall meet the following specifications:

1. Operating voltage – 120 VAC.
2. Strobe output – 12 VDC @ 500 ma.
3. Relay output contacts 10 Amps.
4. A push button shall be externally mounted on enclosure to acknowledge an alarm condition while the strobe light continues to flash until alarm condition is no longer present. Locate the button either a) on the panel where it will not be encumbered by other equipment, or b) remotely somewhere convenient inside the building.
5. A push to test button shall be mounted on the dead front to test visual alarm devices.

2.05 CONTROL BREAKERS

A. Control and GFCI Breakers

1. All control breakers shall be Square D QOU Miniature Circuit Breakers or approved equal, Class 720 sized appropriately.

2. All Control breakers shall be accessible with the dead front door in the closed position.
3. The breaker for the externally mounted Control and Auxiliary Device Transformer (required where a generator is not provided) shall be installed by the control panel manufacturer.
4. In addition to the required control breakers, three additional 15 amp breakers will be installed for future loads.
5. The neutral for all 120V AC circuits will be provided by an isolated multi-tap buss bar installed by the panel manufacturer.

2.06 PUMP PROTECTION

A. Phase Monitor

1. A line voltage rated, adjustable phase monitor shall be installed to sense low voltage, loss of power, reversed phasing and loss of a phase. Control circuit shall de-energize upon sensing any of the faults and shall automatically restore service upon return to normal power.
2. Phase monitor shall be dual voltage and be of an 8-pin and utilize an 8-pin relay base.
3. Relay shall have a 20 second delay to normal after a fault reset.
4. Manufacturer is MPE or approved equal.

B. Pump Monitor Relay

1. One plug in solid state Pump Monitor Relay unit shall be supplied for each pump to monitor the pump for over-temp and leakage. The unit shall have an 11-pin, round base to mate with a standard 11-pin socket. The unit shall also be flanged in order to allow dead front door mounting.
2. The unit shall be powered by 24VAC, 24VDC, or 120VAC. LED indication shall be provided for power on, over-temp, and leakage conditions. An over-temp reset push-button shall be provided to allow reset of unit.
3. The sensor input circuitry is to contain both hardware and software filters to provide noise immunity, as well as sensor input short circuit protection.
4. Pump Monitor Relay shall be of type approved by pump manufacturer as to not void any pump manufacturer warranties.
5. Manufacturer is MPE PMR2 or approved equal.

2.07 CLIMATE CONTROL

A. Air Vents

1. Air vents and fans shall be supplied at a minimum for proper ventilation and maintaining ambient temperature for the installed equipment. Ventilation must meet all manufacturers standards for proper operating conditions for all components in the control panel based on an ambient exterior temperature range of from -5^0 F to 100^0 F.
2. All vent openings shall be louvered and screened to prevent entrance of insects into the enclosure.

3. Inlet vent opening shall also have a washable filter to filter out fine dirt and pollen particulates.
4. Ventilation fan shall be controlled by a thermostat manufactured by Hoffman part number ATEMNO or approved equal.

B. Air Conditioning

1. Air conditioning shall be provided as required for control/starter/drive enclosures in order to maintain the manufacturers' recommended operating temperature for all components within the enclosure over the ambient exterior temperature range listed in Part A.
2. In addition to the exterior ambient temperature range, the enclosure/panel builder shall account for heat gain within the enclosure due to heat dissipation from electrical components during operation and make allowance for such when sizing the ventilation/air conditioner equipment.

C. Heaters and Condensation Control

1. All Control Enclosures shall utilize a Hoffman Unit Heater Model DAH2001A or approved equal to control ambient temperature inside of enclosure during cold exterior ambient temperatures.

2.08 CONTROL TRANSFORMER

A. The control transformer shall have its own separate breaker located inside the control panel properly sized for its incoming service. A UL approved Surge/Lightning protector shall be installed to protect the incoming service of the control transformer.

B. The control transformer shall be properly sized to accommodate the total load of the 120V breakers located inside the main control panel plus a minimum of 20% additional capacity. The minimum allowable size of the transformer shall be 1 KVA.

C. The interconnecting conduit between the control transformer and control panel shall enter the control panel via the bottom of the control panel cabinet and be rigid conduit properly supported to prevent damage to conduit.

D. A neutral wire shall be run from the control transformer to inside of the control panel and landed on an isolated multi-connection bus bar installed by the control panel manufacturer.

2.09 PUSH BUTTONS, SELECTOR SWITCHS, AND PILOT LIGHTS

A. All required Push Buttons and Selector Switches shall be manufactured by Square D and will be in the 9001 series.

B. All required Pilot lights shall be LED type manufactured by Square D and be in the 9001 series.

C. All pilot devices shall be installed with securing notches or mechanical components to prevent rotation of the devices per manufacturer's recommendations.

2.10 ELAPSED TIME METERS

A. Each pump shall have an elapsed run time meter. These meters shall be manufactured by Redington/Trumeter and be shall model 722 Series or approved equal.

2.11 CONTROL RELAYS

A. All control relays shall be 11-pin TPDT relays as manufactured by Square D and be in the 8501 series type K or approved equal.

B. All control relays shall have pilot lights to indicate state of relay.

C. All Control relays shall be of the tubular type and be pluggable into a standard 11-pin socket.

2.12 UN-INTERRUPTABLE POWER SUPPLY

A. All Control Circuits shall be powered by a UPS properly sized to provide back-up power to controls for a period of 20 minutes before falling below required voltage.

B. All UPS systems shall be manufactured by APC, Eaton 9SX Series, or approved equal.

C. UPS shall have a relay contact to indicate to the PLC when it is on battery back-up mode.

2.13 ENCLOSURE ACCESSORIES

A. All enclosures will have a LED trouble light installed across the top of the cabinet. The light will be controlled by a switch located on the dead front panel. Door switch shall automatically turn the light on when the door is opened and automatically turn the light off when the door is closed.

B. A 15 AMP GFCI receptacle will be installed on the dead front panel.

2.14 CONTROL REQUIREMENTS

A. Control Scheme

1. The control scheme is to use a primary controller to operate the station as required on a regular basis. This controller shall take care of all the functions needed to operate the station in the proper manor. This controller shall communicate (via either Ethernet or Modbus communication devices) all of the current conditions at the lift station as well as any other alarms. A secondary controller shall serve as a back-up to the primary control unit in the event the primary fails to operate. When the Controller Selector Switch is set in the "Auto" position, the Back-up controller will take over control of the station when the liquid level in the wet well reaches a predetermined level. The Controller Selector Switch will have 3 selections; Primary, Auto, and Back-up. Each controller shall utilize a separate level probe for its monitoring of the wet well. Once the backup controller is engaged, it should

continue to operate the pump station until an operator pushes a manual reset button on the control panel.

2.15 PRIMARY CONTROLLER

A. The primary controller shall be a MODICON M221 Series Model TM221CE40R PLC manufactured by the Square D Company or approved equal. Provide Model TM3D18 Digital Input Cards, TM3AI2H Analog Input Cards, & TM3AQ4 Analog Output cards as required. The PLC shall have all the required components to properly operate, control, and monitor all station functions. PLC shall include necessary ethernet ports as required for connection to modem and HMI. The HMI for operator interface at the lift station shall be a MAGELIS Color Touch-Screen Model HMIGTO5315 with HMIZG62 UV Cover manufactured by Square D Company.

B. The PLC shall operate the wetwell pumps as required in a pump down configuration. The PLC shall monitor the full range of the level probe via a 4-20 ma input. The level probe shall be manufactured by MPE Inc., or approved equal, and be part number LP-97-10-50 or an approved equal. Probe Level inputs shall utilize a Level Probe Converter manufactured by MPE Inc. and be part number LPC-420 providing a 4-20 ma input to the PLC. The PLC shall communicate vie either Ethernet or Modbus protocols to an external SCADA System. The operating program for both the PLC and HMI shall be provided by the Owner or his designee to ensure that system communicates correctly with the existing SCADA System. All station functions will be monitored and transmitted to the existing SCADA system. These functions are as follows:
    1. Automatic Lead/Lag operation.
    2. Automatic alternation of all pumps.
    3. Monitor and alarm on all pump faults including over-temp, over-current, seal-failure, etc.
    4. High and Low level alarms.
    5. Phase failure relay status from Phase monitor relay the MCSP.
    6. Float Switch status in Dry-pit (when applicable).
    7. Wet Well Level via two probes.
    8. Generator Fault (when applicable).
    9. Generator Run (when applicable).
    10. Generator Low Fuel (when applicable).
    11. Monitor Modbus communications for pump monitoring devices such as:

        A. Soft-Start, Drive, or breaker state and faults.
        B. Motor voltage.
        C. Running state.
        D. Amp draw.
        E. Pump run times.

C. The Magelis HMI shall offer the operator the ability to perform the following functions:

    1. Select pump state. Hand, Off, Automatic.
    2. View liquid level in wet well.
    3. Change set points for Lead On/Off, Lag On/Off, Alternating Order, High Alarm, and Low Alarm.

4. View all faults with a running history of all pumps for a period of at least 30 days.

2.16 BACK-UP CONTROLLER

A. The quadraplex back-up controller will take over pump station control in the event that the primary controller fails. This shall happen when either the PLC has a major fault or when the level in the wet well reaches a predetermined set point. The quadraplex back-up controller shall be manufactured by MPE Inc., or approved equal, and be part number SC2000-44ES. This back-up controller shall communicate via a Modbus Protocol connection to the SCADA System. The back-up controller shall use a level probe manufactured by MPE Inc. or approved equal and be part number LP-97-10-50. The back-up controller will have four (4) points monitored for pump operation and high level alarms. Required probe relays shall be manufactured by MPE Inc. and be probe compatible.

2.17 CELLULAR MODEM

B. The cellular modem for transmission of data to the SCADA System shall be manufactured by Red-Lion or approved equal; use SixNet series and be part number RAM-6901-VZ with antenna part number Red-Lion part number ANT-MA710AABI001 or equal. Antenna shall mount on exterior of enclosure with cable to modem. Utilize the latest version of this modem transmitter available from the manufacturer, 5G if available.

2.18 VFD CONTROLS

A. The station shall utilize VFD's (variable frequency drives) per the Division 11235 Specification, and the soft drives shall be provided with by-pass contactors. Where not practical for a single enclosure due to size or cooling constraints the vendor may provide drives in a separate motor control center. The MCSP shall control all VFD's when their local HOA switch is in the automatic mode. Monitoring of drives shall be via Modbus protocol. Speed control of drives shall also be via Modbus in automatic mode, with a preset speed setting input from the HMI screen or remote SCADA in the future. Run/stop commands will be via hardwired signals to accommodate the backup functionality. Standard Solid State overload relays shall be used. Integrated MODBUS overload systems such as Square-D TeSys shall not be utilized.

B. The by-pass contactor shall have a drive/off/by-pass switch. Pump shall run in automatic mode via either primary or secondary controller in either drive or by-pass mode. However, unit can only be placed in by-pass mode manually by an operator at the local D/O/B switch. The D/O/B switch shall also provide contact closure inputs to the PLC to provide D/O/B status.

PART 3 EXECUTION

3.01 GENERAL PRACTICES

A. All switches, relays and enclosure components shall be labeled with engraved marking plates.

B. All wiring shall be labeled at both ends to match as-built drawings.

C. A complete set of as-built schematics shall be laminated to inside of outer enclosure door.

D. All terminal strips shall be labeled.

3.02 SYSTEM PROGRAMMING

A. The awarded panel manufacturer shall coordinate with the Owner or their designee to provide all PLC, HMI, and Cellular modem programming and testing prior to start-up of the equipment. Owner or their designee will provide to awarded panel manufacturer a complete listing of I/O wiring requirements prior to construction of control panel.

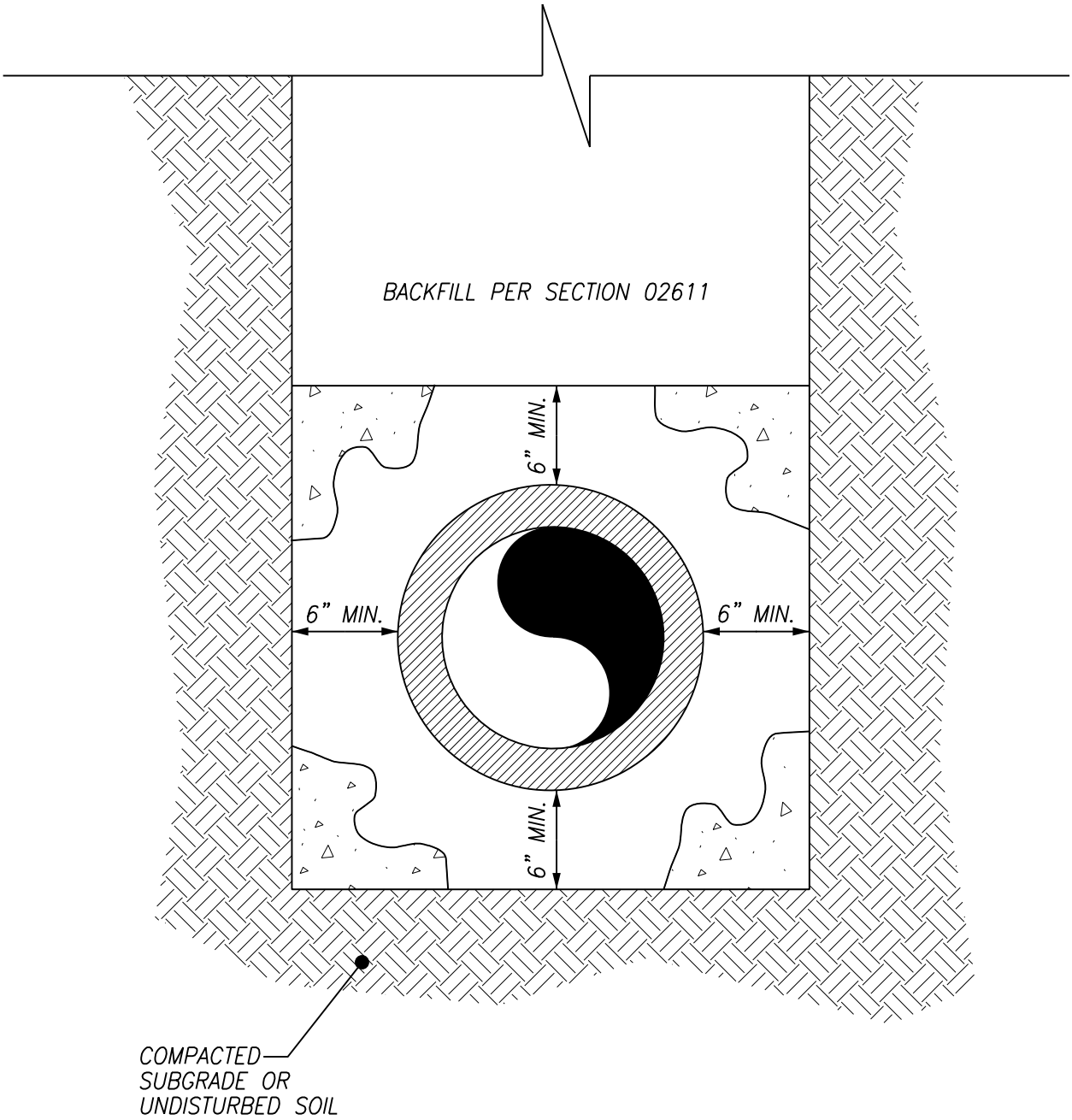
B. In accordance with Specification Section 11235, Submersible Pumps, the controls manufacturer shall coordinate with the pump station manufacturer to ensure that a fully integrated, operable pump station is provided.

3.03 DOCUMENTATION

A. A minimum of five (5) complete sets of "As Built" documentation shall be supplied to LCUB. This documentation shall consist of:

1. Complete as built drawings in both hard copy and PDF Format.
2. Catalog sheets on all components used in both hard copy and PDF Format.

End of Section



NOTE: CONCRETE– f'c = 2,500 psi

LCUB
Going the Extra Mile
7698 CREEKWOOD PARK BLVD.
LENOIR CITY, TN 37772
TELEPHONE 844.687.5282

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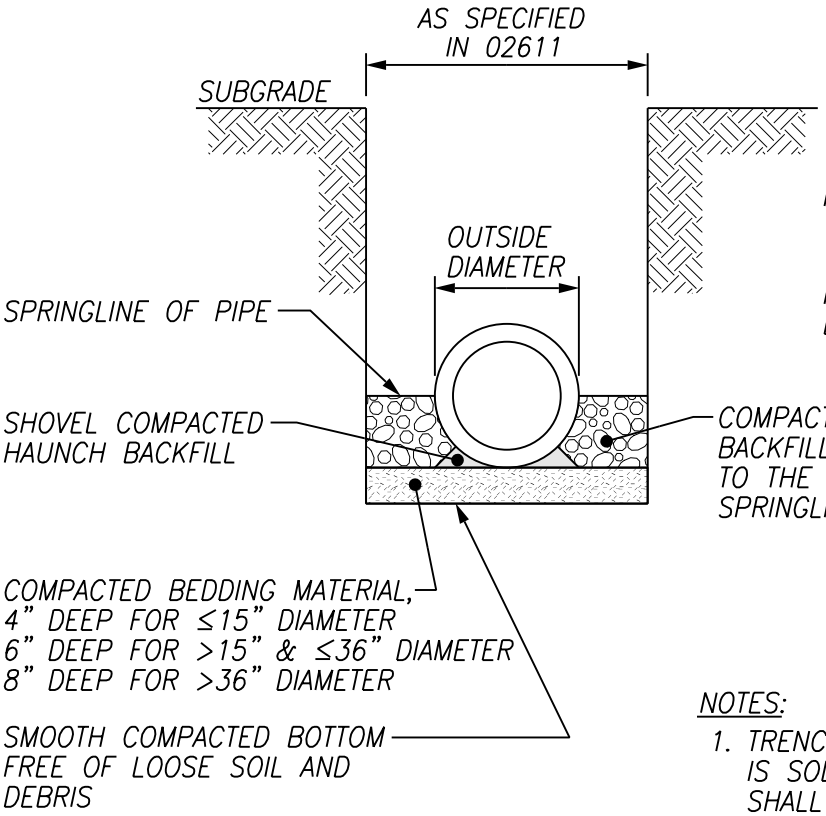
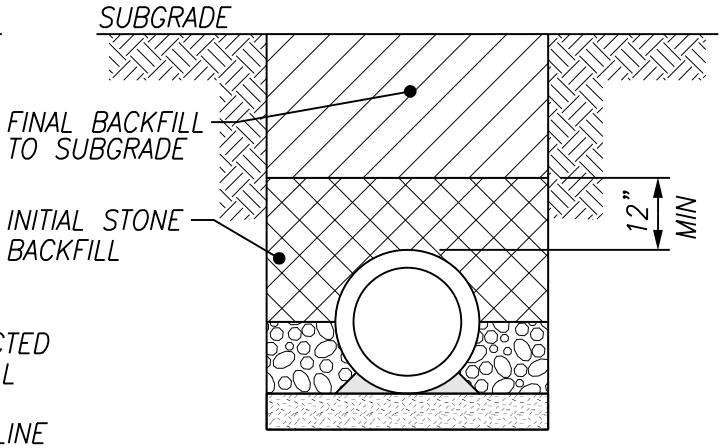
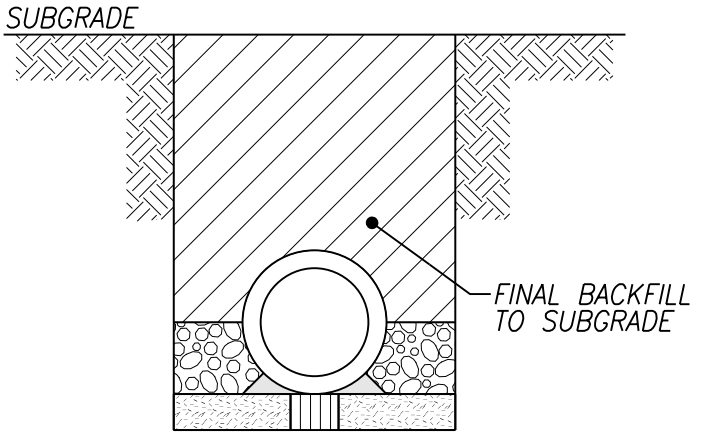
CONCRETE ENCASEMENT		Date: 07/30/19
		DRAWING NUMBER: S1





BACKFILL FOR FLEXIBLE PIPE



BACKFILL FOR RIGID PIPE

NOTES:

1. TRENCH DESIGN AND SAFETY FOR PIPELINE CONSTRUCTION IS SOLELY THE RESPONSIBILITY OF THE CONTRACTOR AND SHALL CONFORM WITH ALL APPLICABLE LOCAL, STATE, AND OSHA REGULATIONS.
2. BEDDING MATERIAL AND BACKFILL MATERIAL UP TO THE SPRINGLINE SHALL BE #57 OR #67 STONE.
3. REGARDLESS OF BACKFILL MATERIAL OR PIPE MATERIAL, PLACE BACKFILL IN 8" LOOSE LIFTS AND COMPACT STONE TO 100% OF THE STANDARD PROCTOR DENSITY AT 2% LESS THAN THE OPTIMUM MOISTURE CONTENT AS DETERMINED BY AASHTO T99 METHOD D. INITIAL BACKFILL SHALL BE #57 OR #67 STONE.
4. FINAL BACKFILL SHALL BE #57 OR #67 STONE UNDER PAVEMENTS & WITHIN 3' OF PAVEMENT.
5. FINAL BACKFILL BEYOND 3' OF PAVEMENT SHALL BE STRUCTURAL SOIL BACKFILL.

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Going the Extra Mile
7698 CREEKWOOD PARK BLVD.
LENOIR CITY, TN 37772
TELEPHONE 844.687.5282

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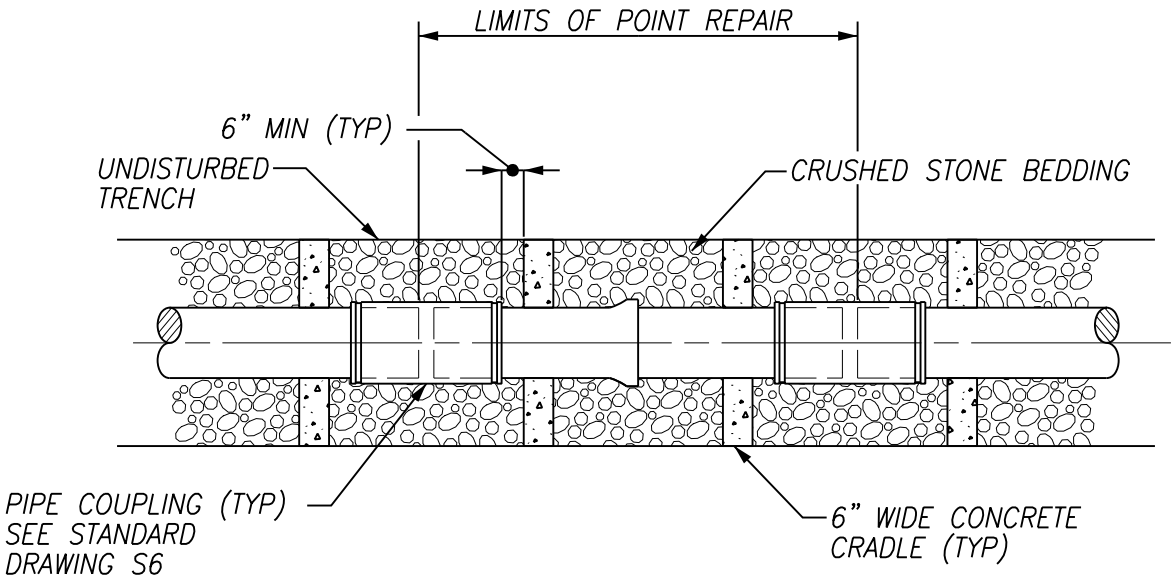
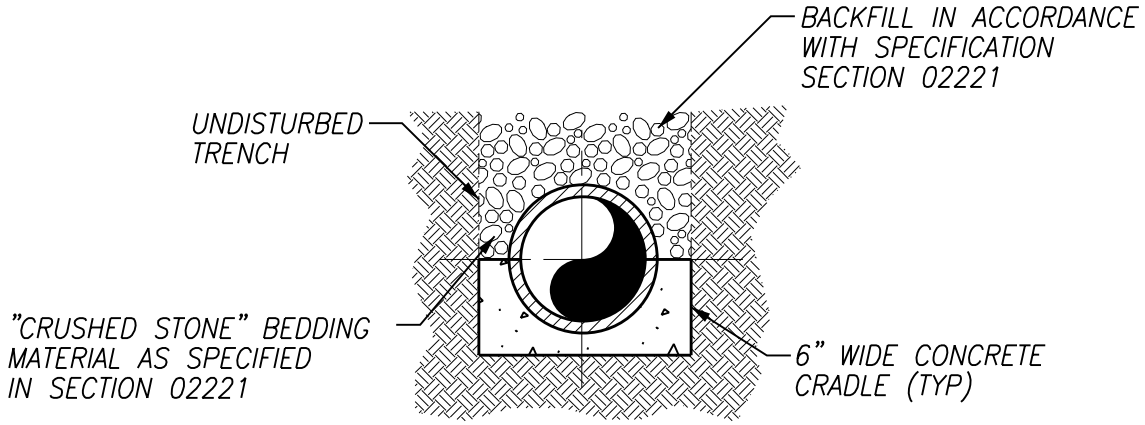
PIPE BEDDING AND BACKFILL		Date: 09/14/20
		DRAWING NUMBER: S2



PLAN



SECTION

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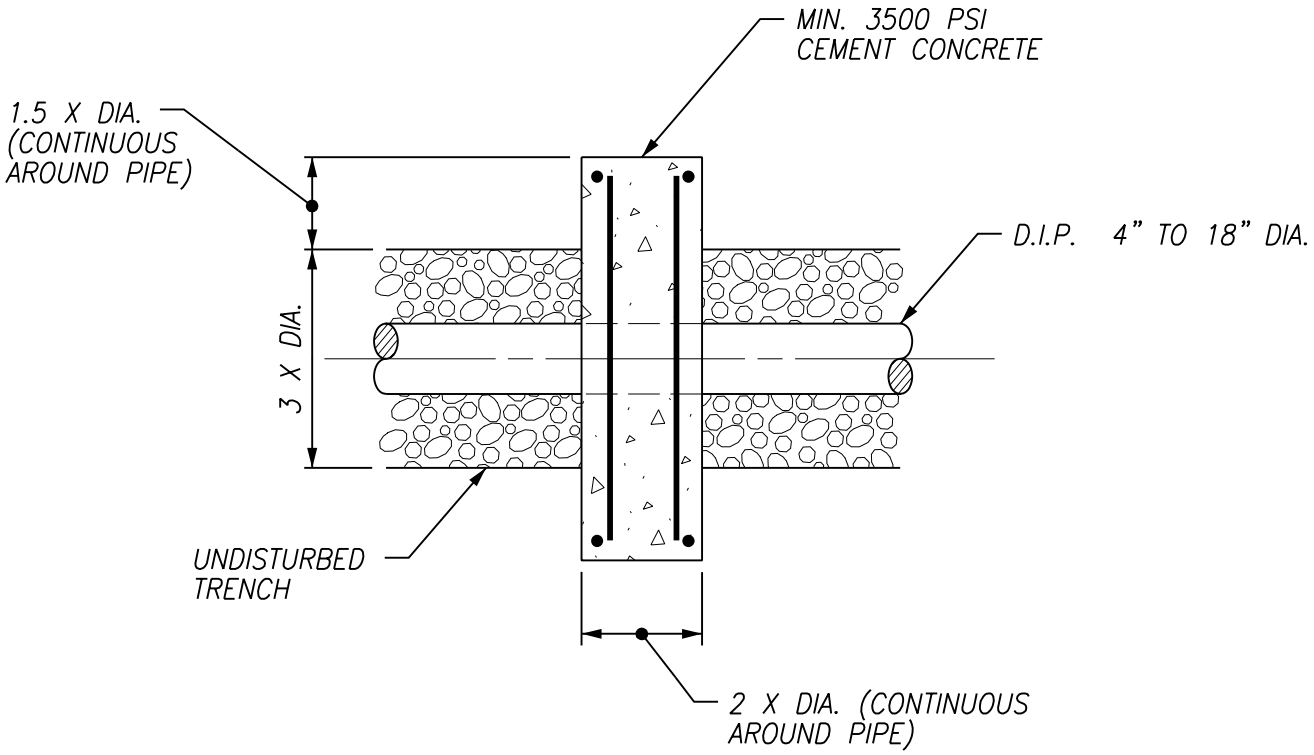
LENOIR CITY, TN 37772
TELEPHONE 844.687.5282

APPROVED BY: LCUB	DRAWN BY: FMA	Scale: NTS
TYPICAL POINT REPAIR DETAIL		Date: 07/30/19
		DRAWING NUMBER: S3



PLAN

NOTES:

1. TO BE FORMED TO CORRECT DIMENSIONS AND POURED INTO NOTCHES CUT INTO UNDISTURBED TRENCH SIDES AND BOTTOM.
2. USE (1) #5 BAR @ CENTER OF THE ANCHOR AND 6" CLEAR FROM EACH SIDE FACE FOR ANCHORS UP TO 12" IN WIDTH.
3. USE TWO (2) #5 BARS @ 3" CLEAR FROM EACH FACE AND 6" CLEAR FROM EACH SIDE OF THE ANCHORS UP TO 12" IN WIDTH.
4. PLACE AS SHOWN ON THE PROJECT PLANS OR AS DIRECTED BY THE ENGINEER.
5. KEEP EXCAVATIONS DRY IN ACCORDANCE WITH SPECIFICATION SECTION 02221.

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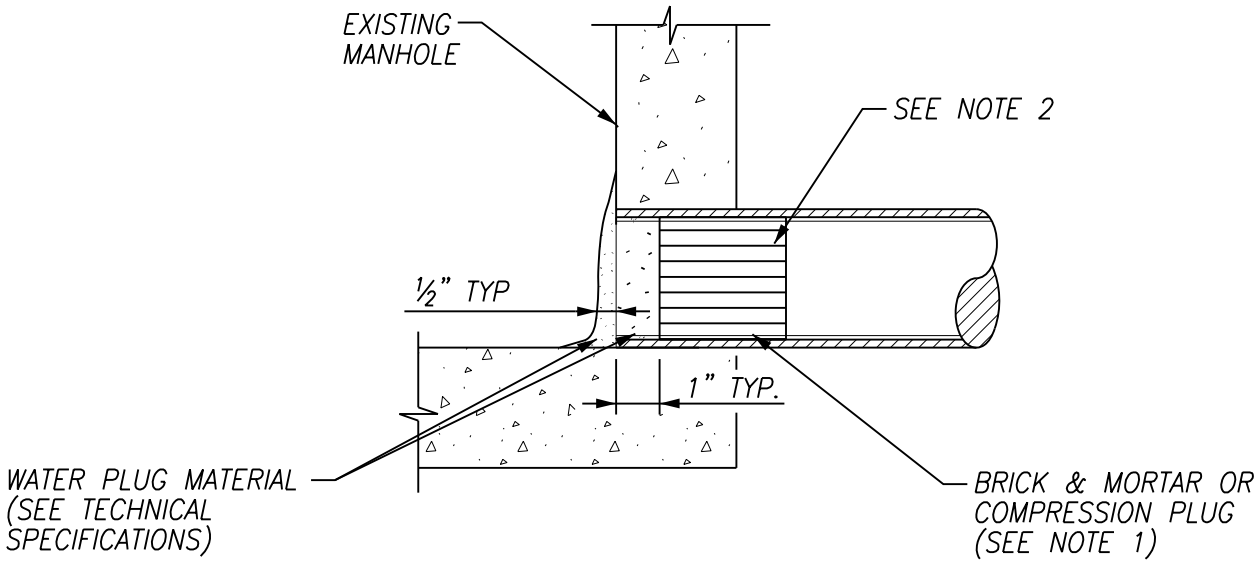
LENOIR CITY, TN 37772
TELEPHONE 844.687.5282

APPROVED BY: LCUB	DRAWN BY: FMA	Scale: NTS
TYPICAL PIPE "DEAD-MAN" ANCHOR		Date: 07/30/19
		DRAWING NUMBER: S4



NOTES:

1. PLUG DIMENSIONS

PIPE SIZE (IN.)	MIN. THICKNESS
1–6	COMPRESSION PIPE PLUG
8–12	8" OF BRICK OR COMPRESSION PLUG
14–18	8" OF BRICK
21–30	16" OF BRICK
36–48	24" OF BRICK

2. INSIDE OF EXISTING PIPE AND MANHOLE SURFACES TO BE HAND CLEANED, PRESSURE WASHED, ACID CLEANED AND RE-PRESSURE WASHED PRIOR TO INSTALLING PLUG.

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LENOIR CITY, TN 37772
TELEPHONE 844.687.5282

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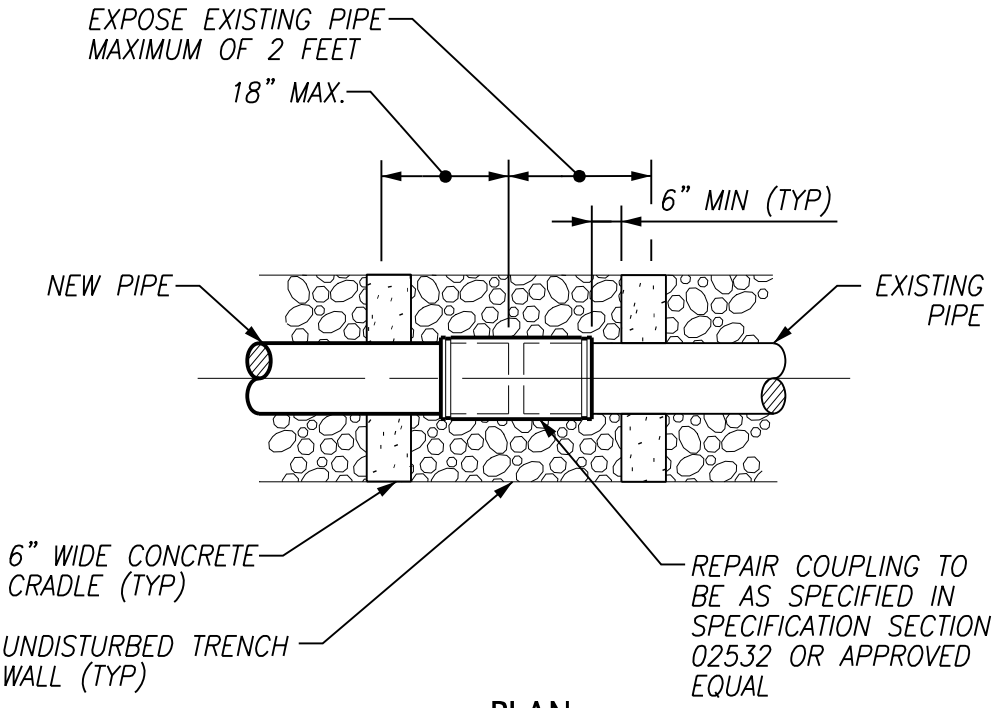
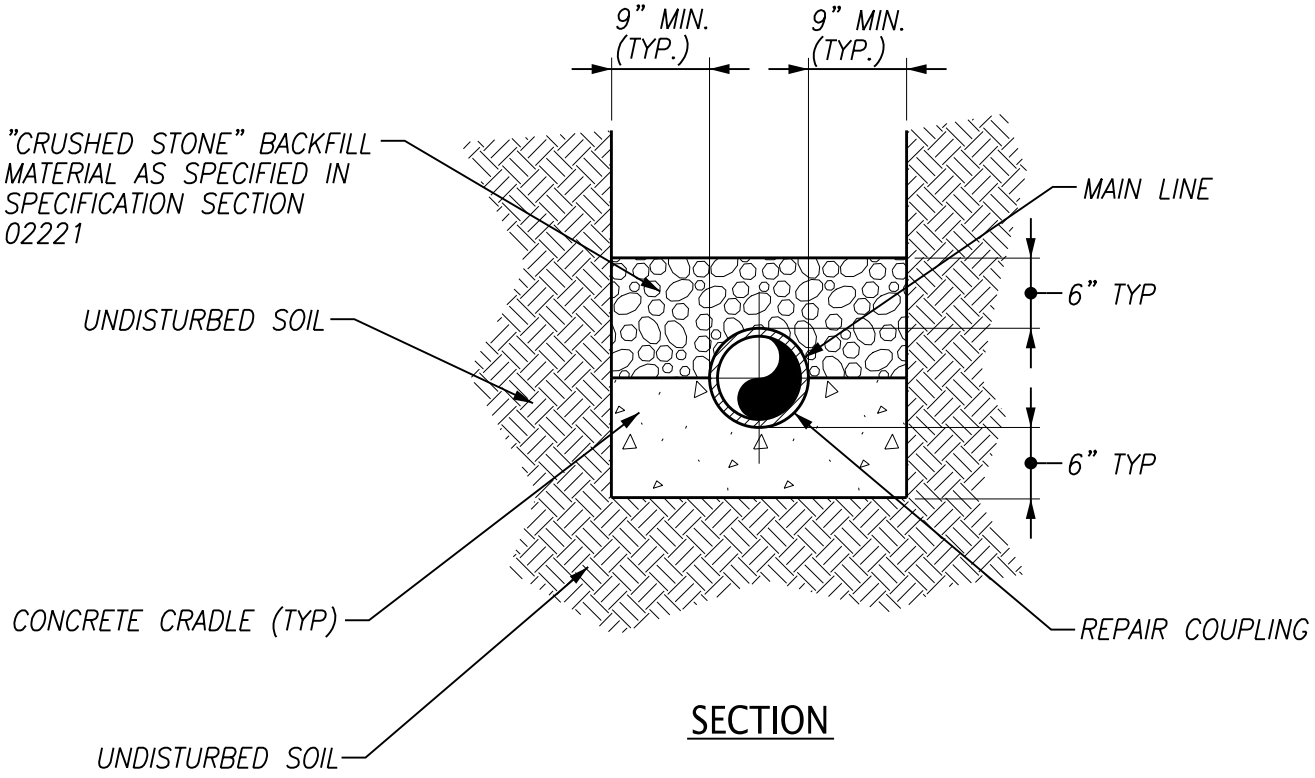
TYPICAL PIPE PLUG DETAIL		Date: 07/30/19
		DRAWING NUMBER: S5



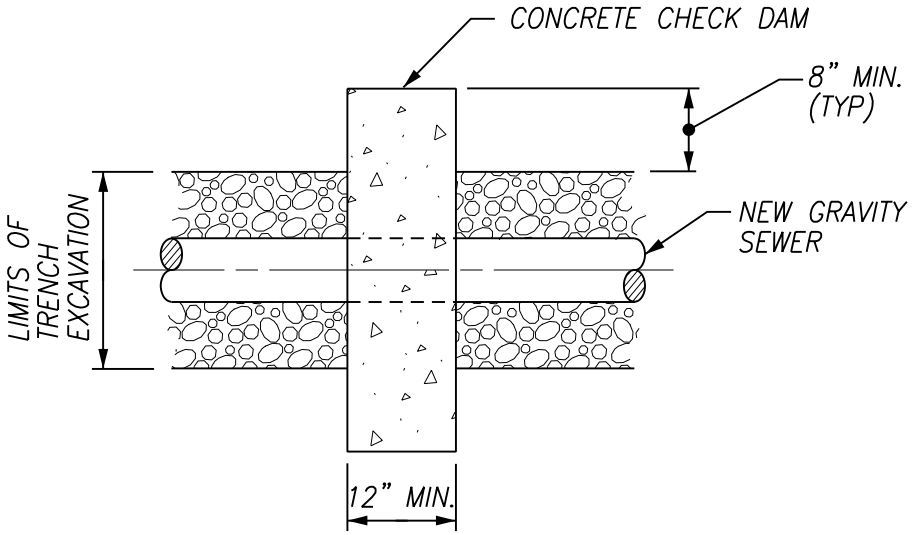
PLAN



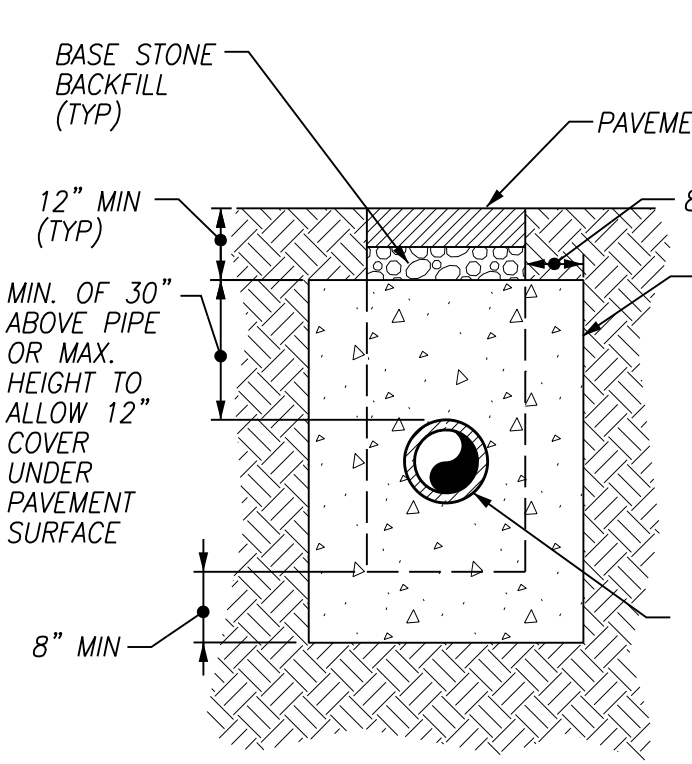
SECTION

LCUB
Going the Extra Mile
7698 CREEKWOOD PARK BLVD.
LENOIR CITY, TN 37772
TELEPHONE 844.687.5282

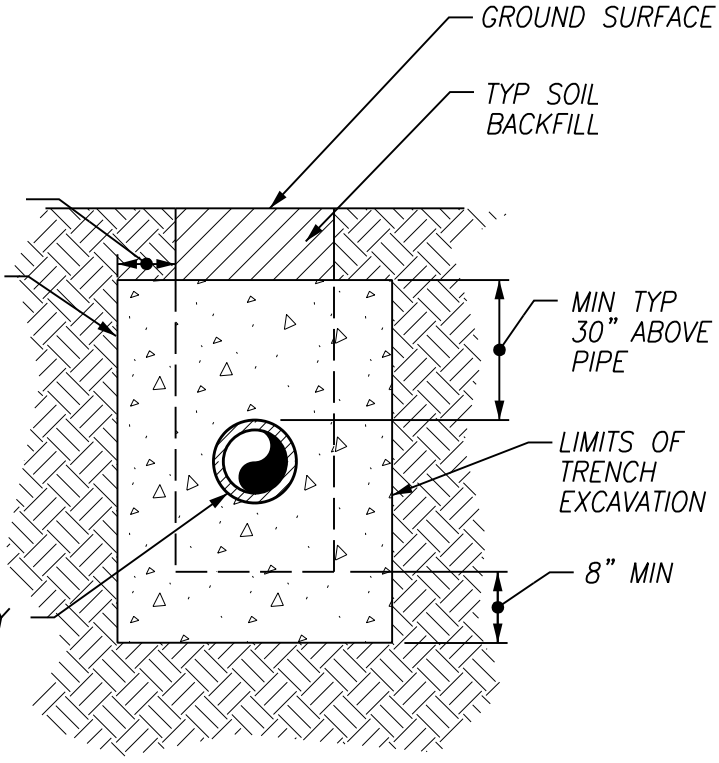
APPROVED BY: LCUB	DRAWN BY: FMA	Scale: NTS
TYPICAL SEWER COUPLING DETAIL		Date: 07/30/19
		DRAWING NUMBER: S6



PLAN



SECTION - PAVED AREAS



SECTION - NON-PAVED AREAS

NOTES:

1. CLAY CHECK DAMS MAY BE USED AS AN ALTERNATE TO CONCRETE IN CERTAIN AREAS UPON OWNER'S APPROVAL.

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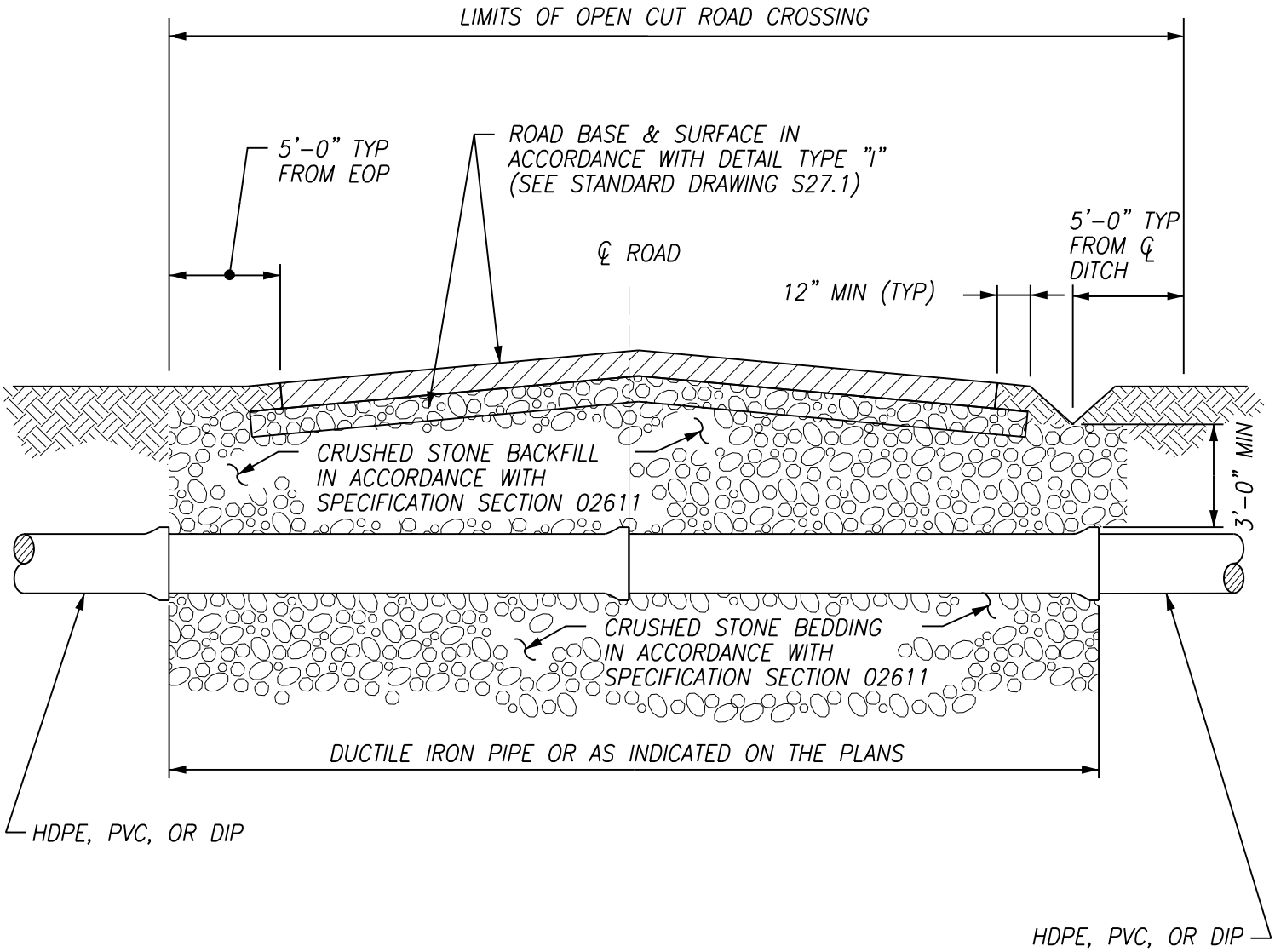
APPROVED BY: LCUB	DRAWN BY: FMA	Scale: NTS
CHECK DAMS FOR GRAVITY SEWERS		Date: 07/30/19
		DRAWING NUMBER: S7



SECTION

NOTES:

1. ALL PIPING WITHIN THE LIMITS OF THE OPEN CUT ROAD CROSSING SHALL BE DIP TO MATCH THE SIZE OF PIPING SHOWN ON THE PLANS.
2. DETAIL APPLIES TO ROADWAYS, DRIVEWAYS, SIDEWALKS, PARKING LOTS, AND OTHER PAVED AREAS.
3. IF STEEL CASING IS REQUIRED FOR ROAD CROSSING, DUCTILE IRON PIPE WITH RESTRAINED JOINTS SHALL BE UTILIZED FOR CARRIER PIPE.
4. DUCTILE IRON PIPE SHALL BE LINED IN ACCORDANCE WITH SPECIFICATION SECTION 02532, 2.02 A.6.

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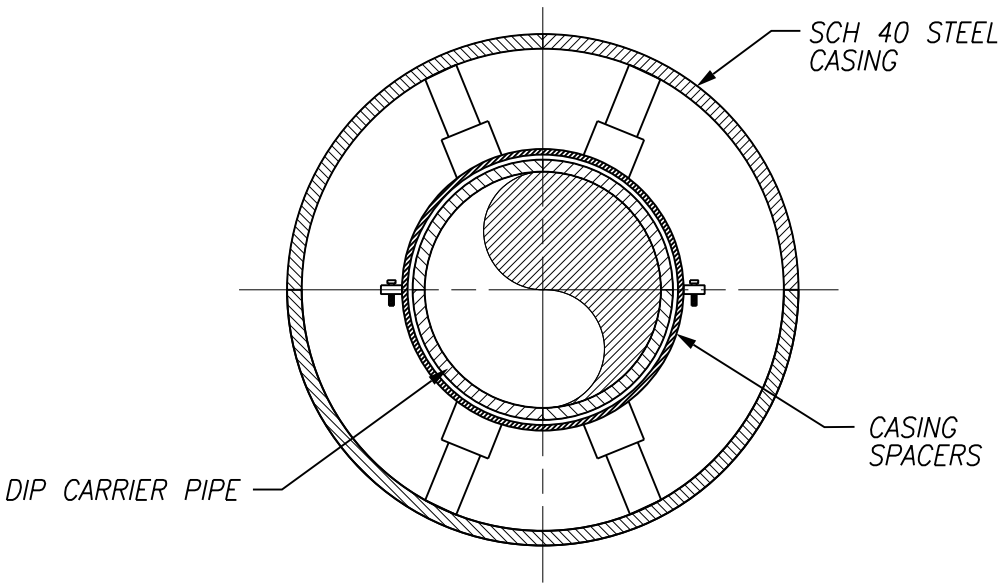
APPROVED BY: LCUB	DRAWN BY: FMA	Scale: NTS
TYPICAL OPEN CUT ROAD CROSSING		Date: 07/30/19
		DRAWING NUMBER: S8



NOTES:

1. CARRIER PIPE SHALL BE CLASS 350 SLIP JOINT DUCTILE IRON PIPE (WITH PROTECTO 401 LINING) INSTALLED WITH FIELD-LOK GASKETS TO EXTEND A MINIMUM OF TWO PIPE JOINTS BEYOND THE CASING.
2. INSTALL CASING SPACERS IN STRICT COMPLIANCE WITH THE WRITTEN MANUFACTURER'S INSTRUCTIONS.
3. PROVIDE CASING END SEALS IN ACCORDANCE WITH LCUB REQUIREMENTS.
4. CONTRACTOR TO CONFIRM THAT ALL PROPOSED CASING SPACERS WILL FIT INSIDE OF SPECIFIED STEEL CASING AS SHOWN ON THE PLANS PRIOR TO ORDERING MATERIALS.

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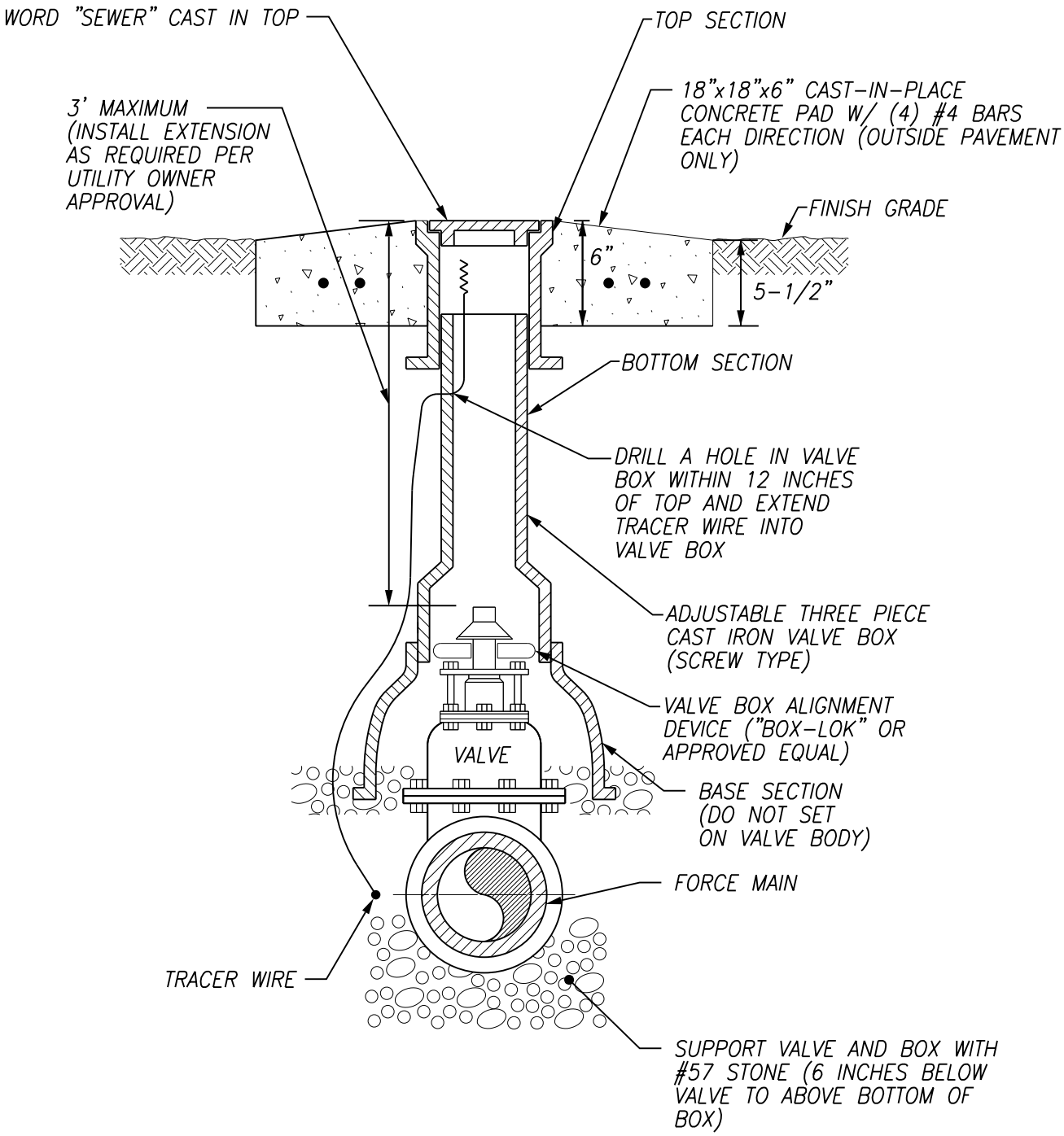
APPROVED BY: LCUB	DRAWN BY: FMA	Scale: NTS
CASING AND SPACER DETAIL		Date: 07/30/19
		DRAWING NUMBER: S9



NOTES:

1. SEWER VALVE SHALL HAVE A FIBERGLASS LOCATOR MARKER (OUTSIDE OF PAVEMENT ONLY) AT OWNER'S DIRECTION.

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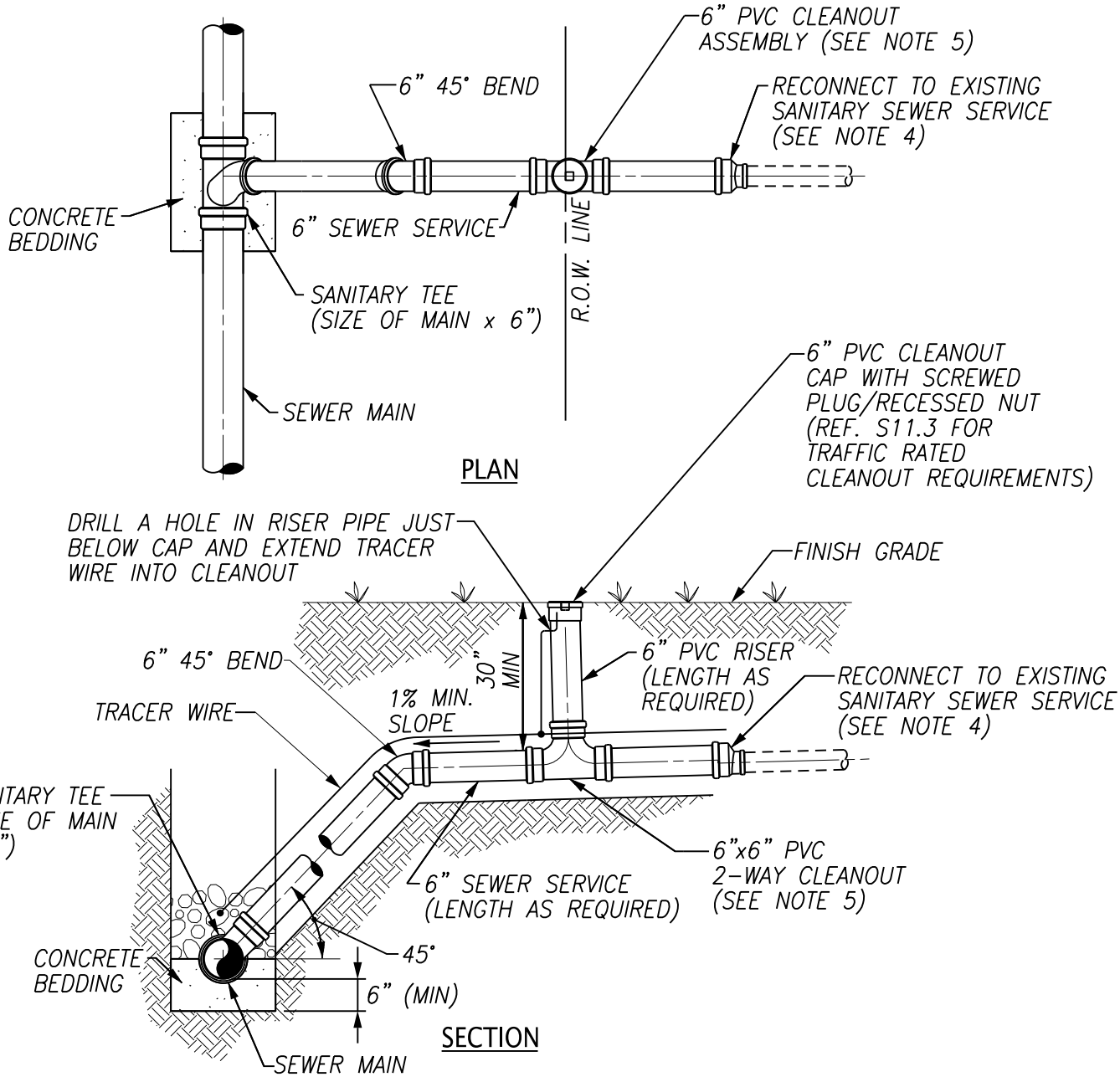
APPROVED BY: LCUB	DRAWN BY: FMA	Scale: NTS
		Date: 07/30/19

TYPICAL VALVE BOX

DRAWING NUMBER: S10



NOTES:

1. REFER TO PROJECT SPECIFICATIONS FOR MATERIAL AND BACKFILL REQUIREMENTS.
2. CONTRACTOR TO COORDINATE FIELD LOCATION OF SEWER SERVICES AND CLEANOUT ASSEMBLIES WITH LCUB.
3. DETAIL DEPICTS MOST DESIRABLE METHOD FOR SANITARY SEWER SERVICE RECONNECTION. CONTRACTOR TO USE ADDITIONAL FITTINGS, ADAPTERS, CONNECTORS, ETC. AS REQUIRED TO RECONNECT EXISTING SANITARY SERVICES.
4. ALL SERVICE LATERALS SHALL BE 6" TO PROPERTY LINE AND INSTALLED AT 1% (MIN.) SLOPE UNLESS FIELD VERIFIED BY THE ENGINEER. A 6"x4" ECCENTRIC INCREASER COUPLING (WITH TAPER) AS MANUFACTURED BY ROYAL BUILDING PRODUCTS/PLASTIC TRENDS (PART NUMBER G616-4) SHALL BE USED FOR SINGLE FAMILY RESIDENTIAL CONNECTION.
5. SERVICE LATERAL CLEANOUT SHALL BE A 2-WAY CLEANOUT AS MANUFACTURED BY ROYAL BUILDING PRODUCTS/PLASTIC TRENDS (G1006) AND EXTEND 3 FEET ABOVE FINISHED GRADE TO MARK SEWER LOCATION UNTIL BUILDING CONNECTION IS MADE.

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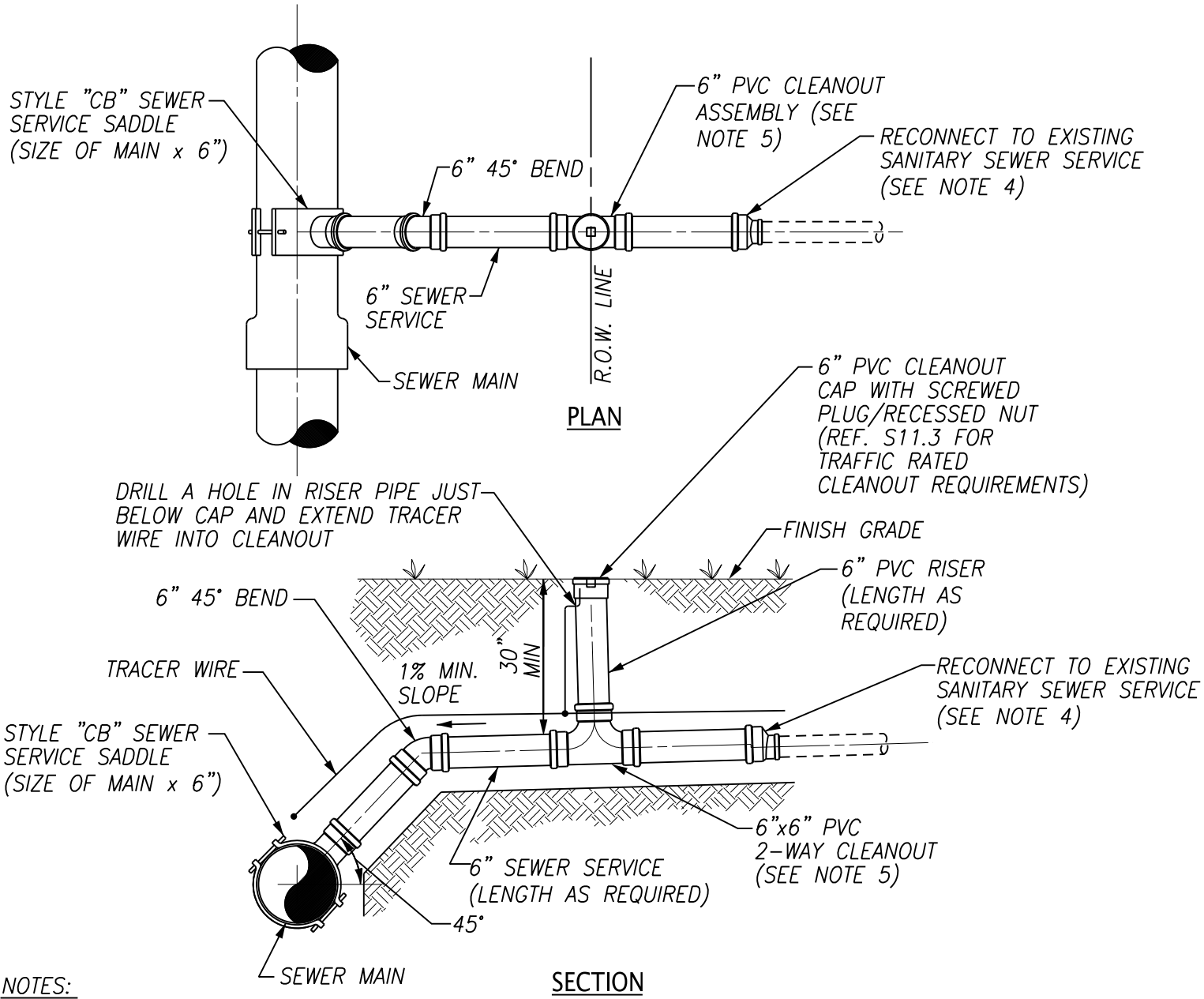
APPROVED BY: LCUB	DRAWN BY: FMA	Scale: NTS
TYPICAL SANITARY SEWER SERVICE RECONNECTION (NEW MAINS)		Date: 07/30/19
		DRAWING NUMBER: S11.1



NOTES:

1. REFER TO PROJECT SPECIFICATIONS FOR MATERIAL AND BACKFILL REQUIREMENTS.
2. CONTRACTOR TO COORDINATE FIELD LOCATION OF SEWER SERVICES AND CLEANOUT ASSEMBLIES WITH LCUB.
3. DETAIL DEPICTS MOST DESIRABLE METHOD FOR SANITARY SEWER SERVICE RECONNECTION. CONTRACTOR TO USE ADDITIONAL FITTINGS, ADAPTERS, CONNECTORS, ETC. AS REQUIRED TO RECONNECT EXISTING SANITARY SERVICES.
4. ALL SERVICE LATERALS SHALL BE 6" TO PROPERTY LINE AND INSTALLED AT 1% (MIN.) SLOPE UNLESS FIELD VERIFIED BY THE ENGINEER. A 6"x4" ECCENTRIC INCREASER COUPLING (WITH TAPER) AS MANUFACTURED BY ROYAL BUILDING PRODUCTS/PLASTIC TRENDS (PART NUMBER G616-4) SHALL BE USED FOR SINGLE FAMILY RESIDENTIAL CONNECTION.
5. SERVICE LATERAL CLEANOUT SHALL BE A 2-WAY CLEANOUT AS MANUFACTURED BY ROYAL BUILDING PRODUCTS/PLASTIC TRENDS (G1006) AND EXTEND 3 FEET ABOVE FINISHED GRADE TO MARK SEWER LOCATION UNTIL BUILDING CONNECTION IS MADE.

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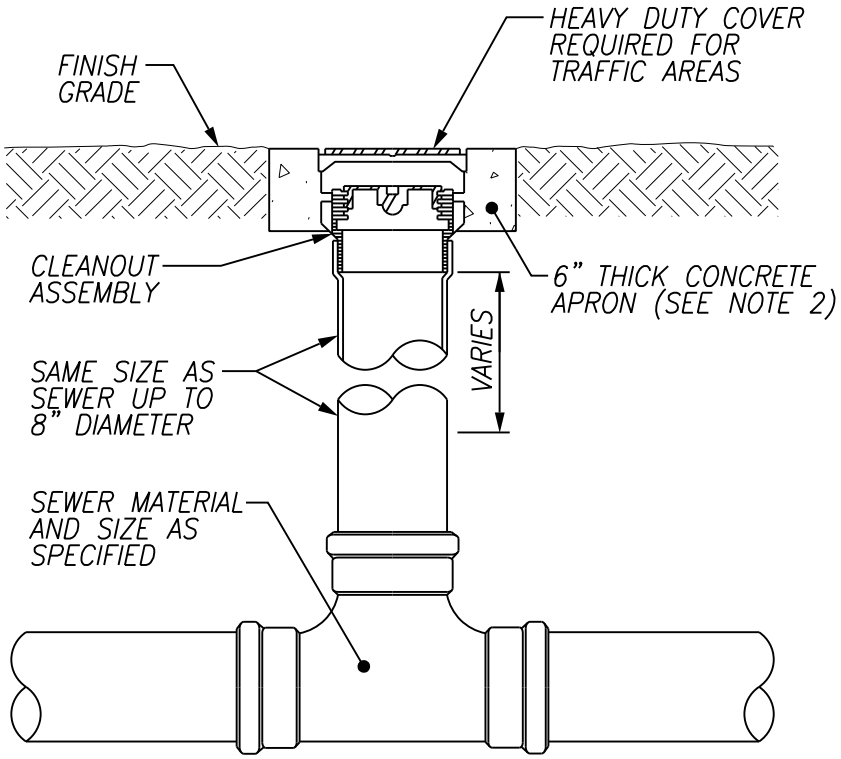
APPROVED BY: LCUB	DRAWN BY: FMA	Scale: NTS
TYPICAL SANITARY SEWER SERVICE RECONNECTION (EXISTING MAINS)		Date: 07/30/19
		DRAWING NUMBER: S11.2



NOTES:

1. TRAFFIC RATED CLEANOUTS ARE REQUIRED FOR CLEANOUTS LOCATED WITHIN PAVEMENT, ROADWAYS, DRIVEWAYS OR ANY OTHER AREAS DEEMED NECESSARY BY THE OWNER OR OWNER'S REPRESENTATIVE.

2. PROVIDE CONCRETE APRON AROUND CLEANOUT AS SHOWN IN GRAVEL AREAS ONLY.

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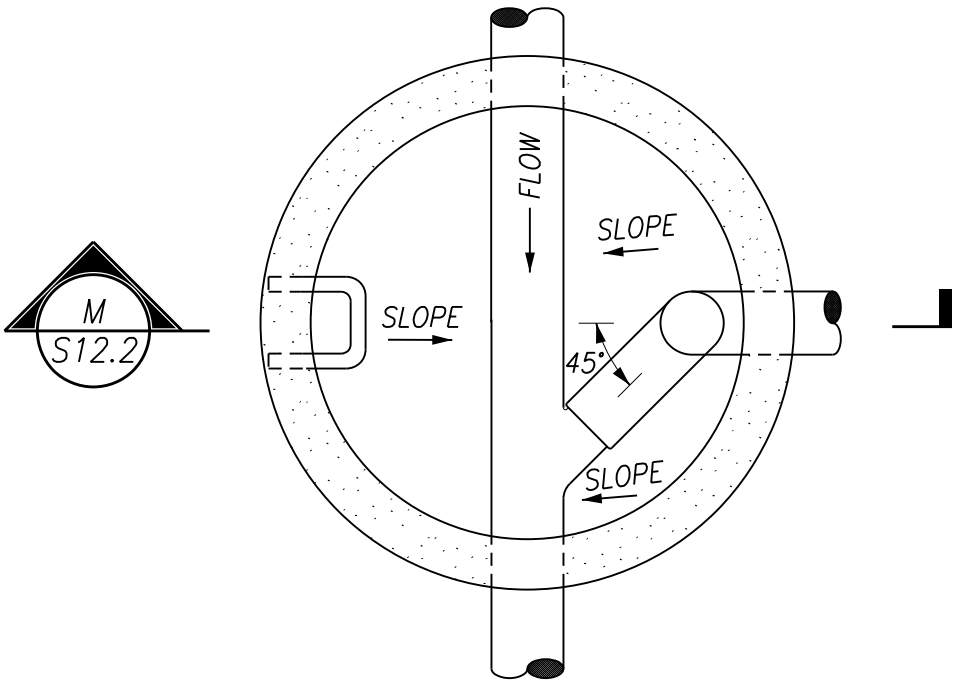
APPROVED BY: LCUB	DRAWN BY: FMA	Scale: NTS
TRAFFIC RATED CLEANOUT DETAIL		Date: 07/30/19
		DRAWING NUMBER: S11.3



PLAN

NOTES:

1. REF. LCUB STANDARD SPECIFICATIONS FOR PRECAST MANHOLE COMPONENTS AND CONNECTION DETAILS.
2. INSIDE DROP BOWL ASSEMBLY SHALL BE INSTALLED WITH STAINLESS STEEL FASTENERS IN ACCORDANCE WITH THE WRITTEN MANUFACTURER'S RECOMMENDATIONS.
3. ABANDONMENT OF EXISTING OUTSIDE DROP ASSEMBLY (WHERE REQUIRED) SHALL BE INCIDENTAL TO THE COST OF THE INSIDE DROP ASSEMBLY. THE ABANDONMENT PROCEDURE SHALL BE AS FOLLOWS:
   - A. REMOVE FLOW FROM SUBJECT LINE SEGMENT BY PLUGGING, BY-PASS PUMPING OR OTHER METHODS APPROVED BY OWNER AND ENGINEER.
   - B. PLUG EXISTING INCOMING SANITARY SEWER (LOWER PIPE) FROM INSIDE MANHOLE WITH CONCRETE OR GROUT PLUG.
   - C. FILL EXISTING VERTICAL OUTSIDE DROP PIPE TO WITHIN 6" OF TOP WITH CRUSHED STONE.
   - D. CAP OFF REMAINING 6" OF EXISTING DROP PIPE WITH CONCRETE OR GROUT PLUG. PROVIDE SMOOTH FINISH TO MATCH INVERT OF EXISTING INCOMING SNAITARY SEWER.

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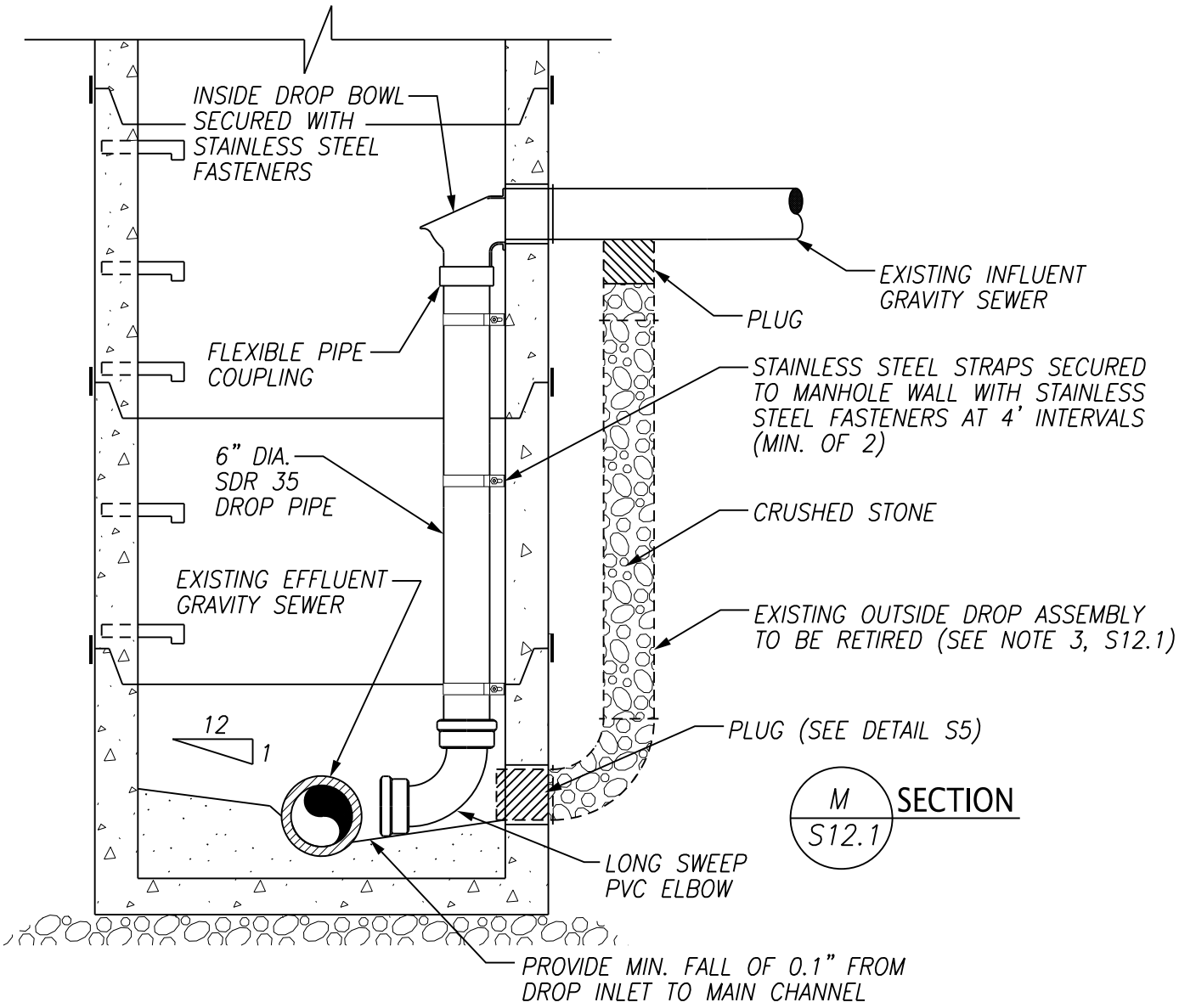
APPROVED BY: LCUB	DRAWN BY: FMA	Scale: NTS
TYPICAL INSIDE DROP ASSEMBLEY (PLAN)		Date: 07/30/19
		DRAWING NUMBER: S12.1



REQUIRED DROP PIPE SIZES	
INFLUENT PIPE	DROP PIPE
8"	6"
10"	8"
12"	10"

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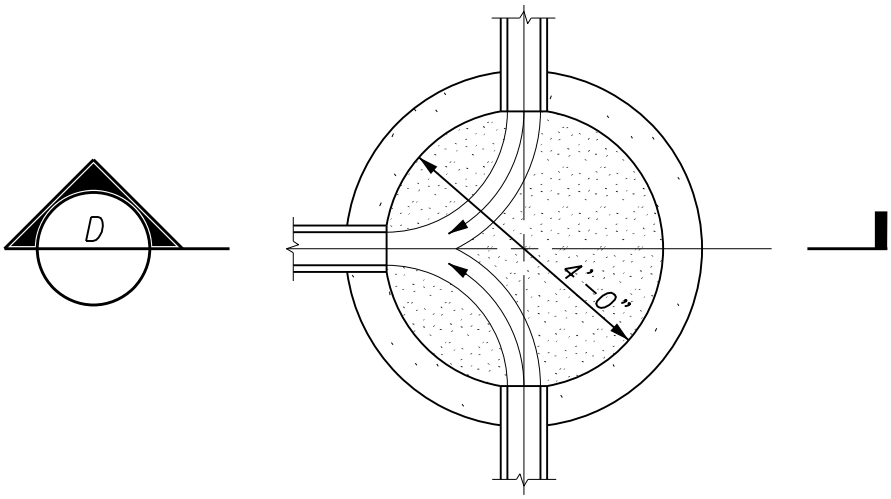
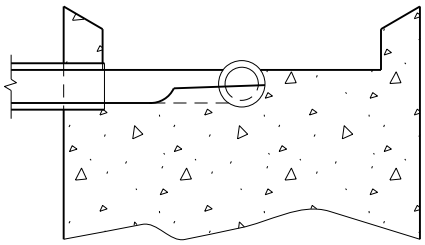
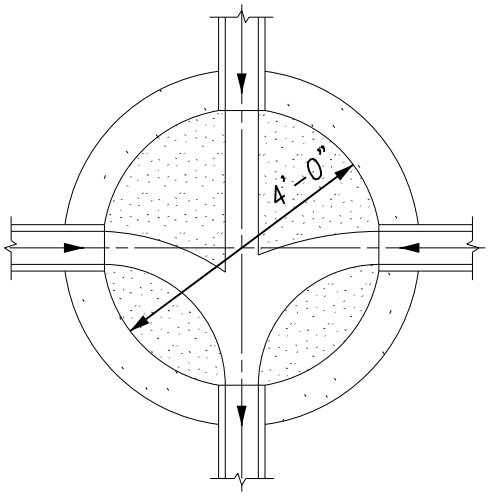
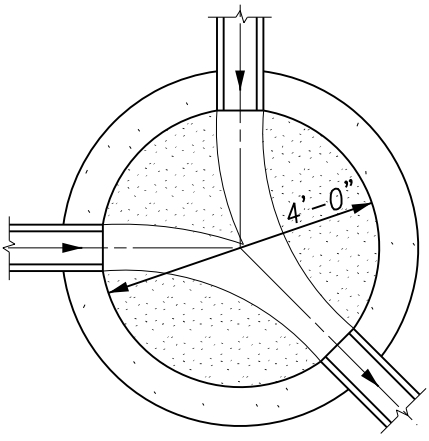
APPROVED BY: LCUB	DRAWN BY: FMA	Scale: NTS
TYPICAL INSIDE DROP ASSEMBLEY (SECTION)		Date: 07/30/19
		DRAWING NUMBER: S12.2





D SECTION





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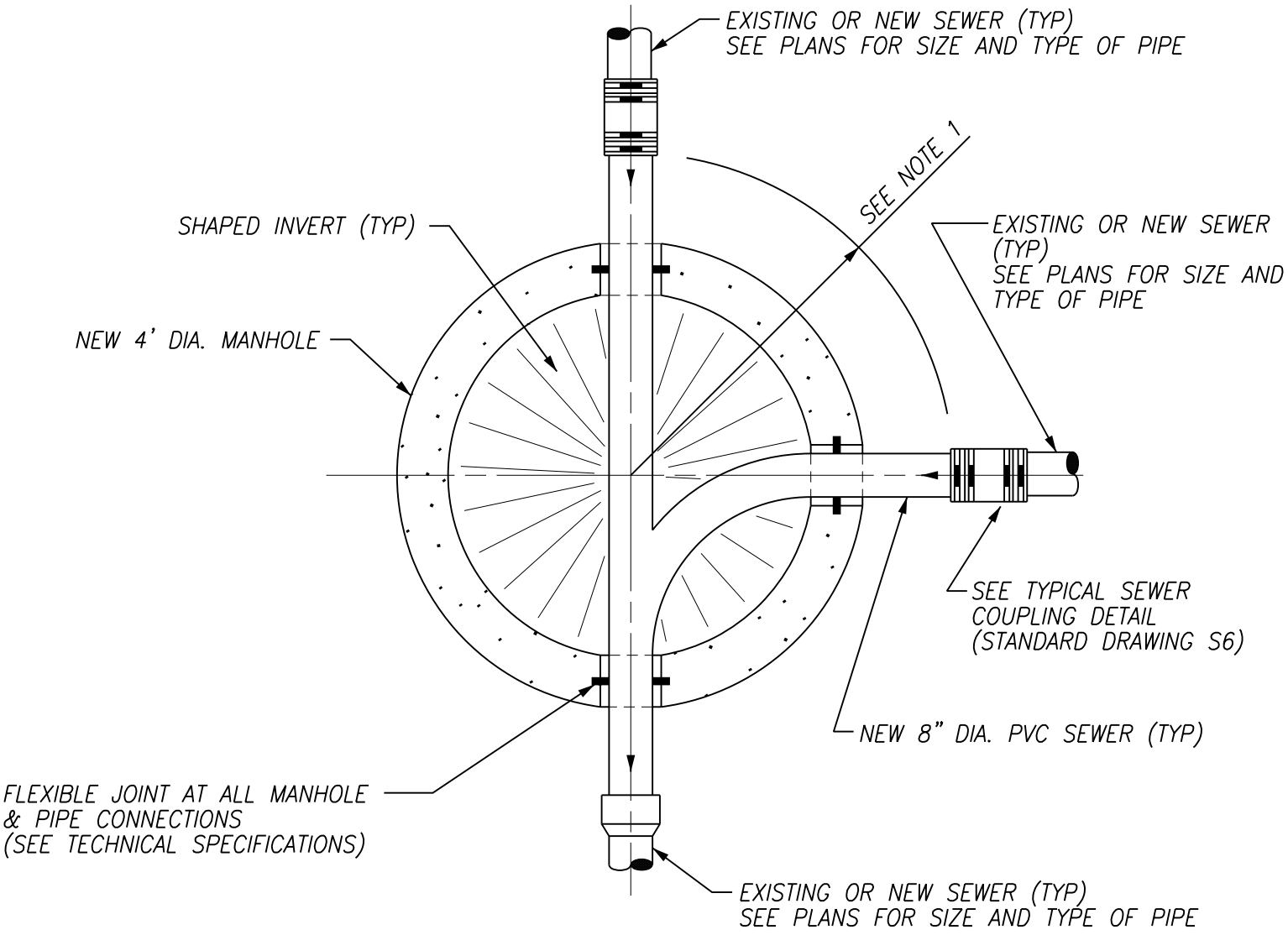
APPROVED BY: LCUB	DRAWN BY: FMA	Scale: NTS
MANHOLE INVERT PLANS		Date: 07/30/19
		DRAWING NUMBER: S13



NOTES:

1. CUT EXISTING SEWER A MINIMUM OF 3 FT. FROM EXISTING MANHOLE AND TO A SOUND SECTION OF PIPE.
2. REMOVE AND DISPOSE OF OLD MANHOLE AND SECTIONS OF OLD PIPE.
3. INSTALL NEW MANHOLE WITH SECTIONS OF NEW SEWER AND SECURE AS SHOWN IN DETAIL.
4. CONTRACTOR TO EXERCISE EXTREME CAUTION WHILE REMOVING & INSTALLING SEWER COMPONENTS TO PREVENT EXISTING SEWER PIPE SCHEDULED TO REMAIN IN SERVICE FROM BEING MOVED OR DAMAGED.
5. NEW MANHOLES SHALL REPLACE EXISTING MANHOLES TO MATCH ALL DETAILS OF ALIGNMENT, GRADE, DEPTH AND CONFIGURATION, OR AS OTHERWISE SHOWN ON PLANS.
6. CONTRACTOR SHALL CONFIRM DIMENSIONS & CONFIGURATIONS OF EXISTING MANHOLES PRIOR TO ORDERING & PLACEMENT.
7. SEE PROJECT PLANS TO DETERMINE SPECIAL CONDITIONS OF MANHOLE REPLACEMENT.
8. ALL NEW MANHOLES SHALL PASS VACUUM TESTS PRIOR TO PLACING INTO SERVICE.
9. SEE SPECIFICATION SECTION 02532.

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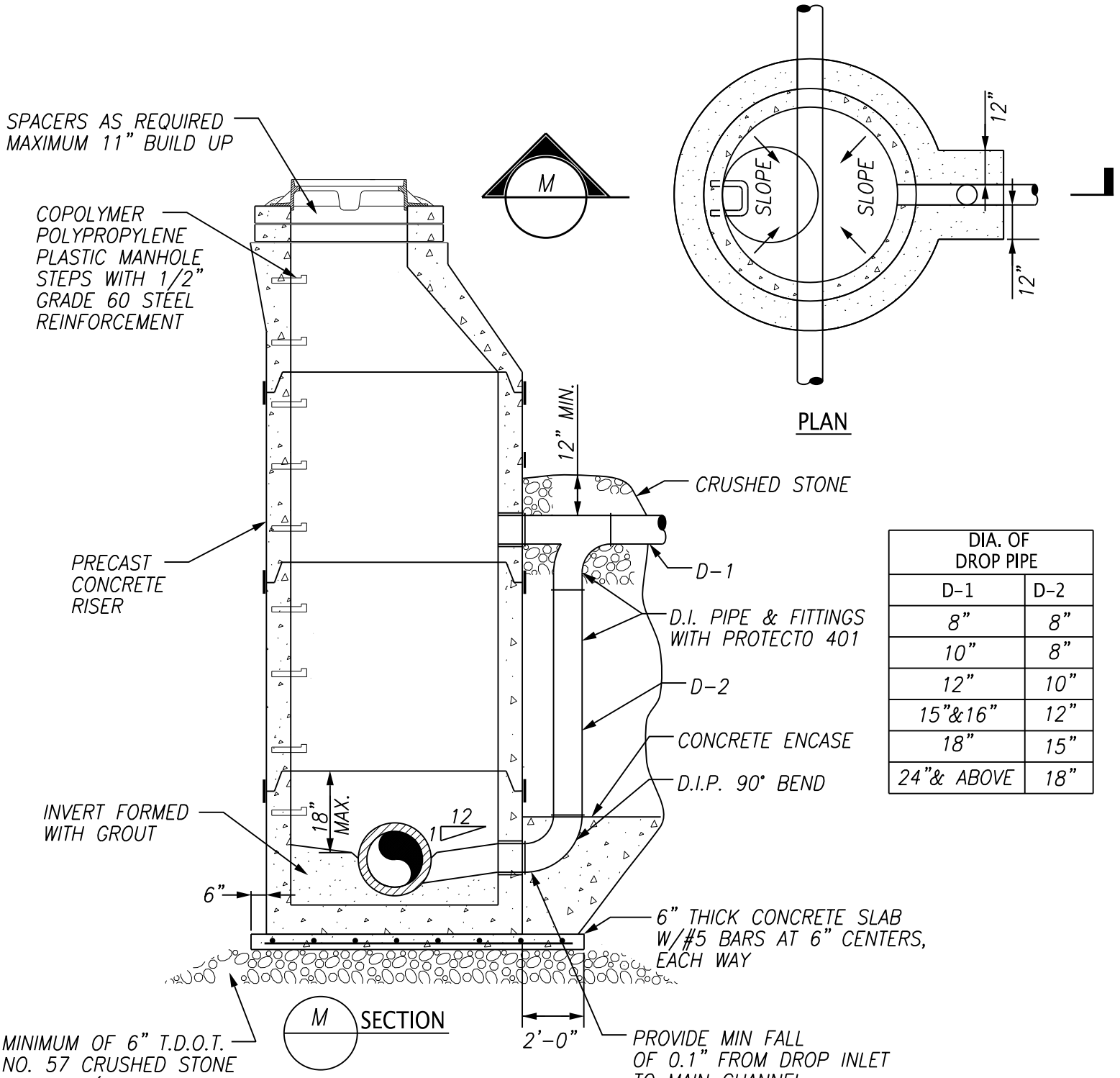
APPROVED BY: LCUB	DRAWN BY: FMA	Scale: NTS
MANHOLE REPLACEMENT DETAIL		Date: 07/30/19
		DRAWING NUMBER: S14



DIA. OF DROP PIPE	
D-1	D-2
8"	8"
10"	8"
12"	10"
15"&16"	12"
18"	15"
24"& ABOVE	18"

NOTES:

1. USE STANDARD FRAME AND COVER UNLESS OTHERWISE SPECIFIED.
2. REF. STANDARD DRAWING S16.3 FOR PRECAST MANHOLE COMPONENT CONNECTION DETAILS.

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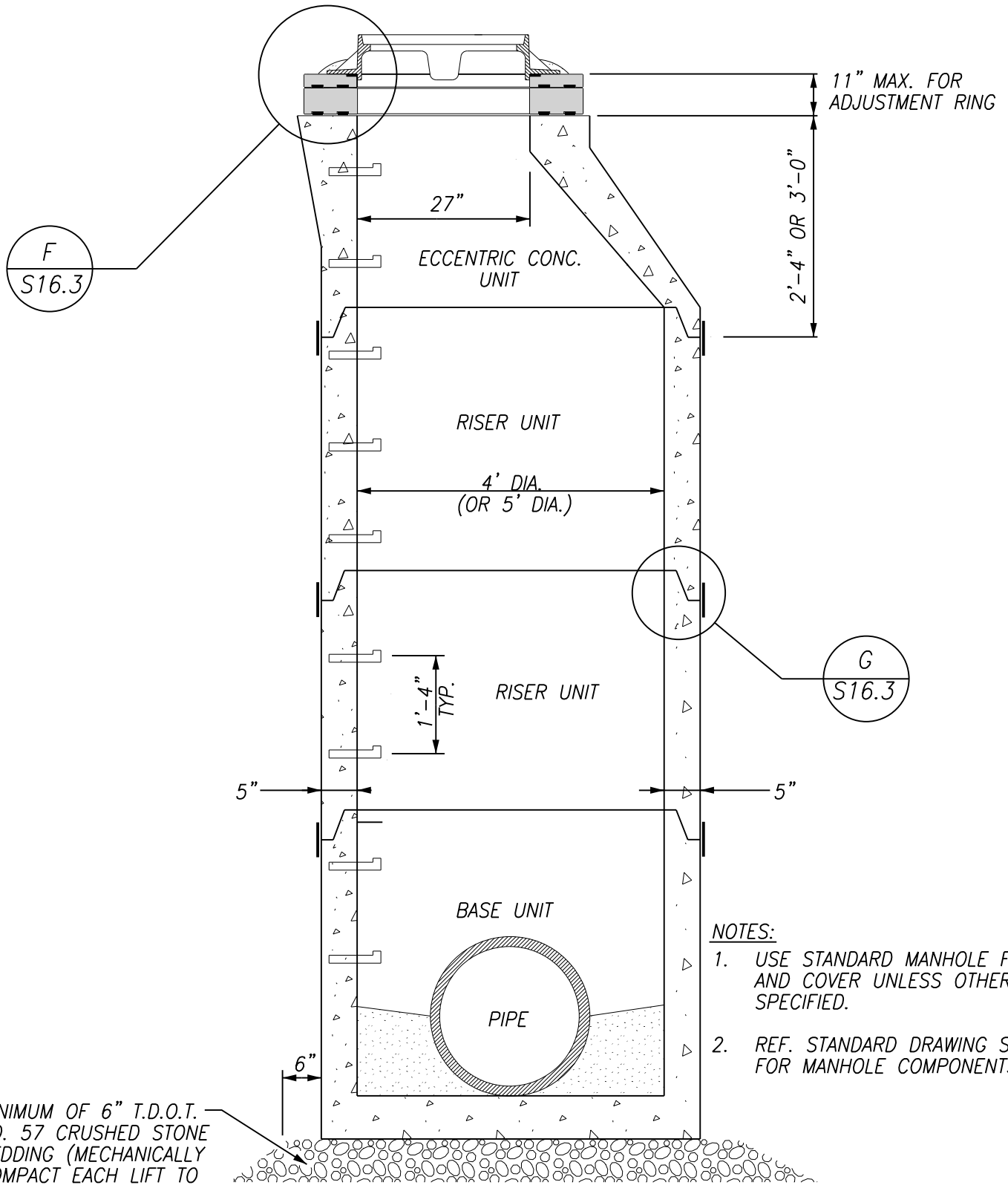
APPROVED BY: LCUB	DRAWN BY: FMA	Scale: NTS
TYPICAL DROP MANHOLE		Date: 07/30/19
		DRAWING NUMBER: S15



NOTES:

1. USE STANDARD MANHOLE FRAME AND COVER UNLESS OTHERWISE SPECIFIED.
2. REF. STANDARD DRAWING S16.3 FOR MANHOLE COMPONENTS.

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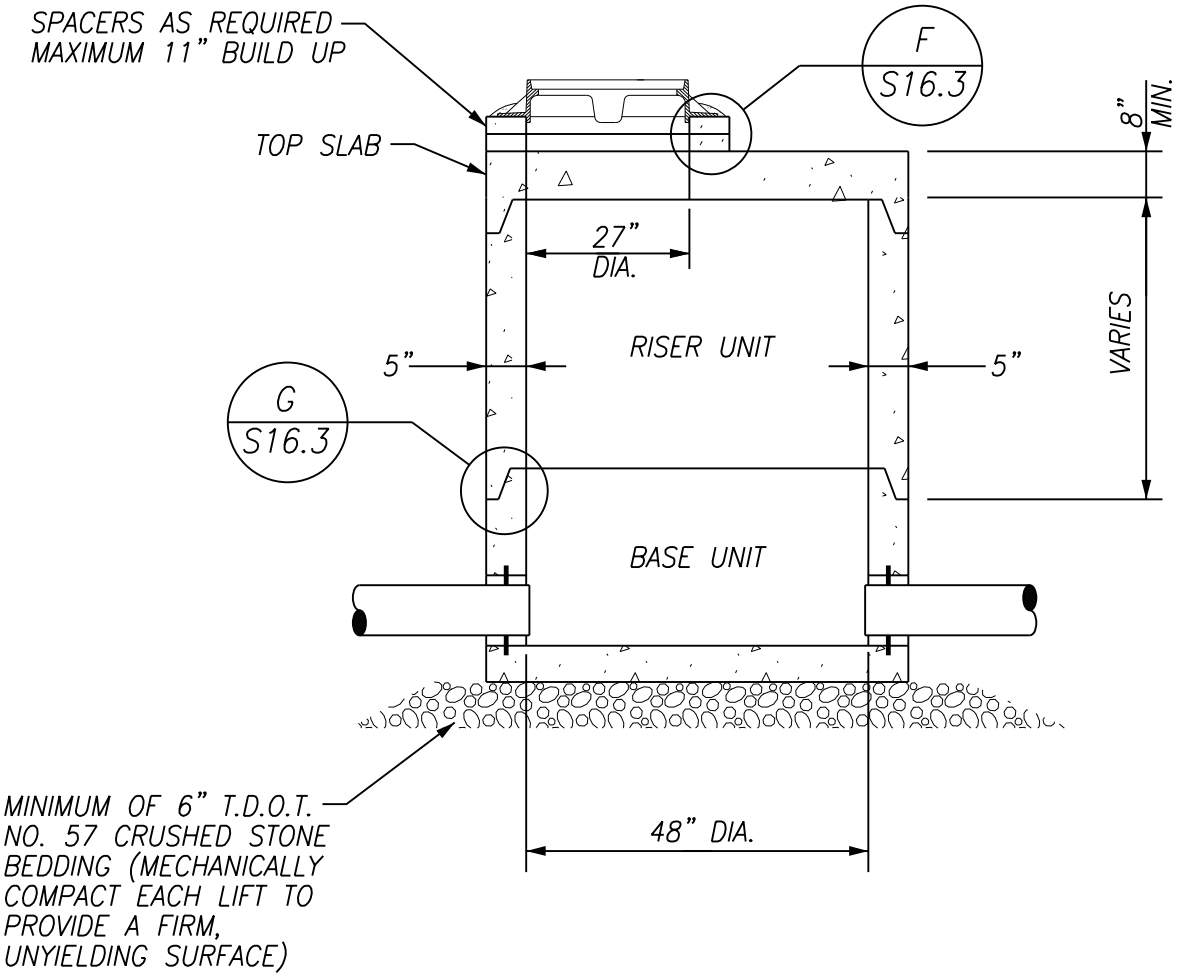
APPROVED BY: LCUB	DRAWN BY: FMA	Scale: NTS
STANDARD PRECAST MANHOLE CONE TYPE		Date: 07/30/19
		DRAWING NUMBER: S16.1



NOTES:

1. USE STANDARD MANHOLE FRAME AND COVER UNLESS OTHERWISE SPECIFIED.
2. REF. STANDARD DRAWING S16.3 FOR PRECAST MANHOLE COMPONENTS.

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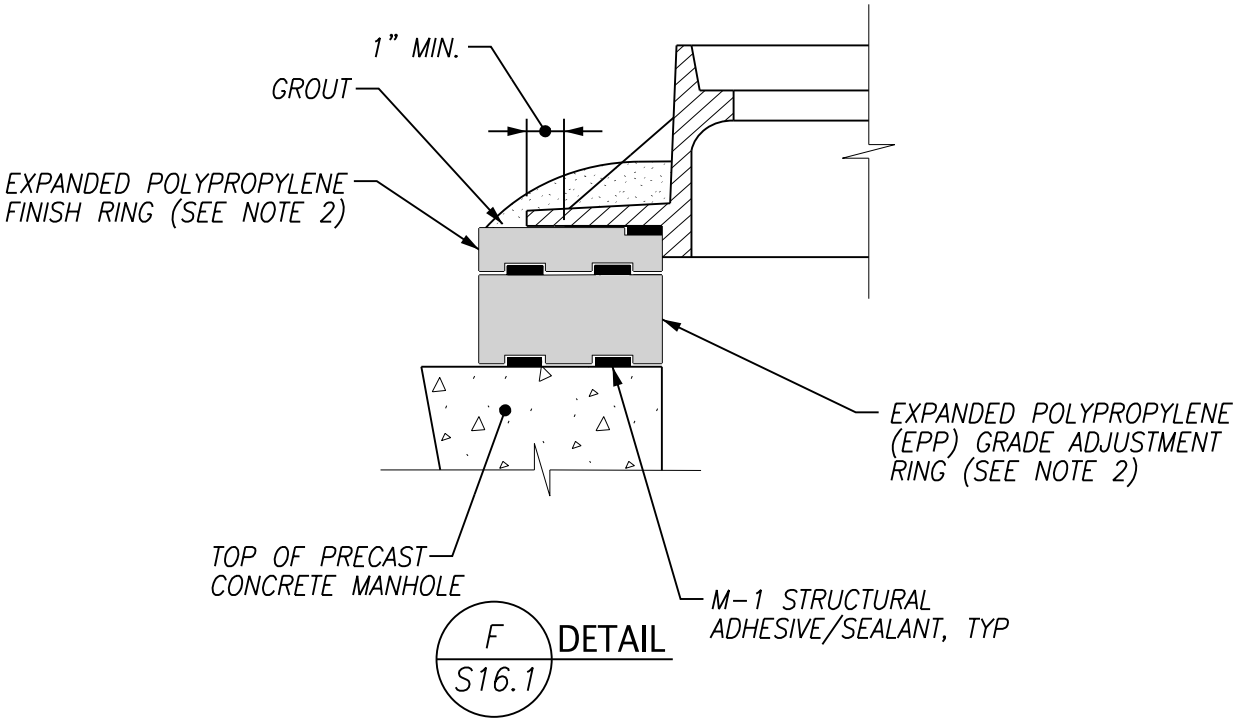
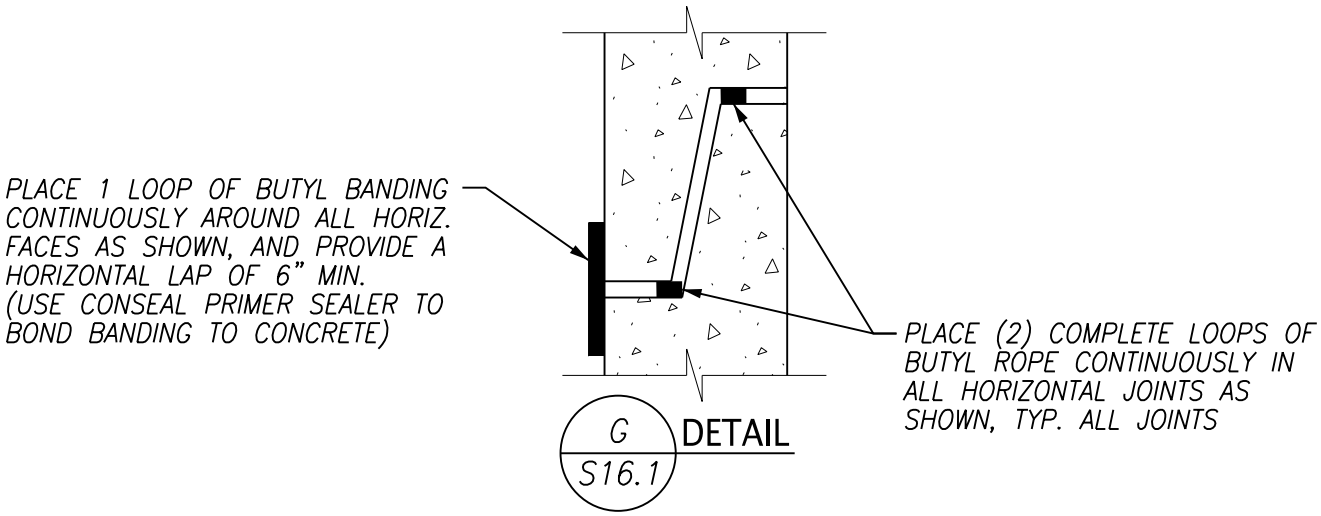
APPROVED BY: LCUB	DRAWN BY: FMA	Scale: NTS
STANDARD PRECAST MANHOLE FLAT TOP TYPE		Date: 07/30/19
		DRAWING NUMBER: S16.2



F DETAIL S16.1



G DETAIL S16.1

NOTES:

1. BUTYL ROPE MATERIAL SHALL HAVE A MINIMUM NOMINAL CROSS SECTION DIMENSION OF ONE AND ONE-QUARTER INCHES (1.25") OR AS RECOMMENDED BY THE PRECAST MANHOLE MANUFACTURER.

2. MANHOLE GRADE ADJUSTMENT RINGS AND FINISH RINGS (FOR 4 FT. DIAMETER MANHOLES) SHALL BE 40-27 PRO-RING AS MANUFACTURED BY "CRETEX SPECIALTY PRODUCTS" OR APPROVED EQUAL. ADJUSTMENT RINGS SHALL MEET ALL REQUIREMENTS AS OUTLINED IN SPECIFCATION SECTION 02532 PARAGRAPH 2.10. CONTRACTOR SHALL PROVIDE MANHOLE TOP REPAIR MATERIALS AND/OR SLOPE ADJUSTMENT RING AS NECESSARY OR AS DIRECTED BY OWNER'S REPRESENTATIVE.

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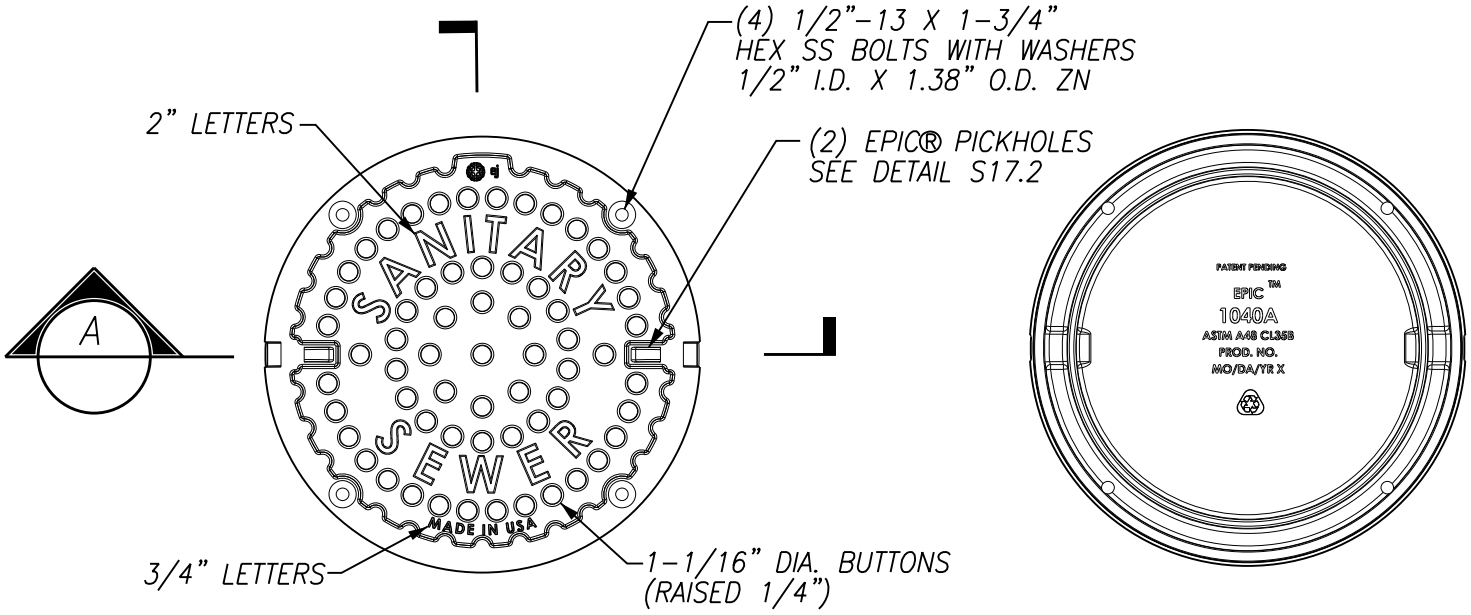
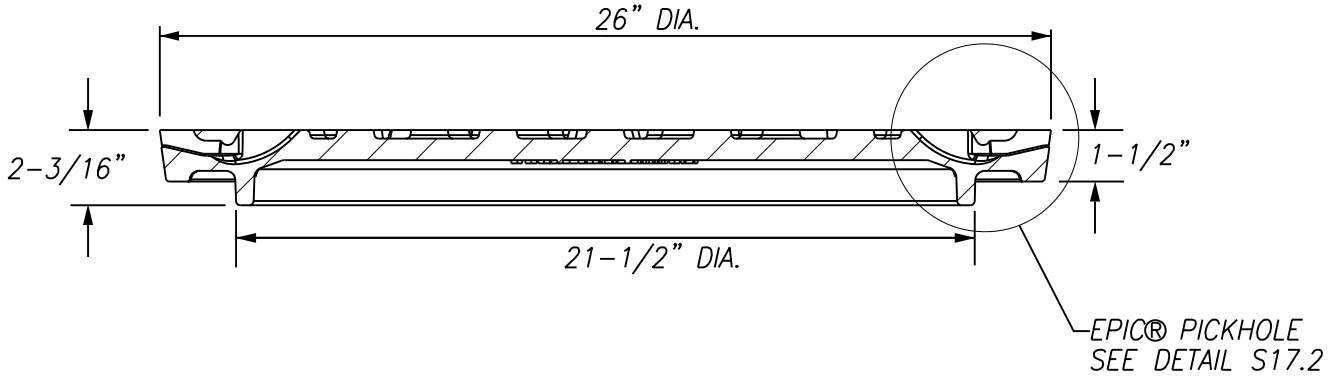
APPROVED BY: LCUB	DRAWN BY: FMA	Scale: NTS
STANDARD PRECAST MANHOLE DETAILS		Date: 07/30/21
		DRAWING NUMBER: S16.3



COVER FACE

COVER BACK



A SECTION

NOTES:

1. COVER SHALL BE AS FOLLOWS:
   EJ PRODUCT #00103939
   NAME: 1040A SOLID COVER SANITARY SEWER

   WEIGHT AS FOLLOWS:

COVER:	125 LBS
FRAME:	154 LBS.
TOTAL:	279 LBS.

2. REF. STANDARD DRAWING S17.2.

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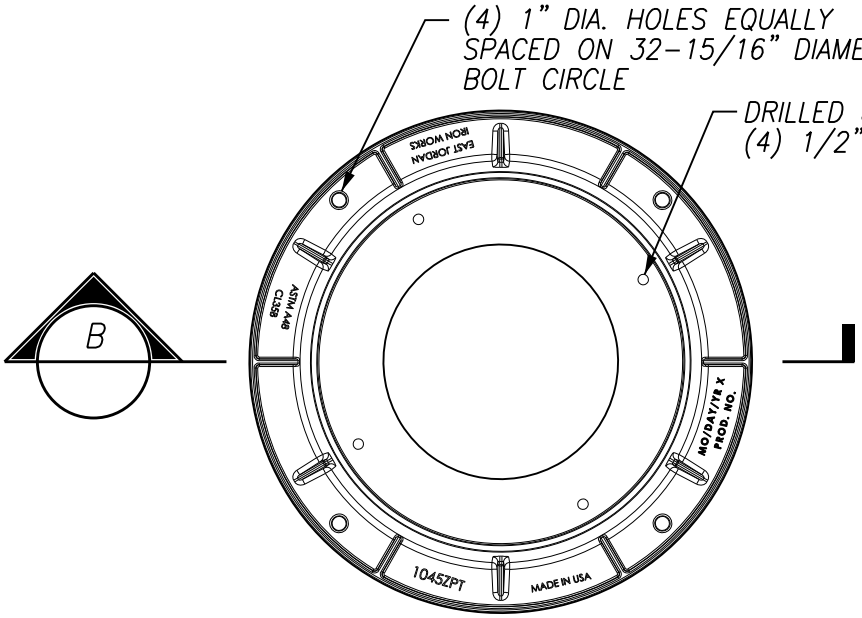
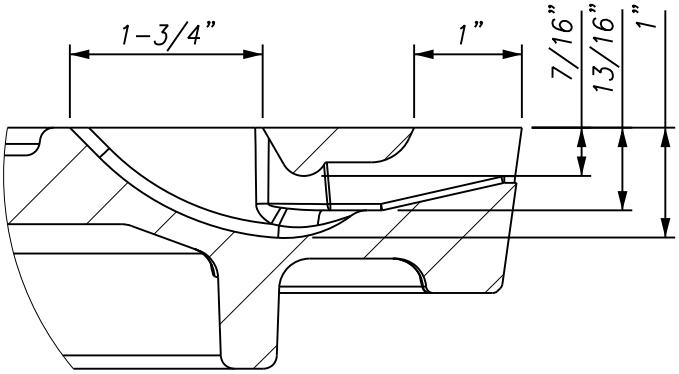
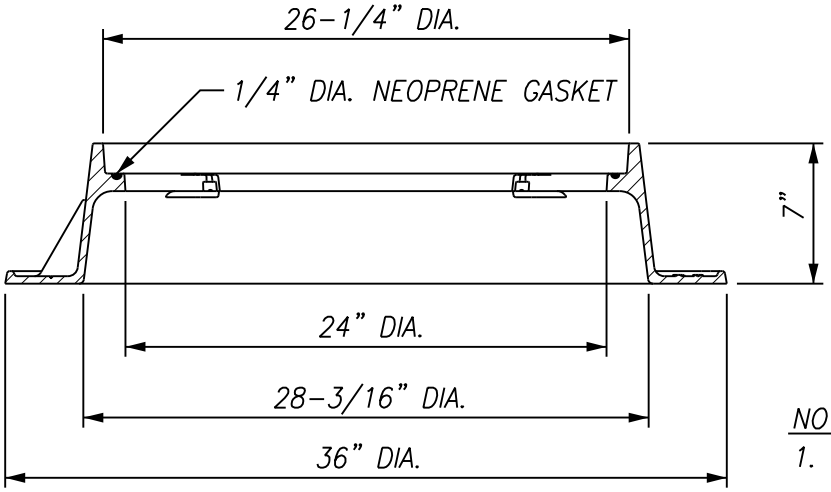
APPROVED BY: LCUB	DRAWN BY: FMA	Scale: NTS	
HEAVY-DUTY WATERTIGHT MANHOLE FRAME & COVER (FOR REHABILITATED MANHOLES) 1 OF 2		Date: 07/30/19	
		DRAWING NUMBER: S17.1	



FRAME PLAN



PICKHOLE DETAIL



B SECTION

NOTES:

1. FRAME SHALL BE AS FOLLOWS:
   EJ PRODUCT #00104513
   NAME: 1045ZPT 7" TALL FRAME
   FOR BOLTING WITH EON FEATURE

2. ANCHOR WATERTIGHT FRAME TO MANHOLE WITH (4) EACH 3/4" DIA. X 6" LONG STAINLESS STEEL APPROVED CHEM-SET TYPE ANCHOR BOLTS COMPLETE WITH WASHERS & NUTS.

3. REF. STANDARD DRAWING S17.1.

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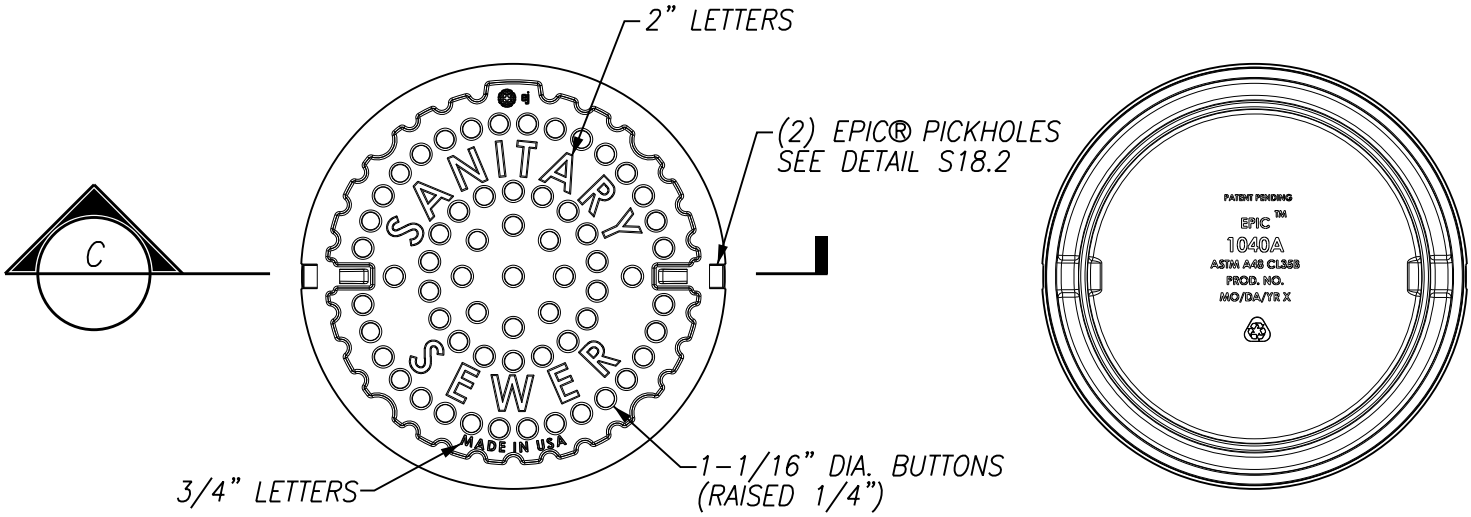
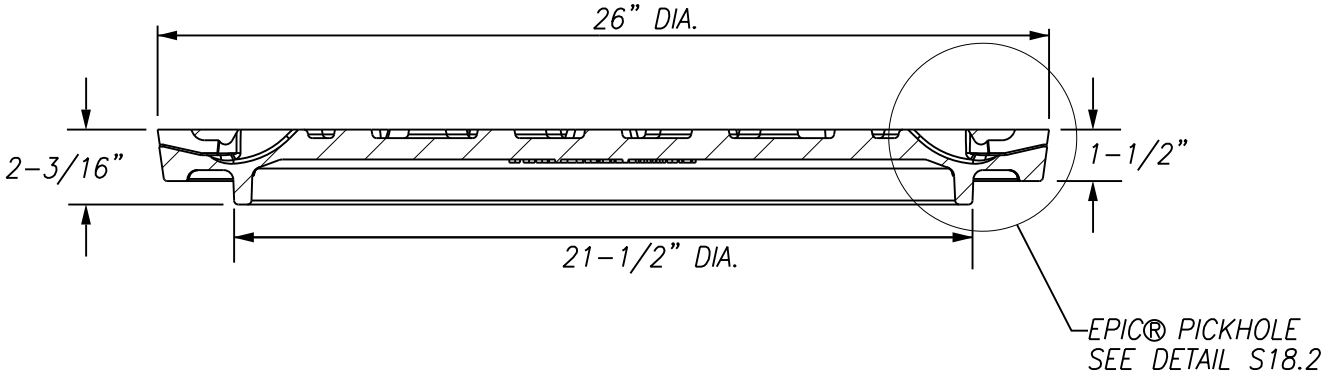
APPROVED BY: LCUB	DRAWN BY: FMA	Scale: NTS
HEAVY-DUTY WATERTIGHT MANHOLE FRAME & COVER (FOR REHABILITATED MANHOLES) 2 0F 2		Date: 07/30/19
		DRAWING NUMBER: S17.2



COVER FACE

COVER BACK



C SECTION

NOTES:

1. COVER SHALL BE AS FOLLOWS:
   EJ PRODUCT #00103939
   NAME: 1040A SOLID COVER SANITARY SEWER

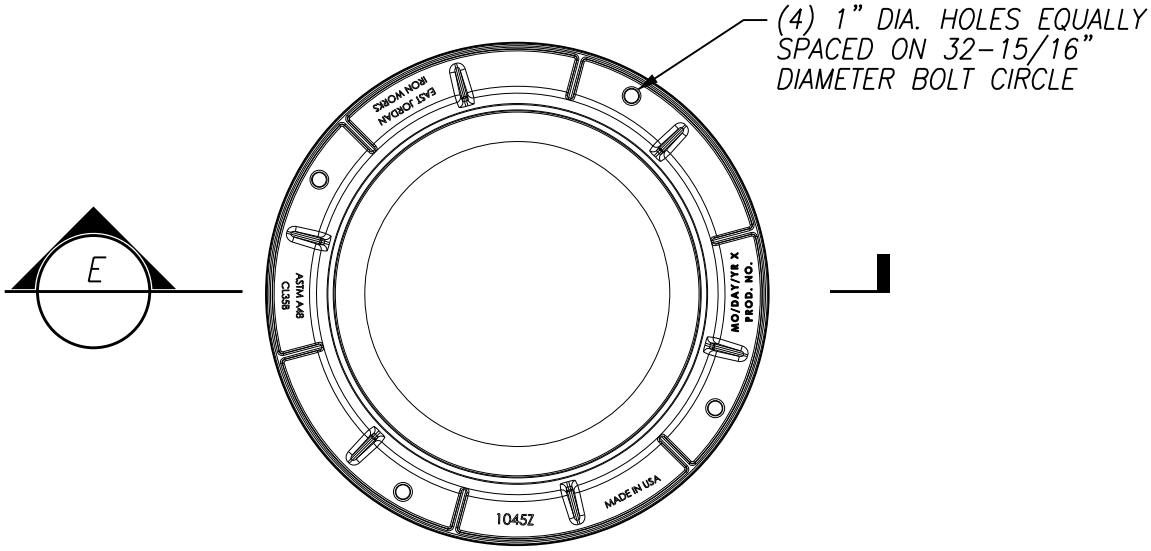
   WEIGHT AS FOLLOWS:

COVER:	125 LBS
FRAME:	179 LBS.
TOTAL:	304 LBS.

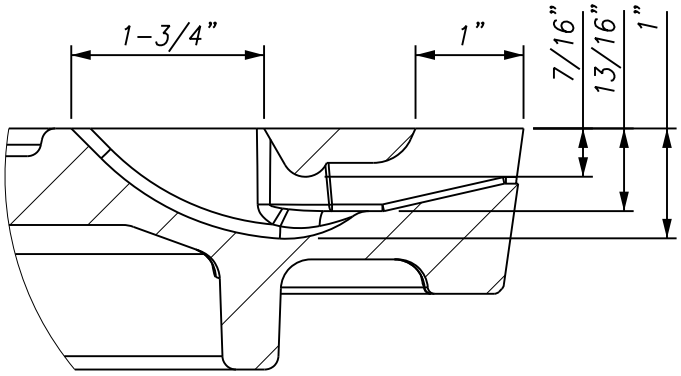
2. REF. STANDARD DRAWING S18.2.

LCUB Going the Extra Mile
7698 CREEKWOOD PARK BLVD.
LENOIR CITY, TN 37772
TELEPHONE 844.687.5282

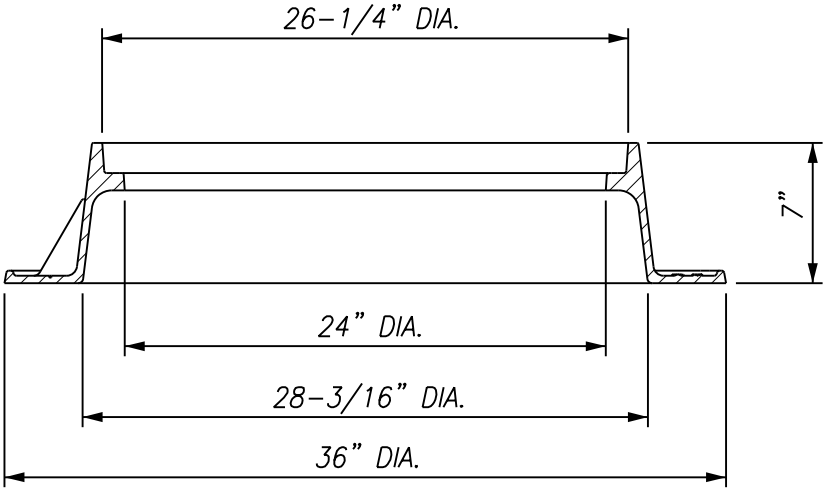
APPROVED BY: LCUB	DRAWN BY: FMA	Scale: NTS	
HEAVY-DUTY STANDARD MANHOLE FRAME & COVER (FOR REHABILITATED MANHOLES) 1 OF 2		Date: 07/30/19	
		DRAWING NUMBER: S18.1	



FRAME PLAN



PICKHOLE DETAIL



E SECTION

NOTES:

1. FRAME SHALL BE AS FOLLOWS:
   EJ PRODUCT #00104511
   NAME: 1045Z 7" TALL FRAME

2. REF. STANDARD DRAWING S18.1.

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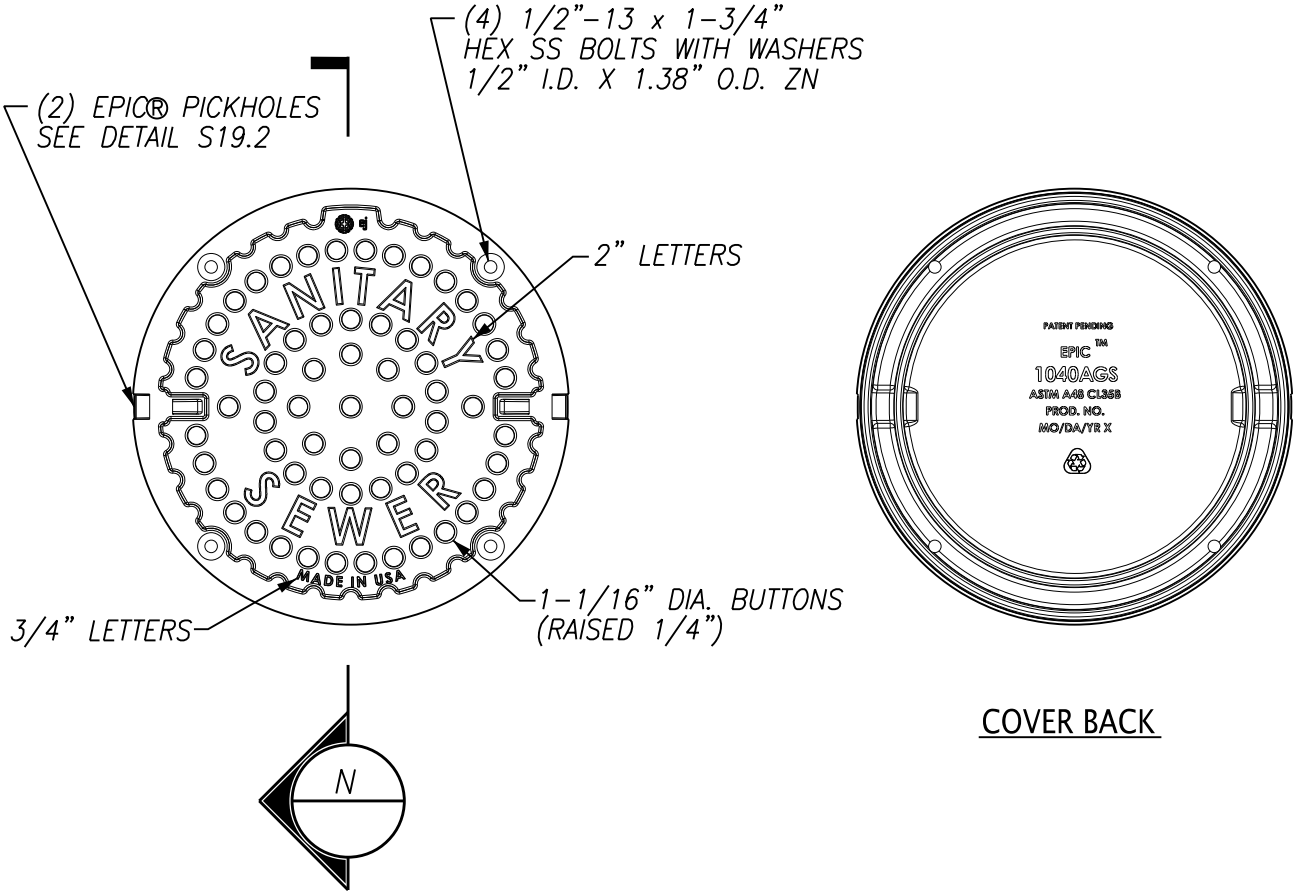
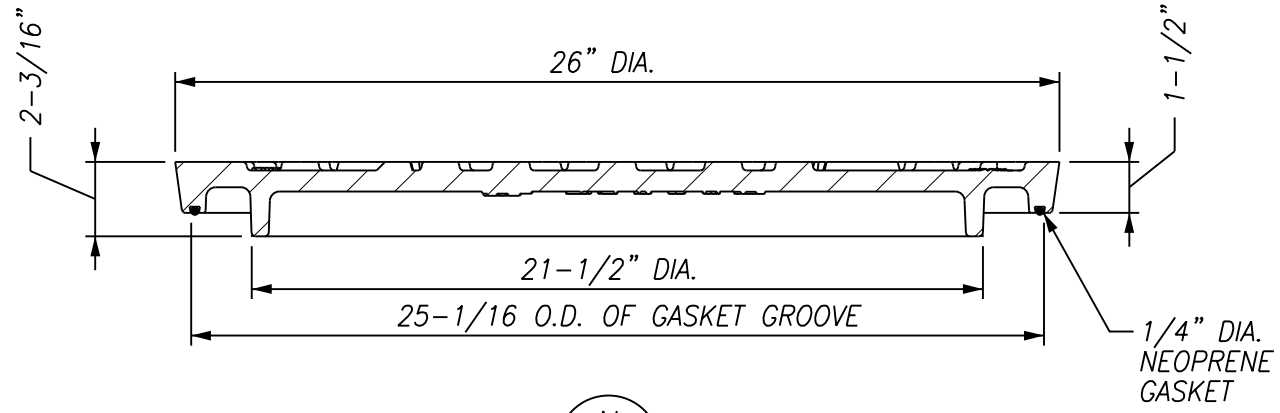
TELEPHONE 844.687.5282

APPROVED BY: LCUB	DRAWN BY: FMA	Scale: NTS
HEAVY-DUTY STANDARD MANHOLE FRAME & COVER (FOR REHABILTATED MANHOLES) 2 OF 2		Date: 07/30/19
		DRAWING NUMBER: S18.2



COVER FACE

COVER BACK



N SECTION

NOTES:

1. FRAME & COVER SHALL BE AS FOLLOWS:
   EJ PRODUCT #NPR16-3109A

   WEIGHT AS FOLLOWS:

COVER:	125 LBS
FRAME:	239 LBS.
TOTAL:	364 LBS.

2. REF. STANDARD DRAWING S19.2.

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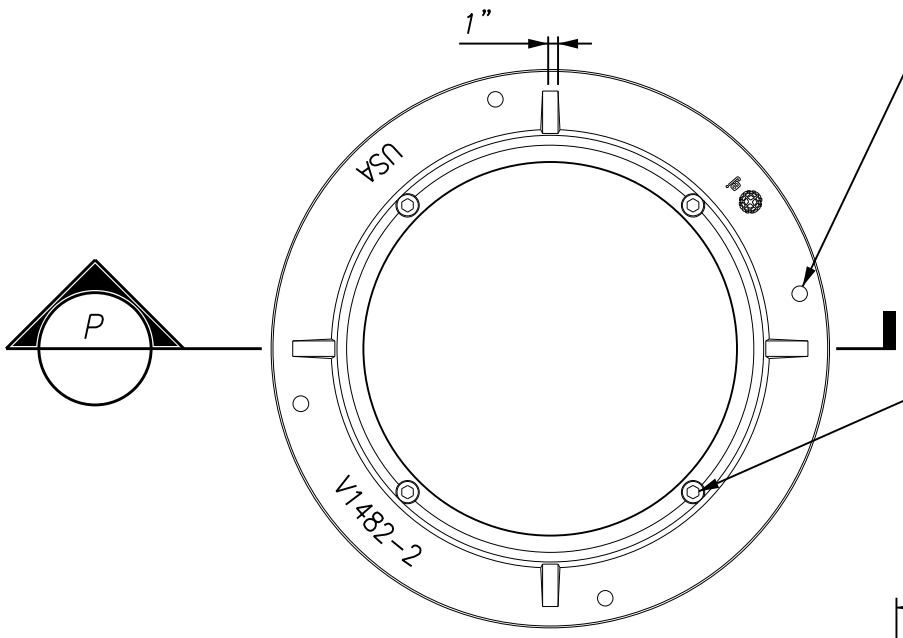
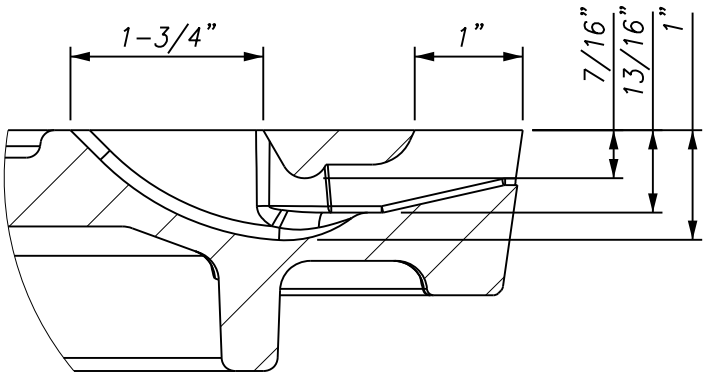
TELEPHONE 844.687.5282

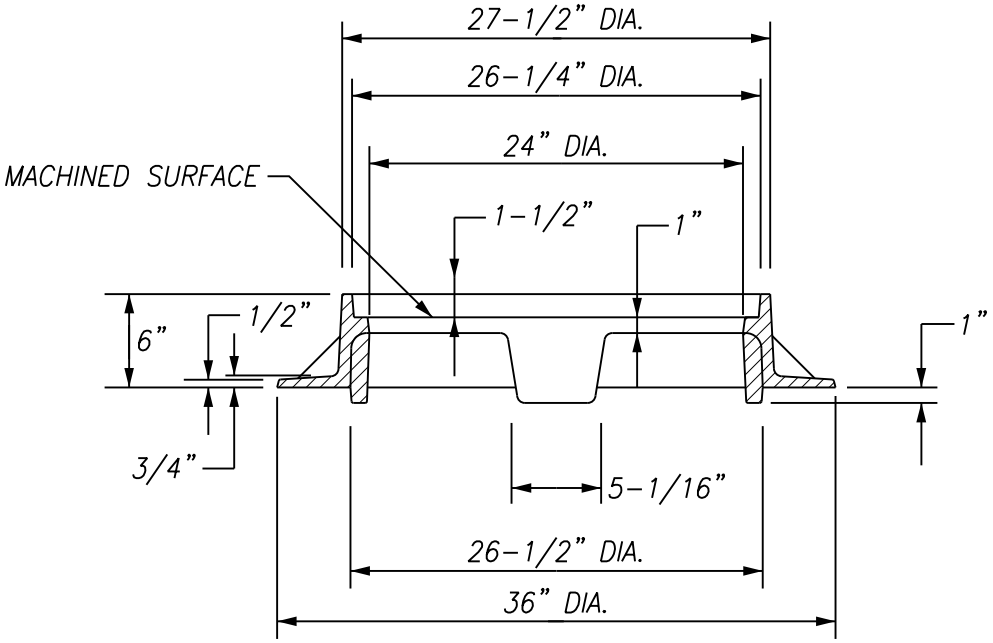
APPROVED BY: LCUB	DRAWN BY: FMA	Scale: NTS	
HEAVY-DUTY WATERTIGHT MANHOLE FRAME & COVER (FOR NEW MANHOLES) 1 OF 2		Date: 07/30/19	
		DRAWING NUMBER: S19.1	



FRAME PLAN



PICKHOLE DETAIL



P SECTION

NOTES:

1. ANCHOR WATERTIGHT FRAME TO MANHOLE WITH (4) EACH 3/4" DIA. x 6" LONG STAINLESS STEEL APPROVED CHEM-SET TYPE ANCHOR BOLTS COMPLETE WITH WASHERS & NUTS.
2. REF. STANDARD DRAWING S19.1.

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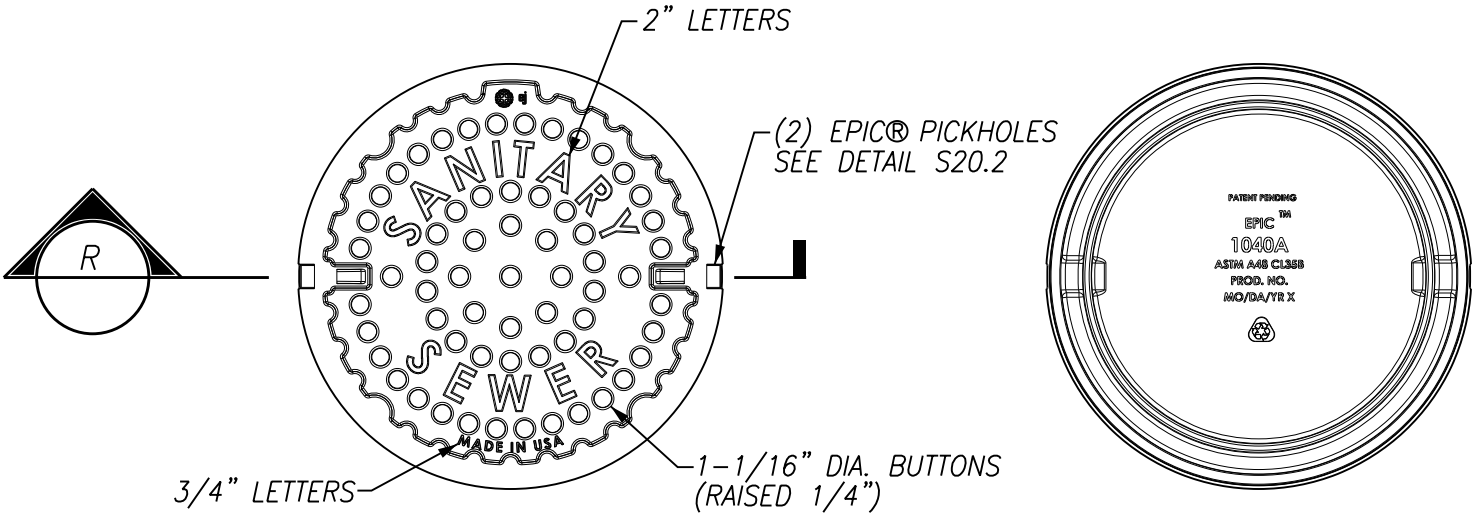
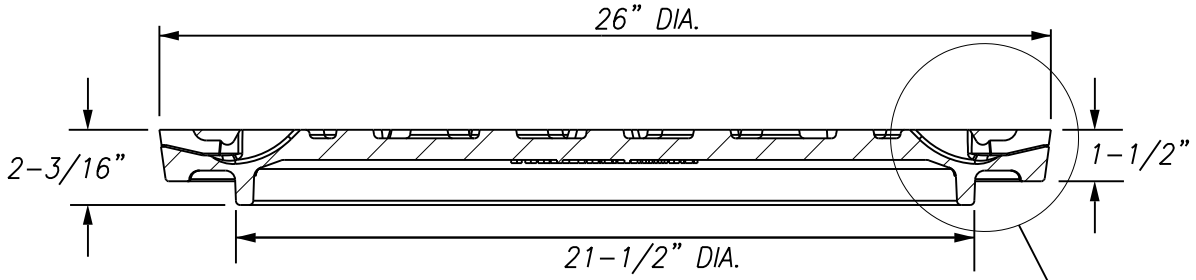
LENOIR CITY, TN 37772
TELEPHONE 844.687.5282

APPROVED BY: LCUB	DRAWN BY: FMA	Scale: NTS
HEAVY-DUTY WATERTIGHT MANHOLE FRAME & COVER (FOR NEW MANHOLES) 2 OF 2		Date: 07/30/19
		DRAWING NUMBER: S19.2



COVER FACE

COVER BACK

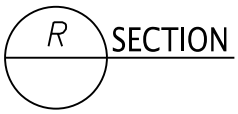


NOTES:

1. COVER SHALL BE AS FOLLOWS:

   A. EJ PRODUCT #00103939, 1040A SOLID COVER SANITARY SEWER, OR

   B. JOHN BOUCHARD & SONS. CO 1156 COVER



SECTION

WEIGHT AS FOLLOWS:

COVER:	125 LBS
FRAME:	211 LBS.
TOTAL:	336 LBS.

2. REF. STANDARD DRAWING S20.2.

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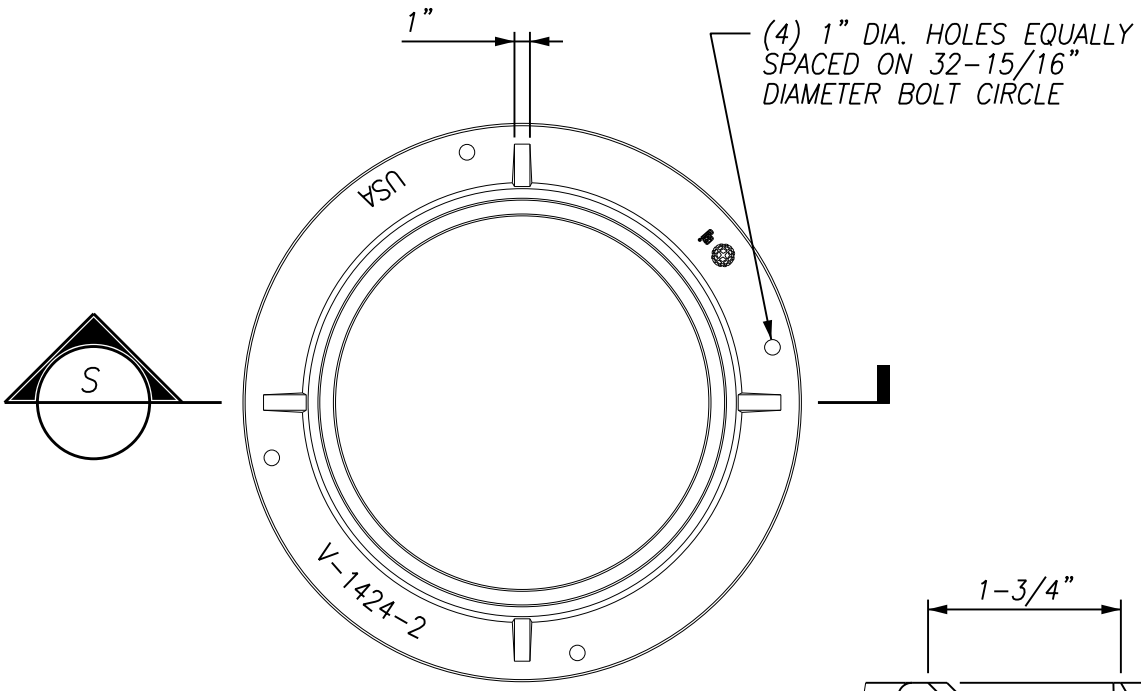
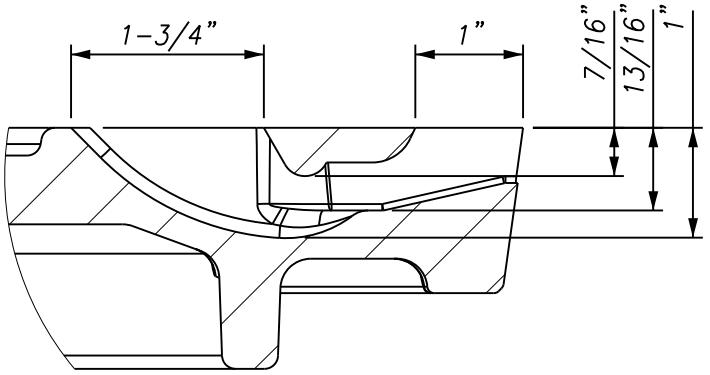
LENOIR CITY, TN 37772
TELEPHONE 844.687.5282

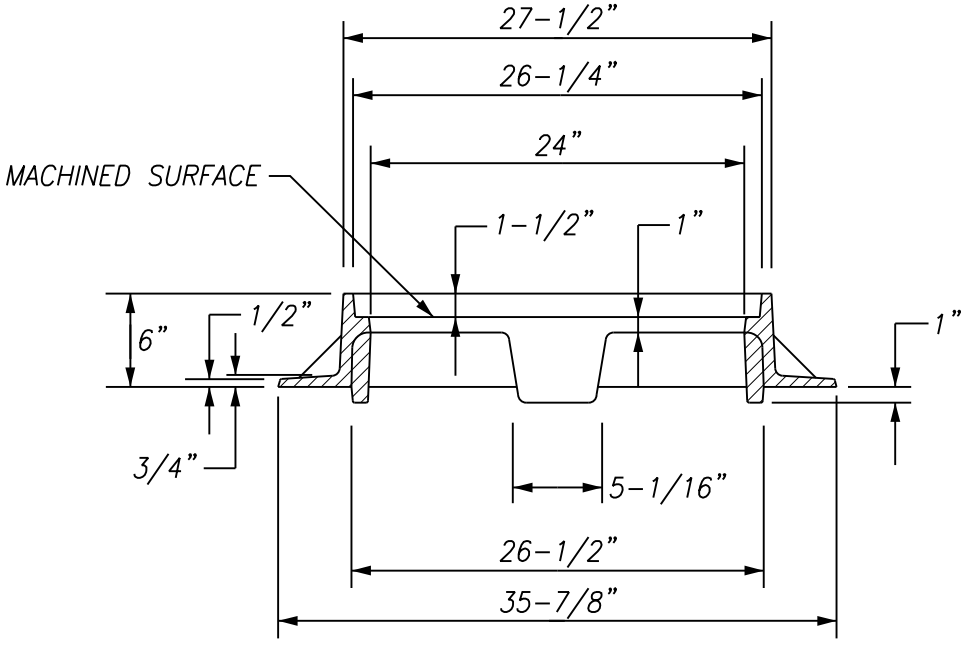
APPROVED BY: LCUB	DRAWN BY: FMA	Scale: NTS	
HEAVY-DUTY STANDARD MANHOLE FRAME & COVER (FOR NEW MANHOLES) 1 OF 2		Date: 07/30/21	
		DRAWING NUMBER: S20.1	



FRAME PLAN



PICKHOLE DETAIL A



S SECTION

NOTES:

1. FRAME TO BE AS FOLLOWS:
   - A. EJ PRODUCT#41424210, V1424-2 6" TALL FRAME WITH CENTERING LUGS, OR
   - B. JOHN BOUCHARD & SONS CO. 1156 FRAME
2. ANCHOR STANDARD FRAME TO MANHOLE WITH (4) EACH 3/4" DIA. x 6" LONG STAINLESS STEEL APPROVED CHEM-SET TYPE ANCHOR BOLTS COMPLETE WITH WASHERS & NUTS.
3. REF. STANDARD DRAWING S20.1.

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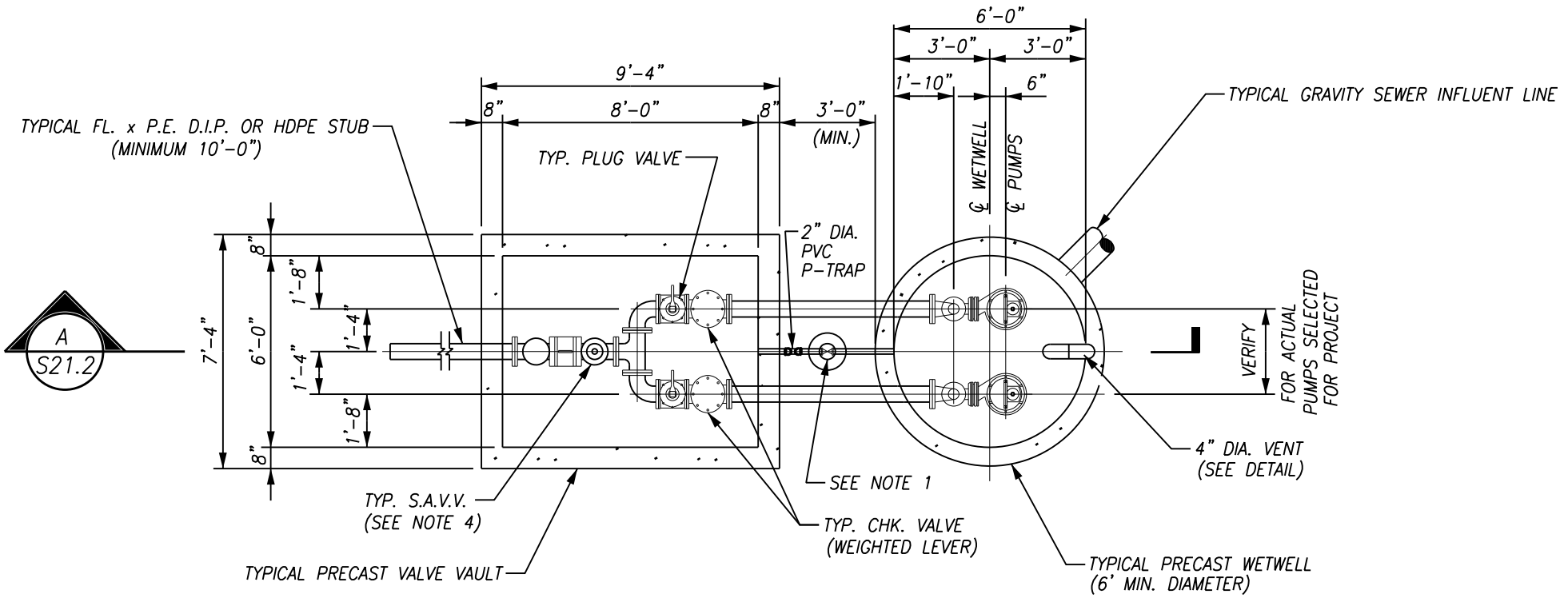
LENOIR CITY, TN 37772
TELEPHONE 844.687.5282

APPROVED BY: LCUB	DRAWN BY: FMA	Scale: NTS
HEAVY-DUTY STANDARD MANHOLE FRAME & COVER (FOR NEW MANHOLES) 2 OF 2		Date: 07/30/21
		DRAWING NUMBER: S20.2



PLAN
NTS

NOTES:

1. INSTALL 2" DIA. PVC DRAIN BETWEEN WETWELL AND VALVE VAULT WITH 2'' BRASS VALVE & C.I. VALVE BOX. SLOPE DRAIN AT 1/8" PER FOOT.
2. VERIFY PIPE PENETRATIONS AND ALL OTHER DIMENSIONS WITH PUMP MANUFACTURER.
3. PRESSURE SENSOR, ISOLATION VALVE, AND OIL FILLED PRESSURE GAUGE (WITH DIMENSIONS IN FEET OF HEAD) SHALL BE "RED VALVE" SERIES 40 OR APPROVED EQUAL AND SHALL BE PRE-ASSEMBLED AND OIL FILLED AT THE FACTORY.
4. S.A.V.V. TO BE 2" ARI MODEL D-025 SEWAGE AIR VACUUM VALVE & 2" ISOLATION VALVE WITH FULL ACCESSORY PACKAGE. PIPE AIR & BLOW-OFF DISCHARGE TO WETWELL.
5. ELECTRICAL CONTROL PANEL LOCATION TO BE DETERMINED BY THE OWNER.
6. ALL MOUNTING HARDWARE TO BE STAINLESS STEEL, NO EXCEPTIONS.
7. THE DEVELOPER OR THEIR CONTRACTOR SHALL CONTACT LCUB TO DETERMINE THE ELECTRICAL SERVICE REQUIREMENTS FOR THE PUMP STATION.
8. DIMENSIONS, SIZES, PIPING, ETC. SHOWN ON THIS DRAWING ARE FOR INFORMATION PURPOSES ONLY. IT IS THE RESPONSIBILITY OF THE DESIGN ENGINEER TO SPECIFY THE EQUIPMENT AND APPURTENANCES APPROPRIATE FOR EACH SPECIFIC PUMP STATION INSTALLATION. PUMP STATION CONTROLS AND DETAILS SHALL BE DESIGNED AND INSTALLED IN ACCORDANCE WITH LCUB'S LATEST UPDATES AND REVISIONS.
9. SUBMERSIBLE SEWAGE PUMP SHALL BE MANUFACTURED BY "FLYGT" OR APPROVED EQUAL.
10. ALL PIPING IN THE WETWELL AND VALVE VAULT SHALL BE FLANGED PIPING AND FITTINGS. FLANGED COUPLING ADAPTERS, RESTRAINT FITTINGS, REPAIR COUPLINGS, ETC. SHALL NOT BE ALLOWED.

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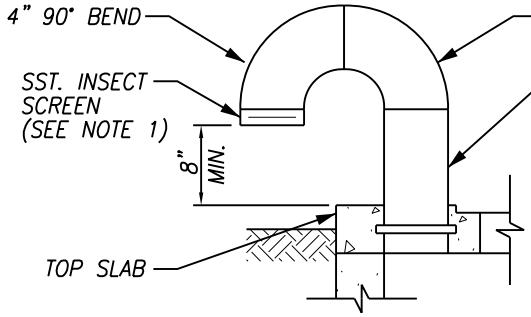
APPROVED BY: LCUB	DRAWN BY: FMA	Scale: NTS
PUMP STATION PLAN		Date: 07/30/19
		DRAWING NUMBER: S21.1

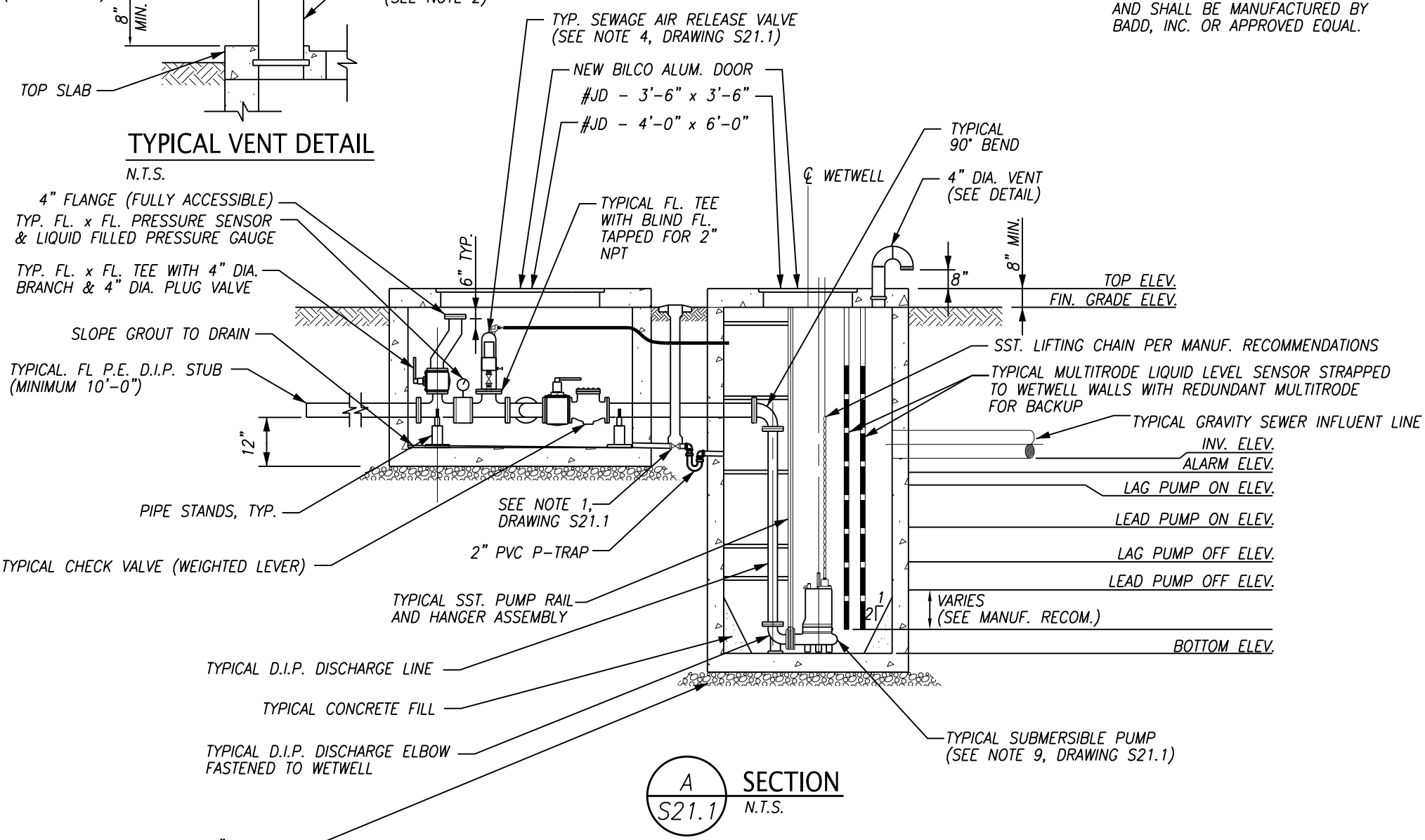


TYPICAL VENT DETAIL

N.T.S.

VENT NOTES:

1. INSTALL 4" DIA. (MIN.) x 10 GA. THICK, FINE MESH SST. INSECT SCREEN.
2. VENT COMPONENTS SHALL BE 304 SST. AND SHALL BE MANUFACTURED BY BADD, INC. OR APPROVED EQUAL.



A / S21.1 SECTION

N.T.S.

LCUB Going the Extra Mile
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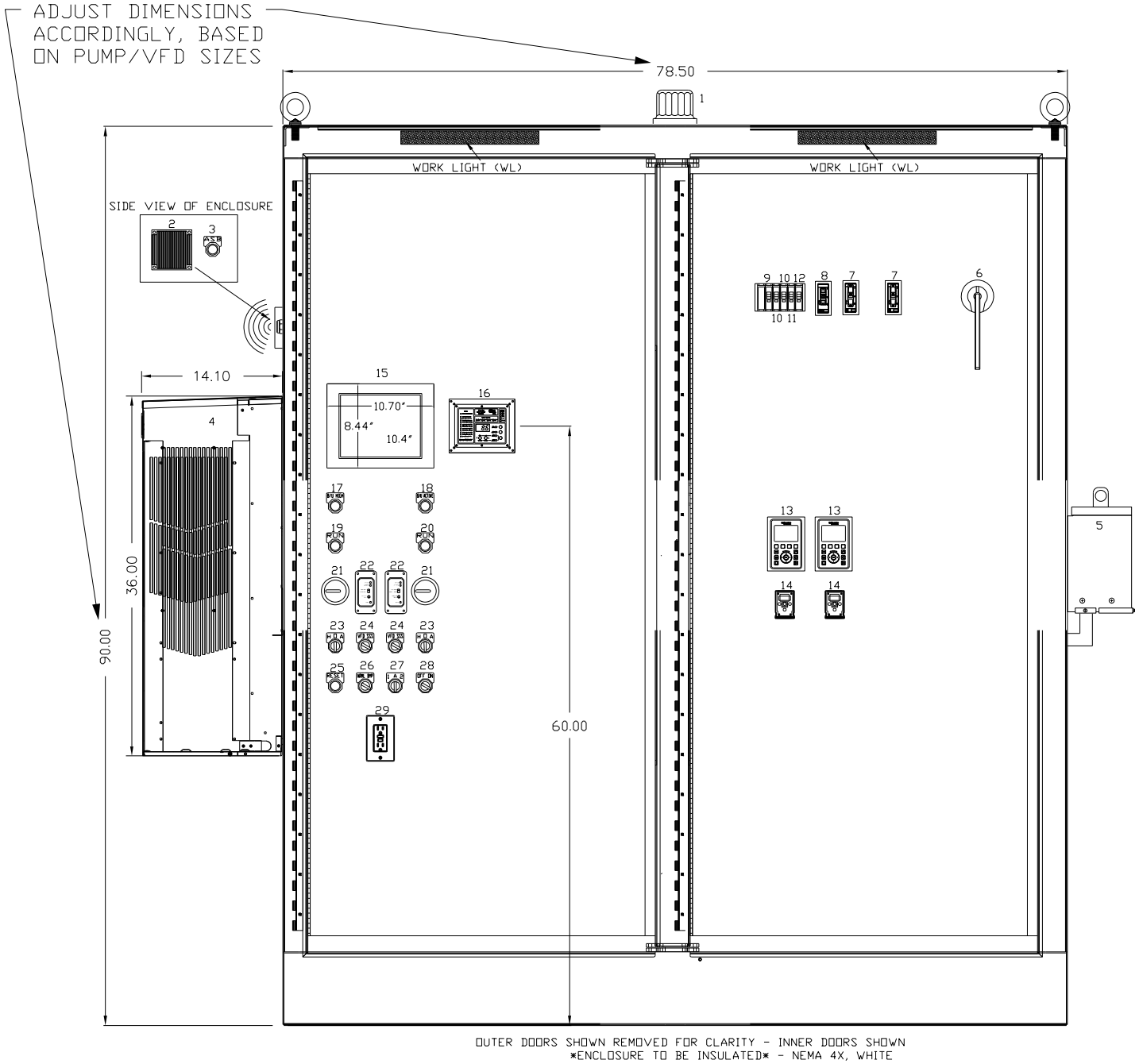
LENOIR CITY, TN 37772
TELEPHONE 844.687.5282

APPROVED BY: LCUB	DRAWN BY: FMA	Scale: NTS
PUMP STATION SECTION		Date: 07/30/19
		DRAWING NUMBER: S21.2



OUTER DOORS SHOWN REMOVED FOR CLARITY - INNER DOORS SHOWN
ENCLOSURE TO BE INSULATED - NEMA 4X, WHITE

1 - AL ALARM LIGHT
2 - AH ALARM HORN
3 - ASB ALARM SILENCE BUTTON
4 - AC AIR CONDITIONER
5 - CPT CONTROL POWER TRANSFORMER
6 - MCB MAIN BREAKER OPERATOR
7 - MB1 & 2 MOTOR BREAKERS 1 & 2
8 - TCB1 TRANSFORMER BREAKER 1 (LINE)
9 - TCB2 TRANSFORMER BREAKER 2 (LOAD)
10 - CB1 & 2 CIRCUIT BREAKERS 1 & 2
11 - DRB DUPLEX RECEPTACLE BREAKER
12 - CCB CONTROL BREAKER
13 - VFD KEYPADS
14 - SSS KEYPADS
15 - HMI HUMAN MACHINE INTERFACE WITH COVER
16 - SC2000 PUMP CONTROLLER
17 - PL1 BACKUP HIGH LEVEL LIGHT
18 - PL2 BACKUP ACTIVE LIGHT
19 - RL1 PUMP 1 RUN LIGHT
20 - RL2 PUMP 2 RUN LIGHT
21 - ETM1 & 2 ELAPSED TIME METERS 1 & 2
22 - PMR PUMP MONITOR RELAYS
23 - HOA HAND-OFF-AUTO SWITCHES
24 - VFD/SSS SELECTOR SWITCHES
25 - BACKUP RESET BUTTON
26 - NORMAL/BYPASS SELECTOR SWITCH
27 - BACKUP MODE PUMP ALTERNATOR SWITCH
28 - WLS WORK LIGHT OFF-ON SWITCH
29 - DR GFI DUPLEX RECEPTACLE

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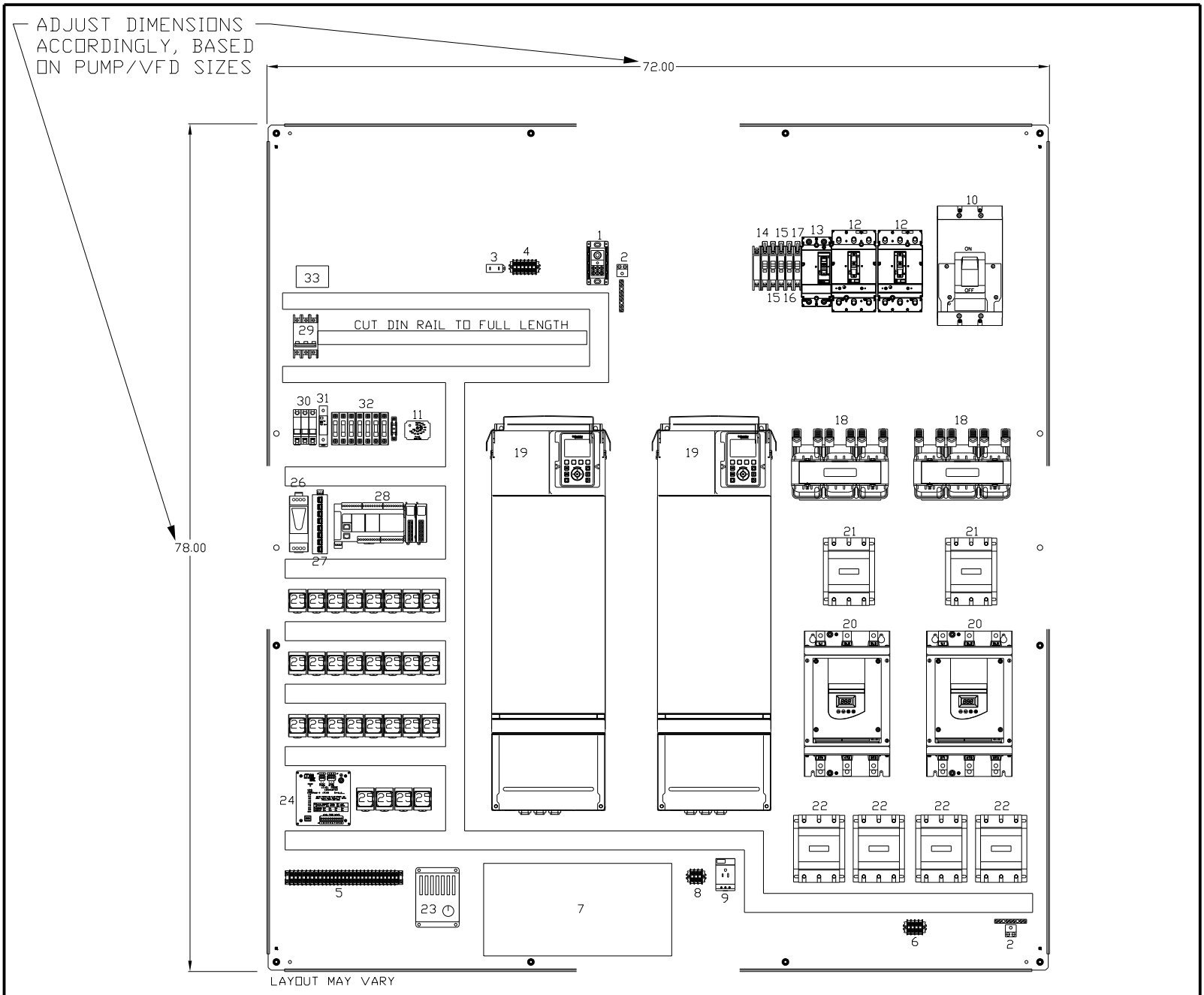
APPROVED BY: LCUB	DRAWN BY: FMA	Scale: NTS
LIFT STATION CONTROL PANEL ENCLOSURE DETAIL (1 OF 2)		Date: 07/30/21
		DRAWING NUMBER: S22.1



1 - N NEUTRAL
2 - G GROUND
3 -FL FLASHER
4 - TS-A TERMINAL STRIP A
5 - TS-B, D & E TERMINAL STRIP B, D & E
6 - TS-C TERMINAL STRIP C
7 - UPS UNINTERRUPTIBLE POWER SUPPLY
8 - UPS LOAD TERMINALS (L,G & N)
9 - SR SINGLE RECEPTACLE (UPS)
10 - MCB MAIN BREAKER
11 - PHASE MONITOR
12 - MB1 & 2 MOTOR BREAKERS 1 & 2
13 - TCB1 TRANSFORMER BREAKER 1 (LINE)
14 - TCB2 TRANSFORMER BREAKER 2 (LOAD)
15 - CB1 & 2 CIRCUIT BREAKERS 1 & 2
16 - DRB DUPLEX RECEPTACLE BREAKER
17 - CCB CONTROL BREAKER
18 - LR1 & 2LINE REACTORS 1 & 2
19 - VFD 1 & 2 VARIABLE FREQUENCY DRIVES 1 & 2
20 - SSS 1 & 2 SOLID STATE STARTERS 1 & 2
21 - SC1 & 2 SHORTING CONTACTORS 1 & 2
22 - IC1 & 2/IC1A & 2A ISOLATION CONTACTORS
23 - HT HEATER W/INTERGRAL THERMOSTAT
24 - MPE LEVEL PROBE SIGNAL CONVERTER
25 - R RELAYS
26 - PS 24VDC POWER SUPPLY
27 - UNMANAGED ETHERNET SWITCH
28 - PLC PROGRAMMABLE LOGIC CONTROLLER
29 - ACB AIR CONDITIONER BREAKER
30 - SPD1 SURGE PROTECTION DEVICE 1
31 - SPD2 SURGE PROTECTION DEVICE 2
32 - F FUSE HOLDERS
33 - MODEM

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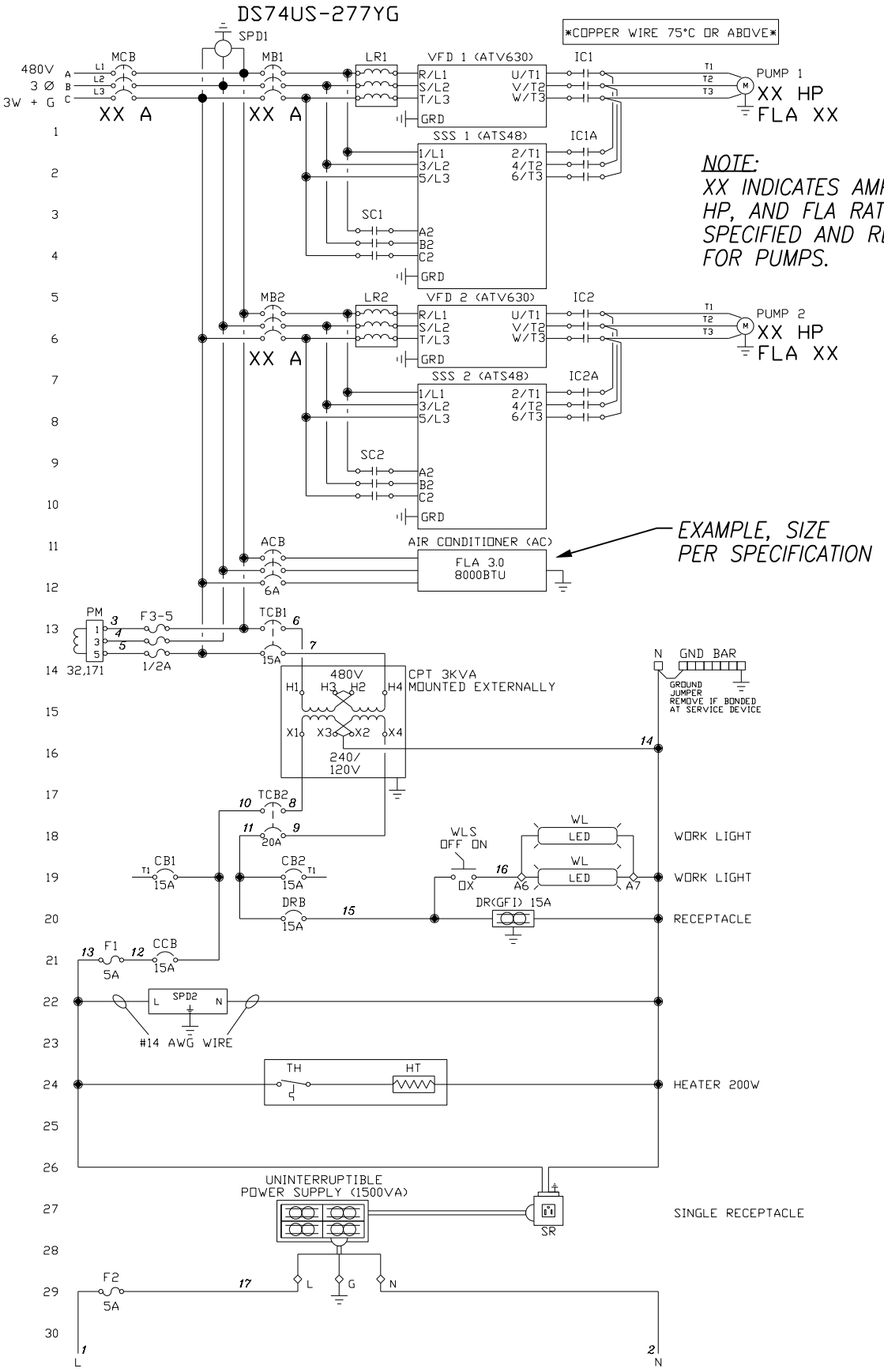
APPROVED BY: LCUB	DRAWN BY: FMA	Scale: NTS
LIFT STATION CONTROL PANEL ENCLOSURE DETAIL (2 OF 2)		Date: 07/30/21
		DRAWING NUMBER: S22.2



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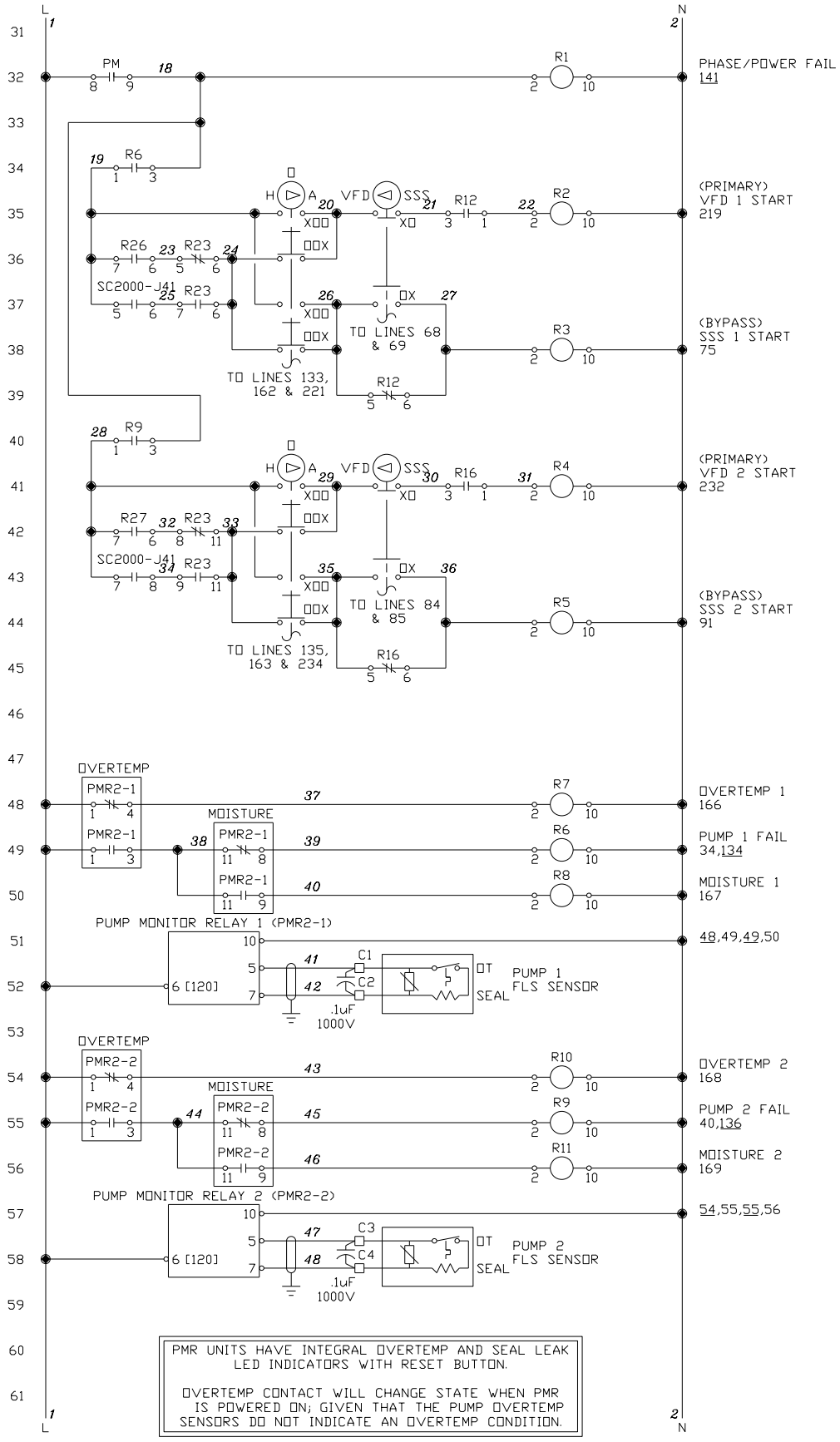
TELEPHONE 844.687.5282

APPROVED BY:	LCUB	DRAWN BY:	FMA	Scale:	NTS

LIFT STATION CONTROL PANEL WIRING DIAGRAM (1 OF 9)

Date: 07/30/21

DRAWING NUMBER: S22.3



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LENOIR CITY, TN 37772
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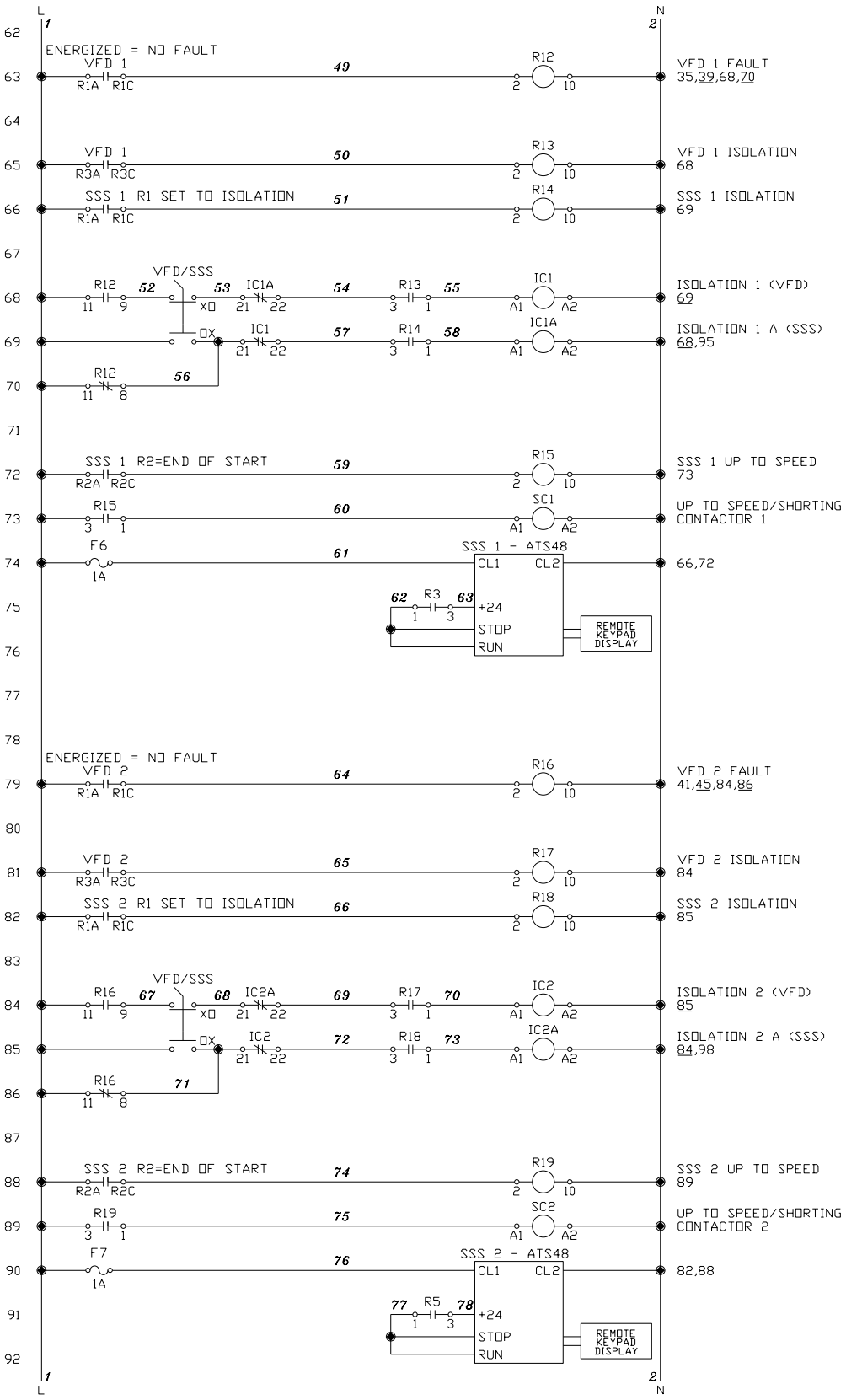
APPROVED BY: LCUB	DRAWN BY: FMA	Scale: NTS
LIFT STATION CONTROL PANEL WIRING DIAGRAM (2 OF 9)		Date: 07/26/21
		DRAWING NUMBER: S22.4



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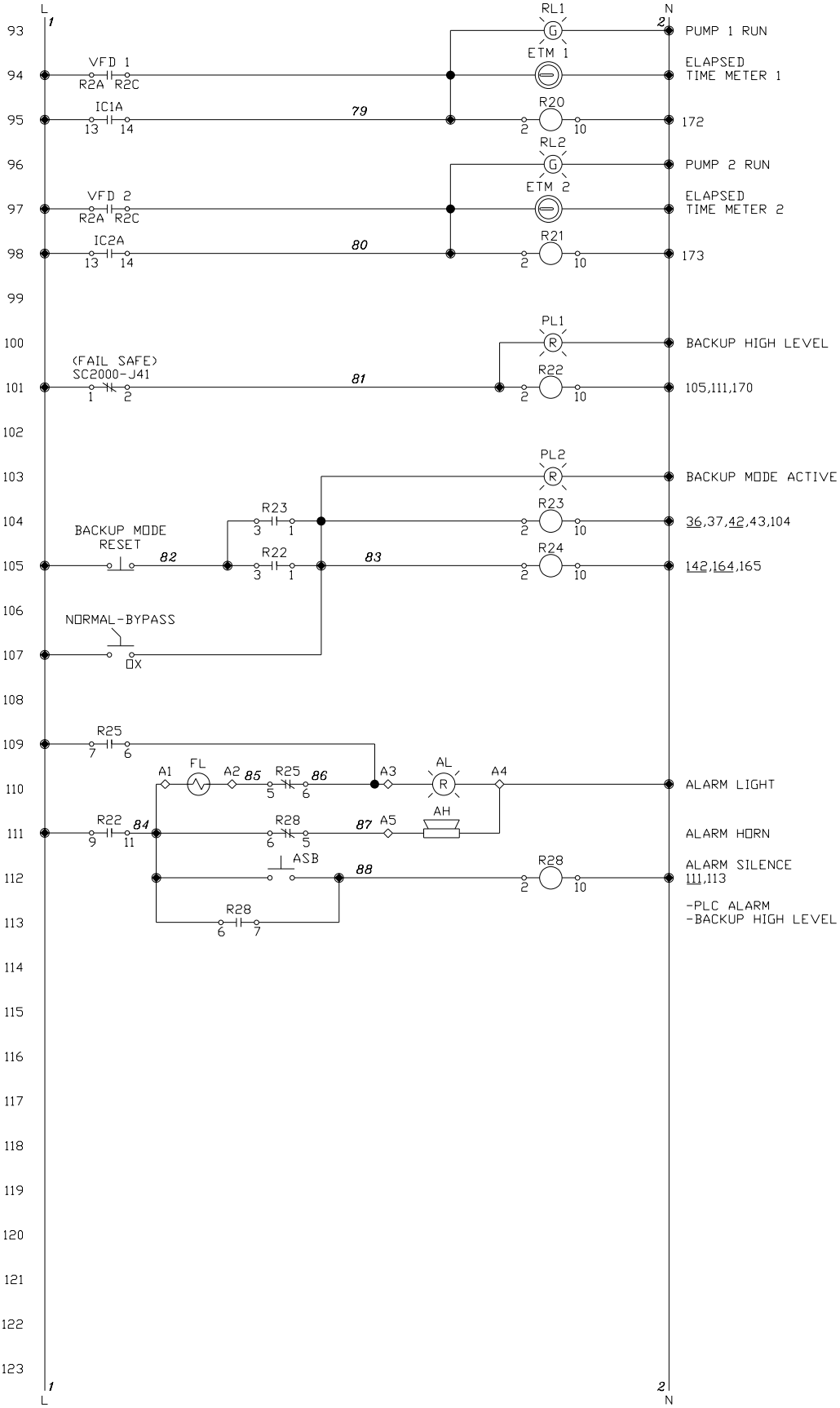
TELEPHONE 844.687.5282

APPROVED BY: LCUB	DRAWN BY: FMA	Scale: NTS
LIFT STATION CONTROL PANEL WIRING DIAGRAM (3 OF 9)		Date: 07/26/21
		DRAWING NUMBER: S22.5



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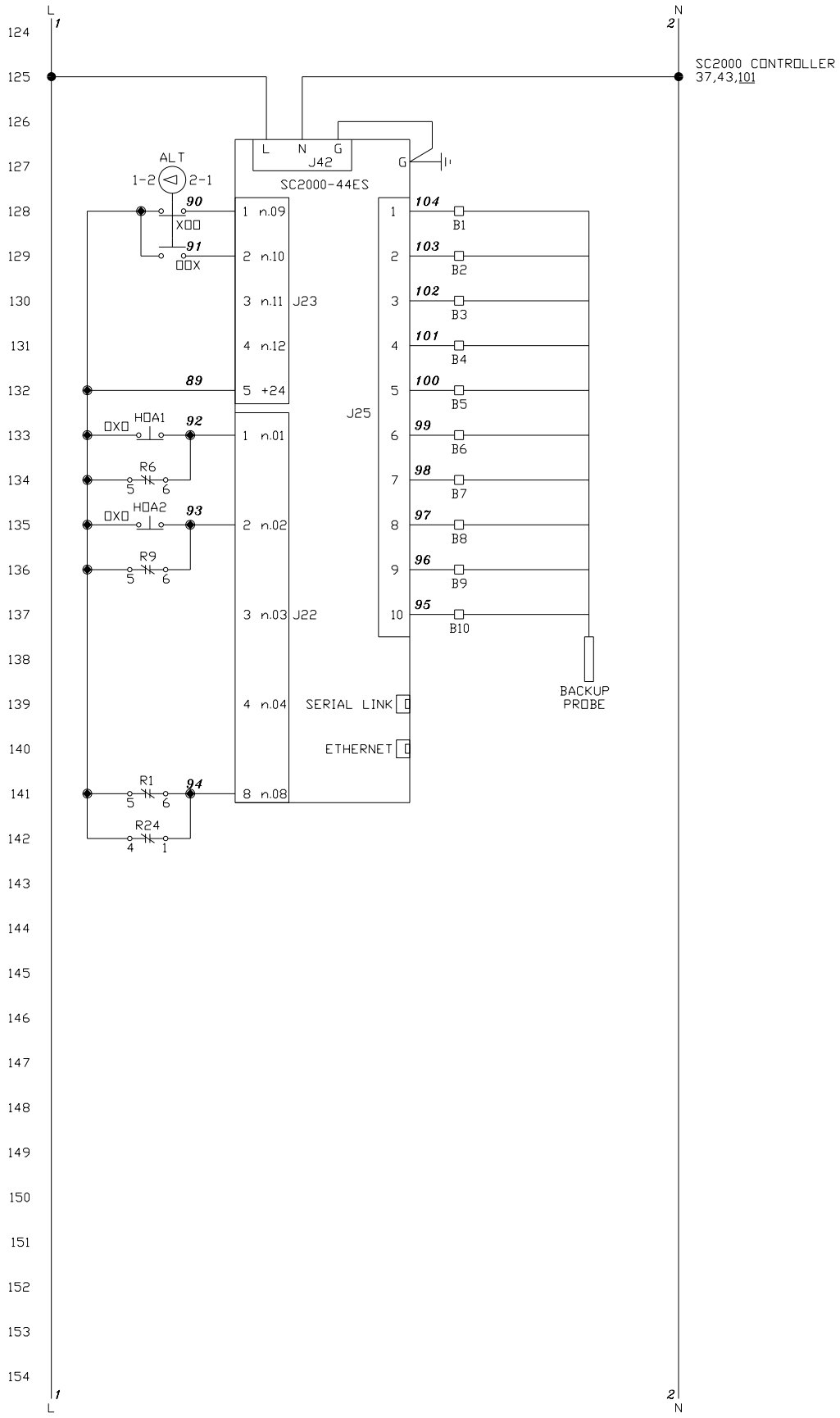
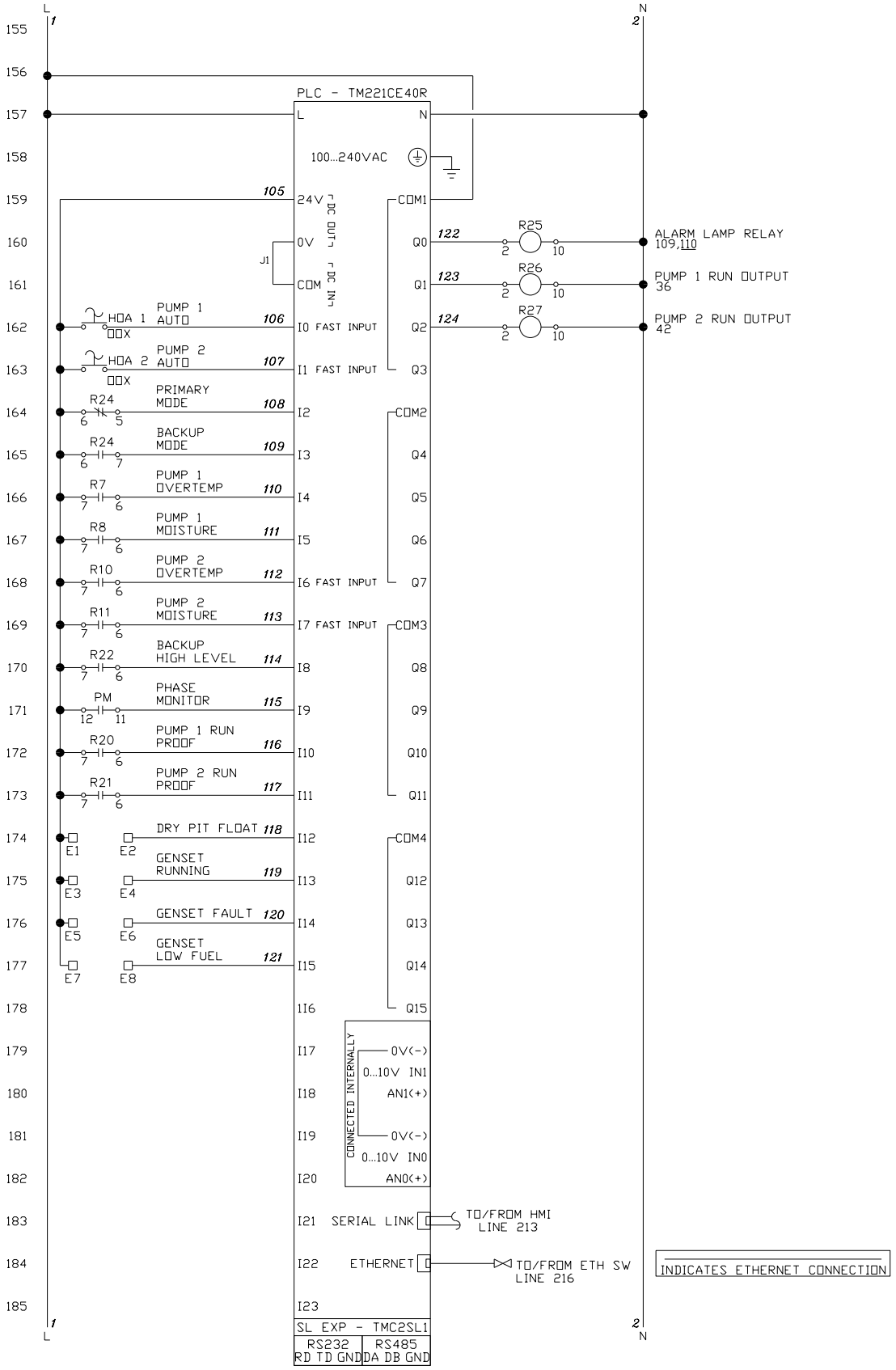
APPROVED BY: LCUB	DRAWN BY: FMA	Scale: NTS
LIFT STATION CONTROL PANEL WIRING DIAGRAM (4 OF 9)		Date: 07/26/21
		DRAWING NUMBER: S22.6



LCUB Going the Extra Mile 7698 CREEKWOOD PARK BLVD. LENOIR CITY, TN 37772 TELEPHONE 844.687.5282	APPROVED BY: LCUB	DRAWN BY: FMA	Scale: NTS
	LIFT STATION CONTROL PANEL WIRING DIAGRAM (5 OF 9)		Date: 07/26/21
			DRAWING NUMBER: S22.7



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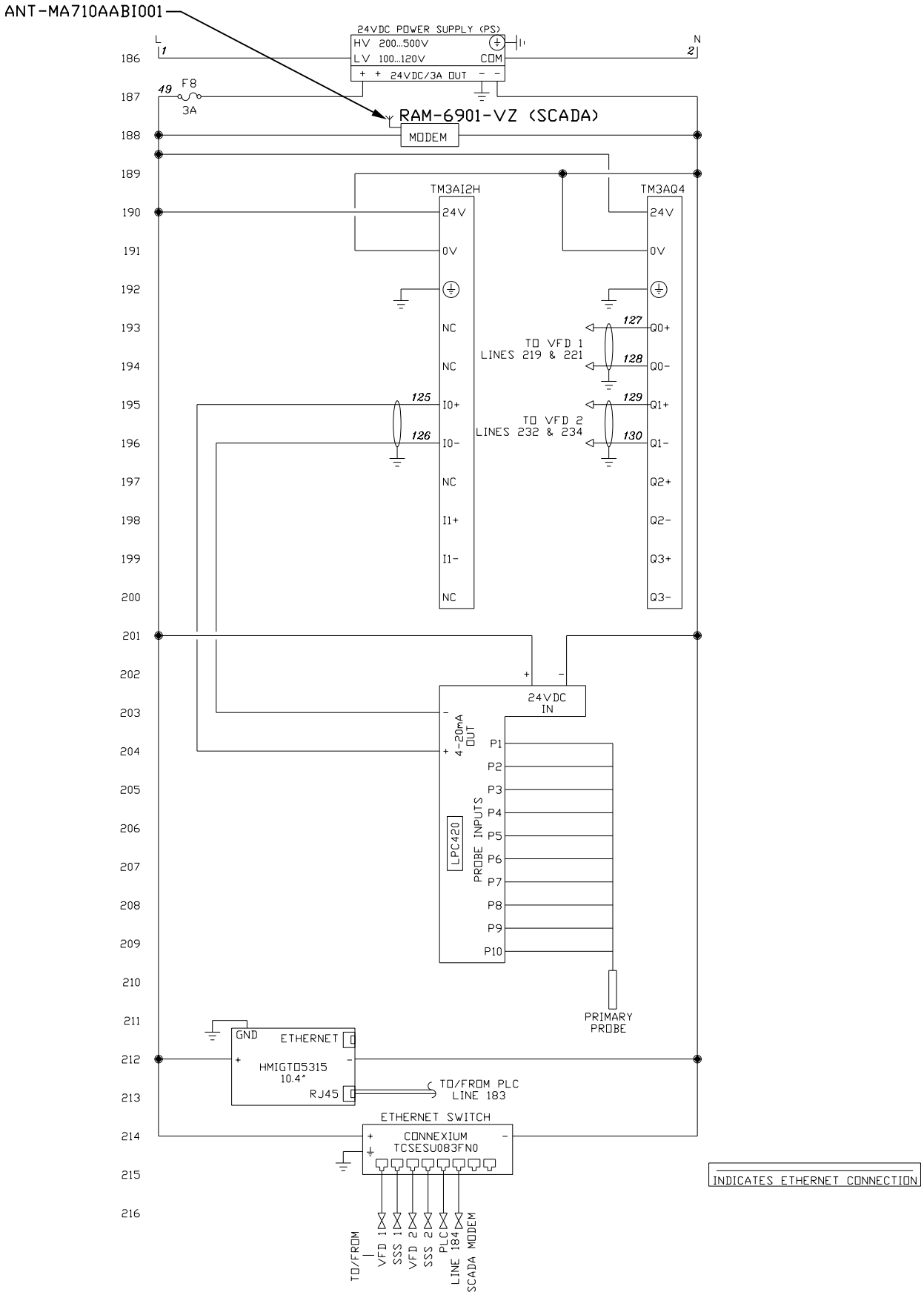
APPROVED BY:	LCUB	DRAWN BY:	FMA	Scale:	NTS

LIFT STATION CONTROL PANEL WIRING DIAGRAM (6 OF 9)

Date: 07/26/21

DRAWING NUMBER: S22.8



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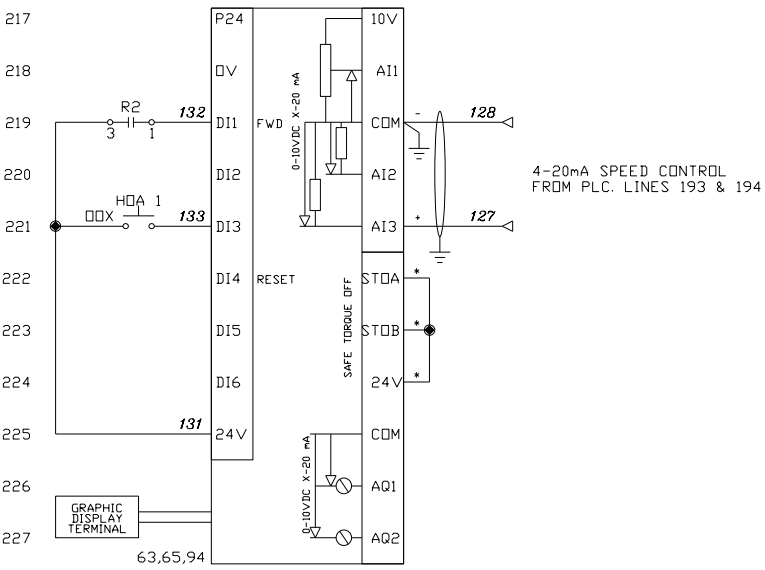
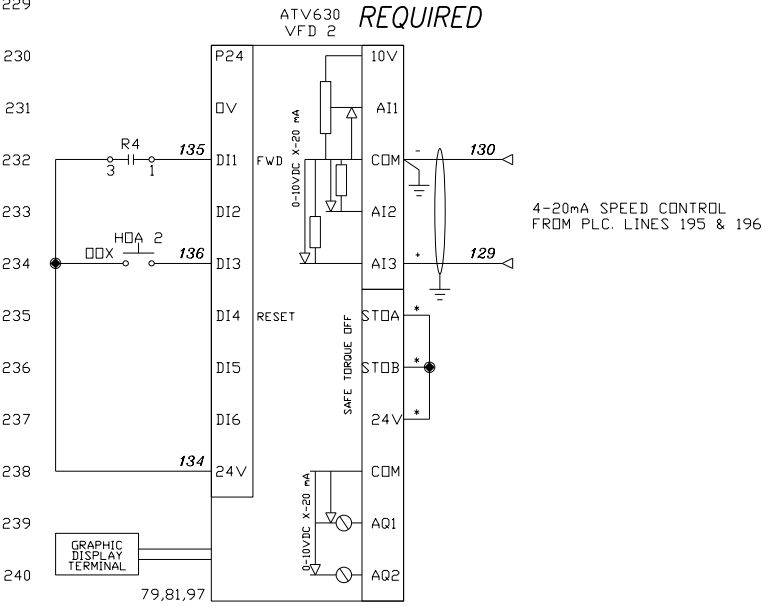
APPROVED BY: LCUB	DRAWN BY: FMA	Scale: NTS
LIFT STATION CONTROL PANEL WIRING DIAGRAM (7 OF 9)		Date: 07/30/21
		DRAWING NUMBER: S22.9

SIZE PER PUMP REQUIRED



4-20mA SPEED CONTROL
FROM PLC. LINES 193 & 194

SIZE PER PUMP REQUIRED



4-20mA SPEED CONTROL
FROM PLC. LINES 195 & 196

LAST WIRE #136

VFD CONFIGURATIONS:

1. SIMPLY START-
   - MOTOR STANDARD = 60Hz NEMA
   - NOMINAL MOTOR POWER = 85HP
   - NOMINAL MOTOR VOLTAGE = 480V
   - NOMINAL MOTOR CURRENT = 110A
   - NOMINAL MOTOR FREQUENCY = 60HZ
   - 2 / 3 WIRE CONTROL = 2 WIRE CONTROL
   - MAXIMUM FREQUENCY = 60HZ
   - MOTOR THERMAL CURRENT = 110A
   - LOW SPEED = 0HZ
   - HIGH SPEED = 60HZ

5. COMPLETE SETTINGS-
   - 5.5 COMMAND & REFERENCE-
     - REF. FREQUENCY 1 CONFIG = REF. FREQ. RMT. TERM.
     - REF. 1B. CHANNEL = AI3
     - REF. 1B. SWITCH = DI3
     - CONTROL MODE = SEPARATE
     - CMD. CHANNEL 1 = TERMINAL
     - CMD. CHANNEL 2 = TERMINAL
     - FREQ. SWITCH ASSIGN. = REF. FREQ. CHANNEL 1
     - 2 WIRE TYPE = LEVEL

   - 5.11 I/O-
     - AI/AQ:
       - AI3 CONFIGURATION:
         - AI3 TYPE = CURRENT
         - MIN. VALUE = 4.0mA
         - MAX. OUTPUT = 20.0mA
     - RELAY:
       - R1 CONFIGURATION = OPERATING STATE FAULT
       - R2 CONFIGURATION = DRIVE RUNNING
       - R3 CONFIGURATION = MAINS CONTACTOR CONTROL

   - 5.12 ERROR/WARNING HANDLING-
     - AUTO FAULT RESET = YES
     - 4-20mA LOSS:
       - AI3 4-20mA LOSS = FALLBACK SPEED
       - FALLBACK SPEED = 60Hz

LCUB Going the Extra Mile
7698 CREEKWOOD PARK BLVD.
LENOIR CITY, TN 37772
TELEPHONE 844.687.5282

APPROVED BY: LCUB	DRAWN BY: FMA	Scale: NTS
LIFT STATION CONTROL PANEL WIRING DIAGRAM (8 OF 9)		Date: 07/30/21
		DRAWING NUMBER: S22.10

Nonintrinsically safe wiring terminals

TERMINAL STRIP ON LPC420

P1	P2	P3	P4	P5	P6	P7	P8	P9	P10

PRIMARY PROBE

TERMINAL STRIP B (TS-B)

1	2	3	4	5	6	7	8	9	10

BACKUP PROBE

TERMINAL STRIP C (TS-C)

1	2	3	4

SF&T SF&T

PUMP 1 PUMP 2
FLS SENSORS

TERMINAL STRIP E (TS-E)

1	2	3	4	5	6	7	8

I0.12 DRY PIT FLOAT
I0.13 GENSET RUNNING
I0.14 GENSET FAULT
I0.15 GENSET LOW FUEL

TERMINATIONS SHOWN ON THE BOTTOM OF THE TERMINAL STRIP ARE ENTERING CONTROL PANEL. TERMINATIONS SHOWN ON THE TOP OF THE TERMINAL STRIP ARE SIGNALS LEAVING CONTROL PANEL.

COPPER WIRE 75°C OR ABOVE

INDICATES DEVICES AND/OR CONNECTIONS BY INSTALLER

FUSE REPLACEMENT CHART	
FUSE	REPLACEMENT
F1,2	KTK-R-5/600V
F3-5	KTK-R-1/2/600V
F6,7	FNQ-R-1/600V
F8	ABC-3-R

EXAMPLE NAME PLATE, UPDATE PER PROJECT

CUSTOMER	NEDROW & ASSOCIATES			
JOB NAME	HWY 321 LCUB			
ENCLOSURE UL TYPE RATING: 1				
VOLTAGE	480	PHASE 3		HZ 60
H.P.	#1 85	#2 85	#3 X	#4 X
F.L.A.	110	110	X	X
TOTAL F.L.A. 230				
SERIAL #	21-0646		DATE: 2021	
SCCR:	10 KA SYMMETRICAL RMS, 480 V. MAX.			
MANUFACTURED BY:				
STA CON INC 2525 S. OBT APOPKA FL 32703				

T&B BLACKBURN LUG TORQUE TIGHTENING	
Wire Range/Screw Type & Wrench Size AWG CU	Torque lb-in.
(SLOTTED) 10-14	20
(SLOTTED) 8	25
(SLOTTED) 4-6	35
(SLOTTED) 2-2/0	50
(3/16 HEX) 2/0	100
(5/16 HEX) 3/0[250]-350	275
(3/8 HEX) 500-600	450*
(3/8 HEX) 750-1000	550
*=UNLESS OTHERWISE NOTED ON CONNECTOR	

SQD Ground Busbar PK7GTA, PK12GTA, PK15GTA	
Wire Range AWG CU-AL	Torque lb-in.
14-10 CU, 12-10 AL	20
8	25
6-4	35
Two 14 or 12 CU, Two 12 or 10 AL	25

SQD Terminal Block GK6 + GR6 + GC6	
Wire Range AWG CU	Torque lb-in.
(Type GK6) 22-10	11-12
(Type GR6) 22-8	18-20
(Type GC6) 18-4	32-35

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LENOIR CITY, TN 37772
TELEPHONE 844.687.5282

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LIFT STATION CONTROL PANEL WIRING DIAGRAM (9 OF 9)

Date: 07/30/21

DRAWING NUMBER: S22.11

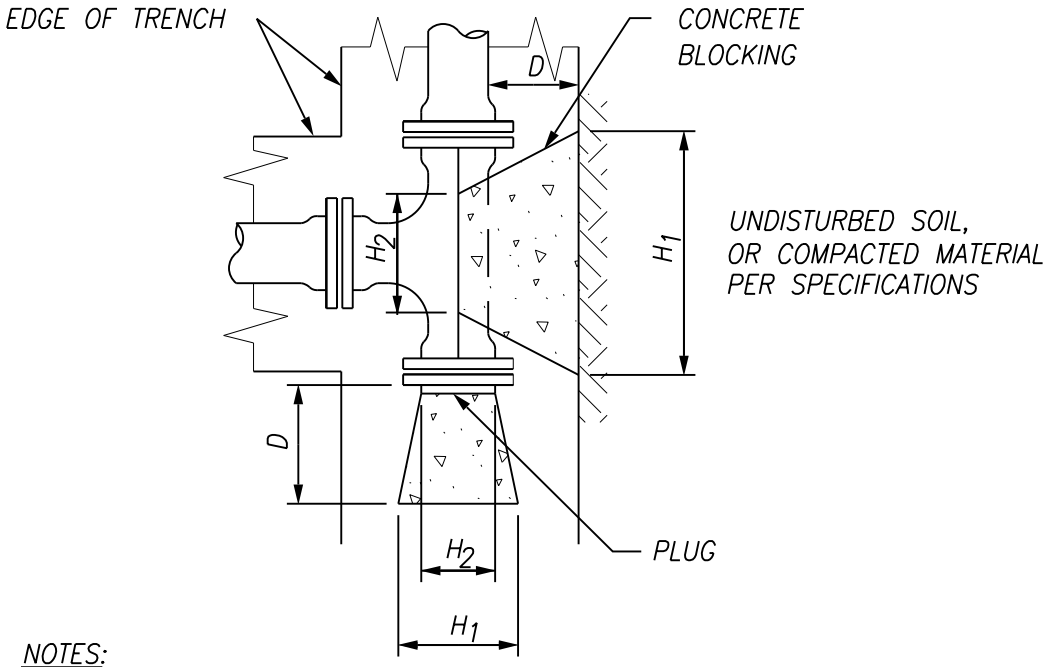

TABLE OF DIMENSIONS FOR CONCRETE BLOCKING					
SIZE PIPE (INCHES)	TEES, PLUGS CROSSES				
	H_1	H_2	V	D	CU FT.
2&2-1/4	18	10	12	18	1.9
3 & 4	24	12	12	18	2.3
6	24	16	18	18	3.5
8	36	18	18	18	5.1
10	48	24	18	24	7.2
12	54	30	24	24	13.4
16	60	34	36	24	22.5

NOTES:

1. THRUST BLOCKING BASED UPON AN INTERNAL HYDROSTATIC PRESSURE OF 200 PSI AND AN ALLOWABLE SOIL BEARING CAPACITY OF 4000 LBS/SF. SHOULD HYDROSTATIC PRESSURE BE GREATER AND/OR SOIL BEARING CAPACITY SHOULD BE LESS THAN THAT NOTED ABOVE, CONTRACTOR SHALL INCREASE SIZE AS REQUIRED AND PROVIDE CALCULATIONS TO SUPPORT SAID MODIFICATION.
2. LCUB SHALL APPROVE ALL THRUST BLOCKS.
3. FITTING JOINTS SHALL NOT BE POURED IN CONCRETE OR HAVE CONCRETE SPILLED ON THE BOLTS OR NUTS. WRAP ALL FITTINGS, BOLTS, FLANGES, ETC. IN 6 MIL PLASTIC PRIOR TO PLACING CONCRETE.
4. CONTRACTOR SHALL BE RESPONSIBLE FOR PROPER APPLICATION OF THRUST RESTRAINT SYSTEM TO PREVENT MOVEMENT OF PIPE AND FITTINGS.
5. ALL FITTINGS SHALL BE MECHANICAL JOINT AND HAVE RESTRAINED JOINTS AT THE FITTING IN ADDITION TO THE CONCRETE THRUST BLOCK. ALSO, DUCTILE IRON PIPE SHALL BE INSTALLED WITH JOINT RESTRAINING GASKETS FOR THE REQUIRED DISTANCES FROM EACH FITTING AS SPECIFIED ON DETAILS S23.4 AND S23.5.
6. DIMENSIONS FOR THRUST BLOCKS FOR CAPS AND VALVES SHALL BE THE GREATER OF THE VALUE SHOWN IN THE TABLE OR THE VALUE GOVERNED BY TRENCH WIDTH SHOWN IN THE DETAIL.

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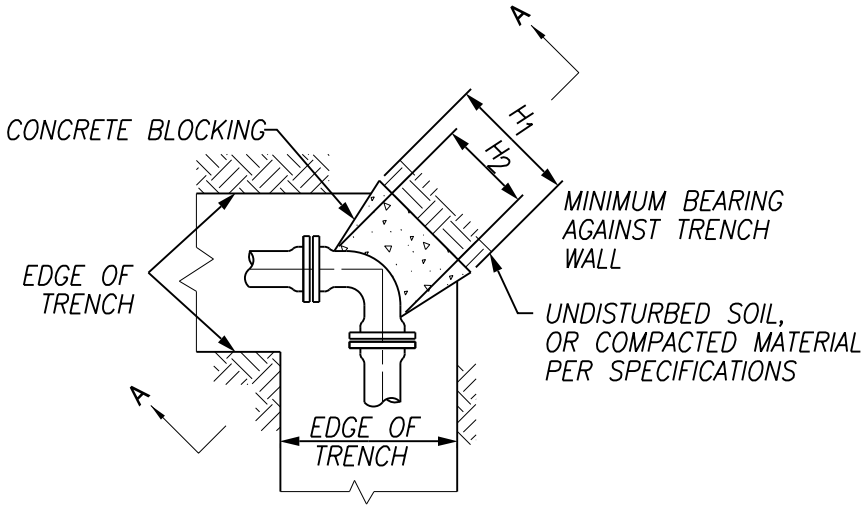
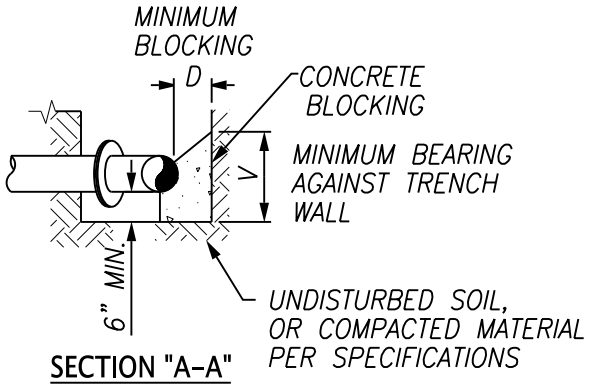
APPROVED BY: LCUB	DRAWN BY: FMA	Scale: NTS
TYPICAL THRUST BLOCKS FOR TEES, PLUGS, AND CROSSES		Date: 07/30/19
		DRAWING NUMBER: S23.1



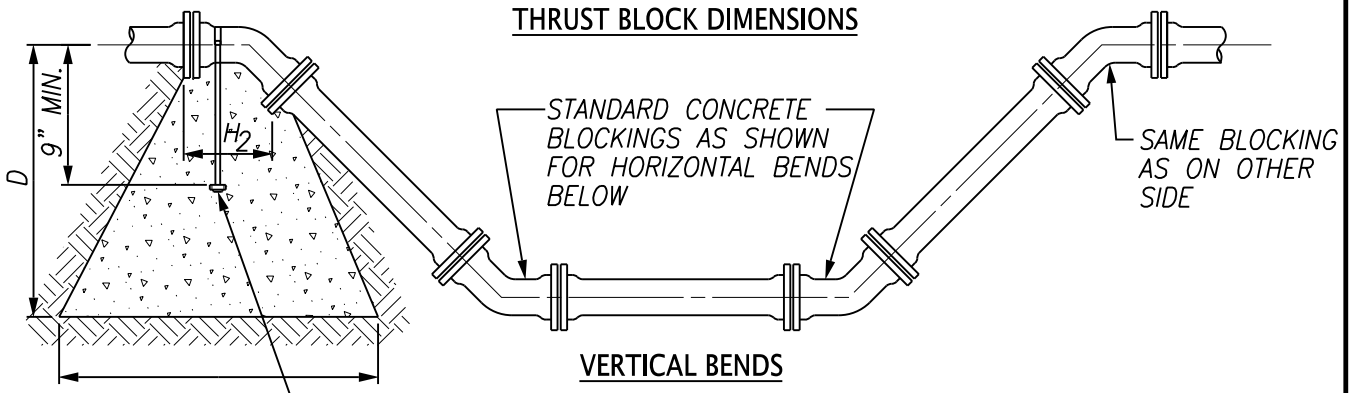
HORIZONTAL BENDS



SECTION "A-A"

TABLE OF DIMENSIONS FOR CONCRETE BLOCKING																					
SIZE	90° BENDS					45° BENDS					22 1/2° BENDS					11 1/4° BENDS					SIZE
PIPE (INCHES)	H_1	H_2	V	D	CU FT.	H_1	H_2	V	D	CU FT.	H_1	H_2	V	D	CU FT.	H_1	H_2	V	D	CU FT.	PIPE
2&2-1/4	18	10	12	18	1.9	18	6	12	18	1.5	18	6	12	18	1.5	18	6	12	18	1.5	2&2-1/4
3 & 4	24	12	12	18	2.3	18	8	12	18	1.6	18	8	12	18	1.6	18	8	12	18	1.6	3 & 4
6	30	16	18	18	4.1	24	10	16	18	3.2	24	10	16	18	3.2	24	10	16	18	3.2	6
8	39	18	24	18	7.3	30	11	18	18	4.0	24	11	18	18	3.5	24	11	16	18	3.4	8
10	54	32	24	18	10.3	24	18	21	18	4.6	24	18	21	18	4.6	24	18	21	18	4.6	10
12	54	32	36	24	18.2	42	18	24	24	9.6	24	18	24	24	6.6	24	18	21	24	6.1	12
16	69	48	48	24	29.0	48	30	36	24	17.0	36	30	27	24	11.8	27	24	27	24	9.1	16

THRUST BLOCK DIMENSIONS



3/4" THREADED ROD W/HEX NUTS AND 4"x4"x1/4" PLATE WASHER

VERTICAL BENDS

NOTES:

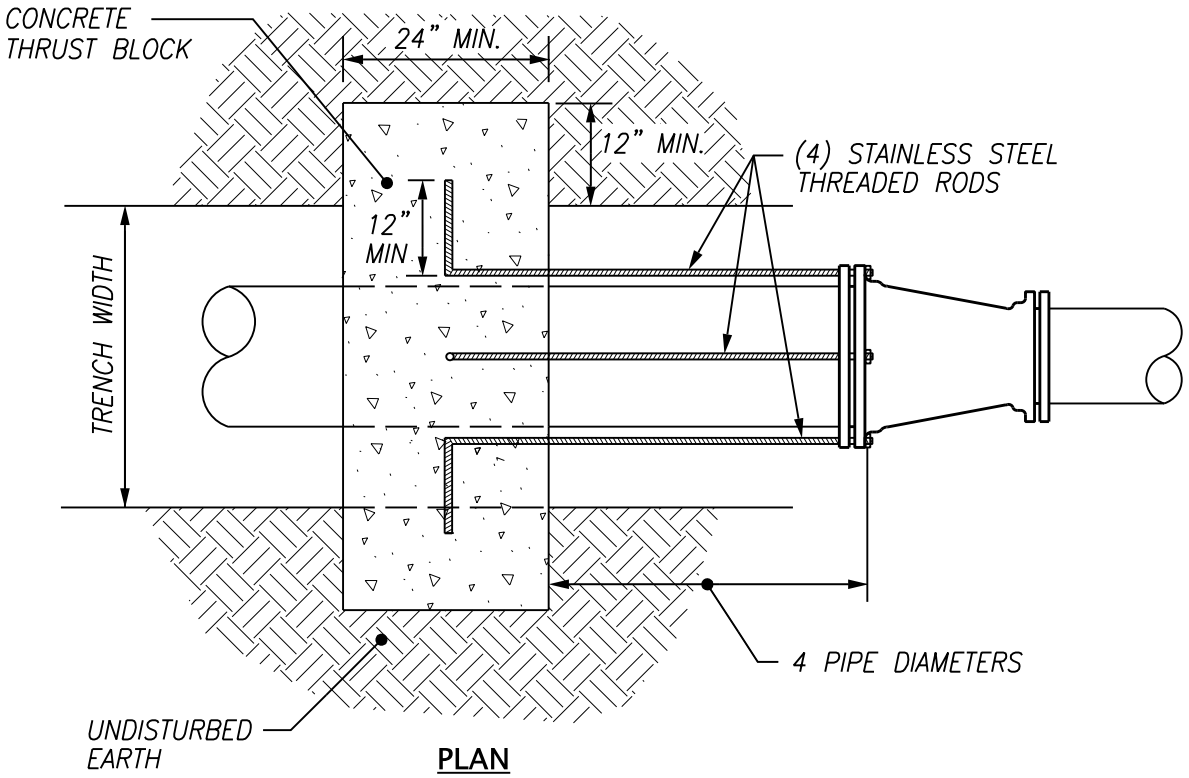
1. THRUST BLOCKING BASED UPON AN INTERNAL HYDROSTATIC PRESSURE OF 200 PSI AND AN ALLOWABLE SOIL BEARING CAPACITY OF 4000 LBS/SF. SHOULD HYDROSTATIC PRESSURE BE GREATER AND/OR SOIL BEARING CAPACITY SHOULD BE LESS THAN THAT NOTED ABOVE, CONTRACTOR SHALL INCREASE SIZE AS REQUIRED AND PROVIDE CALCULATIONS TO SUPPORT SAID MODIFICATION.
2. LCUB SHALL APPROVE ALL THRUST BLOCKS.
3. FITTING JOINTS SHALL NOT BE POURED IN CONCRETE OR HAVE CONCRETE SPILLED ON THE BOLTS OR NUTS. WRAP ALL FITTINGS AND PIPE IN PLASTIC PRIOR TO PLACING CONCRETE.
4. CONTRACTOR SHALL BE RESPONSIBLE FOR PROPER APPLICATION OF THRUST RESTRAINT SYSTEM TO PREVENT MOVEMENT OF PIPE AND FITTINGS.
5. ALL FITTINGS SHALL BE MECHANICAL JOINT AND HAVE RESTRAINED JOINTS AT THE FITTING AND FOR THE DISTANCE SPECIFIED IN STANDARD DETAILS S23.4 AND S23.5.
6. DIMENSIONS FOR THRUST BLOCKS FOR CAPS AND VALVES SHALL BE THE GREATER OF THE VALUE SHOWN IN THE TABLE OR THE VALUE GOVERNED BY TRENCH WIDTH SHOWN IN THE DETAIL.

LCUB Going the Extra Mile
7698 CREEKWOOD PARK BLVD.
LENOIR CITY, TN 37772
TELEPHONE 844.687.5282

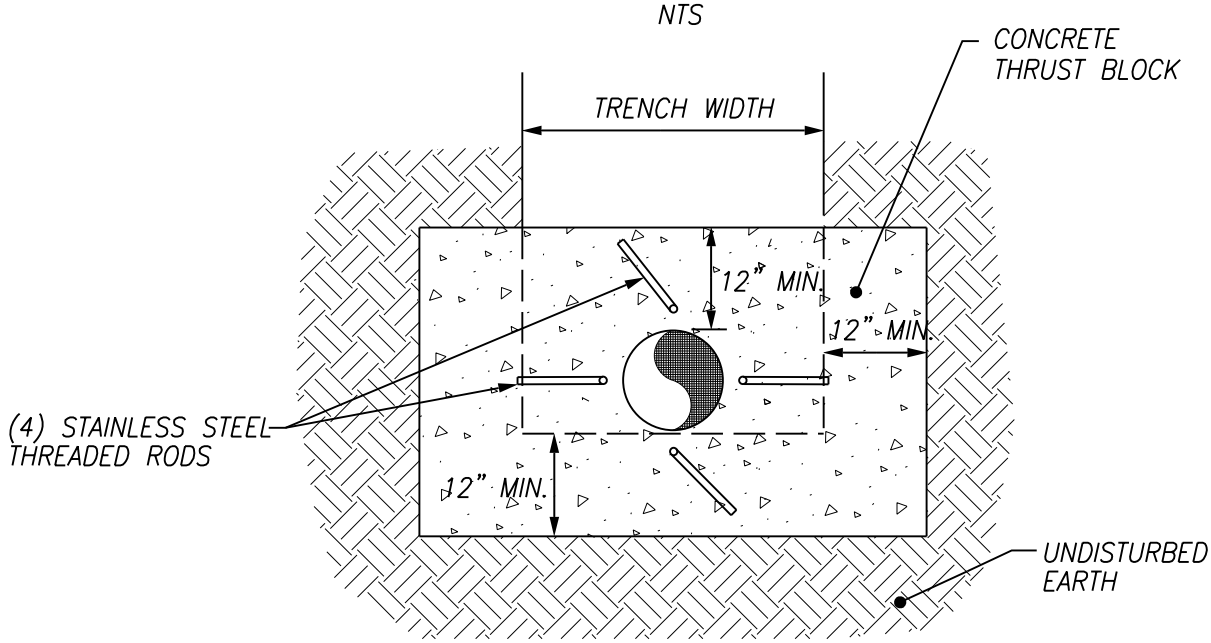
APPROVED BY:	LCUB	DRAWN BY:	FMA	Scale:	NTS
				Date:	07/30/19

THRUST BLOCK AND ANCHOR BLOCK FOR BENDS

DRAWING NUMBER: S23.2



PLAN
NTS



SECTION
NTS

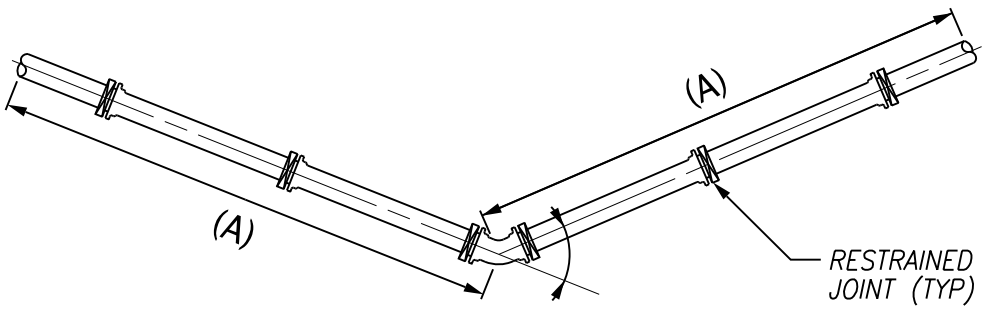
NOTES:

1. *CONCRETE SHALL BE 4,000 PSI FROM A COMMERCIAL PLANT.*

2. *ALL FITTINGS SHALL BE MECHANICAL JOINT AND HAVE RESTRAINED JOINTS AT THE FITTING IN ADDITION TO THE CONCRETE THRUST BLOCK. ALSO, DUCTILE IRON PIPE SHALL BE INSTALLED WITH JOINT RESTRAINING GASKETS FOR THE REQUIRED DISTANCES FROM EACH FITTING AS SPECIFIED ON DETAILS S23.4 AND S23.5.*

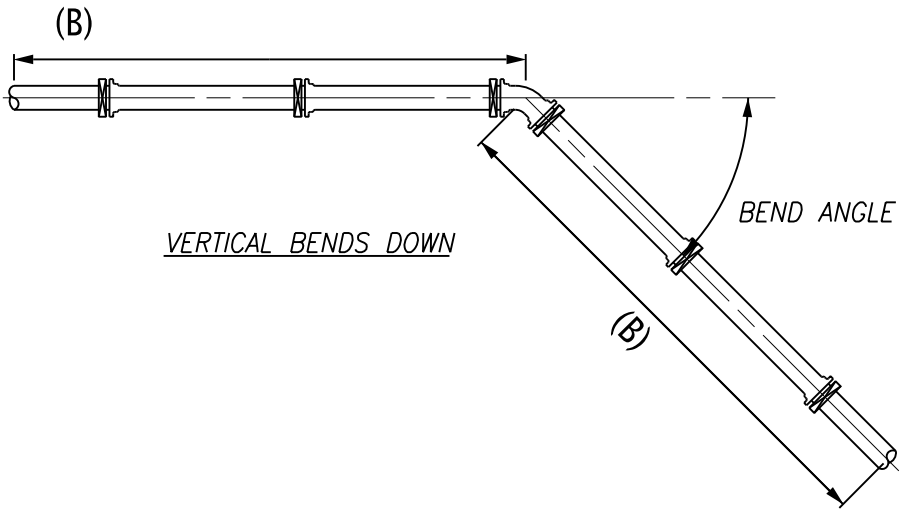
LCUB
Going the Extra Mile
7698 CREEKWOOD PARK BLVD.
LENOIR CITY, TN 37772
TELEPHONE 844.687.5282

APPROVED BY: LCUB	DRAWN BY: FMA	Scale: NTS
TYPICAL THRUST BLOCK FOR REDUCER DETAIL		Date: 07/30/19
		DRAWING NUMBER: S23.3

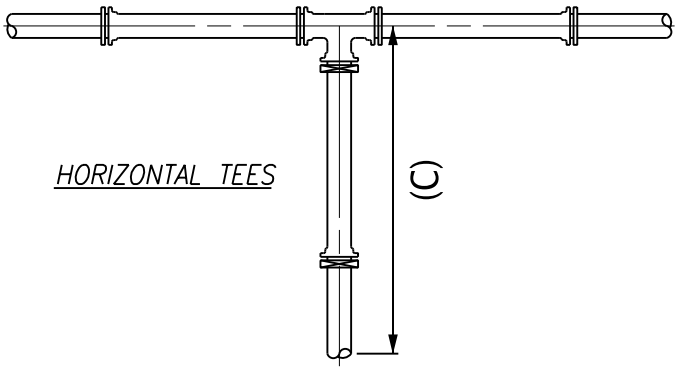


HORIZONTAL BENDS AND VERTICAL BENDS UP

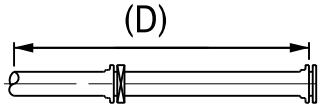
BEND ANGLE



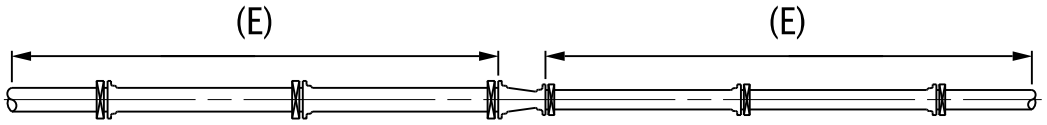
VERTICAL BENDS DOWN



HORIZONTAL TEES



DEAD ENDS



REDUCERS

NOTES:

1. SEE DETAIL S23.5 FOR RESTRAINED JOINT DIMENSION TABLE.

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Going the Extra Mile
7698 CREEKWOOD PARK BLVD.
LENOIR CITY, TN 37772
TELEPHONE 844.687.5282

APPROVED BY: LCUB	DRAWN BY: FMA	Scale: NTS
RESTRAINED JOINT DIMENSIONS		Date: 07/30/19
		DRAWING NUMBER: S23.4

TABLE OF LENGTHS REQUIRING JOINT RESTRAINT FOR DUCTILE IRON PIPE

NOMINAL PIPE DIAMETER (INCHES)	(A) RESTRAINED LENGTH FOR HORIZONTAL BENDS AND FOR VERTICAL UP BENDS BY FITTING TYPE (FEET)				(B) RESTRAINED LENGTH FOR VERTICAL BENDS DOWN BY FITTING TYPE (FEET)				(C) RESTRAINED LENGTH FOR HORIZONTAL TEES BY BRANCH SIZE (FEET)	(D) RESTRAINED LENGTH FOR DEAD ENDS (FEET)	REDUCERS		
	11.25	22.5	45	90	11.25	22.5	45	90			LARGER PIPE SIZE (INCHES)	SMALLER PIPE SIZE (INCHES)	(E) RESTRAINED LENGTH (FEET)
4	3	6	13	31	5	11	22	53	26	27	4	3	N/A
6	4	9	19	45	8	15	32	77	38	38	6	4	23
8	6	12	24	59	10	20	42	100	50	50	8	6	22
10	7	14	30	72	12	25	51	123	61	62	10	8	21
12	8	17	35	85	14	29	61	147	73	73	12	10	21
											12	6	53

NOTES:

1. ALL PIPE JOINTS THAT FALL WITHIN THE RESTRAINED LENGTHS SHOWN FOR THE VARIOUS CONFIGURATIONS SHALL BE RESTRAINED JOINTS USING MECHANICAL JOINT GRIPRING PIPE RESTRAINTS OR MEGALUGS AND JOINT RESTRAINING GASKETS.
2. IF ANOTHER BEND, TEE, OR REDUCER FALLS WITHIN THE RESTRAINED LENGTH, THE TABLE VALUES MUST BE ADJUSTED. IN-LINE REDUCERS MAY ALSO REQUIRE ADDITIONAL JOINT RESTRAINT. IF THE PLANS HAVE NO SPECIFIC INSTRUCTIONS, CONSULT WITH THE DESIGN ENGINEER OR THE OWNER'S FIELD REPRESENTATIVE.
3. THE RESTRAINED LENGTHS SHOWN ARE BASED ON THE FOLLOWING CONDITIONS. IF FIELD CONDITIONS VARY FROM THESE CONDITIONS, CONSULT WITH THE DESIGN ENGINEER OR THE OWNER'S FIELD REPRESENTATIVE.

   SOIL TYPE: CLAY OF MEDIUM TO LOW PLASTICITY, LL<50, 25% COARSE PARTICLES – CLAY 2
   LAYING CONDITIONS: FLAT BOTTOM TRENCH. BACKFILL CONSOLIDATED TO PIPE CENTERLINE – TYPE 2
   DEPTH OF COVER: 3 FEET MINIMUM
   WORKING PRESSURE: 185 PSI
   SAFETY FACTOR: 1.5
   POLYETHYLENE ENCASEMENT: NONE

4. SUBMIT DETAILS OF RESTRAINT SYSTEM FOR REDUCERS TO OWNER FOR APPROVAL.
5. RETAINER GLANDS SHALL BE "GRIPRINGS" AS MANUFACTURED BY ROMAC INDUSTRIES, "MEGALUG" AS MANUFACTURED BY EBAA IRON, INC., SIGMA ONE-LOK SERIES SLDE, OR APPROVED EQUAL AND SHALL BE INSTALLED ON EVERY FITTING.
6. CONTRACTOR SHALL INSTALL DUCTILE IRON PIPE WITH RESTRAINING GASKETS FOR PUSH-ON JOINT PIPE A MINIMUM DISTANCE FROM EACH VALVE OR FITTING AS REQUIRED IN THE ABOVE TABLE. GASKETS SHALL BE FIELD LOK 350 AS MANUFACTURED BY U.S. PIPE OR APPROVED EQUAL.

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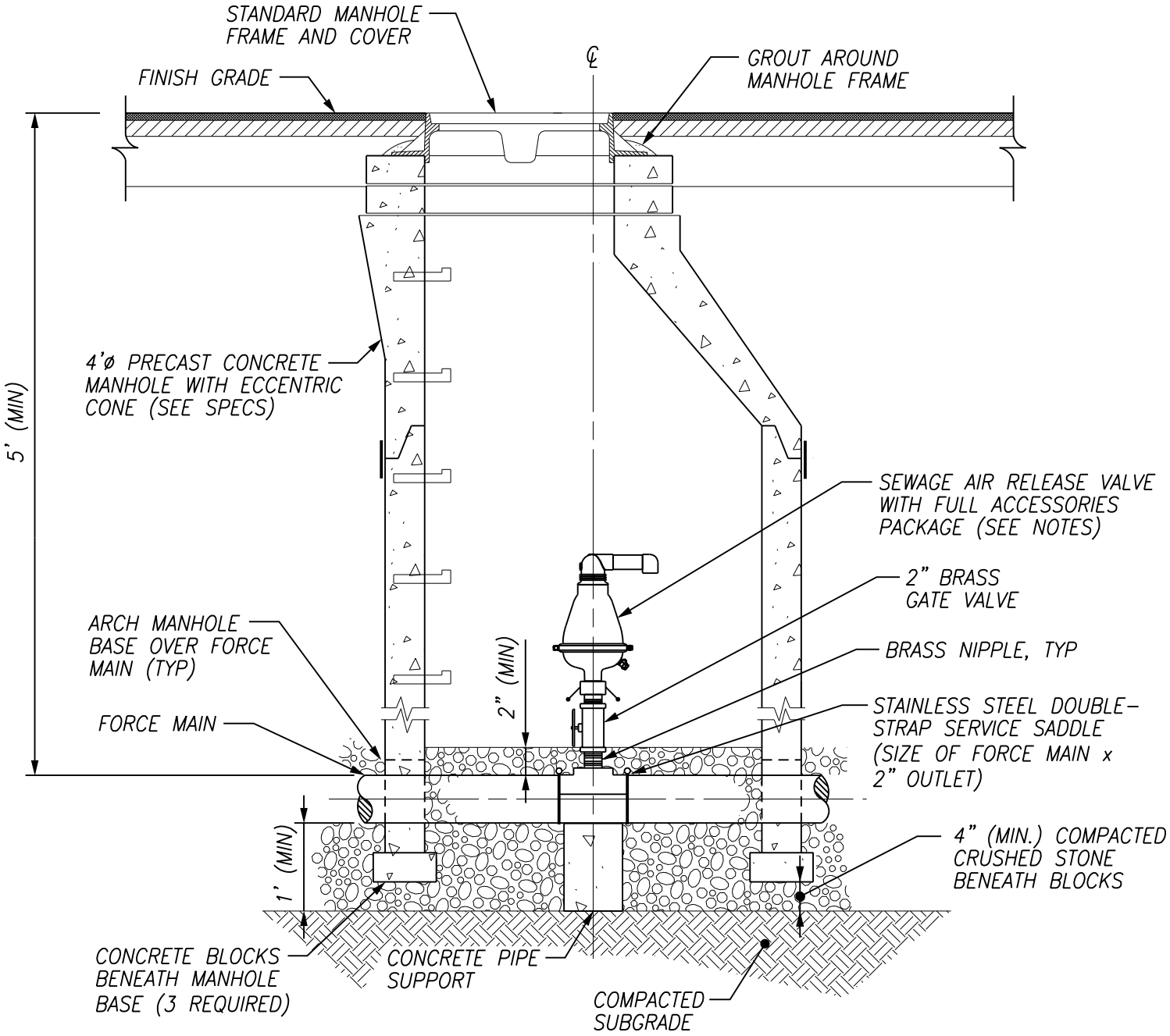
7698 CREEKWOOD PARK BLVD.
LENOIR CITY, TN 37772
TELEPHONE 844.687.5282

APPROVED BY: LCUB	DRAWN BY: FMA	Scale: NTS
RESTRAINED JOINT TABLE		Date: 07/30/19
		DRAWING NUMBER: S23.5



NOTES:

1. SEWAGE AIR RELEASE VALVE TO BE 2-INCH S-025 AUTOMATIC AIR RELEASE VALVE AS MANUFACTURED BY A.R.I. OR EQUAL.
2. SEWAGE AIR/VACUUM VALVE INSTALLATION TO BE SIMILAR EXCEPT VALVE SHALL BE 2-INCH D-025 COMBINATION AIR VALVE AS MANUFACTURED BY A.R.I. OR EQUAL.

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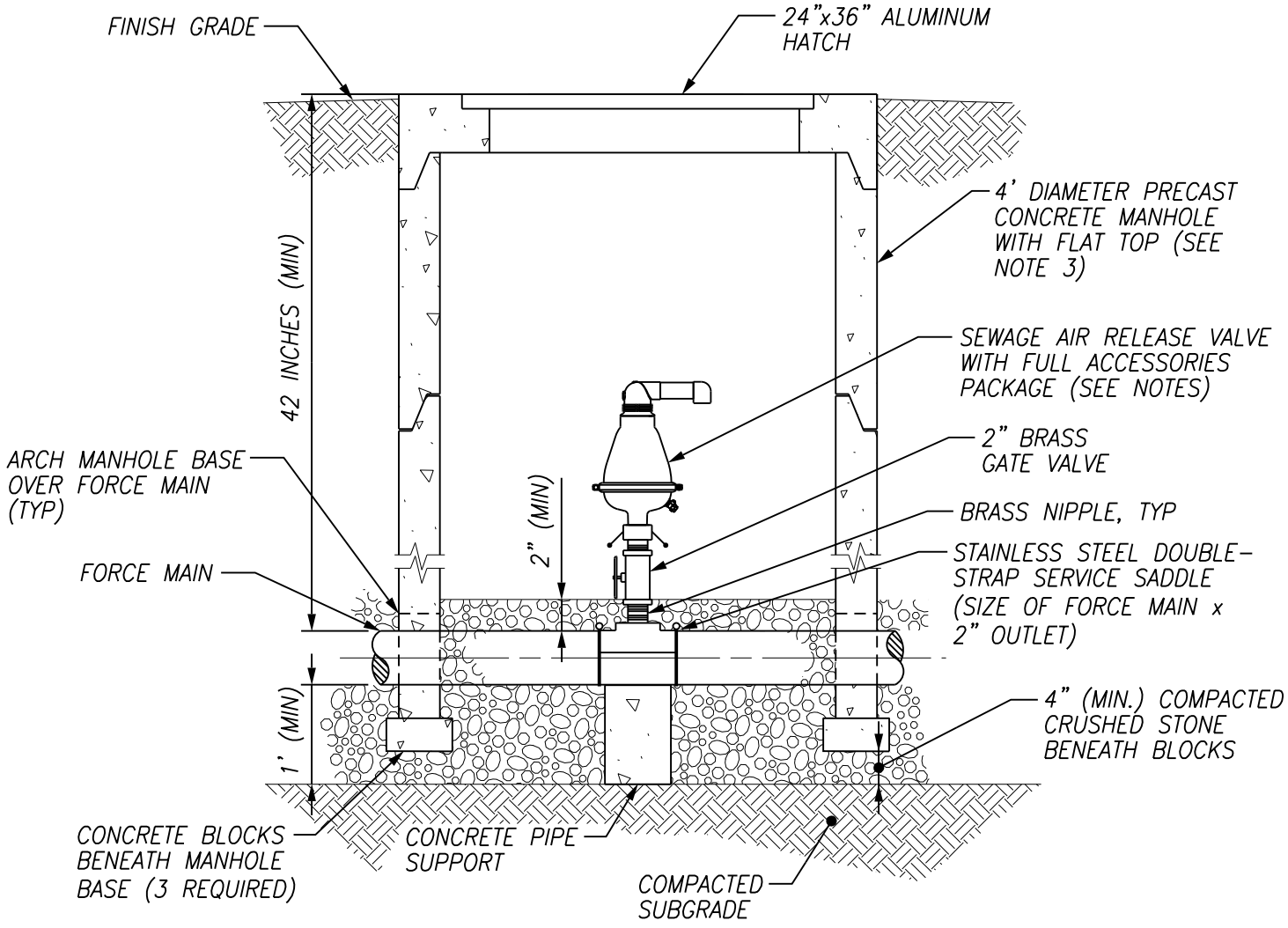
LENOIR CITY, TN 37772
TELEPHONE 844.687.5282

APPROVED BY: LCUB	DRAWN BY: FMA	Scale: NTS
SEWAGE AIR RELEASE VALVE; SEWAGE AIR/VACUUM VALVE DETAIL (PAVED AREAS)		Date: 07/30/21
		DRAWING NUMBER: S24.1



NOTES:

1. SEWAGE AIR RELEASE VALVE TO BE 2-INCH S-025 AUTOMATIC AIR RELEASE VALVE AS MANUFACTURED BY A.R.I. OR EQUAL.
2. SEWAGE AIR/VACUUM VALVE INSTALLATION TO BE SIMILAR EXCEPT VALVE SHALL BE 2-INCH D-025 COMBINATION AIR VALVE AS MANUFACTURED BY A.R.I. OR EQUAL.
3. SEE DETAIL S24.1 FOR SARV INSTALLATIONS IN ROADWAYS.
4. STEEL VALVE BOX AND LID (AS MANUFACTURED BY DARTER STEEL) MAY BE ALLOWED IN CERTAIN LOCATIONS.

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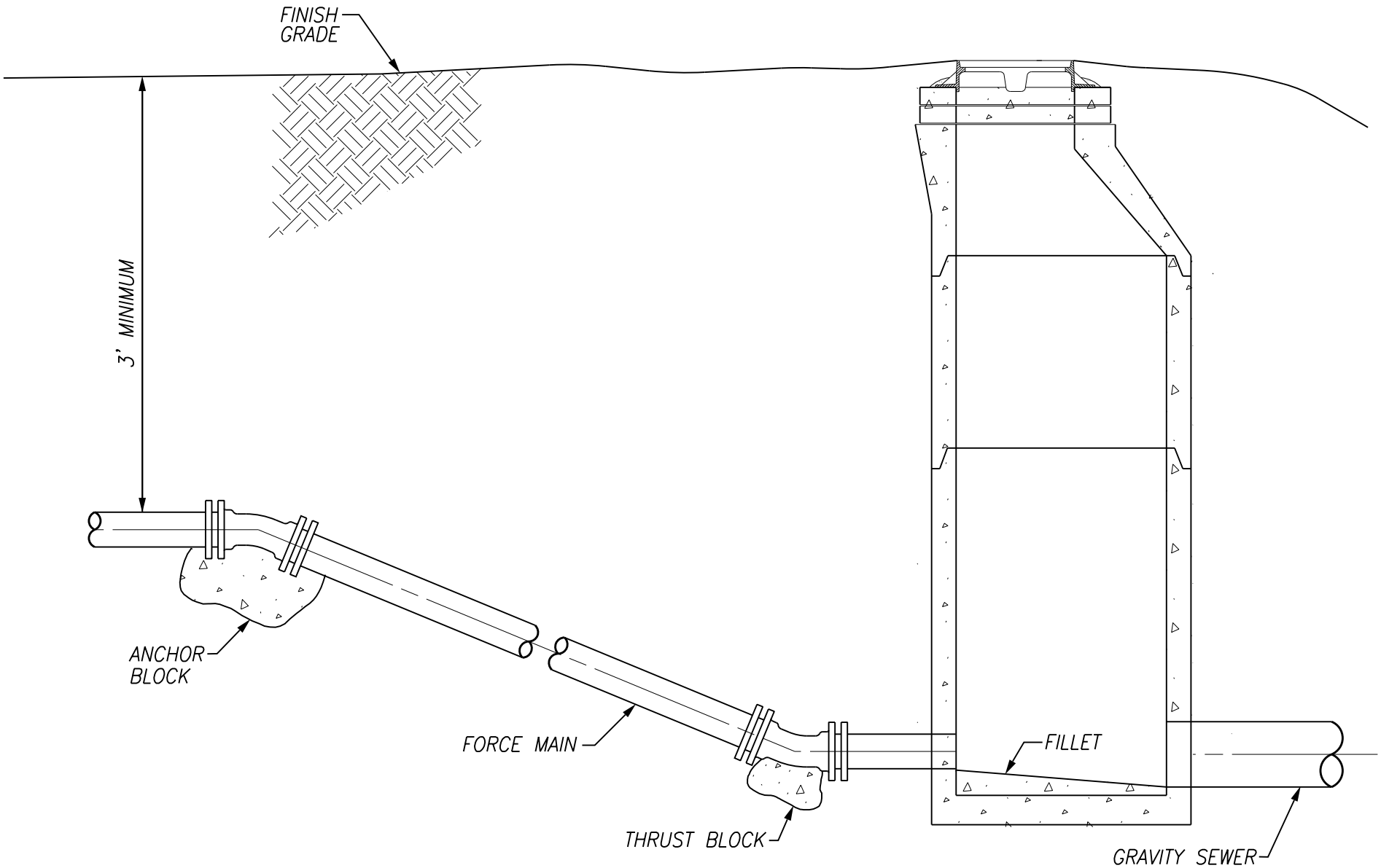
APPROVED BY: LCUB	DRAWN BY: FMA	Scale: NTS
SEWAGE AIR RELEASE VALVE; SEWAGE AIR/VACUUM VALVE DETAIL (NON-PAVED AREAS)		Date: 07/30/21
		DRAWING NUMBER: S24.2



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APPROVED BY: LCUB	DRAWN BY: FMA	Scale: NTS
		Date: 07/30/19

FORCE MAIN CONNECTION TO GRAVITY SEWER DETAIL

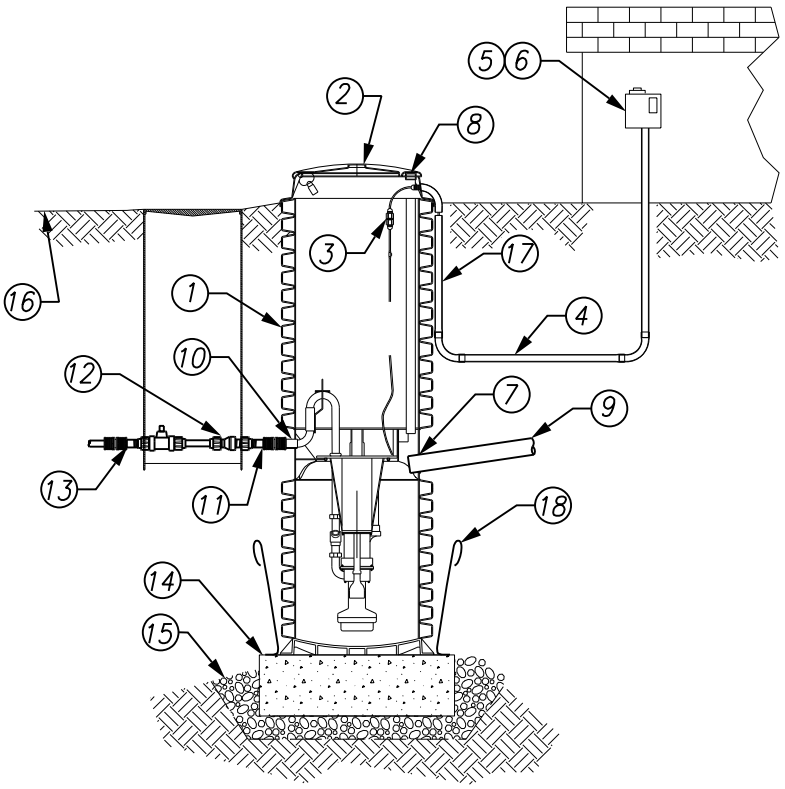
DRAWING NUMBER: S25

1. GRINDER PUMP BASIN – HIGH DENSITY POLYETHYLENE (HDPE).
2. ACCESS WAY COVER – FURNISHED WITH PADLOCK.
3. ELECTRICAL QUICK DISCONNECT – LEAD FROM PUMP CORE TERMINATES HERE.
4. POWER AND ALARM LEAD – CIRCUITS TO BE INSTALLED IN ACCORDANCE WITH LOCAL CODES.
5. DISCONNECT PANEL – RAINPROOF (NEMA) 4X ENCLOSURE EQUIPPED WITH CIRCUIT BREAKERS OF DISCONNECT SWITCH. LOCATE ACCORDING TO LOCAL CODES.
6. ALARM DEVICE – EVERY INSTALLATION IS TO HAVE A VISUAL AND AUDIBLE ALARM DEVICE IN A NEMA 4X PANEL TO ALERT THE HOMEOWNER OF A POTENTIAL MALFUNCTION. VISUAL DEVICES SHOULD BE PLACED IN VERY CONSPICUOUS LOCATIONS.
7. INLET – 4" EPDM GROMMET (4.5" OD). FOR GRAVITY SERVICE LINE.
8. WET WELL VENT – 2.0" TANK VENT, SUPPLIED BY FACTORY IN UNITS WITH ACCESS WAYS.
9. GRAVITY SERVICE LINE – 4" SCH. 40 PVC PIPE & FITTINGS.
10. DISCHARGE OUTLET – 1 1/4" FEMALE PIPE THREAD.
11. STAINLESS STEEL FLEXIBLE CONNECTION (M x F IP THREADED), AS PROVIDED BY LCUB.
12. HDPE x STAINLESS STEEL TRANSITION (FUSED x M THREAD). POLYCAM SERIES 710HD, SDR-11, OR APPROVED EQUAL.
13. DISCHARGE LINE – 1 1/4" NOMINAL PIPE SIZE, SEE SPECS FOR MATERIAL REQUIREMENTS.
    13.1. 2" SCH-40 PVC CASING REQUIRED UNDER DRIVEWAYS AND SIDEWALKS.
    13.2. TRACER WIRE REQUIRED FROM FORCE MAIN SEWER TO PUMP.
    13.3. REFER TO LCUB STANDARD DRAWINGS S26.8 – S26.11 FOR SERVICE JUNCTION AND CONTINUATION TO FORCE MAIN.
14. PRECAST CONCRETE ANCHOR (ANTI-FLOTATION BASE).
    14.1. 370 LBS (2.5 CU FT) PER FOOT OF TOTAL STATION HEIGHT IS REQUIRED TO PREVENT TANK FROM FLOATING.
    14.2. SECURE BASIN TO ANCHOR USING EIGHT (8) RED HEAD TRUEBOLT WEDGE ANCHORS (WS-3580) OR APPROVED EQUAL. (3/8" DIA, 5" LENGTH, 5935-LB PULLOUT)
15. BEDDING MATERIAL – 6" MINIMUM DEEP, ROUNDED AGGREGATE.
16. FINISH GRADE – GRADE LINE TO BE 1" TO 4" BELOW THE REMOVABLE COVER, AND SLOPE AWAY FROM ACCESS WAY.
17. CONDUIT – 1" OR 1 1/4" PVC TO BURY DEPTH REQUIRED BY LOCAL CODE.
18. REQUIRED TO LIFT TANK AFTER BALLAST HAS BEEN ATTACHED (4 PLACES, EVENLY SPACED AROUND TANK.
19. NO PERMANENT OBSTRUCTIONS PERMITTED WITHIN 6-FT OF PUMP OR DISCHARGE LINE.
20. BACKFILL EXCAVATION WITH GRAVEL UP TO DISCHARGE (OUTLET) AND GRAVITY (INLET) LINES (NOT SHOWN FOR CLARITY).

INDIVIDUAL PUMP SYSTEM

THE INSTALLATION OF THE INDIVIDUAL PUMP SYSTEM SHALL COMMENCE AFTER THE PRESSURE SEWER MAINS AND SERVICE CONNECTIONS HAVE BEEN INSTALLED, APPROVED BY THE ENGINEER, AND ACCEPTED BY LENOIR CITY UTILITIES BOARD (LCUB). INSTALLATION OF THE INDIVIDUAL PUMP SYSTEM SHALL INCLUDE THE FOLLOWING STEPS BY THE CONTRACTOR:

1. EXAMINE PROPERTY WITH LCUB RPR TO DETERMINE BEST LOCATION TO INSTALL E-ONE PUMP STATION AND ROUTING OF PRESSURE SEWER SERVICE LATERAL.
2. INSTALL E-ONE PUMP STATION AT DESIGNATED LOCATION AS WELL AS THE DISCONNECT PANEL TO THE SIDE OF THE HOUSE AT LOCATION DESIGNATED BY LCUB.
3. INSTALL 1-1/4" PRESSURE SEWER SERVICE LATERAL FROM THE E-ONE PUMP STATION TO SERVICE CONNECTION.
4. CONNECT GRAVITY SEWER SERVICE LATERAL FROM THE HOUSE TO THE E-ONE PUMP STATION AND COMPLETE WIRING OF CONTROL PANEL.
5. OPEN BALL VALVE AT THE SERVICE CONNECTION AND TEST SYSTEM.
6. CLEAN-UP AND RESTORE PROPERTY TO ORIGINAL CONDITION.



THE PROPERTY OWNER SHALL PROVIDE THE FOLLOWING SPECIFIED ELECTRICAL CIRCUITS TO THE LOCATION OF THE PROPOSED CONTROL PANEL.

1. PUMP 240 VOLT, 2 POLE, 15 AMP
2. ALARM 120 VOLT, SINGLE POLE, 20 AMP

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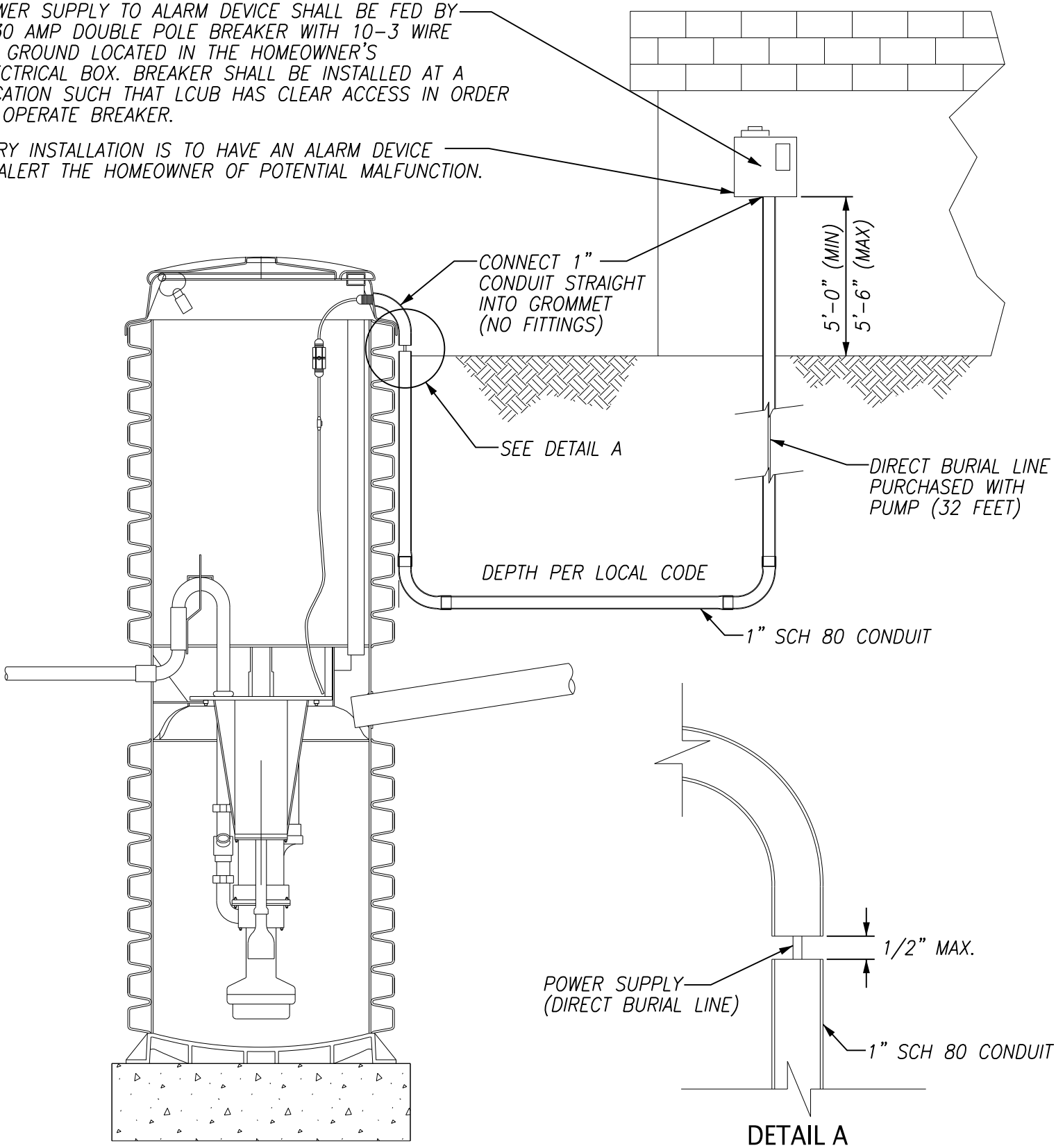
LENOIR CITY, TN 37772
TELEPHONE 844.687.5282

APPROVED BY: LCUB	DRAWN BY: FMA	Scale: NTS
E/ONE MODEL DH071 GRINDER PUMP REQUIREMENTS		Date: 09/14/20
		DRAWING NUMBER: S26.1

POWER SUPPLY TO ALARM DEVICE SHALL BE FED BY A 30 AMP DOUBLE POLE BREAKER WITH 10-3 WIRE W/ GROUND LOCATED IN THE HOMEOWNER'S ELECTRICAL BOX. BREAKER SHALL BE INSTALLED AT A LOCATION SUCH THAT LCUB HAS CLEAR ACCESS IN ORDER TO OPERATE BREAKER.

EVERY INSTALLATION IS TO HAVE AN ALARM DEVICE TO ALERT THE HOMEOWNER OF POTENTIAL MALFUNCTION.



DETAIL A

NOTES:

1. SEE DETAILS S26.3 AND S26.4 FOR WIRING DIAGRAMS.

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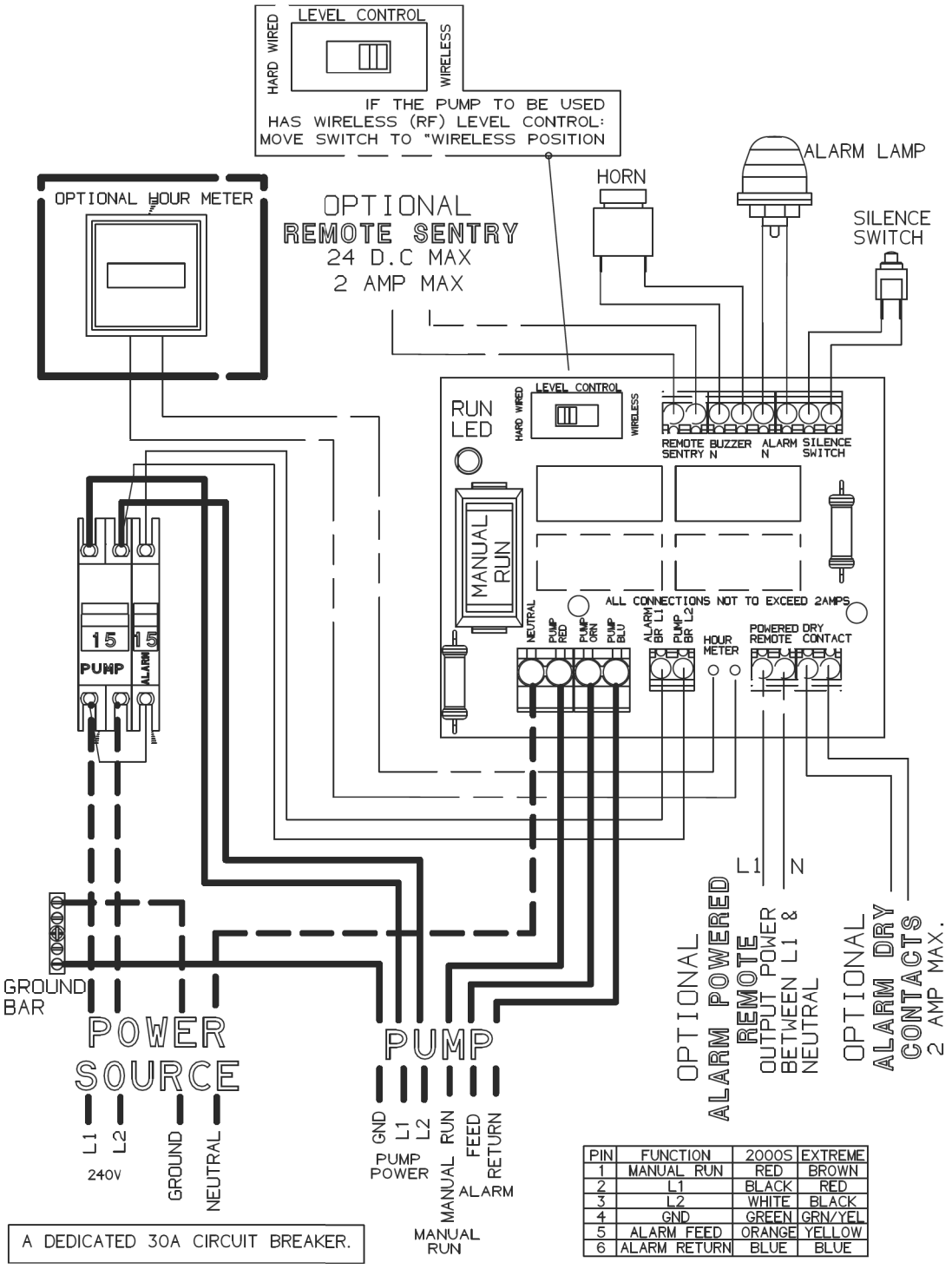
APPROVED BY: LCUB	DRAWN BY: FMA	Scale: NTS
E/ONE RESIDENTIAL GRINDER PUMP STATION ELECTRICAL REQUIREMENTS		Date: 09/14/20
		DRAWING NUMBER: S26.2



PIN	FUNCTION	2000S	EXTREME
1	MANUAL RUN	RED	BROWN
2	L1	BLACK	RED
3	L2	WHITE	BLACK
4	GND	GREEN	GRN/YEL
5	ALARM FEED	ORANGE	YELLOW
6	ALARM RETURN	BLUE	BLUE

240 VOLT WIRING

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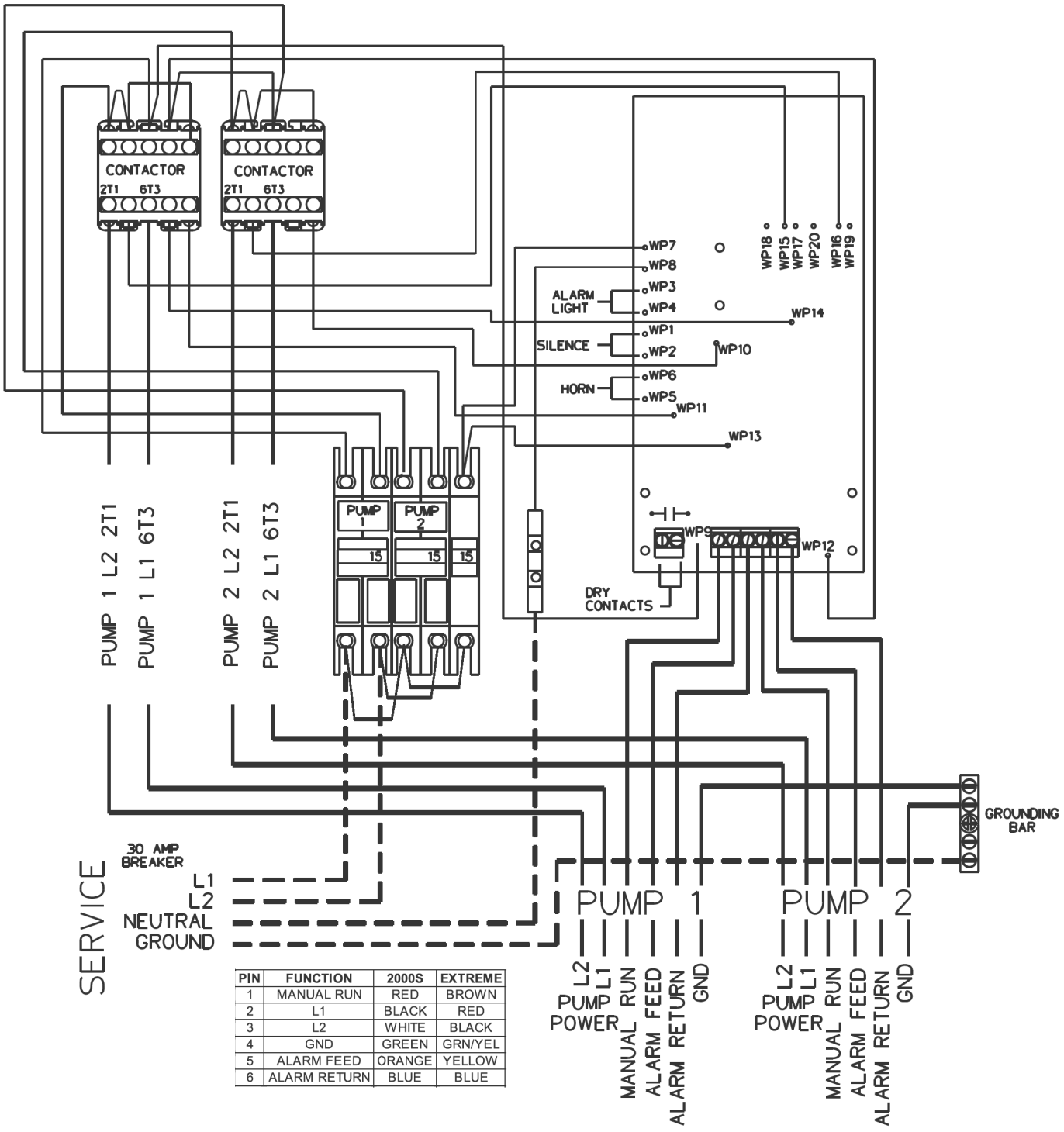
APPROVED BY:	LCUB	DRAWN BY:	FMA	Scale:	NTS

E/ONE GRINDER PUMP STATION
SIMPLEX 240 VOLT
WIRING DIAGRAM

Date: 07/30/21

DRAWING NUMBER: S26.3



PIN	FUNCTION	2000S	EXTREME
1	MANUAL RUN	RED	BROWN
2	L1	BLACK	RED
3	L2	WHITE	BLACK
4	GND	GREEN	GRN/YEL
5	ALARM FEED	ORANGE	YELLOW
6	ALARM RETURN	BLUE	BLUE

240 VOLT DUPLEX WIRING

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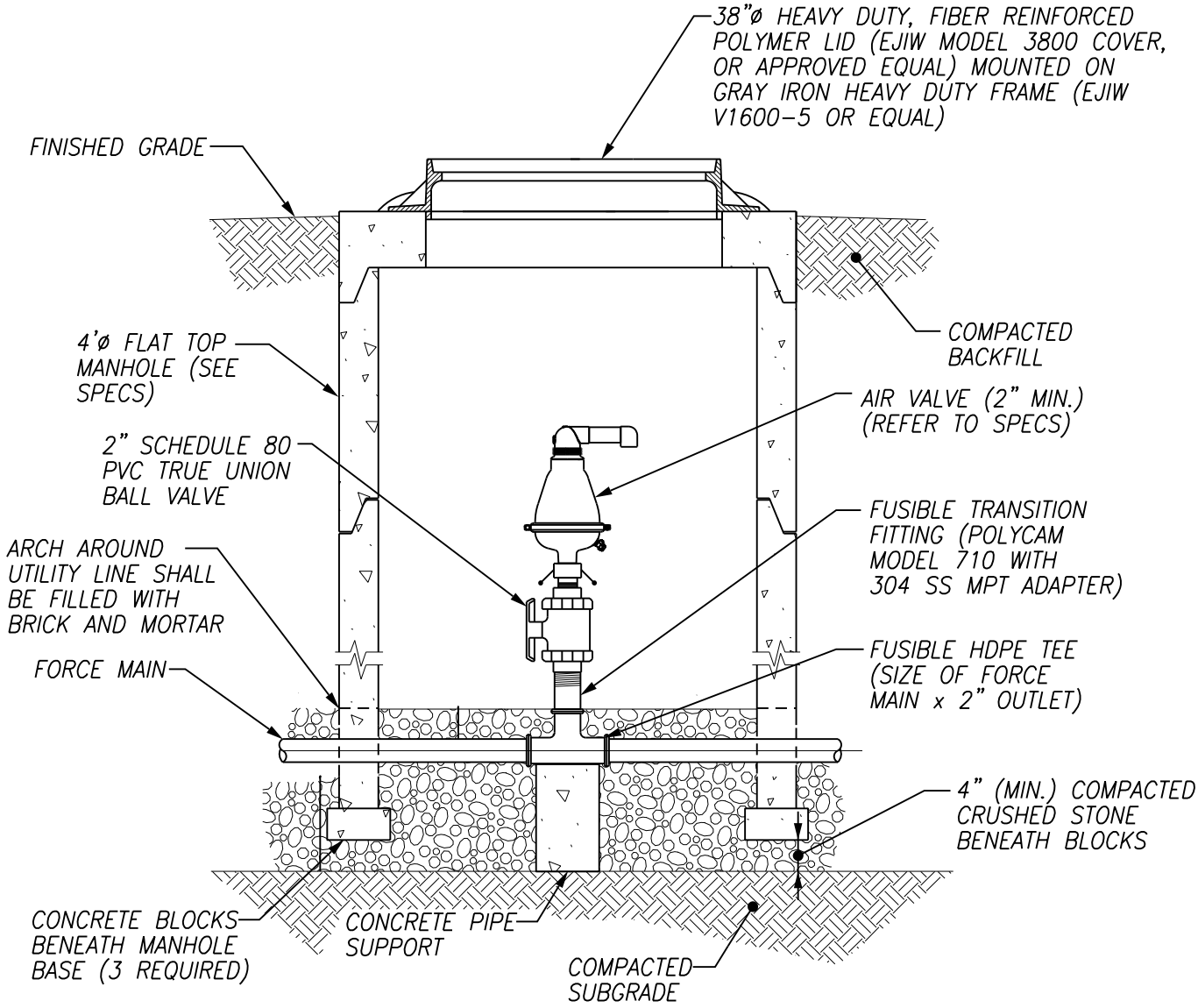
LENOIR CITY, TN 37772
TELEPHONE 844.687.5282

APPROVED BY:	LCUB	DRAWN BY:	FMA	Scale:	NTS
E/ONE GRINDER PUMP STATION DUPLEX 240 VOLT WIRING DIAGRAM				Date:	07/30/21
				DRAWING NUMBER:	S26.4



NOTES:

1. TEE, PIPE, ISOLATION VALVE AND ACCESSORIES TO BE SAME DIAMETER AS COMBINATION AIR RELEASE VALVE.
2. PROVIDE ADDITIONAL BRACING SUPPORT AS REQUIRED BY OWNER.
3. PIPE, VALVES AND FITTINGS SHALL BE THREADED, NPT.
4. CONTACT OWNER FOR DIRECTION ON INSTALLATIONS REQUIRING AN AIR VALVE LARGER THAN 2-INCHES.
5. INSTALLATION REQUIRES A MIN. DEPTH OF 42-INCHES. COORDINATE WITH LCUB RPR.
6. STEEL VALVE BOX AND LID (AS MANUFACTURED BY DARTER STEEL) MAY BE ALLOWED IN CERTAIN LOCATIONS.

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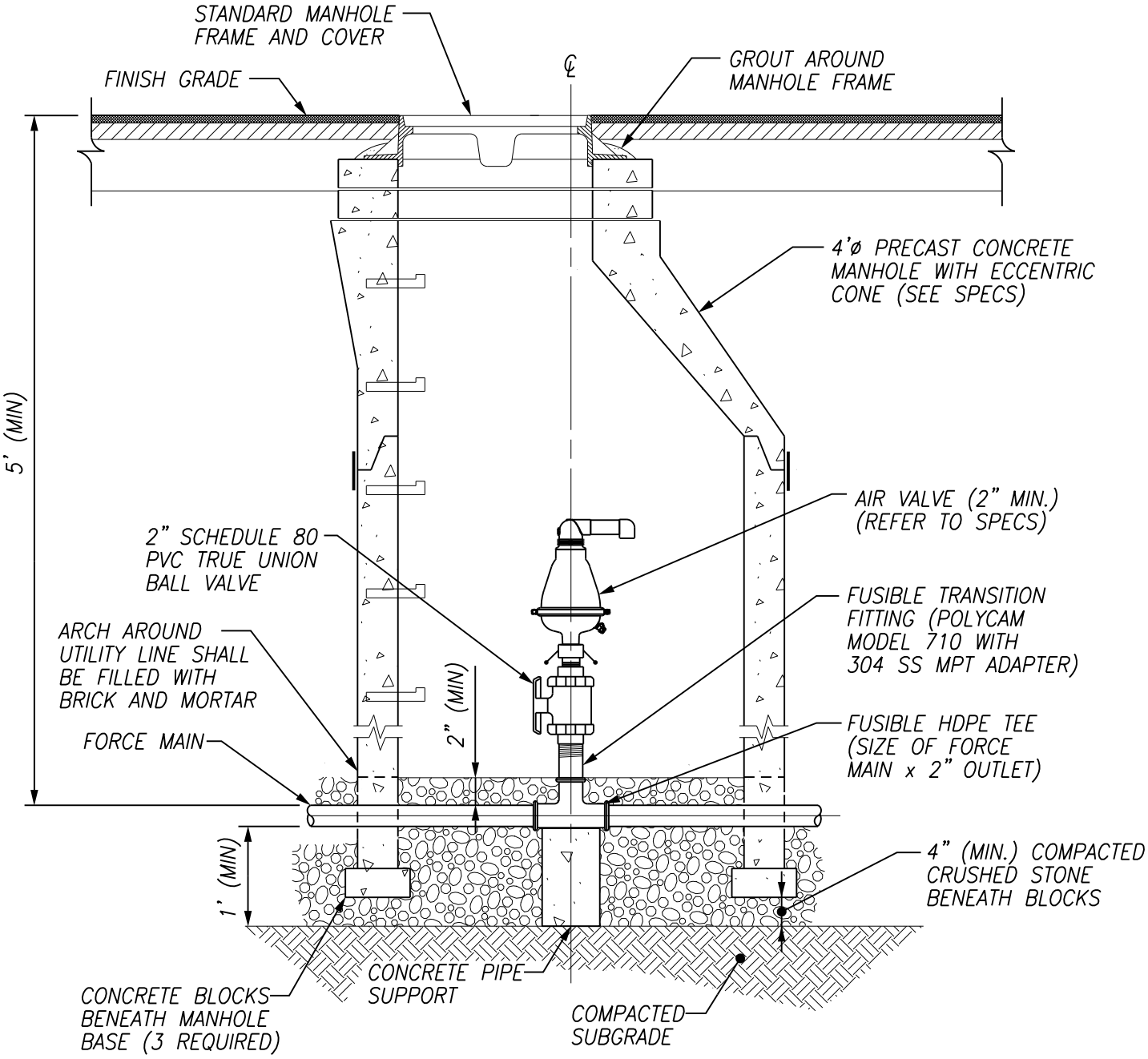
APPROVED BY: LCUB	DRAWN BY: FMA	Scale: NTS
LPS COMBINATION AIR VALVE (NON-PAVED AREAS)		Date: 07/30/21
		DRAWING NUMBER: S26.5



NOTES:

1. TEE, PIPE, ISOLATION VALVE AND ACCESSORIES TO BE SAME DIAMETER AS COMBINATION AIR RELEASE VALVE.
2. PROVIDE ADDITIONAL BRACING SUPPORT AS REQUIRED BY OWNER.
3. PIPE, VALVES AND FITTINGS SHALL BE THREADED, NPT.
4. CONTACT OWNER FOR DIRECTION ON INSTALLATIONS REQUIRING AN AIR VALVE LARGER THAN 2-INCHES.

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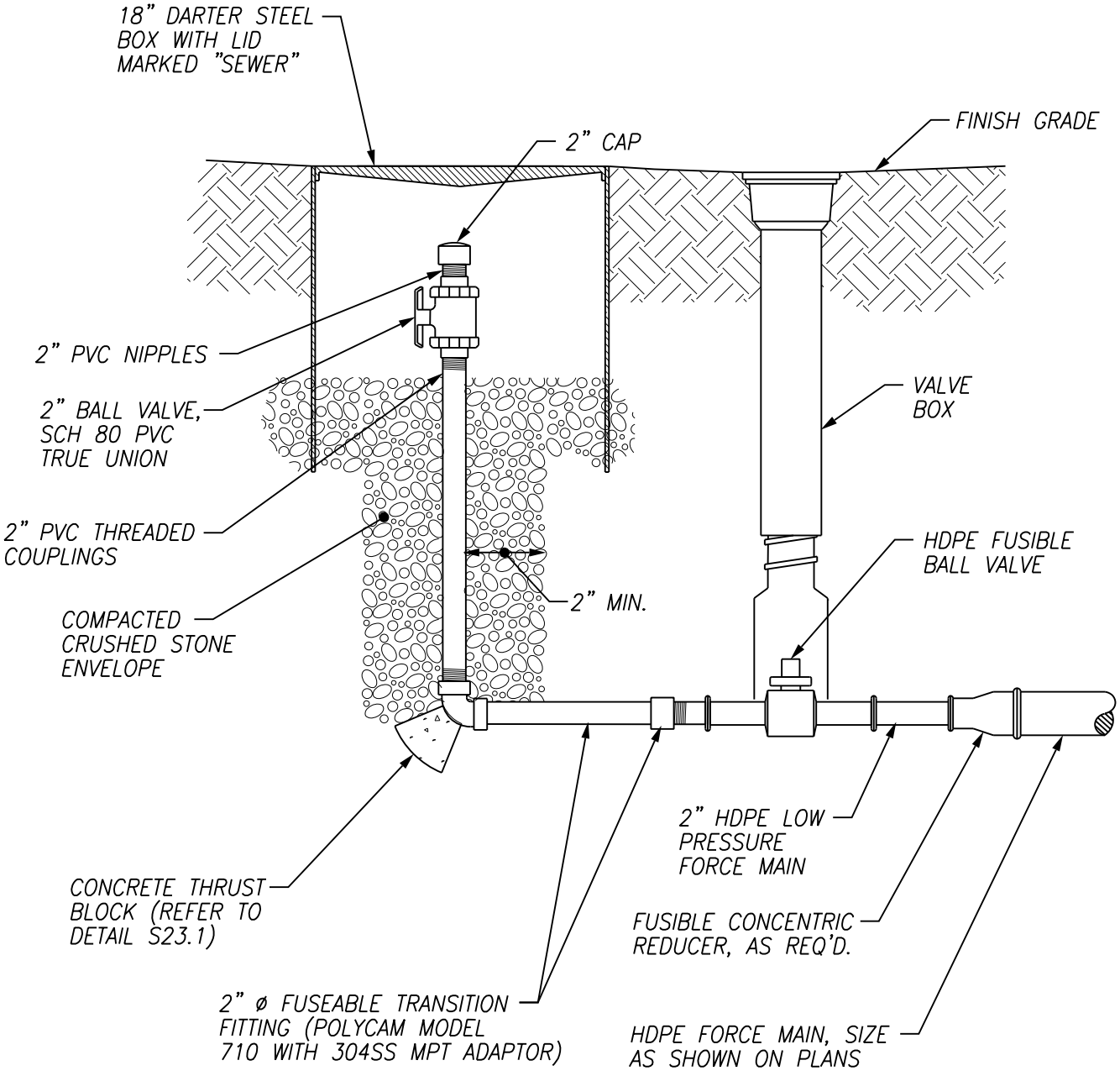
APPROVED BY: LCUB	DRAWN BY: FMA	Scale: NTS
LPS COMBINATION AIR VALVE (PAVED AREAS)		Date: 07/30/21
		DRAWING NUMBER: S26.6



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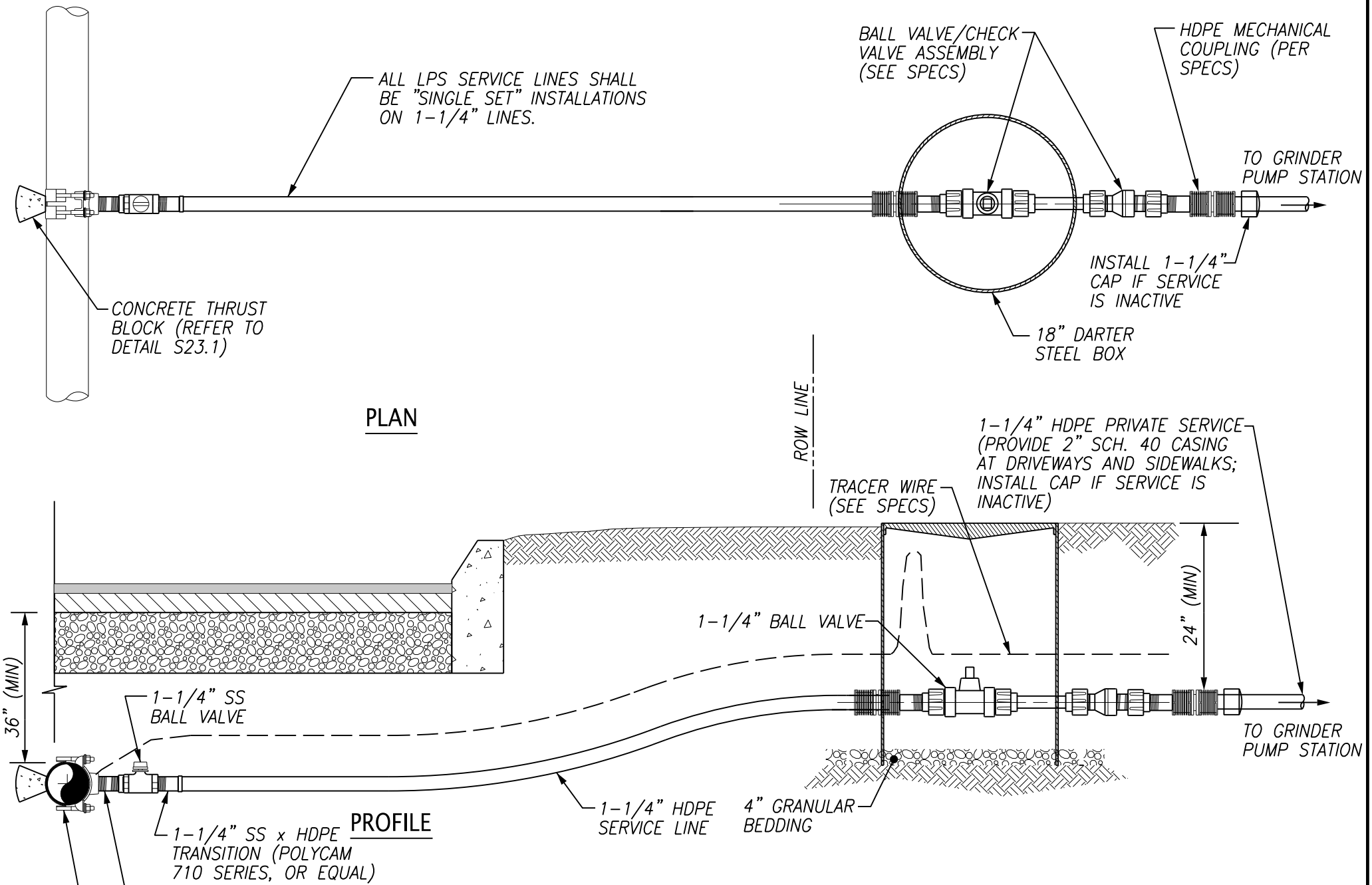
APPROVED BY: LCUB	DRAWN BY: FMA	Scale: NTS
LPS END-OF-LINE FLUSHING STATION		Date: 07/30/21
		DRAWING NUMBER: S26.7



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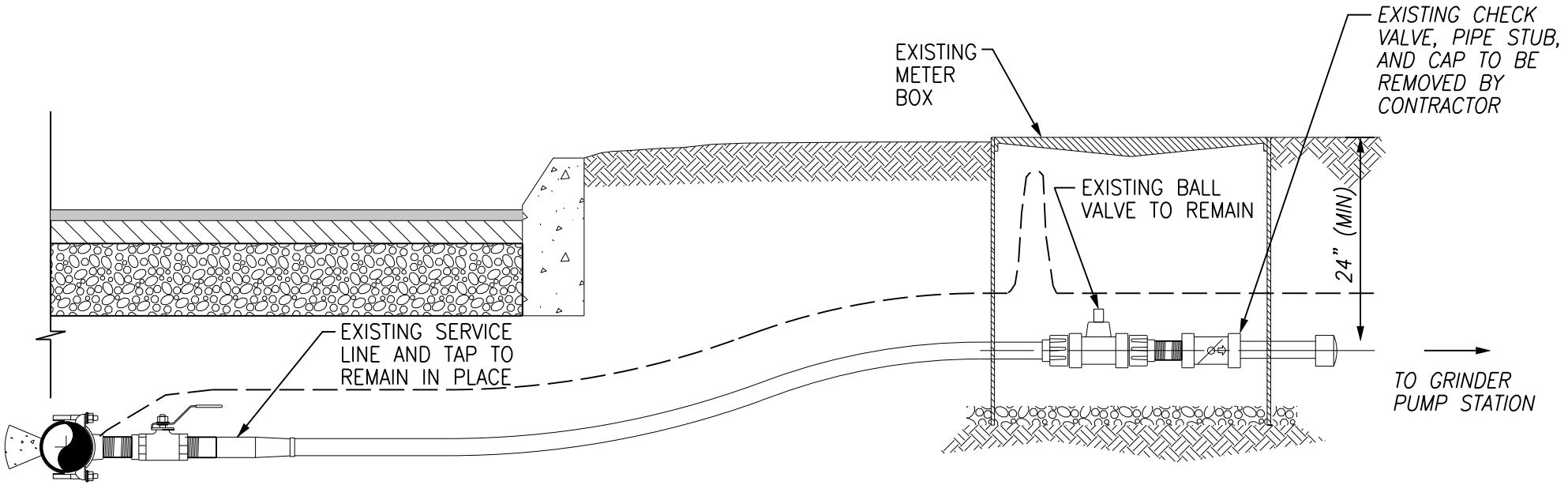
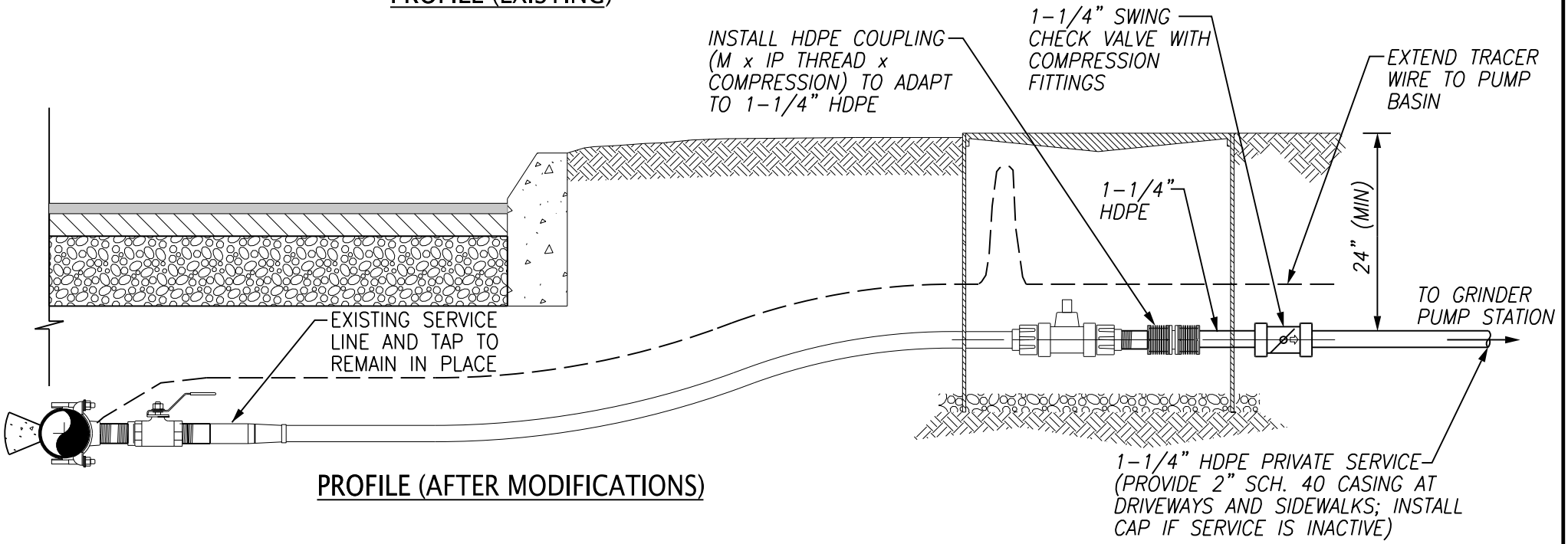
APPROVED BY: LCUB	DRAWN BY: FMA	Scale: NTS
LPS SINGLE SERVICE CONNECTION TO EXISTING HDPE FORCE MAIN		Date: 04/11/23
		DRAWING NUMBER: S26.8



PROFILE (EXISTING)



PROFILE (AFTER MODIFICATIONS)

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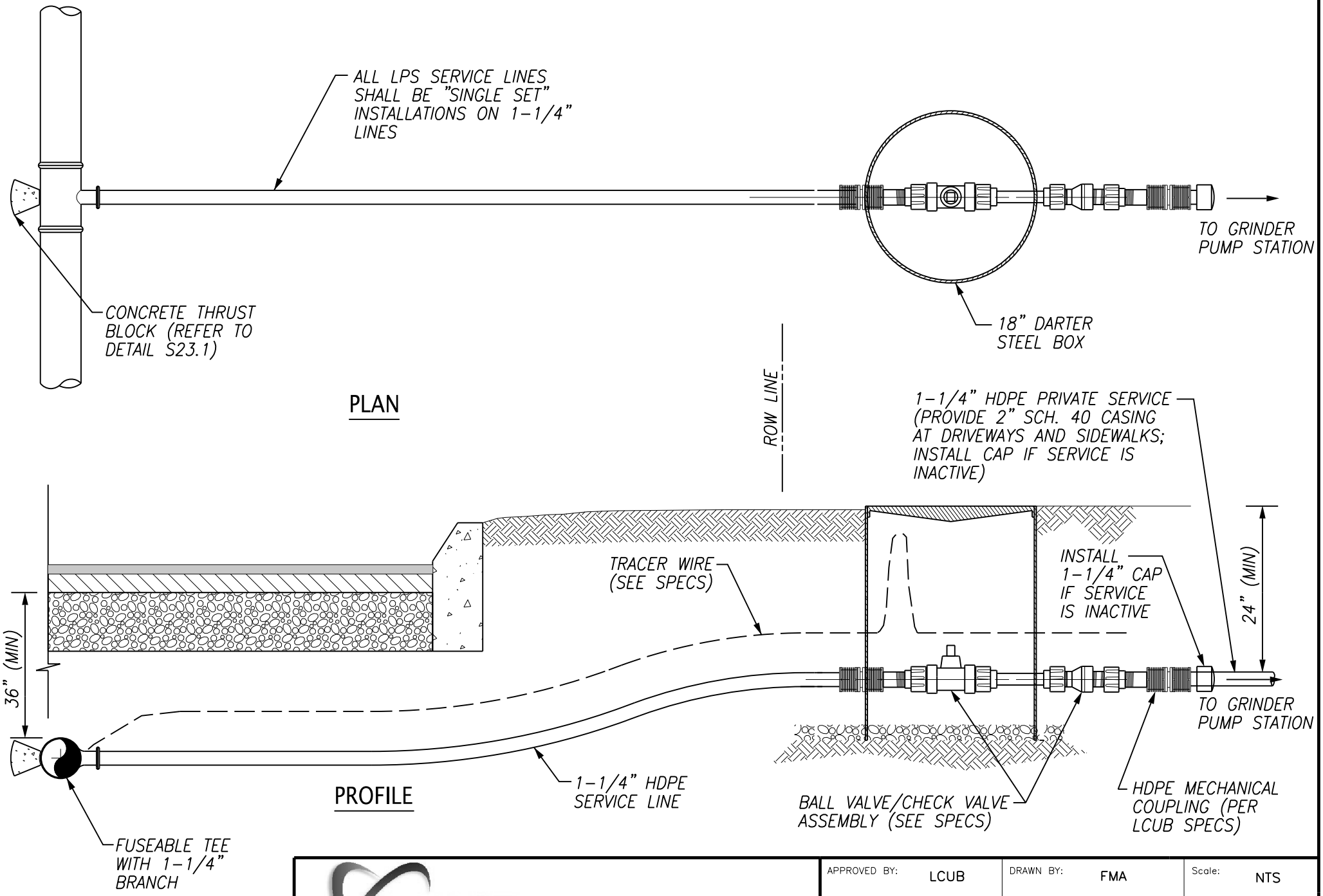
APPROVED BY: LCUB	DRAWN BY: FMA	Scale: NTS
LPS SINGLE SERVICE CONNECTION TO EXISTING LATERAL STUB-OUT		Date: 09/14/20
		DRAWING NUMBER: S26.9



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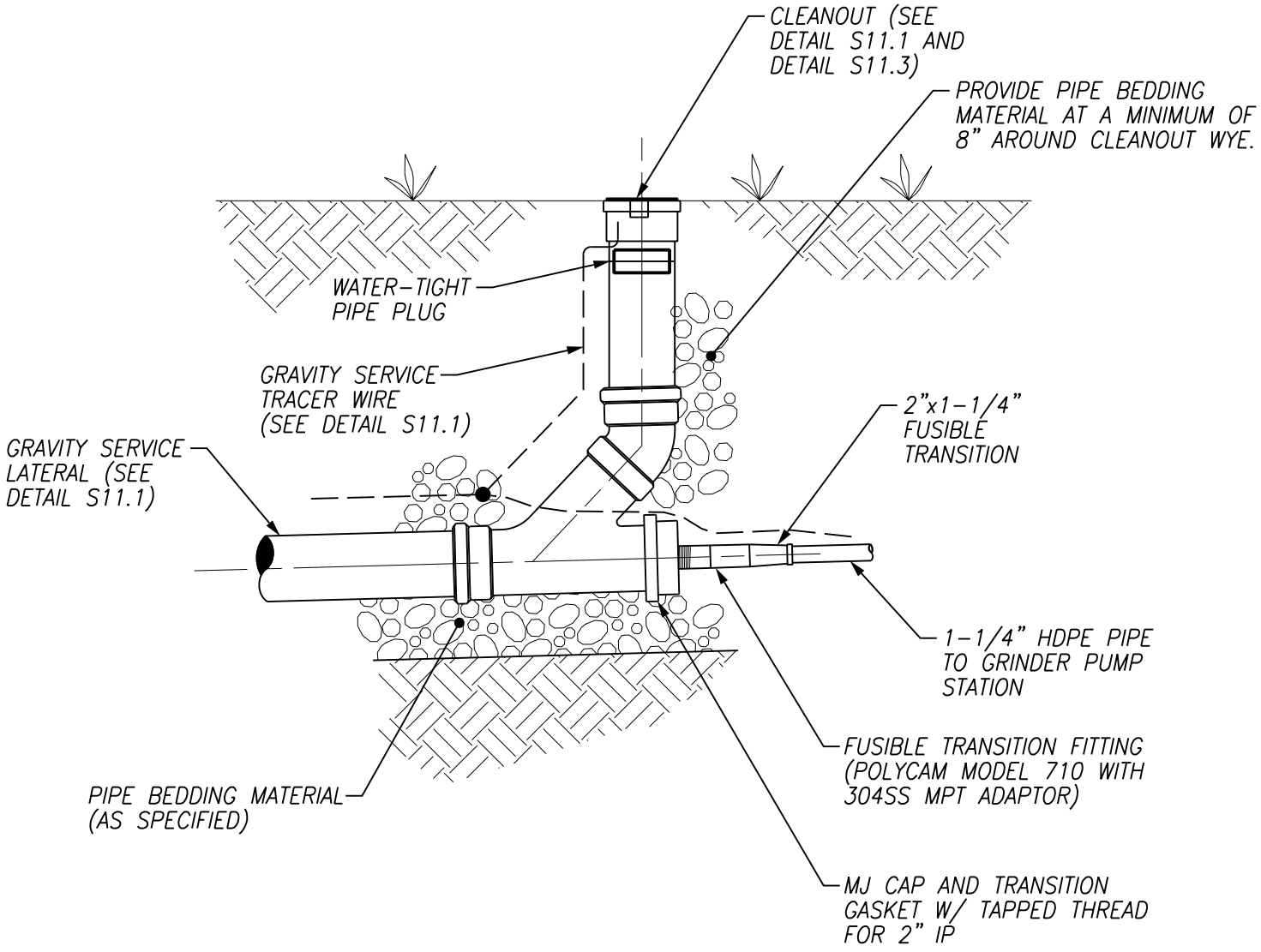
APPROVED BY: LCUB	DRAWN BY: FMA	Scale: NTS
LPS SINGLE SERVICE CONNECTION TO NEW HDPE FORCE MAIN		Date: 04/11/23
		DRAWING NUMBER: S26.10



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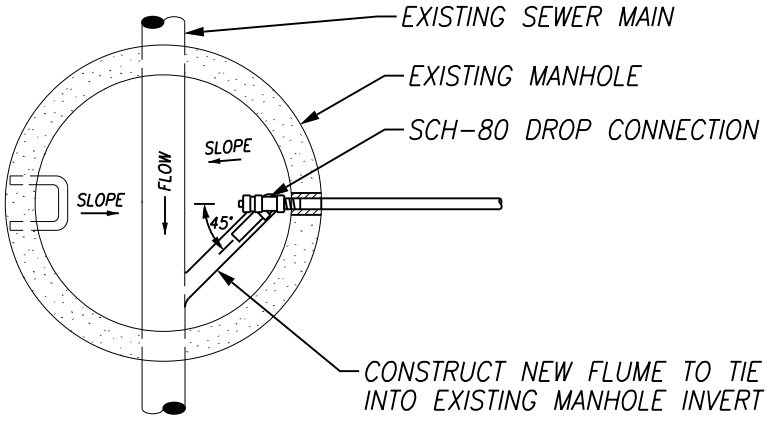
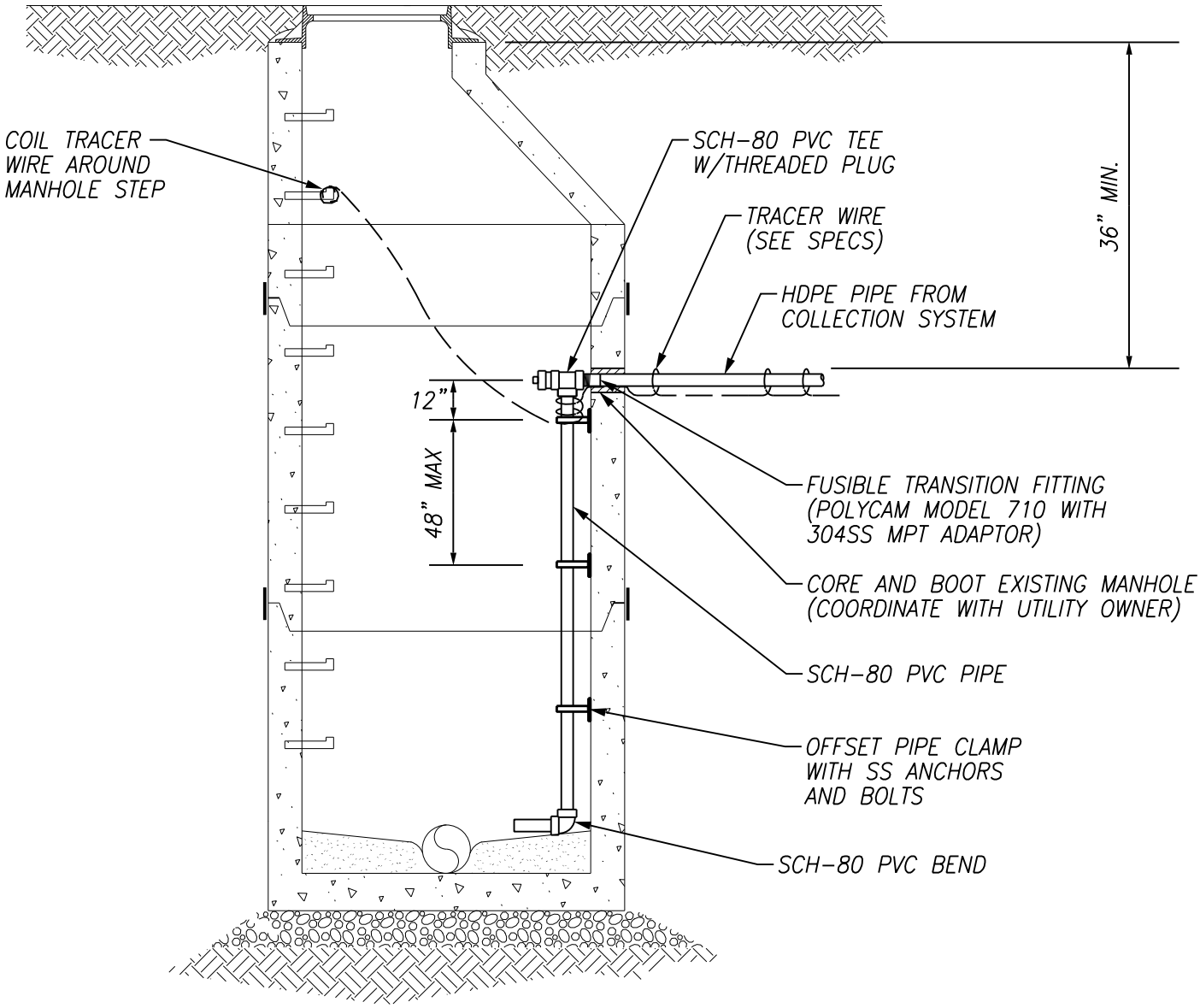
APPROVED BY: LCUB	DRAWN BY: FMA	Scale: NTS
LPS SINGLE SERVICE CONNECTION TO GRAVITY SERVICE LINE		Date: 09/14/20
		DRAWING NUMBER: S26.11



NOTE:
CONNECTION OF LOW PRESSURE SEWER SYSTEM TO GRAVITY SEWER REQUIRES THE APPLICATION OF OBIC MANHOLE COATING AT TIE-IN MANHOLE AND NEXT TWO MANHOLES DOWNSTREAM. APPLICATION TO BE PROVIDED BY A MANUFACTURER-CERTIFIED CONTRACTOR.

PLAN VIEW



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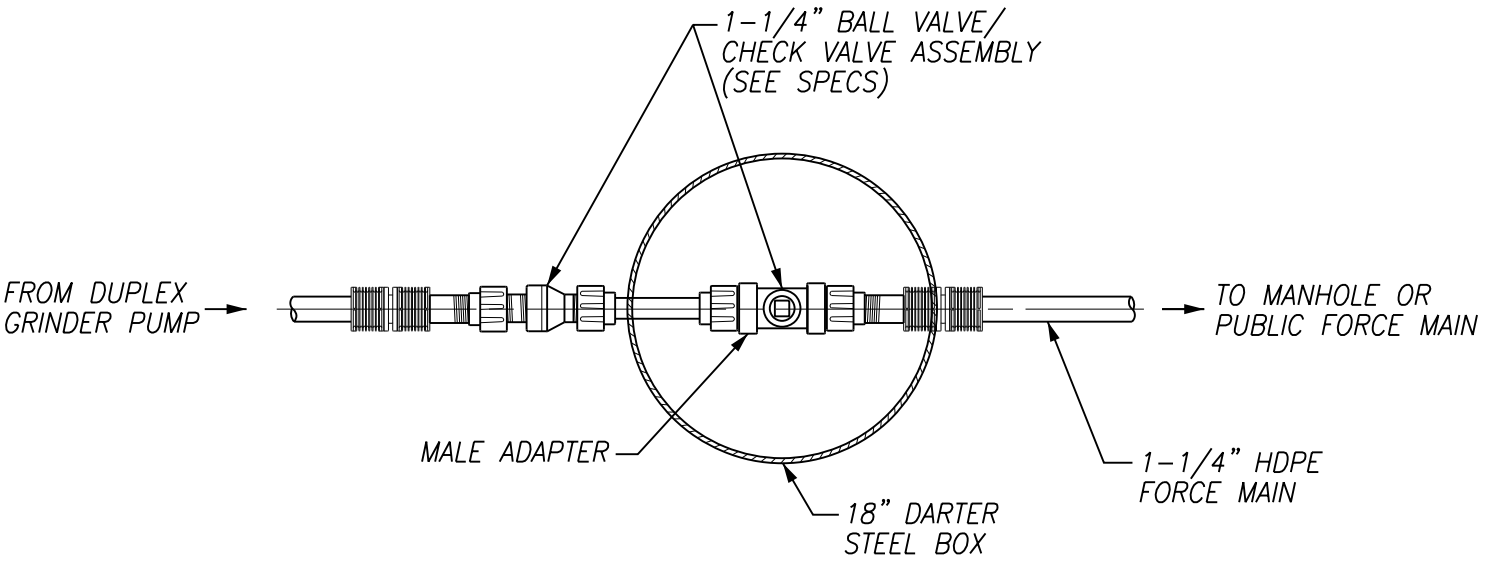
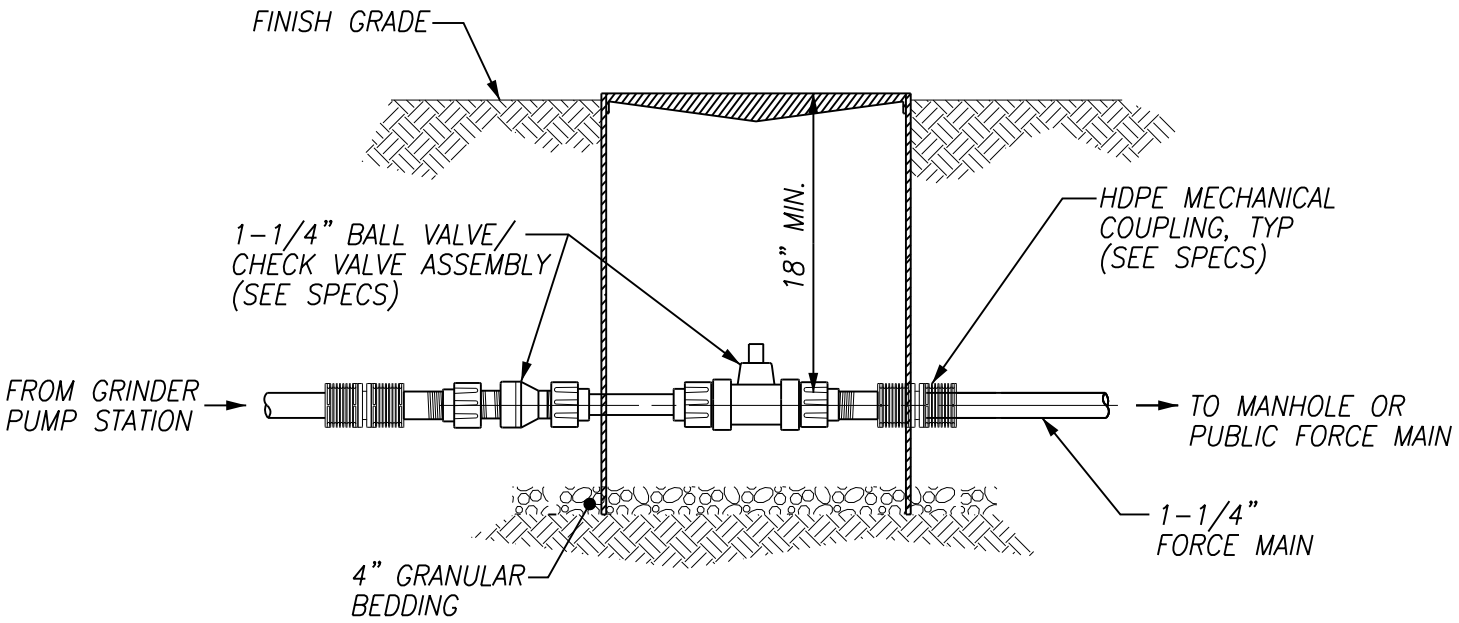
APPROVED BY: LCUB	DRAWN BY: FMA	Scale: NTS
LOW PRESSURE SEWER DROP CONNECTION		Date: 09/14/20
		DRAWING NUMBER: S26.12



PLAN



SECTION

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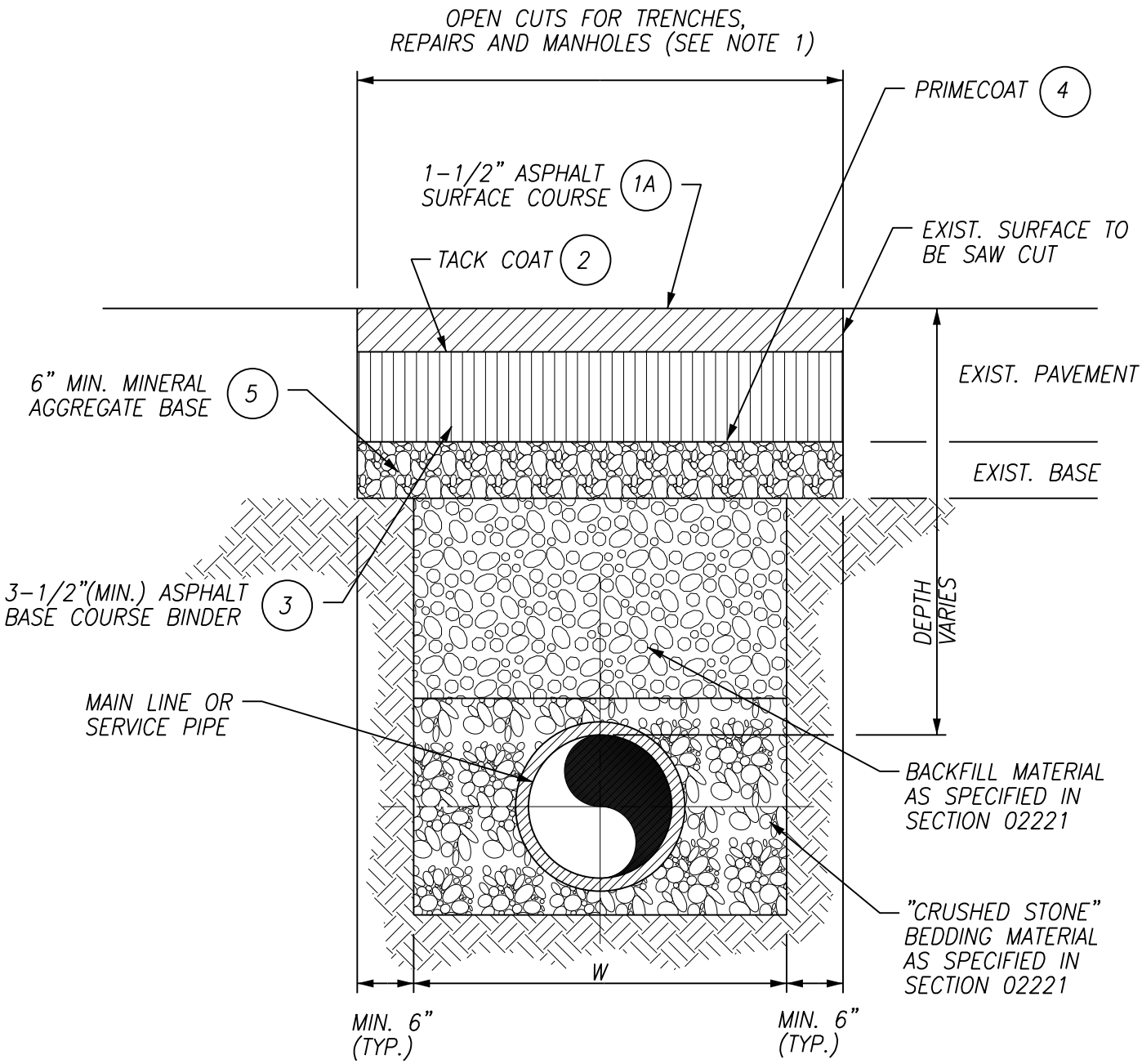
TELEPHONE 844.687.5282

APPROVED BY: LCUB	DRAWN BY: FMA	Scale: NTS
LOW PRESSURE SEWER SERVICE BOX		Date: 07/30/21
		DRAWING NUMBER: S26.13



NOTES:

1. AT THE DISCRETION OF THE OWNER, WHEN TRENCH PARALLELS CENTERLINE OF ROADWAY AND WIDTH IS EQUAL TO OR GREATER THAN HALF THE LANE WIDTH, THEN THE PAVEMENT WIDTH FOR THE SURFACE COURSE SHALL BE FOR AN OVERLAY OF THE ROADWAY ENTIRE LANE WIDTH.
2. FOR PATCH SIZES, TRENCH WIDTHS AND PAVEMENT WIDTHS, SEE PAVEMENT WIDTH SCHEDULE ON STANDARD DRAWING S27.3.
3. PAVEMENT REPAIRS/REPLACEMENT SHALL BE THERMALLY BONDED WITH THE EXISTING ASPHALT EDGES.

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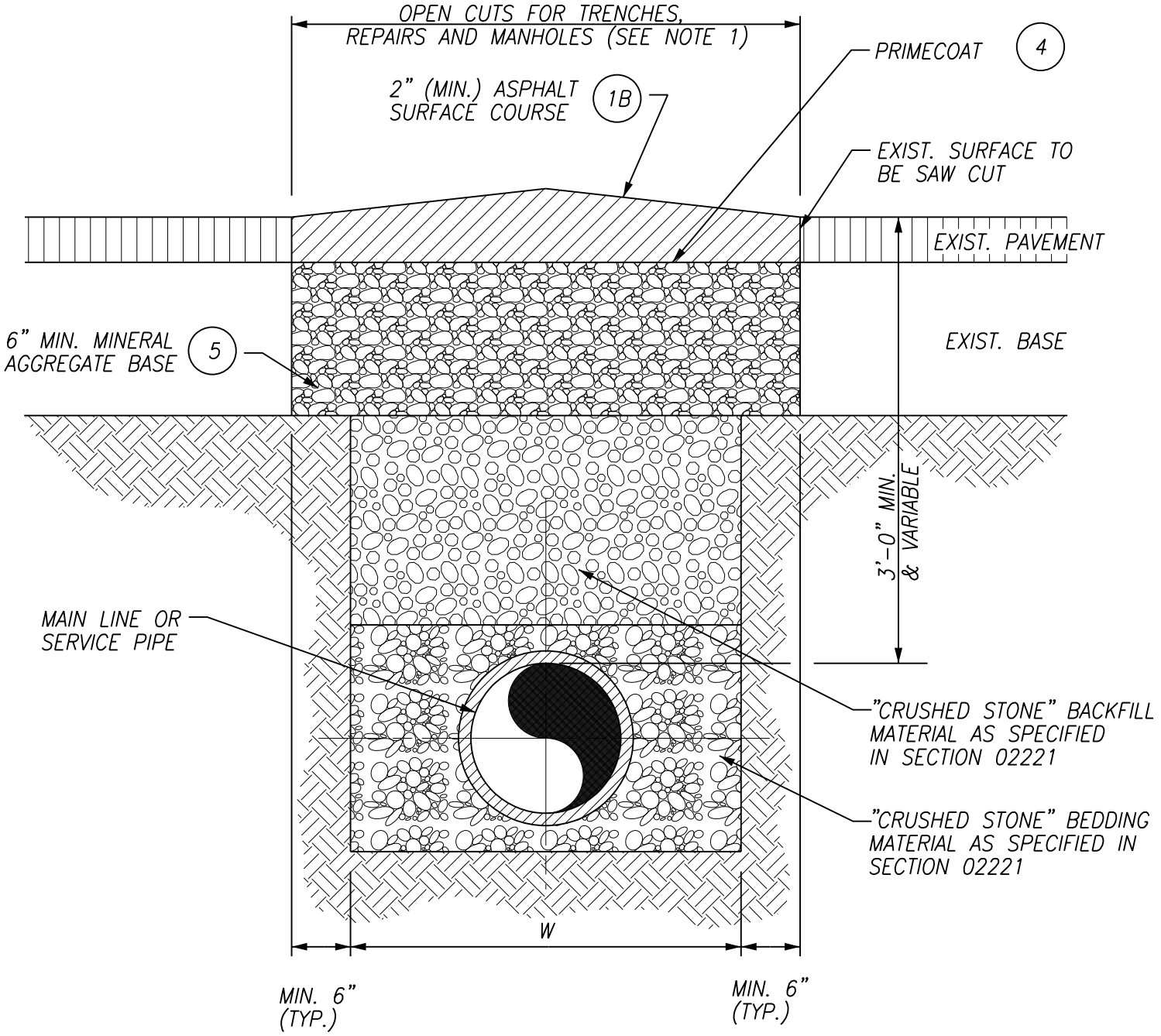
APPROVED BY: LCUB	DRAWN BY: FMA	Scale: NTS
TYPICAL ASPHALT PAVEMENT REPLACEMENT TYPE "I" LENOIR CITY STREETS & STATE HIGHWAYS		Date: 07/30/19
		DRAWING NUMBER: S27.1



NOTES:

1. AT THE DISCRETION OF THE OWNER, WHEN TRENCH PARALLELS CENTERLINE OF ROADWAY AND WIDTH IS EQUAL TO OR GREATER THAN HALF THE LANE OR ROADWAY WIDTH, THEN THE PAVEMENT WIDTH SHALL BE FOR AN OVERLAY OF THE ENTIRE LANE OR ROADWAY WIDTH.
2. FOR PATCH SIZES, TRENCH WIDTHS AND PAVEMENT WIDTHS, SEE PAVEMENT WIDTH SCHEDULE ON STANDARD DRAWING S27.3.
3. PAVEMENT REPAIRS/REPLACEMENT SHALL BE THERMALLY BONDED WITH THE EXISTING ASPHALT EDGES.

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APPROVED BY: LCUB	DRAWN BY: FMA	Scale: NTS
TYPICAL ASPHALT PAVEMENT REPLACEMENT TYPE "II" OPEN CUT PARKING AREAS & DRIVEWAY CROSSING		Date: 07/30/19
		DRAWING NUMBER: S27.2

PAVEMENT SCHEDULE

1.	BITUMINOUS SURFACING COURSE (ROADWAY) – SEE TECHNICAL SPECIFICATIONS A. 411E (MODIFIED) B. 411E (T.D.O.T. STD. OR MODIFIED)
2.	BITUMINOUS MATERIAL FOR TACK COAT (TC) (RATE – 0.02 GAL./SQ. YARD)
3.	BITUMINOUS BINDER COURSE (ROADWAY) @ MIN. 3–1/2" THICK – 307 B – SEE TECHNICAL SPECIFICATIONS
4.	BITUMINOUS MATERIAL FOR PRIME COAT (PC) (RATE – 0.35 GAL./SQ. YARD)
5.	MINERAL AGGREGATE BASE @ MIN. 6" DEEP TYPE "A" BASE, GRADING "D"

PAVEMENT WIDTH SCHEDULE

DEPTH FROM SURFACE TO INVERT (FEET)	WIDTH OF TRENCH (INCHES)	PAVEMENT PATCH WIDTH (INCHES)	MANHOLES SIZE OF PATCH (FEET)
4.0	PIPE DIAMETER + 18"	WIDTH + 12"	12 X 12
4.1 TO 8.0	PIPE DIAMETER + 36"	WIDTH + 12"	14 X 14
8.1 TO 12.0	PIPE DIAMETER + 42"	WIDTH + 12"	16 X 16
12.1 AND UP	PIPE DIAMETER + 42"	WIDTH + 12" (A)	16 X 16 (A)

(A) MAXIMUM PAVEMENT WIDTH AND/OR SIZE FOR ANY DEPTH OF TRENCH.

(B) PAVEMENTS SHALL BE MADE IN STRICT ACCORDANCE WITH SECTION 02610.

NOTES:

1. PAVEMENT DEPTHS SHOWN IN THE DETAILS ARE MINIMUM FOR THIS PROJECT, BUT MAY BE INCREASED AT THE DIRECTION OF THE ENGINEER.

2. ROADWAYS AND HIGHWAYS SHALL HAVE SURFACE COURSE PLACED AND HEAT BLENDED AND SEALED TO EXISTING PAVEMENT TO PRODUCE A SMOOTH/SEALED SURFACE. MEANS, METHODS AND EQUIPMENT SHALL BE SUBMITTED AND APPROVED BY THE ENGINEER PRIOR TO BEGINNING WORK ON THE PROJECT.

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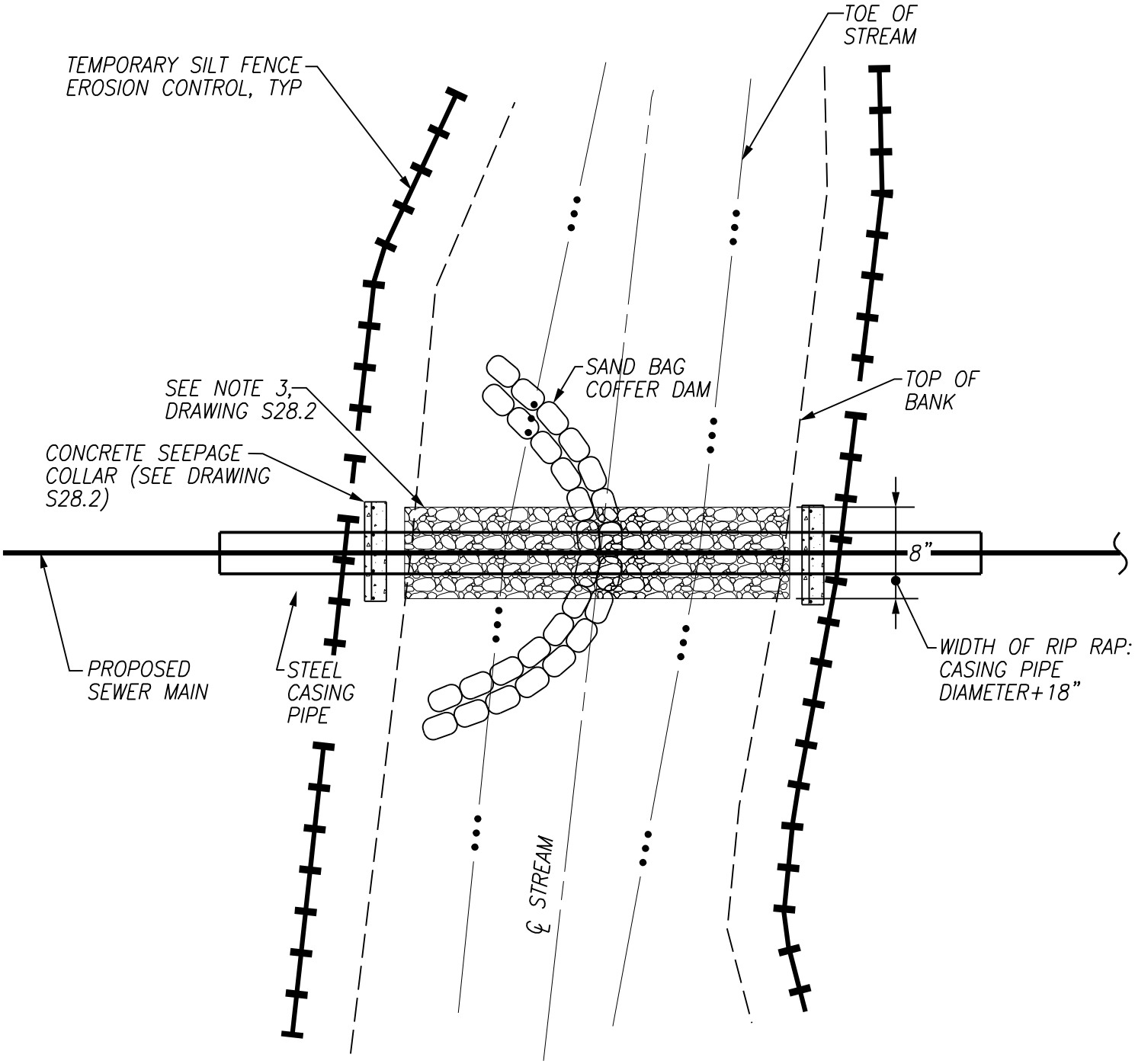
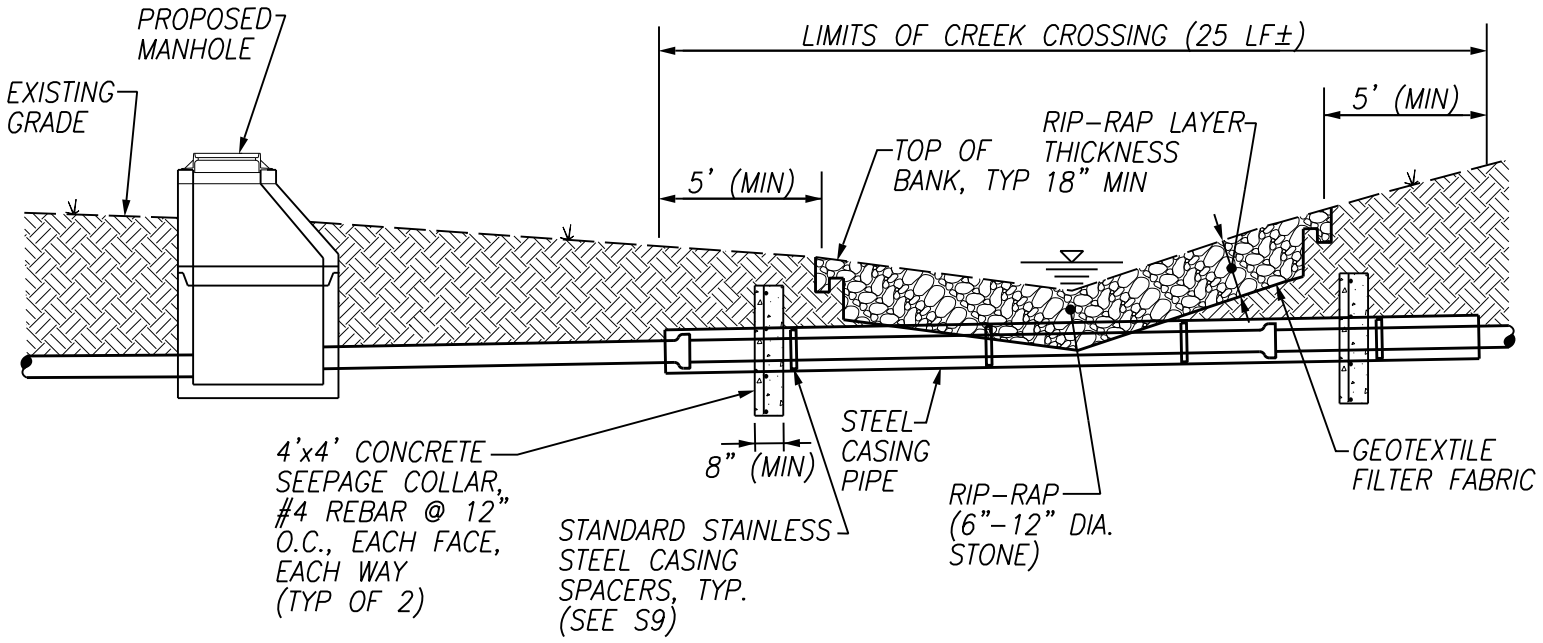
APPROVED BY: LCUB	DRAWN BY: FMA	Scale: NTS
PAVEMENT SCHEDULE AND PAVEMENT WIDTH SCHEDULE		Date: 07/30/19
		DRAWING NUMBER: S27.3



PLAN

LCUB Going the Extra Mile
7698 CREEKWOOD PARK BLVD.
LENOIR CITY, TN 37772
TELEPHONE 844.687.5282

APPROVED BY: LCUB	DRAWN BY: FMA	Scale: NTS
STREAM CROSSING DETAIL (PLAN)		Date: 07/30/19
		DRAWING NUMBER: S28.1



SECTION

NOTES:

1. CONTRACTOR SHALL PERFORM PROPOSED SANITARY SEWER LINE CROSSING OF STREAMS IN STRICT ACCORDANCE WITH THE TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION AQUATIC RESOURCE ALTERATION (GENERAL) PERMIT FOR UTILITY LINE CROSSINGS OF STREAMS.

2. CONTRACTOR TO INSTALL SAND BAG BERM (OR OTHER METHOD TO DIVERT STREAM FLOW AS APPROVED BY THE TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION) FOR OPEN CUT INSTALLATION OF PROPOSED SANITARY SEWER LINE ACROSS STREAMS AS SHOWN ON THE PROJECT PLANS. PERFORM ONE-HALF OF CREEK CROSSING, BACKFILL, THEN RE-LOCATE SAND BAG BERM TO OPPOSITE SIDE OF CREEK AND REPEAT.

3. TRENCH BACKFILL SHALL BE CLEAN #57 OR #67 CRUSHED STONE UP TO WITHIN EIGHTEEN (18") INCHES OF CREEK BOTTOM. THE TOP EIGHTEEN (18") INCHES SHALL BE 8-12 INCH NOMINAL SIZE RIP-RAP OR RIVER ROCK.

4. ANY EXCAVATION OF THE STREAM CHANNEL AREA SHALL BE SEPARATED FROM FLOWING WATER, AND ACCOMPLISHED DURING LOW FLOW CONDITIONS. THIS SHALL BE ACCOMPLISHED BY THE USE OF FLUMES, LINED DIVERSION CHANNEL WITH SAND BAG BERM, DIVERSION PIPE INLET, OR IN SOME CASES, COFFER DAMS. COST TO BE INCLUDED IN OTHER ITEMS OF CONSTRUCTION.

5. THE SEEPAGE COLLAR SHALL NOT ENCASE A PIPE JOINT.

6. GEOTEXTILE FILTER FABRIC SHALL BE SYNTHETIC INDUSTRIES EROSION XV OR EQUAL. INSTALL PER WRITTEN MANUFACTURER'S SPECIFICATIONS.

7. ALL RIP-RAP SHALL BE HAND PLACED IN A MANNER TO MINIMIZE VOIDS.

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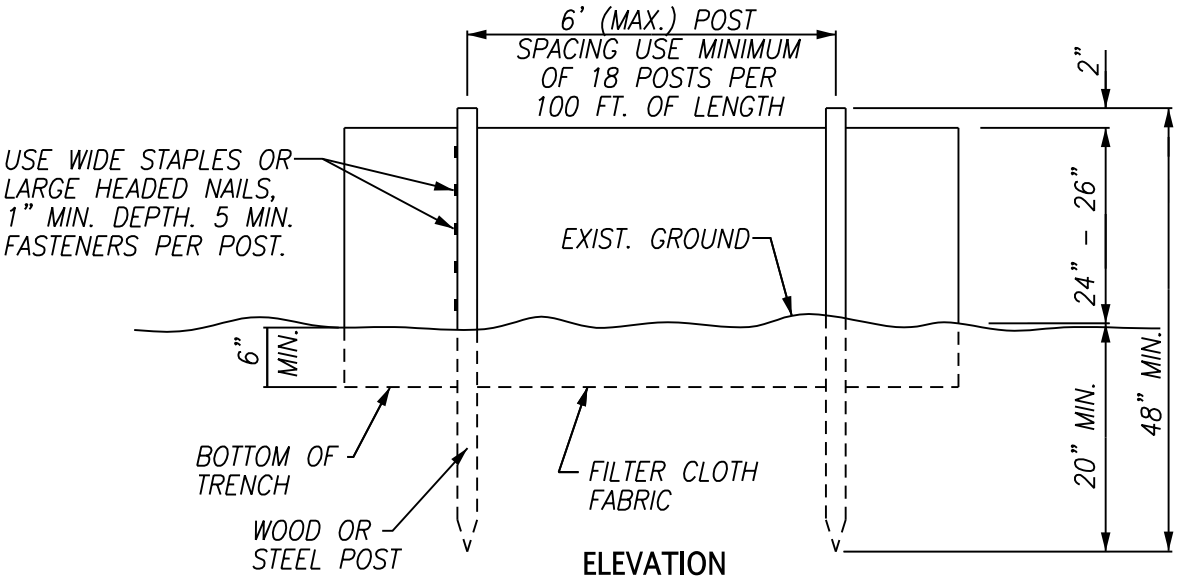
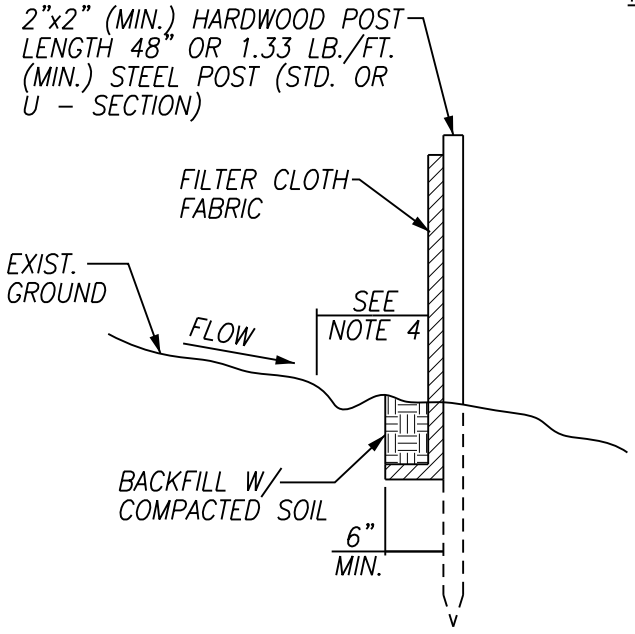
APPROVED BY: LCUB	DRAWN BY: FMA	Scale: NTS
STREAM CROSSING DETAIL (SECTION)		Date: 07/30/19
		DRAWING NUMBER: S28.2



ELEVATION



SECTION

NOTES:

1. SILT FENCE SHALL BE PRE-ASSEMBLED AND INSTALLED IN ACCORDANCE WITH THE MANUFACTURERS SPECIFICATIONS.
2. SILT FENCE SHALL HAVE AN APPROVED BACKING OR A BUILT-IN REINFORCED STRUCTURE AS RECOMMENDED BY THE MANUFACTURER TO SUPPORT THE GEOTEXTILE FABRIC.
3. ONCE PERMANENT VEGETATION IS ESTABLISHED, REMOVE THE SILT FENCE, BACKFILL TRENCH WITH TOPSOIL, AND APPLY SEED AND MULCH TO ALL DISTURBED AREAS. LEGALLY DISPOSE OF REMOVED FENCE OFF-SITE.
4. PLACE SILT FENCE AT LEAST 5 TO 7 FEET AWAY FROM STEEP OR LONG SLOPES TO IMPOUND STORMWATER RUNOFF.
5. POST SPACING SHALL BE 4 FEET MAXIMUM WITHIN A DRAINAGE CHANNEL.
6. TURN LAST 7 TO 10 FEET OF SILT FENCE UPHILL.

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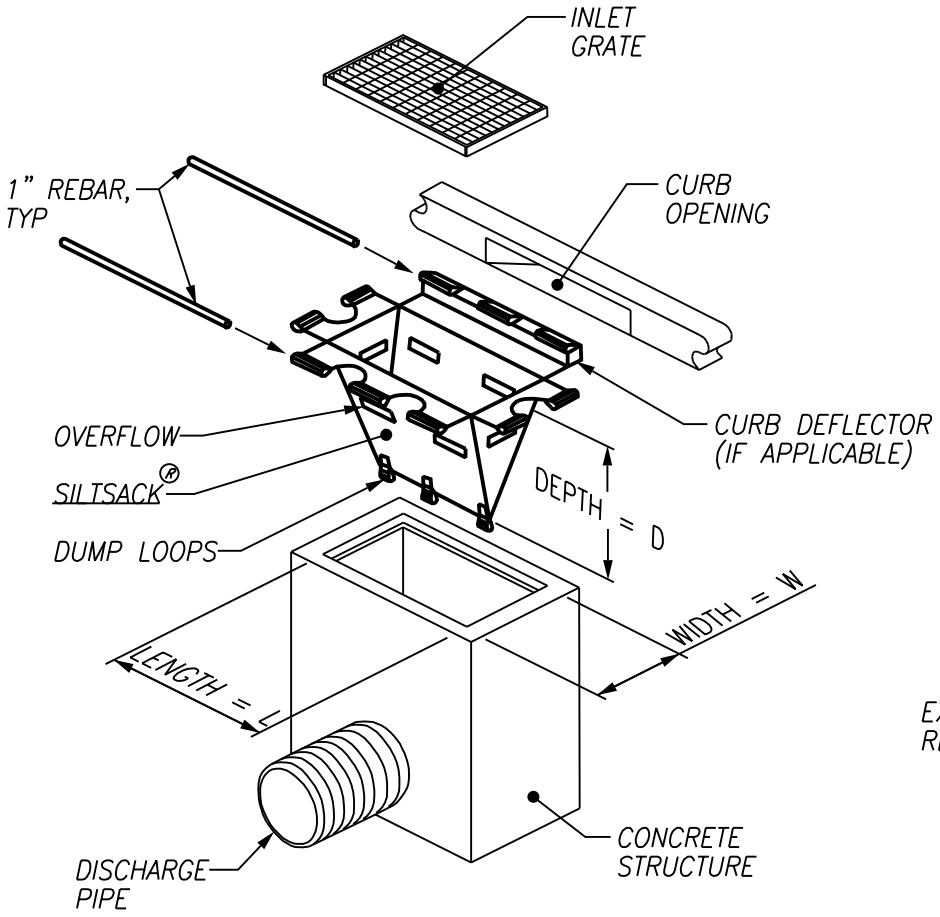
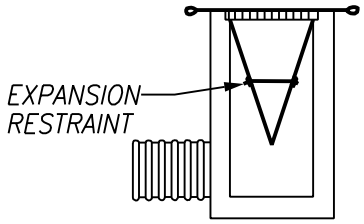
APPROVED BY: LCUB	DRAWN BY: FMA	Scale: NTS
SILT FENCE		Date: 07/30/21
		DRAWING NUMBER: S29





SIDE VIEW

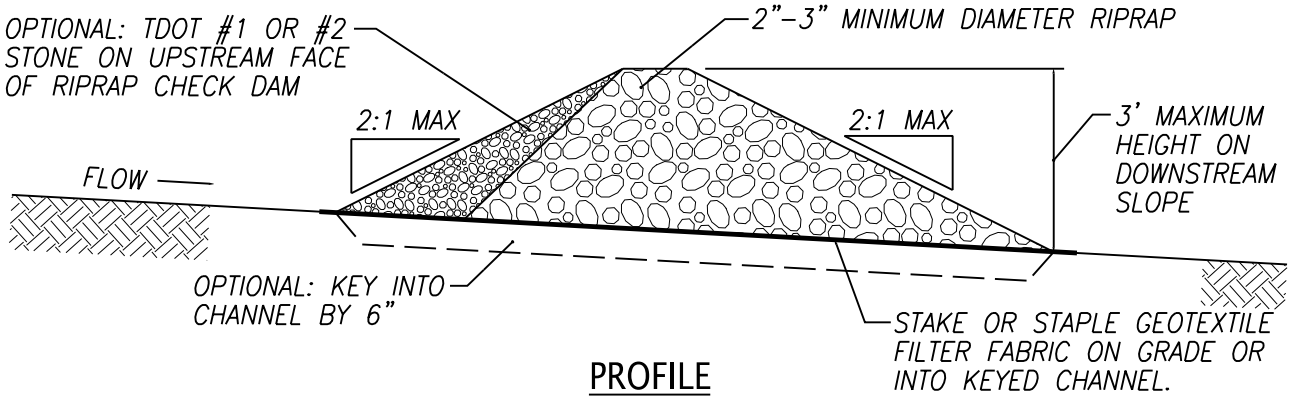
NOTES:

1. THE INLET SEDIMENT CONTROL DEVICE SHALL BE SILTSACK®, OR EQUIVALENT, FOR USE ON STORM STRUCTURES LOCATED IN PAVED AREAS WHERE THERE IS A POTENTIAL FOR RECEIVING SEDIMENT LADEN RUNOFF.

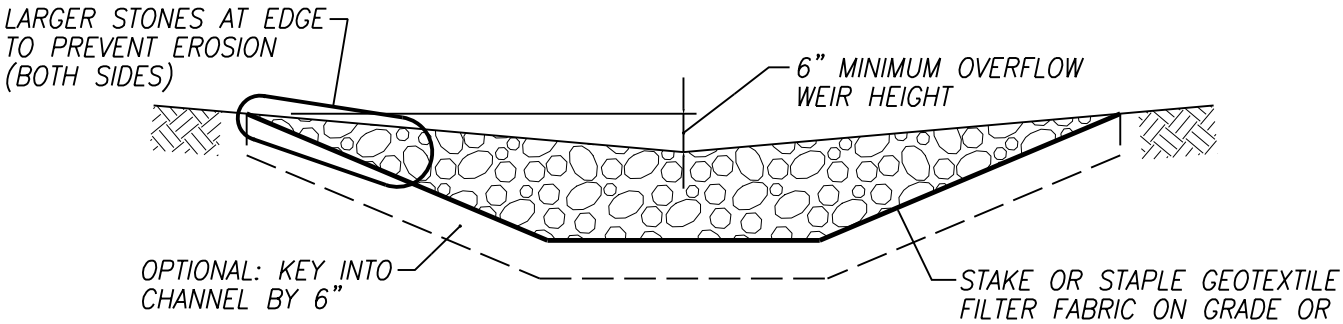
2. REMOVE ONCE PERMANENT VEGETATION IS ESTABLISHED.

LCUB Going the Extra Mile
7698 CREEKWOOD PARK BLVD.
LENOIR CITY, TN 37772
TELEPHONE 844.687.5282

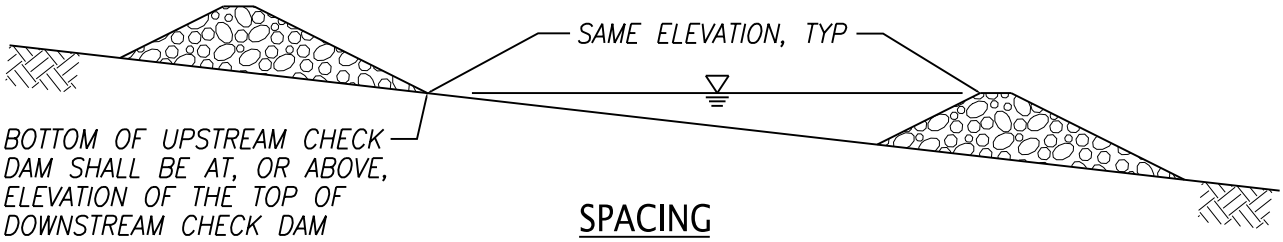
APPROVED BY: LCUB	DRAWN BY: FMA	Scale: NTS
INLET SEDIMENT CONTROL DEVICE		Date: 07/30/21
		DRAWING NUMBER: S30



PROFILE



SECTION



SPACING

NOTES:

1. GEOTEXTILE SEPARATION FABRIC SHALL BE GEOTEX 801 (8 OUNCE NON-WOVEN) BY PROPEX OR EQUAL.
2. CONSTRUCT, MAINTAIN, AND REMOVE IN ACCORDANCE WITH THE TENNESSEE EROSION & SEDIMENT CONTROL HANDBOOK.

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LENOIR CITY, TN 37772
TELEPHONE 844.687.5282

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TEMPORARY ROCK CHECK DAM		Date: 07/30/21
		DRAWING NUMBER: S31

LCUB GENERAL NOTES TO BE INCLUDED ON THE SANITARY SEWER DRAWINGS:

1. ALL WORK TO BE PERFORMED WILL BE IN ACCORDANCE WITH THE LENOIR CITY UTILITIES BOARD WATER AND WASTEWATER DEPARTMENT (CURRENT EDITION) SPECIFICATIONS AND DETAILS.

2. A PRE-CONSTRUCTION CONFERENCE SHALL BE CONDUCTED WITH LCUB REPRESENTATIVES, DESIGN ENGINEER, AND UTILITY CONTRACTOR PRIOR TO ANY UTILITIES CONSTRUCTION ACTIVITIES BEGINNING.

3. WASTEWATER LINE MATERIALS, INSTALLATION AND TESTING SHALL BE IN ACCORDANCE WITH LCUB WATER AND WASTEWATER DEPARTMENT STANDARDS (CURRENT EDITION).

4. ALL SERVICE LATERALS SHALL BE 6" DIAMETER FROM MAIN TO PROPERTY LINE AND INSTALLED AT MINIMUM 1% SLOPE UNLESS FIELD VERIFIED BY THE ENGINEER. A 6"x4" INCREASER BUSHING -ECCENTRIC (PART NUMBER 32642) SHALL BE USED FOR SINGLE FAMILY RESIDENTIAL CONNECTION.

5. SERVICE LATERAL CLEANOUT SHALL BE A 2-WAY CLEANOUT AS MANUFACTURED BY PLASTIC TRENDS (G 1006) AND EXTEND 3 FEET ABOVE FINISHED GRADE TO MARK SEWER SERVICE LOCATION UNTIL BUILDING CONNECTION IS MADE.

6. WASTEWATER LATERAL DISCHARGE (MAIN FLOOR ELEVATION) SHALL BE A MINIMUM OF 6" ABOVE THE TOP OF THE LOWEST OF THE TWO ADJACENT MANHOLES.

7. ALL INDIVIDUAL LOW PRESSURE WASTEWATER GRINDER PUMPS/BASEMENT PUMPS SHALL BE PRIVATE AND WILL NOT BE OWNED NOR MAINTAINED BY LCUB.

8. ALL WASTEWATER PUMP STATIONS REQUIRED AND PRE-APPROVED BY LCUB SHALL BE SUBMERSIBLE FLYGT PUMP STATIONS.

9. ALL CONSTRUCTION AND TESTING ACTIVITIES MUST BE OBSERVED BY A RESIDENT PROJECT REPRESENTATIVE (RPR) AS DESIGNATED BY LCUB. WORK PERFORMED WITHOUT DESIGNATED RPR OVERSIGHT AND APPROVAL SHALL NOT BE ACCEPTED BY LCUB.

10. ALL COSTS INCURRED BY LCUB FOR PROJECT-RELATED RPR AND GENERAL ENGINEERING SERVICES DURING CONSTRUCTION SHALL BE REIMBURSED BY THE PROPERTY OWNER/DEVELOPER.

11. ALL PROJECT CLOSEOUT DOCUMENTS MUST BE PROVIDED BY THE OWNER/DEVELOPER PRIOR TO LCUB ACCEPTING OWNERSHIP OF NEW FACILITIES AS FOLLOWS:
    A. RECORD DRAWINGS
    B. RPR DAILY REPORTS
    C. CONSTRUCTION PHOTOS
    D. RPR TESTING REPORTS
    E. CCTV FOR NEW GRAVITY WASTEWATER MAINS
    F. VERIFIED GIS DATA COLLECTED BY LCUB-APPROVED STAFF
    G. ASSOCIATED EASEMENT DOCUMENTS

12. LCUB HAS THE RIGHT TO REQUIRE A LARGER DIAMETER PIPE SIZE OR DUCTILE IRON PIPE BASED UPON HYDRAULIC ANALYSIS, DEPTH, SOIL, AND FUTURE CONDITIONS.

13. BLASTING NOT PERMITTED.

14. ASSOCIATED WASTEWATER FEES FOR DEVELOPMENT PROJECTS SHALL INCLUDE, BUT NOT LIMITED TO, TAPS, CAPITAL RESERVE, SPECIAL ASSESSMENT, ETC. AND SHALL BE BILLED AT THE END OF EACH PROJECT PHASE AND PAYMENT SHALL BE DUE FROM DEVELOPER AT THAT TIME. WASTEWATER SERVICE SHALL NOT BE MADE LIVE UNTIL PAYMENT IS RECEIVED IN FULL.

15. DEVELOPER (OWNER) AND/OR CONTRACTOR SHALL BE REPSONSIBLE FOR ANY EXISTING SEWER COLLECTION SYSTEM IMPROVEMENTS REQUIRED TO PROVIDE HYDRAULIC SEWER CAPACITY TO THE NEW DEVELOPMENT AND MAINTAIN EXISTING/FUTURE HYDRAULIC SEWER CAPACITY.

16. LOW PRESSURE SEWER SYSTEMS SHALL ONLY BE APPROVED IN CERTAIN AREAS OF THE LCUB SEWER COLLECTION SYSTEM AND UNDER SPECIAL CIRCUMSTANCES. LCUB DESIRES TO UTILIZE GRAVITY SEWER WHERE FEASIBLE AND SHALL NOT OWN NOR MAINTAIN INDIVIDUAL GRINDER PUMPS OR PRIVATE LOW PRESSURE SEWER SERVICE LINES.

17. DEVELOPER (OWNER) AND/OR CONTRACTOR SHALL BE RESPONSIBLE FOR INSTALLING MINIMUM SDR 35 PIPE FOR SANITARY SEWER SERVICES TO DEPTH OF 12 FEET. ANY SANITARY SEWER SERVICES WHICH ARE OVER 12 FEET DEPTH SHALL REQUIRE WATER LINE AND/OR MECHANICAL JOINT QUALITY PIPE.

18. DEVELOPER (OWNER) AND/OR CONTRACTOR SHALL BE RESPONSIBLE FOR INSTALLING ALL 6-INCH SEWER TAPS, 6-INCH SERVICE LINES, AND 6-INCH 2-WAY CLEANOUT PER LCUB STANDARD SPECIFICATIONS FOR THE NEW DEVELOPMENT.

19. RIGHT-OF-WAYS AND EASEMENTS NEEDED FOR THE SEWER LINE THAT FALLS INSIDE/OUTSIDE OF THE PROPERTY SHALL BE SIGNED AND FURNISHED PRIOR TO START OF PROJECT.

20. CONTRACTOR SHALL FIELD VERIFY AND POTHOLE ALL UTILITIES AS INDICATED BY DRAWING, GIS, TENNESSEE ONECALL, ETC.

21. ALL CONTRACTORS SHALL BE LICENSED CONTRACTORS WITH "MU" CLASSIFICATION IN THE STATE OF TENNESSEE AS REQUIRED BY THE CONTRACTOR'S LICENSING ACT OF 1994 AND RELATED AMENDMENTS THERETO.

21. DEVELOPMENT PHASING SHALL BE APPROVED ONLY BEFORE P.E., LCUB, AND TDEC STAMPS ARE APPLIED AT THE BEGINNING OF THE PROJECT. NO RE-PHASING WILL BE ALLOWED OR APPROVED AFTER CONSTRUCTION OF A PROJECT HAS BEGUN.

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LENOIR CITY, TN 37772
TELEPHONE 844.687.5282

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GENERAL SEWER NOTES		Date: 04/11/23
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