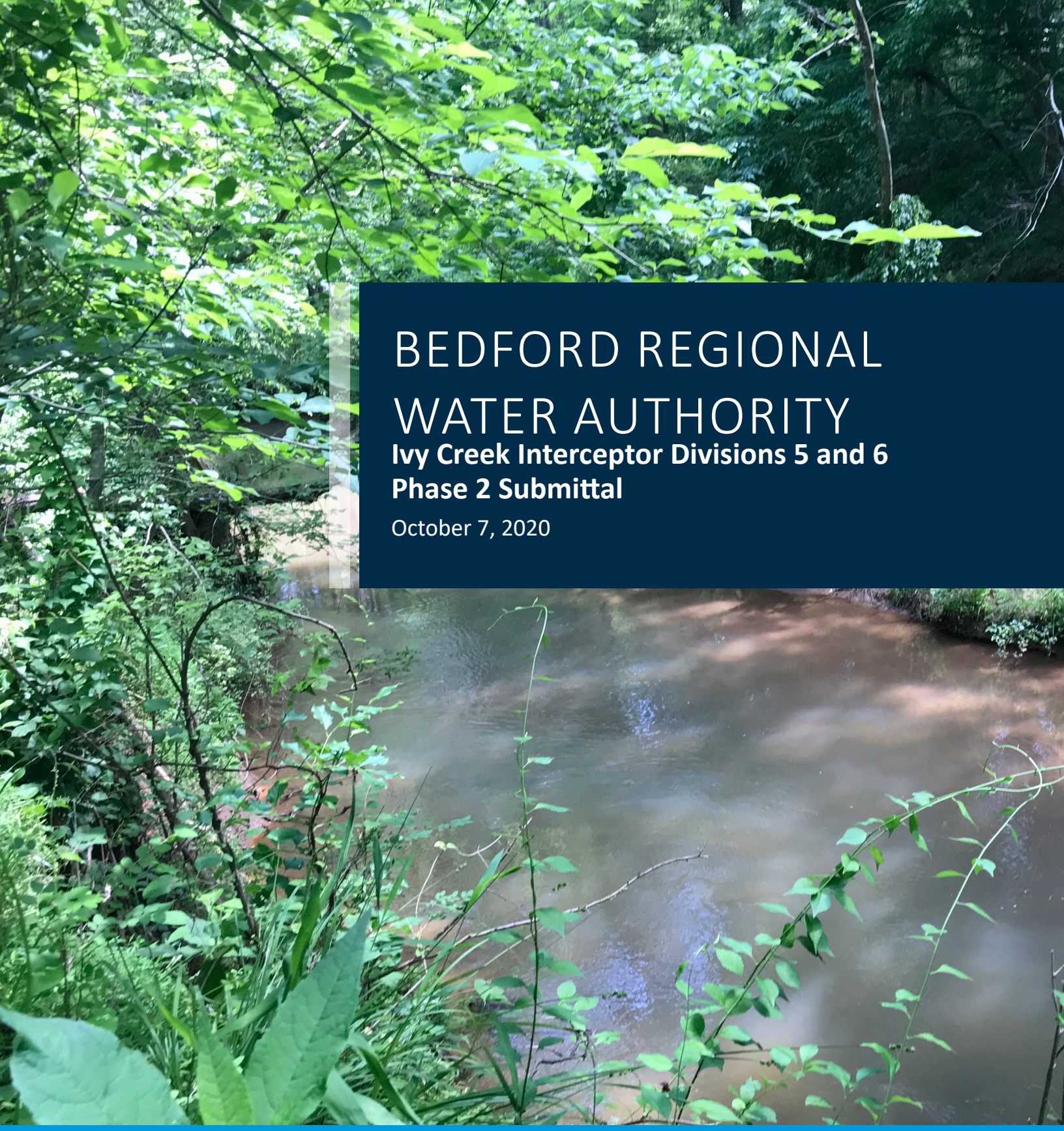


BEDFORD REGIONAL WATER AUTHORITY

Ivy Creek Interceptor Divisions 5 and 6 Phase 2 Submittal

October 7, 2020

EC PACE
COMPANY, INC.
General Contractors Since 1926
Utilities, Grading, Horizontal Boring, Pipe Bursting

Table of Contents

A. Topographical Map

Topographical Map

A topographical map of the site can be found in Appendix A.

B. Description of the Qualifying Project

Description of the Qualifying Project

Project Characteristics

Allocation of Risk: As the Design-Builder, E.C. Pace understands that work completed beyond the negotiated agreements and completion dates will have financial costs and consequences for BRWA. We understand and agree with the importance of on-time project delivery and accountability. With this in mind, we will work with BRWA to establish a schedule of liquidated damages that would be applied should the project, or an agreed-upon phase of the project, not be completed on time. We propose that the value of the liquidated damages be based on an estimate of actual damages and that they be assessed as compensation to BRWA.

Ownership Assumptions: While preparing this proposal, we have assumed that the Design-Builder, E.C. Pace, would take full ownership of the work during construction and would be responsible for maintenance of the work, the project site, and all related support facilities. This would include legal liability for prosecution of the work and operation of the project.

Phased or Partial Openings: Once a section or phase of the project is complete and fully serviceable, phased or partial acceptance could take place if it provides a benefit to BRWA. Once a section or phase is accepted, BRWA would have full ownership of the completed work. The Route 460 pump station could be put into service as soon as it is complete. The Ivy Creek Interceptor could be put into service in sections, beginning with the downstream section of Division 5. As part of our preliminary scheduling effort, we anticipate the downstream section of Division 5 taking place first, starting with the connection to the existing interceptor. This will allow for the full operation of each successive portion of the interceptor as it is installed upstream.

Additional Assumptions: The Design-Build team has assumed that all creek crossings will be able to be permitted as open-cut. If creek crossings are required to be installed via trenchless methods, additional geotechnical or design work may be required. E.C. Pace has also assumed that construction will be able to begin no later than the middle of Summer 2021. If construction begins later than this date, there would be construction cost implications. Additional Contingencies For the project to be successful, the Design-Build team is relying on the ability to facilitate obtaining the necessary easements. This is of particular importance for the Ivy Creek Interceptor. If an easement cannot be obtained, it may require a significant adjustment to the sewer alignment which could result in additional cost accounted for in the contingency.

Ivy Creek Interceptor

Project Understanding

The BRWA is a water Authority located in Bedford, Virginia, that provides area customers with high quality and reliable water and wastewater services. In 2020, a preliminary engineering report (PER) was updated that detailed the improvements needed on the BRWA interceptor system. In the PER, it was proposed to construct two new sections of the Ivy Creek Sewer Interceptor, Division 5 and 6, to allow the Forest area to be served by gravity and to allow sufficient sewer capacity for economic development. The Ivy Creek Interceptor project includes the decommissioning of the Lake Vista Pump Station (LVPS) and the construction of approximately 7,500 linear feet of 24 or 30-inch sewer for Division 5 in the City of Lynchburg and 11,000 linear feet of 24 or 30-inch sewer for Division 6 in Bedford County. A metering flume will also be placed at the City of Lynchburg and Bedford County boundary to measure flows conveyed from BRWA. Further details about the decommissioning of the LVPS, flume station, and sewer line can be found in the Technical Approach Section.

The existing sewer collects wastewater through a series of gravity sewers in the Forest and New London area, which is conveyed to the LVPS. From the LVPS, wastewater is pumped through the Lake Vista force main to the Lake Vista gravity sewer, where it then crosses into the City of Lynchburg and is conveyed to the City's regional wastewater treatment plant (WWTP). The LVPS has historically not been able to convey design flow and has experienced continuous odor and maintenance issues. The existing Forest and New London service areas cumulatively total approximately 8,230 acres of service area and have a large potential for residential and commercial development. With the addition of future sewer interceptors and development potential, the service area for Forest and New London could expand substantially to 34,000 acres, which is more than a fourfold increase in service area.

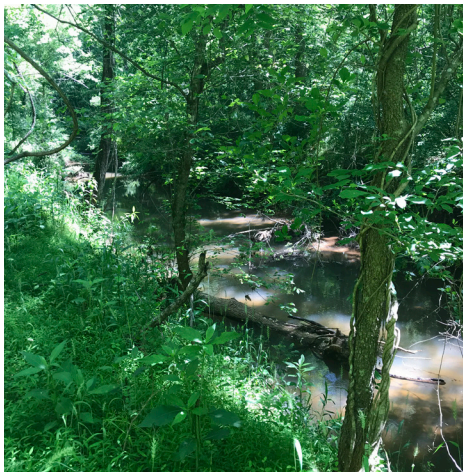
BRWA currently purchases capacity for entry points in the existing City of Lynchburg owned Tomahawk Creek (B-1 and B-2), Blackwater Creek, Ivy Creek (B-3), and Cheese Creek (B-4 and B-5) Interceptors. Current purchased capacity in the Tomahawk Creek and Blackwater Creek Interceptors (B-1 and B-2) is 2.0 MGD peak flow and 0.80 MGD average daily flow. Current purchased capacity in the Ivy Creek and Cheese Creek Interceptors (B-4 and B-5) is 2.27 MGD peak flow and 0.91 MGD average daily flow. The allotted capacity for the Ivy Creek Interceptor (B-3) has not been purchased by BRWA in the Ivy Creek Division 5 segment since they are designing and constructing the new Interceptor. (Reference Appendix D for City of Lynchburg and BRWA Interceptor Overview Map)

Future wastewater flows were projected in the PER for a 20-year planning window and through buildout to the year 2060. From the growth projections, it is anticipated that BRWA will exceed sewer capacity allocations at entry point B-3 (0.91 MGD) and WWTP capacity allocations (1 MGD) between 2035 and 2060 and, at that time, would need to purchase additional capacity.

The Ivy Creek Interceptor projects will allow expansion and economic development in the BRWA service area beyond 2060 and allow wastewater to be conveyed via gravity to the City of Lynchburg with the decommissioning and repurposing of the LVPS.

Site Plan/Sewer Layout

The preliminary sewer layout drawings, provided in the PER, were modified by the E. C. Pace and CHA team for this proposal. Sewer manholes and alignments that were modified to increase reliability, decrease maintenance issues, and save on cost are bolded in the figures in Appendix A.



Authority Responsibilities

The work to be performed by BRWA includes:

- Project funding from DEQ to include construction, design, permitting, construction administration, the cost for permanent and temporary easement, and land acquisition. Bridge funding for BRWA is available as part of this proposal and is further discussed in the Project Funding section.
- Construction inspection. E. C. Pace will provide an hourly cost for inspection services for BRWA to consider, if needed.
- Independent geotechnical or special inspections during construction.
- Provision of water (potable or non-potable depending on application) for construction testing.

E. C. Pace and CHA Responsibilities

The work to be performed by the E. C. Pace and CHA team, above and beyond expected design and construction services, includes:

- Coordination of project kickoff and progress meetings with BRWA
- Verification of sewer capacity and peaking factors. Reference the Technical Approach section for additional details.
- Bridge funding for the Ivy Creek Interceptor project, if needed.
- Facilitate permanent and temporary easements for construction.
- Preparation of easement agreements and plats.
- Coordination of permanent electrical service and SCADA integration for flume station.
- Environmental and cultural resource assessments.
- As-built drawings at project closeout
- Compliance with all DEQ funding construction and administration requirements

Public Support or Opposition

Public support, with no opposition, is anticipated for this project. This project allows for economic development in the area and for the elimination of pump station maintenance at the LVPS.

Project Benefit and Compatibility

The Ivy Creek Interceptor project allows economic development in the Forest, New London and Bedford areas by providing enhanced sewer service to existing customers and providing new sewer service for developing parcels.

Route 460 Pump Station

Project Understanding

CHA has already provided design services for the construction of a 2.0 MGD water distribution booster pump station. The pump station's purpose is to boost flow from and to the outer portions of the BRWA's water distribution system. As a means of increasing the distribution system reliability, the pump station was designed with the unique ability to allow pumped flow to run in any of three different directions. The pump station is primarily designed to move water from the Lakes Water Treatment Plant (WTP) into the community of Forest, potentially supplementing flow into the City of Bedford. In the case of a pipe break or other emergency, however, the pump station will have the ability to reverse flow and use the normally downstream system as a source for the other portions.

Site Plan/Pump Station Layout

The final pump station drawings, completed by CHA and provided in the PPEA, have select drawing sheets included in Appendix C.

Authority Responsibilities

The work to be performed by BRWA includes:

- Cash funding to include construction, design, permitting, construction administration, the cost for permanent and temporary easement, and land acquisition. Bridge funding for BRWA is available as part of this proposal and is further discussed in the Project Funding section.
- Construction inspection. E.C. Pace will provide an hourly cost for inspection services for BRWA to consider, if needed.
- Independent geotechnical or special inspections during construction.
- Provision of water (potable or non-potable depending on application) for construction testing.

E. C. Pace and CHA Responsibilities

The work to be performed by the E. C. Pace and CHA team, above and beyond expected design and construction services, includes:

- E.C. Pace can provide Bridge funding options for the Ivy Creek Interceptor project, if needed.
- Coordination of project kickoff and progress meetings with BRWA
- As-built drawings at the end of the project
- Environmental and cultural resource assessments.
- Coordination with the BRWA and the SCADA contractor for system integration

BRWA PPEA Technical Approach

Our Team has a unique understanding of BRWA's sanitary sewer system from our previous work with the Authority. Our design partner CHA's previous work has allowed our Team to develop a great working relationship with the Authority's engineering staff. E. C. Pace and CHA have a specific understanding of the Ivy Creek Sanitary Sewer and Route 460 Pump Station from the published PER, communication with the Authority, and recent field visits (June 2020) as part of this proposal preparation. A brief discussion below outlines the specifics for the technical approach that will be taken for project success.

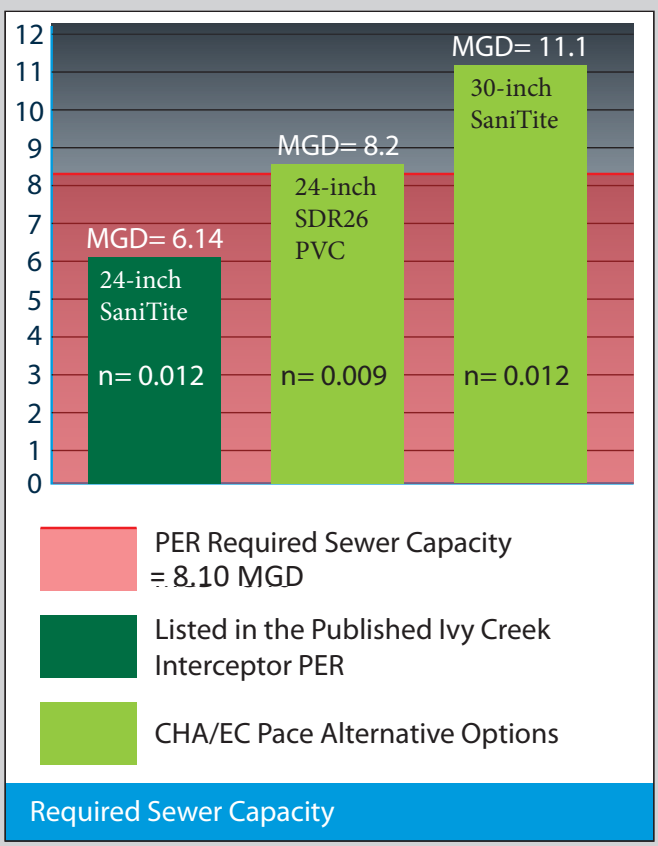
Sanitary Sewer

For this project, one of the plastic pipe materials the PER proposed was to utilize ADS SaniTite pipe, which is a triple walled polypropylene pipe. SaniTite is made with a reinforced bell and spigot and is high impact resistant HDPE. HDPE also has the advantage of being light weight and easy to handle in the field.

The PER uses a peaking factor of 2.5 for the Ivy Creek Interceptor. Virginia Sewage Collection and Treatment (SCAT) regulations require a peaking factor for interceptors of 2.0. Because of the variability in peaking factor and sewer capacity as related to pipe materials, a careful evaluation of required sewer performance should be completed before construction begins to:

- Confirm required peaking factors from DEQ
- Verify needed sewer capacity
- Determine a recommended pipe material
- Finalize a corresponding pipe diameter

In the PER provided with the PPEA, the recommended pipe diameter for the ADS manufactured SaniTite pipe was 24-inches. With the manufacturer specified recommended Manning's coefficient of 0.012, sewer capacity would only reach 6.14 MGD as shown in the figure on the right. In the PER, a required sewer capacity of 8.10 MGD was listed. Therefore, two pipe options were evaluated as part of this project: 24-inch SDR26 PVC and 30-inch SaniTite. Using 30-inch SaniTite pipe (assumed slope = 0.0015 ft/ft), a sewer capacity of approximately 11 MGD (17.2 cfs) can be achieved. For SDR26, the 24-inch pipe cost is approximately the same as the larger diameter SaniTite. The SDR26 pipe provides a lower capacity at 8.20 MGD, but meets and exceeds PER required flows. Given that the larger SaniTite pipe provides a higher sewer capacity at a comparable construction cost to the SDR26 pipe, the design-build team recommends the installation of the larger SaniTite pipe.



In the published Ivy Creek Interceptor PER, the Manning's coefficient of 0.009 was used for sewer capacity calculations (Section 3.4). Since the Manning's coefficient directly impacts sewer capacity, any pipe material with a coefficient larger than 0.009 and diameter 24-inches and smaller would not result in the desired sewer capacity of 8.10 MGD.

If sewer capacity becomes an issue during construction due to an increase in flows from planned developments, E. C. Pace has the experience and equipment required to provide full bypass pumping for the duration of the project.

E. C. Pace and CHA would work with BRWA to anticipate a schedule for the addition of sewer flows from new developments to provide bypass pumping, if needed. Peak hour flow rates at the Lake Vista Pump Station are also recommended to size bypass pumping at the tie in locations. The addition of flow monitors at the Lake Vista Pump Station is recommended during the early design phase since data provided in the PER was peak daily and not peak hourly flow.

New Developments and Corresponding Wastewater Flows

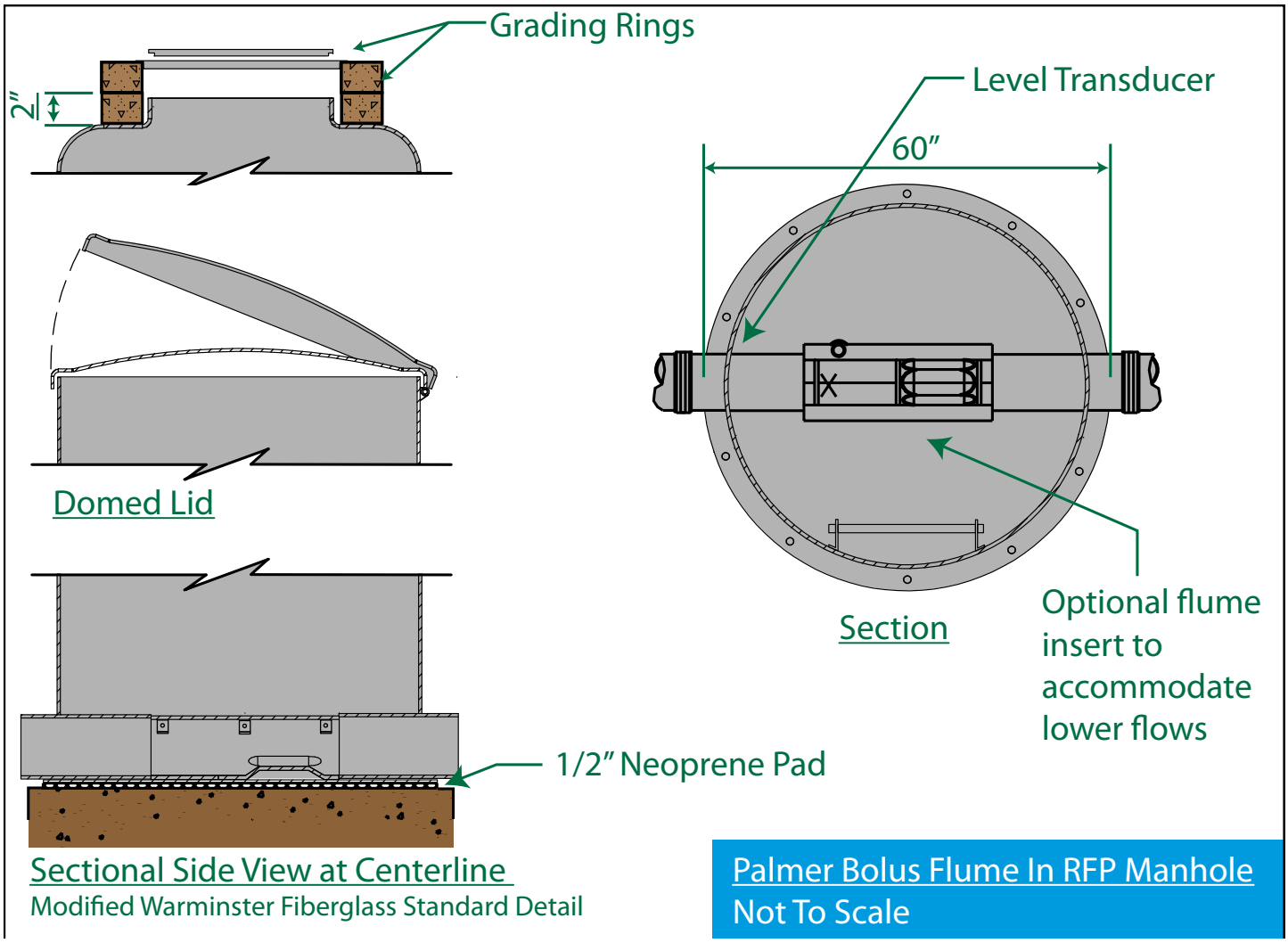
BRWA #	Planning #	Name	Number of Lots/ Units Added	Average GPD
2017-058	SP180051	Forest Enterprises LLC - Site Plan	1	4800
2017-072		Brentwood Community Church - Site Plan	1	1285
2018-106		NLBTC Lot 7 EDA Shell Building - Site/Design Plan	1	3038.4
2012-041	SP130019	Jefferson Commons Commercial Lot 2	1	625
2020-019	SD20-0010	Valtim Minor Subdivision - Plat	1	
2020-039	SD20-0022	B & A Properties of Virginia - Plat (Spring Creek)	4	2500
2011-020.2		Grandview - Phase 1B	63	15750
2017-059	SP180008	Nanotouch - NLB&T Center - Site Plan	1	250
2017-060		Burnbridge Sewer Extension - Design	13	
2018-076	SP190016	Cottontown Manor Phase 3 - Site Plan	62	24800
2018-096	SP200002	Route 221 Carwash - Site Plan	1	14000
2019-034	SP190044	Westin Village Townhomes 2019 - Site/Design	96	24000
2019-101		Sheetz New London Sewer Extension - Design	1	
2019-117		Westyn Village Condotels	241	60250
2020-034	SP20-0008	Cottontown Manor Phase 4 - Site Plan	24	9600
2011-021		Grandview - Phase 2	54	13500
2012-015	SP130017	Jefferson Commons Commercial Lot 1	1	625

The proposed sewer alignment was also evaluated by looking at existing topographic information and from the completed field visit in June 2020. Several realignments and minor design adjustments are recommended for ease of maintenance such as the addition of manholes on either side of stream crossings. Some realignments are recommended to remain on more even grade or to eliminate deep sewers. The proposed alignment across Cottontown Road may require extensive coordination with the power utility or a realignment in this area. It appears that there are large transmission power lines in this area and, typically, power utilities do not allow other utility encroachments within 50 feet of any asset (tower). The proposed alignment in the PER will encroach on the power utility right of way and appears to be closer than 50 feet to the transmission tower.

Ivy Creek Near Interceptor Location

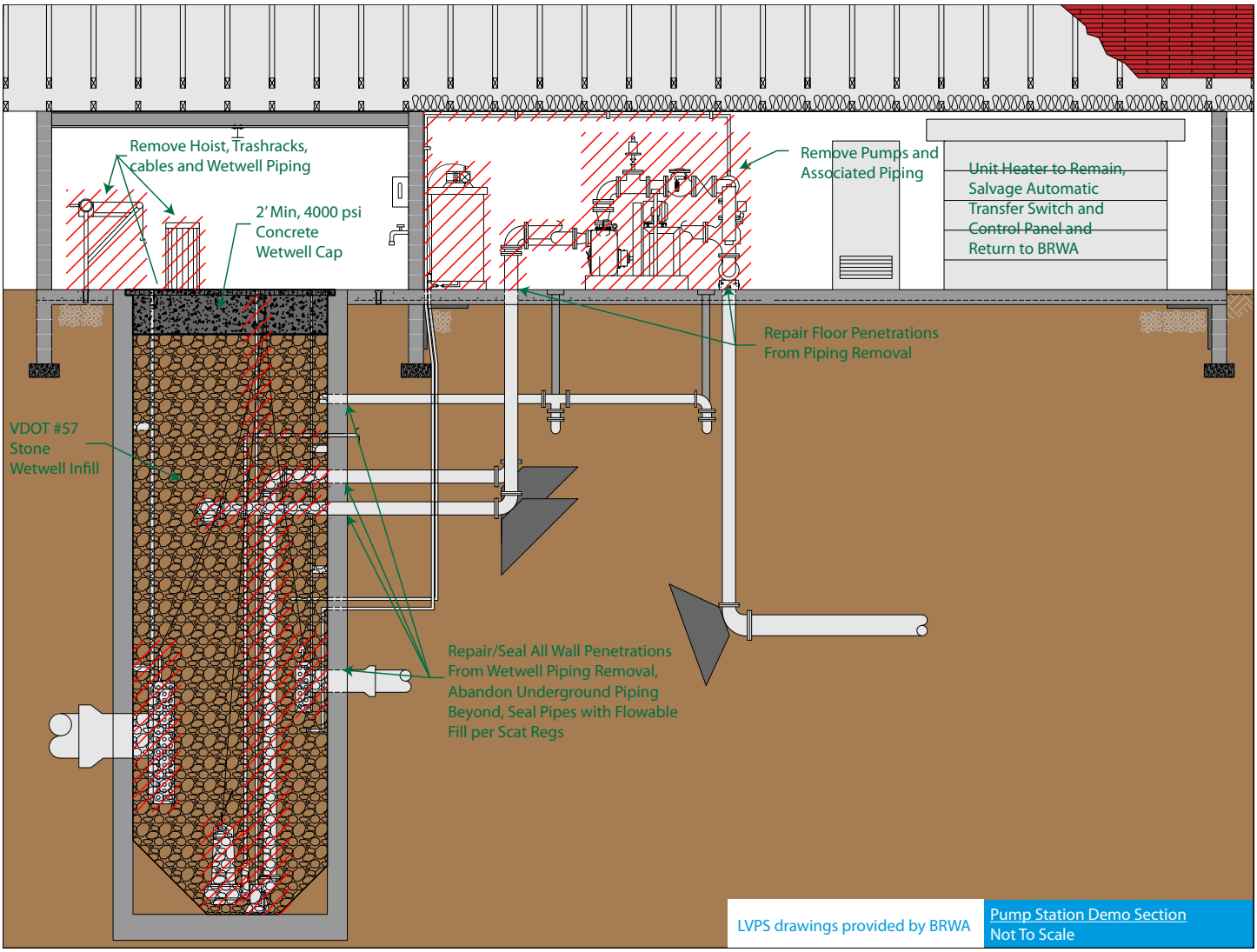
Lake Vista Pump Station

Metering Manhole



For the metering flume on the Bedford and Lynchburg boundary, several flume options were considered. The proposed design incorporates a fiberglass packaged flow monitoring system with a Palmer-Bowlus flume, which is commonly used for the measurement of in-line sewer flow applications. The fiberglass reinforced plastic (FRP) manhole includes a Palmer-Bowlus flume with a dome top cover for easier access. For ease of maintenance and enhanced flume access, it is proposed to have a 5-foot diameter hatch with an OSHA compliant stainless-steel reinforced access ladder. The flume will come with an insert to allow for the measurement of current flows, with the option to remove the insert to provide a larger flume once wastewater flows increase in the future.

For design considerations, the recommended Palmer-Bowlus flume cannot become more than 85 percent submerged and is a long-throated flume, which requires laminar flow conditions to provide an accurate measurement. Because of this, the flume must have a minimum of 25 pipe diameters, or 50 feet, of straight pipe runs upstream. For flow measurement, an ultrasonic transducer is proposed above the flume that is integrated into BRWA and the City of Lynchburg's SCADA system to provide real-time flow data.



Lake Vista Pump Station

As part of this project, the Lake Vista Pump Station was intended to be demolished once the gravity sewer was placed in service. **E. C. Pace and CHA have proposed to repurpose the existing building for use in the Lake Vista community or by the BRWA.**

It is proposed to fill the existing wet well with VDOT 57 stone and cap with concrete to make this area safe and live load bearing. All piping, hoists, pumps, and other associated equipment will be removed from the building. The existing heater will remain, and E. C. Pace will salvage and return to the BRWA the control panel, automatic transfer switch, and any other equipment requested by the BRWA. All floor and wall penetrations will be repaired, as needed, for a structurally sound and safe building. E. C. Pace and CHA's goal for this project is to allow the Lake Vista Pump Station building to be occupied safely so that it could be usefully repurposed to the BRWA or the surrounding community.

Route 460 Pump Station

The base approach for the CHA designed Route 460 Pump Station is to provide the pump station as shown on the engineering plans. Some value engineering options were explored as an assumption that full build-out may not be needed immediately and can be discussed further with the BRWA, if desired. Some value engineering options included the phasing of pumps into the pump station, providing a flat roof, or allowing a monorail or gantry crane system.

C. Current Plans for Development (Similar Experience)

E. C. Pace Qualifications

E.C. Pace has been an industry leader in the installation of water and wastewater systems in Virginia since 1926. Based in Roanoke, Virginia, **we focus on building relationships and client satisfaction**. We work with many repeat clients both public and private. A small sample of repeat clients includes:

- Bedford Regional Water Authority
- Western Virginia Water Authority
- NRV Regional Water Authority
- Virginia Department of Transpiration
- City of Roanoke
- Virginia Tech Corporate Research Center

Legal Structure

E.C. Pace is 100% owned by Mark Pace, who represents the 4th generation of family ownership. The company was incorporated in 1976 and has been licensed to conduct business in Virginia since 1926.

Ability to Self-Perform

E.C. Pace routinely self-performs 75% to 90% of the work on our projects, including installation of water, wastewater and gas pipelines as well as underground structures such as box culverts, retention systems, vaults and manholes. E.C. Pace also self-performs a wide variety of trenchless pipeline installations, including jack and bore, pipe bursting and tunneling. We also perform excavation, grading, road building, and restoration. To further enhance our ability to self-perform work, E.C. Pace also works closely with its sister company, Virginia Blasting Services, which performs rock drilling and blasting for both mass and trench line applications. Virginia Blasting Services specializes in close proximity blasting, which allows for safe rock excavation near structures and sensitive infrastructure.

Safety

Safety is part of our culture at E.C. Pace. All our personnel in supervisory roles are certified in OHSA Competent Person for Excavations and Confined Space Entry. In addition, we also provide training in VDOT basic and intermediate traffic control, First Aid and Safety and OSHA 10 Hour and 30 Hour Construction. To apply a holistic

Roanoke, VA Office

EC PACE COMPANY, INC. *at a Glance*

Established:

1926

Number of Personnel:

100

Contact:

Patrick Wade, PE
pwade@ECPace.com
(540)314-8552

Office Location:

1811 Hollins Rd Northeast
Roanoke, VA, 24012
(540)343-6816

Financial Responsibility

E.C. Pace has been in business since 1926, resulting in a strong financial position. Our combination of liquidity, bonding capacity and banking allows E.C. Pace to bid almost any water or wastewater project as a prime contractor. Mark Pace is 100% owner with no partners with an equity interest of 20% or greater. **(Copies of E.C. Pace's Audited Financial Statements are available upon request. We ask that they remain confidential).**

and real-world approach in the field, we employ a third-party safety company to oversee our safety program. Our third-party firm routinely conducts site visits and inspections to provide real-time guidance and feedback. By having a third party perform this function, we are able maintain an objective view of the safety concerns for both our employees and the public for each individual situation.

Construction Workload

E.C. Pace has the capacity to complete construction of the Ivy Creek Interceptor project while concurrent projects are occurring. E.C. Pace's project team will be completing construction of the project according to the provided construction schedule and as agreed upon with BRWA. E.C. Pace has executed a bid bond for this project. Reference Appendix E to view the bid bond.

Water and Wastewater Qualifications

We provide a full range of construction services that include everything from pipe and structure installation to testing and bypass pumping. We understanding of the unique characteristics of public projects that can include funding provisions, scheduling constrains, and planned public disruptions. Our planning and scheduling process attempts to identify a full range of issues as early in a project as possible so that delays are minimized. We routinely present value engineering proposals that can save time and money for owners.

Water

E.C. Pace offers a wide array of construction services for water infrastructure that include storage, pumping, transmission, distribution and service work. Our company has completed hundreds of projects ranging from ¾" water services to 36" transmission mains. We have a proven track record of delivering high quality work that is on-time and on-budget.

Waste Water

E.C. Pace provides construction services for sewer installations that include collection, distribution, and transmission systems; both gravity flow and force main. We self-perform the vast majority of our work, including trenchless installations and temporary bypass pumping. Our staff has completed over one hundred projects ranging from 4" force main to 72" sewer interceptors. We specialize in rough terrain installations that include rock excavation.

Blacksburg, VA Office

CHA at a Glance

Established:

1952

Number of Personnel:

1,000

Contact:

Stephen Steele, PE
540-212-4368
ssteele@chacompanies.com

Office Location:

1341 Research Center Drive
Suite 2100
Blaksburg, VA 24060

CHA Qualifications

CHA is a highly diversified, full-service engineering and construction management firm working to ***responsibly improve the world we live in***. Located throughout the United States and Canada, we provide a wide range of planning and design services to public, private, and institutional clients.

Our talented professionals ***strive to elate our clients*** in everything we do. CHA will work with E.C. Pace from start to finish, adapting teams, schedules, budgets, and services to each unique challenge.

CHA's team of highly trained engineers is supported by hundreds of other technical specialists available to provide a vast array of services to our clients.

Together with you, we design, study, manage, and build results that ***enhance our world***.

We provide full service programming and design for:

- Alternative Delivery
- Architectural
- Asset Management
- Aviation Design & Planning
- Civil Engineering
- Construction Engineering
- Electrical
- Energy Solutions
- Environmental, Health and Safety
- Geospatial Innovation
- Geotechnical
- Health and Safety
- Land Development
- Life Safety and Security
- Mechanical
- Program Management
- Sports Planning and Architecture
- Structural
- Survey
- Sustainability
- Tank Rehabilitation
- Technology Solutions
- Transportation Engineering and Planning
- Water and Wastewater
- Wireless Communications

Design Quality Control Procedures

CHA will develop a project specific QA/QC Plan to maintain excellent professional standards for technical performance and the accuracy of all design drawings and specifications developed for the project. As the Design Project Manager, Lindsay Swain, will be responsible for scheduling the completion of required QA/QC reviews by the Quality Assurance/ Quality Control (QA/QC) Manager, Doug Hudgins. Our multi-level review process typically works as follows:

- Each team member will be carefully chosen to make sure that all work is initially completed by individuals with the appropriate expertise, and these individuals will be required to review their own work.
- Lindsay will provide a second review for each work task or deliverable.
- Lindsay will subsequently forward her initial review and the project documents to the QA/QC Manager, Doug Hudgins, for an independent technical review including project constructability.
- Following independent review, the documents (with all comments) will be returned to the design team and corrected prior to a second review by Doug Hudgins to maintain compliance.
- Only documents that have been fully reviewed in accordance with these procedures will be issued to E.C. Pace and BRWA for final review and approval. Our quality control procedures for these sanitary sewer rehabilitation and replacements have proven to be effective in eliminating project surprises and change orders.

Handling of Design Errors and Omissions

CHA is a large professional engineering firm that performs thousands of projects each year. For a firm of its size and diversity, CHA's involvement in claims of errors or omissions is remarkably infrequent, due chiefly to its competent and well-trained staff and its rigorous and comprehensive Technical Excellence program. Inevitably, project issues can and sometimes do arise, and on those occasions, CHA's project manager and, where appropriate, senior management work with the client to find an acceptable resolution. Furthermore, for the protection of CHA and its clients, CHA always maintains a comprehensive insurance program, which includes professional liability, workers' compensation, comprehensive general liability, automobile and umbrella policies, with limits sufficient to cover the defense and payment of all outstanding claims against CHA.

Design Workload

CHA has the ability to complete the work on this project simultaneously with other client commitments. Our proposed project team has the availability to complete the proposed design project in accordance with the schedule outlined in our proposal. By submitting this proposal, CHA commits to meeting the milestones identified in our project schedule.

Water and Wastewater Qualifications

Our water and wastewater management offerings include full engineering and support services from initial planning through permitting, design, bidding, construction administration, start-up, certification, and ongoing operational assistance. We have provided creative and cost-effective solutions for municipalities and service authorities throughout Virginia.

Water

CHA provides comprehensive water services with a commitment to safety, reliability, and affordability. Our highly qualified staff has developed thousands of water-related projects, including source of supply, distribution, storage, treatability evaluations, treatment plant design, operation & maintenance plans, and sludge dewatering projects. The staff in our Blacksburg office has completed numerous water projects in Virginia and is familiar with Virginia regulations and Virginia Department of Health (VDH) requirements.

Wastewater Qualifications

CHA is one of the leading collection system and wet weather flow engineering firms in Virginia. CHA has assisted its many clients in constructing new gravity sewer lines, pump stations, and force mains. Our experience includes modeling, sewer system evaluation surveys, infiltration and inflow studies, sewer system rehabilitation, and equalization basin design. CHA has two Pipeline Assessment & Certification Program (PACP) and Manhole Assessment & Certification Program (MACP) certified technicians in our Blacksburg, Virginia office alone.

CHA Services

Water Distribution

- Booster Pump Station Design
- Construction Contract Administration and Resident Inspection
- Distribution System Design
- Storage Tank Design
- Supervisory Control and Data Acquisition (SCADA)
- Water Distribution System Modeling

Water Treatment

- Comprehensive Treatment Plant Design
- Contract Administration and Resident Inspection
- DBP Compliance
- Intake Design
- Project Funding and Permitting
- Solids Dewatering and Disposal
- SCADA
- Treatability Studies and Process Optimization

Wastewater Collection Systems

- Collection System and Pump Station Design
- Inflow and Infiltration (I&I) Studies
- Sanitary Sewer Evaluation Surveys (SSES)
- Sewer Rehabilitation
- System Mapping
- Hydraulic Modeling
- Capacity Management Operation and Maintenance Programs
- SCADA

Wastewater Treatment

- System Hydraulic Modeling
- Treatability Studies and Process Evaluation/ Optimization
- Secondary and Tertiary Treatment System Design
- Biological Nutrient Reduction
- Enhanced Biological Nutrient Reduction
- Solids Handling, Treatment, and Disposal (SCADA)
- Contract Administration and Resident Inspection

Project Experience

E.C. Pace and CHA Common Project Experience

- Over the course of more than 10 years, E.C. Pace and CHA have been involved in several successful design, bid, build projects, where CHA has performed engineering services for the Owner, including construction observation/inspection and construction administration services, and E. C. Pace has constructed the project.
- In completing these projects, E.C. Pace and CHA have demonstrated an ability to work cooperatively, with a common-sense, reasonable approach to resolve field discrepancies and project issues with solutions that were satisfactory to all parties involved (owner, engineer and contractor) and did not add any additional cost for the Owner. E.C. Pace has completed all of these projects on budget and on schedule.
- E.C. Pace and CHA have never been involved in a claim or a threatened claim on any of these common projects

Examples of the collaborative efforts and strong working relationship between E.C. Pace and CHA are listed throughout the following pages.

Project Experience

VDOT Order I43 – 10th Street Improvements

Roanoke, Virginia

Original Contract Price: $11,994,818.00

Final Contract Price: $12,761.118.40

Project Duration: 5/2016 to 4/2018

Reference: Virginia Dept. of Transportation – Mr. Sid Scott (540) 387-5492
Mattern & Craig Inc. – Mr. Bradley Craig (540) 345-9342

Description of Work: Upgrade to all underground utilities followed by rebuilding the road. Utility work included 24" sanitary sewer interceptor and bypass pumping. The project also included two underground retention structures as well as a precast arch bridge and close proximity blasting for utilities. The team finished project early and received the full contractor incentive.

Project Experience

Prices Fork Pump Station & Water Transmission Main

Montgomery County, Virginia

Original Contract Price: $4,137,663.00

Final Contract Price: $4,102,785.00

Project Duration: 10/2017 to 10/2018

Reference:
New River Valley Water Authority – Mr. Caleb Taylor (540) 639-2575 Whitman, Requardt & Associates – Mr. Gary Fern (540) 951-3727

Description of Work: Installed 16-inch water main and installed pump station. Project included a major creek crossing, jack and bore installation under roadway, rock excavation, and rough terrain open cut waterline installations.

Project Experience

Trout Run Drainage Structure

Roanoke, Virginia

Original Contract Price: $2,067,750.00

Final Contract Price: $2,037,750.00

Project Duration: 2/2015 to 6/2015

Reference: City of Roanoke – Engineering Office (540) 853-2731

Description of Work: Installed liner plates in the existing arch tunnel and grouted the annular space for the Amtrak Rail Platform. Extended 70 laterals into the new liner plates.

Project Experience

SFRR to RMR 36-inch Raw Water Main: Birdwood Golf Course

Charlottesville, Virginia

Original Contract Price: $2,571,264.00

Final Contract Price: $2,479,359.21

Project Duration: 12/2018 to 9/2019

Reference: Rivanna Water & Sewer Authority –
Ms. Michelle Simpson (434) 977-2970 ext. 202
Michael Baker International – Mr. Pasquale Arcese (703) 334-4918

Description of Work: Installed 6,069 linear feet of 36-inch ductile iron water main through the Birdwood Golf Course. Significant close proximity blasting. Completed the project well ahead of schedule.

Project Experience

Clubhouse Drive Sanitary Sewer Replacement

Roanoke, Virginia

Original Contract Price: $452,836.00

Final Contract Price: $481,922.60

Project Duration: 1/2019 to 9/2019

Reference: Western Virginia Water Authority –
Mr. Will Bulloss, P.E. (540) 283-2939

Description of Work: Installed 900 feet of 30-inch sewer line, extensive bypass pumping and rock excavation.

Project Experience

Huntington Boulevard Water & Sewer Main Replacement

Roanoke, Virginia

Original Contract Price: $1,630,359.00

Final Contract Price: $1,528,072.00

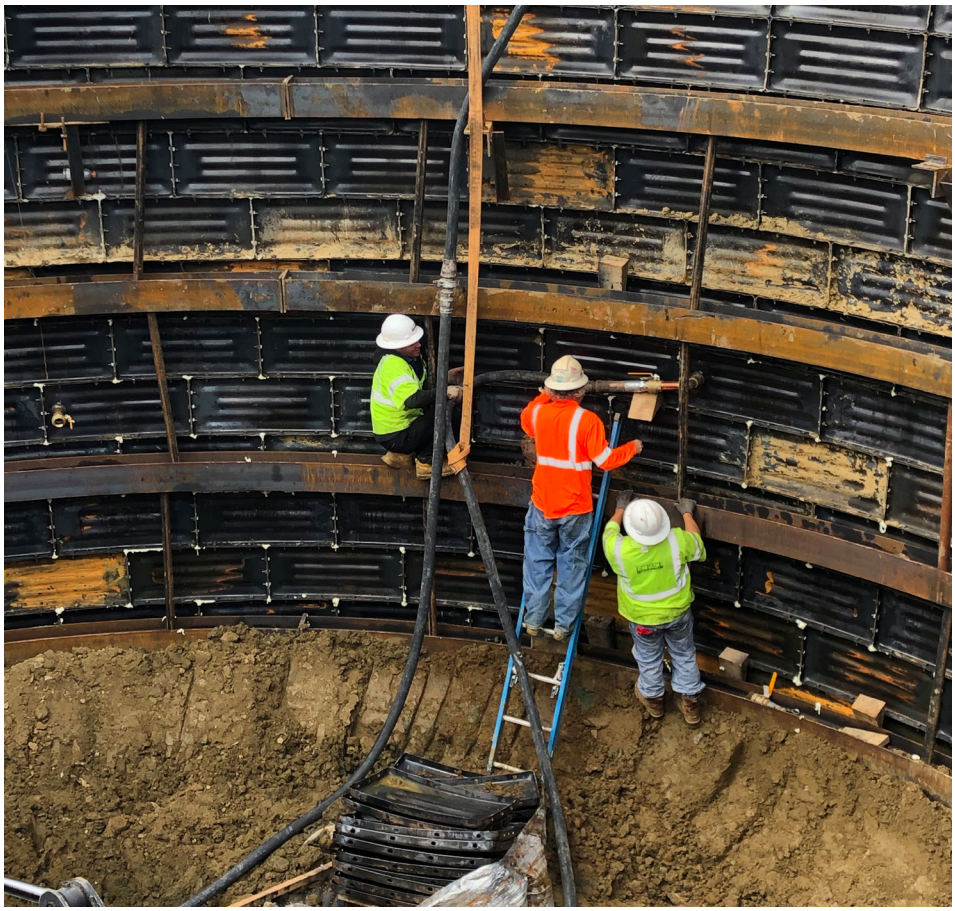
Project Duration: 10/2018 to 6/2019

Reference: Western Virginia Water Authority – Mr. Scott Kroll (540) 283-8232

Description of Work: Installed 1,384 feet of 8-inch sewer main and 2,559 feet of 8-inch water main. Replaced majority of the sewer in the same trench, extensive bypass pumping, and multiple lateral connections.

Project Experience

VDOT Order E36 – Route 220 Emergency Bore



Franklin County, Virginia

Original Contract Price: $637,533.39

Final Contract Price: $678,264.75

Project Duration: 10/2019 to 12/2019

Reference: Virginia Dept. of Transportation – Tony Handy, P.E. (540) 352-9050

Description of Work: Emergency bore under Route 220 to repair storm drain. The project installed 200 feet of 48-inch casing. The bore pit was 30 feet deep, so the team installed 4-foot diameter drilled shaft liner plate shoring system immediately adjacent to RTE 200.

Project Experience

Salem Turnpike Sanitary Sewer

Roanoke, Virginia

Original Contract Price: $1,657,788.00

Final Contract Price: $1,657,788.00

Project Duration: 5/2019 to 6/2020

Reference: **Western Virginia Water Authority – Mr. Scott Kroll (540) 283-8232**

Description of Work: Installed 18-inch sewer main along Salem Turnpike and through intersection with Peters Creek Road, including a hand-mined tunnel under the roadway intersection. Extensive rock excavation and bypass pumping were required.

CHA Project Experience

Bedford Regional Water Authority

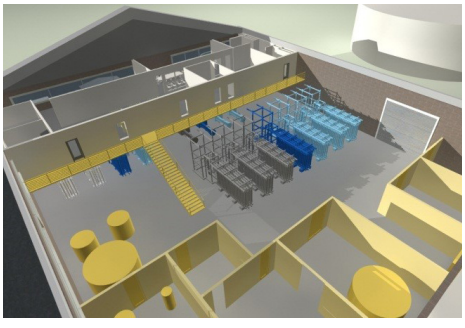
Smith Mountain Lake Water Treatment Plant and Lakes to Forest Water Line Extension

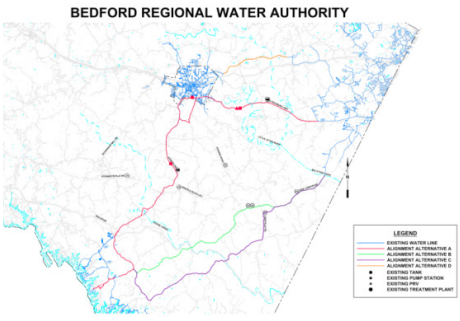
Contact:
Brian Key, PE,
Executive Director
(540) 586-7679
b.key@brwa.org

CHA provided design and engineering consulting services as part of the Progressive Design-Build (PDB) delivery of the Smith Mountain Lake Water Treatment Plant and the Lakes to Forest Water Line Extension projects. The project provided detailed preliminary evaluations of major project elements and development of final design plans to allow for Guaranteed Maximum Price (GMP) to be completed. Scope of work included technical evaluations, field investigations, and planning/design services to define the water system improvements that meet the Bedford Regional Water Authority's immediate and future system needs. Specific project elements included:

- Raw Water Transmission Pipeline: Alignment and hydraulic evaluation of approximately 14,000 linear feet of 18-inch to 24-inch raw water force main from the existing raw water intake location to the proposed Camp 24 water treatment plant site. Development of final plan and profile drawings including horizontal alignment, profile details at critical crossing areas, and existing utility conflicts based on available GIS mapping/field investigations.
- Finished Water Transmission Pipeline: Alignment and hydraulic evaluation of approximately 130,000 linear feet of 18-inch to 24-inch transmission main from the proposed Camp 24 water treatment plant location north along Route 122 and east along Route 460 to the existing Forest water distribution system. Development of final plan and profile drawings including horizontal alignment, profile details at critical crossing areas, and existing utility conflicts based on available GIS mapping/field investigations. Preparation of an environmental assessment and acquisition of all environmental and construction permits.
- Membrane Water Treatment Plant: Building services for architectural, structural, HVAC, electrical, and fire protection for development of 30 percent design drawings of a new membrane water treatment plant located at the Camp 24 site. Facility designs were completed using building information modeling technology (REVIT by Autodesk).

This project enabled the BRWA to provide water service in all areas of Bedford County, including the Lakes community, the Town of Bedford, and the Forest community.



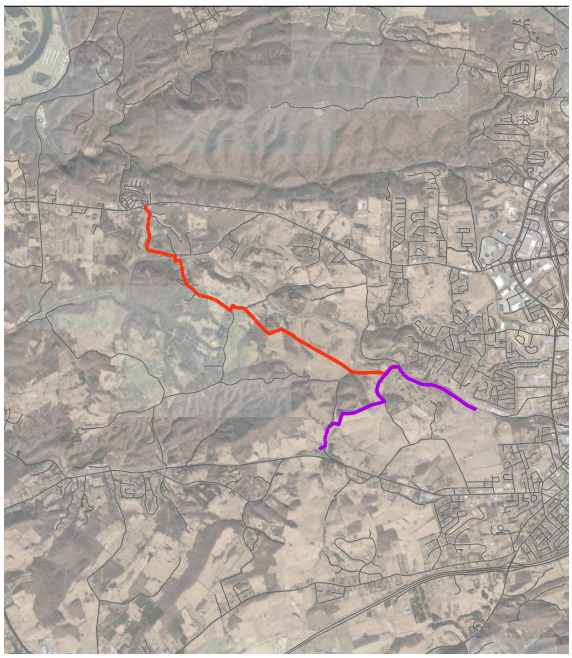


CHA Project Experience

NRV Regional Water Authority and Chrisman Mill Pump Station

Plum Creek Waterline Transmission Main

Contact:
Caleb Taylor, PE,
Executive Director
3515 Peppers Ferry Road
Radford, VA 24141
(540) 639-2575
ctaylor@nrvwater.org



CHA provided a Preliminary Engineering Report, final design, construction contract administration, and inspection services for this project. Services included:

- Coordination with all five Authority members, including the client, two towns, the county, and a major university
- Preparation, submission and approval of a Preliminary Engineering Report to the Virginia Department of Health that met all regional stakeholder future water needs
- System hydraulic model and analysis
- Final technical design services for the 28,000 linear feet of 12 and 20-inch water transmission main to serve as a redundant feed line that will serve all the stakeholders
- Final design services for a booster pump station that includes provisions for expansion in the future to all for both immediate and long terms needs
- Surveying coordination and fields services
- Geotechnical coordination and field services
- Environmental review and permitting services
- Virginia Department of Transportation permitting
- Railroad permitting
- Bidding, construction contract administration, and inspection services

CHA/E.C. Pace Successful Project Resolutions

- E. C. Pace presented value engineering opportunity to save the Owner $95,000. CHA and E. C. Pace cooperated to obtain VDOT approval for the change and implement field adjustments.
- Due to a change in the funding source after project award, AIS certified pipe and materials were no longer needed. E. C. Pace successfully renegotiated prices with suppliers to credit the Owner a $150,000 savings in material costs.
- E. C. Pace proposed a realignment for 500 feet of waterline due to a communications line being located incorrectly. CHA and E. C. Pace completed a field visit and corrected the issue at that time with a field change. No additional cost was placed on the Owner.

CHA Project Experience

Bland County Public Service Authority

Water Treatment Plant and Water System Improvements Project

Contact:
Eric Workman,
Bland County Administrator
612 Main Street, Suite 201
Bland, VA 24345
(276) 688-4622
eworkman@bland.org

The BCSA owns and operates two water distribution systems: one serves the community of Bland, and the other serves the communities of Bastian and Rocky Gap. There are no redundant sources for either water system. The Bland water system serves approximately 150 residential and 27 commercial customers from a groundwater well source treated via a high-rate filtration packaged WTP. The Bastian/Rocky Gap water system serves approximately 345 residential and 21 commercial customers with water purchased from the Bluefield Valley Water Works Company (BVWW). The Bland WTP was constructed in 1992 with many components nearing the end of their service life and required significant upgrades.

CHA evaluated alternatives to address the needs of the water system. The recommendation for improvements included an upgrade to the existing Bland WTP and multiple improvements to the distribution system. The WTP upgrade proposed replacement of the existing high-rate filtration modules with membrane filtration modules, that would allow the BCSA to reduce the operation and maintenance costs for the WTP while also increasing the service life of the plant. The WTP will remain at the current capacity (172,800 gpd), with the option to expand in the future by adding more membrane modules. The water distribution recommended improvements includes replacement of approximately 9,000 feet of 8-inch waterline, construction of 4 pressure reducing/metering stations, and upgrade of the existing metering system from touch-read to radio-read.

CHA Project Experience

Plant Modernization PER, Planning & Design

New River Valley Regional Water Authority

CHA assisted the NRV Regional Water Authority (Authority) in the planning and design of the raw water intake and 12.4 MGD WTP modernization project for the Authority.

The comprehensive Preliminary Engineering Report (PER) was developed to upgrade and modernize the Authority's 12.4 MGD conventional water filtration plant. The raw water intakes and water filtration plant had not been through a major renovation since the late 1970s and the Authority requested an independent review of all unit processes and ancillary facilities. The proposed improvements include:

- Raw water intake and pump facilities updated to 16 MGD
- Raw water pretreatment and disinfection byproducts control
- New coagulation/ flocculation tanks
- Plate settlers in the sedimentation basins
- Rehabilitation of the 6 filters
- Connecting WTP to new gravity sewer

This comprehensive modernization project will meet the long-term needs of the Authority over a 30-year planning period and recommended upgrading this existing water filtration plant by combining the raw water intake and pumping into one structure to pump up to 11,200 gpm (16 MGD) to the plant. New plate settlers would be added to the existing sedimentation basins to enhance clarification. The treatment capacity would be increased to an instantaneous rate of 16 MGD by refurbishing the filters to a filtration rate of 5.2 gpm/ft2. This would enable the Authority to reduce to 16 hours of operation to provide redundancy and operational flexibility. A new chlorine contact tank and finished water pumping facility would be constructed to provide storage and to enable new electrical service and standby generator facilities to be constructed. New office, maintenance, laboratory, and locker room facilities were designed as well. The chemical storage and feed facilities were replaced and renovated to provide a safer working environment.

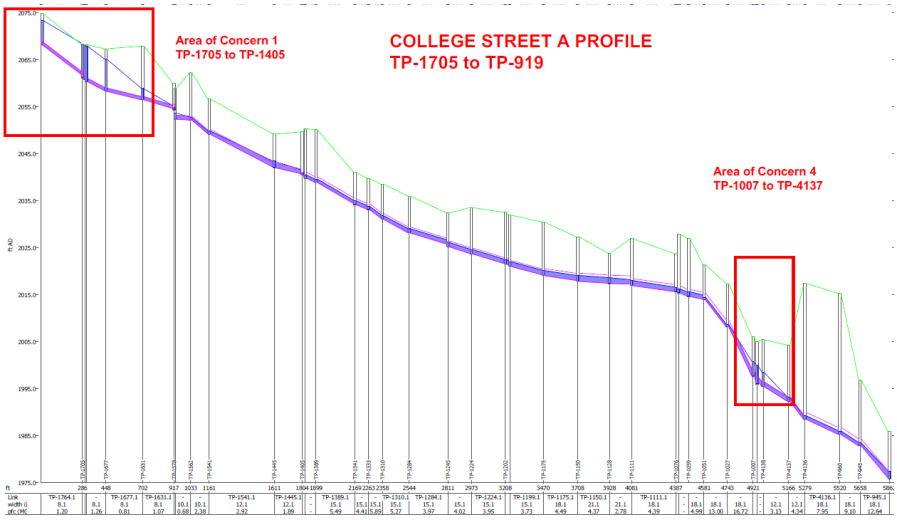
CHA/E.C. Pace Successful Project Resolutions

- Due to a discrepancy in topographic information, sewer manhole rims were not initially placed at the correct elevation. E. C. Pace and CHA worked together to verify that manhole rim elevations were corrected for the future parking lot elevation. at no additional cost to the Authority

CHA Project Experience

Town of Christiansburg, VA

College Street Sanitary Sewer Evaluation and Replacement



The College Street sanitary sewer basin has a history of sanitary sewer overflows. The Town hired CHA initially to evaluate the cause of the SSOs and propose alternatives to remedy the sanitary sewer overflows in this basin in 2012. Additional flow monitoring was conducted in 2015 and the sanitary sewer model was updated in 2016.

The College Street sanitary sewer basin consists of approximately 1,100 manholes and 40 miles of sanitary sewer ranging in size from 6-21 inches in diameter. During periods of heavy rainfall, there are several SSO locations along College Street and along Hickok Street. As part of this evaluation, CHA analyzed flow data, developed a dynamic sanitary sewer model, predicted future flows from undeveloped lots in the basin, and evaluated alternatives. CHA developed future flow projections over a 30-year planning period and routed these future flows along with the 2-year recurrence interval flows through the system utilizing the model. Alternatives that were evaluated included collection system storage, conveyance improvements, and I&I abatement. The selected alternative included a combination of I&I abatement that targeted a 30 percent removal of the peak wet weather flows and four sections of sewer upsizing by replacement. The cost of the I&I abatement program is estimated to be $930K, and the combined cost of the sewer replacements is estimated to be $1.9M.

CHA recently designed the replacement and upsizing of 3,800 linear feet of sanitary sewer near Mill Lane and along North Franklin Street. The project will relieve wet weather-related SSOs at Hickok Street. The pipe replacement consists of a stream crossing, a railroad crossing and Mill Lane crossing.

CHA Project Experience

Western Virginia Water Authority

Mudlick Creek Interceptor

As part of the Western Virginia Water Authority's Special Order by Consent with the VDEQ, CHA was selected to evaluate the Mudlick Creek sewer shed. The existing sewer shed suffers from sanitary sewer overflows during periods of heavy rainfall due to infiltration and inflow. The sewer shed encompasses approximately 12 square miles and includes approximately 15,000 residents. This analysis included the following:

- Field Survey and Condition Assessment of over 500 Manholes
- Flow Monitoring
- GIS Geodatabase Development
- Design Storm Development
- Hydraulic Modeling
- Existing System Assessment
- Sewer System Evaluation Survey and I&I Study
- Alternatives Evaluation
- Preliminary Engineering Report
- Design of 9,600 Linear Feet of 36-Inch Sanitary Sewer
- Design Plans and Specifications
- Environmental Permitting including Stream Crossings
- Bidding Services
- Construction Phase Services
- Resident Project Representation

CHA oversaw the installation of six flow monitors in the study area and developed a hydraulic model from the manhole inspections and survey. Results of the hydraulic modeling and the evaluation recommended construction of a new 2-mile, 36-inch diameter interceptor along Mudlick Creek to remedy the sanitary overflow sewers based upon a 2-year design storm. Other alternatives that were considered included collection system storage and upstream infiltration and inflow abatement. Due to the sensitivity of the location of the overflows in Garst Mill Park, the Authority selected the conveyance alternative to remedy the overflows in the park.

CHA Project Experience

Pump Station Upgrades

City of Covington, VA

The City of Covington owns and operates three wastewater pump stations within the collection system. Each pump station consists of a bypass manhole, wet well, and two suction lift centrifugal pumps. The pumps are in below ground water-tight vaults within the 100-year flood plain of the Jackson River, which is classified as perennial surface water with a 303d impaired listing. The pump station equipment was nearing the end of its service life.

CHA assisted the City in securing VDEQ CWRLF funding for the upgrade project that included new pumps, motors, valves, pump controls, site security, and mobile generator. Funding required updates to the Operations and Maintenance (O&M) manual and preparation of a fiscal sustainability plan. CHA also specified a cellular-based remote communication unit with web-based monitoring, alarm callouts, and reporting.

The new communication system replaced a land-line autodialer and provided pump station monitoring and reporting without the higher cost investment in radio telemetry or SCADA upgrades. Electrical and control equipment was placed on an elevated structural platform to lift the equipment above the 100-year flood levels.

CHA Project Experience

Water Infrastructure Project

Covington, VA

The City of Covington operates a 6 MGD conventional water treatment plant with water withdrawal from the Jackson River and a water distribution system that contains approximately 50 miles of pipeline with six water storage tanks and three pump stations in seven pressure zones. In 2010, CHA completed a comprehensive water system evaluation report for the City to address growing needs at both the treatment plant and in the distribution system.

The work included development of system mapping and a hydraulic model to identify recommended water distribution system improvements to correct problems with pressure, fire flow delivery, and regulation of the tanks and pressure zones. A comprehensive evaluation of the treatment plant was completed to address issues with the intake, solids management, filter controls, and automation.

Design of the system improvements and construction were completed in early 2015. The new water treatment plant facilities included a new intake screen, new filter controls, a continuous sludge withdrawal system, a plant and system-wide SCADA system to automate operations and improve control. Distribution system improvements included over 40,000-feet of new water transmission and distribution piping throughout the City, new pressure regulating stations, and a new water booster pump station.

CHA/E.C. Pace Successful Project Resolutions

- None of the utilities were marked correctly during construction.
- Hydrants had to be installed on lines where materials and sizes were not identified correctly. CHA and E. C. Pace worked together to facilitate E. C. Pace's procurement of correct fittings, couplings, and relocation of utilities as necessary.
- Worked through all field issues to complete project ahead of schedule.

CHA Project Experience

Western Virginia Water Authority

Old Roanoke River Interceptor Improvements

CHA was retained to implement the recommendations in the 2004 report "Roanoke River Interceptor CCTV Inspection." That report concluded that the Old Roanoke River Interceptor was in relatively good condition for its age. With this information in hand, the Authority began considering rehabilitation and potential reactivation of the Old Roanoke River Interceptor to provide additional conveyance capacity.

To assess the Old Roanoke River Interceptor's conveyance capacity, CHA developed a dynamic hydraulic model that used the base mapping provided by the Authority and the predicted 2-year, 24-hour storm flows from the Mudlick Creek Interceptor, developed for a separate project. The hydraulic model was built using MIKE URBAN, a GIS-based modeling software from the Danish Hydraulic Institute. This software utilizes the MOUSE hydraulic engine for solving hydraulic equations in collection networks. The model indicated that additional conveyance capacity for the Roanoke River Interceptor system would be required if the Authority desires to convey the 2-year, 24-hour storm to the WPCP. Based upon the modeling effort to date, these future conditions could be met by reinstating the Old Roanoke River Interceptor and maintaining the new Roanoke River Interceptor.

The first phase of interceptor rehabilitation before reactivation was focused on manholes as recommended by B&V. 34 manhole frames and covers were replaced, 17 vents were installed, and incidental repairs were made at several structures. An unrelated cured-in-place lining project was included with the project to increase the scope with the intent of lowering costs due to increased bidder interest.

While preparing bidding documents for the second phase of rehabilitation, CHA determined that the report had understated the structural deterioration of the interceptor. The report focused on active infiltration and largely ignored several indications of significant sulfide attack. Rather than continue to follow the recommendations from the initial report, it was decided that the better course of action would be to complete rehabilitation efforts on the manhole walls, perform targeted grouting to directly reduce system flows, and re-inspect the interceptor. Bids were solicited in January 2012, the CCTV inspections were performed, and the interceptor joint grouting was completed as well as the rehabilitation of approximately 75 manholes.

After this first construction project, the Authority authorized CHA to evaluate the 45,000 feet of interceptor and develop a revised preliminary engineering report and capital improvements plan to continue the rehabilitation efforts. This preliminary engineering report was completed in 2013.

CHA Project Experience

I&I Study and Sanitary Sewer Rehabilitation Plan

Covington, Virginia

As part of a Letter of Agreement with the VDEQ, CHA was hired to develop an I&I Study and Sanitary Sewer Rehabilitation Plan. The City's wastewater treatment plant experiences excessive flows during periods of high-intensity rainfall. These high flows result in bypasses at the wastewater treatment plant. Since very little I&I investigative work had been performed on the sanitary sewer system to date, the VDEQ requested the City to initially perform a system-wide evaluation of I&I. The results of the initial work would then enable the City to focus on a specific sewer shed that had the most significant contribution to I&I and a resulting project would be implemented.

The I&I Study and Sanitary Sewer Rehabilitation Plan summarized the SSES work as well as presented a Phase I sewer separation project for construction. As part of the SSES, flows were monitored at the City's three pump stations and four flow meters were installed on the gravity sewer sheds for over 12 weeks. CHA assisted the City in purchasing these meters for future I&I work. As a result of the initial flow monitoring step, CHA inspected approximately 150 manholes throughout the system, which aided in developing a more accurate map. CHA performed smoke testing in the downtown area that revealed areas of combined sewers with multiple roof leaders and storm inlet connections.

The results of the field activities were compiled in a GIS database and a phased rehabilitation plan was developed. This report was submitted to the VDEQ for review and approval and was utilized to secure funding for I&I abatement and storm sewer separation projects throughout the City.

CHA Project Experience

Shenandoah Pump Station Preliminary Engineering Report

Blacksburg, VA

The Town is actively evaluating their sanitary sewer system to update and modernize pump stations, reduce infiltration and inflow, and manage these assets.

CHA has provided engineering services to support this effort, including an Infiltration and Inflow study in the Cedar Run sewer shed, and developing a comprehensive Capacity Management Operations and Maintenance program for the Town. The Shenandoah I Pump Station PER was another project to support the Town's effort to prevent sanitary sewer overflows. The Shenandoah I Pump Station has provided reliable service for the last 25 years.

During extreme wet weather events, sanitary sewer overflows have been observed at the pump station and in the gravity sewer just downstream of the force main discharge. These overflows were observed in 2004 during an excessive wet period. Due to its age, the pump station requires refurbishment and modernization as part of the Town's proactive asset management program.

The Preliminary Engineering Report was completed to confirm adequate sewer system capacity for a defined planning period for the pumps stations sewer shed and to update/modernize the Shenandoah I Pump Station.

D. Permits and Approvals

Permits and Approvals

The Design-Build team will acquire the following permits for the Ivy Creek Project:

- DEQ Certificate to Construct
- DEQ Certificate to Operate
- Joint Permit Application (USACE Nationwide 12 and VMRC)
- VSMP Permit
- VDOT Land Use Permit
- Land Disturbance Permit – Bedford County and City of Lynchburg
- Blasting Permit – Bedford County and City of Lynchburg

The E.C. Pace and CHA team will acquire the following permits for the Route 460 Pump Station:

- VDH Construction Permit
- VSMP Permit
- Blasting Permit - Bedford County
- Building Permit - Bedford County

E. General Plans for Financing

General Plans for Financing

Funding Resources and Budgeting

The ability to both consider economic factors and budgets is an important factor in the design and implementation of any major capital improvement project. We recognize the importance of cost-effective design and work closely with our clients to maximize their efforts and meet budget requirements. Where appropriate, our designs incorporate phasing opportunities, constructability review, and value engineering as a means of controlling costs.

Project phasing and innovative implementation approaches are key components of any financing and cost control strategy. Our team has extensive experience in the development of multiple construction contracts and fast-tracking of design and construction activities to minimize cost and meet funding agency requirements, including grant or loan limits, prescribed drawdown schedules, and user rates.

Project Funding

It is E.C. Pace and CHA's understanding that the BRWA will use cash funding for the Route 460 Pump Station and will acquire a DEQ State Revolving Fund (SRF), prepared by another engineering firm, to finance the Ivy Creek Interceptor project. The applicable goals of the DEQ SRF program are to provide long-term renewing sources of financing for wastewater treatment improvement needs, encourage self-sufficiency at the state and local levels for wastewater financing, and provide an alternative to traditional financing through lower-cost loans to local governments.

The DEQ loan for this project will cover construction, design, permitting, construction administration, the cost for permanent and temporary easement, and land acquisition. E.C. Pace and CHA understand that BRWA may not have debt service capacity readily available until approximately 2023. Bridge funding from E.C. Pace for BRWA is included as part of this proposal until the existing debt service capacity is freed in 2023. Bridge financing options are further discussed in the Loan Options section.

E.C. Pace and CHA have worked on numerous projects that have been funded by the DEQ SRF program and understand the unique reporting requirements. E.C. Pace and CHA, as part of the DEQ SRF funding requirements, will comply with the following major components of the loan program:

- Sewer size and appurtenances to be in conformance with established standards in the Virginia Sewerage Regulations
- American Iron and Steel compliance
- Compliance with the Virginia Public Procurement Act
- Inclusion of the VRLF Contract Inserts
- Compliance with Equal Employment Opportunity
- Certification on Non-Segregated Facilities
- Compliance with Minority and Women's Business Enterprise Goals (MBE/WBE)
- Compliance with the Civil Rights Act of 1964
- Compliance with Age Discrimination Act of 1975, Rehabilitation Act of 1973, and the prohibition against sex discrimination
- Compliance with the Clean Air Act
- Procurement of goods and materials from Small Businesses in Rural Areas of the Commonwealth of Virginia wherever practical and feasible
- Contractors to maintain a drug-free workplace during the performance of contract duties for any wastewater revolving loan-assisted project
- DEQ-approved, Sewer Use Ordinance in place before the final disbursement of loan proceeds

Bridge Financing

In order to provide flexibility for the funding of the Ivy Creek Interceptor Project, E.C. Pace has partnered with Freedom First Credit Union to provide up to two million dollars in bridge financing using any one of the three options below. The intent of these financing options is to allow BRWA flexibility in its debt service during the first three years of repayment. The bridge financing would allow debt service of the DEQ SRF loan at a much lower initial payment.

Funding Options

E.C. Pace is offering a bridge funding option for BRWA. Such funding will help the Authority to finance the Ivy Creek Interceptor project without exceeding the debt service capacity. We understand that the Authority can take on additional SRF funding in 2023, at which time the loan will be paid back to E.C. Pace. The available loan options from E.C. Pace are shown below. An amortization schedule is available upon request.

$2MM Loan Options

Collateral: 1st lien Deed of Trust on pump house and land*
As a construction project, Loan to Value limited to 80% of appraised value.
1.0% Origination Fee ~ No Prepayment Penalty

Option 1: $5,400/month	Option 2: $6,250/month	Option 3: $5,400/month
		
Your 36-month Payments		
15-year term, 20 year amortization. Interest Only payments during construction (up to 3 years). Converts to Principal & Interest payments for remaining 12 years.	15-year term, 20-year amortization. Interest Only payments during construction (up to 3 years). Converts to Principal & Interest payments for remaining 12 years.	36 months. Interest-Only Payments. Balance would be due at the end of 36 months. Optional loan modification or refinance once construction is completed.
WSJ Prime + 0.0% with a floor of 3.25% during the 36-month interest-only period, converts to a fixed rate 5-year TCM + 2.75%, with a floor of 3.75%. This will adjust every 5 years after the initial fixed-rate period to the then 5-year TCM + 2.75%.	Fixed at 3.75% during the 36-month interest-only period, adjusts to a fixed rate that will be set at the 5-year TCM + 2.75%, with a floor of 3.75%. This fixed rate will adjust after years 8 and 13 to the then 5-year TCM + 2.75%.	WSJ Prime + 0.0% with a floor of 3.25%. 

**Land available to take a lien on.*

Cost Estimates

Below are the estimated project costs. The estimate provided is fully inclusive of all design and construction related costs based on the plans, schedule, details, and assumptions described in this proposal. This estimate is intended to be as accurate as possible and includes all elements of work for delivery of a complete project.

Third party construction inspection services can be requested by the BRWA at a rate of $100.00 per hour.

Ivy Creek Interceptor Project Cost	
Project Name	**Cost Estimate**
Ivy Creek Interceptor	$8,342,070.00
Route 460 Pump Station	$2,313,000.00
Construction Subtotal	$10,655,070.00
Engineering Services	$665,941.00
Construction Total	$11,321,011.00
Development Related Bypass Pumping (contract adder)	$500,000.00

Note: These cost estimates are not part of a guaranteed maximum price (GMP). Final project cost to be negotiated as part of Phase II. A detailed engineering services and construction schedule can be found in Appendix B.

F. Contacts

Contacts

E.C. Pace Contact:

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(540) 314-8552

CHA Contacts:

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540-212-4368
ssteele@chacompanies.com

Lindsay Swain, PE
1341 Research Center Drive
Suite 2100
(540) 227-7262
lswain@chacompanies.com

G. Detailed Site Plan

Detailed Site Plan

A detailed site plan can be found in Appendix A for the Ivy Creek Sewer project and Appendix C for the Route 460 Pump Station.

H. Public Utility Facilities

Public Utility Facilities

There are two main utility crossings that were identified during our site visits. There is a natural gas transmission line owned by East Tennessee Natural Gas Company and overhead power lines owned by American Electric Power. There is the potential for additional smaller utility crossings that will be identified once property owner access has been established and Virginia 811 utility tickets can be called in. For the major crossings, the utility owner will be contacted early in the design process and a best practices method for crossing will be established and incorporated into the design. Minor utility crossings will be test excavated as soon as practical and any required crossings will be performed in accordance with the Virginia Utility Damage Prevention Act.

I. Statement of Easement Strategy

Statement of Easement Strategy

The first step will be to research each parcel using the Bedford and Lynchburg databases. The sales history for each property will be verified as part of the quality control process. The easement exhibits will be prepared, clearly identifying and quantifying acreage of the temporary and permanent construction easements needed. Parcel owners will be communicated using several methods, including in-person communication, mailed letters, door hangers, and community information meetings. Easements will be negotiated with the parcel owners and then presented to BRWA for final approval. BRWA will be responsible for recording all easements in the proper courthouse.

J. Listing of All Firms; Guarantees and Warranties

Listing of All Firms; Guarantees and Warranties

Authority Responsibilities

The work to be performed by BRWA includes:

- Project funding from DEQ to include construction, design, permitting, construction administration, the cost for permanent and temporary easement, and land acquisition. Bridge funding for BRWA is available as part of this proposal and is further discussed in the Project Funding section.
- Construction inspection. E.C. Pace will provide an hourly cost for inspection services for BRWA to consider, if needed.
- Independent geotechnical or special inspections during construction.
- Provision of water (potable or non-potable depending on application) for construction testing.

E. C. Pace and CHA Responsibilities

The work to be performed by the E.C. Pace and CHA team, above and beyond expected design and construction services, includes:

- Coordination of project kickoff and progress meetings with BRWA
- Verification of sewer capacity and peaking factors. Reference the Technical Approach section for additional details.
- Bridge funding for the Ivy Creek Interceptor project, if needed.
- Facilitate permanent and temporary easements for construction.
- Preparation of easement agreements and plats.
- Coordination of permanent electrical service and SCADA integration for flume station.
- Environmental and cultural resource assessments.
- As-built drawings at project closeout
- Compliance with all DEQ funding construction and administration requirements

Guarantees and Warranties

Performance and payment bonds will be provided for the construction work equal to the value of the work. Additionally, the work will be under warranty for one year.

K. Total Life-Cycle Cost

Total Life-Cycle Cost

The BRWA has evaluated the potential revenue generation from future connections related to the development area that will be served by this project. The revenue generation supports a project up to $9.0M. The cost of this project is under the $9.0M threshold, which meets the requirements for moving forward with this project related to the total life-cycle cost.

L. User Fees, Lease Payments, and Other Service Payments

User Fees, Lease Payments, and Other Service Payments

This is not applicable to this project. It is our understanding that all funding will be public or through the DEQ Virginia Clean Water Revolving Loan Fund.

M. Government Support or Other Opposition

Government Support or Other Opposition

Public support, with no opposition, is anticipated for this project. This project allows for economic development in the area and for the elimination of pump station maintenance at the LVPS.

Public support, is anticipated for this project. This project allows for distribution system reliability and flexibility, pumping water from the water treatment plant to several areas of Forest and, potentially, the City of Bedford.

N. Demonstration of Consistency

Demonstration of Consistency

The following figure outlines consistency with the master planning and the supporting documents for the project.

O. Affected Local Jurisdictions

Affected Local Jurisdictions

The Ivy Creek Interceptor project allows economic development in the Forest, New London and Bedford areas by providing enhanced sewer service to existing customers and providing new sewer service for developing parcels.

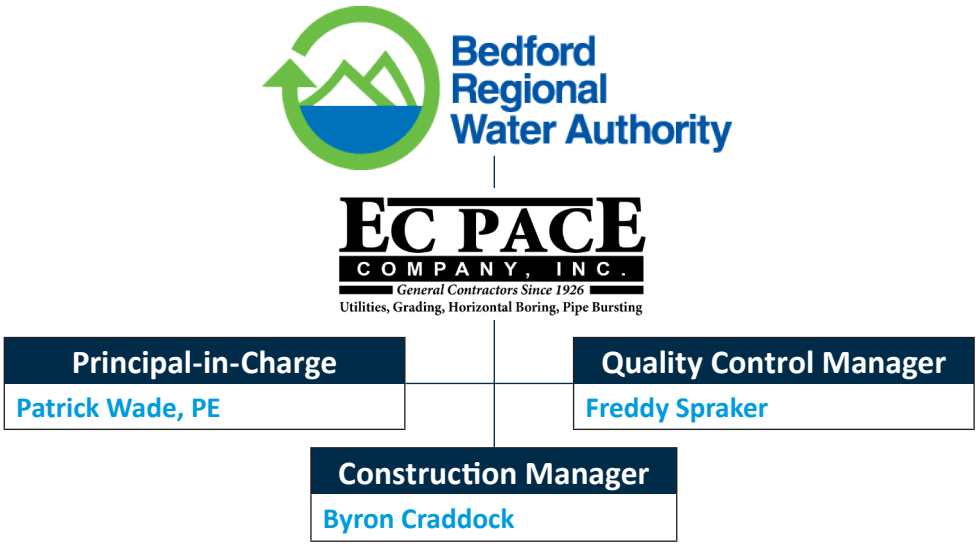
The Route 460 Pump station allows for water to flow from the Lakes Water Treatment Plant into the community of Forest, with the potential to supplement flow into the City of Bedford.

P. Executive Management and the Officers

Executive Management and the Officers

Mark Pace
Owner
E.C. Pace Company, Inc.

Patrick Wade, PE
Executve Vice President
E.C. Pace Company, Inc.



Q. Sureties Proposed

Sureties Proposed

Payment and Performance Bonds for the full value of the project will be provided by the Design-Builder's bonding company, The Hanover Insurance Company.

R. Project Schedule

Project Schedule

The E. C. Pace and CHA team will work together to complete the Ivy Creek Interceptor project on budget and within the agreed-upon timeframe. Note that the assumed schedule is based on a Fall 2020 issued Notice to Proceed (NTP). If the NTP is issued at a later date, engineer and construction schedule adjustments will need to be made. The estimated times for completion are listed in the tables below.

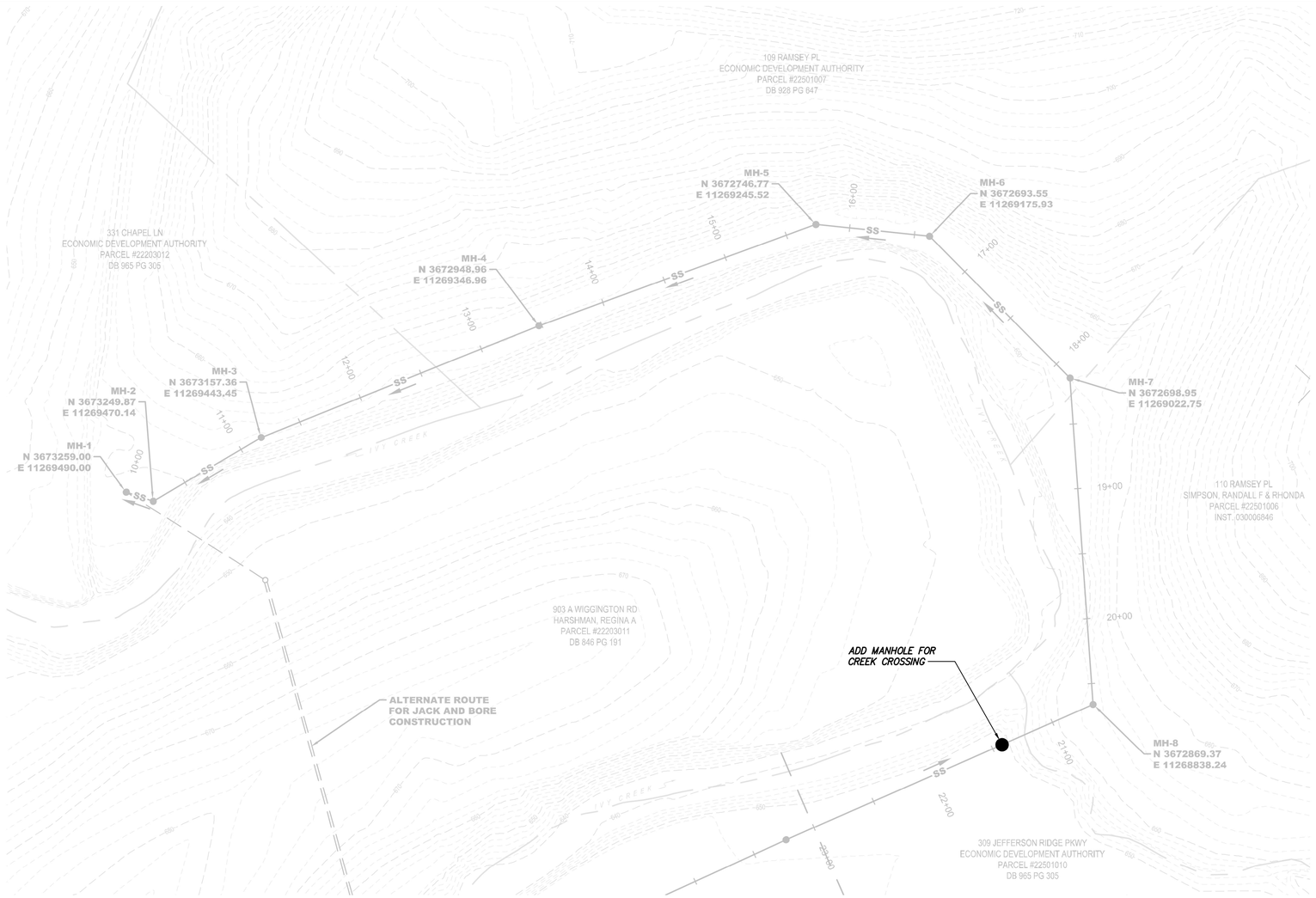
Ivy Creek Interceptor Project Schedule	
Project Name	**Estimated Time for Completion (Days)**
Ivy Creek Interceptor, Division 5	305
Ivy Creek Interceptor, Division 6	380

Route 460 Pump Station Project Schedule	
Project Name	**Estimated Time for Completion (Days)**
Route 460 Pump Station	270

Engineering Schedule			
Phase	**Start Date**	**Duration (months)**	**End Date**
Phase I Submittal	7/7/2020	2	9/5/2020
Phase II Submittal	9/5/2020	2	11/4/2020
Notice of Award	11/4/2020	0.25	11/11/2020
Notice to Proceed	11/11/2020	0.5	11/26/2020
Route 460 Pump Station Geotech	11/26/2020	0.5	12/11/2020
Ivy Creek Survey	11/26/2020	1.5	1/10/2021
Ivy Creek Design	1/10/2021	2	3/11/2021
Ivy Creek Permitting	3/1/2021	2	4/16/2021
Ivy Creek Easements	2/15/2021	3	5/16/2021
Route 460 Pump Station Permitting	11/26/2020	1.5	1/10/2021
Route 460 Pump Station Construction	11/19/2020	9	10/13/2021
Ivy Creek Construction	5/18/2021	19	9/26/2022

A detailed construction schedule can be found in Appendix B.

Appendix A.
Ivy Creek Topographical Map



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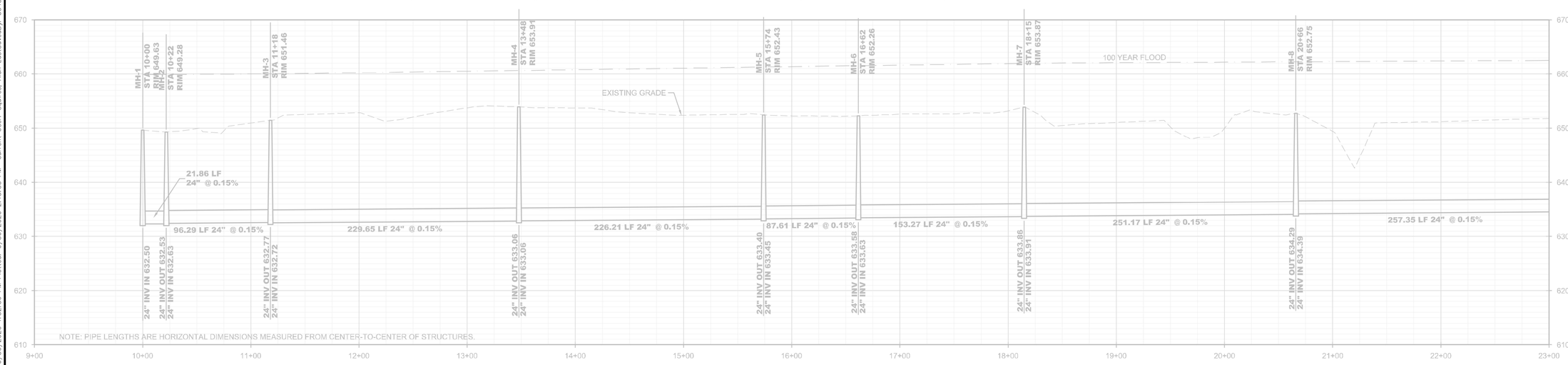

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IVY CREEK INTERCEPTOR

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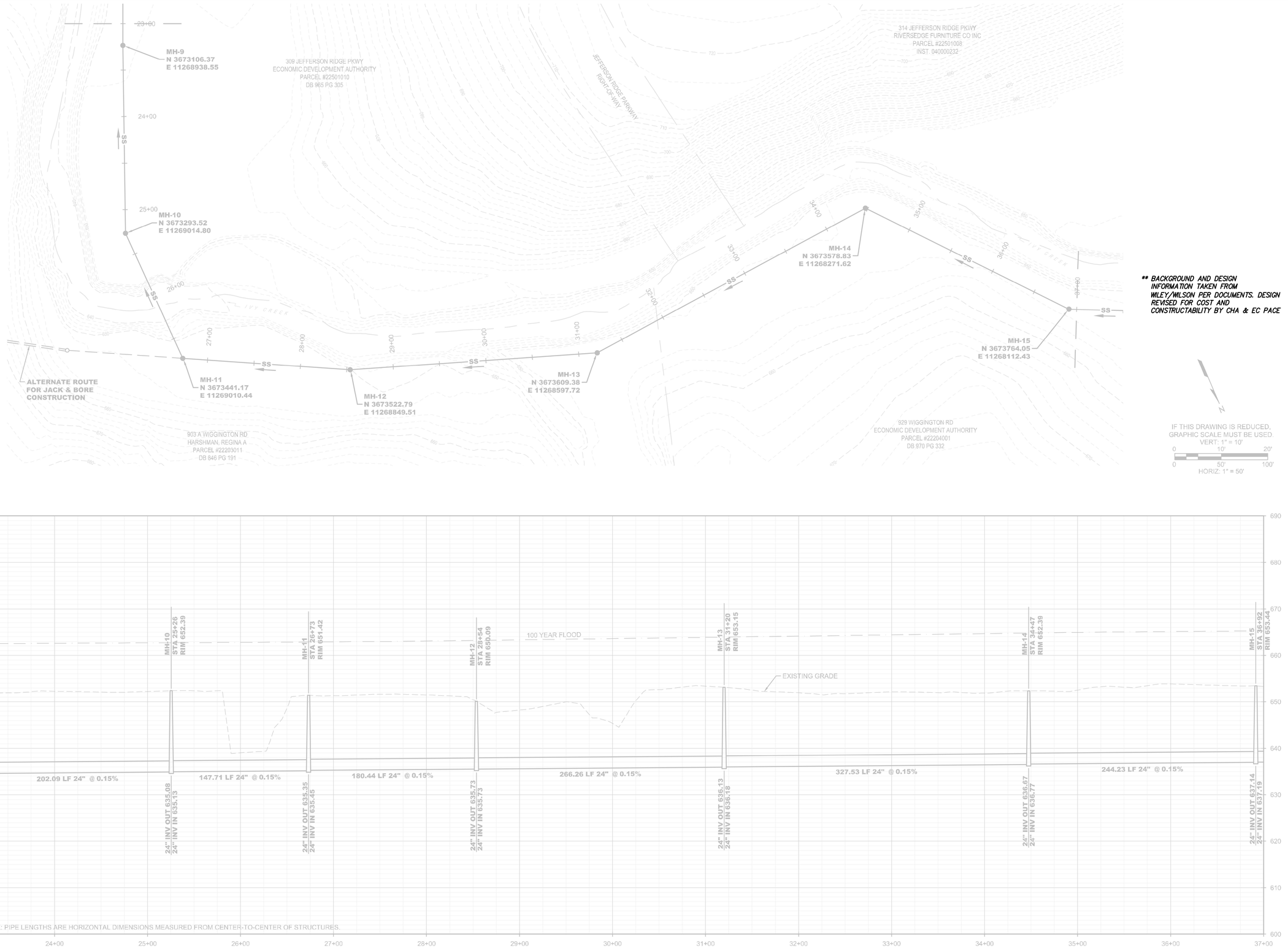

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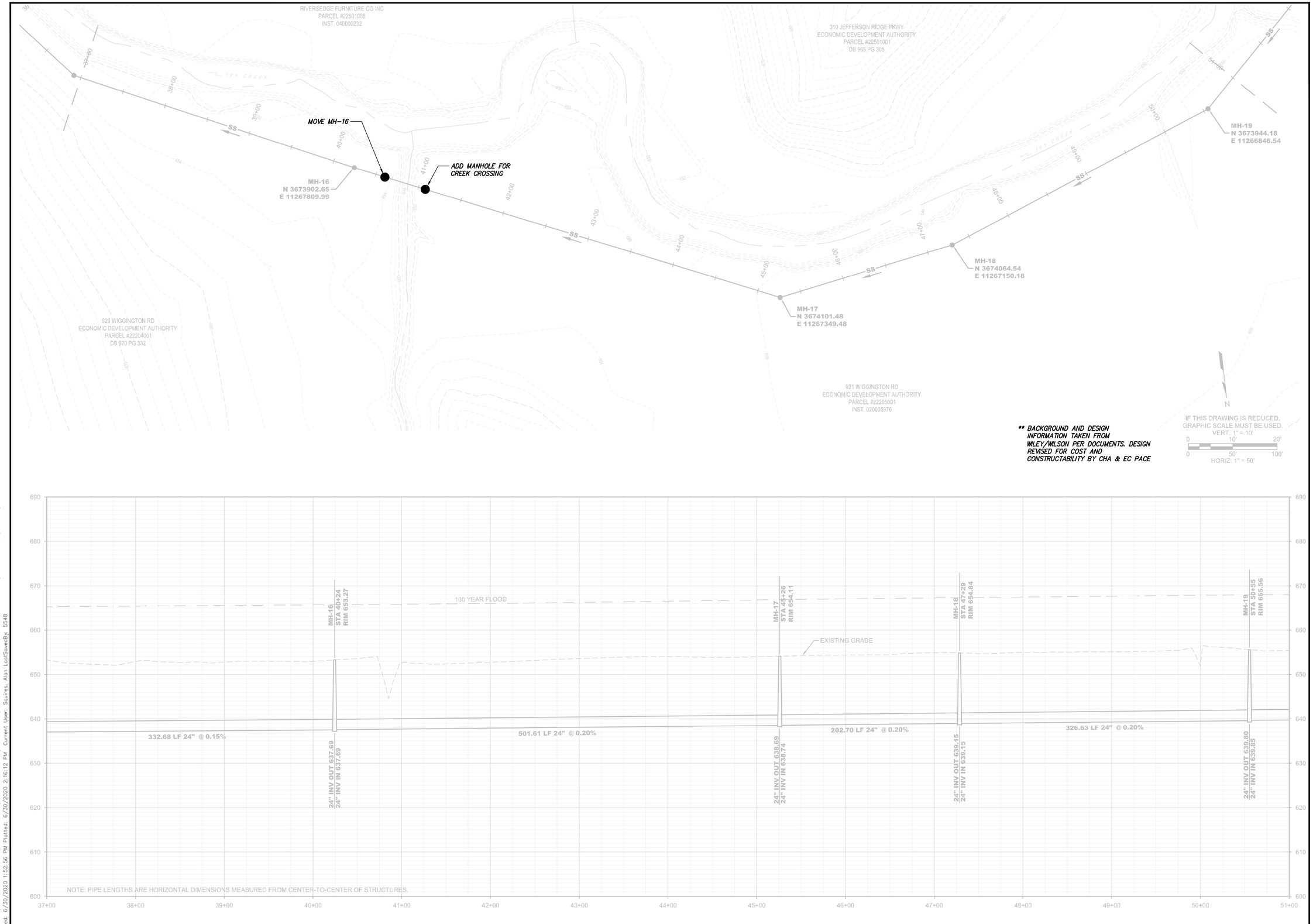

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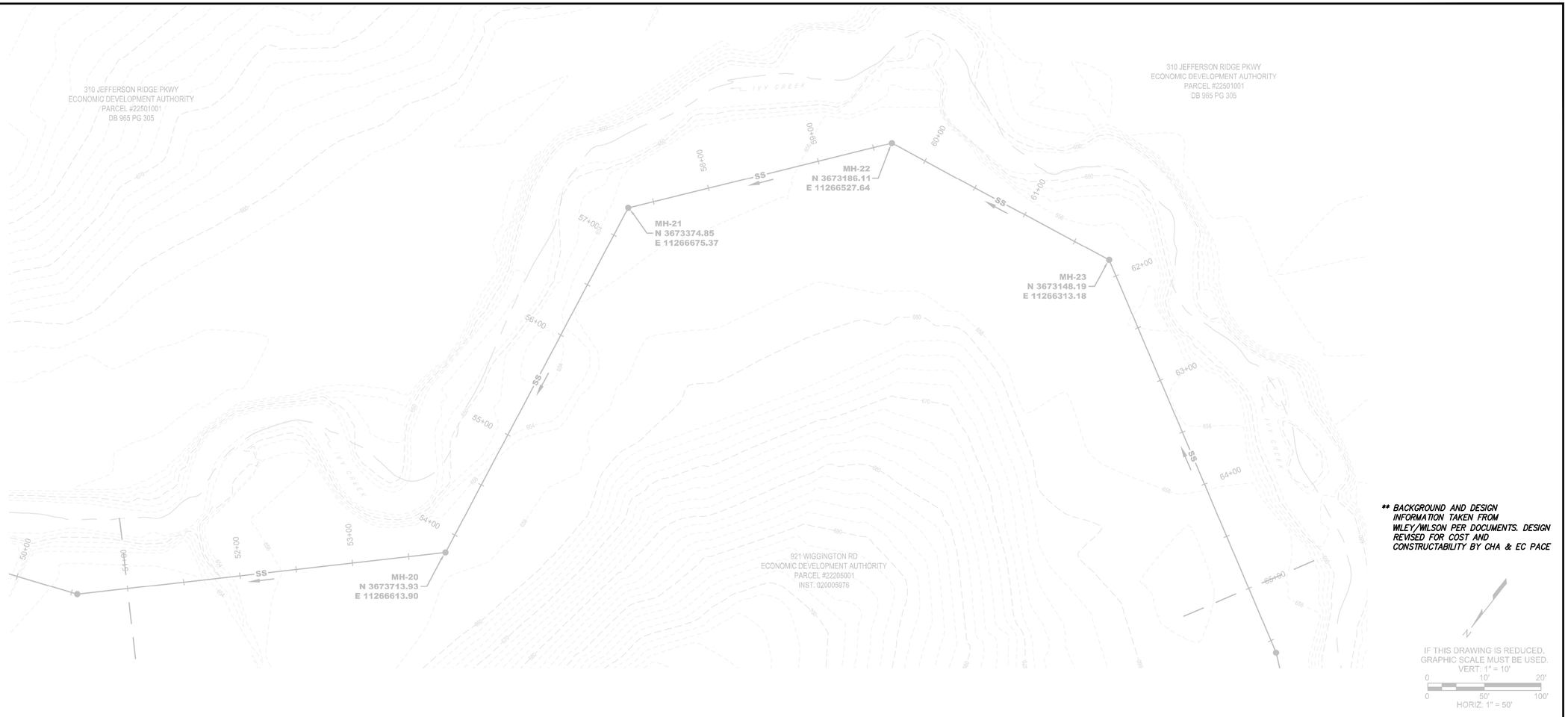

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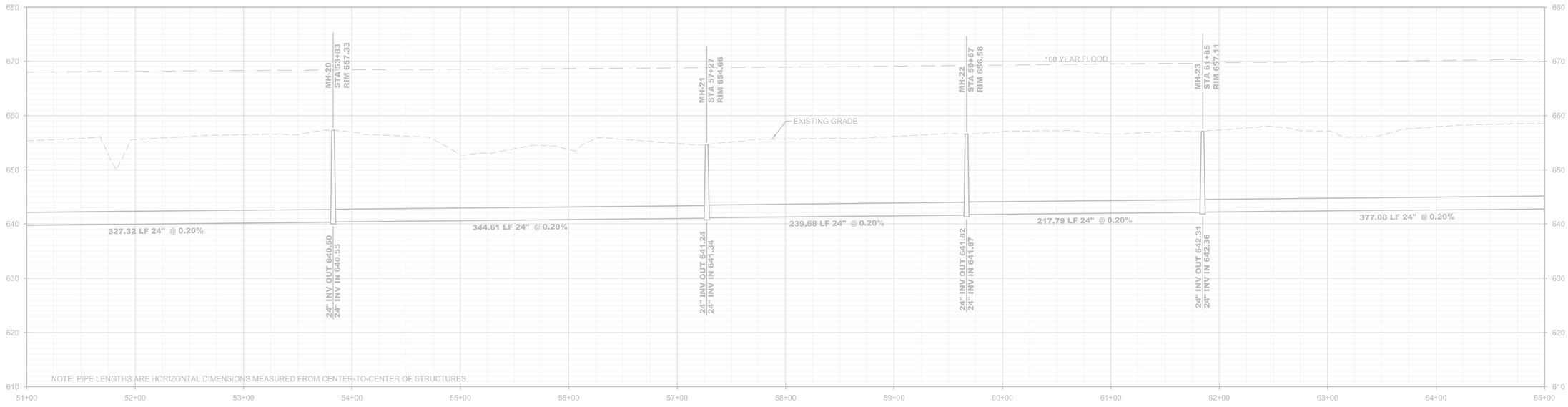

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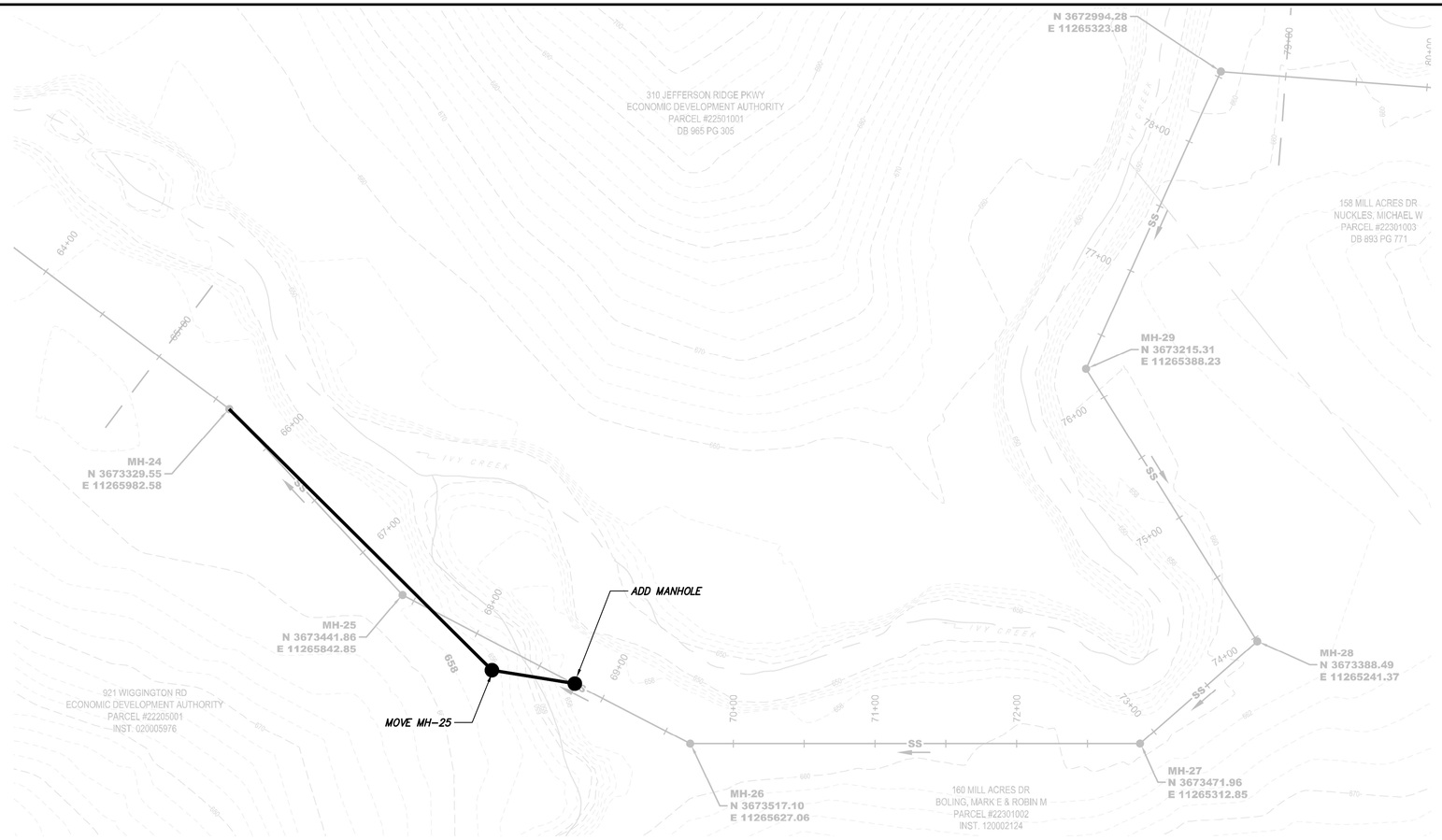

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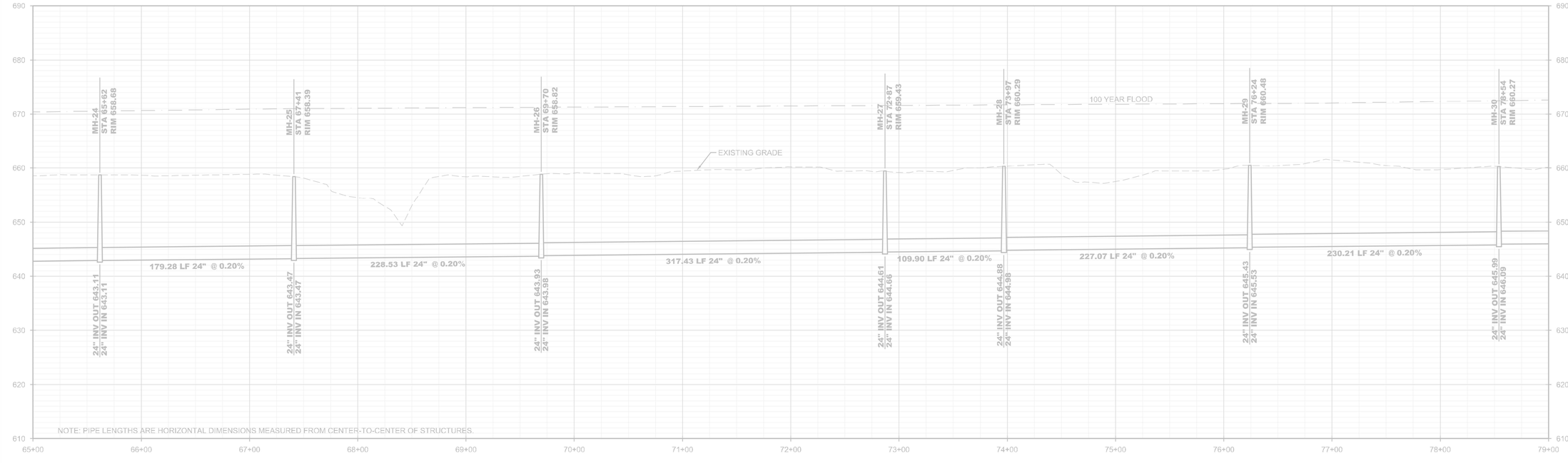

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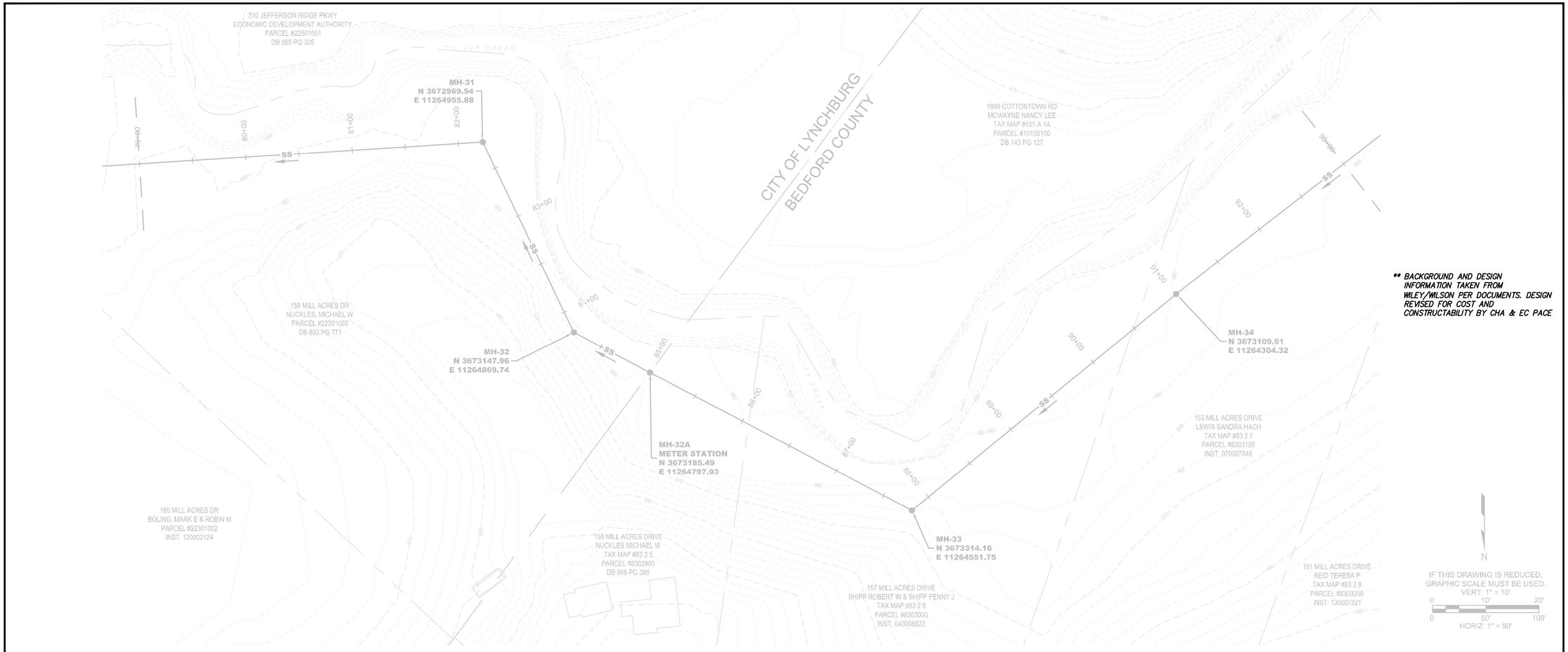

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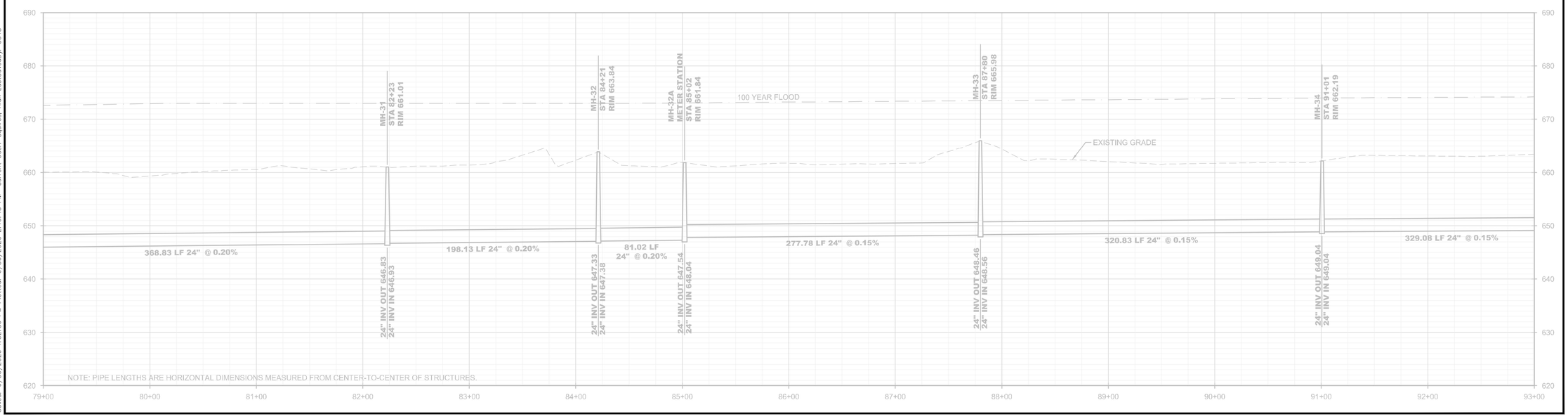

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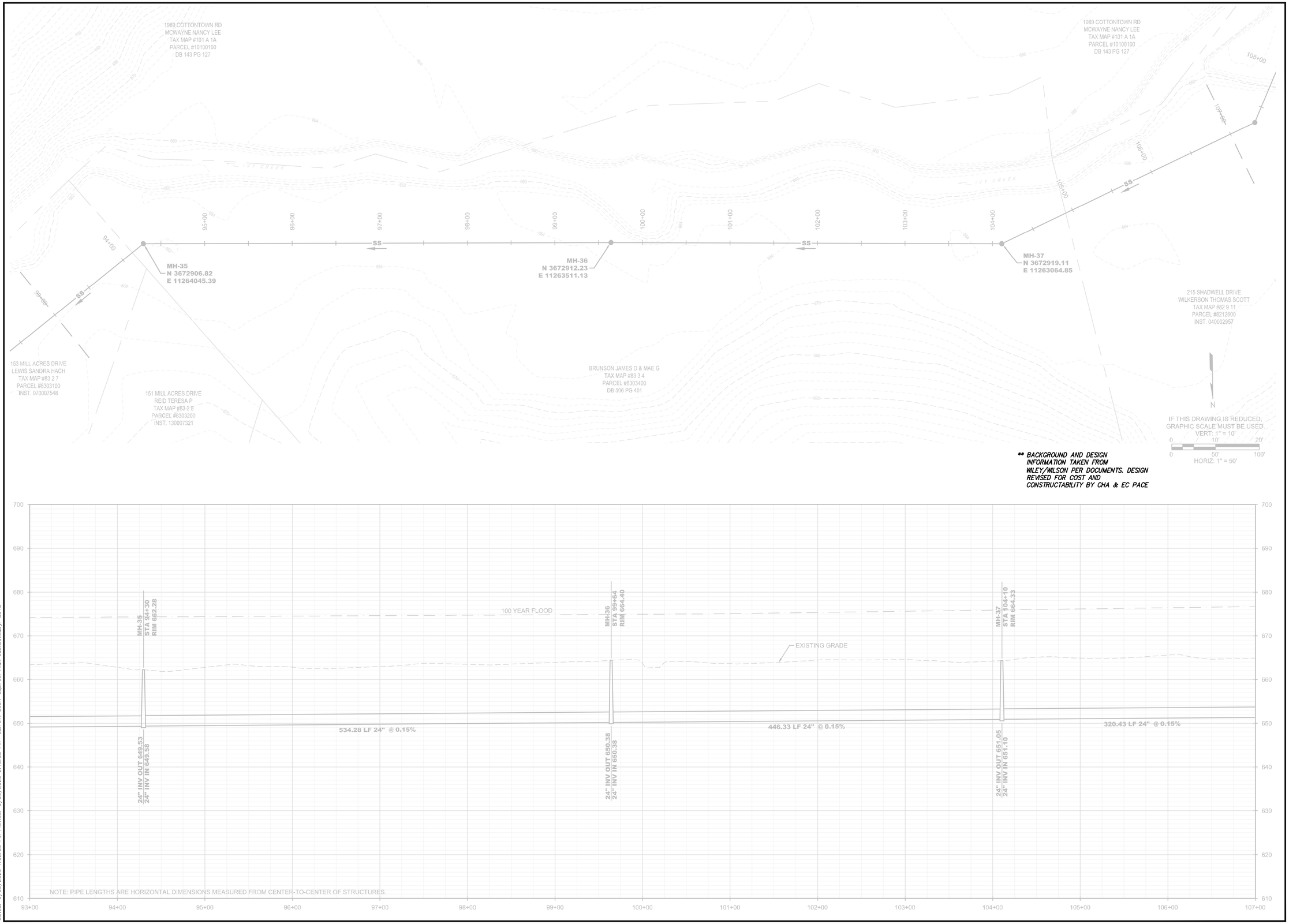

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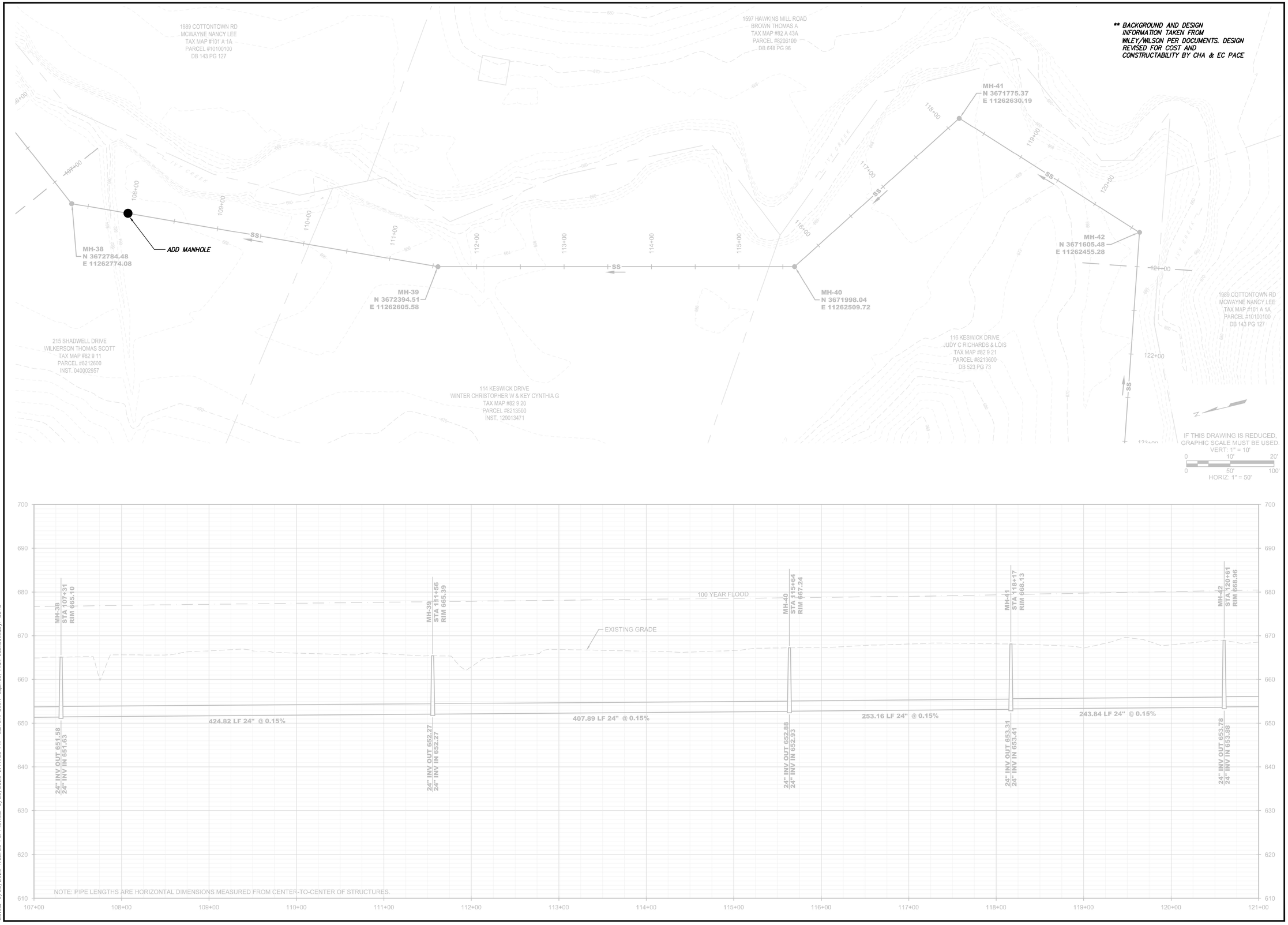

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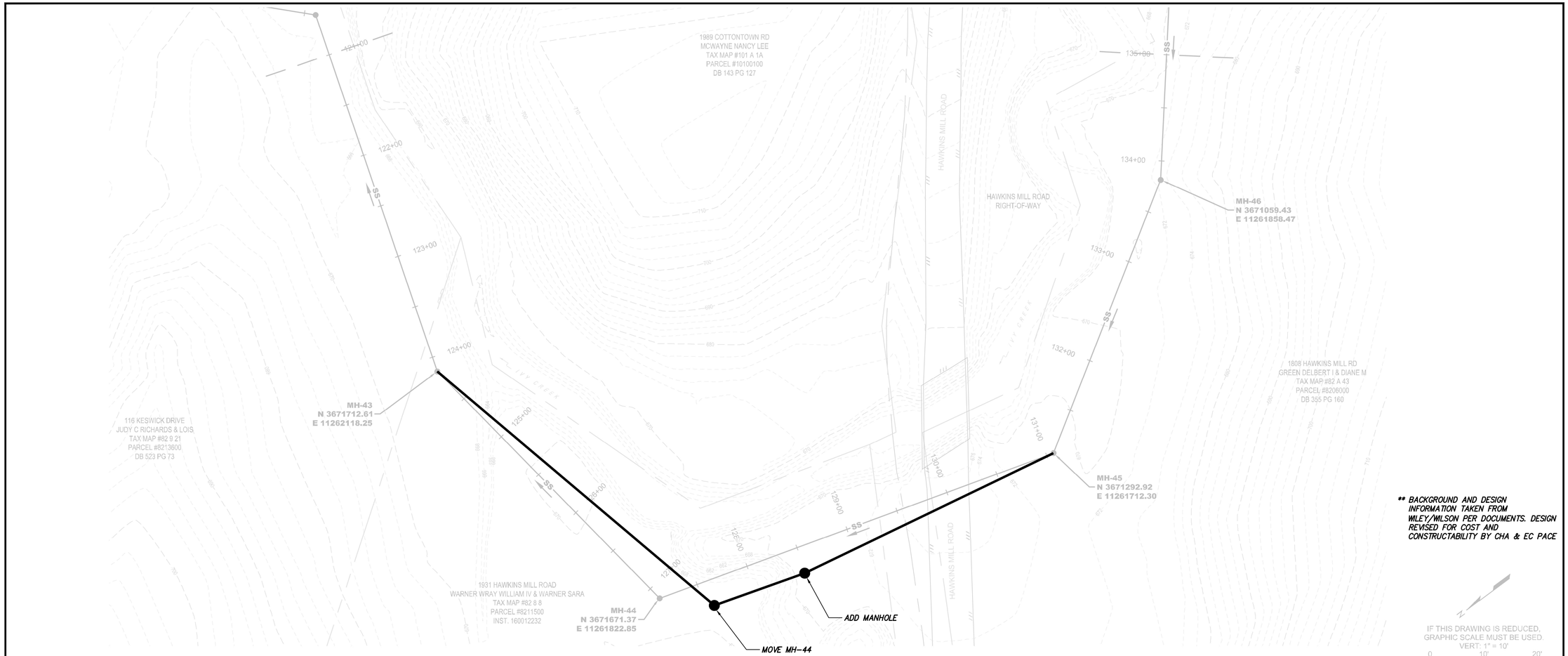

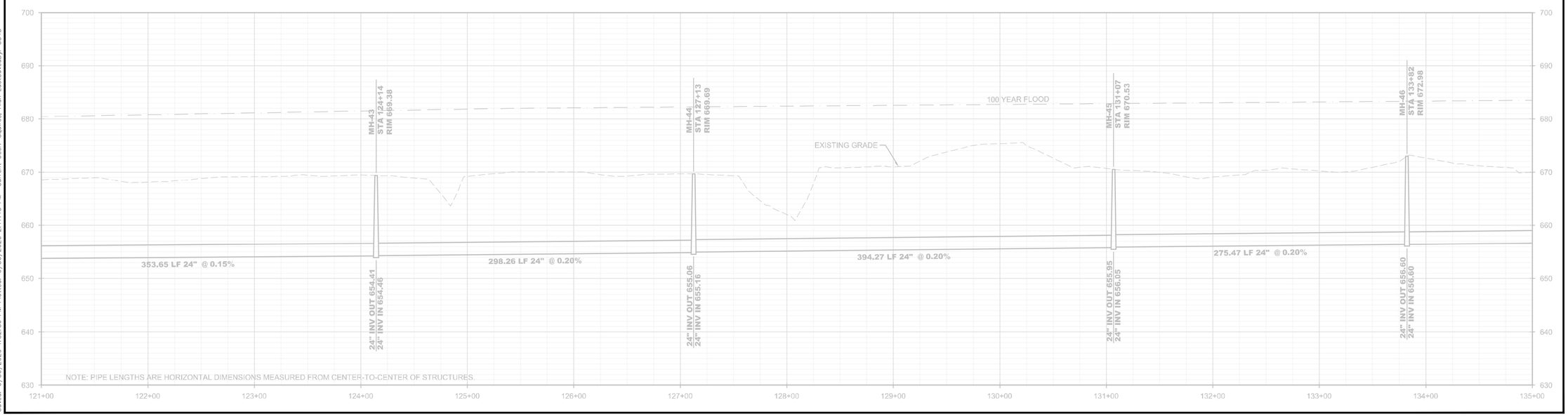

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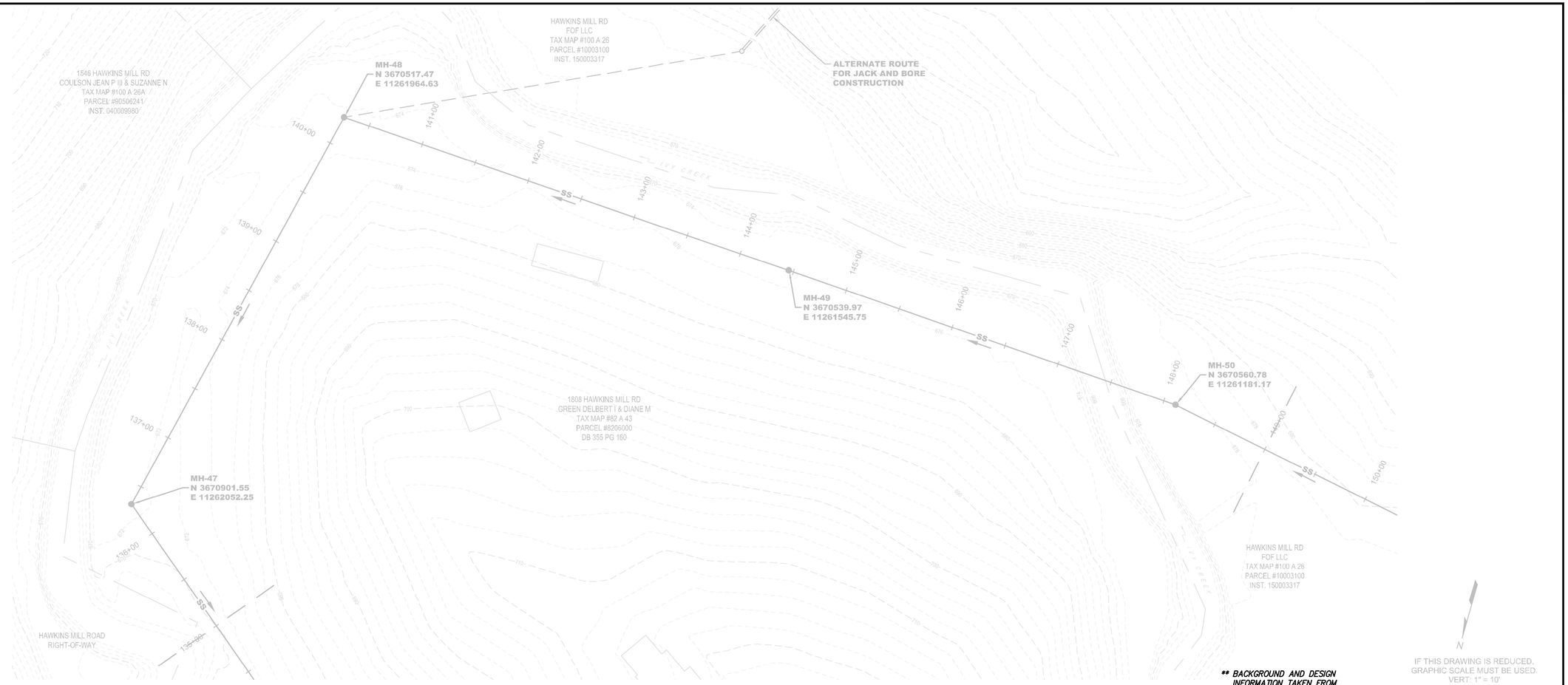

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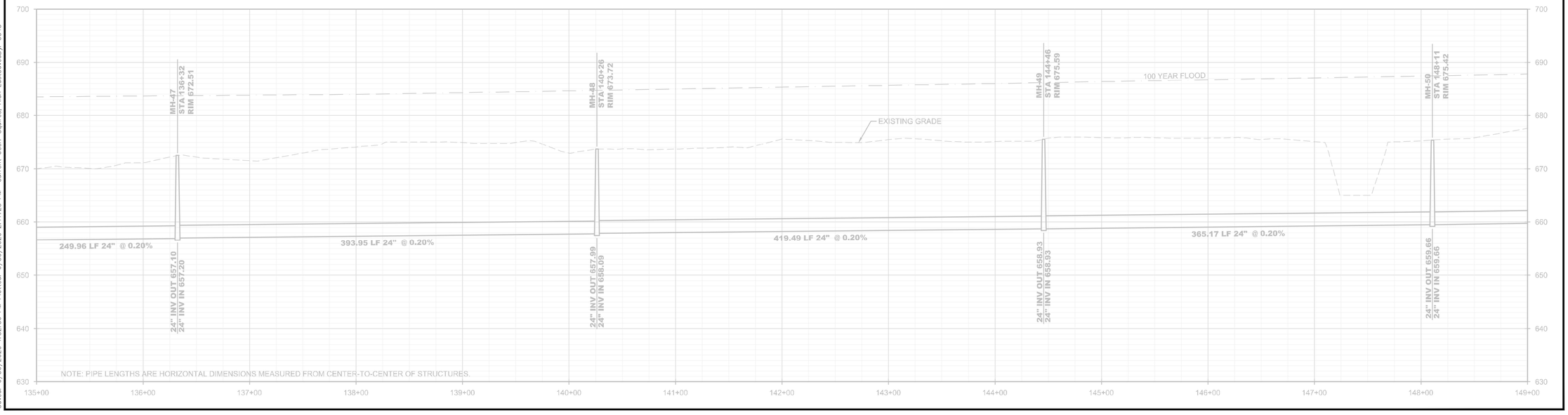

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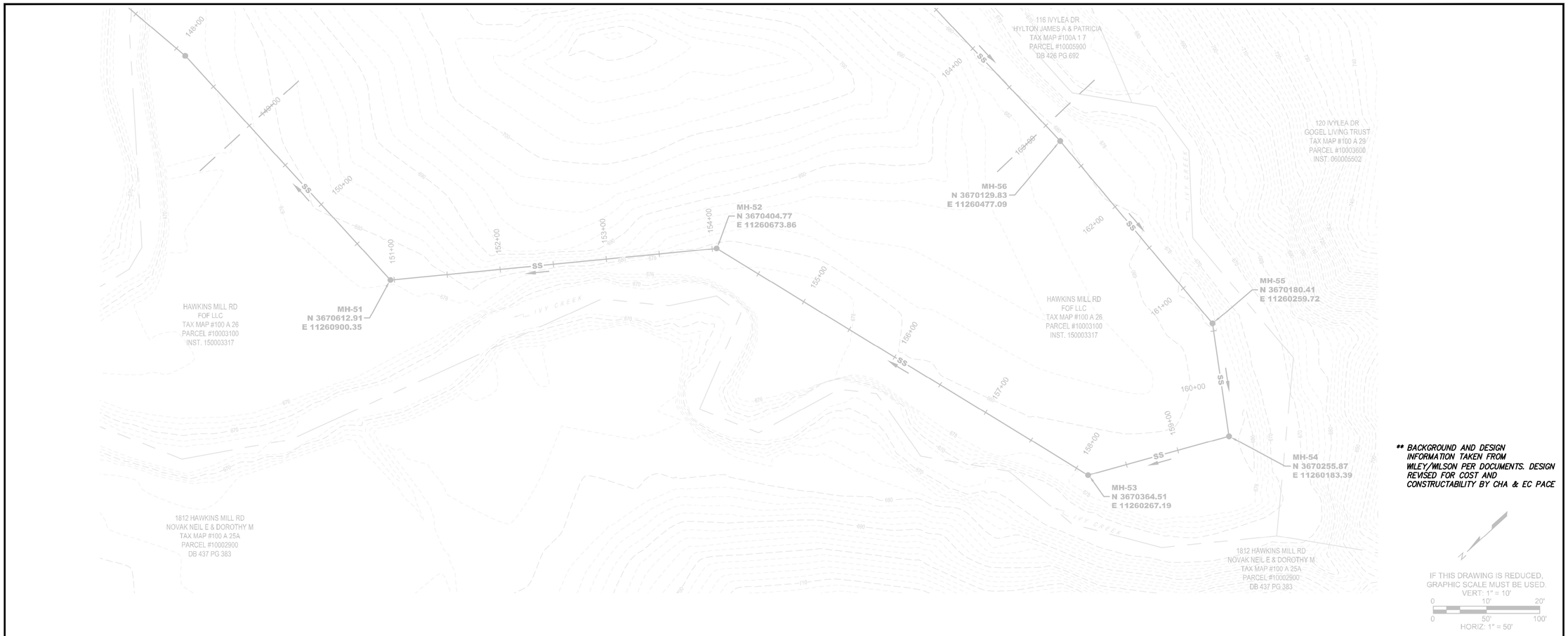

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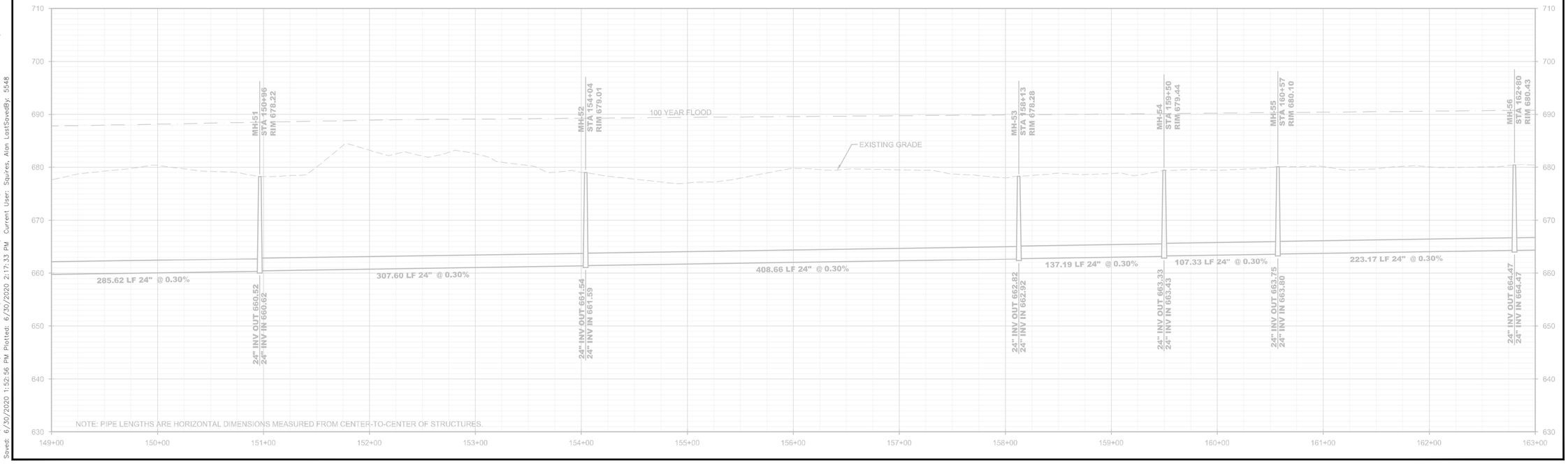

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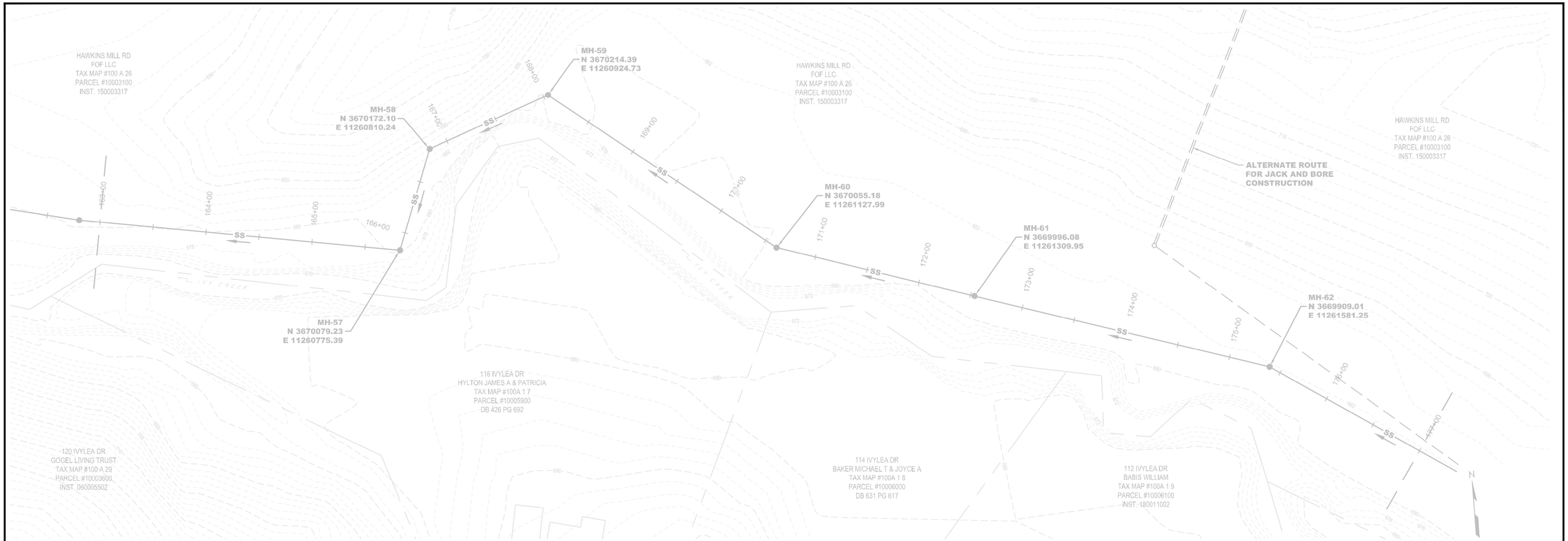

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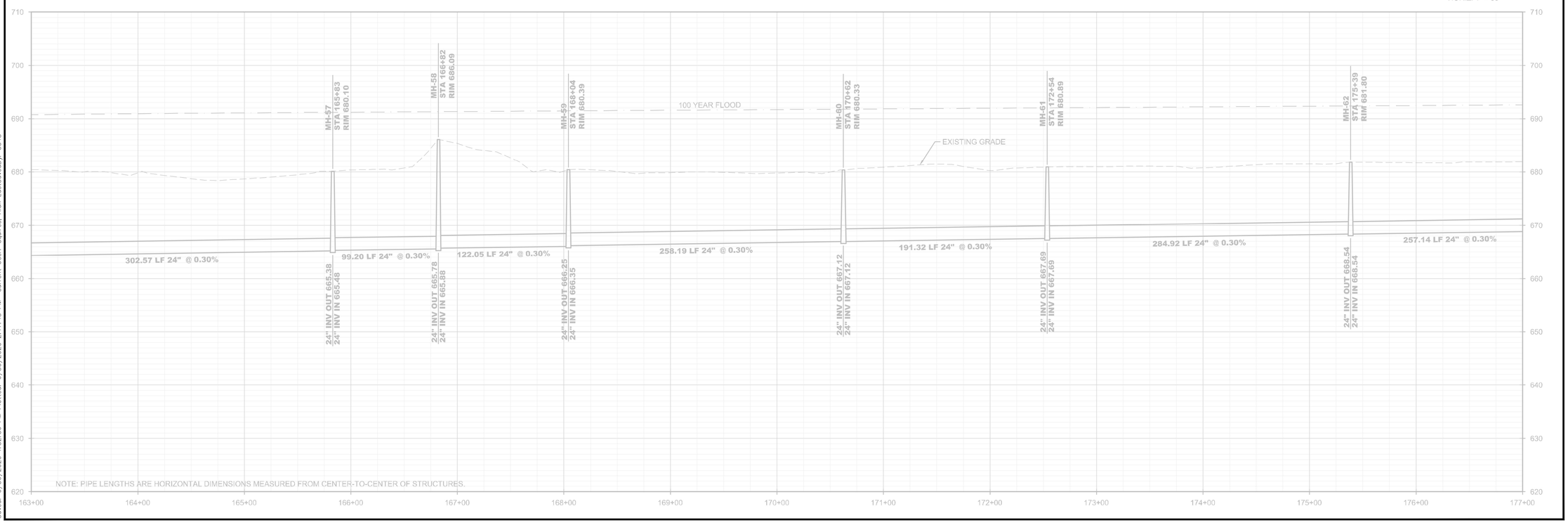

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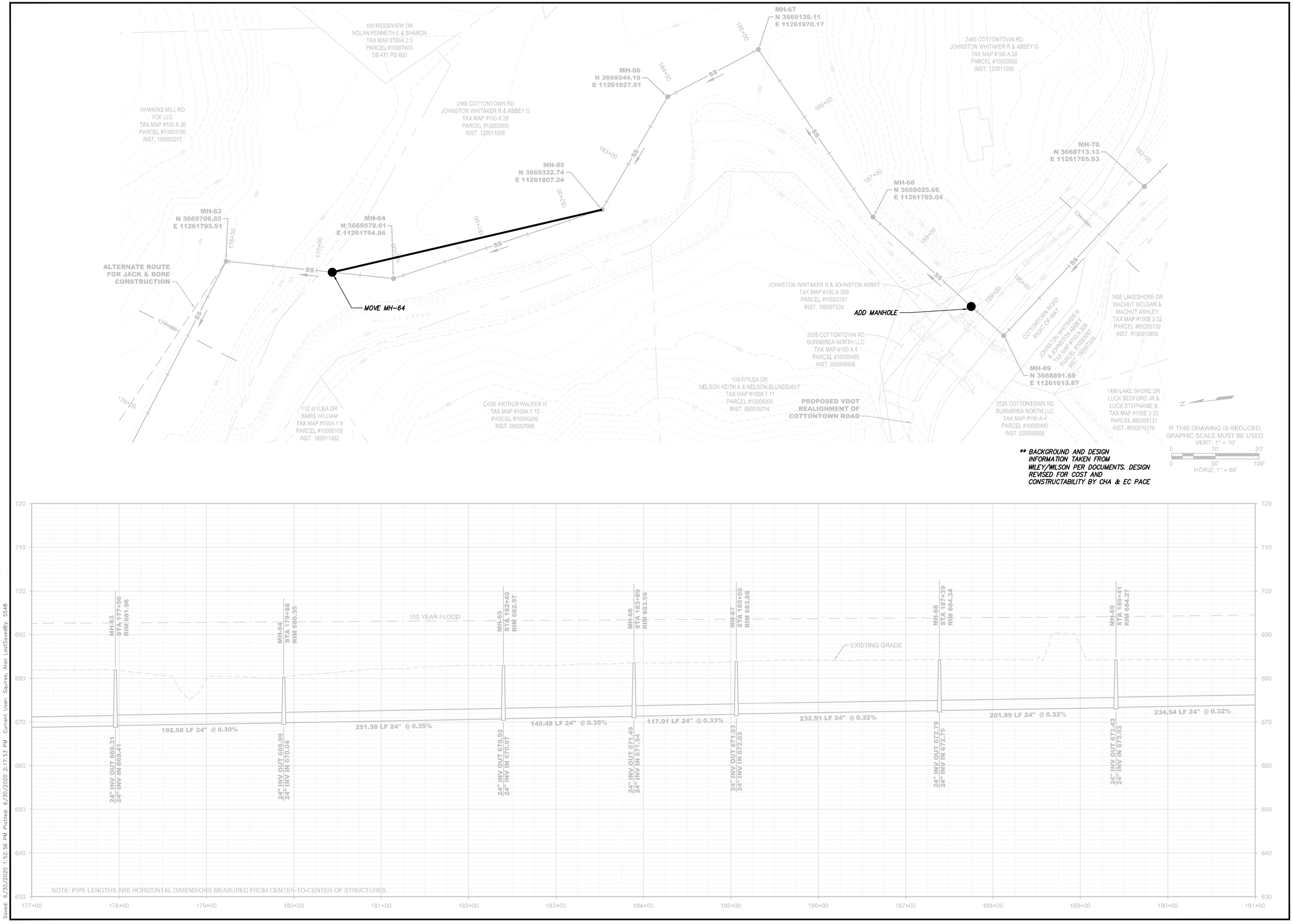

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PROPOSAL NO:
X64825

BEDFORD REGIONAL WATER AUTHORITY

IVY CREEK INTERCEPTOR

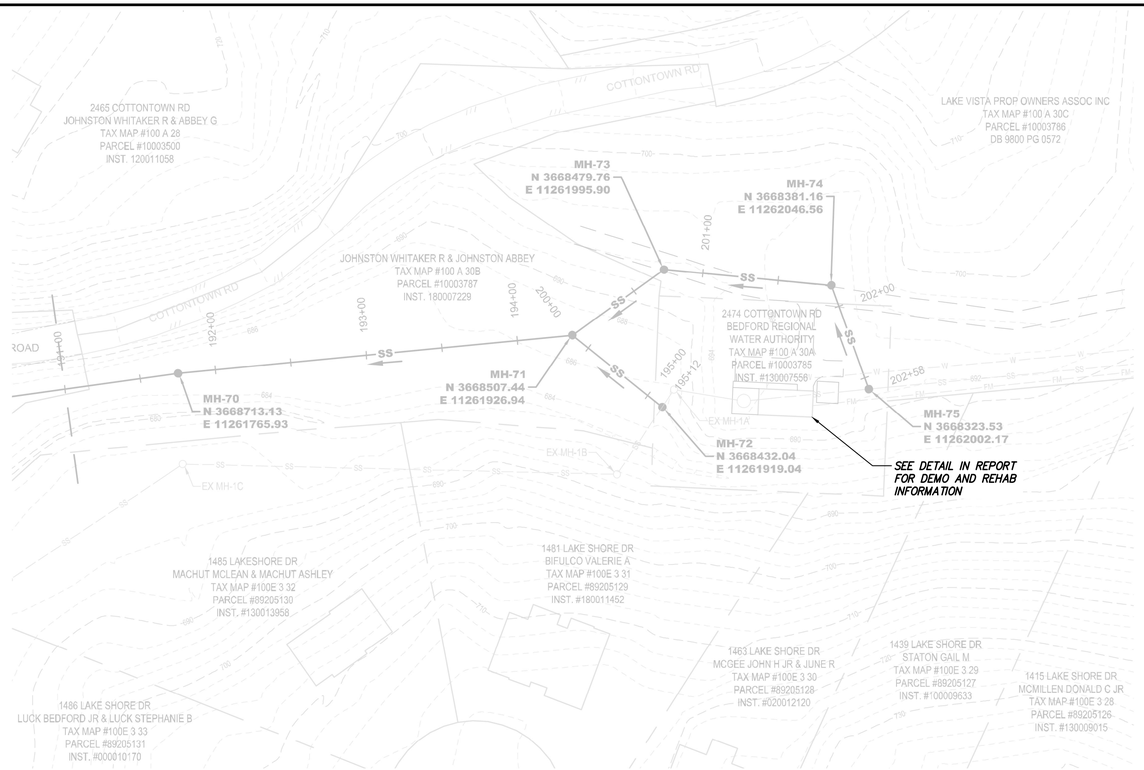
No.	Submittal / Revision	App'd.	By	Date

PROPOSED SANITARY SEWER PLAN & PROFILE

Designed By:	Drawn By:	Checked By:
Issue Date:	Project No:	Scale: AS NOTED

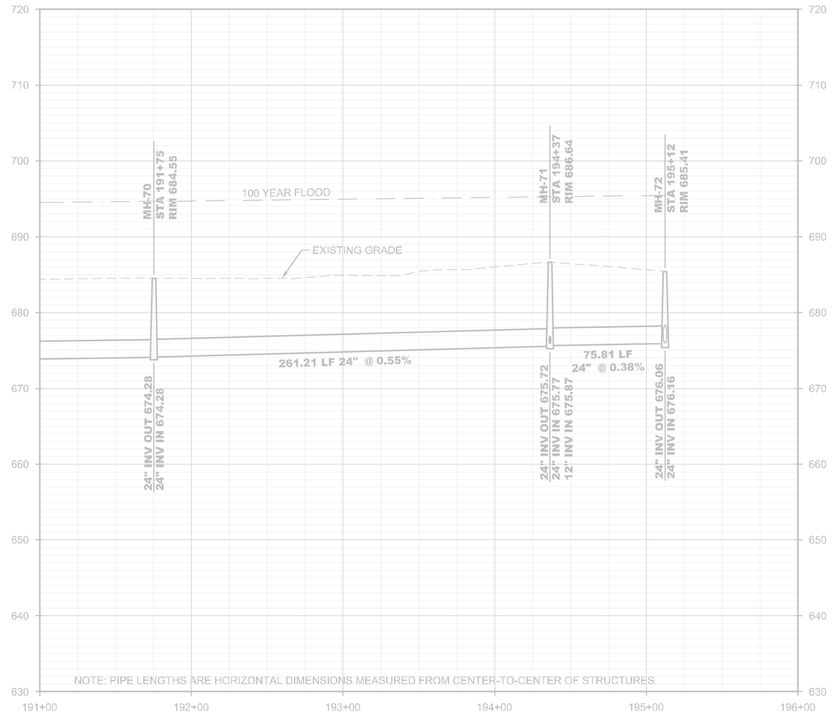
Drawing No.:
C-113

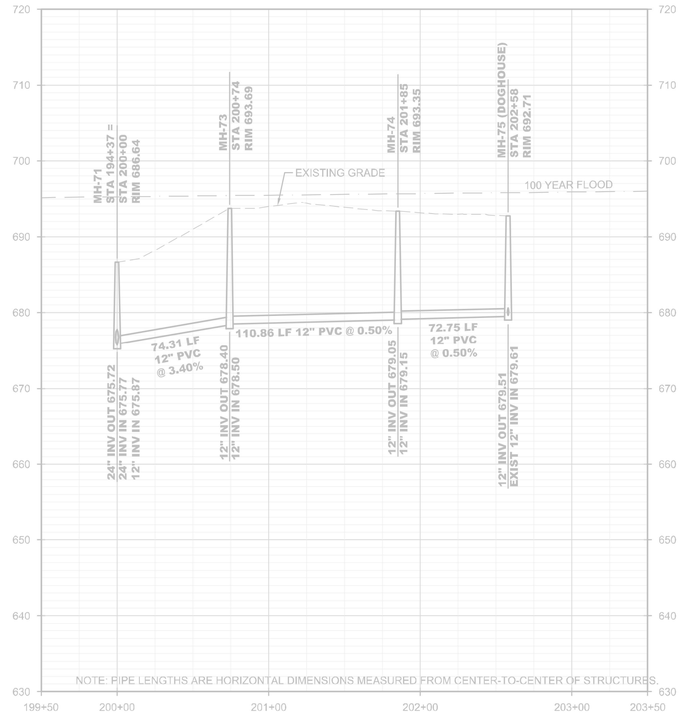
File: V:\CHA200_PROPOSALS\WATER MARKET\PROPOSALS_2020\WASTEWATER\X64825_IVY CREEK INTERCEPTOR DIV 5 AND 6\WORKING DOCS\FIGURES\IVY CREEK INTERCEPTOR ALIGN.DWG
Saved: 6/30/2020 1:52:56 PM Plotted: 6/30/2020 2:17:53 PM Current User: Squires, Alan LastSavedBy: 5548



** BACKGROUND AND DESIGN INFORMATION TAKEN FROM WILEY/WILSON PER DOCUMENTS. DESIGN REVISED FOR COST AND CONSTRUCTABILITY BY CHA & EC PACE

IF THIS DRAWING IS REDUCED, GRAPHIC SCALE MUST BE USED.
VERT: 1" = 10'
0 10' 20'
0 50' 100'
HORIZ: 1" = 50'





CHA
1341 Research Center Drive, Suite 2100
Blacksburg, VA 24060-5548
540.552.5548 . www.chacompanies.com

Bedford Regional Water Authority

PROPOSAL NO:
X64825

BEDFORD REGIONAL
WATER AUTHORITY

IVY CREEK INTERCEPTOR

No.	Submittal / Revision	App'd.	By	Date

PROPOSED
SANITARY SEWER
PLAN & PROFILE

Designed By:	Drawn By:	Checked By:
Issue Date:	Project No:	Scale: AS NOTED

Drawing No.:
C-114

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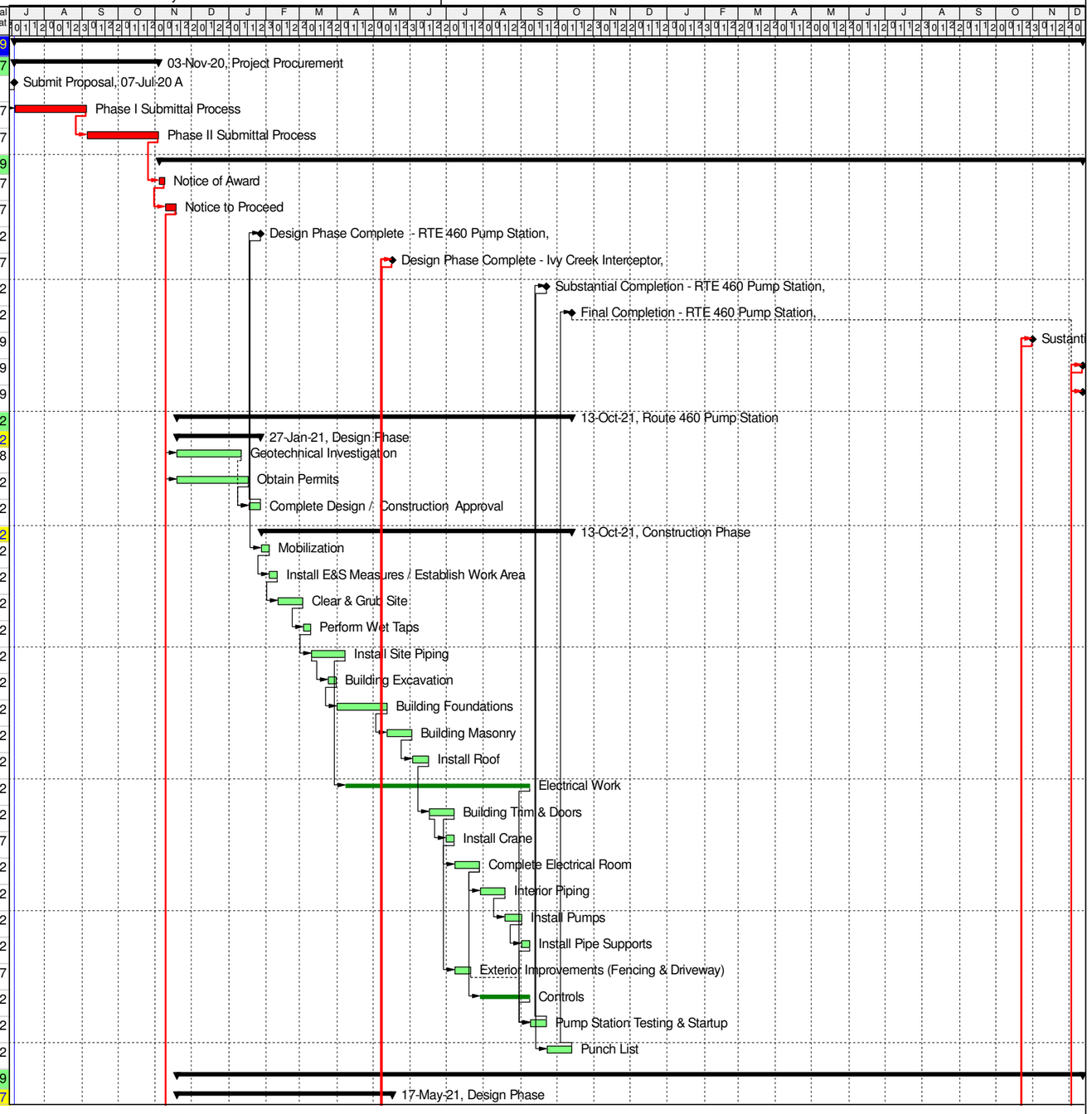
Saved: 6/30/2020 1:52:56 PM Plotted: 6/30/2020 2:18:03 PM Current User: Squires, Alan LastSavedBy: 5548

Appendix B. Construction Schedule

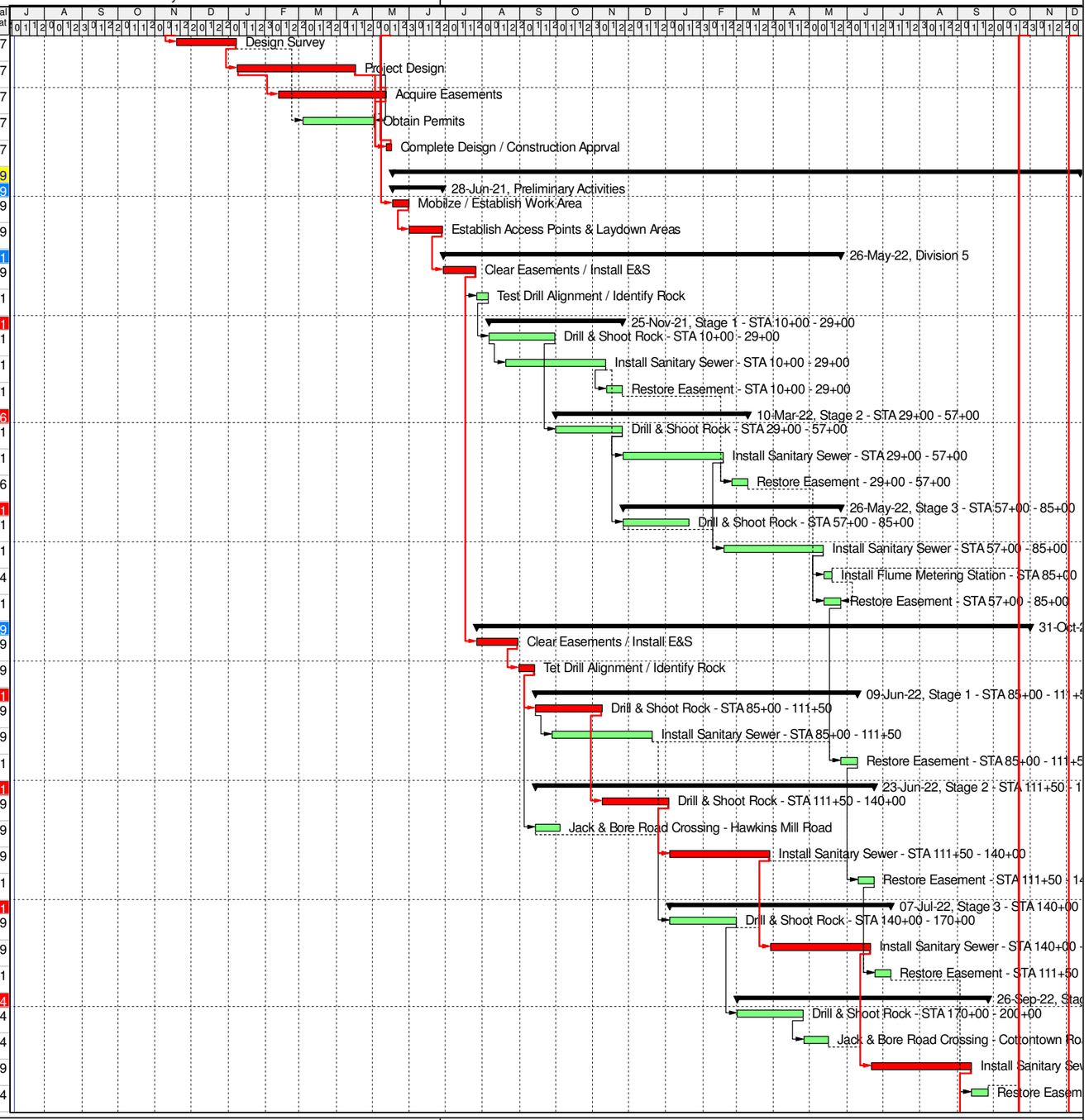
Activity ID	Activity Name	Original Duration	Remaining Duration	Early Start	Early Finish	Late Start	Late Finish	Total Float
Ivy Creek Interceptor & RTE 460 Pump Station		627	627	07-Jul-20	12-Dec-22	03-Aug-2	06-Jan-23	19
Project Procurement		86	86	07-Jul-20	03-Nov-20	03-Aug-2	30-Nov-20	17
PP1000	Submit Proposal	0	0	07-Jul-20				
PP1010	Phase I Submittal Process	60	60	07-Jul-20	04-Sep-20	03-Aug-2	01-Oct-20	27
PP1020	Phase II Submittal Process	60	60	05-Sep-20	03-Nov-20	02-Oct-20	30-Nov-20	27
Project Milestones		541	541	04-Nov-20	12-Dec-22	01-Dec-2	06-Jan-23	19
M1000	Notice of Award	5	5	04-Nov-20	08-Nov-20	01-Dec-2	05-Dec-20	27
M1010	Notice to Proceed	10	10	09-Nov-20	18-Nov-20	06-Dec-2	15-Dec-20	27
M1020	Design Phase Complete - RTE 460 Pump Station	0	0		27-Jan-21		24-Apr-22	452
M1030	Design Phase Complete - Ivy Creek Interceptor	0	0		17-May-21		13-Jun-21	27
M1040	Substantial Completion - RTE 460 Pump Station	0	0		22-Sep-21		16-Dec-22	322
M1050	Final Completion - RTE 460 Pump Station	0	0		13-Oct-21		06-Jan-23	322
M1060	Sustantial Completion - Ivy Creek Intercptor	0	0		31-Oct-22		25-Nov-22	19
M1070	Final Completion - Ivy Creek Interceptor	0	0		12-Dec-22		06-Jan-23	19
M1080	Final Completion - Entire Project	0	0		12-Dec-22		06-Jan-23	19
Route 460 Pump Station		227	227	19-Nov-20	13-Oct-21	14-Feb-22	06-Jan-23	322
Design Phase		42	42	19-Nov-20	27-Jan-21	14-Feb-22	24-Apr-22	322
DPS1000	Geotechnical Investigation	30	30	19-Nov-20	11-Jan-21	04-Mar-22	14-Apr-22	328
DPS1005	Obtain Permits	60	60	19-Nov-20	17-Jan-21	14-Feb-22	14-Apr-22	452
DPS1010	Complete Design / Construction Approval	10	10	18-Jan-21	27-Jan-21	15-Apr-22	24-Apr-22	452
Construction Phase		185	185	28-Jan-21	13-Oct-21	25-Apr-22	06-Jan-23	322
PSC1000	Mobilization	5	5	28-Jan-21	03-Feb-21	25-Apr-22	29-Apr-22	322
PSC1010	Install E&S Measures / Establish Work Area	5	5	04-Feb-21	10-Feb-21	02-May-2	06-May-22	322
PSC1020	Clear & Grub Site	15	15	11-Feb-21	03-Mar-21	09-May-2	27-May-22	322
PSC1030	Perform Wet Taps	5	5	04-Mar-21	10-Mar-21	30-May-2	03-Jun-22	322
PSC1040	Install Site Piping	20	20	11-Mar-21	07-Apr-21	06-Jun-22	01-Jul-22	322
PSC1050	Building Excavation	5	5	25-Mar-21	31-Mar-21	20-Jun-22	24-Jun-22	322
PSC1060	Building Foundations	30	30	01-Apr-21	12-May-21	27-Jun-22	05-Aug-22	322
PSC1070	Building Masonry	15	15	13-May-21	02-Jun-21	08-Aug-2	26-Aug-22	322
PSC1080	Install Roof	10	10	03-Jun-21	16-Jun-21	29-Aug-2	09-Sep-22	322
PSC1090	Electrical Work	110	110	08-Apr-21	08-Sep-21	04-Jul-22	02-Dec-22	322
PSC1100	Building Trim & Doors	15	15	17-Jun-21	07-Jul-21	12-Sep-2	30-Sep-22	322
PSC1110	Install Crane	5	5	01-Jul-21	07-Jul-21	14-Nov-2	18-Nov-22	357
PSC1120	Complete Electrical Room	15	15	08-Jul-21	28-Jul-21	03-Oct-22	21-Oct-22	322
PSC1130	Interior Piping	15	15	29-Jul-21	18-Aug-21	24-Oct-22	11-Nov-22	322
PSC1140	Install Pumps	10	10	19-Aug-21	01-Sep-21	14-Nov-2	25-Nov-22	322
PSC1150	Install Pipe Supports	5	5	02-Sep-21	08-Sep-21	28-Nov-2	02-Dec-22	322
PSC1160	Exterior Improvements (Fencing & Driveway)	10	10	08-Jul-21	21-Jul-21	21-Nov-2	02-Dec-22	357
PSC1170	Controls	30	30	29-Jul-21	08-Sep-21	24-Oct-22	02-Dec-22	322
PSC1180	Pump Station Testing & Startup	10	10	09-Sep-21	22-Sep-21	05-Dec-2	16-Dec-22	322
PSC1190	Punch List	15	15	23-Sep-21	13-Oct-21	19-Dec-2	06-Jan-23	322
Ivy Creek Interceptor		530	530	19-Nov-20	12-Dec-22	16-Dec-2	06-Jan-23	19
Design Phase		180	180	19-Nov-20	17-May-21	16-Dec-2	13-Jun-21	27



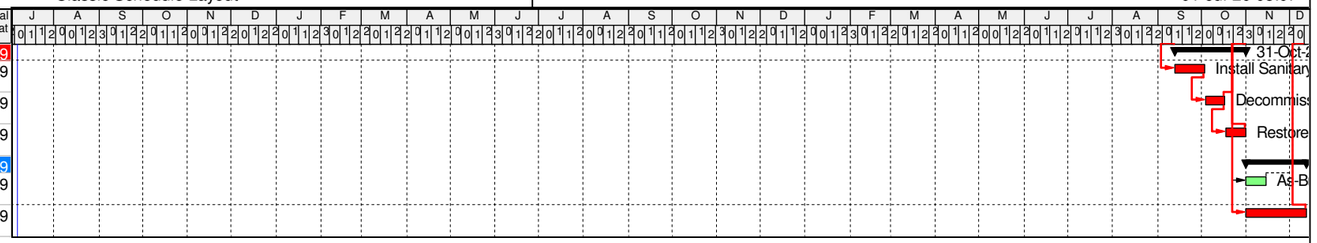
Remaining Level of Effort | Actual Work | Critical Remaining Work
Actual Level of Effort | Remaining Work | Milestone

TASK filter: All Activities

Activity ID	Activity Name	Original Duration	Remaining Duration	Early Start	Early Finish	Late Start	Late Finish	Total Float
D1000	Design Survey	50	50	19-Nov-20	07-Jan-21	16-Dec-2	03-Feb-21	27
D1010	Project Design	100	100	08-Jan-21	17-Apr-21	04-Feb-21	14-May-21	27
DA1000	Acquire Easements	90	90	12-Feb-21	12-May-21	11-Mar-21	08-Jun-21	27
DP1000	Obtain Permits	60	60	04-Mar-21	02-May-21	10-Apr-21	08-Jun-21	37
DP1010	Complete Deisgn / Construction Apprval	5	5	13-May-21	17-May-21	09-Jun-21	13-Jun-21	27
Construction Phase		410	410	18-May-21	12-Dec-22	14-Jun-21	06-Jan-23	19
Preliminary Activities		30	30	18-May-21	28-Jun-21	14-Jun-21	23-Jul-21	19
P1000	Mobilze / Establish Work Area	10	10	18-May-21	31-May-21	14-Jun-21	25-Jun-21	19
P1010	Establish Access Points & Laydown Areas	20	20	01-Jun-21	28-Jun-21	28-Jun-21	23-Jul-21	19
Division 5		238	238	29-Jun-21	26-May-22	26-Jul-21	30-Sep-22	91
C6000	Clear Easements / Install E&S	20	20	29-Jun-21	26-Jul-21	26-Jul-21	20-Aug-21	19
C6010	Test Drill Alignment / Identify Rock	8	8	27-Jul-21	05-Aug-21	01-Dec-2	10-Dec-21	91
Stage 1 - STA 10+00 - 29+00		80	80	06-Aug-21	25-Nov-21	13-Dec-2	02-Sep-22	201
C6100	Drill & Shoot Rock - STA 10+00 - 29+00	40	40	06-Aug-21	30-Sep-21	13-Dec-2	04-Feb-22	91
C6110	Install Sanitary Sewer - STA 10+00 - 29+00	60	60	20-Aug-21	11-Nov-21	10-Jan-22	01-Apr-22	101
C6120	Restore Easement - STA 10+00 - 29+00	10	10	12-Nov-21	25-Nov-21	22-Aug-2	02-Sep-22	201
Stage 2 - STA 29+00 - 57+00		115	115	01-Oct-21	10-Mar-22	07-Feb-22	16-Sep-22	136
C6200	Drill & Shoot Rock - STA 29+00 - 57+00	40	40	01-Oct-21	25-Nov-21	07-Feb-22	01-Apr-22	91
C6210	Install Sanitary Sewer - STA 29+00 - 57+00	60	60	26-Nov-21	17-Feb-22	04-Apr-22	24-Jun-22	91
C6220	Restore Easement - 29+00 - 57+00	10	10	25-Feb-22	10-Mar-22	05-Sep-2	16-Sep-22	136
Stage 3 - STA 57+00 - 85+00		130	130	26-Nov-21	26-May-22	13-Jun-22	30-Sep-22	91
C6300	Drill & Shoot Rock - STA 57+00 - 85+00	40	40	26-Nov-21	20-Jan-22	13-Jun-22	05-Aug-22	141
C6310	Install Sanitary Sewer - STA 57+00 - 85+00	60	60	18-Feb-22	12-May-22	27-Jun-22	16-Sep-22	91
C6320	Install Flume Metering Station - STA 85+00	5	5	13-May-22	19-May-22	22-Sep-2	28-Sep-22	94
C6330	Restore Easement - STA 57+00 - 85+00	10	10	13-May-22	26-May-22	19-Sep-2	30-Sep-22	91
Division 6		330	330	27-Jul-21	31-Oct-22	23-Aug-2	25-Nov-22	19
C5000	Clear Easements / Install E&S	25	25	27-Jul-21	30-Aug-21	23-Aug-2	24-Sep-21	19
C5010	Tet Drill Alignment / Identify Rock	10	10	31-Aug-21	13-Sep-21	27-Sep-2	08-Oct-21	19
Stage 1 - STA 85+00 - 111+50		193	193	14-Sep-21	09-Jun-22	11-Oct-21	14-Oct-22	91
C5100	Drill & Shoot Rock - STA 85+00 - 111+50	40	40	14-Sep-21	08-Nov-21	11-Oct-21	03-Dec-21	19
C5110	Install Sanitary Sewer - STA 85+00 - 111+50	60	60	28-Sep-21	20-Dec-21	08-Nov-2	28-Jan-22	29
C5120	Restore Easement - STA 85+00 - 111+50	10	10	27-May-22	09-Jun-22	03-Oct-22	14-Oct-22	91
Stage 2 - STA 111+50 - 140+00		203	203	14-Sep-21	23-Jun-22	06-Dec-2	28-Oct-22	91
C5200	Drill & Shoot Rock - STA 111+50 - 140+00	40	40	09-Nov-21	03-Jan-22	06-Dec-2	28-Jan-22	19
C5210	Jack & Bore Road Crossing - Hawkins Mill Road	15	15	14-Sep-21	04-Oct-21	17-Jan-22	04-Feb-22	89
C5220	Install Sanitary Sewer - STA 111+50 - 140+00	60	60	04-Jan-22	28-Mar-22	31-Jan-22	22-Apr-22	19
C5230	Restore Easement - STA 111+50 - 140+00	10	10	10-Jun-22	23-Jun-22	17-Oct-22	28-Oct-22	91
Stage 3 - STA 140+00 - 170+00		133	133	04-Jan-22	07-Jul-22	28-Feb-22	11-Nov-22	91
C5300	Drill & Shoot Rock - STA 140+00 - 170+00	40	40	04-Jan-22	28-Feb-22	28-Feb-22	22-Apr-22	39
C5310	Install Sanitary Sewer - STA 140+00 - 170+00	60	60	29-Mar-22	20-Jun-22	25-Apr-22	15-Jul-22	19
C5320	Restore Easement - STA 111+50 - 140+00	10	10	24-Jun-22	07-Jul-22	31-Oct-22	11-Nov-22	91
Stage 4 - STA 170+00 - 200+00		150	150	01-Mar-22	26-Sep-22	02-May-2	25-Nov-22	44
C5400	Drill & Shoot Rock - STA 170+00 - 200+00	40	40	01-Mar-22	25-Apr-22	02-May-2	24-Jun-22	44
C5410	Jack & Bore Road Crossing - Cottontown Road	15	15	26-Apr-22	16-May-22	27-Jun-22	15-Jul-22	44
C5420	Install Sanitary Sewer- STA 170+00 - 200+00	60	60	21-Jun-22	12-Sep-22	18-Jul-22	07-Oct-22	19
C5430	Restore Easement - STA 170+00 - 200+00	10	10	13-Sep-22	26-Sep-22	14-Nov-2	25-Nov-22	44



Activity ID	Activity Name	Original Duration	Remaining Duration	Early Start	Early Finish	Late Start	Late Finish	Total Float
STage 5 - Lake Vista Pump Station		35	35	13-Sep-22	31-Oct-22	10-Oct-22	25-Nov-22	19
C5500	Install Sanitary Sewer / Connect to Existing Sewer I	15	15	13-Sep-22	03-Oct-22	10-Oct-22	28-Oct-22	19
C5510	Decommission Pump Station	10	10	04-Oct-22	17-Oct-22	31-Oct-22	11-Nov-22	19
C5520	Restore Site	10	10	18-Oct-22	31-Oct-22	14-Nov-2	25-Nov-22	19
Project Closeout		30	30	01-Nov-22	12-Dec-22	28-Nov-2	06-Jan-23	19
C7000	As-Built Survey / Record Drawings	10	10	01-Nov-22	14-Nov-22	26-Dec-2	06-Jan-23	39
C7010	Punch List	30	30	01-Nov-22	12-Dec-22	28-Nov-2	06-Jan-23	19



Remaining Level of Effort
Actual Level of Effort
Actual Work
Remaining Work
Critical Remaining Work
Milestone

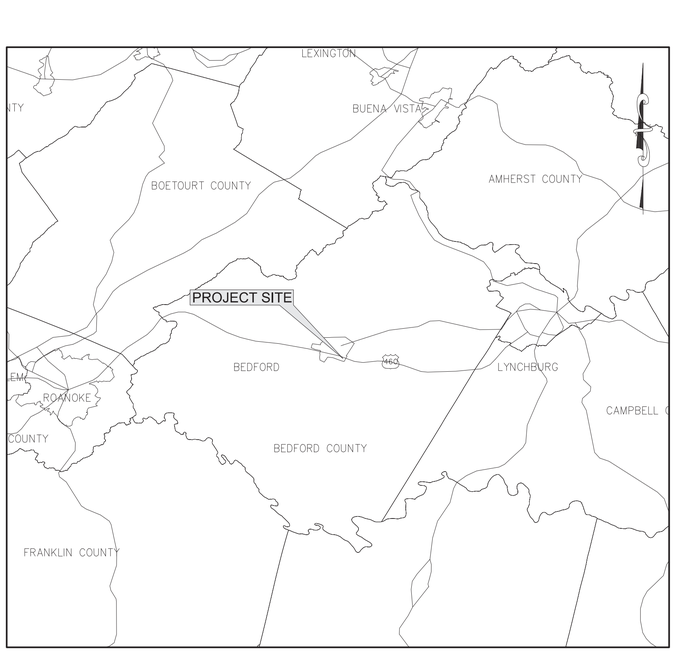
TASK filter: All Activities

Appendix C.
Route 460 Pump Station Plans (Select Sheets)

ROUTE 460 PUMP STATION
BEDFORD, VA

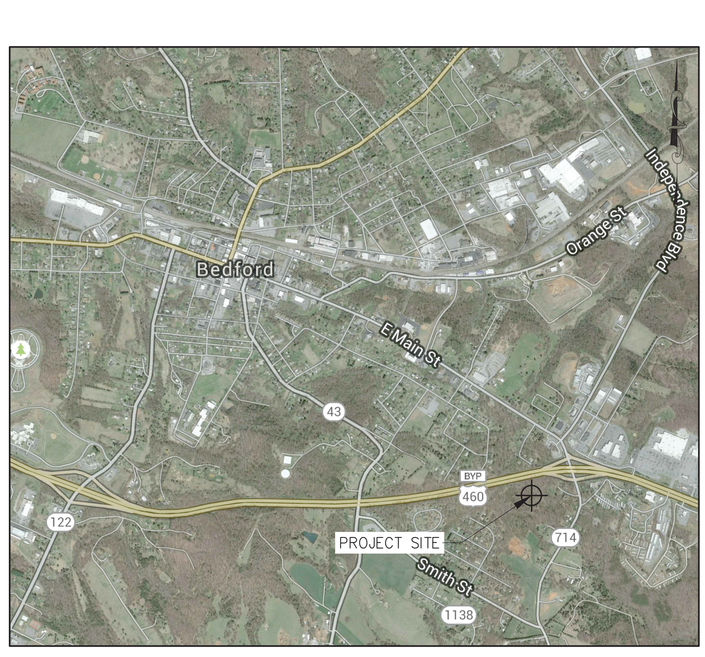
OWNER:
BEDFORD REGIONAL WATER AUTHORITY
1723 FALLING CREEK RD
BEDFORD, VA 24523
(540) 586-7679

PREPARED BY:
CHA CONSULTING
1341 RESEARCH CENTER DRIVE
SUITE 2100
BLACKSBURG, VIRGINIA 24060
(540) 552-5548



LOCATION MAP
SCALE: N.T.S.

Know what's **below.**
Call before you dig.



VICINITY MAP
SCALE: N.T.S.

CHA
1341 Research Center Drive, Suite 2100
Blacksburg, VA 24060
540.552.5548 • www.chacompanies.com

BEDFORD
REGIONAL WATER
AUTHORITY

COMMONWEALTH OF VIRGINIA
ERIC T. ANDERSON
Lic. No. 040613
6/20/18
PROFESSIONAL ENGINEER

ROUTE 460 PUMP STATION
BEDFORD, VA.

No.	Submittal / Revision	App'd	By	Date
	BID ISSUE	ETA	CTB	06/20/18

COVER SHEET

Designed By:	Drawn By:	Checked By:
ETA	CTB	SMS
Issue Date:	Project No:	Scale:
08/01/17	27872-3002	AS SHOWN

Drawing No.:
G-001

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GENERAL NOTES:

1. THE ENGINEER SHALL BE NOTIFIED IN WRITING OF ANY CONDITIONS THAT VARY FROM THOSE SHOWN ON THE PLANS. THE CONTRACTOR'S WORK SHALL NOT VARY FROM THE PLANS WITHOUT THE EXPRESSED APPROVAL OF THE ENGINEER.
2. THE CONTRACTOR SHALL COMPLY WITH ALL REQUIRED PERMITS.
3. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING AND INCURRING THE COST OF ALL REQUIRED PERMITS, INSPECTIONS, CERTIFICATES, ETC.
4. CONTRACTOR SHALL BE RESPONSIBLE FOR DEWATERING AND THE MAINTENANCE OF SURFACE DRAINAGE DURING THE COURSE OF WORK.
5. CONTRACTOR TO GRADE ALL AREAS ON THE SITE TO PROVIDE POSITIVE DRAINAGE.
6. UPON COMPLETION OF THE WORK, ALL DISTURBED AREAS SHALL BE RESTORED TO A CONDITION EQUAL TO OR BETTER THAN THAT WHICH EXISTED PRIOR TO CONSTRUCTION.
7. ALL WORK SHALL BE DONE IN STRICT COMPLIANCE WITH ALL APPLICABLE NATIONAL, STATE, AND LOCAL CODES, STANDARDS, ORDINANCES, RULES, AND REGULATIONS.
8. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING ALL FIELD LAYOUT. THE CONTRACTOR SHALL TAKE TIES TO ALL UTILITY CONNECTIONS AND PROVIDE MARKED-UP AS-BUILT PLANS FOR ALL UTILITIES SHOWING TIES TO CONNECTIONS, BENDS, VALVES, LENGTHS OF LINES, AND INVERTS. AS-BUILT PLANS SHOWING ALL UNDERGROUND UTILITIES INSTALLED OR ENCOUNTERED SHALL BE REVIEWED BY THE OWNER AND HIS REPRESENTATIVES. THE CONTRACTOR SHALL PROVIDE ANY CORRECTION OR ADMISSIONS TO THE SATISFACTION OF THE OWNER AND HIS REPRESENTATIVES BEFORE UTILITIES WILL BE ACCEPTED.
9. CONTRACTOR SHALL FIELD VERIFY ALL EXISTING SITE CONDITIONS PRIOR TO COMMENCING WORK AND SHALL IMMEDIATELY NOTIFY ENGINEER OF ANY DISCREPANCIES.
10. CONTRACTOR SHALL CONFINE ALL CONSTRUCTION ACTIVITIES ASSOCIATED WITH WORK SPECIFIED UNDER THIS CONTRACT TO THE AREA WITHIN LIMITS OF CONSTRUCTION.
11. CONTRACTOR SHALL BE RESPONSIBLE TO OBTAIN ANY CONSTRUCTION EASEMENTS AT HIS OWN EXPENSE.
12. CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR SITE SAFETY AND FOR COMPLIANCE WITH ALL FEDERAL, STATE AND LOCAL HEALTH AND SAFETY CODES, LAWS, REGULATIONS AND ORDINANCES INCLUDING, BUT NOT LIMITED TO THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA)
13. CONTRACTOR SHALL RESTORE ALL AREAS DISTURBED BY CONSTRUCTION; INCLUDING ACCESS AND SITE ROADWAYS, DITCHES, DRAINAGE STRUCTURES AND OTHER EXISTING FEATURES TO THEIR ORIGINAL CONDITION OR TO A CONDITION SATISFACTORY TO THE ENGINEER.
14. ALL REQUIRED TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES SHALL BE INSTALLED AND MAINTAINED BY THE CONTRACTOR IN ACCORDANCE WITH APPROVED SEDIMENT AND EROSION CONTROL PLAN.
15. CONTRACTOR SHALL OBTAIN ALL REQUIRED PERMITS AND PAY ALL FEES OF SUCH, PRIOR TO COMMENCING WORK.
16. CONTRACTOR SHALL BE RESPONSIBLE FOR THE STAKING AND LAYOUT OF ALL PROPOSED STRUCTURES AND IMPROVEMENTS.
17. MATERIAL SCHEDULES AND LISTS INCLUDED AS A PART OR WITH THESE CONSTRUCTION DRAWINGS ARE FURNISHED TO THE CONTRACTOR FOR REFERENCE PURPOSES ONLY. THESE SCHEDULES AND LISTS SHALL NOT BE CONSTRUED A BILL OF MATERIALS UPON WHICH TO BASE A BID. THE CONTRACTOR SHALL BE RESPONSIBLE TO REVIEW AND TAKE INTO CONSIDERATION ALL DETAILED DRAWINGS, SCHEMATICS AND TECHNICAL SPECIFICATIONS INCLUDED UNDER THIS CONTRACT IN THE PREPARATION OF HIS BID AND PERFORMANCE OF THE WORK.
18. CONTRACTOR SHALL CONFIRM ALL CONNECTIONS AND TIE-POINTS OF PROPOSED WORK WITH EXISTING FACILITIES INCLUDING ALL STRUCTURAL, MECHANICAL, ELECTRICAL, PIPING AND OTHER UTILITY SYSTEMS. PROVIDE SKETCH TO ENGINEER NOTING ANY IDENTIFIED DISCREPANCIES.
19. CONTRACTOR SHALL VERIFY ALL PIPING LAYOUTS, CONNECTIONS TO EXISTING FACILITIES, PROPOSED UTILITY LOCATIONS AND DIMENSIONS SHOWN ON THE DRAWINGS.
20. ALTHOUGH SUCH WORK MAY NOT BE SPECIFICALLY SHOWN, THE CONTRACTOR SHALL FURNISH AND INSTALL ANY SUPPLEMENTAL OR MISCELLANEOUS ITEMS, APPURTENANCES AND DEVICES INCIDENTAL TO OR NECESSARY FOR A SOUND AND COMPLETELY OPERATIONAL INSTALLATION.
21. DUE TO THE VARIATION IN EQUIPMENT APPROVED FOR BID UNDER THIS CONTRACT, NOT ALL CONDUIT, WIRING OR SMALL DIAMETER PIPING HAS NECESSARILY BEEN SHOWN ON THE DRAWINGS. HOWEVER THE CONTRACTOR SHALL BE RESPONSIBLE TO PROVIDE ALL REQUIRED PIPING, CONDUIT AND WIRING INCIDENTAL TO OR NECESSARY FOR A SOUND AND COMPLETELY OPERATIONAL INSTALLATION.
22. CONTRACTOR SHALL PROVIDE ANY SHORING REQUIRED TO PROTECT EXISTING FACILITIES DURING EXCAVATION FOR INSTALLATION OF PROPOSED STRUCTURES AND UTILITIES. CONTRACTOR SHALL BE RESPONSIBLE FOR SHORING DESIGN. DESIGN SHALL BE PERFORMED BY A REGISTERED PROFESSIONAL ENGINEER LICENSED TO PRACTICE IN THE COMMONWEALTH OF VIRGINIA. ALL ANTICIPATED COSTS FOR SHORING AND DESIGN SHALL BE INCLUDED IN THE CONTRACTOR'S BASE BID PRICE.
23. THE CONTRACTOR SHALL BE RESPONSIBLE TO PROVIDE ALL TEMPORARY PIPING, PUMPING OF FLOWS AND UTILITY SERVICE INCLUDING POWER, AS REQUIRED TO MAINTAIN PLANT OPERATIONS AS DESCRIBED IN THE SPECIFICATIONS.
24. ALL TEMPORARY PIPING AND UTILITIES SHALL BE INSTALLED IN TRENCHES AND BACKFILLED, UNLESS OTHERWISE APPROVED BY THE ENGINEER IN WRITING. CONTRACTOR SHALL PROTECT ALL TEMPORARY LINES FROM FREEZING, AND PROVIDE ALL REQUIRED THRUST RESTRAINTS.
25. ACCESS TO ALL EXISTING FACILITIES SHALL BE MAINTAINED BY THE CONTRACTOR THROUGHOUT CONSTRUCTION.
26. THE CONTRACTOR SHALL PROVIDE A DETAILED CONSTRUCTION PLAN AND SCHEDULE TO THE ENGINEER FOR APPROVAL PRIOR TO BEGINNING ANY CONSTRUCTION ACTIVITY.
27. ALL COATINGS AND MATERIALS WHICH MAY COME IN CONTACT WITH POTABLE WATER SHALL MEET NSF-61
28. ALL PIPE MATERIAL AND INSTALLATION SHALL BE IN ACCORDANCE WITH THE LATEST EDITION OF THE BRWA MASTER SPECIFICATIONS.
29. ALL UNDERGROUND UTILITIES SHALL BE INSTALLED WITH TRACER WIRE AND ELECTRONIC MARKERS (OMNI MARKERS), PER BRWA MASTER SPECIFICATIONS.

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BEDFORD
REGIONAL WATER
AUTHORITY

COMMONWEALTH OF VIRGINIA
ERIC T. ANDERSON
Lic. No. 040613
6/20/18
PROFESSIONAL ENGINEER

ROUTE 460 PUMP STATION
BEDFORD, VA.

No.	Submittal / Revision	App'd.	By	Date
	BID ISSUE	ETA	CTB	06/20/18

GENERAL NOTES & SHEET LIST

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Drawing No.:
G-002

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TABLE OF ABBREVIATIONS

AASHTO	AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTAION OFFICIALS	MISC	MISCELLANEOUS
		MON	MONUMENT
ABS	PLASTIC PIPE	N	NORTH
AC	ACRE	NAVAIDS	NAVIGATIONAL AIDS
ACCM	ASPHALT COATED CORRUGATED METAL	NIC	NOT IN CONTRACT
AFF	ABOVE FINISHED FLOOR	NOTAM	NOTICE TO AIRMEN
ALT	ALTERNATE	O/S	OFFSET
ASZ	AIRPORT SAFETY ZONE	OFA	OBJECT FREE AREA
APPROX	APPROXIMATE	OFZ	OBSTACLE FREE ZONE
ASPH	ASPHALT	OAR	OWNER'S AUTHORIZED REPRESENTATIVE
ATCT	AIR TRAFFIC CONTROL TOWER	PL	PROPERTY LINE
AWG	AMERICAN WIRE GAUGE	PC	POINT OF CURVATURE
BL	BASELINE	PE	PERMANENT EASEMENT
BB	BOTTOM OF BANK OR BERM	PERF	PERFORATED
BC	BOTTOM OF CURB	PERP	PERPENDICULAR
BFE	BASEMENT FLOOR ELEVATION	PP	POWER POLE, POWER PANEL
BLDG	BUILDING	PPM	PARTS PER MILLION
BM	BENCHMARK	PRC	POINT OF REVERSE CURVATURE
BOT	BOTTOM	PSF	POUNDS PER SQUARE FOOT
BRL	BUILDING RESTRICTION LINE	PSI	POUNDS PER SQUARE INCH
BSMT	BASEMENT	PT	POINT OR POINT OF TANGENCY
BVC	BEGINNING OF VERTICAL CURVE	PVC	POINT OF VERTICAL CURVATURE OR POLYVINYL CHLORIDE
BW	BOTTOM OF WALL		
C	CHORD	PVI	POINT OF VERTICAL INTERSECTION
CAP	CORRUGATED ALUMINIM PIPE	PVT	POINT OF VERTICAL TANGENCY
CB	CATCH BASIN	PWR	POWER
CF	CUBIC FOOT OR CUBIC FEET	R	RADIUS
CFM	CUBIC FEET PER MINUTE	RAD	RADIAL
CI	CURB INLET	RCCP	REINFORCED CONCRETE CULVERT PIPE
CIP	CAST IRON PIPE	RCP	REINFORCED CONCRETE PIPE
CL	CLASS OR CENTERLINE	RD	ROOF DRAIN
CMP	CORRUGATED METAL PIPE	REINF	REINFORCING
CO	CLEANOUT	REQD	REQUIRED
CONC	CONCRETE	ROW	RIGHT-OF-WAY
CR	COUNTRY ROAD	ROW W/A	RIGHT-OF-WAY WITH ACCESS
CSP	CORRUGATED STEEL PIPE	ROW WO/A	RIGHT-OF-WAY WITHOUT ACCESS
CTR	CENTER	RPM	REVOLUTIONS PER MINUTE
CULV	CULVERT	RR	RAILROAD
CV	CHECK VALVE	RSA	RUNWAY SAFETY AREA
CY	CUBIC YARD	RT	RIGHT
DI	DROP INLET	RW	RETAINING WALL
DIA	DIAMETER	RWY, R/W	RUNWAY
DIP	DUCTILE IRON PIPE	S	SOUTH
DWG	DRAWING	SCH	SCHEDULE
E	EAST	SF	SQUARE FOOT OR SQUARE FEET
EA	EACH	SH	STATE HIGHWAY
EJ	EXPANSION JOINT	SHT	SHEET
ELEC	ELECTRIC	SMH	SANITARY MANHOLE
ELEV	ELEVATION	SPECS	SPECIFICATIONS
EOP	EDGE OF PAVEMENT	SQ	SQUARE
FD	FLOOR DRAIN	STA	STATION OR STATIONARY
FDN	FOUNDATION	STMH	STORM MANHOLE
FFE	FINISHED FLOOR ELEVATION	STY	STORY
FT	FOOT OR FEET	SY	SQUARE YARD
GAL	GALLON	TAN	TANGENT
GPM	GALLONS PER MINUTE	TC	TOP OF CURB
GRD	GROUND OR GRADE	TE	TEMPORARY EASEMENT
GV	GATE VALVE	TEL	TELEPHONE
HDPE	HIGH DENSITY POLYETHELENE PIPE	TEMP	TEMPORARY
HORIZ	HORIZONTAL	TF	TOP OF FRAME
HP	HIGH POINT OR HORSE POWER	TRANS	TRANSFORMER OR TRANSVERSE
HPS	HIGH PRESSURE SODIUM	TSA	TAXIWAY SAFETY AREA
HR	HAND RAIL OR HOUR	TV	TELEVISION
HT	HEIGHT	TWY, T/W	TAXIWAY
HW	HEADWALL	TYP	TYPICAL
HYD	HYDRANT	UD, U/D	UNDERDRAIN
IN	INCH(ES)	U(ND)G	UNDERGROUND
IP(F)	IRON PIPE (FOUND)	UTIL	UTILITY
JB	JUNCTION BOX	VC	VERTICAL CURVE
LAT	LATITUDE	VCP	VITRIFIED CLAY PIPE
LB	POUND	VERT	VERTICAL
LF	LINEAR FOOT OR LINEAR FEET	VOL	VOLUME
LONG	LONGITUDE	W	WEST
LP	LAMP POST, LIGHT POLE, LIGHT PANEL OR LOW POINT	W/	WITH
		WF	WOOD FRAME
LT	LEFT	W/O	WITHOUT
MFR	MANUFACTURER	WW	WING WALL
MH	MANHOLE	WWF	WELDED WIRE FABIC OR WOVEN WIRE FABRIC
MIN	MINIMUM		

NOTE: SOME ABBREVIATIONS MAY NOT HAVE BEEN USED

LEGEND

DESCRIPTION	SYMBOL
FENCE	
5' OR 10' CONTOUR LINE	250
1' OR 2' CONTOUR LINE	202
SPOT ELEVATION	120.5 OR x 120.5
DITCH OR SWALE	
EDGE OF STREAM OR RIVER	
LAKE OR POND	
PROPERTY LINE	
SILT FENCE	
GRADING LIMITS	
EDGE OF PAVEMENT	
CURB	
EDGE OF GRAVEL/DIRT ROAD	
EDGE OF WOODS	
BUILDING	
STORM SEWER	
SANITARY SEWER	
FORCE MAIN	
WATER LINE	
GAS LINE	
UNDERGROUND ELECTRIC	
UNDERGROUND TELEPHONE	
OVERHEAD TELEPHONE	
OVERHEAD ELECTRIC	
UNDERDRAIN	
GUIDE RAIL	
CLEANOUT	CO
END SECTION	
CATCH BASIN	
STORM MANHOLE	
HYDRANT	
WATER VALVE/CONTROL VALVE	
SPRINKLER HEAD	
SANITARY SEWER MANHOLE	S
PULL BOX	
TELEPHONE PEDESTAL	
ELECTRIC BOX	PB
ELECTRIC MANHOLE	
LIGHT POLE, LAMP POST	
POWER POLE / UTILITY POLE	

LEGEND (CONTINUED)

DESCRIPTION	SYMBOL
SIGN - SINGLE FACED	OR
SIGN - DOUBLE FACED	OR
CONCRETE MONUMENT	
RIGHT-OF-WAY MONUMENT	
IRON ROD, PIN, OR PIPE	
BORING LOCATION	B-1
CBR LOCATION	CBR
TREES, SHRUBS, BUSHES	XX-3 XX-5
DETAIL CALLOUT	X DETAIL IDENTIFICATION NO. X—X SHEET NO. WHERE DETAIL IS SHOWN
DETAIL IDENTIFICATION NO.	X DETAIL TITLE

NOTE: SOME FEATURES IN THE LEGEND MAY NOT HAVE BEEN USED

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BEDFORD REGIONAL WATER AUTHORITY

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6/20/18
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LEGEND & ABBREVIATIONS

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SITE PLAN

Designed By:	Drawn By:	Checked By:
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Issue Date:	Project No:	Scale:
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Drawing No.:
C-101

EXIST. 16" WATERLINE
16" X 16" X 12 TEE
EXIST. 16" VALVE
NEW ACTUATED PS BYPASS VALVE V-130. SEE SHEET C-701 & NOTE 2 THIS SHEET.
16" X 16" X 12 TEE
EXIST 12" VALVE (TYP. OF 2)
EXIST EMERGENCY PUMP CONNECTION (TYP. OF 2)
EXIST. 12" X 12" X 8" TEE
REMOVE EXISTING MJ CAP & CONNECT TO EXISTING WL (TYP. OF 2)
EXIST. 8" VALVE (TYP. OF 3)
EXIST. 16" X 16" X 8" TEE
16" WATER DI
12" WATER DI
8" WATER DI
PROPOSED ROUTE 460 PUMP STATION
BOLLARD (TYP.) SEE DETAIL 4 C-701
CONC. SIDEWALK. SEE DETAIL 3 C-701
16' DOUBLE SWING GATE, SEE DETAIL FE-1
CHAIN LINK FENCE, SEE DETAIL FE-1
CENTER PIPE SECTION OVER SANITARY FORCE MAIN SO EACH PIPE JOINT IS EQUIDISTANT FROM THE CROSSING. SEE DETAIL HC-1
MIN. 10.0'
3' SWING GATE, SEE DETAIL FE-1
8" TAPPED CONNECTION. VERIFY DIAMETER AND MATERIAL PRIOR TO ORDERING TAPPING SLEEVE. SEE DETAIL 7 C-701
10' WIDE GRAVEL DRIVE INSTALLED TO MISS THE LARGE TREES ON THE EXISTING PROPERTY
EXISTING 30' X 30' GRAVEL PARKING AREA OVER GEO-FABRIC. 120 LF OF 6' TALL CHAIN LINK FENCE AND 12' WIDE DOUBLE LEAF GATE. DEMOLISH AND REMOVE EXISTING FENCING
950
5.0'
FF: 950.50'
948
CONC. SPLASH PAD, SLOPED AS SHOWN. CONSTRUCT PER SIDEWALK DETAIL
TO
TS
MU
PS
ALL DISTURBED AREAS
TRANSFORMER PAD (FINAL LOCATION TO BE DETERMINED BY SERVICE PROVIDER)
EXISTING 8" WATER LINE
ROUTE 460/ EAST MAIN STREET
TAX MAP# 237-3-10-T
EAST CREST DRIVE
14'-0" WIDE GRAVEL ACCESS ROAD. SEE DETAIL 5 C-701
PUBLIC UTILITY EASEMENT 25.0'
INGRESS/ EGRESS EASEMENT FOR BRWA UTILITY LOT ACCESS PER PB 59 PG 136 53.4'
TAX MAP# 236-3-18-T
TAX MAP# 237-3-16-T
962.2
964
2 POSTS WITH CHAIN AND BRWA PADLOCK INSTALLED AT END OF EXISTING PAVEMENT
CE
EAST CREST DR.
942
944
946
948
950
952
954
956

N

0 SCALE: 1"=10' 20'
Scale in feet

NOTES:

1. ALL PIPE MATERIAL AND INSTALLATION SHALL BE IN ACCORDANCE WITH THE LATEST EDITION OF BRWA MASTER SPECIFICATIONS
2. PROVIDE DOGHOUSE MANHOLE WITH WATERTIGHT FRAME AND COVER. INSTALL NEW NEMA 6 ACTUATOR ON EXISTING 16" BFLY VALVE. WIRE VALVE PER SHEET E-704.

PROPOSED SITE PLAN
SCALE: 1" = 10'

EROSION AND SEDIMENT CONTROL NARRATIVE:

PROJECT DESCRIPTION

THIS PROJECT INCLUDES THE CONSTRUCTION OF A NEW WATER PUMP STATION IN BEDFORD COUNTY VIRGINIA AND GRAVEL ACCESS ROAD. THE PUMP STATION WILL BE CMU BLOCK CONSTRUCTION WITH METAL STANDING SEAM ROOF.

EXISTING SITE CONDITIONS:

WOODED AREA WITH TERRAIN SLOPING AT 6% TO 15%.

ADJACENT PROPERTY:

ADJACENT TO US ROUTE 460 BYPASS. ADJACENT TO RESIDENTIAL NEIGHBOR HOOD WITH ACCESS VIA EAST CREST DRIVE.

OFF-SITE AREAS:

ALL CUT MATERIAL WILL BE DISPOSED OF BY THE CONTRACTOR AT HIS EXPENSE AND AT NO ADDITIONAL COST TO THE OWNER AND BE REMOVED TO AN ACCEPTABLE DISPOSAL SITE. IF THE NEED FOR OFF-SITE LAND DISTURBING ACTIVITIES ARISES DURING CONSTRUCTION THE CONTRACTOR SHALL SUBMIT A SUPPLEMENTAL E&S PLAN COVERING THIS ACTIVITY FOR APPROVAL BY THE PLAN APPROVING AUTHORITY.

SOILS:

THE FOLLOWING SOILS INFORMATION IS ACCORDING TO THE SCS SOILS INFORMATION FROM THE NRCS WEB SOIL SURVEY:

56D3 - FAIRVIEW SANDY CLAY LOAM, 15-20% SLOPES, SEVERLY ERODED

CRITICAL EROSION AREAS:

CRITICAL AREAS INCLUDE CULVERTS AND AREAS DOWNHILL FROM THE PROPOSED DISTURBANCE. THE PROPOSED EROSION AND SEDIMENT CONTROL MEASURES ARE INTENDED TO MINIMIZE ANY POTENTIAL PROBLEMS AND PROMOTE STABILIZATION.

EROSION AND SEDIMENT CONTROL MEASURES - GENERAL: ALL STRUCTURAL AND VEGETATIVE EROSION AND SEDIMENT CONTROL PRACTICES WILL BE CONSTRUCTED AND MAINTAINED IN ACCORDANCE WITH THE MINIMUM STANDARDS AND SPECIFICATIONS OF THE "VIRGINIA EROSION AND SEDIMENT CONTROL HANDBOOK" (VESCH), LATEST EDITION.

MINIMUM STANDARDS: ALL APPLICABLE MINIMUM STANDARDS SHOULD BE ADDRESSED:

1. PERMANENT OR TEMPORARY SOIL STABILIZATION SHALL BE APPLIED TO DENUDE AREAS WITHIN SEVEN (7) DAYS AFTER FINAL GRADE IS REACHED ON ANY PORTION OF THE SITE. TEMPORARY SOIL STABILIZATION SHALL BE APPLIED WITHIN SEVEN (7) DAYS TO DENUDED AREAS THAT MAY NOT BE AT FINAL GRADE BUT WILL REMAIN DORMANT (UNDISTURBED) FOR LONGER THAN FOURTEEN (14) DAYS. PERMANENT STABILIZATION SHALL BE APPLIED TO AREAS THAT ARE TO BE LEFT DORMANT FOR MORE THAN ONE YEAR.
2. PERIMETER DIKES AND DITCHES, SEDIMENT BARRIERS, AND OTHER MEASURES INTENDED TO TRAP SEDIMENT SHALL BE CONSTRUCTED AS A FIRST STEP IN ANY LAND DISTURBING ACTIVITY AND SHALL BE MADE FUNCTIONAL BEFORE LAND DISTURBANCE TAKES PLACE.
3. STABILIZATION MEASURES SHALL BE APPLIED TO EARTHEN STRUCTURES SUCH AS DAMS, DITCHES, AND DIVERSIONS IMMEDIATELY AFTER INSTALLATION.
4. WHERE CONSTRUCTION VEHICLE ACCESS ROUTES INTERSECT PAVED PUBLIC ROADS, PROVISIONS SHALL BE MADE TO MINIMIZE THE TRANSPORT OF SEDIMENT BY (VEHICULAR) TRACKING ONTO THE PAVED SURFACE. WHERE SEDIMENT IS TRANSPORTED ONTO A PUBLIC ROAD SURFACE, THE ROAD SHALL BE CLEANED THOROUGHLY AT THE END OF EACH DAY. SEDIMENT SHALL BE REMOVED FROM THE ROADS BY SHOVELING OR SWEEPING AND TRANSPORTED TO A SEDIMENT CONTROL DISPOSAL AREA. STREET WASHING SHALL BE ALLOWED ONLY AFTER SEDIMENT IS REMOVED IN THIS MANNER.
5. ALL TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES SHALL BE REMOVED WITHIN THIRTY (30) DAYS AFTER FINAL SITE STABILIZATION OR AFTER THE TEMPORARY MEASURES ARE NO LONGER NEEDED, UNLESS OTHERWISE AUTHORIZED BY THE LOCAL PROGRAM ADMINISTRATOR. TRAPPED SEDIMENT AND THE DISTURBED SOIL AREAS RESULTING FROM THE DISPOSITION OF TEMPORARY MEASURES SHALL BE PERMANENTLY STABILIZED TO PREVENT FURTHER EROSION AND SEDIMENTATION.

STRUCTURAL PRACTICES

SILT FENCE - 3.05: SILT FENCE SEDIMENT BARRIERS SHALL BE INSTALLED DOWNSLOPE OF AREAS WITH MINIMAL GRADES TO FILTER SEDIMENT-LADEN RUNOFF FROM SHEET FLOW AS INDICATED.

CULVERT INLET PROTECTION - 3.08: CULVERT INLET PROTECTION SHALL BE INSTALLED TO PREVENT SEDIMENT FROM BEING TRANSFERRED BY A CULVERT PRIOR TO PERMANENT STABILIZATION OF THE DISTURBED PROJECT AREA.

OUTLET PROTECTION - 3.18: OUTLET PROTECTIONS SHALL BE INSTALLED TO PREVENT SCOUR AT STORMWATER OUTLETS, TO PROTECT OUTLET STRUCTURE, AND TO MINIMIZE THE POTENTIAL FOR DOWNSTREAM EROSION BY REDUCING THE VELOCITY AND ENERGY OF CONCENTRATED STORMWATER FLOWS.

VEGETATIVE PRACTICES

GENERAL: A PERMANENT VEGETATIVE COVER SHALL BE ESTABLISHED ON DENUDED AREAS NOT OTHERWISE PERMANENTLY STABILIZED BY PAVEMENT. PERMANENT VEGETATION SHALL NOT BE CONSIDERED ESTABLISHED UNTIL A GROUND COVER IS ACHIEVED THAT IS UNIFORM AND MATURE ENOUGH TO SURVIVE AND INHIBIT EROSION. NEW VEGETATION SHALL BE MAINTAINED AT A MINIMUM OF ONE FULL YEAR AFTER PLANTING. NEW SEEDING SHALL BE SUPPLIED WITH ADEQUATE MOISTURE, ESPECIALLY LATE IN THE SEASON, AND IN ABNORMALLY HOT OR DRY WEATHER. STABILIZATION PRACTICES SHALL BE ACCOMPLISHED IN ACCORDANCE WITH THE APPROPRIATE VESCH STANDARD AND SPECIFICATION AND THE EROSION AND SEDIMENT CONTROL PLAN.

PERMANENT OR TEMPORARY SOIL STABILIZATION SHALL BE APPLIED TO DENUDED AREAS WITHIN SEVEN (7) DAYS AFTER FINAL GRADE IS REACHED ON ANY PORTION OF THE SITE. TEMPORARY SOIL STABILIZATION SHALL BE APPLIED WITHIN SEVEN (7) DAYS TO DENUDED AREAS THAT MAY NOT BE AT FINAL GRADE BUT WILL REMAIN DORMANT (UNDISTURBED) FOR LONGER THAN 30 DAYS. PERMANENT SEEDING SHALL BE USED ON ALL AREAS THAT ARE NOT AT FINAL GRADE AND THAT WILL BE LEFT DORMANT FOR A PERIOD OF MORE THAN 1 YEAR.

1. TEMPORARY SEEDING

   TEMPORARY SEEDING SHALL BE APPLIED OVER CLEARED AREAS THAT WILL NOT BE BROUGHT TO FINAL GRADE WITHIN 14 DAYS. TEMPORARY SEEING MIXES SHALL BE AS DESCRIBED ON THE DETAIL SHEETS OF THE EROSION AND SEDIMENT CONTROL PLAN.

2. PERMANENT SEEDING

   PERMANENT SEEDING IS PROPOSED OVER ALL CLEARED AREAS. PERMANENT SEEDING MIXES SHALL BE AS DESCRIBED ON THE THE EROSION AND SEDIMENT CONTROL PLAN OR AS SHOWN ON THIS SHEET.

PERMANENT STABILIZATION

ALL NON-PAVED AREAS DISTURBED BY CONSTRUCTION SHALL BE STABILIZED WITH PERMANENT SEEDING IMMEDIATELY FOLLOWING FINISH GRADING. SEEDING SHALL BE IN ACCORDANCE WITH STD. & SPEC. 3.32, PERMANENT SEEDING. SEED TYPE SHALL BE AS SPECIFIED FOR "MINIMUM CARE LAWNS" AND "GENERAL SLOPES" IN THE HANDBOOK. MULCH (STRAW OR FIBER) SHALL BE USED ON ALL SEEDED SURFACES. IN ALL SEEDING OPERATIONS SEED, FERTILIZER AND LIME SHALL BE APPLIED PRIOR TO MULCHING.

MANAGEMENT STRATEGIES

1. CONSTRUCTION SHALL BE SEQUENCED SO THAT GRADING OPERATIONS CAN BEGIN AND END AS QUICKLY AS POSSIBLE.

2. ISOLATE TRENCHING FOR UTILITIES AND DRAINAGE FROM DOWNSTREAM CONVEYANCES IN ORDER TO MINIMIZE PERIMETER CONTROLS.

3. ALL CUT AND FILL SLOPES SHALL BE SEEDED WITHIN SEVEN (7) DAYS OF ACHIEVING FINAL GRADE.

4. ALL EROSION AND SEDIMENT CONTROL PRACTICES SHALL BE MAINTAINED UNTIL THEY ARE NO LONGER REQUIRED TO COMPLY WITH THE CONTRACT DOCUMENTS OR STATE LAW. ONLY AFTER INSPECTION AND APPROVAL FROM THE VESCP AUTHORITY MAY ITEMS BE REMOVED FOLLOWING THE STABILIZATION OF CONTRIBUTING AREAS.

INSPECTIONS

THE GENERAL CONTRACTOR SHALL INSPECT DISTURBED AREAS OF THE SITE THAT HAVE NOT BEEN FINALLY STABILIZED, AND AREAS USED FOR STORAGE OF MATERIALS THAT ARE EXPOSED TO PRECIPITATION, STRUCTURAL CONTROL MEASURES, AND THE AREA OF CONSTRUCTION VEHICLE ACCESS AT LEAST EVERY FOURTEEN (14) CALENDAR DAYS, AND WITHIN FORTY-EIGHT (48) HOURS OF THE END OF A STORM EVENT PRODUCING 1/2" OR GREATER OF PRECIPITATION. WHERE AREAS HAVE BEEN FINALLY OR TEMPORARILY STABILIZED OR RUNOFF IS UNLIKELY DUE TO WINTER CONDITIONS (SITE IS COVERED WITH SNOW, ICE, OR FROZEN GROUND EXISTS) SUCH INSPECTIONS SHALL BE CONDUCTED AT LEAST ONCE EVERY MONTH.

INSPECT DISTURBED AREAS AND AREAS OF MATERIALS STORAGE THAT ARE EXPOSED TO PRECIPITATION FOR EVIDENCE OF, OR THE POTENTIAL FOR SEDIMENT ENTERING THE STORM DRAIN SYSTEM. INSPECT E&S CONTROLS IN ACCORDANCE WITH REQUIREMENTS STATED HEREIN, AND INSPECT POINTS OF STORM DRAIN DISCHARGE FOR EXCESSIVE SEDIMENTATION. CORRECT SITE CONTROLS AS REQUIRED TO REDUCE SEDIMENTATION OF STORM DRAINS, CULVERTS, AND RECEIVING CHANNELS.

IF CONTROLS OR SEDIMENT PREVENTION AREAS ARE FOUND TO BE IN NEED OF REPAIR OR MODIFICATION, THE GENERAL CONTRACTOR SHALL PROVIDE ADDITIONAL MEASURES OR MODIFICATIONS TO EXISTING MEASURES AS REQUIRED. ANY ADDITIONAL MEASURES OR MODIFICATIONS TO EXISTING MEASURES SHALL BE RECORDED AS FIELD REVISIONS TO THESE PLANS. IN THE EVENT THAT ADDITIONAL CONTROLS ARE FOUND TO BE REQUIRED, THE GENERAL CONTRACTOR SHALL BE RESPONSIBLE FOR IMPLEMENTING THESE CONTROLS BEFORE THE NEXT ANTICIPATED STORM EVENT. IF IMPLEMENTATION BEFORE THE NEXT STORM EVENT IS IMPRACTICAL, THEY SHALL BE IMPLEMENTED AS SOON AS PRACTICAL.

A REPORT SUMMARIZING THE SCOPE OF INSPECTIONS, NAME OF INSPECTOR, INSPECTOR'S QUALIFICATIONS, DATES OF INSPECTIONS, MAJOR OBSERVATIONS PERTAINING TO THE IMPLEMENTATION OF THESE EROSION CONTROL PLANS, AND ACTIONS TAKEN SHALL BE MADE AND RETAINED AS A PART OF THESE PLANS. MAJOR OBSERVATIONS OF THESE REPORTS SHALL INCLUDE: THE LOCATIONS OF EXCESSIVE SEDIMENTATION FROM THE SITE; LOCATIONS OF CONTROLS IN NEED OF REPAIR; LOCATIONS OF FAILED OR INADEQUATE CONTROLS; AND LOCATIONS WHERE ADDITIONAL CONTROLS ARE NEEDED.

GENERAL EROSION AND SEDIMENT CONTROL NOTES:

ES-1: UNLESS OTHERWISE INDICATED, CONSTRUCT AND MAINTAIN ALL VEGETATIVE AND STRUCTURAL EROSION AND SEDIMENT CONTROL PRACTICES ACCORDING TO MINIMUM STANDARDS AND SPECIFICATIONS OF THE VIRGINIA EROSION AND SEDIMENT CONTROL HANDBOOK, AND VIRGINIA REGULATIONS VR 625-02-00 EROSION AND SEDIMENT CONTROL REGULATIONS.

ES-2: VESCP AUTHORITY INSPECTORS WILL MAKE A CONTINUING REVIEW AND EVALUATION OF THE METHODS AND EFFECTIVENESS OF THE E.S.C. PLAN.

ES-3: PLACE ALL EROSION AND SEDIMENT CONTROL MEASURES PRIOR TO OR AS THE FIRST STEP IN CLEARING, GRADING, OR LAND DISTURBANCE.

ES-4: MAINTAIN A COPY OF THE APPROVED EROSION AND SEDIMENT CONTROL PLAN ON THE SITE AT ALL TIMES.

ES-5: PRIOR TO COMMENCING LAND-DISTURBING ACTIVITIES IN AREAS OTHER THAN INDICATED ON THESE PLANS (INCLUDING, BUT NOT LIMITED TO, OFFSITE BORROW OR WASTE AREA), SUBMIT A SUPPLEMENTARY EROSION CONTROL PLAN TO THE ARCHITECT/ENGINEER FOR REVIEW AND ACCEPTANCE.

ES-6: PROVIDE ADDITIONAL EROSION CONTROL MEASURES NECESSARY TO PREVENT EROSION AND SEDIMENTATION AS DETERMINED BY THE LOCAL AUTHORITY HAVING JURISDICTION.

ES-7: ALL DISTURBED AREAS SHALL DRAIN TO APPROVED SEDIMENT CONTROL MEASURES AT ALL TIMES DURING LAND-DISTURBING ACTIVITIES AND DURING SITE DEVELOPMENT.

ES-8: DURING DEWATERING OPERATIONS, PUMP WATER INTO AN APPROVED FILTERING DEVICE.

ES-9: INSPECT ALL EROSION CONTROL MEASURES DAILY AND AFTER EACH RUNOFF-PRODUCING RAINFALL EVENT. MAKE ANY NECESSARY REPAIRS OR CLEANUP TO MAINTAIN THE EFFECTIVENESS OF THE EROSION CONTROL DEVICES IMMEDIATELY.

ES-10: THE CONTRACTOR SHALL HAVE A RESPONSIBLE LAND DISTURBER ON-SITE AS REQUIRED.

MINIMUM STANDARDS

The following standards are to be provided or addressed on every development project exceeding 10,000 S.F. in area of disturbance. These standards are considered a minimum and may require additional measures as deemed necessary by the local approving authority or the consulting engineer.

No.	CRITERIA, TECHNIQUE OR METHOD	PRACTICES PROVIDED
1	Permanent or temporary soil stabilization shall be applied to denuded areas within seven (7) days after final grade has been reached on any portion of the site. Temporary soil stabilization shall be applied within seven (7) days to denuded areas that may be at final grade but will remain dormant (undisturbed) for longer than fourteen (14) days. Permanent stabilization shall be applied to areas that are to be left dormant for more than one (1) year.	(TS) (PS) (MU) FOR ALL DENUDED AREAS
2	During construction of the project, soil stockpiles shall be stabilized or protected with sediment trapping measures. The contractor is responsible for the temporary protection and permanent stabilization of all soil stockpiles on site as well as soil intentionally transported from the project site.	(TS) (PS) (MU) FOR PROVIDED STOCKPILE
3	A permanent vegetative cover shall be established on denuded areas not otherwise permanently stabilized. Permanent vegetation shall not be considered established until a ground cover is achieved that, in the opinion of the Town, is uniform, mature enough to survive and will inhibit erosion.	(TS) (PS) (MU) FOR ALL DENUDED AREAS
4	Sediment basins and traps, perimeter dikes, sediment barriers and other measures intended to trap sediment shall be constructed as a first step in any land-disturbing activity and shall be made functional before upslope land disturbance takes place.	(ST) FOR ALL DRAINAGE DIVIDES
5	Stabilization methods shall be applied to earthen structures such as dams, dikes and diversions immediately after installation.	(TS) (PS) (MU) FOR ALL EARTHEN STRUCTURES
6	Sediment traps and basins shall be designed and constructed based upon the total drainage area to be served by the trap or basin.	SEE SUPPLEMENTAL CALCULATIONS
7	Cut and fill slopes shall be constructed in a manner that will minimize erosion. Slopes that are found to be eroding excessively within one (1) year of permanent stabilization shall be provided with additional slope stabilization measures until the problem is corrected.	(TS) (PS) (MU) FOR ALL ERODING SLOPES
8	Concentrated runoff shall not flow down cut or fill slopes unless contained within an adequate temporary or permanent channel, flume or slope drain structure.	(SCC)
9	Whenever water seeps from a slope face, adequate drainage or other protection shall be provided.	SHOULD SEEPS OCCUR IN ANY EXISTING OR NEW CUT OR FILL SLOPE, THE CONTRACTOR SHALL FIRST INSURE THAT THERE ARE NOT AREAS OF PONDED WATER AT THE TOPS OF THE SLOPES, AND THEN SHALL CONTACT BOTH THE DESIGN ENGINEER AND THE PROJECT GEOTECHNICAL ENGINEER FOR ON-SITE EVALUATION OF THE AREAS OF SEEPAGE
10	All storm sewer inlets that are made operable during construction shall be protected so that sediment-laden water cannot enter the conveyance system without first being filtered or otherwise treated to remove sediment.	(IP) (CIP) FOR ALL STORM WATER INTAKES
11	Before newly constructed stormwater conveyance channels are made operational, adequate outlet protection and any required temporary or permanent channel lining shall be installed in both the conveyance channel and receiving channel.	(RR) (OP) FOR ALL STORMWATER OUTLETS
12	When work in a live watercourse is performed, precautions shall be taken to minimize encroachment, control sediment transport and stabilize the work area to the greatest extent possible during construction. Nonerodible material shall be used for the construction of causeways and cofferdams. Earthen fill may be used for these structures if armored by nonerodible cover materials.	(SF) FOR THE PROTECTION OF THE NATURAL WATERCOURSE
13	When a live watercourse must be crossed by construction vehicles more than twice in any six (6) month period, a temporary stream crossing constructed of nonerodible material.	PERMANENT CROSSING
14	All applicable federal, state and local regulations pertaining to working in or crossing live watercourses shall be met. The beds and banks of any watercourse shall be stabilized immediately after work in the watercourse is completed.	(TS) (PS) (MU)
15	The beds and banks of a watercourse shall be stabilized immediately after work in the watercourse is completed.	(TS) (PS) (MU)
16	Underground utility lines shall be installed in accordance with the following standards in addition to other applicable criteria: 1) No more than 500 linear feet of any trench may be opened at one time. 2) Excavated material shall be placed on the uphill side of trenches. 3) Effluent from dewatering operations shall be filtered or passed through an approved sediment trapping device, or both, and discharged in a manner that does not adversely affect flowing streams or off-site property. 4) Material used for backfilling trenches shall be properly compacted in order to minimize erosion and promote stabilization. 5) Restabilization shall be accomplished in accordance with these regulations. 6) Applicable safety regulations shall be complied with.	NOT APPLICABLE
17	Where construction vehicle access routes intersect paved or public roads, provisions shall be made to minimize the transport of sediment by vehicular tracking onto the paved surface. Where sediment is transported onto a paved or public road surface, the road surface shall be cleaned thoroughly at the end of each day. Sediment shall be removed from the roads by shoveling or sweeping and transported to a sediment control disposal area. Street washing shall be allowed only after sediment is removed in this manner.	(CE) FOR ALL POINTS OF INGRESS/EGRESS
18	All temporary erosion and sediment control measures shall be removed within thirty (30) days after final site stabilization or after the temporary measures are no longer needed, unless otherwise authorized by the VESCP Authority. Trapped sediment and the disturbed soil areas resulting from the disposition of temporary measures shall be permanently stabilized to prevent further erosion and sedimentation.	(TS) (PS) (MU)
19	Properties and waterways downstream from development sites shall be protected from sediment deposition, erosion and damage due to increases in volume, velocity and peak flow rate of stormwater runoff for the stated frequency storm of 24-hour duration in accordance with the applicable criteria.	SELF-EXPLANATORY SEE PLANS & CALC'S

EROSION & SEDIMENT CONTROL LEGEND

SYMBOL	VA. E&S HANDBOOK STANDARD	
CE	STONE CONSTRUCTION ENTRANCE – 3.02	
SF	SILT FENCE – 3.05	
IP	INLET PROTECTION – 3.07	
TO	TOPSOILING – 3.30	ALL DISTURBED GRASSED AREAS
TS	TEMPORARY SEEDING – 3.31	
PS	PERMANENT SEEDING –3.32	
MU	MULCHING – 3.35	

(TS) TEMPORARY SEEDING SCHEDULE

ACCEPTABLE TEMPORARY SEEDING PLANT MATERIALS

PLANTING DATES	SPECIES	RATE (LBS/ACRE)
SEPT 1–FEB 15	50/50 MIX OF ANNUAL RYEGRASS (LOLIUM MULTI–FLORUM) & CEREAL (WINTER) RYE (SECALE CEREALE)	50–100
FEB 16–APR 20	ANNUAL RYEGRASS (LOLIUM MULTI–FLORUM)	60–100
MAY 1–AUG 31	GERMAN MILLET (SETARIA ITALICA)	50

SEEDINGS MADE IN FALL FOR WINTER COVER AND DURING HOT AND DRY SUMMER MONTHS SHALL BE MULCHED IMMEDIATELY UPON COMPLETION OF SEED APPLICATION WITH TACKIFIED STRAW, IN ACCORDANCE WITH VA E&S STD 3.35.

(PS) PERMANENT SEEDING SCHEDULE

GENERAL SLOPE (3:1 OR LESS)	TOTAL LBS PER ACRE
KENTUCKY 31 FESCUE	200 LBS.
KENTUCKY BLUEGRASS	10 LBS.
RED TOP GRASS	10 LBS.
SEASONAL NURSE CROP	30 LBS.
WHITE CLOVER	2 LBS.
	252 LBS.

SEASONAL NURSE CROP

MARCH, APRIL THROUGH MAY 15	ANNUAL RYE
MAY 16 THROUGH AUGUST 15	FOXTAIL MILLET
AUGUST 16 THROUGH SEPTEMBER,OCTOBER	ANNUAL RYE
NOVEMBER THROUGH FEBRUARY	WINTER RYE

LIME AND FERTILIZER NEEDS SHALL BE DETERMINED BY SOIL TESTS.

SEEDINGS TO BE MULCHED AT THE RATE OF 2 TONS PER ACRE WITH TACKIFIED STRAW, IMMEDIATELY UPON COMPLETION OF SEED APPLICATION, IN ACCORDANCE WITH VA E&S STD 3.35.

SEEDING SCHEDULES

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BEDFORD REGIONAL WATER AUTHORITY

COMMONWEALTH OF VIRGINIA
ERIC T. ANDERSON
Lic. No. 040613
6/20/18
PROFESSIONAL ENGINEER

ROUTE 460 PUMP STATION
BEDFORD, VA.

No.	Submittal / Revision	App'd.	By	Date
	BID ISSUE	ETA	CTB	06/20/18

EROSION CONTROL NARRATIVE

Designed By:	Drawn By:	Checked By:
ETA	CTB	SMS
Issue Date:	Project No:	Scale:
08/01/17	27872-3002	AS SHOWN

Drawing No.:
C-201

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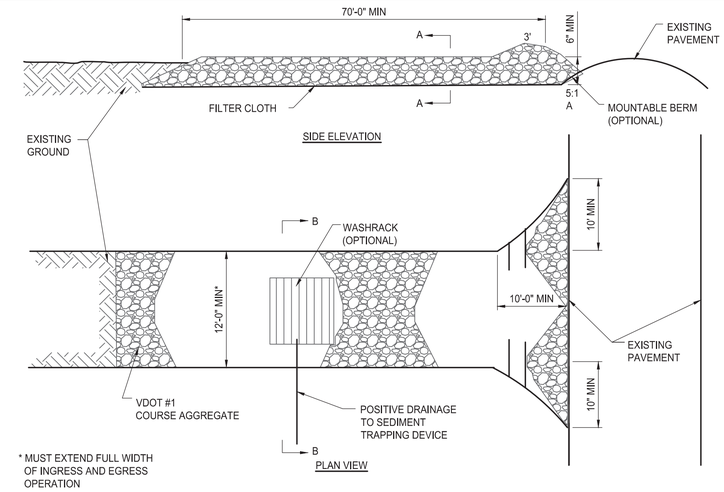
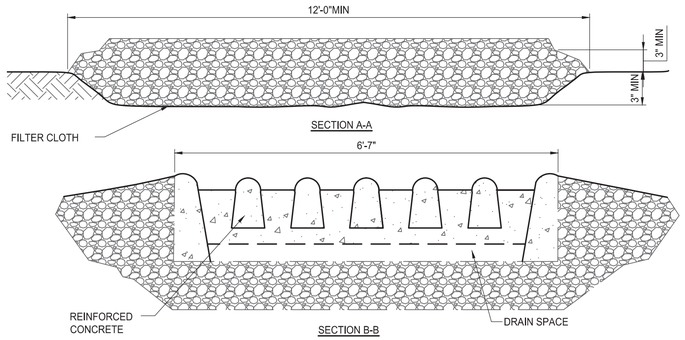
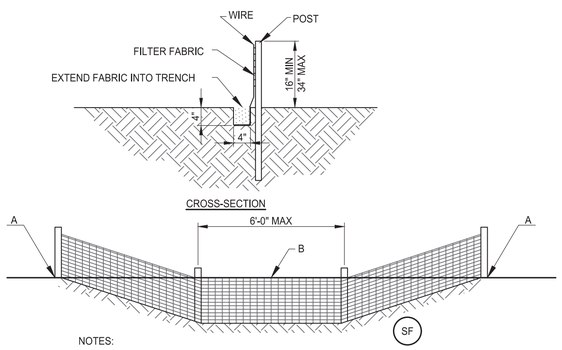




1 STONE CONSTRUCTION ENTRANCE
NOT TO SCALE



NOTES:

1. WHEN POINT B DROPS BELOW POINT A, USE EXTRA STRENGTH FILTER FABRIC WITH A MAXIMUM 3 FOOT SPACING OF POST.

2 SILT FENCE DETAIL
NOT TO SCALE

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BEDFORD, VA.

No.	Submittal / Revision	App'd.	By	Date
	BID ISSUE	ETA	CTB	06/20/18

EROSION CONTROL DETAILS

Designed By:	Drawn By:	Checked By:
ETA	CTB	SMS
Issue Date:	Project No:	Scale:
08/01/17	27872-3002	AS SHOWN

Drawing No.:
C-202

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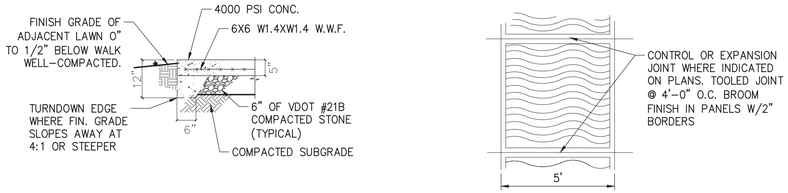
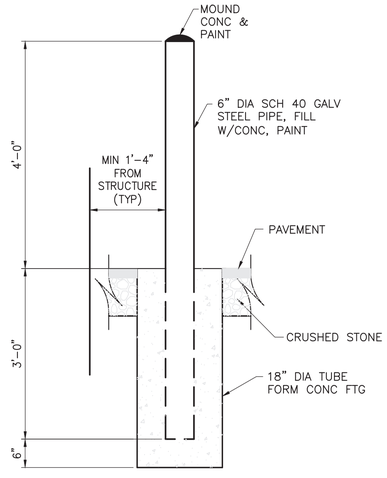
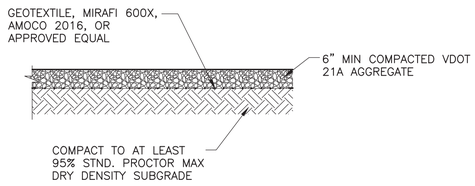


3 TYPICAL SIDEWALK DETAIL
SCALE: 1/2" = 1'-0"

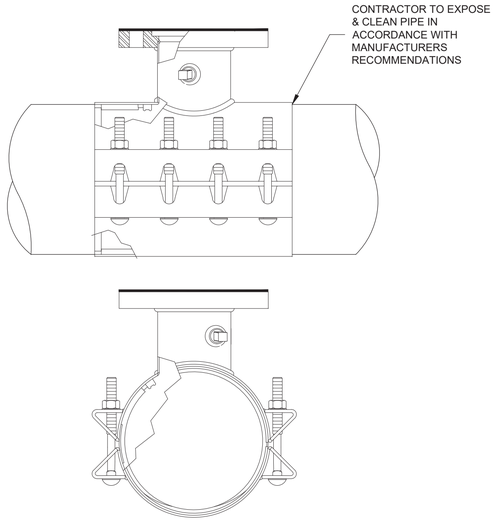


4 TYPICAL BOLLARD DETAIL
SCALE: 3/4" = 1'-0"

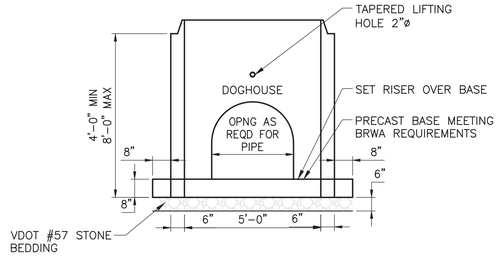


5 TYPICAL GRAVEL PAVING DETAIL
NOT TO SCALE

1. TAPPING SLEEVE SHALL BE POWERSEAL MODEL 3490 TYPE 304 STAINLESS STEEL WITH CARBON STEEL FLANGE, ROMAC'S MODEL SST III, FORD MODEL FTSS WITH CARBON STEEL FLANGE OR APPROVED EQUIVALENT. SLEEVE SHALL BE RATED AT 250 PSI WORKING PRESSURE AND MUST HAVE A TEST PLUG.
2. TAPPING VALVE SHALL BE AVK RESILIENT SEATED GATE VALVE SERIES 25 MJFL MUELLER T-2360 RESILIENT WEDGE TAPPING VALVE WITH MJFL, OR AFC SERIES 2500 RESILIENT WEDGE TAPPING VALVE WITH MJFL. VALVE SHALL BE RATED AT 250 PSI.
3. TAPPING SLEEVE AND VALVE SHALL BE FULL PORT TO ACCEPT FULL SIZE SHELL CUTTER.
4. STEEL FLANGE SHALL MEET AWWA C207.
5. LEAVE TAPPING VALVE IN PLACE.



7 TAPPED CONNECTION
SCALE: N.T.S.



1. FOLLOW ALL BRWA STANDARD MANHOLE DETAILS FOR ALL SECTIONS EXCEPT THE BASE. FOLLOW ALL BRWAS REQUIREMENTS FOR MATERIALS AND INSTALLATION.
2. SEAL CONNECTION BETWEEN BASE & RISER AS NORMAL JOINT CONNECTION.
3. WRAP PIPE WITH A-LOK WATER STOP AND FIELD POUR 4000 PSI GROUT COLLAR AROUND PIPE.

8 DOGHOUSE MANHOLE BASE DETAIL
SCALE: N.T.S.

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ROUTE 460 PUMP STATION
BEDFORD, VA.

No.	Submittal / Revision	App'd.	By	Date
	BID ISSUE	ETA	CTB	06/20/18

CIVIL DETAILS

Designed By:	Drawn By:	Checked By:
ETA	CTB	SMS
Issue Date:	Project No:	Scale:
08/01/17	27872-3002	AS SHOWN

Drawing No.:
C-701

GENERAL NOTES:

1. REFER TO THE PROJECT MANUAL FOR GOVERNING JOB REQUIREMENTS AND MATERIAL SPECIFICATIONS. THE FOLLOWING NOTES ARE SUPPLEMENTAL TO THE ABOVE REQUIREMENTS.
2. DO NOT CHANGE THE SIZE OR SPACING OF STRUCTURAL ELEMENTS WITHOUT THE APPROVAL OF THE ENGINEER.
3. DETAILS SHOWN ARE TYPICAL AND APPLY TO SIMILAR CONDITIONS UNLESS NOTED OTHERWISE.
4. THESE DRAWINGS DO NOT INCLUDE NECESSARY COMPONENTS FOR CONSTRUCTION SAFETY.
5. BRACE AS REQUIRED FOR CONSTRUCTION AND WIND LOADS UNTIL ALL STRUCTURAL ELEMENTS NEEDED FOR STABILITY ARE INSTALLED.
6. THE DESIGN IS BASED ON THE 2012 VIRGINIA UNIFORM STATEWIDE BUILDING CODE.
7. CONTRACTOR SHALL DETERMINE EXACT LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK. HE/SHE AGREES TO BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE OCCASIONED BY HIS/HER FAILURE TO LOCATE AND PRESERVE ALL UNDERGROUND UTILITIES.
8. INCORRECTLY FABRICATED, DAMAGED, OR OTHERWISE MISFITTING OR NONCONFORMING MATERIALS OR CONDITIONS SHALL BE REPORTED TO THE OWNER'S REPRESENTATIVE PRIOR TO REMEDIAL OR CORRECTIVE ACTION. ANY SUCH ACTION SHALL REQUIRE PRE-APPROVAL BY THE ENGINEER.
9. EACH CONTRACTOR SHALL COOPERATE WITH THE OWNER'S REPRESENTATIVE AND COORDINATE HIS/HER WORK WITH THE WORK OF OTHERS.
10. VERIFY SIZE AND LOCATION OF OPENINGS PRIOR TO BEGINNING WORK. FOR DIMENSIONS NOT SHOWN, SEE MECHANICAL, ELECTRICAL, CIVIL AND ARCHITECTURAL DRAWINGS.
11. VERIFY SIZE AND LOCATION OF EQUIPMENT PADS WITH MECHANICAL AND/OR ELECTRICAL CONTRACTOR AND EQUIPMENT MANUFACTURER.

FOUNDATION AND SOIL PREPARATION NOTES:

1. THE FOUNDATION DESIGN IS BASED ON AN ALLOWABLE SOIL BEARING PRESSURE OF 2,500 POUNDS PER SQUARE FOOT. BEARING STRATUM CAPACITY FOR FOOTINGS SHALL BE VERIFIED IN FIELD BY THE GEOTECHNICAL ENGINEER BEFORE PLACING CONCRETE FOOTINGS.
2. THE CONTRACTOR SHALL REVIEW THE REPORT AND BORING LOGS DURING THE BIDDING PHASE OF THE PROJECT.
3. BOTTOM OF ALL FOOTINGS SHALL BE A MINIMUM OF 2'-0" BELOW FINAL FINISHED GRADE. ADJUST FOOTING ELEVATIONS AS REQUIRED TO MAINTAIN MINIMUM FROST COVER.
4. PROVIDE POSITIVE DRAINAGE FOR ALL TRENCHES DURING CONSTRUCTION. DO NOT ALLOW ANY PONDING OF WATER DURING CONSTRUCTION.
5. DO NOT PLACE FOOTINGS IN WATER OR ON FROZEN GROUND. DO NOT ALLOW GROUND BENEATH FOOTINGS TO FREEZE.
6. BEAR ALL FOOTINGS ON COMPACTED STRUCTURAL FILL OR NATURAL RESIDUAL SOILS AS APPROVED BY THE GEOTECHNICAL ENGINEER. SOIL BEARING SURFACES, PREVIOUSLY ACCEPTED BY OWNER'S REPRESENTATIVE, WHICH ARE ALLOWED TO BECOME SATURATED, FROZEN OR DISTURBED SHALL BE REWORKED TO SATISFACTION OF OWNER'S REPRESENTATIVE.
7. STRUCTURAL FILL AND SELECTED FILL: SOUND, DURABLE, SAND, GRAVEL, STONE, OR BLENDS OF THESE MATERIALS, FREE FROM ORGANIC, FROZEN OR OTHER DELETERIOUS MATERIALS, AND MEETING THE FOLLOWING GRADATION REQUIREMENTS:

SIEVE	PERCENT PASSING
4"	100
NO. 40	0 - 70
NO. 200	0 - 10

   1. FINES PASSING NO. 200 SHALL BE NON-PLASTIC.
   2. PARTICLE SIZE ANALYSIS SHALL SHOW NO GAP GRADING.

8. THE SOIL BENEATH THE BUILDING, EXTERIOR EQUIPMENT CONCRETE SLABS, AND 5 FEET AROUND THE PERIMETER SHALL BE TREATED AS FOLLOWS:
   A. STRIP THE AREA OF ALL VEGETATION.
   B. PERFORM ALL CUT OPERATIONS.
   C. THE NEXT 6 INCHES SHALL BE THOROUGHLY SCARIFIED, WITH WATER ADDED TO RAISE THE MOISTURE CONTENT TO AT LEAST 3 PERCENTAGE POINTS ABOVE OPTIMUM, AND RE-COMPACTED TO A DENSITY IN THE RANGE OF 95% TO 100% OF STANDARD PROCTOR. THE FIRST LIFT OF FILL SHALL BE PLACED ON THE COMPACTED SUBGRADE WITHIN EIGHT HOURS OF COMPLETING THE COMPACTION.
   D. THE FILL REQUIRED TO RAISE THE BUILDING TO BENEATH THE FLOOR SLAB SHALL BE EITHER ON SITE FILL OR SELECT (STRUCTURAL) FILL. THE SELECT FILL SHALL HAVE A PLASTICITY INDEX BETWEEN 4 AND 12 AND A LIQUID LIMIT LESS THAN 40. PLACE ALL FILL (ON SITE OR SELECT) FILL IN 8-INCH LIFTS AND COMPACT TO AT LEAST 95% OF THE STANDARD PROCTOR DENSITY AT A MOISTURE CONTENT WITHIN -3 AND +3 PERCENTAGE POINTS OF OPTIMUM.
   E. ALL SLABS-ON-GRADE SHALL BEAR ON A BASE COURSE OF CLEAN, COMPACTED CRUSHED STONE A MINIMUM OF 12" THICK. THE CRUSHED STONE SHALL BE VDOT NO. 57 AGGREGATE.
   F. EACH LIFT SHALL BE TESTED FOR MOISTURE CONTENT AND IN PLACE DENSITY AT A RATE OF ONE TEST PER 3,000 SQUARE FEET (MINIMUM OF THREE PER LIFT).
   G. REFER TO THE SPECIFICATIONS FOR ADDITIONAL SOIL PREPARATION NOTES.

CAST-IN-PLACE CONCRETE NOTES:

1. CONCRETE FOR FOOTINGS, CHANNEL SLAB, AND CHANNEL WALLS SHALL HAVE A 28 DAY DESIGN COMPRESSIVE STRENGTH OF 4,500 PSI, TYPE A OR D WATER REDUCING AGENT AND A 4-5" SLUMP. FLYASH SHALL NOT BE USED WITHOUT THE APPROVAL OF THE ENGINEER BEFORE BIDDING.
2. CONCRETE FOR EXTERIOR EQUIPMENT PADS SHALL HAVE A 28 DAY DESIGN COMPRESSIVE STRENGTH OF 4,500 PSI, 20% OF

   CLASS F FLYASH MAY BE USED WITH THE APPROVAL OF THE ENGINEER AND THE CONCRETE FINISHER/CONTRACTOR BEFORE BIDDING. CONCRETE SHALL BE AIR ENTRAINED FOR SEVERE EXPOSURE PER ACI TABLE 4.2.1. TOLERANCE ON AIR CONTENT AS DELIVERED SHALL BE +\- 1.5 PERCENT.
3. CONCRETE FOR THE CAST IN PLACE FLOOR SLAB SHALL HAVE A 28 DAY DESIGN COMPRESSIVE STRENGTH OF 3,000 PSI, MID OR HIGH RANGE WATER REDUCING AGENT AND A 5-6" SLUMP. 20% OF CLASS F FLYASH MAY BE USED WITH THE APPROVAL OF THE ENGINEER AND THE CONCRETE FINISHER/CONTRACTOR BEFORE BIDDING.
4. CONCRETE SHALL HAVE MAXIMUM WATER TO CEMENT RATIOS AS FOLLOWS:
   1. 3,000 PSI CONCRETE: 0.52
   2. 4,500 PSI CONCRETE: 0.42
5. PLACEMENT OF CONCRETE SHALL BE IN CONFORMANCE WITH ACI 117-06 “SPECIFICATION FOR TOLERANCE FOR CONCRETE AND MATERIALS AND COMMENTARY”.
6. IF THE AIR TEMPERATURE IS GREATER THAN 90 DEGREES WITHIN 24 HOURS AFTER PLACEMENT, HOT WEATHER CONCRETE PROCEDURES SHALL BE USED. THE CONTRACTOR SHALL SUBMIT A PROCEDURE TO THE ENGINEER FOR APPROVAL. THESE PROCEDURES MAY INCLUDE THE FOLLOWING:
   A. PLACING THE CONCRETE IN THE EARLY MORNING HOURS
   B. THE USE OF EVAPORATION REDUCER (SEE BELOW)
   C. THE USE OF MISTING AS A CURING METHOD
   D. THE USE OF WET BLANKETS AS A CURING METHOD
   E. THE USE OF A RETARDING ADMIXTURE (NOT PREFERABLE)
7. FIVE (5) 4"X8" CONCRETE CYLINDERS SHALL BE MADE FOR EVERY 50 CUBIC YARDS OR EACH DAYS POUR, ONE (1) CYLINDER TO BE TESTED AT 7 DAYS, THREE (3) CYLINDERS TO BE TESTED AT AND 28 DAYS, AND ONE (1) CYLINDER TO HOLD. THE CONCRETE SLUMP, TEMPERATURE, AND AIR CONTENT SHALL BE MEASURED EVERY TIME A SET OF FOUR CYLINDERS IS MADE.
8. ALL CONCRETE WORK SHALL BE IN ACCORDANCE WITH THE LATEST EDITIONS OF THE AMERICAN CONCRETE INSTITUTE STANDARDS “CODE REQUIREMENTS FOR ENVIRONMENTAL ENGINEERING CONCRETE STRUCTURES AND COMMENTARY” (ACI 350), THE "BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE" (ACI 318) AND THE "SPECIFICATIONS FOR STRUCTURAL CONCRETE FOR BUILDINGS" (ACI 301). SPLICES IN REINFORCEMENT SHALL MEET CLASS B TENSION LAP REQUIREMENTS UNLESS NOTED OTHERWISE.
9. COVER FOR ALL REINFORCEMENT SHALL MEET THE COVERAGE REQUIREMENTS AS SHOWN IN THE LATEST ACI 350, OR AS SHOWN ON THE DETAILS. COVER DIMENSIONS SHOWN ON THE DETAILS CONTROL OVER ACI.
10. ANY CONCRETE TO BE PLACED FURTHER THAN 16 FEET FROM THE END OF A CONCRETE TRUCK SHALL BE PUMPED WITH A COMMERCIAL CONCRETE PUMPING TRUCK OR OTHER PLACEMENT METHOD APPROVED BY THE ENGINEER. THE CONCRETE TRUCK SHALL NOT BE ALLOWED TO DRIVE OVER THE SUBGRADE OR THE SLAB REINFORCEMENT.
11. REINFORCING STEEL SHALL BE DOMESTIC DEFORMED BILLET STEEL CONFORMING TO ASTM A-615 GRADE 60. #4 REINFORCEMENT BARS AND SMALLER SHALL BE COLD BENT WHENEVER BENDING IS REQUIRED IN THE FIELD. REINFORCEMENT GREATER THAN A #4 BAR MAY NOT BE BENT IN THE FIELD WITHOUT APPROVAL OF THE ENGINEER.
12. PROVIDE CORNER BARS IN STRIP FOOTINGS, THE SAME SIZE AND NUMBER AS CONTINUOUS REINFORCEMENT UNLESS NOTED OTHERWISE.
13. WHERE REQUIRED, STEP NEW FOOTINGS UP OR DOWN IN RATIO OF TWO HORIZONTALS TO ONE VERTICAL TO JOIN EXISTING FOOTINGS. CAST STEPPED FOOTINGS MONOLITHICALLY.
14. DOWEL CONCRETE WALLS AND PIERS INTO FOOTINGS WITH DOWELS THE SAME SIZE AND SPACING AS VERTICAL REINFORCEMENT. EXTEND DOWELS TO WITHIN 3" OF BOTTOM OF FOOTING, TERMINATED WITH ACI STD. 90 DEGREE HOOK, UNLESS NOTED OTHERWISE.
15. PROVIDE A ROUGH CONCRETE SURFACE (1/4" MINIMUM AMPLITUDE) AT THE INTERSECTION OF CONCRETE WALLS, STEM WALLS, AND PILASTERS WITH THE TOP OF FOOTINGS. DO NOT PROVIDE A KEYWAY UNLESS SHOWN OR NOTED ON THE DRAWINGS
16. PROVIDE 3/4" x 3/4" CHAMFER AT ALL EXPOSED CORNERS UNLESS NOTED OTHERWISE.
17. NO HOLES OR OPENINGS ARE PERMITTED THROUGH CONCRETE SLABS EXCEPT AS FOLLOWS:
    A. WHERE SHOWN AND AS DETAILED ON DRAWINGS.
    B. MISCELLANEOUS HOLES THROUGH SLABS WHICH DO NOT DISPLACE MORE THAN ONE BAR. THESE DO NOT REQUIRE ADDITIONAL REINFORCEMENT.
18. LOCATE ADDITIONAL CONSTRUCTION JOINTS REQUIRED TO FACILITATE CONSTRUCTION AS ACCEPTABLE TO ENGINEER. LOCATE WALL CONSTRUCTION JOINTS AT MASONRY CONTROL JOINTS WHERE POSSIBLE. PLACE REINFORCEMENT CONTINUOUSLY THROUGH JOINT. DETAIL JOINT AND SHOW ON SHOP DRAWINGS.
19. CAST CONCRETE ON SLOPED SURFACES BEGINNING AT LOWEST ELEVATION AND CONTINUING MONOLITHICALLY TOWARD HIGHER ELEVATIONS UNTIL INTENDED POUR IS COMPLETED.
20. REINFORCING BARS, BAR SUPPORTS, AND SPACERS SHALL BE DETAILED AND PROVIDED IN ACCORDANCE WITH THE LATEST ACI DETAILING MANUAL. USE WIRE-BAR SUPPORTS COMPLYING WITH CRSI SPECIFICATIONS. SUPPORTS SHALL NOT BE PLACED FURTHER THAN 4 FEET APART. DAYTON SUPERIOR PRODUCTS (800-745-3700) OR EQUAL UNLESS NOTED OTHERWISE IN THE SPECIFICATIONS:
    A. AT SLABS-ON-GRADE: (SLAB THICKNESS MINUS 1 1/2 INCHES) HIGH. USE SUPPORTS WITH SAND PLATES OR HORIZONTAL RUNNERS WHERE BASE MATERIAL WILL NOT SUPPORT CHAIR LEGS. CONCRETE BLOCK OR CLAY MASONRY MAY NOT BE USED.
    B. AT FOOTINGS: 3 IN. HIGH. USE SUPPORTS WITH SAND PLATES OR HORIZONTAL RUNNERS WHERE BASE MATERIAL WILL NOT SUPPORT CHAIR LEGS. CONCRETE BLOCK OR CLAY MASONRY MAY NOT BE USED.
    C. FOR EXPOSED TO VIEW CONCRETE SURFACES WHERE LEGS OF SUPPORTS ARE IN CONTACT WITH THE FORMS, PROVIDE SUPPORTS WITH LEGS THAT ARE PLASTIC PROTECTED (CRSI, CLASS 1) OR STAINLESS STEEL PROTECTED (CRSI, CLASS 2).
21. USE ONE OF THE FOLLOWING SEALERS ON ALL INTERIOR EXPOSED CONCRETE SURFACES WHICH DO NOT RECEIVE A STAIN, PAINT OR OTHER TYPE OF COATING:
    A. SEAL HARD BY L&M
    B. EUCO DIAMOND HARD BY EUCLID
22. EVAPORATION REDUCERS SHALL BE USED AFTER EACH FINISHING OPERATION ON THE CAST IN PLACE CONCRETE FLOOR SLAB UNLESS PRIOR APPROVAL FROM THE ENGINEER HAS BEEN OBTAINED TO NOT USE. SEE SPECIFICATIONS FOR PRODUCT REQUIREMENTS.
23. SAWCUTS IN CONCRETE SLABS ON GRADE SHALL BE MADE AS SOON AS THE CONCRETE IS OF SUFFICIENT STRENGTH TO SAW WITHOUT RAVELING THE AGGREGATE. ANY TIME LAPSE GREATER THAN 8 HOURS AFTER PLACING THE CONCRETE SHALL BE PERMITTED ONLY IF APPROVED BY THE ENGINEER. FILL ALL INTERIOR JOINTS WITH MM-80 JOINT COMPOUND.
24. ADHESIVE ANCHORS WITH REBAR OR THREADED RODS SHALL BE AS NOTED BELOW. INSTALL ACCORDING TO THE MANUFACTURER'S RECOMMENDATIONS, WHICH INCLUDES CLEANING THE HOLE WITH AIR AND USING A MANUFACTURER APPROVED DISPENSING TOOL WITH MIXING NOZZLE.
    A. INTO CONCRETE OR GROUTED CMU: HILTI HIT-HY 200, SIMPSON SET HIGH STRENGTH EPOXY-TIE ANCHORING ADHESIVE OR APPROVED EQUAL.
    B. INTO NON-GROUTED CMU: HILTI HIT HY 20 OR APPROVED EQUAL.
25. NO PIPING OR CONDUITS SHALL BE INSTALLED IN ANY CONCRETE WITHOUT THE APPROVAL OF THE ENGINEER.
26. WATERSTOPS SHALL BE 6" PVC, CENTER BULB TYPE, SUCH AS GREENSTREAK STYLE 732. SEE SECTIONS FOR LOCATIONS.
27. ALL DOWELS, ANCHOR BOLTS, EMBEDDED STEEL, ELECTRICAL CONDUITS, PIPE SLEEVES, PIPING, WATERSTOPS, INSERTS, GROUNDS, AND ALL OTHER EMBEDDED ITEMS AND FORMED DETAILS SHALL BE IN PLACE BEFORE START OF CONCRETE PLACEMENT. FOR EMBEDDED ITEMS AND REQUIRED DETAILS, SEE CIVIL, MECHANICAL, ELECTRICAL, AND ARCHITECTURAL DRAWINGS. VERIFY SIZE AND LOCATION OF ALL OPENINGS.
28. ALL PIPING AND DUCT PENETRATIONS THROUGH NEW STRUCTURAL SLABS ARE TO BE SLEEVED OR CHASED. NO CORING OF SLAB IS PERMITTED. ALL PIPING THROUGH EXISTING STRUCTURAL SLABS MAY BE CORED IF APPROVED BY ENGINEER.
29. THE VAPOR RETARDER INDICATED ON THE SECTIONS SHALL BE EITHER STEGO 10 MIL CLASS A VAPOR RETARDER OR VAPOR BLOCK 10 BY RAVEN INDUSTRIES. USE STEGO OR RAVEN TAPE ON ALL LAPS AND AROUND ALL PENETRATIONS.

STEEL NOTES:

1. STRUCTURAL STEEL FABRICATION AND ERECTION SHALL CONFORM TO THE AISC MANUAL OF STEEL CONSTRUCTION.
2. WELDED CONNECTIONS SHALL CONFORM TO THE LATEST REVISED CODE OF THE AMERICAN WELDING SOCIETY.
3. ANY CONNECTIONS WITHOUT WELD SYMBOLS SHALL BE AT A MINIMUM WELDED ALL AROUND WITH THE MINIMUM FILLET OR BUTT WELD SIZE.
4. STRUCTURAL STEEL ANGLES, PLATES, ETC. SHALL CONFORM TO ASTM A36 REQUIREMENTS (36 KSI). STRUCTURAL STEEL W AND C SHAPES SHALL CONFORM TO ASTM A992 (50 KSI).
5. DO NOT PLACE HOLES THROUGH STRUCTURAL STEEL MEMBERS EXCEPT AS SHOWN AND DETAILED ON STRUCTURAL DRAWINGS.

CONCRETE MASONRY UNIT (CMU) WALL NOTES:

1. REFER TO THE ARCHITECTURAL DRAWINGS OR SPECIFICATIONS FOR TYPES OF MASONRY OTHER THAN CONCRETE MASONRY, SUCH AS BRICK. THESE NOTES DO NOT APPLY TO 4" VENEER CMU. IF THERE ARE ANY CONFLICTS BETWEEN THE WRITTEN SPECIFICATIONS AND THESE NOTES, THESE NOTES SHALL GOVERN.
2. MORTAR SHALL CONFORM TO TABLE 1 OF ASTM C270, TYPE S. THE MORTAR MIX DESIGN (BY VOLUME) SHALL BE SUBMITTED TO THE ENGINEER BEFORE CONSTRUCTION BEGINS. HOLLOW CONCRETE MASONRY UNITS SHALL CONFORM TO ASTM C90 NORMALWEIGHT SPECIFICATIONS WITH A MINIMUM COMPRESSIVE STRENGTH OF 2,800 PSI. THE SPECIFIED COMPRESSIVE STRENGTH, f'm, IS 2,000 PSI.
3. COARSE CONCRETE GROUT SHALL CONFORM TO ASTM C476 WITH A MAXIMUM AGGREGATE SIZE OF 3/8” AND A SLUMP OF 8 TO 11 INCHES. GROUT MAY BE EITHER READY MIXED OR JOB MIXED, AND SHALL BE BASED ON A MIX DESIGN (BY VOLUME) APPROVED BY THE ENGINEER. THE AMOUNT OF COARSE AGGREGATE SHALL NOT EXCEED THE AMOUNT OF FINE AGGREGATE. EVIDENCE THAT THE MIX DESIGN SHOULD ACHIEVE A 28 DAY MINIMUM COMPRESSIVE STRENGTH OF 2500 PSI SHALL BE PROVIDED TO THE ENGINEER. HOWEVER, THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE COMPRESSIVE STRENGTH.
4. WHEN MIXING MORTAR AND GROUT, CONTAINERS OF KNOWN VOLUME SHALL BE USED. MEASUREMENT USING SHOVELS SHALL NOT BE ALLOWED. FOR GROUT, THE SAND AND PEA GRAVEL SHALL BE TAKEN FROM SEPARATE PILES, NOT FROM A PRE-BLENDED PILE. IF MEASUREMENT BY SHOVELING OR USE OF A PRE-BLENDED PILE IS DISCOVERED, THE ENGINEER MAY REQUIRE ALL WALLS BUILT SO FAR TO BE TESTED PER ASTM C 1314 BY CUTTING 3 MASONRY PRISMS AND 3 GROUT CORES OUT OF THE WALL FOR EVERY 5,000 SQUARE FEET OF WALL, AND MAY REQUIRE ANY AREA OF WALL TESTING BELOW 2,000 PSI TO BE REPLACED AT NO COST TO THE OWNER.
5. THREE GROUT PRISMS SHALL BE MADE DURING THE FIRST DAY OF MASONRY WORK AND FOR EVERY 5,000 SF OF WALL (OR LESS) THEREAFTER, WITH ALL THREE PRISMS TESTED AT 28 DAYS. THE ENGINEER MAY REQUIRE ANY AREA OF WALL TESTING BELOW 2,000 PSI TO BE REPLACED AT NO COST TO THE OWNER. EVERY TIME A SET OF GROUT PRISMS IS MADE, THE LABORATORY SHALL VERIFY:
   A. PROPORTIONS OF MORTAR AND GROUT MIXING
   B. REBAR AND JOINT REINFORCEMENT SIZES AND LOCATIONS
   C. PROPER GROUT PLACEMENT AT REBAR
   D. HEADJOINTS ARE FULLY MORTARED
   E. CONTROL JOINTS ARE REINFORCED AND FULLY MORTARED
   F. PROPER COLD AND HOT WEATHER PROCEDURES USED
6. COLD WEATHER AND HOT WEATHER PROCEDURES SHALL BE USED IN ACCORDANCE WITH ACI 530.1/ASCE 6/TMS 602 ARTICLE 1.8C AND 1.8D.
7. REINFORCING STEEL SHALL BE NEW DOMESTIC DEFORMED BILLET STEEL CONFORMING TO ASTM A-615 GRADE 60.
8. ALL LOAD BEARING CMU WALLS (IDENTIFIED ON THE ROOF PLAN) SHALL BE REINFORCED VERTICALLY WITH #5 BARS, AT 4 FEET ON CENTER, AND HORIZONTALLY WITH STANDARD LADDER TYPE DUR-O-WALL, AT 16 INCHES ON CENTER. HORIZONTAL BOND BEAMS SHALL BE REINFORCED WITH 2 #5 BARS. VERTICAL REINFORCEMENT SHALL EXTEND TO THE TOP OF ALL PARAPETS. PROVIDE REINFORCEMENT BARS ALL AROUND ALL OPENINGS, EXTENDING 2 FEET PAST EACH CORNER. REFER TO THE LINTEL SCHEDULE FOR ADDITIONAL REINFORCEMENT. ALL TOP COURSES SHALL HAVE A HORIZONTAL KNOCK-OUT BLOCK BOND BEAM. ALL REINFORCEMENT BARS IN CMU WALLS SHALL BE PROVIDED WITH 1" CONCRETE GROUT COVER.
9. ALL NON-LOAD BEARING CMU WALLS SHALL BE REINFORCED HORIZONTALLY WITH STANDARD LADDER TYPE DUR-O-WALL, AT 16 INCHES ON CENTER. HORIZONTAL BOND BEAMS SHALL BE LOCATED AT THE TOP COURSE OF THE WALL AND ABOVE AND BELOW OPENINGS. HORIZONTAL BEAMS SHALL BE REINFORCED WITH 2 #5 BARS, IN 8 INCH AND 12 INCH WALLS, OR 1 #4 BAR, IN 6 INCH WALLS. PROVIDE 1 #4 BAR VERTICAL REINFORCEMENT ON EACH SIDE OF AN OPENING. EXTEND REINFORCEMENT 2 FEET PAST EACH CORNER OF AN OPENING. REFER TO THE LINTEL SCHEDULE FOR ADDITIONAL REINFORCEMENT. ALL REINFORCEMENT BARS IN CMU WALL SHALL BE PROVIDED WITH 1" CONCRETE GROUT COVER.
10. THE MINIMUM SPLICE LENGTH FOR ALL VERTICAL AND HORIZONTAL REINFORCEMENT IN ALL MASONRY SHALL BE AS FOLLOWS:
    #4 BARS - 1'-0" (MIN)
    #5 BARS - 1'-4" (MIN)
    #6 BARS - 2'-5" (MIN)
    #7 BARS - 3'-4" (MIN)
11. PROVIDE VERTICAL CONTROL JOINTS AT LOCATIONS APPROVED BY THE ARCHITECT, WITH A MAXIMUM SPACING OF 20 FEET. HORIZONTAL BOND BEAM REINFORCEMENT SHALL CONTINUE THROUGH ALL CONTROL JOINTS IN ALL WALLS (BOTH LOAD-BEARING AND NON-LOAD BEARING WALLS). CONTROL JOINTS SHALL CONSIST OF A VERTICAL MASONRY JOINT, RAKED BACK AND CAULKED.

WOOD NOTES:

1. CLIPS AND HOLDDOWNS SHALL BE EQUAL TO SIMPSON CONNECTORS AND SHALL BE INSTALLED ACCORDING TO THE SPECIFICATIONS OF SIMPSON STRONG-TIE COMPANY, INC. (800-999-5099). ALL OPTIONAL HOLES (TRIANGLE, OBROUND, AND DIAMOND) SHALL BE FILLED WITH NAILS.
2. OSB SHEATHING MAY BE USED IN LIEU OF PLYWOOD SHOWN ON THE PLANS UNLESS NOTED OTHERWISE OR EXPOSED TO HIGH MOISTURE.
3. COMPLY WITH THE LATEST EDITIONS OF THE “PLYWOOD DESIGN SPECIFICATION” AND “PANEL DESIGN SPECIFICATION” BY THE ENGINEERED WOOD ASSOCIATION.
4. "RECOMMENDED NAILING SCHEDULE" OF REFERENCED FRAMING STANDARD AND WITH "NATIONAL DESIGN SPECIFICATION FOR WOOD CONSTRUCTION" BY AMERICAN WOOD COUNCIL.
5. PRESERVATIVE WOOD TREATMENT:
   A. GENERAL: WHERE LUMBER OR PLYWOOD IS INDICATED AS PRESSURE-TREATED WOOD OR IS SPECIFIED HEREIN TO BE TREATED, COMPLY WITH APPLICABLE REQUIREMENTS OF AWPA C2 (LUMBER) AND AWPA C9 (PLYWOOD). MARK EACH TREATED ITEM WITH THE QUALITY MARK REQUIREMENTS OF AN INSPECTION AGENCY APPROVED BY ALSC'S BOARD OF REVIEW.
   B. PRESSURE-TREATED WOOD MEMBERS WITH WATER-BORNE PRESERVATIVE TO A MINIMUM RETENTION OF 0.40 PCF, AFTER TREATMENT, KILN-DRY LUMBER TO A MAXIMUM MOISTURE CONTENT OF 15 PERCENT.

ALUMINUM GRATING NOTES:

1. ALUMINUM GRATING SHALL COMPLY WITH APPLICABLE PROVISIONS AND RECOMMENDATIONS OF THE FOLLOWING:
   A. NAAM METAL BAR GRATING MANUAL DESIGNATED ANSI/NAAMM MBG 531 (ALUMINUM AND LIGHT DUTY STEEL AND STAINLESS STEEL GRATING) AND MBG 532 (HEAVY DUTY STEEL GRATING).
2. ALUMINUM MATERIAL SHALL BE ASTM B221, ALUMINUM ALLOY, EXTRUDED BARS, RODS, WIRE, SHAPES AND TUBING.
3. ALUMINUM GRATING SHALL BE:
   A. IKG BORDEN, INC. - TYPE FS,
   B. OHIO GRATINGS, INC. - TYPE 15-SG-4,
   C. OR EQUAL
4. PERIMETER FRAMES SHALL BE EXTRUDED DESIGN, ALLOY 6063-T6 AND SHALL BE PROVIDED BY MANUFACTURER OF APPROVED GRATING SYSTEM. FRAME ASSEMBLIES SHALL BE SHOP FABRICATED WITH MITER CUTS AND WELDED CORNERS AND SHALL BE SIZED TO MATCH GRATING DEPTH. ALL EXPOSED WELDS SHALL BE GROUND SMOOTH.
5. VERTICAL AND HORIZONTAL LEGS OF FRAME SHAPE SHALL HAVE 1/4" WALL THICKNESS. FRAME SHALL BE DESIGNED TO PROVIDE A CONTINUOUS SLOT TO ACCOMMODATE FASTENERS, AND SHALL HAVE A CONTINUOUS EXTRUDED ANCHOR.
6. TRAFFIC SURFACE FOR ALUMINUM BAR GRATINGS SHALL BE GROOVED.
7. INSTALL GRATING IN ACCORDANCE WITH SHOP DRAWINGS AND STANDARD INSTALLATION CLEARANCES AS RECOMMENDED BY THE NAAMM METAL BAR GRATING MANUAL.
8. PERFORM ALL CUTTING AND FITTING REQUIRED FOR INSTALLATION. GRATING SHALL BE PLACED SUCH THAT CROSS BARS ALIGN.
9. WHEREVER GRATING IS PIERCED BY PIPES, DUCTS AND STRUCTURAL MEMBERS, CUT OPENINGS NEATLY AND ACCURATELY TO SIZE AND WELD A RECTANGULAR BAND BAR OF THE SAME HEIGHT AND MATERIAL AS BEARING BARS.
10. CUTOUTS FOR CIRCULAR OBSTRUCTIONS ARE TO BE AT LEAST 2" LARGER IN DIAMETER THAN THE OBSTRUCTION. CUTOUTS FOR ALL PIPING 4" OR LESS SHALL BE MADE IN THE FIELD.
11. ALL RECTANGULAR CUTOUTS ARE TO BE MADE TO THE NEXT BEARING BAR BEYOND THE PENETRATION WITH A CLEARANCE NOT TO EXCEED BEARING BAR SPACING.
12. UTILIZE STANDARD PANEL WIDTHS WHEREVER POSSIBLE.
13. EDGE BAND ALL GRATING PANELS WITH ALUMINUM RECTANGULAR BAR OF SAME SIZE AS GRATING BARS. WELD EDGE BANDING AT EVERY GRATING BAR WITHIN CENTER 75 PERCENT OF BAR DEPTH. GRIND SMOOTH ALL WELDS THAT EXTEND PAST THE TOP OR BOTTOM EDGE.
14. SIZE OF GRATING PANELS SHALL NOT EXCEED 60 POUNDS PER SECTION.
15. GRATING SECTIONS SHALL BE FASTENED DOWN WITH TYPE 316 STAINLESS STEEL SADDLE CLIPS. PROVIDE A MINIMUM OF FOUR FASTENERS (ONE AT EACH CORNER) PER PANEL.
16. ALL ALUMINUM FRAMES AND SUPPORTS IN DIRECT CONTACT WITH CONCRETE OR MASONRY SHALL BE BACKPAINTED WITH BITUMINOUS PAINT.
17. THE CONTRACTOR SHALL SUBMIT FOR APPROVAL SHOP DRAWINGS FOR THE FABRICATION AND ERECTION OF ALL WORK. INCLUDE PLANS, ELEVATIONS, AND DETAILS OF SECTIONS AND CONNECTIONS. SHOW TYPE AND LOCATION OF ALL FASTNERS.
18. THE CONTRACTOR SHALL SUBMIT THE MANUFACTURER'S SPECIFICATIONS, LOAD TABLES, ANCHOR DETAILS AND STANDARD INSTALLATION DETAILS.

COLD FORMED METAL FRAMED TRUSS NOTES:

1. COLD FORMED STEEL TRUSSES SHALL BE DESIGNED IN ACCORDANCE WITH THE AMERICAN IRON AND STEEL INSTITUTE “NORTH AMERICAN STANDARD FOR COLD-FORMED STEEL FRAMING - TRUSS DESIGN (AISI S214-12)”, 2012 EDITION, THE “NORTH AMERICAN SPECIFICATION FOR THE DESIGN OF COLD-FORMED STEEL STRUCTURAL MEMBERS (AISI S100-12)”, 2012 EDITION, AND THE “NORTH AMERICAN STANDARD FOR COLD-FORMED STEEL FRAMING - GENERAL PROVISIONS (AISI 2-200-12)”, 2012 EDITION.
2. COLD FORMED STEEL TRUSSES SHALL BE DESIGNED FOR THE LOADS INDICATED IN THE TRUSS LOADING DIAGRAMS.
3. ROOF PURLINS BRACE THE TOP CHORD OF THE TRUSSES. TEMPORARY AND UPLIFT BRACING SHALL BE PROVIDED AS REQUIRED PER THE TRUSS MANUFACTURER'S RECOMMENDATIONS TO PROVIDE LATERAL STABILITY UNTIL CONNECTIONS ARE COMPLETE (INCLUDING HORIZONTAL BRACING).
4. ROOF TRUSS CONNECTIONS:
   A. ALL FIELD CONNECTIONS ARE TO BE SCREWED UNLESS OTHERWISE NOTED ON THE DRAWINGS.
   B. DESIGN OF CONNECTION SHALL INCLUDE LOADS FROM ALL MEMBERS INCLUDING BRACING MEMBERS.
   C. THE SCREW REQUIREMENTS FOR EACH MEMBER IN A CONNECTION SHALL BE CONSIDERED INDEPENDENTLY TO DETERMINE THE NUMBER OF SCREWS REQUIRED.
   D. ROOF TRUSS CONNECTIONS SHALL BE DESIGNED FOR THE LOADS SHOWN ON THE CONTRACT DRAWINGS.
   E. UNLESS SPLICE, SIZE OR SLOPE CHANGE IS NOTED; BOTTOM AND TOP CHORD MEMBERS OF TRUSSES SHALL BE CONTINUOUS.
   F. WHERE SPLICE IS REQUIRED, LOCATE SPLICE ON THE SIDE OF THE PANEL POINT WHICH HAS THE SMALLER FORCE. SPLICE LOCATION SHALL BE COORDINATED WITH THE ENGINEER OF RECORD.
5. ROOF TRUSSES SHALL BE ASTM A 1003, STRUCTURAL GRADE, TYPE H, METALLIC COATED, GALVANIZED (G60).

DESIGN LOADS:

THE FOLLOWING DESIGN LOADS WERE USED FOR THIS BUILDING BASED ON THE 2012 VIRGINIA UNIFORM STATEWIDE BUILDING CODE:

BUILDING OCCUPANCY CATEGORY - III

DESIGN OF THE CONCRETE SLABS-ON-GRADE ARE BASED ON THE ABOVE EQUIPMENT LOADS. CONTRACTOR SHALL VERIFY ALL FINAL PURCHASED EQUIPMENT LOADS. SHOULD THE LOADS OF THE PURCHASED EQUIPMENT EXCEED THOSE VALUES SHOWN ABOVE, CONTRACTOR SHALL NOTIFY OWNER AND ENGINEER PRIOR TO ORDERING MATERIAL OR PLACING ANY CONCRETE SLABS.

ROOF DEAD LOADS TOP CHORD:		
STANDING SEAM ROOFING:	3	PSF
3/4 INCH PLYWOOD ROOF SHEATHING:	3	PSF
ROOF DEAD LOADS BOTTOM CHORD:		
1/2 INCH PLYWOOD CEILING:	2	PSF
MECHANICAL AND ELECTRICAL ALLOWANCE:	4	PSF
INSULATION	2	PSF
TOTAL	14	PSF
GRATING LIVE LOADS:	100	PSF
ROOF LIVE LOAD:	20	PSF
ROOF SNOW LOAD		
GROUND SNOW LOAD:	25	PSF
FLAT-ROOF SNOW LOAD:	21.2	PSF
SNOW EXPOSURE FACTOR:	1.0	
SNOW LOAD IMPORTANCE FACTOR:	1.1	
THERMAL FACTOR:	1.1	

WIND DESIGN DATA:

ULTIMATE DESIGN WIND SPEED (3 SECOND GUST):	120	MPH
NOMINAL DESIGN WIND SPEED:	93	MPH
WIND IMPORTANCE FACTOR:	1.0	
WIND EXPOSURE CATEGORY:	C	
INTERNAL PRESSURE COEFFICIENTS:	+/- 0.18	

ALL NEW COMPONENTS AND CLADDING NOT DESIGNED BY THE ENGINEER SHALL BE DESIGNED FOR 25 PSF UNLESS OTHERWISE APPROVED BY THE ENGINEER.

EARTHQUAKE DESIGN DATA:

SEISMIC IMPORTANCE FACTOR:	1.25
MAPPED SPECTRAL RESPONSE ACCELERATIONS:	SS = 0.169
	S1 = 0.071
SITE CLASS:	D
SEISMIC DESIGN CATEGORY:	B
BASIC SEISMIC-FORCE-RESISTING SYSTEM:	INTERMEDIATE REINF. MASONRY SHEAR WALLS
DESIGN BASE SHEAR:	21.5 kips
SEISMIC RESPONSE COEFFICIENT:	Cs = 0.0646
RESPONSE MODIFICATION FACTOR:	R = 3.5
ANALYSIS PROCEDURE USED:	EQUIVALENT LATERAL FORCE METHOD

FLOOD HAZARD INFORMATION:
THIS BUILDING IS NOT DESIGNED FOR FLOOD LOADS.

CHA

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BEDFORD REGIONAL WATER AUTHORITY

COMMONWEALTH OF VIRGINIA
CHRISTOPHER J.B. JEDRICH
Lic. No. 042360
06-20-18
PROFESSIONAL ENGINEER

ROUTE 460 PUMPSTATION
BEDFORD, VA

No.	Submittal / Revision	App'd.	By	Date
	BID ISSUE	ETA	CTB	6/20/2018

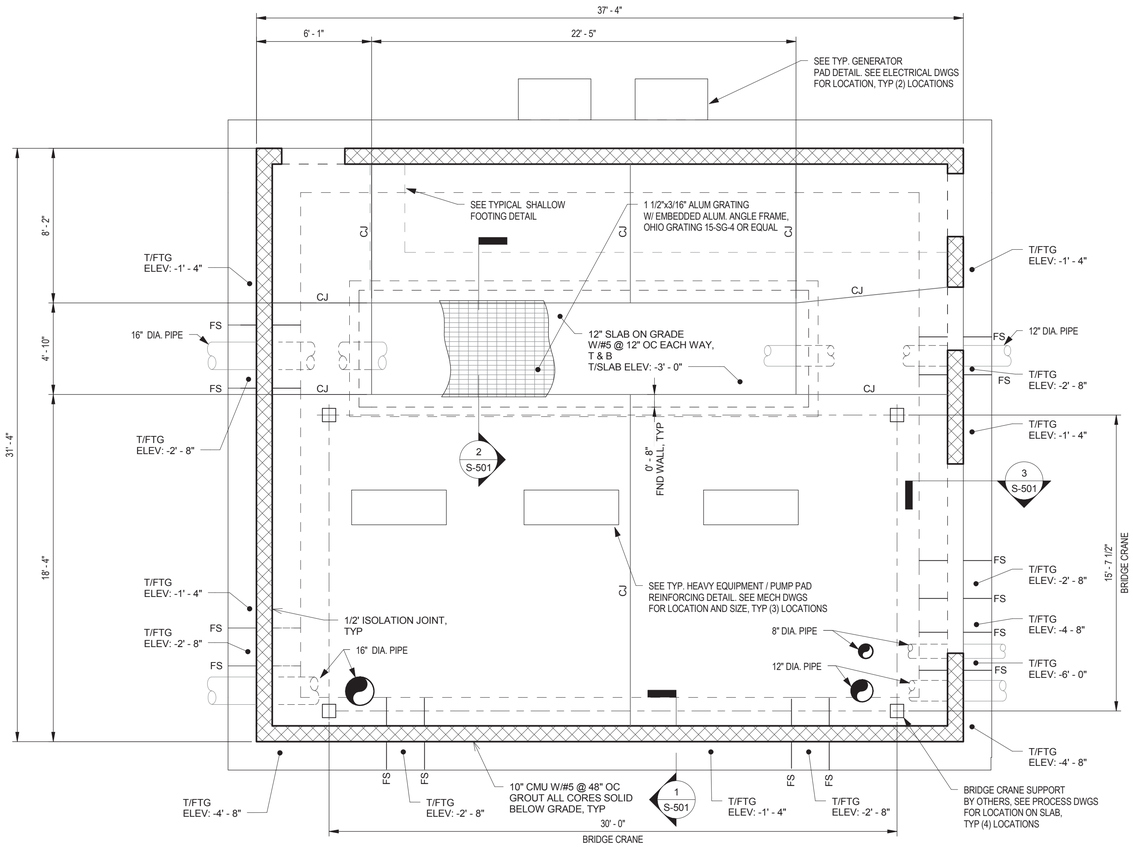
GENERAL NOTES AND DESIGN DATA

Designed By:	Drawn By:	Checked By:
APM	CEC	CJJ
Issue Date:	Project No:	Scale:
08/01/17	27872-3002	AS SHOWN

Drawing No:

S-001

Central File: Update this text with Central file location
Saved: 6/20/2018 7:43:36 AM Current Local File: C:\Users\5799\Documents\Revit 2016\27872 - 3002 - STRUCT16 - CENT_mmono.rvt



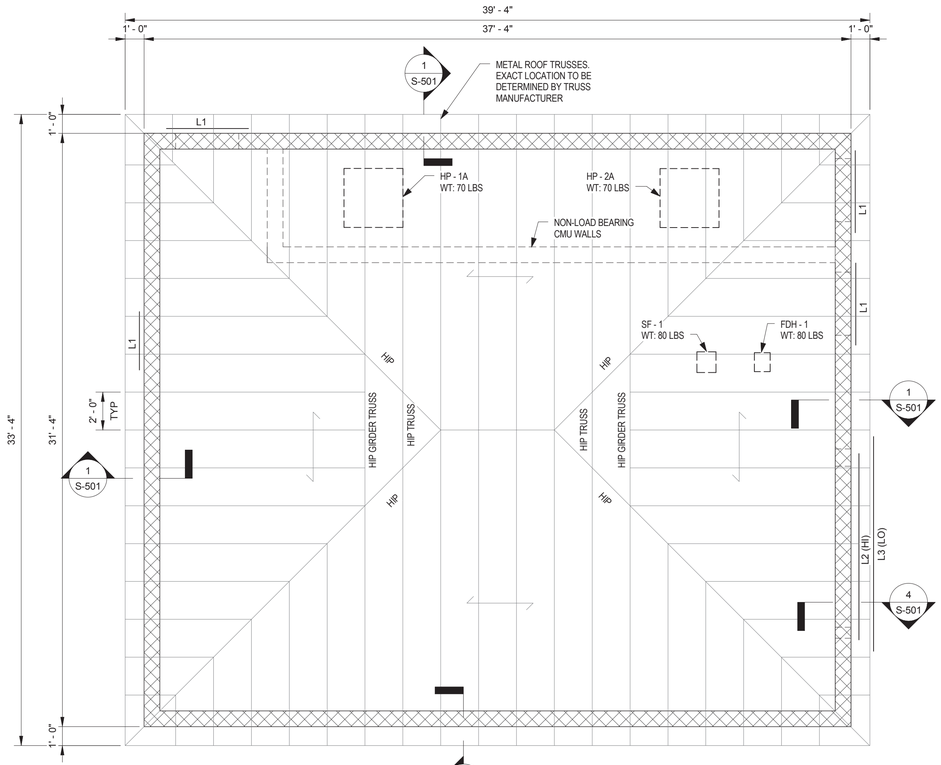
NOTES:
1. PROVIDE A 6" SLAB ON GRADE WITH #4 @ 12" OC EACH WAY, CENTERED, UNLESS NOTED OTHERWISE.
2. FINISHED FLOOR ELEVATION TO BE AT ELEVATION: 950.5' (REFERENCE ELEVATION: 0' - 0" UNLESS NOTED +/- THEREFROM ON PLAN.)
3. FS :DENOTES FOOTING STEP
4. CJ :DENOTES CONTROL JOINT

2 FOUNDATION/FLOOR PLAN

1/4" = 1'-0"

NOTE:

FLOOR SLAB DESIGN AT BRIDGE CRANE AT (4) COLUMNS IS PRELIMINARY AND FOR BID PURPOSES ONLY. GENERAL CONTRACTOR SHALL VERIFY FINAL DESIGN REACTIONS AT COLUMNS WITH SELECTED CRANE MANUFACTURER. CONTRACTOR SHALL COORDINATE WITH THE CRANE MANUFACTURER AND PROVIDE FINAL DESIGN REQUIREMENTS FOR SLAB THICKNESS, SLAB REINFORCING, ANCHOR BOLT DIAMETERS, MATERIAL PROPERTIES AND EMBEDMENT LENGTHS, SEALED AND SIGNED BY A PROFESSIONAL ENGINEER LICENSED IN THE STATE OF VIRGINIA. COST OF SLAB MODIFICATIONS, IF NECESSARY, SHALL BE INCLUDED IN THE CONTRACTOR'S BASE BID.



NOTES:
1. TOP OF CMU WALL AND TRUSS BEARING ELEV: +16' - 8" UNLESS NOTED +/- THEREFROM ON PLAN.
2. TRUSS LAYOUT SHOWN FOR INTENT ONLY, CONTRACTOR TO SUBMIT LIGHT GAUGE TRUSS ROOF SYSTEM CALCULATION AND PLANS SIGNED AND SEALED BY VIRGINIA STATE LICENSED ENGINEER PRIOR TO FABRICATION.
3. CONTRACTOR SHALL VERIFY OPERATION WEIGHT OF ALL MECHANICAL EQUIPMENT. SHOULD LOADS SHOWN ON PLAN BE EXCEEDED, CONTRACTOR SHALL NOTIFY ENGINEER PRIOR TO INSTALLATION.
4. SEE ARCHITECT AND MECHANICAL DRAWINGS FOR ROOF OPENINGS, EQUIPMENT HUNG FROM THE ROOF STRUCTURE, AND ROOFTOP EQUIPMENT.

1 ROOF FRAMING PLAN

1/4" = 1'-0"

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ROUTE 460 PUMPSTATION
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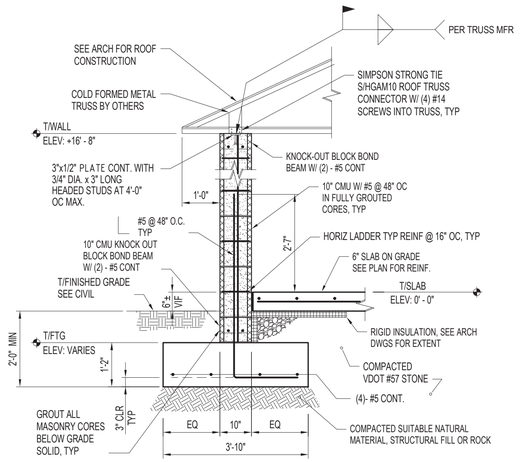
No.	Submittal / Revision	App'd	By	Date
	BID ISSUE	ETA	CTB	6/20/2018

FOUNDATION/FLOOR AND ROOF FRAMING PLAN

Designed By:	Drawn By:	Checked By:
APM	CEC	CJJ
Issue Date:	Project No:	Scale:
08/01/17	27872-3002	AS SHOWN

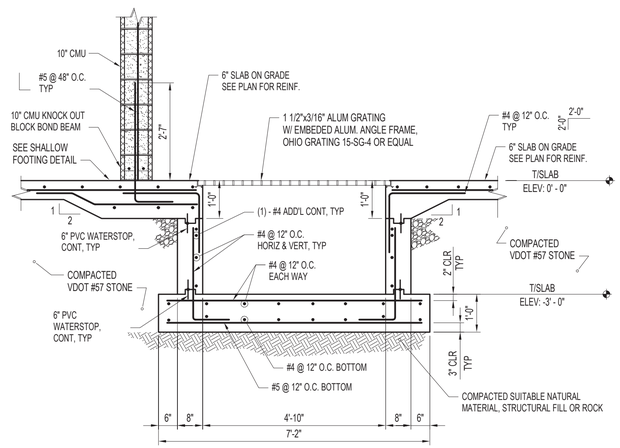
Drawing No:

S-101



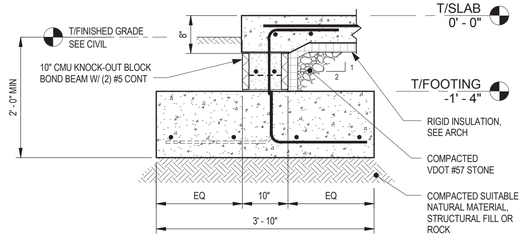
1 S-101 **SECTION**

1/2" = 1'-0"



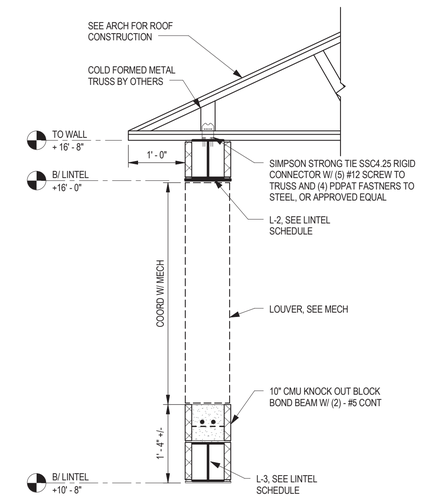
2 S-101 **SECTION**

1/2" = 1'-0"



3 S-101 **SECTION**

3/4" = 1'-0"



4 S-101 **SECTION**

3/4" = 1'-0"

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No.	Submittal / Revision	App'd.	By	Date
	BID ISSUE	ETA	CTB	6/20/2018

SECTIONS AND DETAILS

Designed By:	Drawn By:	Checked By:
APM	CEC	CJJ
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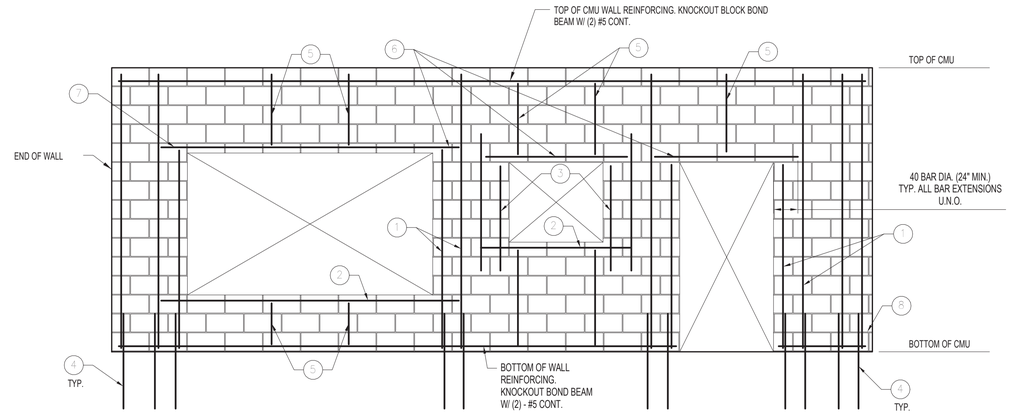
Drawing No:

S-501



OPENING GREATER THAN 16" WIDE

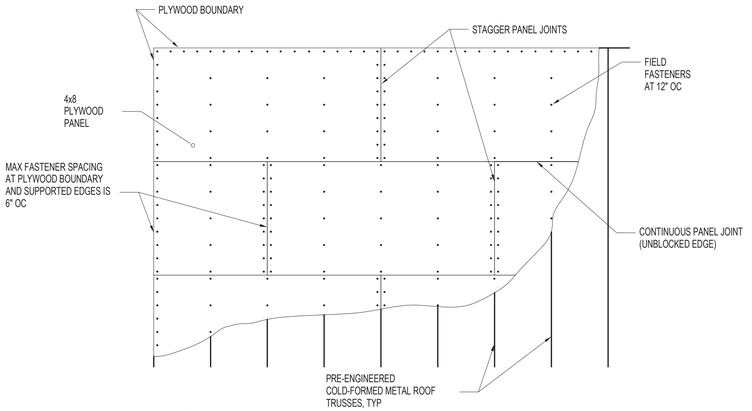
OPENING TO 16" WIDE

DOOR

1. SEE TYPICAL CMU WALL OPENING DETAIL, THIS SHEET. BARS IN CORES DIRECTLY ADJACENT TO OPENING EXTEND TO UNDERSIDE OF LINTEL BEARING. BARS IN CORES 12" AND GREATER FROM OPENINGS EXTEND FULL HEIGHT OF WALL, TYP.
2. SILL BARS. KNOCK OUT BLOCK BOND BEAM W/(2) #5 CONT. BELOW ALL OPENINGS
3. (1) #5 EACH SIDE
4. SEE TYPICAL CMU WALL REINFORCING DETAIL
5. BETWEEN BARS SHOWN, PROVIDE TYPICAL WALL REINF PER TYP. WALL REINFORCING DETAIL
6. U-BLOCK OR STEEL LINTELS, SEE LINTEL SCHEDULE. PROVIDE KNOCKOUT BOND BEAM W/(2)#5 CONTINUOUS ABOVE ALL STEEL LINTELS
7. IF FULL LENGTH IS NOT AVAILABLE, EXTEND AS FAR AS POSSIBLE, HOOK 90°, THEN EXTEND. BEYOND BEND, REMAINDER OF LENGTH REQ'D (NOT LESS THAN 12")
8. PROVIDE HORIZONTAL LADDER TYPE JOINT REINFORCEMENT AT 16" O.C. MAX.

TYP. MASONRY WALL REINFORCEMENT LAYOUT DETAIL

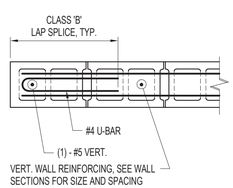
SCALE: N.T.S.



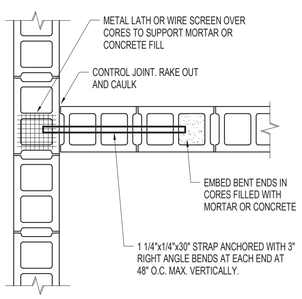
NOTES:
1. PLYWOOD SHALL BE FASTENED TO PRE-ENGINEERED COLD-FORMED METAL ROOF TRUSSES WITH FLAT HEAD STABBER, #8x1-1/2", CLEAR ZINC SCREWS BY GRABBER CONSTRUCTION PRODUCTS OR EQUAL. DRYWALL SCREWS SHALL NOT BE USED.

TYPICAL PLYWOOD FASTENING DETAIL

NOT TO SCALE

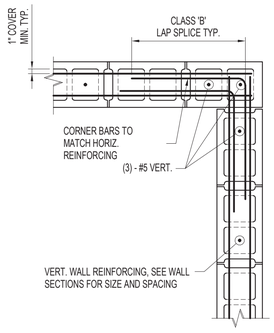


END

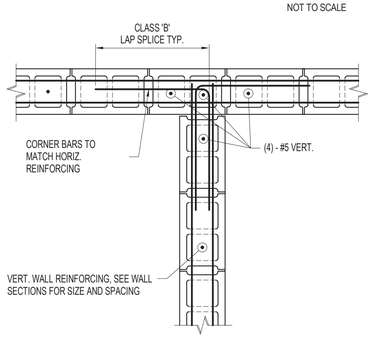


TYP. MASONRY DETAIL AT INTERSECTION

NOT TO SCALE



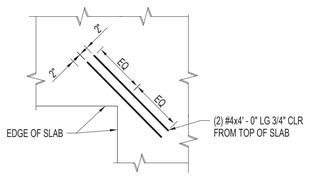
CORNER



INTERSECTION

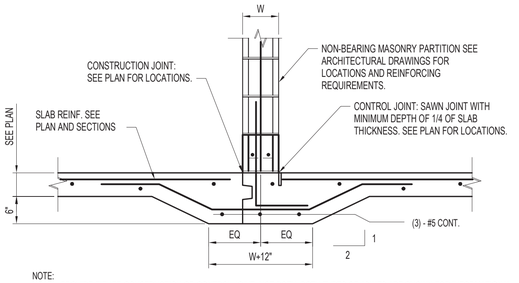
TYP. BOND BEAM DETAILS

NOT TO SCALE



TYP. MASONRY DETAIL AT INTERSECTION

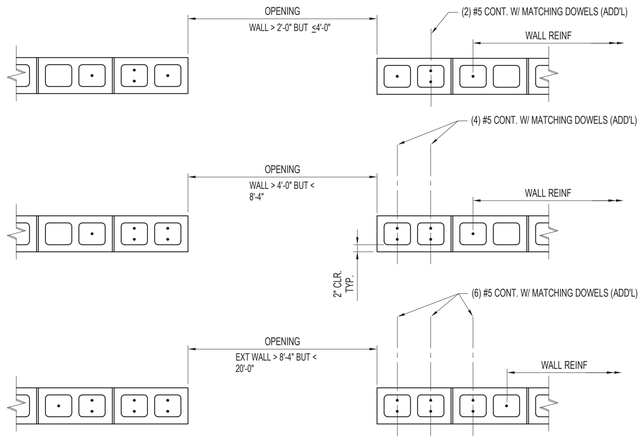
NOT TO SCALE



NOTE:
1. PROVIDE EITHER CONSTRUCTION OR CONTROL JOINT, NOT BOTH. BOTH TYPES OF JOINTS ARE SHOWN FOR INFORMATIONAL PURPOSES.
2. COORDINATE JOINT LOCATIONS WITH PLANS AND REINFORCING SUPPLIER.
3. SEE SPECIFICATIONS FOR UNDER SLAB MATERIAL REQUIREMENTS.
4. NOT INTENDED FOR USE AT LIQUID CONTAINMENT STRUCTURES.

TYP. SHALLOW FOOTING DETAIL

NOT TO SCALE



TYP. ADDITIONAL REINFORCING AT CMU OPENING DETAIL

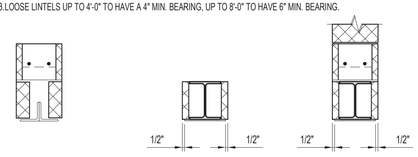
NOT TO SCALE

INTERIOR LINTEL SCHEDULE		
(NON-LOADBEARING MASONRY PARTITION WALLS ONLY)		
MAXIMUM MASONRY OPENING	8 INCH WALLS	12 INCH WALLS
4'-0"	(2) L4x3 1/2x1/4	(3) L4x3 1/2x1/4
6'-0"	(2) L5x3 1/2x1/4	(3) L4x3 1/2x1/4
8'-0"	(2) L6x3 1/2x1/4	(3) L4x3 1/2x1/4

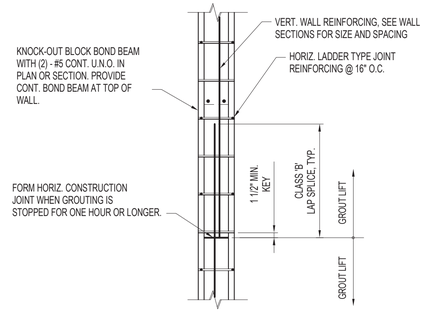
NOTES
1. INTERIOR LINTELS ARE NOT SHOWN ON STRUCTURAL PLANS.
2. ALL HORIZONTAL LINTEL ELEMENTS SUPPORTING EXTERIOR WYTHES OF MASONRY SHALL BE HOT DIP GALVANIZED.
3. SEE ARCHITECTURAL AND MECHANICAL DRAWINGS FOR SIZE AND LOCATION OF OPENINGS.
4. FOR OPENINGS OVER 8'-0" CONSULT STRUCTURAL ENGINEER.
5. ALL ANGLES SCHEDULED ABOVE SHALL BE ORIENTED WITH LONG LEGS VERTICAL, U.N.O.
6. TACK WELD BACK-TO-BACK VERTICAL LEGS OF MULTIPLE ANGLE LINTELS.
7. LOOSE LINTELS UP TO 4'-0" TO HAVE A 4" MIN. BEARING, UP TO 8'-0" TO HAVE 6" MIN. BEARING.
8. STEEL LINTELS SHALL NOT BE USED IN MASONRY FIREWALLS. ONLY CMU LINTELS ARE ACCEPTABLE. AT MASONRY OPENINGS NOT SHOWN ON STRUCTURAL DRAWINGS, CONSULT ARCHITECT.

EXTERIOR LINTEL SCHEDULE				
MARK	SIZE	M.O.	SECTION	REMARKS
L-1	(2)-∠4X4 3/8x1/4"	3'-4"	A	REINFORCE BOND BEAM W/ (2) #5 CONT. EXTEND 2'-0" BEYOND OPENING
L-2	W8x24 + 5/16" PLATE	8'-6"	B	PROVIDE 8" MINIMUM BEARING
L-3	W8x24 + 5/16" PLATE	10'-0"	C	PROVIDE 8" MINIMUM BEARING. REINFORCE BOND BEAM W/ (2) #5 CONT. EXTEND 2'-0" BEYOND OPENING

NOTES
1. SEE ARCHITECTURAL DRAWINGS FOR SIZE AND LOCATION OF OPENINGS.
2. ALL ANGLES SCHEDULED ABOVE SHALL BE ORIENTED WITH LONG LEGS VERTICAL, U.N.O.
3. LOOSE LINTELS UP TO 4'-0" TO HAVE A 4" MIN. BEARING, UP TO 8'-0" TO HAVE 6" MIN. BEARING.

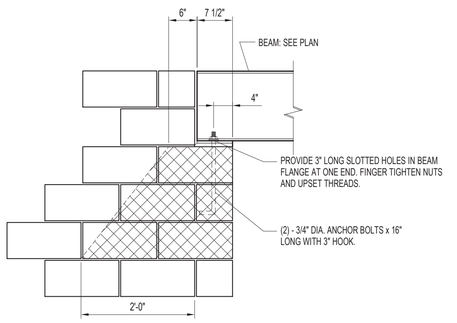


SECTION A SECTION B SECTION C



TYP. MASONRY WALL VERTICAL LAP SPLICE DETAIL

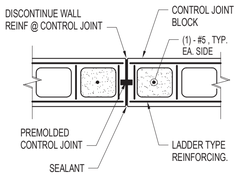
NOT TO SCALE



NOTES:
1. ALL MASONRY UNITS ENTIRELY OR PARTIALLY IN SHADED AREA SHALL BE GROUT FILLED HOLLOW CORE BLOCK.

TYP. BEAM BEARING ON MASONRY WALL DETAIL

NOT TO SCALE



TYP. MASONRY CONTROL JOINT DETAIL

NOT TO SCALE

CHA
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BEDFORD REGIONAL WATER AUTHORITY

COMMONWEALTH OF VIRGINIA
CHRISTOPHER J.B. JEDRICH
Lic. No. 042360
06-20-18
PROFESSIONAL ENGINEER

ROUTE 460 PUMPSTATION
BEDFORD, VA

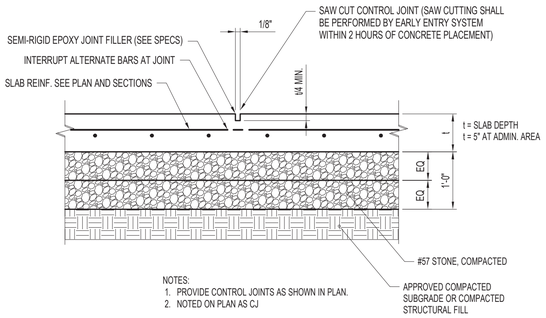
No.	Submittal / Revision	App'd	By	Date
	BID ISSUE	ETA	CTB	6/20/2018

TYPICAL SECTIONS, DETAILS AND SCHEDULES

Designed By:	Drawn By:	Checked By:
APM	CEC	CJJ
Issue Date:	Project No:	Scale:
08/01/17	27872-3002	AS SHOWN

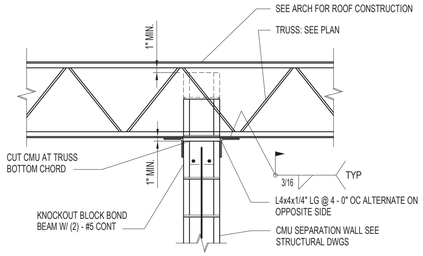
Drawing No:

S-701



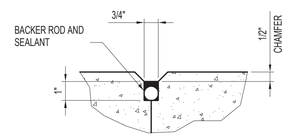
NOTES:
1. PROVIDE CONTROL JOINTS AS SHOWN IN PLAN.
2. NOTED ON PLAN AS CJ

TYP. SLAB ON GRADE CONTROL JOINT DETAIL
NOT TO SCALE

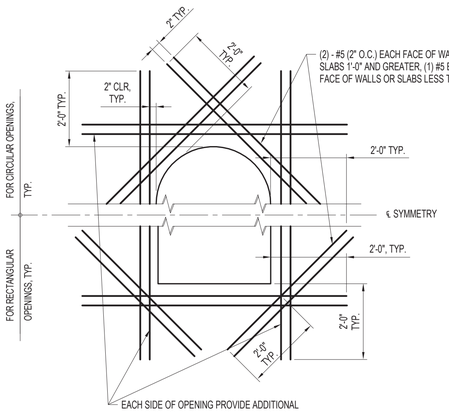


NOTES:
1. PROVIDE 1" MINIMUM GAP BETWEEN TRUSS AND MASONRY ALL AROUND. FILL GAP WITH FIRE-SAFING AS SPECIFIED. SPACE ANGLES AT 15' - 0" OC MAX FOR 6" WALLS OR 20' - 0" OC MAX FOR 8" WALLS.
2. ANGLES NOT REQUIRED WHERE CROSS WALLS PROVIDE LATERAL SUPPORT AT ABOVE MAX SPACING.

CMU PARTITION WALL BRACING - TRUSS
NOT TO SCALE

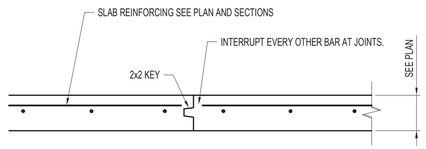


TYP JOINT SEALANT DETAIL
NOT TO SCALE



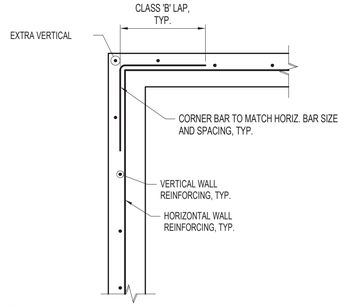
NOTES:
USE ABOVE REINFORCING AROUND OPENING 1'-0" AND LARGER UNLESS NOTED OTHERWISE ON DRAWINGS. FOR OPENINGS LESS THAN 1'-0", NO ADDITIONAL REINFORCING IS REQUIRED. UNLESS NOTED OTHERWISE ON DRAWINGS.

TYP. REINFORCING AT RECTANGULAR AND CIRCULAR OPENINGS IN SLABS AND WALLS
NOT TO SCALE



NOTE:
1. COORDINATE CONSTRUCTION JOINT LOCATIONS WITH PLANS AND REINFORCING SUPPLIER.
2. LOCATION CONSTRUCTION JOINTS AT CONTROL JOINT LOCATIONS.
3. SEE SPECIFICATIONS FOR UNDER SLAB MATERIAL REQUIREMENTS.

TYP. SLAB ON GRADE CONSTRUCTION JOINT DETAIL
NOT TO SCALE



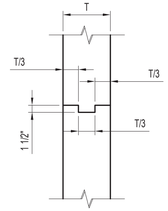
NOTE:
1. POSITION OF HORIZONTAL BARS SHOWN IS SCHEMATIC. BARS ARE IN ONE PLANE, UNLESS NOTED OTHERWISE IN PLAN OR SECTION.
2. REINFORCING STEEL SHALL BE LAPPED PER REINFORCING LAP LENGTH SCHEDULE U.N.O.

TYP. HORIZONTAL WALL REINFORCING
NOT TO SCALE

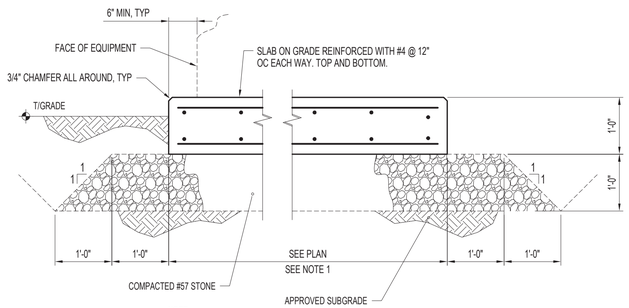
REINFORCING LAP LENGTH			
BAR SIZE	LAP CLASS	VERT.	HORIZ.
#3	B	18	24
#4	B	25	32
#5	B	31	40
#6	B	37	48
#7	B	54	70
#8	B	62	80
#9	B	69	90
#10	B	77	100

NOTES:
1. TABLE TO BE INCLUDED ON ALL REINFORCING SHOP DRAWINGS.

TYP. REINFORCING LAP LENGTH SCHEDULE

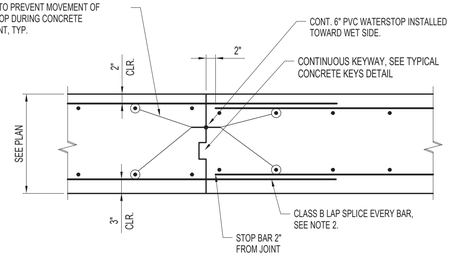


TYP. CONCRETE KEYS
NOT TO SCALE



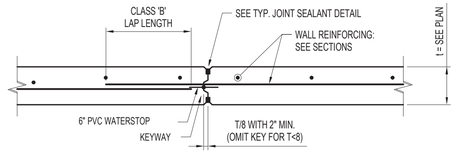
NOTE:
1. CONCRETE PAD TO EXTEND 6" MINIMUM BEYOND EQUIPMENT ON ALL SIDES. COORDINATE DIMENSIONS WITH EQUIPMENT.

TYP. GENERATOR PAD DETAIL
NOT TO SCALE



NOTE:
1. SEE PLAN FOR REQUIRED CONSTRUCTION JOINT LOCATIONS.
2. REINFORCING STEEL SHALL BE LAPPED PER REINFORCING LAP LENGTH SCHEDULE U.N.O.
3. SEE SECTIONS FOR SLAB SIZE AND REINFORCING.
4. PROVIDE 48 HOURS BETWEEN ADJACENT POURS AT CONSTRUCTION JOINTS, TYP

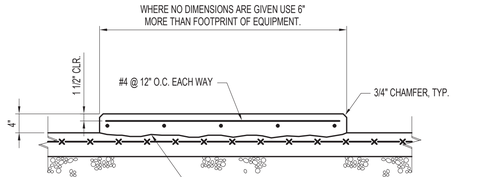
TYP BASE SLAB CONSTRUCTION JOINT DETAIL AT PIPE TRENCHES AND CONTAINMENT AREAS
NOT TO SCALE



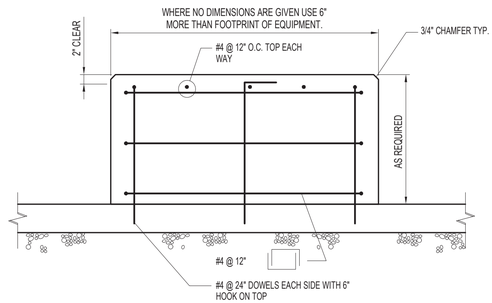
NOTE:
1. LOCATE AT WALL CONTROL JOINTS 60'-0" OC MAXIMUM, UNLESS NOTED OTHERWISE ON PLANS.
2. COORDINATE JOINT LOCATIONS WITH MASONRY CONTROL/EXPANSION JOINTS.

(FOR WALLS 8" OR SMALLER)

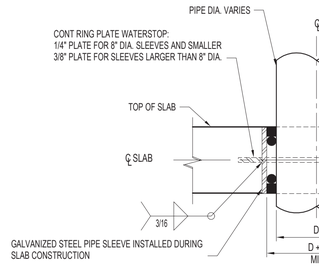
TYP. CONCRETE FOUNDATION WALL CONSTRUCTION JOINT DETAIL (PLAN)
NOT TO SCALE



TYP. GENERAL HOUSEKEEPING PAD REINFORCING DETAILS
NOT TO SCALE

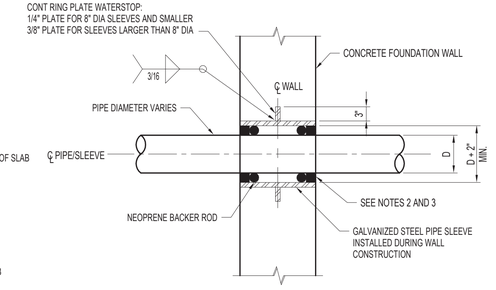


TYP. HEAVY EQUIPMENT/ PUMP PAD REINFORCING DETAILS
NOT TO SCALE



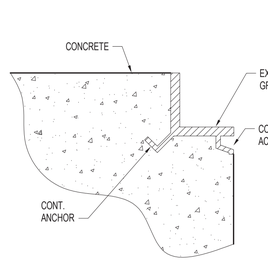
NOTE:
1. D = NOMINAL PIPE SIZE DIAMETER
2. REFERENCE CIVIL AND MECHANICAL DRAWINGS FOR QUANTITIES AND LOCATIONS.

TYP. PIPE SLEEVE THRU NEW SLAB ON GRADE
SCALE: NTS



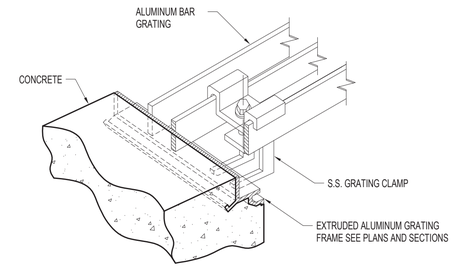
NOTE:
1. D = NOMINAL PIPE SIZE DIAMETER
2. SEAL GAP BETWEEN PIPE AND PIPE SLEEVE WATER TIGHT WITH MASTIC OR BITUMINOUS COATING.
3. SEAL GAP BETWEEN PIPE AND CONCRETE WALL WATER TIGHT WITH "LINK-SEAL" OR EQUAL.
4. REFERENCE CIVIL AND MECHANICAL DRAWINGS FOR QUANTITIES AND LOCATIONS.

TYP. PIPE SLEEVE THROUGH NEW FOUNDATION WALL
NOT TO SCALE



NOTES:
1. BACKPAINT ALL ALUMINUM IN CONTACT WITH CONCRETE WITH BITUMINOUS PAINT

TYP. ALUMINUM GRATING FRAME DETAIL
NOT TO SCALE



NOTES:
1. PROVIDE MANUFACTURER'S STANDARD EMBEDDED ANGLE TO ACCOMMODATE MANUFACTURER'S STANDARD GRATING CLAMPS OR SUBMIT PROPOSED GRATING CLAMP AND ANCHOR DETAIL FOR REVIEW AND APPROVAL

TYP. ALUMINUM GRATING CLAMP CONNECTION DETAIL
NOT TO SCALE

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BEDFORD REGIONAL WATER AUTHORITY

COMMONWEALTH OF VIRGINIA
CHRISTOPHER J.B. JEDRICH
Lic. No. 042360
06-20-18
PROFESSIONAL ENGINEER

ROUTE 460 PUMPSTATION
BEDFORD, VA

No.	Submittal / Revision	App'd.	By	Date
	BID ISSUE	ETA	CTB	6/20/2018

TYPICAL SECTIONS, DETAILS AND SCHEDULES

Designed By:	Drawn By:	Checked By:
APM	CEC	CJJ
Issue Date: 08/01/17	Project No: 27872-3002	Scale: AS SHOWN

Drawing No:
S-702

CODE INFORMATION

APPLICABLE CODES AND STANDARDS
2012 VIRGINIA UNIFORM STATEWIDE BUILDING CODE (VUSBC)
2012 VIRGINIA ENERGY CONSERVATION CODE (VECC) COMPLIANCE PATH:
ASHRAE A 90.1 SECTIONS 5 THROUGH 10
2010 ADA STANDARDS FOR ACCESSIBLE DESIGN, SEPTEMBER 15, 2010

USE GROUP AND OCCUPANCY CLASSIFICATION (SECTION 302)
U - UTILITY

CONSTRUCTION CLASSIFICATION (SECTION 602): TYPE IIB
SECTION 903: AN AUTOMATIC SPRINKLER SYSTEM IS NOT REQUIRED PER SECTION 903.
SECTION 906: PORTABLE FIRE EXTINGUISHERS ARE REQUIRED AS INDICATED.
SECTION 907 - FIRE ALARM AND DETECTION SYSTEM:
NO AUTOMATIC FIRE ALARM SYSTEM IS REQUIRED PER SECTION 907.

GENERAL ARCHITECTURAL NOTES:

1. UNLESS OTHERWISE NOTED, ALL DIMENSIONS ARE CLEAR DIMENSIONS.
2. THE INTENT OF THE CONTRACT DOCUMENTS IS TO INCLUDE ALL WORK AND ITEMS REQUIRED FOR THE COMPLETION OF THAT WORK. ALL WORK LISTED, SHOWN, OR IMPLIED ON THE CONSTRUCTION DOCUMENTS SHALL BE PROVIDED BY THE CONTRACTOR; AS IT IS REASONABLE TO INFER THE WORK AS NECESSARY TO PROVIDE THE INTENDED RESULT. THE USE OF THE WORD "PROVIDED" IN CONNECTION WITH ANY ITEM SHOWN SHALL MEAN "FURNISHED, INSTALLED, AND CONNECTED," UNLESS NOTED OTHERWISE.
3. CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATION OF CONSTRUCTION DOCUMENTS AND SHOP DRAWINGS. CONTRACTOR SHALL NOTIFY ARCHITECT IN WRITING, IMMEDIATELY, OF ANY DISCREPANCIES IN PLANS, SHOP DRAWINGS, AND/OR SPECIFICATION. SHOULD A DISCREPANCY BE FOUND, DO NOT PROCEED UNTIL CLARIFICATIONS HAVE BEEN MADE BY THE ARCHITECT/ENGINEER.
4. CONTRACTOR SHALL FIELD VERIFY ALL DIMENSIONS AND FIELD CONDITIONS; DO NOT SCALE DRAWINGS. IF INSUFFICIENT INFORMATION EXISTS, NOTIFY THE ARCHITECT/ENGINEER IMMEDIATELY FOR CLARIFICATION PRIOR TO PROCEEDING WITH THE WORK.
5. ITEMS MARKED "NIC" ARE "NOT IN CONTRACT". SUCH ITEMS ARE INCLUDED IN THE DOCUMENTS AND REQUIRE CONTRACTOR COORDINATION FOR CONSTRUCTION.
6. DETAILS MARKED "TYPICAL" OR "TYP" SHALL APPLY IN ALL CASES UNLESS OTHERWISE NOTED.
7. ALL ITEMS SHOWN ON DRAWINGS SHALL BE ASSUMED TO BE NEW WORK UNLESS NOTED AS EXISTING.
8. MATERIAL HATCHES ARE FOR MATERIAL IDENTIFICATION PURPOSES ONLY. HATCHES ARE NOT TO BE USED FOR MATERIAL QUANTIFICATION.

ABBREVIATIONS (SEE OTHER SHEETS FOR DETAIL-SPECIFIC ABBREVIATIONS)

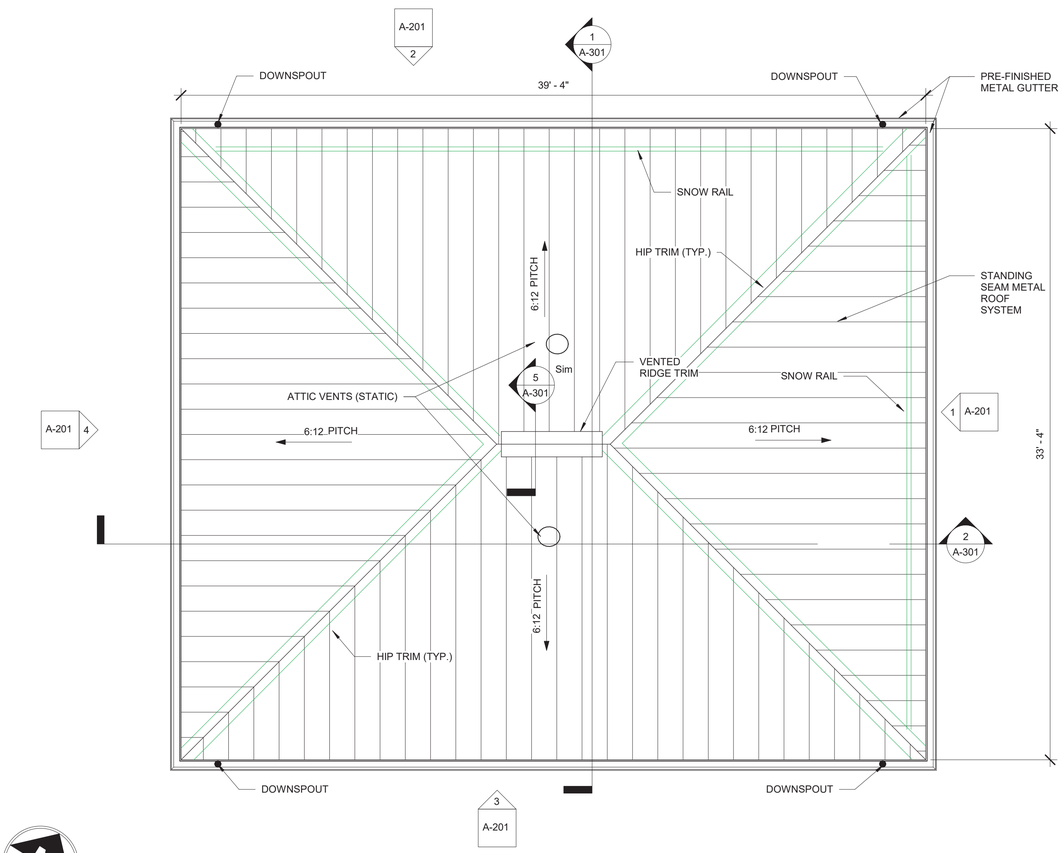
AFF	ABOVE FINISHED FLOOR
AHU	AIR HANDLING UNIT
ALUM	ALUMINUM
CMU	CONCRETE MASONRY UNIT
CONC	CONCRETE
CONT	CONTINUOUS
DIA	DIAMETER
DIM	DIMENSION
DS	DOWNSPOUT
DWG	DRAWING
EA	EACH
ELEC	ELECTRICAL
EPS	EXTRUDED POLYSTYRENE
EQ	EQUAL
EXIST	EXISTING
FD	FLOOR DRAIN
FEC	FIRE EXTINGUISHER CABINET
FE	FIRE EXTINGUISHER
FIN	FINISH, FINISHED
FRP	FIBERGLASS REINFORCED PLASTIC
FV	FIELD VERIFY
GEN	GENERAL
GWB	GYPSUM WALL BOARD
HDPE	HIGH DENSITY POLYETHYLENE
HDW	HARDWARE
HM	HOLLOW METAL
IHM	INSULATED HOLLOW METAL
INSUL	INSULATION
MAS	MASONRY
MAX	MAXIMUM
MECH	MECHANICAL
MIN	MINIMUM
MO	MASONRY OPENING
MR	MOISTURE RESISTANT
MTL	METAL, MATERIAL
NIC	NOT IN CONTRACT
OC	ON CENTER
OPP	OPPOSITE
PTD	PAINT, PAINTED
PT	PRESSURE TREATED
RC	ROOF CAP
RS	ROLLED STEEL
SIM	SIMILAR
STRUCT	STRUCTURAL
TOM	TOP OF MASONRY
T/SLAB	TOP OF SLAB
TYP	TYPICAL
UNO	UNLESS NOTED OTHERWISE
VTR	VENT THROUGH ROOF
WD	WOOD

FIRE RESISTANCE RATING FOR BUILDING ELEMENTS

BUILDING ELEMENT		WALLS & STRUCTURE	OPENINGS
PRIMARY STRUCTURAL FRAME		0 HR (TABLE 601)	NR
BEARING WALLS	EXTERIOR	0 HR (TABLE 601)	NR
	INTERIOR	0 HR (TABLE 601)	NR
NONBEARING WALLS	EXTERIOR	0 HR (TABLE 602)	NR
	INTERIOR	0 HR (TABLE 601)	NR
FLOOR CONSTRUCTION		0 HR (TABLE 601)	NR
ROOF CONSTRUCTION		0 HR (TABLE 601)	NR

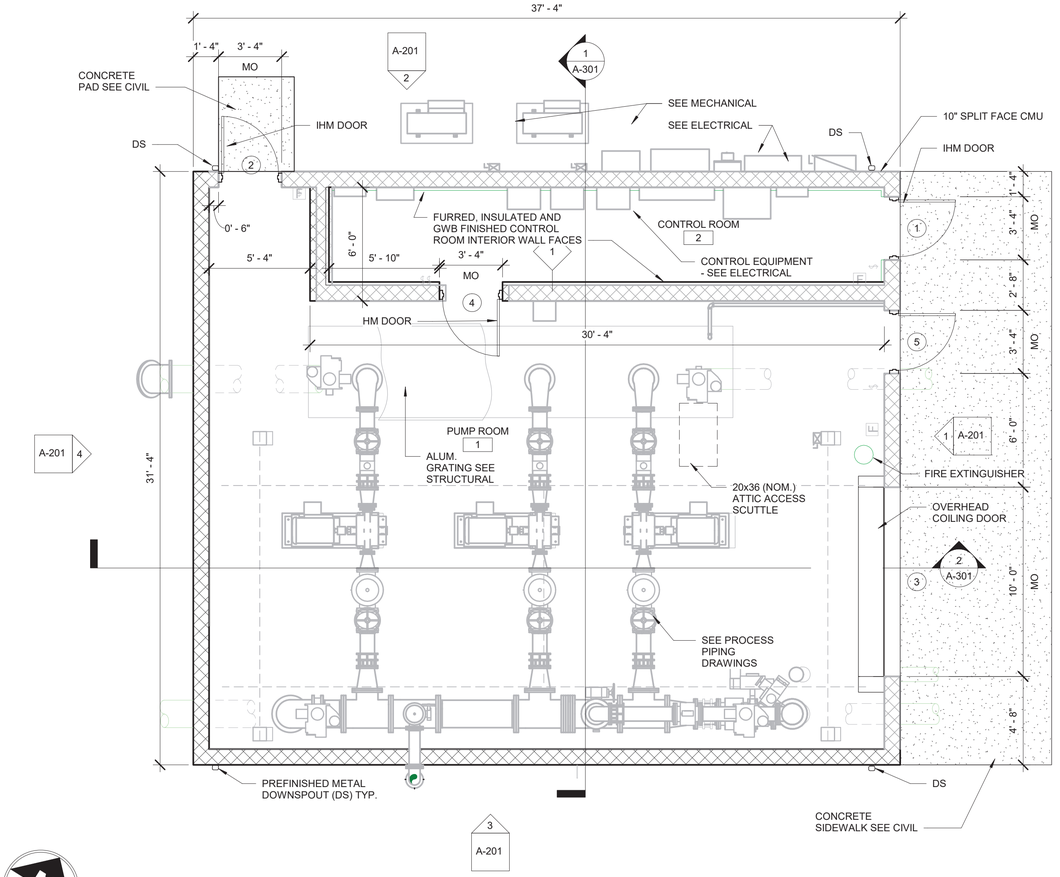
NOTE: NR = NO REQUIREMENT

0' 2' 4' 8' 16' 1/4"=1'-0"
0' 1/2" 1" 2" 4"



PLAN NORTH

2 ROOF PLAN
1/4" = 1'-0"



PLAN NORTH

1 FLOOR PLAN
1/4" = 1'-0"

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BEDFORD REGIONAL WATER AUTHORITY

COMMONWEALTH OF VIRGINIA
DOUGLAS S. WILLIAMS
Lic. No. 010069
6-20-18
ARCHITECT

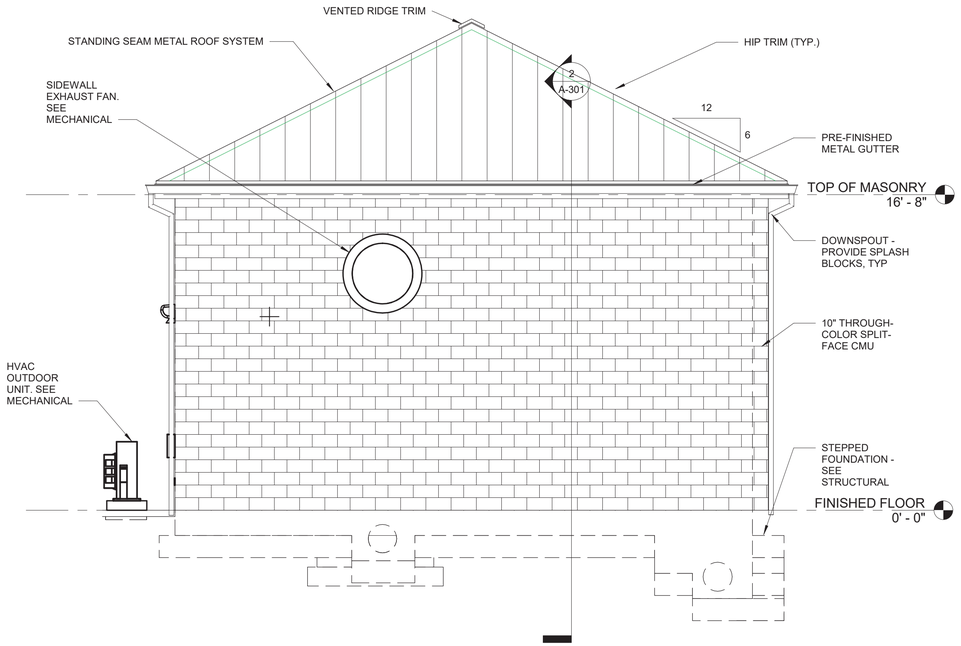
ROUTE 460 PUMP STATION
BEDFORD, VA

No.	Submittal / Revision	App'd	By	Date
	Bid Issue	HR	DsW	6-20-2018

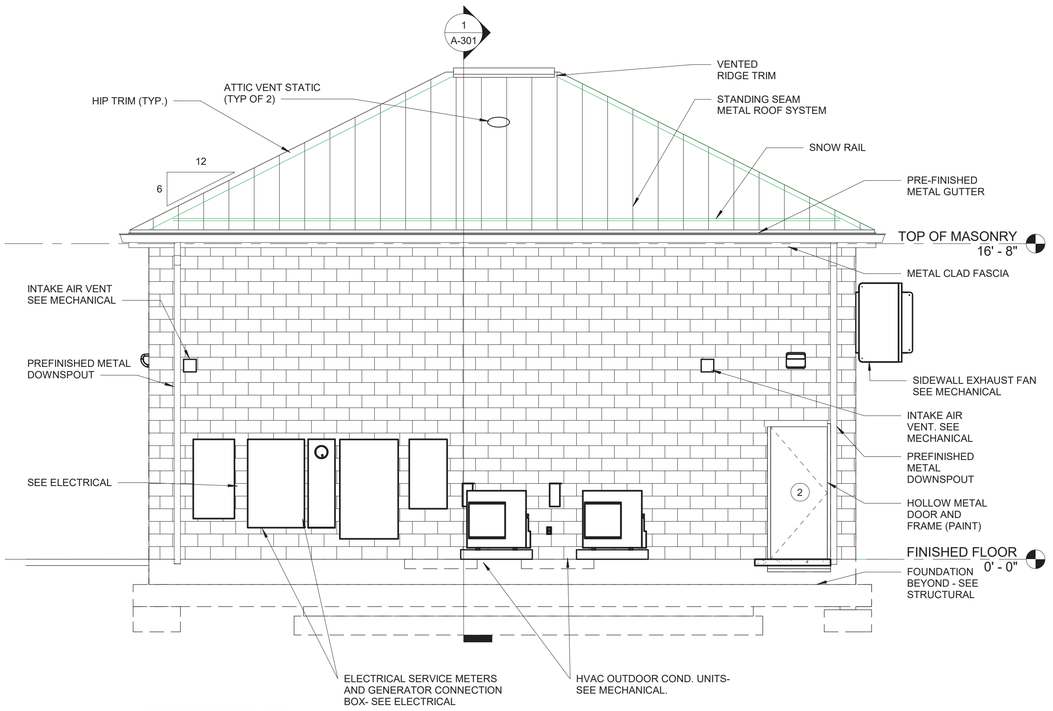
FLOOR PLAN, ROOF PLAN, CODE INFORMATION, AND NOTES

Designed By:	Drawn By:	Checked By:
AHW	AHW	DCC
Issue Date:	Project No:	Scale:
08/01/2017	27872-3002	AS SHOWN

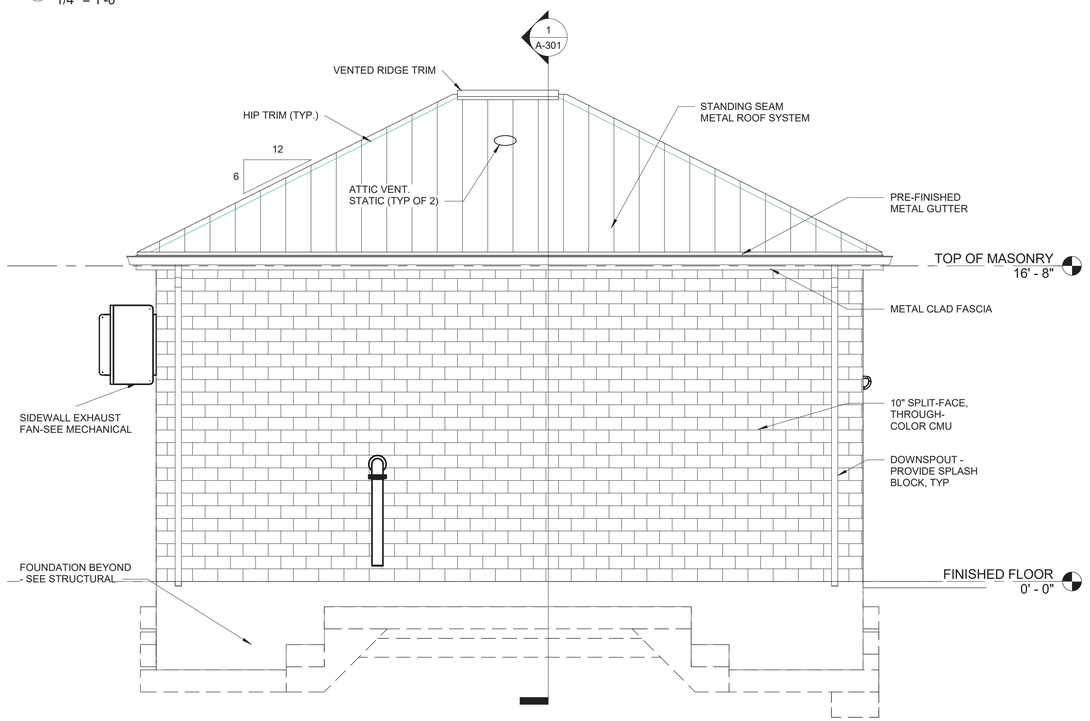
Drawing No:
A-101



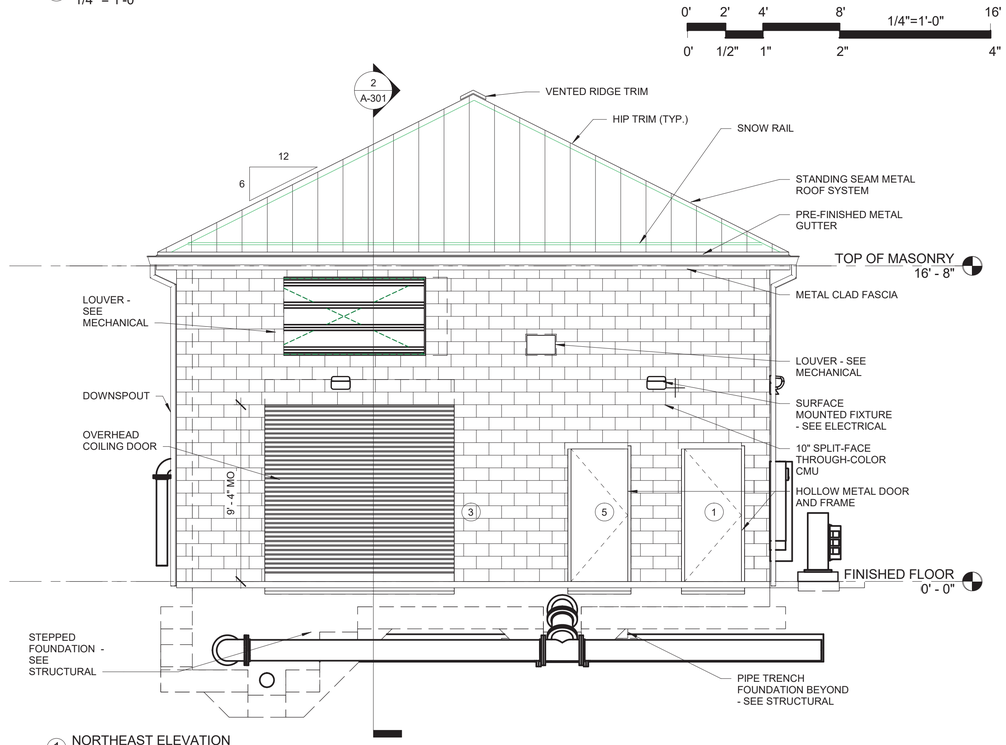
4 SOUTHWEST ELEVATION
1/4" = 1'-0"



2 NORTHWEST ELEVATION
1/4" = 1'-0"



3 SOUTHEAST ELEVATION
1/4" = 1'-0"



1 NORTHEAST ELEVATION
1/4" = 1'-0"

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BEDFORD REGIONAL WATER AUTHORITY

COMMONWEALTH OF VIRGINIA
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ROUTE 460 PUMP STATION
BEDFORD, VA

No.	Submittal / Revision	App'd	By	Date
	Bid Issue	HR	DsW	6-20-2018

BUILDING ELEVATIONS

Designed By:	Drawn By:	Checked By:
AHW	AHW	DCC
Issue Date:	Project No:	Scale:
08/01/2017	27872-3002	AS SHOWN

Drawing No:

A-201

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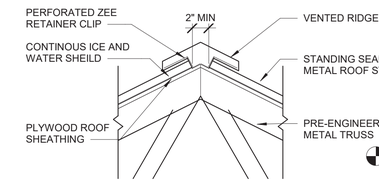
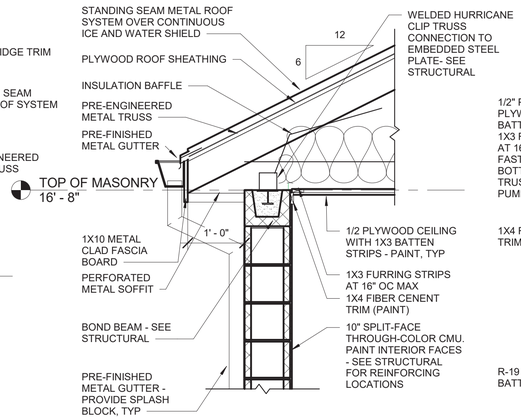
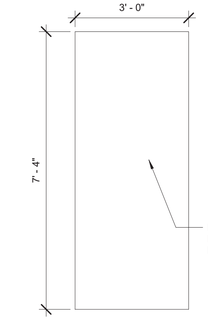
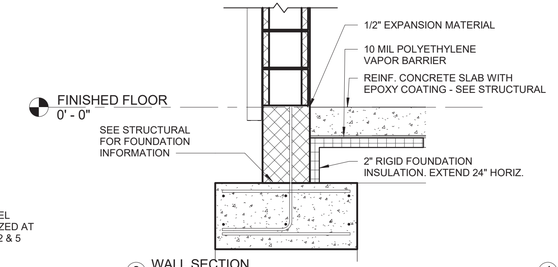


5 RIDGE DETAIL
3/4" = 1'-0"

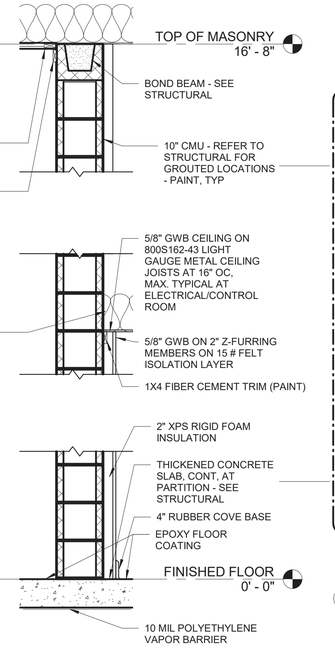




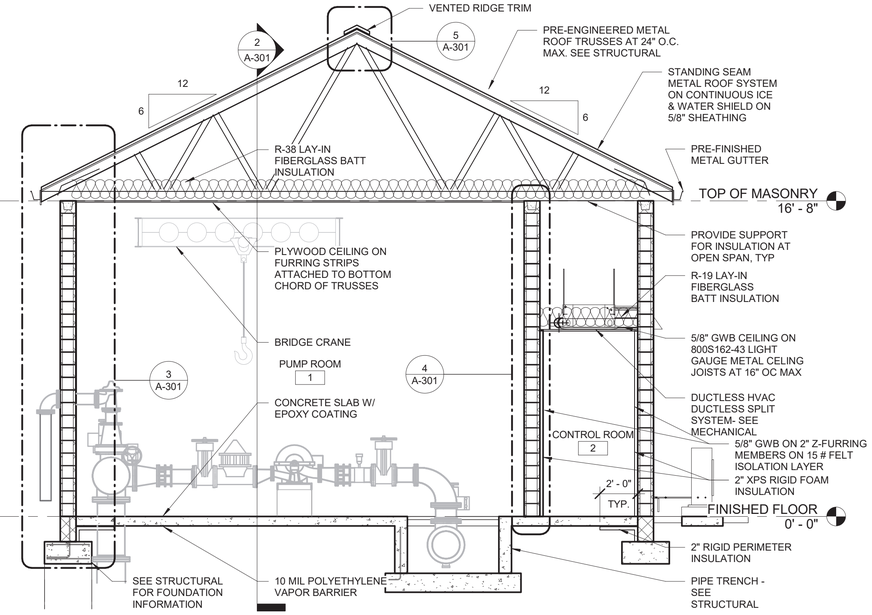
11 DOOR TPYE A
1/2" = 1'-0"



3 WALL SECTION
3/4" = 1'-0"

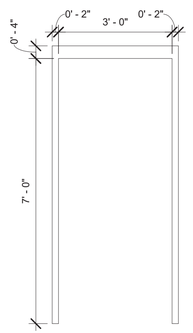


4 PARTITION TYPE 1
3/4" = 1'-0"

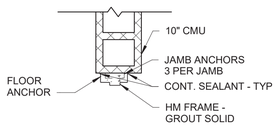


1 BUILDING SECTION
1/4" = 1'-0"

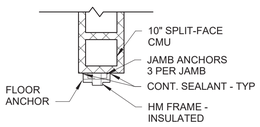
0' 2' 4' 8' 16'
1/4"=1'-0"
0' 1/2" 1" 2" 4"



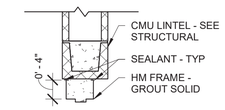
10 FRAME TYPE 1
1/2" = 1'-0"



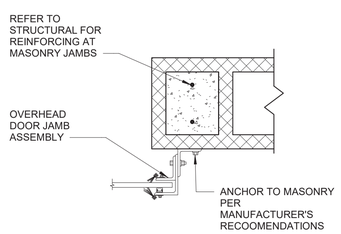
8 DOOR JAMB 2
3/4" = 1'-0"



7 DOOR JAMB 1
3/4" = 1'-0"

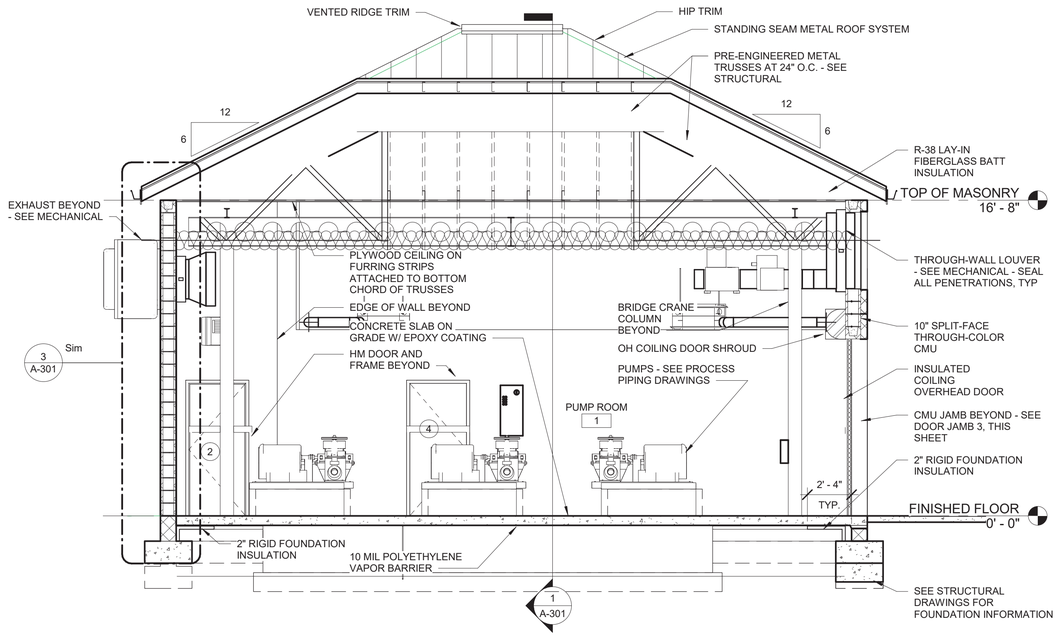


6 DOOR HEAD 1
3/4" = 1'-0"



9 DOOR JAMB 3
1 1/2" = 1'-0"

Door Schedule										
Mark	Height	Width	Finish	Door Material	Door Type	Frame Material	Frame Type	Fire Rating	Jamb	Head
1	7' - 0"	3' - 0"	PAINT	IHM GALV	A	HM	I	--	1	1
2	7' - 0"	3' - 0"	PAINT	IHM GALV	A	HM	I	--	1	1
3	9' - 4"	10' - 0"	PRE FINISHED	STEEL	B	STEEL	MFG.STD.	--	3	--
4	7' - 0"	3' - 0"	PAINT	HM	A	HM	I	--	2	1
5	7' - 0"	3' - 0"	PAINT	IHM GALV	A	HM	I	--	1	1



2 BUILDING SECTION
1/4" = 1'-0"

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BEDFORD REGIONAL WATER AUTHORITY

COMMONWEALTH OF VIRGINIA
DOUGLAS S. WILLIAMS
Lic. No. 010069
6.20.18
ARCHITECT

ROUTE 460 PUMP STATION
BEDFORD, VA

No.	Submittal / Revision	App'd	By	Date
	Bid Issue	HR	DsW	6-20-2018

BUILDING SECTIONS, DETAILS AND DOOR SCHEDULE

Designed By:	Drawn By:	Checked By:
AHW	AHW	DCC
Issue Date:	Project No:	Scale:
08/01/2017	27872-3002	AS SHOWN

Drawing No:

A-301

TO/ FROM LAKES

TO/ FROM FOREST

NOTES:

1. ALL PIPE MATERIALS AND INSTALLATION SHALL BE IN ACCORDANCE WITH THE LATEST BRWA MASTER SPECIFICATIONS.
2. ALL FLANGED PIPING TO UTILIZE STAINLESS STEEL BOLTS, WASHERS AND NUTS MEETING ASTM F593 AND ASTM F594.
3. FOR PURPOSES OF PIPE SUPPORTS AND HANGERS, THE INTERIOR OF THE PUMP STATION IS CONSIDERED A CORROSIVE AREA.

TERMINATE SUMP PUMP DISCHARGE IN 2 CUYDS OF No.57 STONE

1"-DR-PVC

SUMP PUMP P-104

16" FCA

16"X16"X12" TEE (TYP. OF 3)

16" BFLY V-101

LONG RADIUS RED. EL. 12"X8" (TYP OF 3)

16"X12" RED.

12" BFLY V-114

PE/PIT 101

8" GV V-102

8" GV V-105

8" GV V-108

2" AIR RELEASE VALVE

BRIDGE CRANE SUPPORT (TYPICAL)

8"' FCA (TYP. OF 3)

8"X6" RED. (TYP. OF 3)

PUMP P-101

PUMP P-102

PUMP P-103

100 HP GOULDS MODEL 3410 4"X6" 13/H PUMP OR EQUAL

PS 101

PS 102

PS 103

8"X4" RED. (TYP. OF 3)

8" CONTROL VALVE V-103

8" CONTROL VALVE V-106

8" CONTROL VALVE V-109

OVER HEAD SELF SUPPORTED BRIDGE CRANE

8" GV V-104

8" GV V-107

8" GV V-110

6" ANGLE SURGE ANTICIPATION VALVE IN VERTICAL PIPE. V-117

8" MAGMETER

8" FCA (TYP. OF 3)

6" GV IN VERTICAL PIPE.

12"X8" RED. (TYP. OF 3)

TO/ FROM BEDFORD

B M-401

16" BFLY V-115

16"X16"X6" TEE

PE/PIT 102

16"X16"X12" TEE (TYP. OF 3)

16"X12" TEE W/ 12" GATE VALVE & 12"X8" RED. IN VERTICAL

12" GV V-113

8" BFLY V-112

A M-401

1 PUMP STATION FINISHED FLOOR

1/2" = 1'-0"

0" 1/2" 1" 1-1/2"

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BEDFORD REGIONAL WATER AUTHORITY

COMMONWEALTH OF VIRGINIA
ERIC T. ANDERSON
Lic. No. 040613
6/20/18
PROFESSIONAL ENGINEER

ROUTE 460 PUMPSTATION
BEDFORD, VA

No.	Submittal / Revision	App'd.	By	Date
	BID ISSUE	ETA	CTB	06/20/18

PUMP STATION FLOOR PLAN

Designed By:	Drawn By:	Checked By:
ETA	CTB	SMS
Issue Date:	Project No:	Scale:
08/01/17	27872-3002	AS SHOWN

Drawing No:

M-101

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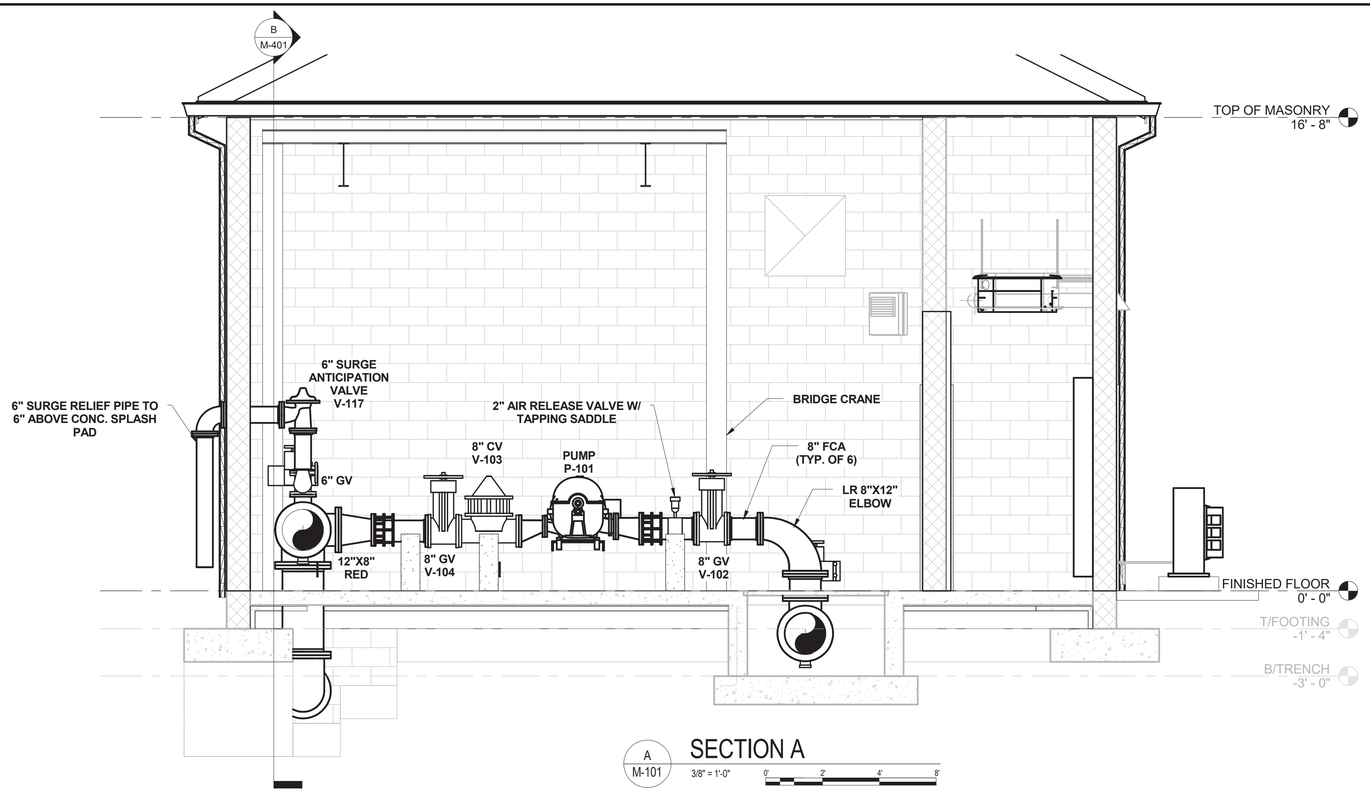
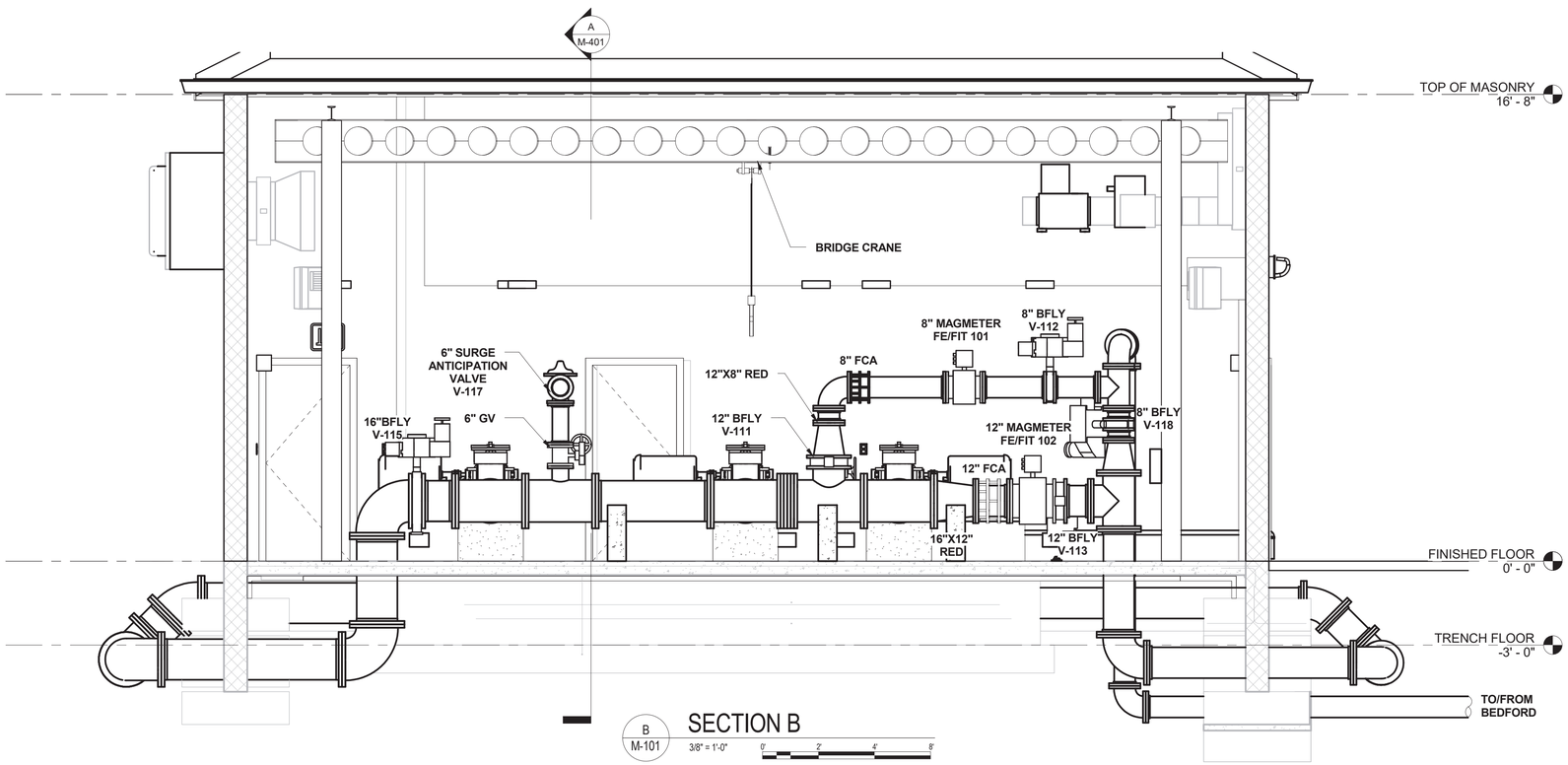


A M-101 SECTION A

3/8" = 1'-0" 0' 2' 4' 8'



B M-101 SECTION B

3/8" = 1'-0" 0' 2' 4' 8'

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BEDFORD REGIONAL WATER AUTHORITY

COMMONWEALTH OF VIRGINIA
ERIC T. ANDERSON
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6/20/18
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ROUTE 460 PUMPSTATION
BEDFORD, VA

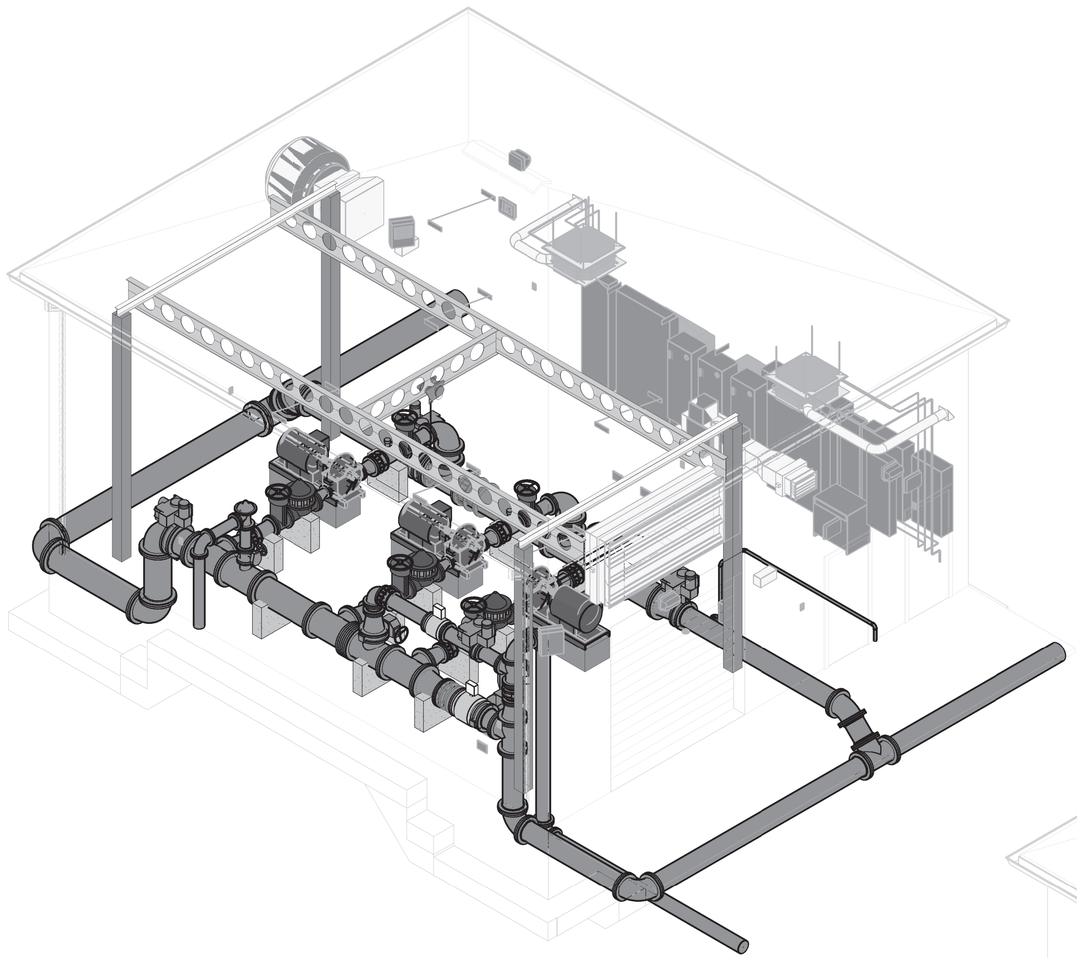
No.	Submittal / Revision	App'd.	By	Date
	BID ISSUE	ETA	CTB	06/20/18

PUMP STATION SECTIONS

Designed By:	Drawn By:	Checked By:
ETA	CTB	SMS
Issue Date:	Project No:	Scale:
08/01/17	27872-3002	AS SHOWN

Drawing No:

M-401



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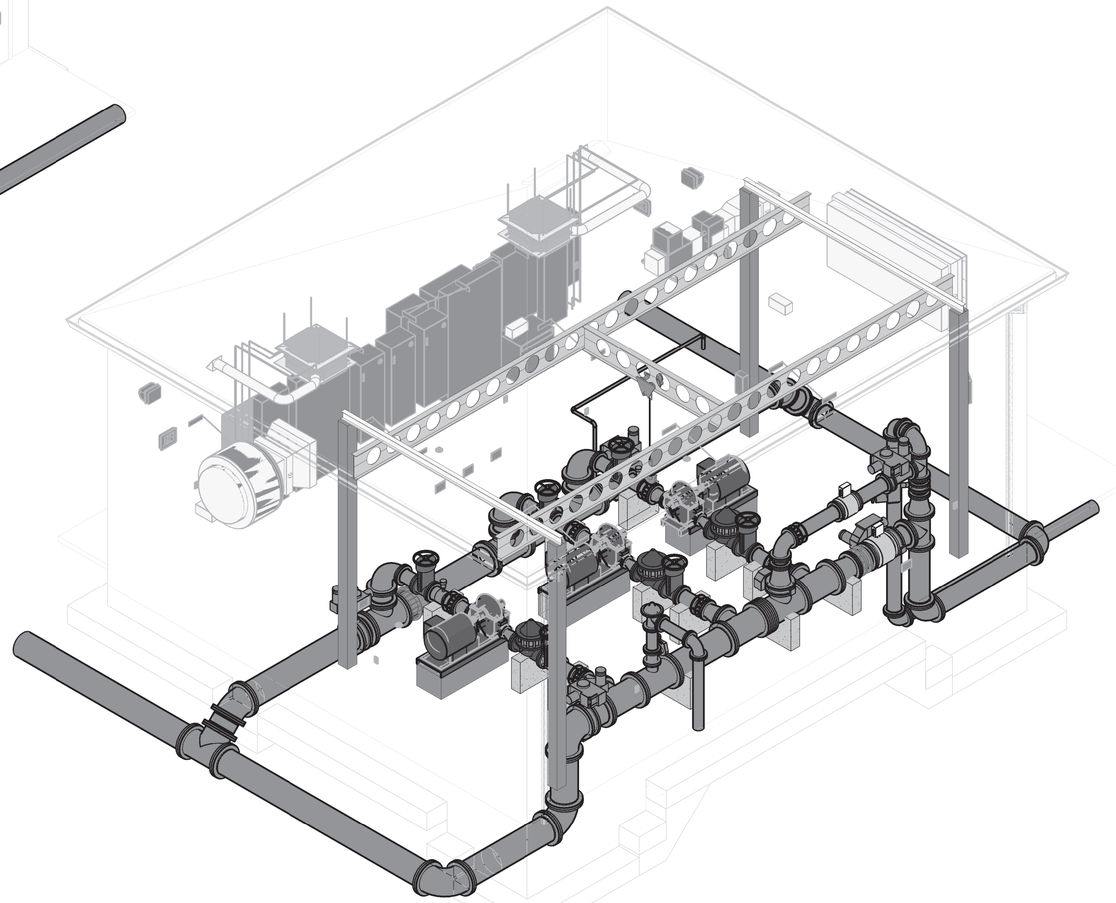

2 ISOMETRIC 2
NOT TO SCALE

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COMMONWEALTH OF VIRGINIA
ERIC T. ANDERSON
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6/20/18
PROFESSIONAL ENGINEER

ROUTE 460 PUMPSTATION
BEDFORD, VA

No.	Submittal / Revision	App'd.	By	Date
	BID ISSUE	ETA	CTB	06/20/18

PUMP STATION
ISOMETRICS

Designed By:	Drawn By:	Checked By:
ETA	CTB	SMS
Issue Date:	Project No:	Scale:
08/01/17	27872-3002	AS SHOWN

Drawing No:
M-402

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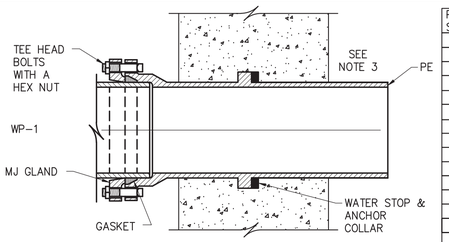
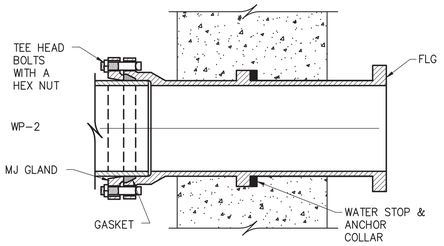
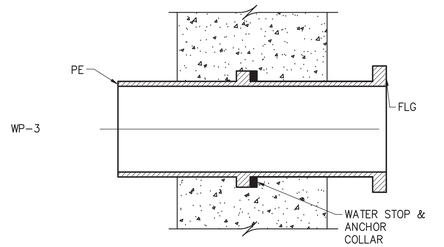


3" THRU 54" MJ-FLG-PE WALL PIPE

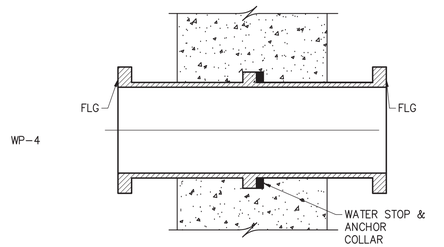
PIPE SIZE	A	B	C
3"	5.00"	2.00"	5.50"
4"	5.75"	2.25"	6.00"
6"	5.75"	2.75"	6.00"
8"	6.25"	2.75"	6.50"
10"	6.50"	3.00"	6.50"
12"	6.50"	3.00"	6.50"
14"	7.00"	3.50"	7.75"
16"	7.25"	3.50"	7.75"
18"	7.50"	3.75"	7.75"
20"	7.50"	3.75"	7.75"
24"	8.00"	4.00"	8.25"
30"	9.50"	5.00"	9.75"
36"	9.75"	5.25"	9.75"
42"	10.0"	5.50"	10.0"
46"	10.0"	6.00"	10.0"
54"	–	6.25"	–



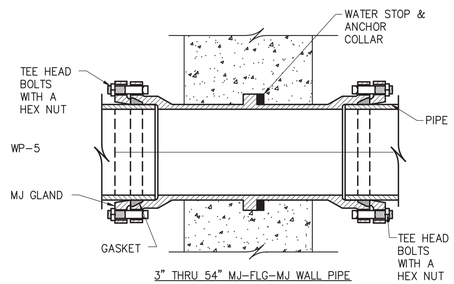
3" THRU 54" MJ-FLG-FLG WALL PIPE



3" THRU 54" PE-FLG-FLG WALL PIPE



3" THRU 54" FLG-FLG-FLG WALL PIPE

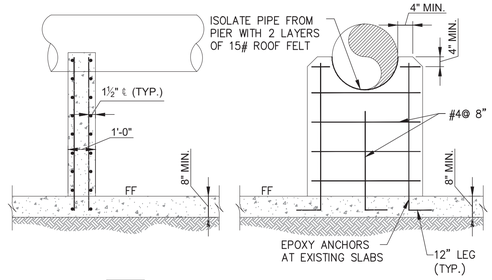


3" THRU 54" MJ-FLG-MJ WALL PIPE

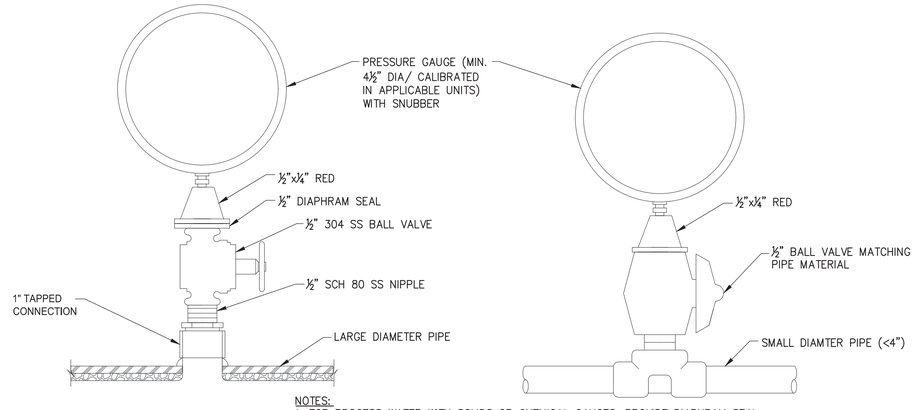
NOTES:

1. WALL PIPE DETAILS ARE TYPICAL FOR ALL WALL AND SLAB PENETRATIONS.
2. SUPPORTS AND HANGERS FOR PIPING SHALL BE IN ACCORDANCE WITH SPECIFICATION 400507
3. FOR WP-1. IF NO CONNECTION TO PE END OF PIPE IS TO BE MADE, CUT FLUSH WITH WALL
4. SEE SPEC SECTION 017330 FOR ALLOWABLE USE OF THESE WALL PENETRATIONS

1 WALL PIPE PENETRATION DETAILS
SCALE: N.T.S.



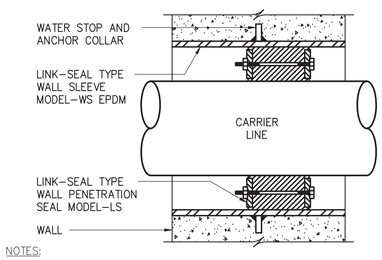
2 CONCRETE PIPE SUPPORT
NOT TO SCALE



NOTES:

1. FOR PROCESS WATER WITH SOLIDS OR CHEMICAL GAUGES, PROVIDE DIAPHRAM SEAL OF MATERIAL COMPATABLE WITH CARRIED FLUID AS RECOMMENDED BY MFG.
2. SEE SPECIFICATION 230519 SECTION 2.6.B.

3 PRESSURE GAUGE OR PRESSURE SWITCH
NOT TO SCALE



NOTES:

1. ON PIPES 30" IN DIAMETER OR LARGER THE CONTRACTOR MAY POUR THE PIPE IN PLACE IN LIEU OF THE USE OF WALL SLEEVES OR WALL PIPES. PIPE TO HAVE SEAL RING WELDED IN CENTER OF WALL PENETRATION. WALL PIPE TO BE OMITTED ON EXISTING CONCRETE WALLS.
2. ALL MATERIALS IN CONTACT WITH PROCESS WATER TO BE NSF-61 APPROVED.

4 LINK SEAL DETAIL
SCALE: N.T.S.

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BEDFORD REGIONAL WATER AUTHORITY

COMMONWEALTH OF VIRGINIA
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6/20/18
PROFESSIONAL ENGINEER

ROUTE 460 PUMP STATION
BEDFORD, VA.

No.	Submittal / Revision	App'd.	By	Date
	BID ISSUE	ETA	CTB	06/20/18

MECHANICAL DETAILS

Designed By:	Drawn By:	Checked By:
ETA	CTB	SMS
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08/01/17	27872-3002	AS SHOWN

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M-701

MECHANICAL ABBREVIATIONS

AD	ACCESS DOOR
AFF	ABOVE FINISH FLOOR
APD	AIR PRESSURE DROP
BHP	BRAKE HORSEPOWER
CD	CONDENSATE DRAIN
CFM	CUBIC FEET PER MINUTE
COND	CONDENSATE
dB	DECIBEL
DB	DRY BULB
DN	DOWN
DX	DIRECT EXPANSION
EA	EXHAUST AIR
EAT	ENTERING AIR TEMPERATURE
EC	ELECTRICAL CONTRACTOR
EDH	ELECTRIC DUCT HEATER
EF	EXHAUST FAN
ELEV	ELEVATION
ESP	EXTERNAL STATIC PRESSURE
EUH	ELECTRIC UNIT HEATER
FD	FIRE DAMPER
FF	FINISH FLOOR
FLA	FULL LOAD AMPS
FPM	FEET PER MINUTE
FT	FOOT / FEET
GA	GAUGE OR GAGE
HC	HEATING CONTRACTOR
HP	HORSEPOWER
HPU	HEAT PUMP UNIT
HZ	HERTZ
IN	INCHES
IN WG	INCHES WATER GAUGE
KW	KILOWATTS
LAT	LEAVING AIR TEMPERATURE
LV	LOUVER
MAX	MAXIMUM
MBH	BTU PER HOUR (THOUSAND)
MCA	MINIMUM CIRCUIT AMPS
MIN	MINIMUM
MOCP	MAXIMUM OVERCURRENT PROTECTION
MTG HGT	MOUNTING HEIGHT
N/A	NOT APPLICABLE
NC	NOISE CRITERIA
N C	NORMALLY CLOSED
NIC	NOT IN CONTRACT
NTS	NOT TO SCALE
OA	OUTSIDE AIR
PH	PHASE
PSI	POUNDS PER SQUARE INCH
PSIG	POUND-FORCE PER SQUARE INCH GAUGE
RPM	REVOLUTIONS PER MINUTE
SA	SUPPLY AIR
SF	SQUARE FEET
STR	STARTER
TD OR ΔT	TEMPERATURE DIFFERENCE
TSP	TOTAL STATIC PRESSURE
TYP	TYPICAL
VOLT	VOLTAGE
W	WATT
WB	WET BULB
°F	DEGREES FAHRENHEIT
&	AND
#	NUMBER

MECHANICAL CONTROL SYMBOLS (ONE-LINE)

M	MOTORIZED DAMPER
TE	TEMPERATURE ELEMENT
STR	MOTOR STARTER
T 24	THERMOSTAT - LOW VOLTAGE (24 VOLT - MOUNT AT 48" AFF)
T 120	THERMOSTAT - LINE VOLTAGE (120 VOLT - MOUNT AT 48" AFF)
AO	ANALOG OUTPUT
AI	ANALOG INPUT
DO	DIGITAL OUTPUT
DI	DIGITAL INPUT

MECHANICAL LINE-TYPES (ONE-LINE)

2" COND	CONDENSATE PIPING (SIZE AS INDICATED)
12"x12" SA	SUPPLY AIR DUCTWORK (SIZE AS INDICATED)
12"x12" EA	EXHAUST AIR DUCTWORK (SIZE AS INDICATED)
12"x12" OA	OUTSIDE AIR DUCTWORK (SIZE AS INDICATED)

MECHANICAL SYMBOLS (ONE-LINE)

	SUPPLY / OUTSIDE AIR DUCT UP
	RETURN / EXHAUST AIR DUCT UP
	SUPPLY / OUTSIDE AIR DUCT DOWN
	RETURN / EXHASUT AIR DUCT DOWN
	FLEXIBLE DUCT CONNECTION
VD	VOLUME CONTROL DAMPER IN DUCT
	FLEXIBLE DUCT, MAXIMUM LENGTH 4'-0"
	SUPPLY / OUTSIDE AIR SIDEWALL REGISTER / GRILLE
	RETURN / EXHAUST AIR SIDEWALL REGISTER / GRILLE
FD	FIRE DAMPER IN DUCT
SD	SMOKE DAMPER IN DUCT
M	MOTOR OPERATED DAMPER IN DUCT
	AIRFLOW ARROW

DUCTWORK FITTING STANDARDS

THE FOLLOWING INDICATE THE STANDARD FOR DUCTWORK FITTINGS REQUIRED FOR THIS PROJECT

ACCEPTABLE

- SMOOTH RADIUS ELBOWS W/ R/D ≥ 1.5 — ROUND, FLAT, OVAL OR RECTANGULAR
- SMOOTH RADIUS ELBOWS W/ R/D ≥ .75 WITH FULL RADIUS SPLITTER VANE — ROUND, FLAT, OVAL OR RECTANGULAR
- RECTANGULAR THROAT W/ RADIUS HEEL
- MITERED ELBOWS (TRANSFER DUCT ONLY)
- OFFSET W/ ANGLE ≤ 30° — ROUND, FLAT, OVAL OR RECTANGULAR
- SMOOTH RADIUS WYE W/ R/D ≥ 1.5 — ROUND, FLAT, OVAL OR RECTANGULAR
- WYE W/ ANGLE ≤ 90° — ROUND, FLAT, OVAL OR RECTANGULAR
- TRANSITION WYE ANGLE ≤ 30° — ROUND, FLAT, OVAL OR RECTANGULAR
- TEE W/ 45° ENTRY BRANCH TO MAIN — ROUND, FLAT, OVAL OR RECTANGULAR
- CONICAL TEES — ROUND, FLAT, OVAL OR RECTANGULAR
- TEE WITH BRANCH ANGLE ≤ 45° — ROUND, FLAT, OVAL OR RECTANGULAR
- DOUBLE TEE W/ 45° ENTRY BRANCH TO MAIN — ROUND, FLAT, OVAL OR RECTANGULAR

NOT ACCEPTABLE

- MITEREDELBOWS (SUPPLY) — ROUND, FLAT, OVAL OR RECTANGULAR
- MITERED ELBOWS W/ VANES — ROUND, FLAT, OVAL OR RECTANGULAR
- WYE W/ TURNING VANES W/ OR W/OUT DIVIDER — ROUND, FLAT, OVAL OR RECTANGULAR
- SMOOTH RADIUS ELBOWS W/ R/D ≤ 1.5 — ROUND, FLAT, OVAL OR RECTANGULAR
- ELBOWS Z-SHAPED (SUPPLY ONLY) — ROUND, FLAT, OVAL OR RECTANGULAR
- WYE W/ OR W/OUT DIVIDER — RECTANGULAR
- BELLMOUTH FITTINGS — ROUND, FLAT, OVAL OR RECTANGULAR
- SPIN-IN-FITTINGS — ROUND OR RECTANGULAR
- STRAIGHT TEES — ROUND OR RECTANGULAR
- DOUBLE TEE WITH BRANCH ANGLE ≤ 45° — ROUND, FLAT, OVAL OR RECTANGULAR

MECHANICAL LINE-TYPES (TWO-LINE)

12"x12" SA	SUPPLY AIR DUCTWORK (SIZE AS INDICATED)
12"x12" EA	EXHAUST AIR DUCTWORK (SIZE AS INDICATED)
12"x12" OA	OUTSIDE AIR DUCTWORK (SIZE AS INDICATED)
2" COND	CONDENSATE PIPING (SIZE AS INDICATED)
2" RL	REFRIGERANT LIQUID PIPING (SIZE AS INDICATED)
2" RS	REFRIGERANT SUCTION PIPING (SIZE AS INDICATED)

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BEDFORD REGIONAL WATER AUTHORITY

COMMONWEALTH OF VIRGINIA
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6/20/2018
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ROUTE 460 PUMPSTATION
BEDFORD, VA.

No.	Submittal / Revision	App'd.	By	Date
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LEGEND, ABBREVIATIONS AND SYMBOLS

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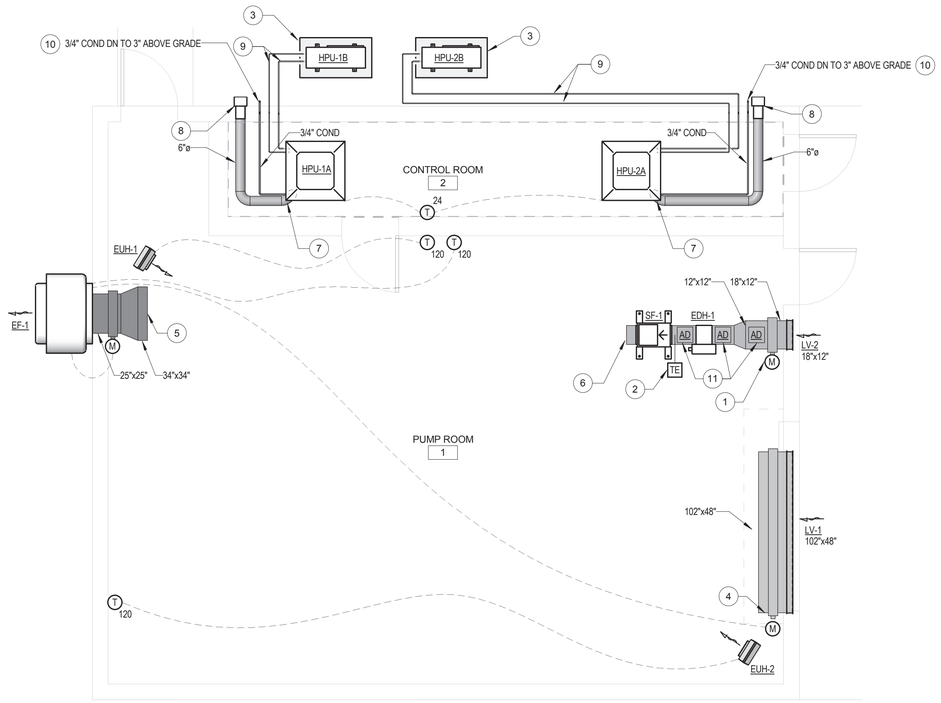

1 FIRST FLOOR PLAN
1/4" = 1'-0"

CODED NOTES

1. 120 VAC MOTORIZED DAMPER TO BE INTERLOCKED WITH SF-1
2. TEMPERATURE ELEMENT AT EDH-1 AIR DISCHARGE
3. CONCRETE PAD FOR OUTDOOR UNIT BY STRUCTURAL
4. 120 VAC MOTORIZED DAMPER FOR LV-1
5. PROVIDE 1/2" SPACING STAINLESS STEEL WIRE MESH SCREEN AT OPEN DUCT (34"x34")
6. PROVIDE 1/2" SPACING STAINLESS STEEL WIRE MESH SCREEN AT FAN DISCHARGE
7. 6" Ø OA INTAKE DUCT TO BE CONNECTED WITH FRESH AIR INTAKE OF THE INDOOR UNIT
8. 6" STAINLESS STEEL FRESH AIR INTAKE VENT WITH 1/4" WIRE MESH SCREEN, LUXURY METAL WALL VENT 6" ROUND MODEL OR APPROVED EQUAL
9. ROUTE SPLIT SYSTEM REFRIGERANT LINES TO HEAT PUMPS OUTSIDE ON GRADE. REFRIGERANT LINES SHALL BE SIZED PER MANUFACTURER'S INSTRUCTIONS AND RECOMMENDATIONS.
10. ROUTE AND SLOPE CONDENSATE DRAIN PIPE OUTSIDE AND DOWN TO GRADE; PROVIDE INSECT SCREEN AT OUTLET AND SPASH BLOCK ON GRADE.
11. PROVIDE ACCESS DOORS ON BOTH SIDES OF DUCT MOUNTED ELECTRIC HEATING COIL AND AT OUTSIDE AIR INTAKE DAMPER.

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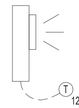
SEQUENCES OF OPERATION, GENERAL

THE SEQUENCES OF OPERATION ARE PROVIDED TO ASSIST IN THE FAMILIARIZATION WITH THE CONTROL LOGIC PRESENTED ON THE SYSTEM SCHEMATICS. THE SEQUENCES ARE NOT INTENDED TO BE ALL INCLUSIVE.

IT IS UNDERSTOOD THAT UPON A CONTROL LOOP SETPOINT BEING SATISFIED, EQUIPMENT SHUTDOWN OR EQUIPMENT FAILURE, THE REVERSE SEQUENCE FROM WHAT IS DESCRIBED SHALL OCCUR TO SHUTDOWN SYSTEMS OR STOP EQUIPMENT IN A CONTROLLED MANNER.

SOME OF THE SIMPLER, REPETITIVE LOGIC NECESSARY HAS NOT BEEN INCLUDED IN THE SEQUENCES.

THE CONTROL SYSTEM SEQUENCE OF OPERATION SHALL BE DEVELOPED WITH THE INPUT, AND FINAL APPROVAL, OF THE OWNER.

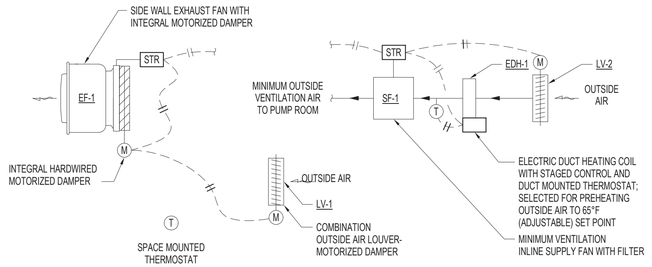


NOTES:
1. PROVIDE MANUFACTURER'S THERMOSTAT THERMAL BREAK MOUNTING ACCESSORY.

1 ELECTRIC UNIT HEATER FLOW DIAGRAM
NOT TO SCALE

SEQUENCE OF OPERATION

ELECTRIC PROPELLER UNIT HEATERS (EUH-1& 2)
1. ELECTRIC UNIT HEATERS (UH) SHALL PROVIDE AUXILIARY ELECTRIC FREEZE PROTECTION HEATING FOR THE PROCESS AREA, SELECTED AT A 65°F (MANUALLY ADJUSTABLE) SPACE TEMPERATURE SETPOINT.
2. ELECTRIC UNIT HEATER SHALL START, WHEN THE SPACE TEMPERATURE (SIGNALED BY ITS WALL MOUNTED THERMOSTAT) IS BELOW 65°F (MANUALLY ADJUSTABLE). THE UNIT HEATER SHALL STOP WHEN THE TEMPERATURE OF THE SPACE IS ABOVE 67°F (MANUALLY ADJUSTABLE).
3. INTENT IS FOR EQUIPMENT TO OPERATE STAND ALONE.



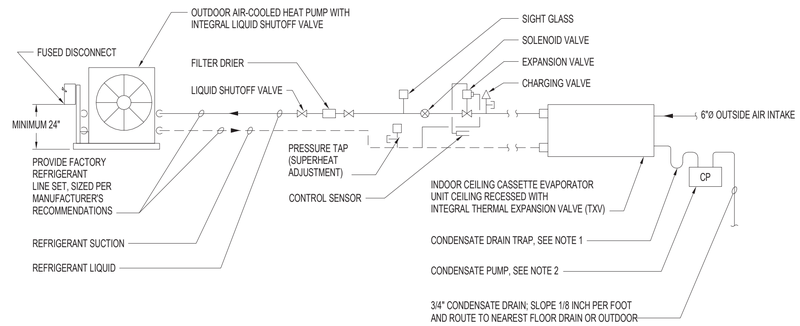
2 EXHAUST FAN & MINIMUM VENTILATION FLOW DIAGRAM
NOT TO SCALE

SEQUENCE OF OPERATION

SIDE WALL EXHAUST FAN (EF-1/LV-1)
1. THE EXHAUST FAN SHALL START WHEN THE SPACE TEMPERATURE (SIGNALED BY THE WALL-MOUNTED THERMOSTAT) IS ABOVE 80°F (MANUALLY ADJUSTABLE). THE FAN'S INTEGRAL MOTORIZED ISOLATION DAMPER SHALL BE HARDWIRE INTERLOCKED TO OPEN WHENEVER THE FAN IS STARTED, AND TO STOP WHENEVER THE FAN STOPS. THE EXHAUST FANS SHALL STOP WHEN THE SPACE TEMPERATURE IS BELOW 78°F (MANUALLY ADJUSTABLE).
2. THE MINIMUM VENTILATION SUPPLY FAN SHALL START AND OPERATE WHENEVER THE EXHAUST FAN IS STOPPED AND NOT OPERATING. THE FAN SHALL BE INTERLOCKED WITH ITS OWN INTEGRAL MOTORIZED ISOLATION DAMPER. THE DAMPER SHALL BE OPENED WHEN FAN IS STARTED AND SHALL BE CLOSED WHEN FAN IS STOPPED.
4. THE EXHAUST FAN'S DEDICATED OUTSIDE AIR LOUVER WITH MOTORIZED DAMPER SHALL BE HARDWIRE INTERLOCKED TO OPEN WHENEVER THAT FAN STARTS, AND CLOSE WHENEVER IT STOPS.
5. INTENT IS FOR EQUIPMENT TO OPERATE STAND ALONE.

MINIMUM VENTILATION OUTSIDE AIR SUPPLY FAN (SF-1/LV-2)
1. MINIMUM VENTILATION OUTSIDE AIR SUPPLY FAN SHALL PROVIDE MINIMUM REQUIRED MAKEUP VENTILATION OUTSIDE AIR FOR THE PUMP ROOM YEAR ROUND. THE SUPPLY FAN SHALL BE HARDWIRE INTERLOCKED TO START WHENEVER THE EXHAUST FANS ARE NOT OPERATING. THE SUPPLY FAN'S DEDICATED OUTSIDE AIR LOUVER WITH MOTORIZED ISOLATION DAMPER SHALL BE HARDWIRE INTERLOCKED TO OPEN WHENEVER THE FAN IS STARTED, AND TO CLOSE WHENEVER THE FAN STOPS.
2. THE INTENT IS FOR THE EQUIPMENT TO OPERATE STAND ALONE.

ELECTRIC DUCT MOUNTED HEATING COIL (EDH-1)
1. THE ELECTRIC DUCT HEATING COIL SHALL BE ENERGIZED WHEN ITS DISCHARGE AIR TEMPERATURE (SIGNALED BY ITS DUCT MOUNTED THERMOSTAT) IS BELOW 65°F (MANUALLY ADJUSTABLE). THE DUCT HEATING COIL SHALL BE DE-ENERGIZED WHEN THE AIR TEMPERATURE IS ABOVE 67°F (MANUALLY ADJUSTABLE).
2. ELECTRIC DUCT HEATING COIL SHALL HAVE MULTIPLE STAGES OF HEATING, INTEGRAL WITH MANUFACTURER'S FACTORY MOUNTED SCR CONTROLS AND SAFETIES.
3. INTENT IS FOR EQUIPMENT TO OPERATE STAND ALONE.



NOTES:
1. PROVIDE CHILLED WATER CONDENSATE DRAIN WITH TRAP HEIGHT PER MANUFACTURER'S INSTALLATION SPECIFICATIONS AND REQUIREMENTS.
2. PROVIDE MANUFACTURER'S RECOMMENDED CONDENSATE PUMP, OR LITTLE GIANT CONDENSATE PUMP MODEL VCMA-20UL, CAPABLE OF 48 GPH AT 10 FT WC; PROVIDE POWER CONNECTION FOR 1/30 HP AT 120V/1PH/60HZ.

3 DUCTLESS SPLIT SYSTEM PIPING FLOW DIAGRAM
NOT TO SCALE

SEQUENCE OF OPERATION

SPLIT SYSTEM HEAT PUMP UNITS (HP-1A & 2A)
1. CEILING CASSETTE INDOOR AIR HANDLING UNIT SHALL MAINTAIN THE CONDITIONED SPACE TEMPERATURE AT 75°F (ADJUSTABLE) IN THE COOLING MODE AND 72°F (ADJUSTABLE) IN THE HEATING MODE. THE DIGITAL WALL MOUNTED PROGRAMMABLE THERMOSTAT FURNISHED WITH THE INDOOR UNIT SHALL CONTROL THE SPACE TEMPERATURE WHERE THE UNIT IS SERVING. REFER TO DRAWINGS FOR THERMOSTAT LOCATIONS
2. OUTDOOR AIR COOLED HEAT PUMP UNIT SHALL BE STARTED WHENEVER THERE IS A CALL FOR COOLING OR HEATING BY THE WALL MOUNTED PROGRAMMABLE THERMOSTAT.
3. AT A MINIMUM, PROGRAMMABLE THERMOSTAT SHALL B E CAPABLE OF SEVEN DAY SCHEDULE, OCCUPIED/UNOCCUPIED SET POINTS CONTROL AND AUTO CHANGEOVER BETWEEN COOLING AND HEATING.
4. MINIMUM REQUIRED MAKEUP VENTILATION OUTSIDE AIR FOR THE AREAS SERVED BY THE CEILING CASSETTE HEAT PUMP UNITS SHALL BE DUCTED FROM AN OUTSIDE AIR INTAKE BRICK VENT.
5. INTENT IS FOR EQUIPMENT TO OPERATE STAND ALONE.

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FLOW DIAGRAMS

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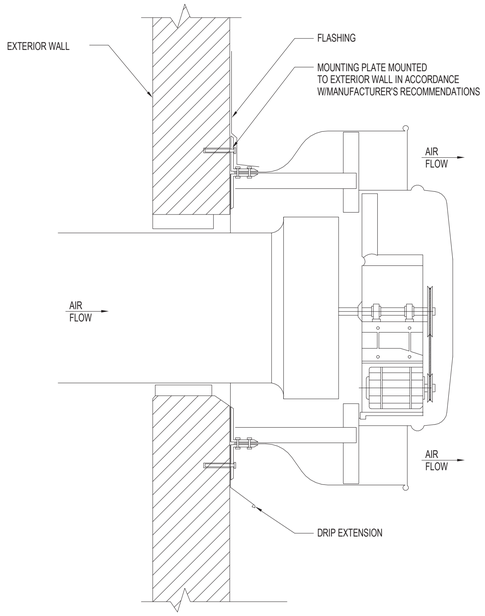
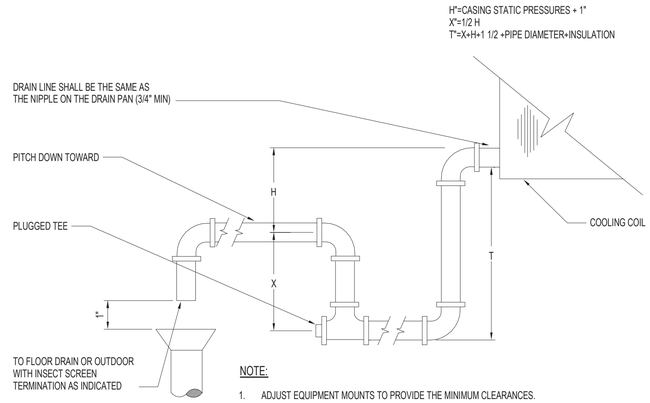


1 CENTRIFUGAL SIDEWALL EXHAUSTER DETAIL
NOT TO SCALE



NOTE:

1. ADJUST EQUIPMENT MOUNTS TO PROVIDE THE MINIMUM CLEARANCES.

2 COOLING COIL CONDENSATE TRAP DETAIL
NOT TO SCALE

FAN SCHEDULE

TAG	LOCATION	SERVICE	TYPE	CFM	TSP (IN WG)	BHP (HP)	FAN MOTOR DATA					MANUFACTURER & MODEL#	REMARKS
							RPM	HP	VOLT	PH	FLA		
EF-1	PUMP RM	EXHAUST	BELT-DRIVE	11,300	0.35	2.74	1725	3	460	3	4.8	GREENHECK #CWB-300-30	PROVIDE FACTORY-MOUNTED AND WIRED NEMA-3R DISCONNECT SWITCH, SPRING HANGING ISOLATORS AND BRACKETS.
SF-1	PUMP RM	SUPPLY	BELT-DRIVE	260	0.5	0.09	1725	1/4	120	1	5.8	GREENHECK #BSQ-70-4	PROVIDE FACTORY-MOUNTED AND WIRED NEMA-3R DISCONNECT SWITCH, SPRING HANGING ISOLATORS AND BRACKETS.

ELECTRIC UNIT HEATER SCHEDULE

TAG	LOCATION	SERVICE	TYPE	MBH	CFM	THROW (FT)	EAT (°F)	LAT (°F)	ELECTRICAL				MOTOR DATA				MOUNTING HEIGHT (FT)	MANUFACTURER & MODEL#	REMARKS
									KW	VOLT	PH	MCA	RPM	HP	VOLT	PH			
EUH-1	PUMP RM	FREEZE PROTECTION HEATING	HORIZONTAL DISCHARGE	17.1	400	12	65	105	5	460	3	6.1	1550	1/125	460	3	9	TRANE #UHEC-053DACA	PROVIDE MANUFACTURER'S MOUNTING BRACKETS AND HARDWARE FOR CEILING SUSPENDED OR WALL MOUNTED INSTALLATION. PROVIDE UNIT HEATER WITH 120 LINE VOLTAGE THERMOSTAT, INSTALLED AND WIRED BY EC.
EUH-2	PUMP RM	FREEZE PROTECTION HEATING	HORIZONTAL DISCHARGE	17.1	400	12	65	105	5	460	3	6.1	1550	1/125	460	3	9	TRANE #UHEC-053DACA	

DUCTLESS HEAT PUMP SPLIT SYSTEM SCHEDULE

TAG (INDOOR/ OUTDOOR)	SERVICE	COOLING (BTUH)	HEATING @ 17°F (BTUH)	SEER	OA CFM	REFRIGERANT	OUTDOOR UNIT	ELECTRICAL DATA (OUTDOOR UNIT)					INDOOR UNIT			REMARKS
							MANUFACTURER & MODEL#	VOLT	PH	HZ	MCA	MOCP	MANUFACTURER & MODEL#	CFM (HIGH/LOW)	MOUNTING STYLE	
HPU-1A/1B	CONTROL ROOM	24,000	16,000	13.6	30	R410A	MITSUBISHI PUZ-A24NHA4	208	1	60	18	30	MITSUBISHI PLA-A24NHA4	640/420	CEILING RECESSED	PROVIDE FRESH AIR INTAKE KIT, CONDENSATE PUMP AND MOUNTING BRACKET FOR INDOOR UNITS. PROVIDE INVERTER TYPE COMPRESSOR, LOW AMBIENT CONTROL (FOR 0° AMBIENT COOLING), WIND BAFFLE AND MOUNTING BASE FOR OUTDOOR UNIT. INDOOR UNIT POWERED FROM OUTDOOR UNIT.
HPU-2A/2B	CONTROL ROOM	24,000	16,000	13.6	30	R410A	MITSUBISHI PUZ-A24NHA4	208	1	60	18	30	MITSUBISHI PLA-A24NHA4	640/420	CEILING RECESSED	

ELECTRIC DUCT HEATER SCHEDULE

TAG	LOCATION	SERVICE	TYPE	DUCT SIZE (WXH)	DESIGN CFM	EAT (°F)	LAT (°F)	NO. OF CONTROL STEPS	ELECTRICAL			MANUFACTURER & MODEL#	REMARKS
									KW	VOLT	PH		
EDH-1	PUMP RM	OA HEATING	FLANGED ELECTRIC DUCT MOUNTED HEATER	12"x12"	260	0	65	2	6.0	460	3	GREENHECK #IDHC FLANGED	PROVIDE UL LISTED DUCT HEATER AND PANEL, STEP CONTROLLER, AND CONTROL OPTION INCLUDING THERMAL CUTOUTS, AIRFLOW SWITCH, CONTACTOR, DISCONNECT SWITCH, CONTROL TRANSFORMER, AND DOOR INTERLOCKING DISCONNECTING SWITCH. PROVIDE WITH MANUFACTURER'S THERMOSTAT FOR DUCT MOUNTING AT ELECTRIC DUCT HEATING COIL DISCHARGE. PROVIDE ANY NECESSARY HARDWARE, ACCESSORIES AND APPURTENANCES FOR ELECTRIC DUCT HEATING COIL INSTALLATION.

LOUVER SCHEDULE

TAG	LOCATION	AREA	SERVICE	TYPE	WIDTH (IN)	HEIGHT (IN)	FREE AREA (SF)	DESIGN AIRFLOW (CFM)	MAX VELOCITY (FPM)	MATERIAL	FINISH	OPERATOR	MANUFACTURER & MODEL#	REMARKS
LV-1	EXTERIOR WALL	PUMP RM	OUTSIDE AIR INTAKE FOR EF-1	FIXED BLADE DRAINABLE, WITH INTEGRAL MOTORIZED DAMPER	102	48	16.13	11,300	701	ALUMINUM	KYNAR 2-COATS MINIMUM	120 VAC	GREENHECK #ECD-601-102X48 WITH CONTROL ACTUATOR(S)	PROVIDE LOW-LEAKAGE MOTORIZED DAMPER, PROVIDE ALL RELAYS AND WIRING NECESSARY TO HARD-WIRE INTERLOCK DAMPER MOTOR WITH EF-1; PROVIDE CONTROLS TRANSFORMER AS NECESSARY TO COORDINATE DAMPER MOTOR VOLTAGE WITH FAN MOTOR VOLTAGE. COORDINATE FINAL LOUVER COLOR AND FINISH WITH ARCHITECT; PROVIDE INTERNAL ALUMINUM BIRD AND INSECT SCREEN.
LV-2	EXTERIOR WALL	PUMP RM	OUTSIDE AIR INTAKE FOR SF-1	WIND-DRIVEN FIXED BLADE DRAINABLE	18	14	0.38	260	510	ALUMINUM	KYNAR 2-COATS MINIMUM	NA	GREENHECK #EHH-601-18X14	COORDINATE FINAL LOUVER COLOR AND FINISH WITH ARCHITECT; PROVIDE ALUMINUM INSECT SCREEN ON INSIDE.

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ELECTRICAL ABBREVIATIONS

A	AMPERE
AC	ALTERNATING CURRENT
AF	AMPERE FRAME
AFF/G	ABOVE FINISHED FLOOR/GRADE
AIC	AMPERE INTERRUPTING CAPACITY
AT	AMPERE TRIP
AUX	AUXILIARY
A/V	AUDIBLE/VISUAL
AWG	AMERICAN WIRE GAUGE
BB	BACKBOARD
BCW	BARE COPPER WIRE
BATT	BATTERY
BTM	BOTTOM
BKR	BREAKER
BLDG	BUILDING
C	CONDUIT
CAB	CABINET
CATV	COMMUNITY ACCESS TELEVISION (CABLE TELEVISION)
CB	CIRCUIT BREAKER
CIR	CIRCUIT
CKT	CIRCUIT
C	CENTERLINE
CO	COMPANY
COMM	COMMUNICATIONS
CONN	CONNECTION, CONNECT
CUH	CABINET UNIT HEATER
CT	CURRENT TRANSFORMER
CU	COPPER
CWA	CONSTANT WATTAGE AUTOTRANSFORMER
	DELTA CONNECTION
∆	DEEP
DB	DECIBEL
DET	DETECTOR
DIA	DIAMETER
DISC	DISCONNECT
DIST	DISTRIBUTION
DIV	DIVISION
DN	DOWN
DWG	DRAWING
EA	EACH
EBH	ELECTRIC BASEBOARD HEATER
EF	EXHAUST FAN
EL	ELEVATION
ELEC	ELECTRIC(AL)
EMER	EMERGENCY
ENCL	ENCLOSURE
EQUIP	EQUIPMENT
EWC	ELECTRIC WATER COOLER
EXT	EXTERIOR
F	FUSE(D)
FA	FIRE ALARM
FACP	FIRE ALARM CONTROL PANEL
FC	FOOTCANDLES
FIXT	FIXTURE
FLR	FLOOR
FLUOR	FLUORESCENT
FT	FOOT(FEET)
FUT	FUTURE
G,GND	GROUND
GALV	GALVANIZE(D)
GC	GENERAL CONTRACTOR
GFI	GROUND FAULT CIRCUIT INTERRUPTER
GFP	GROUND FAULT PROTECTION
HD	HEAVY DUTY
HGT	HEIGHT
HID	HIGH INTENSITY DISCHARGE
HO	HIGH OUTPUT
HOA	HAND-OFF-AUTOMATIC
HP	HORSEPOWER
HPF	HORSE POWER FACTOR
HPS	HIGH PRESSURE SODIUM
HTR	HEATER
HV	HIGH VOLTAGE
HW	HOT WATER
ID	IDENTIFY, IDENTIFICATION
INCAND	INCANDESCENT
J-BOX	JUNCTION BOX
J.C.	JANITOR CLOSET
JCT	JUNCTION
KCM/Kcmil	THOUSAND CIRCULAR MILS
KVA	KILO VOLT AMPERE
KW	KILOWATT
LGT	LIGHTING
LT(S)	LIGHT(S)
LED	LIGHT EMITTING DIODE
L	LOUVER
MAX	MAXIMUM
MCB	MAIN CIRCUIT BREAKER
MC	METAL CLAD CABLE
MFR	MANUFACTURER
MH	METAL HALIDE
MECH	MECHANICAL
MIN	MINIMUM
ML	MOTORIZED LOUVER
MLO	MAIN LUGS ONLY
MT	MOUNT
MTD	MOUNTED
MTR	MOTOR
N	NORTH
NEC	NATIONAL ELECTRICAL CODE
NF	NON-FUSED
NL	NIGH LIGHT
NO#	NUMBER
OC	OVER COUNTER
OL	OVERLOAD
P	POLE(S)
PA	PUBLIC ADDRESS
PNL	PANEL
PR	PAIR
PRI	PRIMARY
PWR	POWER
	PHASE
PT	PRESSURE TREATED
RECEPT	RECPTACLE
RGS	RIGID GALVANIZED STEEL
RM	ROOM
WP	WEATHER PROOF

ELECTRICAL ABBREVIATIONS CON'T

SEC	SECONDARY
SH	SHIELDED
SPKR	SPEAKER
SPD	SURGE PROTECTION DEVICE
SW	SWITCH
TEMP	TEMPORARY/TEMPERATURE
T-STAT	THERMOSTAT
TB	TERMINAL BOARD
TYP	TYPICAL
UH	UNIT HEATER
UON	UNLESS OTHERWISE NOTED
V	VOLT, VOLTS
VA	VOLT-AMPERES
VFD	VARIABLE FREQUENCY DRIVE
W	WATT,WIRE
W/	WITH
WP	WEATHERPROOF
XFMR/T	TRANSFORMER
Y	WYE CONNECTION

DEVICES AND APPURTENANCES

SM	MOTOR RATED TOGGLE SWITCH WITH THERMAL OVERLOADS SIZED PER NEC
	ALL RECEPTACLES TO BE MOUNTED AT 48" ABOVE FINISHED FLOOR DUPLEX RECEPTACLE, SUBSCRIPT DENOTES -WP=WEATHER PROOF GFI=GROUND FAULT CURRENT INTERRUPTER
S	COMBINATION SMOKE / HEAT DETECTOR ALARM, CEILING MOUNTED, 120V WITH 9 VOLT BATTERY BACKUP, WITH AUX CONTACTS TO BE MONITORED VIA PLC/SCADA. UL LISTED, MANUFACTURED BY GENTEX, 9123 SERIES OR APPROVED EQUAL.

POWER DISTRIBUTION EQUIPMENT

	SURFACE MOUNTED BRANCH CIRCUIT PANELBOARD 480/277V, 3Ø, 4W, UON
	SURFACE MOUNTED BRANCH CIRCUIT PANELBOARD 480/277V, 3Ø, 4W, UON
	DISTRIBUTION PANEL
VFD	VARIABLE FREQUENCY DRIVE
	COMBINATION MOTOR STARTER/FUSED DISCONNECT NEMA-4X
	DISCONNECT SWITCH, NON-FUSED
	DISCONNECT SWITCH, FUSED

LIGHTING

REFER TO LIGHTING FIXTURE SCHEDULE FOR TYPE, LAMP, BALLAST, POWER REQUIREMENTS, MOUNTING HEIGHT AND MANUFACTURER.

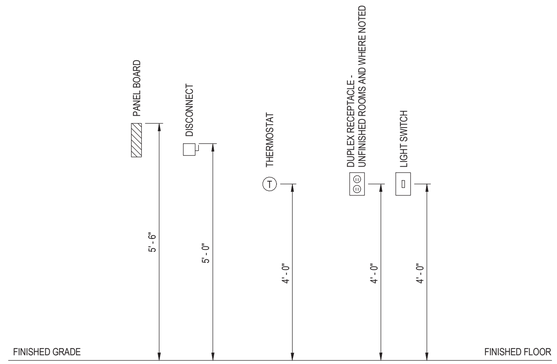
$	SINGLE POLE LIGHT SWITCH, SUBSCRIPT DENOTES: -3=3 WAY SWITCH -4=4 WAY SWITCH O=OCCUPANCY WALL SWITCH -D=DIMMER SWITCH -K=KEYED SWITCH -a=LOWER CASE LETTER DENOTES CONTROL OF FIXTURE (S) AND/OR LAMPS WITH MATCHING LETTER
	1X4 LIGHT FIXTURE
	EXTERIOR LIGHT
	EXIT SIGN
	EMERGENCY WALL PACK
	EXTERIOR LIGHTING

GENERAL

#	NUMBER IN CIRCLE, WITH OR WITHOUT ARROW OR LEADER, REFER TO MATCHING NUMBERED CODED NOTE
#	NUMBER IN DIAMOND, WITH OR WITHOUT ARROW OR LEADER; REFER TO THE DEMOLITION CODED NOTE WITH THE MATCHING NUMBER
X XXX	DETAIL CALLOUT

ONE LINE DIAGRAMS

	POWER TRANSFORMER
AMPS FRAME → 400AF AMPS TRIP → 400AT NR. OF POLES → 3P GFP	MOLDED CASE CIRCUIT BREAKER W/GROUND FAULT PROTECTION
M.T.S. U G L	MANUAL TRANSFER SWITCH G - GENERATION U - UTILITY L - LOAD
X	MOTOR
	GROUND
VFD	VARIABLE FREQUENCY DRIVE
M	UTILITY METER
CT/PT	CURRENT TRANSFORMER / POTENTIAL TRANSFORMER



MOUNTING ELEVATIONS NOTES:

1. COORDINATE MOUNTING HEIGHTS WITH ARCHITECTURAL PLANS, ELEVATIONS AND CASEWORK DETAILS.

2. IN LOCATIONS WHERE DIVICES ARE MOUNTED AT THE SAME HEIGHT, DEVICES SHALL BE PROPERLY "GAUGED" WHEN FEASIBLE AND SHALL HAVE A SINGLE COVER PLATE.

3. IN LOCATIONS WHERE DIFFERENT DEVICES ARE MOUNTED AT DIFFERENT HEIGHTS WITHIN FOUR FEET OF ONE ANOTHER, DEVICES SHALL BE MOUNTED SUCH THAT THEY HAVE A COMMON CENTERLINE. IF THERE ARE THREE OR MORE DEVICES, THE CONTRACTOR SHALL REQUEST A DETAIL FROM THE ARCHITECT.

4. ELEVATIONS SHOWN ARE TYPICAL, EXCEPTIONS ARE NOTED ON PLANS

1 TYPICAL DEVICE MOUNTING ELEVATIONS

NOT TO SCALE

GENERAL NOTES

1. GENERAL NOTES APPLY TO ALL CONTRACT DRAWINGS.
2. REFER TO ARCHITECTURAL, CIVIL, INSTRUMENTATION, MECHANICAL AND STRUCTURAL DRAWINGS FOR SYMBOLS ASSOCIATED WITH WORK OF OTHER TRADES.
3. CONDUIT RUNS SHOWN ARE DIAGRAMMATIC. EXACT LOCATION OF ALL CONDUIT RUNS SHALL BE DETERMINED IN THE FIELD. COORDINATE INSTALLATIONS AND AVOID CONFLICT WITH UTILITIES, FOUNDATIONS, EQUIPMENT, PIPING, DUCTWORK, ACCESS DOORS AND WORK BY OTHER TRADES.
4. UNLESS OTHERWISE INDICATED, CIRCUITS SHALL BE 3/4"C.-2#12, 1#12 G. SINGLE PHASE AND 3/4"C.-3# 12, 1#12 G. THREE PHASE. ALL EXPOSED EXTERIOR CONDUITS FOR POWER CIRCUITS SHALL BE RGS CONDUITS.
5. PROVIDE TEMPORARY POWER AND LIGHTING FOR CONSTRUCTION WORK.
6. THE CONTRACTOR SHALL PROVIDE A DETAILED SET OF RECORD DRAWINGS, FOR THE BUILDINGS, SITE, AND DETAILS, CONSISTENT WITH PROVISIONS IN THE SPECIFICATIONS.
7. WHERE PRACTICAL, I/O WIRING CAN BE COMBINED (ROUTED IN A COMMON RACEWAY) BY SIGNAL TYPE PROVIDED THE RACEWAY DOES NOT EXCEED 40% INSIDE AREA OF CONDUCTOR FILL AS PER NEC REQUIREMENTS OF RACEWAY FILL. RACEWAYS CAN BE CONDUIT, WIREWAY OR CABLE TRAY. ALL EXTERIOR EXPOSED RACEWAYS SHALL BE RGS CONDUIT. DO NOT MIX SIGNAL TYPES IN A COMMON RACEWAY.
8. PROVIDE ONE #12AWG (MIN.) GROUNDING CONDUCTOR IN EACH WIRING RACEWAY INCLUDING CONTROL AND I/O WIRING RACEWAYS. PROVIDE PROPER GROUNDING OF ALL EQUIPMENT AS REQUIRED BY THE NEC.
9. WIRING REQUIREMENTS MAY VARY PER INSTRUMENT, VALVE OR DEVICE MANUFACTURER. PROVIDE POWER AND CONTROL WIRING, POWER SUPPLIES ETC. AS REQUIRED BY THE FINAL SELECTED EQUIPMENT MANUFACTURER'S REQUIREMENTS.
10. CONCEAL CONDUITS AND/OR WIRING WITHIN WALLS, UNDERFLOORS AND/OR ABOVE CEILINGS EXCEPT FOR ELECTRICAL ROOMS, MECHANICAL ROOMS, GARAGE SPACES AND AS NOTED IN CONTRACT DOCUMENTS.
11. CONDUIT TYPE AS FOLLOWS: UNDERGROUND - SCHEDULE 80 PVC; EXTERIOR, WET/DAMP - RIGID GALVANIZED STEEL; PUMP ROOM - RIGID GALVANIZED STEEL; DRY, ELECTRICAL/CONTROL ROOM - EMT.
12. NO WELDING OR DRILLING OF THE BUILDING STEEL IS PERMITTED WITHOUT PRIOR STRUCTURAL ENGINEER'S APPROVAL. CLAMPING IS TO BE USED EXCLUSIVELY.
13. TO PREVENT THE TRANSFER OF TEMPERATURE, MOISTURE AND GASES, PROVIDE POLYWATER FST DUCT SEALANT FOR ANY CONDUIT ENTERING AN ELECTRICAL ENCLOSURE I NTHE BUIDLING INTERIOR FROM OUTDOORS OR FROM BELOW GRADE. ELECTRICAL ENCLOSURES INCLUDE ELECTRICAL POWER DISSTRIBUTION PANELS, BRANCH CIRCUIT PANELS, MOTOR CONTROL CENTERS, TRANSFORMERS, CONTROL PANELS, SAFETY SWITCHES, ENCLOSED CIRCUIT BREAKERS, TRANSFER SWITCHES ETC.
14. PROVIDE WIRING AND GROUNDING OF VFD'S AND MOTORS PER MANUFACTURER'S RECOMMENDATIONS. SEE VARIABLE FREQUENCY DRIVE GROUNDING DETAIL FOR GROUNDING REQUIREMENTS.
15. USE XLPE DRIVE CABLE FOR MOTOR FEEDERS FROM VFD TO MOTOR. EACH VFD MOTOR FEEDER SHALL BE ROUTED IN A SEPARATE DEDICATED RACEWAY WITH GROUND CONDUCTOR AND NOT COMBINED WITH ANY OTHER CIRCUITS. THIS IS TO AVOID HARMONIC NOISE AND REFLECTIVE WAVE INTERFERENCES.
16. PROVIDE ALL REQUIRED PROGRAMMING OF VFD'S. PROVIDE A HARD COPY OF EACH VFD'S PROGRAMMING PARAMETERS TO THE OWNER AND ENGINEER. PROGRAM VFD'S TO RESET RATHER THAN FAULT AFTER A POWER FAILURE CONDITION.
17. ALL ETHERNET CAT 6 NETWORKING CABLE SHALL BE ROUTED IN A DEDICATED RACEWAY/CONDUIT 1" MINIMUM.
18. PROVIDE PROPER GROUNDING FOR ALL EQUIPMENT PER THE NATIONAL ELECTRICAL CODE (NEC) REQUIREMENTS.
19. PROVIDE A HOUSEKEEPING/EQUIPMENT PAD FOR ALL SLAB/FLOOR MOUNTED ELECTRICAL AND CONTROL EQUIPMENT, INCLUDING BUT NOT LIMITED TO PWOER DISTRIBUTION EQUIPMENT SWICHGEAR, PANELS, MOTOR CONTROL CENTERS, VFD'S, AUTOMATIC TRANSFER SWITCHES, TRANSFORMERS, AND CONTROL PANELS. HOUSINGKEEPING PADS TO BE A MINIMUM OF 4" THICK, SEE DETAIL.
20. THE TRANSFORMER PAD AND ELECTRICAL SERVICE REQUIREMENTS MUST CONFORM TO THE ELECTRICAL UTILITY REQUIREMENTS AND STANDARDS. THE ELECTRICAL UTILITY SERVICING THIS PROJECT SITE IS THE TOWN OF BEDFORD, VIRGINIA. CONTRACTOR IS RESPONSIBLE FOR PAYING ALL UTILITY FEES REQUIRED FOR THE ELECTRICAL SERVICE. FOR ADDITIONAL INFORMATION CONCERNING THE UTILITY SERVICE APPLICATION, CONTACTS, AND REQUIREMENTS, VISIT HTTP://WWW.BEDFORDVA.GOV/1174/SERVICE-STANDARDS.

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BEDFORD REGIONAL WATER AUTHORITY

ROUTE 460 PUMP STATION
BEFORD, VA.

COMMONWEALTH OF VIRGINIA
JOHN J. WUJEK
Lic. No. 0402048359
6/20/2018
PROFESSIONAL ENGINEER

No.	Submittal / Revision	App'd.	By	Date
1	BID ISSUE	ETA	CTB	06/20/18

ELECTRICAL LEGEND, ABBREVIATIONS AND SYMBOLS

Designed By:	Drawn By:	Checked By:
NS	CJE	JJW
Issue Date:	Project No:	Scale:
08/01/17	27872-3002	AS SHOWN

Drawing No:

E-001

Central File: Update this text with Central file location
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BYPASS CONTROL VALVE V-130, BELOW GRADE SEE C-101

2 E-701 UNDERGROUND CONCRETE ENCASED CONDUITS. PROVIDE (2) 1" CONDUITS, ONE 1"C FOR POWER (3#12+GND) AND ONE 1"C FOR CONTROL WIRING PER FIELD WIRED I/O SCHEDULE, E-704.

3 E-702 SEE E-101 FOR SERVICE ENTRANCE EQUIPMENT LOCATIONS

UNDERGROUND CEMENT ENCASED CONDUITS. PROVIDE (3) 2-1/2" CONDUITS FOR UTILITY POWER, (1) 2-1/2" CONDUIT FOR UTILITY SPARE. SEE DETAIL 2/E-701 FOR CONSTRUCTION DETAILS. PROVIDE NYLON PULL LINE IN ALL SPARE CONDUITS WITH 6 FOOT SLACK EACH END.

PUMP STATION BUILDING

(2) SPARE 2" TELECOMMUNICATION CONDUITS. TERMINATE INSIDE BUILDING 24" ABOVE FINISHED FLOOR. PROVIDE WITH PULL LINE. CAP WITH 2" PLASTIC BUSHING AND CONDUIT PENNY.

PROVIDE 18" VERTICAL CLEARANCE BETWEEN WATER LINE AND ELECTRICAL AT CROSSING

UNDERGROUND SERVICE ENTRANCE FEEDER

1 E-701

T

ROUTE 460/
EAST MAIN STREET

TAX MAP#
237-3-10-T

EAST CREST DRIVE

2 E-701 UNDERGROUND CONCRETE ENCASED CONDUITS. PROVIDE (3) 3" CONDUITS FOR UTILITY POWER, (1) 3" CONDUIT FOR UTILITY SPARE, (2) 2" SPARE COMMUNICATION CONDUITS. SEE DETAIL 2/E-701 FOR CONSTRUCTION DETAILS. PROVIDE NYLON PULL LINE IN ALL SPARE CONDUITS WITH 6 FOOT SLACK EACH END.

UTILITY PAD MOUNTED TRANSFORMER

UNDERGROUND CONCRETE ENCASED CONDUITS. PROVIDE (3) 3" CONDUITS FOR UTILITY POWER, (1) 3" CONDUIT FOR UTILITY SPARE, (2) 2" SPARE COMMUNICATION CONDUITS. SEE DETAIL 2/E-701 FOR CONSTRUCTION DETAILS. PROVIDE NYLON PULL LINE IN ALL SPARE CONDUITS WITH 6 FOOT SLACK EACH END.

2 E-701

UNDERGROUND PRIMARY UTILITY SERVICE FEEDER

TAX MAP#
236-3-18-T

1 E-702 EXISTING ELECTRICAL UTILITY POLE

(2) SPARE 2-1/2" TELECOMMUNICATION CONDUITS. TERMINATE 8' TO 10' ABOVE GRADE ON POLE. PROVIDE WITH PULL LINE. CAP WITH 2-1/2" PLASTIC BUSHING AND CONDUIT PENNY.

TAX MAP#
237-3-16-T

ELECTRICAL SITE PLAN
1" = 10'

GRAPHIC SCALE (FEET)
1"=10'
0' 10' 20' 30' 40' 50'

COMMONWEALTH OF VIRGINIA
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Lic. No. 0402048359
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6/20/2018

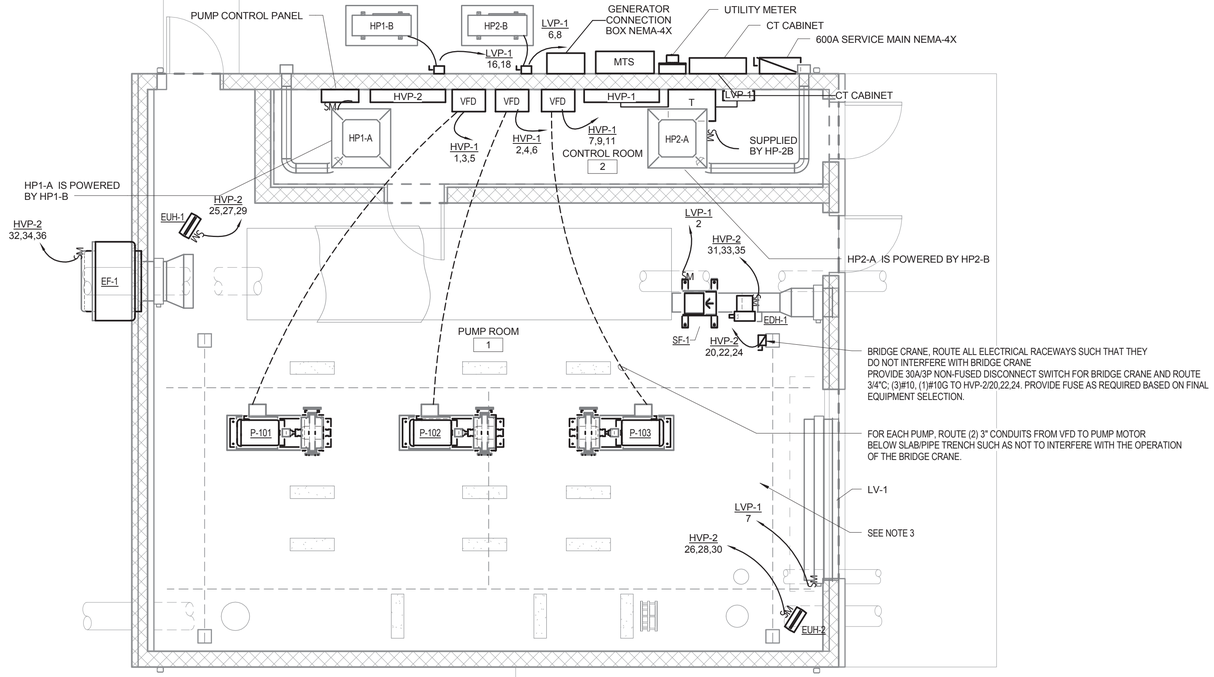
ROUTE 460 PUMP STATION
BEDFORD, VA.

No.	Submittal / Revision	App'd	By	Date
	BID ISSUE	ETA	CTB	06/20/18

ELECTRICAL SITE PLAN

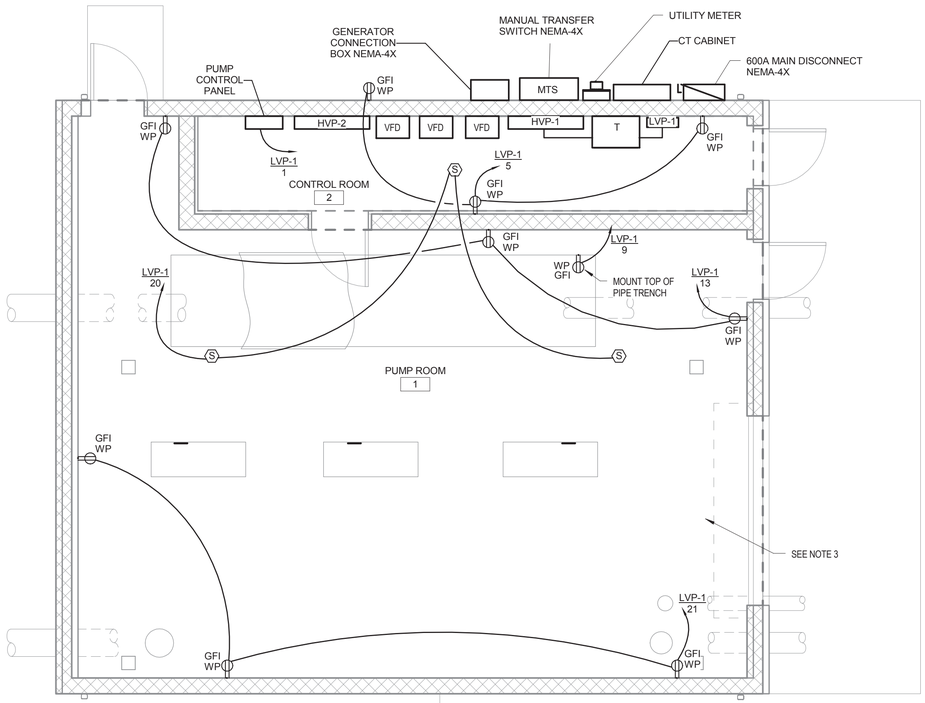
Designed By:	Drawn By:	Checked By:
NMS	CE	JJW
Issue Date:	Project No:	Scale:
08/01/17	27872-3002	AS SHOWN

Drawing No.:
E-002



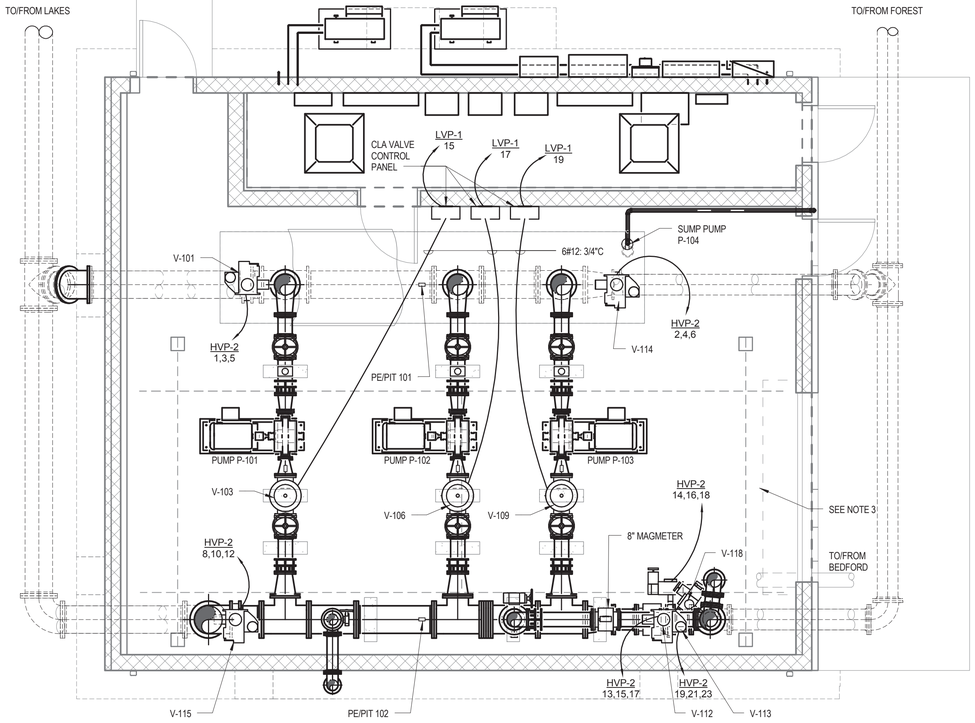
1 PUMP STATION - MECHANICAL - ELECTRICAL POWER PLAN

1/4" = 1'-0" 0' 2' 4' 8'



2 PUMP STATION - POWER PLAN

1/4" = 1'-0" 0' 2' 4' 8'



3 PUMP STATION - PROCESS AUTOMATION ELECTRICAL PLAN

1/4" = 1'-0" 0' 2' 4' 8'

GENERAL NOTES

1. FOR LOCATION OF PROCESS EQUIPMENT SUCH AS CONTROL VALVES AND INSTRUMENTATION, SEE SHEET M-101.
2. SEE SHEET E-704 FOR ADDITIONAL WIRING REQUIREMENT INFORMATION.
3. CONDUITS ROUTED TO DEVICES MOUNTED BENEATH BRIDGE CRANE MUST BE ROUTED BENEATH FLOOR SLAB SUCH AS NOT TO INTERFERE WITH THE OPERATION OF THE BRIDGE CRANE.

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ROUTE 460 PUMP STATION
BEFORD, VA.

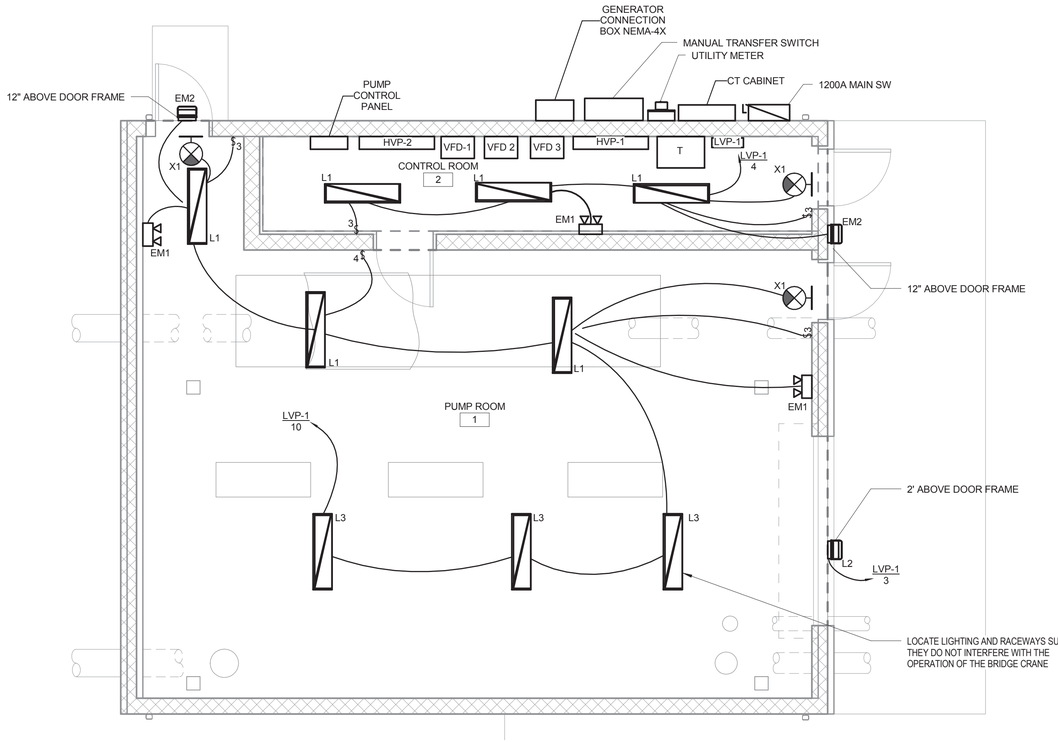
No.	Submittal / Revision	App'd.	By	Date
1	BID ISSUE	ETA	CTB	06/20/18

POWER AND SYSTEMS PLAN

Designed By:	Drawn By:	Checked By:
NS	CJE	JJW
Issue Date: 08/01/17	Project No: 27872-3002	Scale: AS SHOWN

Drawing No:

E-101



1 FINISHED FLOOR - LIGHTING PLAN

1/4" = 1'-0" 0' 2' 4' 8'

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No.	Submittal / Revision	App'd.	By	Date
1	BID ISSUE	ETA	CTB	06/20/18

LIGHTING PLAN

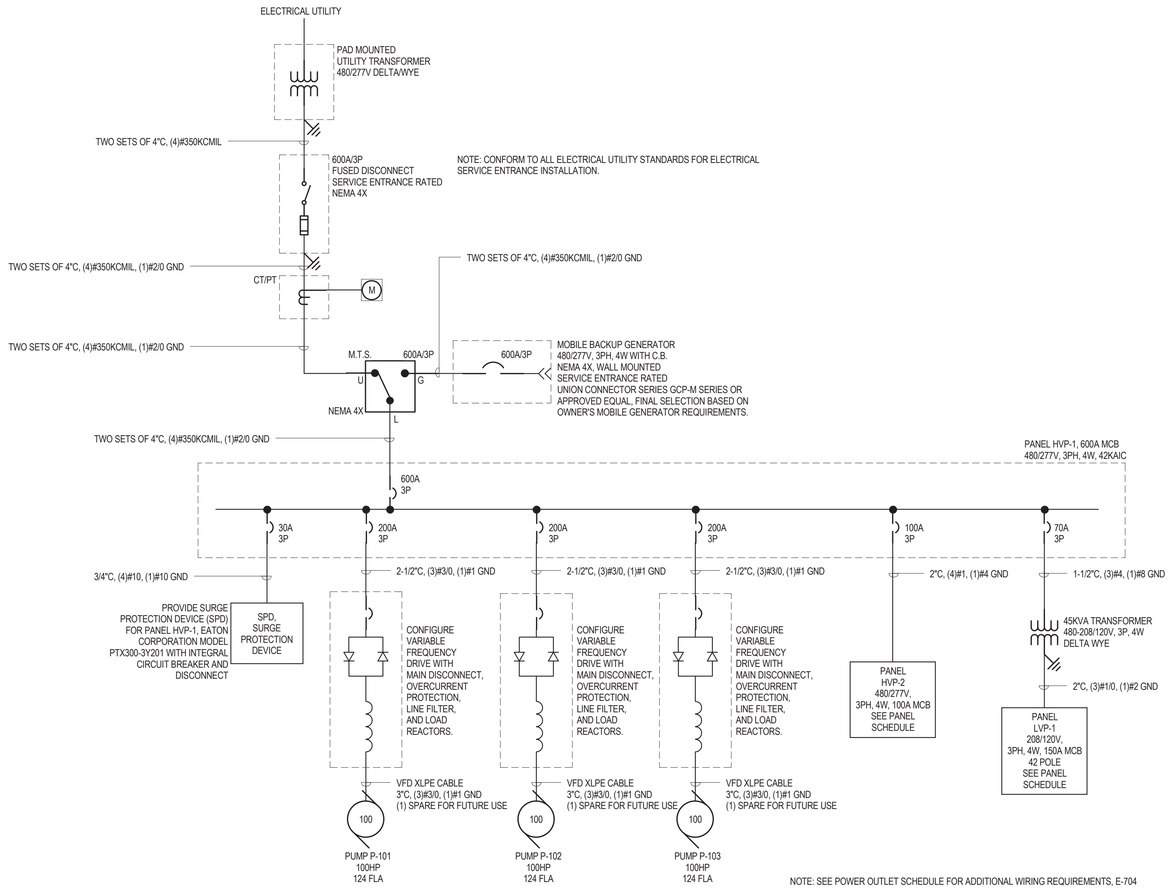
Designed By:	Drawn By:	Checked By:
NS	CJE	JJW
Issue Date:	Project No:	Scale:
08/01/17	27872-3002	AS SHOWN

Drawing No:

E-201

Lighting Fixture Schedule

FIXTURE TAG	FIXTURE TYPE	DESCRIPTION	FIXTURE MOUNTING	VOLTS	LAMPS	WATTAGE	MANUFACTURER CATALOG NUMBER	COMMENTS
EM1	LED	EMERGENCY BATTERY BACKUP LIGHT; 3000K COLOR TEMPERATURE	WALL, 8' AFF	120V	LED	20 W	LITHONIA INDX618 SEL	
EM2	LED	EXTERIOR EMERGENCY WALL MOUNTED LED FIXTURE WITH AMBIENT LIGHT SENSOR & MOTION CONTROL; 3000K COLOR TEMPERATURE	WALL	120V	LED	20 W	LITHONIA WSTLED-1-10A700/30K-SR4-MVOLT-PIR-COLOR BY ARCH-ELOW	
L1	LED	ENCLOSED AND GASKETED RATED INDUSTRIAL FIXTURE; 3000K COLOR TEMPERATURE	SUSPENDED, 9' AFF TO BOTTOM	120V	1	39 W	LITHONIA FEM4 LED 3L IMAFL 120	
L2	LED	EXTERIOR WALL MOUNTED LED FIXTURE; 3000K COLOR TEMPERATURE	WALL	120V	LED	20 W	LITHONIA WSTLED2-10A700/30K-SR4-MVOLT-PIR-COLOR BY ARCH	
L3	LED	ENCLOSED AND GASKETED RATED INDUSTRIAL FIXTURE; 3000K COLOR TEMPERATURE	SUSPENDED, 16' 8" AFF TO BOTTOM	120V	1	78 W	LITHONIA FEM86L LED 3L IMAFL 120	
X1	LED	EMERGENCY BATTERY BACK-UP AND LED EXIT LIGHT, UL LISTED WET; 3000K COLOR TEMPERATURE	WALL	120V	LED	3 W	LITHONIA LV S W 1 R 120 EL N 4X	



1 ELECTRICAL ONE-LINE

NOT TO SCALE

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ROUTE 460 PUMP STATION
BEFORD, VA.

No.	Submittal / Revision	App'd	By	Date
1	BID ISSUE	ETA	CTB	06/20/18

ONE-LINE DIAGRAM

Designed By:	Drawn By:	Checked By:
NS	CJE	JJW
Issue Date: 08/01/17	Project No: 27872-3002	Scale: AS SHOWN

Drawing No:

E-601

LOCATION: CONTROL ROOM
MOUNTING: SURFACE
SOURCE: UTILITY

PANEL ID
HVP-1

VOLTS, PHASE, WIRE: 480/277V, 3 PHASE, 4 WIRE
MAINS: 600A MCB
SHORT CIRCUIT RATING: 22kAIC

CKT	LOAD DESCRIPTION	CB/ AMPS	P	A		B		C		P	CB/ AMPS	LOAD DESCRIPTION	CKT
1				34333 VA	34333 VA								2
3	VARIABLE FREQUENCY DRIVE, PUMP P-101	200 A	3			34333 VA	34333 VA			3	200 A	VARIABLE FREQUENCY DRIVE, PUMP P-102	4
5								34333 VA	34333 VA				6
7				34333 VA	11923 VA								8
9	VARIABLE FREQUENCY DRIVE, PUMP P-103	200 A	3			34333 VA	11923 VA			3	100 A	HVP-2	10
11								34333 VA	11923 VA				12
13				4843 VA	0 VA								14
15	PANEL LVP-1 VIA 45KVA TRANSFORMER	70 A	3			3843 VA	0 VA			3	30 A	SURGE PROTECTION DEVICE	16
17								5740 VA	0 VA				18
19				0 VA	0 VA								20
21	PREPARED SPACE	0 A	3			0 VA	0 VA			3	0 A	PREPARED SPACE	22
23								0 VA	0 VA				24
25				0 VA	0 VA								26
27	PREPARED SPACE	0 A	3			0 VA	0 VA			3	0 A	PREPARED SPACE	28
29								0 VA	0 VA				30
		TOTAL LOAD:		119766 VA		118766 VA		120663 VA					
		TOTAL AMPS:		433 A		429 A		436 A					

NOTES:
SEE ONE-LINE DIAGRAM FOR CONDUIT AND CABLE FOR FEEDERS.

LOCATION: CONTROL ROOM
MOUNTING: SURFACE
SOURCE: HVP-1 VIA 45KVA TRANSFORMER

PANEL ID
LVP-1

VOLTS, PHASE, WIRE: 208/120V, 3 PHASE, 4 WIRE
MAINS: 150A MCB
SHORT CIRCUIT RATING: 10kAIC

CKT	LOAD DESCRIPTION	CB/ AMPS	P	A		B		C		P	CB/ AMPS	LOAD DESCRIPTION	CKT
1	PUMP CONTROL PANEL	20 A	1	0 VA	700 VA					1	20 A	SF-1 RM. 1	2
3	LIGHTING: EXTERIOR WALL PACK	20 A	1			55 VA	117 VA			1	20 A	LIGHTING	4
5	RECEPTACLE CONTROL ROOM	20 A	1					540 VA	2600 VA	2	40 A	HP2-A and HP2-B	6
7	LV-1	20 A	1	1000 VA	2600 VA								8
9	RECEPTACLE SUMP PUMP	20 A	1			180 VA	351 VA			1	20 A	LIGHTING	10
11	SPARE	20 A	1					0 VA	0 VA	1	20 A	SPARE	12
13	RECP. PUMP ROOM	20 A	1	540 VA	0 VA					1	20 A	SPARE	14
15	CLA VALVE V-103	20 A	1			0 VA	2600 VA			2	40 A	HP1-A and HP1-B	16
17	CLA VALVE V-106	20 A	1					0 VA	2600 VA				18
19	CLA VALVE V-109	20 A	1	0 VA	3 VA					1	20 A	SMOKE DETECTOR	20
21	RECEPTACLE	20 A	1			540 VA	0 VA			1	20 A	SPARE	22
23	SPARE	20 A	1					0 VA	0 VA	1	20 A	SPARE	24
25	SPARE	20 A	1	0 VA	0 VA					--	--	SPACE	26
27	SPARE	20 A	1			0 VA	0 VA			--	--	SPACE	28
29	SPACE	--	--					0 VA	0 VA	--	--	SPACE	30
31	SPACE	--	--	0 VA	0 VA					--	--	SPACE	32
33	SPACE	--	--			0 VA	0 VA			--	--	SPACE	34
35	SPACE	--	--					0 VA	0 VA	--	--	SPACE	36
37	SPACE	--	--	0 VA	0 VA					--	--	SPACE	38
39	SPACE	--	--			0 VA	0 VA			--	--	SPACE	40
41	SPACE	--	--					0 VA	0 VA	--	--	SPACE	42
		TOTAL LOAD:		4843 VA		3843 VA		5740 VA					
		TOTAL AMPS:		42 A		32 A		49 A					

NOTES:
1. PROVIDE 3/4"C, (2)#12, (1)#12G FOR EACH 20A/1P CIRCUIT BREAKER.
2. PROVIDE 3/4"C, (3)#8, (1)#8G FOR EACH 40A/2P CIRCUIT BREAKER.

LOCATION: CONTROL ROOM
MOUNTING: SURFACE
SOURCE: HVP-1

PANEL ID
HVP-2

VOLTS, PHASE, WIRE: 480/277V, 3 PHASE, 4 WIRE
MAINS: 100A MLO
SHORT CIRCUIT RATING: 22kAIC

CKT	LOAD DESCRIPTION	CB/ AMPS	P	A		B		C		P	CB/ AMPS	LOAD DESCRIPTION	CKT
1				570 VA	570 VA								2
3	LAKES SUCTION SIDE ISOLATION VALVE V-101	15 A	3			570 VA	570 VA			3	15 A	FOREST SUCTION SIDE ISOLATION / CONTROL VALVE V-114	4
5								570 VA	570 VA				6
7				0 VA	570 VA								8
9	SPARE	15 A	3			0 VA	570 VA			3	15 A	LAKES DISCHARGE SIDE ISOLATION / CONTROL VALVE V-115	10
11								0 VA	570 VA				12
13				570 VA	570 VA								14
15	BEDFORD FLOW METER CONTROL VALVE V-112	15 A	3			570 VA	570 VA			3	15 A	BEDFORD METER ISOLATION VALVE V-118	16
17								570 VA	570 VA				18
19				570 VA	1333 VA								20
21	FOREST DISCHARGE SIDE ISOLATION / CONTROL VALVE V-113	15 A	3			570 VA	1333 VA			3	30 A	BRIDGE CRANE	22
23								570 VA	1333 VA				24
25				1667 VA	1667 VA								26
27	PUMP ROOM ELECTRIC UNIT HEATER EUH-1	15 A	3			1667 VA	1667 VA			3	15 A	PUMP ROOM ELECTRIC UNIT HEATER EUH-2	28
29								1667 VA	1667 VA				30
31				2000 VA	1267 VA								32
33	PUMP ROOM ELECTRIC DUCT HEATER EDH-1	15 A	3			2000 VA	1267 VA			3	15 A	PUMP ROOM EXHAUST FAN EF-1	34
35								2000 VA	1267 VA				36
37				0 VA	570 VA								38
39	SPARE	15 A	3			0 VA	570 VA			3	15 A	PS BYPASS VALVE V-130	40
41								0 VA	570 VA				42
		TOTAL LOAD:		11923 VA		11923 VA		11923 VA					
		TOTAL AMPS:		43 A		43 A		43 A					

NOTES:
1. PROVIDE 3/4"C, (3)#12, (1)#12G FOR EACH 15A/3P CIRCUIT BREAKER.
2. PROVIDE 3/4"C, (3)#10, (1)#10G FOR EACH 30A/3P CIRCUIT BREAKER.

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BEDFORD
REGIONAL WATER
AUTHORITY

COMMONWEALTH OF VIRGINIA
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6/20/2018
PROFESSIONAL ENGINEER

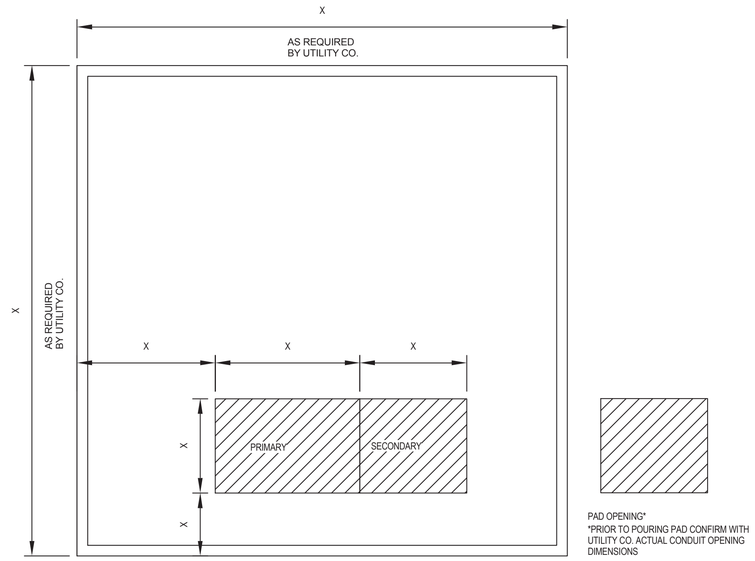
ROUTE 460 PUMP STATION
BEFORD, VA.

No.	Submittal / Revision	App'd	By	Date
1	BID ISSUE	ETA	CTB	06/20/18

PANEL SCHEDULES

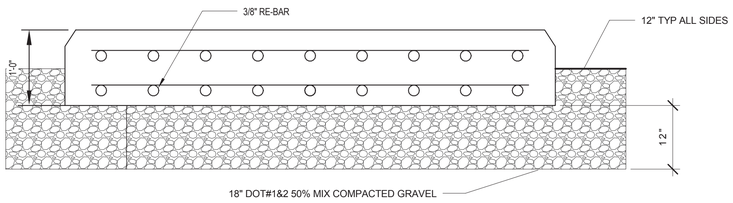
Designed By:	Drawn By:	Checked By:
NS	CJE	JJW
Issue Date:	Project No:	Scale:
08/01/17	27872-3002	AS SHOWN

Drawing No:
E-602



PAD OPENING*
*PRIOR TO POURING PAD CONFIRM WITH UTILITY CO. ACTUAL CONDUIT OPENING DIMENSIONS

FRONT OF TRANSFORMER



NOTE:
THE TRANSFORMER PAD AND ELECTRICAL SERVICE REQUIREMENTS MUST CONFORM TO THE ELECTRICAL UTILITY REQUIREMENTS AND STANDARDS. THE ELECTRICAL UTILITY SERVICING THIS PROJECT SITE IS THE TOWN OF BEDFORD, VIRGINIA. CONTRACTOR IS RESPONSIBLE FOR PAYING ALL UTILITY FEES REQUIRED FOR THE ELECTRICAL SERVICE. FOR ADDITIONAL INFORMATION CONCERNING THE UTILITY SERVICE APPLICATION, CONTACTS, AND REQUIREMENTS, VISIT HTTP://WWW.BEDFORDVA.GOV/1174/SERVICE-STANDARDS.

1 TRANSFORMER PAD DETAIL

NOT TO SCALE

CONCRETE PAD REQUIREMENTS FOR PAD MOUNT TRANSFORMERS.

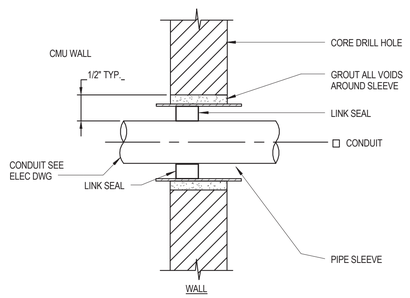
1. THE CONCRETE PAD IS TO BE FURNISHED BY THE ELECTRICAL CONTRACTOR FOR THE ELECTRICAL UTILITY REQUIREMENTS.
2. MINIMUM PAD THICKNESS SHALL BE 12", WITH 3/8" RE-BAR ON 12" CENTERS, INSTALLED BOTH WAYS THROUGHOUT CONCRETE PAD.
3. CORNERS AND EDGES OF FOUNDATION TO BE BEVELED.
4. THE ELEVATIONS OF THE PAD TOP SHALL BE A MINIMUM OF 4" ABOVE FINISHED GRADE.
5. THE PAD MUST BE LOCATED SUCH THAT THE MINIMUM CLEARANCE BETWEEN THE PAD AND ANY STRUCTURES OR FENCES IS 3 FEET ALONG THE SIDES AND BACK AND 10 FEET ALONG THE FRONT: THE AREA MUST BE EASILY ACCESSIBLE BY HEAVY TRUCKS FOR MAINTENANCE.
6. IF THE PAD IS LOCATED IN A TRAFFIC AREA, GUARD POSTS MUST BE FURNISHED AND INSTALLED AT THE CORNER OF THE PAD.
7. BEFORE POURING CONCRETE, THE CONTRACTOR SHOULD CONTACT THE ELECTRICAL UTILITY FOR INSPECTION OF FOUNDATION.

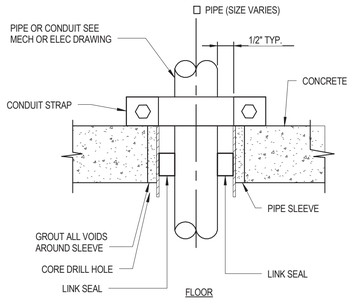
CODED NOTES

1. TRANSFORMER SIZE AND TYPE AS NOTED ON PLANS.
2. TRANSFORMER HOUSING GROUNDING LUGS/BAR.
3. GROUND TO CONDUIT BUSHINGS IF REQUIRED.
4. ALL CONDUCTOR AND CONDUIT SIZES AS NOTED ON PLANS.
5. 4/0 BARE COPPER WIRE TO BUILDING STEEL OR WATER SERVICE PER NEC 250. IF WATER SERVICE UTILIZES NONE CONDUCTIVE TYPE PIPE, GROUND TO BUILDING STEEL OR 5/8" DIA. x 10' LONG GROUND ROD. PROVIDE ADDITIONAL GROUNDING POINTS TO OBTAIN 25 OHMS OR LESS RESISTANCE.

3 SEPARATELY DERIVED GROND DETAIL

NOT TO SCALE

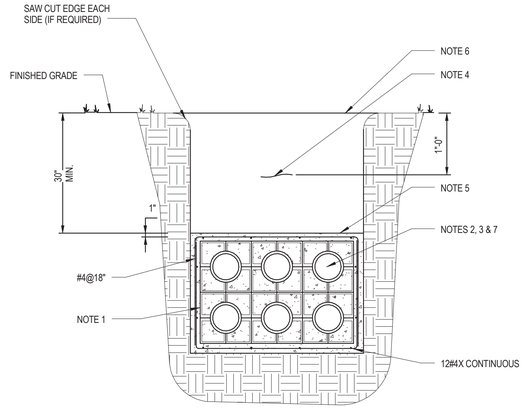




NOTE: ANCHOR PIPE AS REQUIRED TO PREVENT MOVEMENT THRU PENETRATION.

4 CONDUIT PENETRATIONS WITH LINK SEAL

NOT TO SCALE

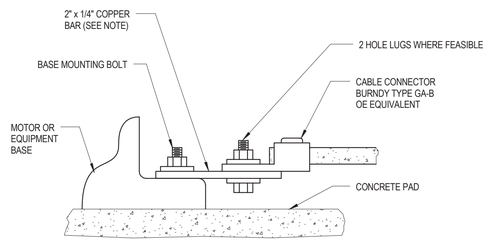


DUCT NOTES

1. PROVIDE BASE SPACERS AND INTERMEDIATE SPACERS AT 5'-0" ON CENTER.
2. PROVIDE WIRING IN CONDUITS AS INDICATED ON PLANS AND/OR ON FEEDER SCHEDULE AND PROVIDE PULL WIRE IN EACH SPARE CONDUIT.
3. MINIMUM 48" RADIUS FOR CONDUIT BENDS.
4. PROVIDE RED 6" WIDE CONDUCTIVE MARKING TAPE LABELED: "DANGER - BURIED HIGH VOLTAGE CABLE", AND BLUE MARKING TAPE LABELED: "COMMUNICATION CONDUITS" (INSTALL ABOVE THE ENTIRE LENGTH OF THE DUCTBANK).
5. UNDER PAVED AREAS ENCASE CONDUITS WITH 3" COVER, ALL SIDES 4000 PSI CONCRETE. THE SLOPE OF DUCTBANK SHALL BE LIMITED TO 5% MAXIMUM. SAND ENVELOPE MAY BE USE IN LIEU OF CONCRETE UNDER NON-PAVED AREAS. DUCTBANK SHALL BE SLOPED TOWARDS MANHOLE FOR DRAINAGE.
6. REPLACE EXISTING SURFACE CONDITIONS IN KIND TO INCLUDE, BUT NOT LIMITED TO: CONCRETE, CRUSHED STONE, SELECT GRAVEL, ASPHALT, TOPSOIL, GRASS, ETC. REPLACE SELECT BACKFILL IN 6" LIFTS, COMPACT EACH PLACEMENT.
7. CONDUIT SIZE AND QUANTITY AS INDICATED ON PLAN(S) AND/OR ON SCHEDULES.

2 DUCT BANK CONSTRUCTION DETAIL

NOT TO SCALE

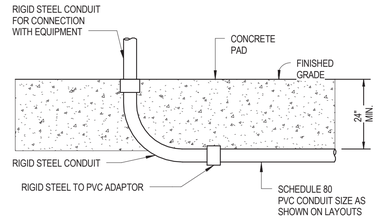


NOTE

1. WHERE FEASIBLE, CONNECT CABLE CONNECTOR TO BASE MOUNTING BOLT AND OMIT COPPER BAR.

5 GROUNDING EQUIPMENT CONNECTION

NOT TO SCALE



6 CONDUIT RISER THRU FLOOR/SLAB DETAIL

NOT TO SCALE

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BEDFORD REGIONAL WATER AUTHORITY

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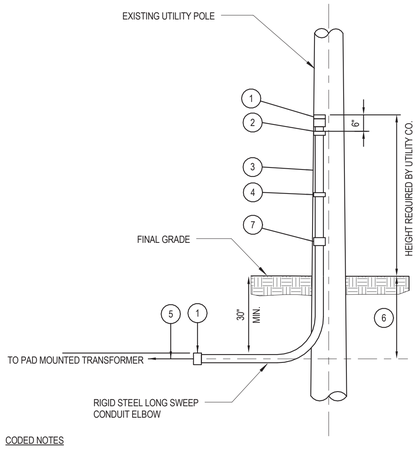
BEFORD, VA.

No.	Submittal / Revision	App'd	By	Date
1	BID ISSUE	ETA	CTB	06/20/18

DETAILS

Designed By:	Drawn By:	Checked By:
NS	CJE	JJW
Issue Date:	Project No:	Scale:
08/01/17	27872-3002	AS SHOWN

Drawing No:
E-701

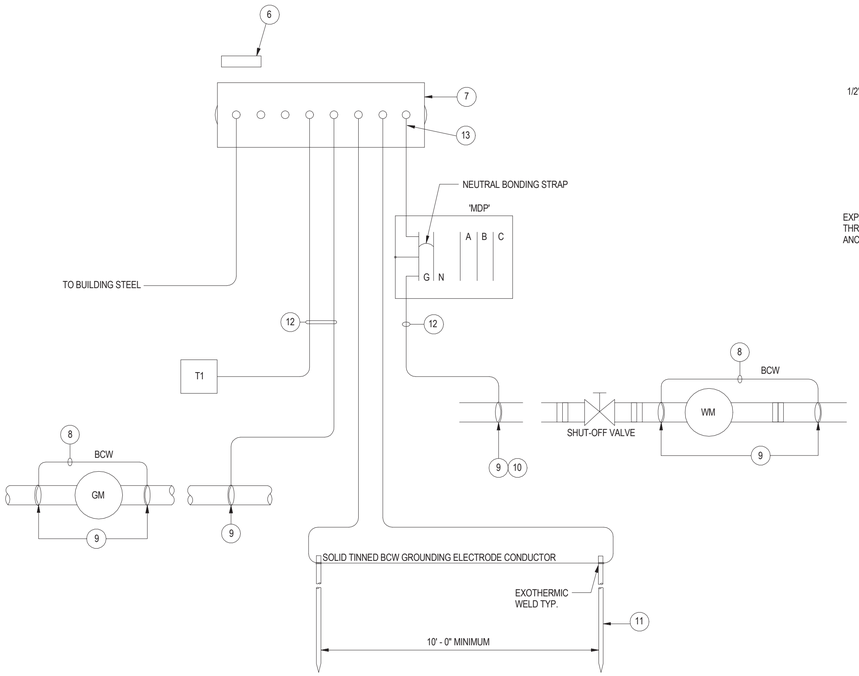


CODED NOTES

1. INSULATING BUSHING.
2. FOR GALVANIZED STEEL CONDUIT ELBOWS, THEY SHALL BE GROUNDED BY BONDING TO AN APPROVED V-BOLT TYPE GROUND CLAMP 6" (150 MM) FROM TOP OF THE CONDUIT. A CONDUCTOR OF SUFFICIENT LENGTH SHALL BE PROVIDED TO EXTEND 24" (600 MM) BEYOND THE UTILITY COMPANY'S SECONDARY NEUTRAL. THE CONDUCTOR SHALL BE SIZED AS REQUIRED BY THE NATIONAL ELECTRICAL CODE, ARTICLE 250, BUT IN NO CASE SHALL IT BE SMALLER THAN #4 AWG COPPER. RECOMMEND USE OF CORROSION RESISTANT BEND IN LOCATIONS SUBJECT TO HIGHWAY SALTING.
3. PROVIDE RIGID GALVANIZED STEEL RISER CONDUIT. THE CONDUIT SHALL RISE ON THE SIDE OF THE POLE AWAY FROM TRAFFIC. CONSULT UTILITY COMPANY FOR PROPER LOCATION ON POLE.
4. PIPE STRAPS, INSTALL AT NOT MORE THAN 30" (750 MM) INTERVALS.
5. PRIMARY SERVICE LATERAL IN CONCRETE DUCTBANK TO TRANSFORMER.
6. THE BURIAL DEPTH SHALL BE 30" (760 MM) MINIMUM.
7. ROUTE SPARE CONDUIT 12" ABOVE FINISHED GRADE. CAP AND SEAL WATERTHIGHT.

1 RISER POLE PRIMARY

NOT TO SCALE

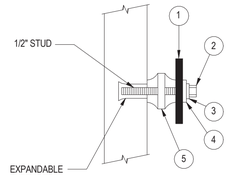


NOTES

1. UNLESS OTHERWISE NOTED, GROUNDING CONDUCTORS SHALL BE #4/0 AWG.
2. UNLESS OTHERWISE NOTED, PROVIDE INSULATED GROUNDING CONDUCTORS.
3. PROVIDE GROUNDING SYSTEM AS INDICATED AND PER NEC.

2 GROUNDING SYSTEM - SCHEMATIC DIAGRAM

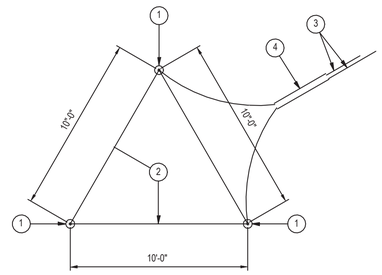
NOT TO SCALE



GROUND BUS BAR - SIDE VIEW
(SEE DETAIL BELOW)

GROUND DIAGRAM CODED NOTES

1. COPPER BUS 1/4" x 2".
2. CAP SCREW 1/2" - 13 x 1.
3. LOCK WASHER.
4. INSULATED WASHER.
5. FIBERGLASS REINFORCED POLYESTER INSULATED WITH 1/2" - 13 THREADED HOLE BOTH ENDS.
6. ENGRAVED PHENOLIC PERMANENTLY ATTACHED LABEL READING "BUILDING GROUND BUS".
7. BUILDING GROUND BUS LOCATED IN ELECTRIC RM. IN THE VICINITY OF "MDP". INSTALL ON WALL WITH INSULATING STAND OFF. SEE SIDE VIEW.
8. GROUND JUMPER AROUND WATER METER, GAS METER AND INSULATING JOINTS.
9. T&B 3900 'BU' SERIES GROUND CLAMP WITH CABLE CLAMP.
10. METALLIC COLD WATER SERVICE. USE T&B 'BU' SERIES GROUND CLAMP WITH 3/4" CONDUIT HUB AND CABLE CLAMP.
11. DRIVEN GROUND ROD ON BUILDING EXTERIOR (TYP. OF 3).
12. PROVIDE GROUNDING CONDUCTOR IN CONDUIT.
13. PROVIDE (2) HOLE COMPRESSION LUG CONNECTION.

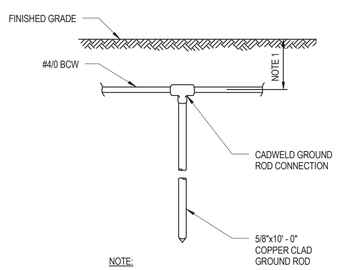


CODED NOTES

1. 5/8"x10'-0" COPPERWELD GROUND ROD. TOP OF GROUND ROD SHALL BE 12" MINIMUM BELOW FINISHED GRADE.
2. #4/0 BARE STRANDED COPPER GROUND GRID CONDUCTOR.
3. #4/0 BARE STRANDED COPPER GROUNDING ELECTRODE CONDUCTOR.
4. 2" PVC SCHEDULE 40 CONDUIT FROM GROUNDING GRID TO EQUIPMENT.

3 ELECTRICAL SERVICE GROUNDING GRID DETAIL

NOT TO SCALE

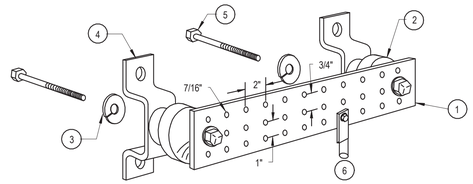


NOTE:

1. 30" MINIMUM.

4 GROUND ROD DETAIL

NOT TO SCALE

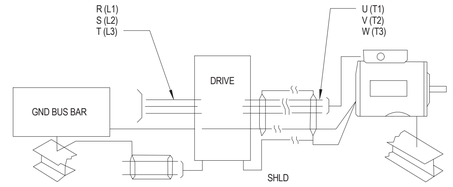


CODED NOTES

1. COPPER GROUND BAR, 1/4"X4"X20", NEWTON INSTRUMENT CO. CAT. NO. B-6142. HOLE CENTERS TO MATCH NEMA DOUBLE LUG CONFIGURATION.
2. INSULATORS, NEWTON INSTRUMENT CAT. NO. 3061 -4
3. 5/8" LOCKWASHERS, NEWTON INSTRUMENTS CO. CAT NO. 3015 -8
4. WALL MOUNTING BRACKET, NEWTON INSTRUMENT CO. CAT NO. A-6065
5. 5/8-11 X 1" H.H.C.S.BOLTS, NEWTON INSTRUMENT CO. CAT NO. 3012-1
6. #6CU GROUND CONDUCTOR W/ COMPRESSION LUG FITTING. ROUTE IN 1"C BACK TO NEAREST PANELBOARD AND TERMINATE ON GROUND BUS.

6 GROUNDING BUS BAR DETAIL

NOT TO SCALE



NOTES:

1. FOR INSTALLATION WITHIN A CABINET, A SINGLE SAFETY GROUND POINT, OR GROUND BUS BAR CONNECTED DIRECTLY TO BUILDING STEEL SHOULD BE USED. ALL CIRCUITS INCLUDING THE AC INPUT GROUND CONDUCTOR SHOULD BE GROUNDED INDEPENDENTLY AND DIRECTLY TO THIS POINT/BAR.
2. SAFETY GROUND-PE.
   THIS IS THE SAFETY GROUND FOR THE DRIVE THAT IS REQUIRED BY CODE. THIS POINT MUST BE CONNECTED TO ADJACENT BUILDING STEEL (GIRDER, JOIST), A FLOOR GROUND ROD, OR BUS BAR (SEE ABOVE). GROUNDING POINTS MUST COMPLY WITH NATIONAL AND LOCAL SAFETY REGULATIONS AND/OR ELECTRICAL CODES. GROUND IMPEDENCE MUST CONFORM TO THE REQUIREMENTS OF NATIONAL AND LOCAL INDUSTRIAL SAFETY REGULATIONS AND/OR ELECTRICAL CODES. THE INTEGRITY OF ALL GROUND CONNECTIONS SHOULD BE PERIODICALLY CHECKED.

7 VARIABLE FREQUENCY DRIVE - GND DETAIL

NOT TO SCALE

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COMMONWEALTH OF VIRGINIA
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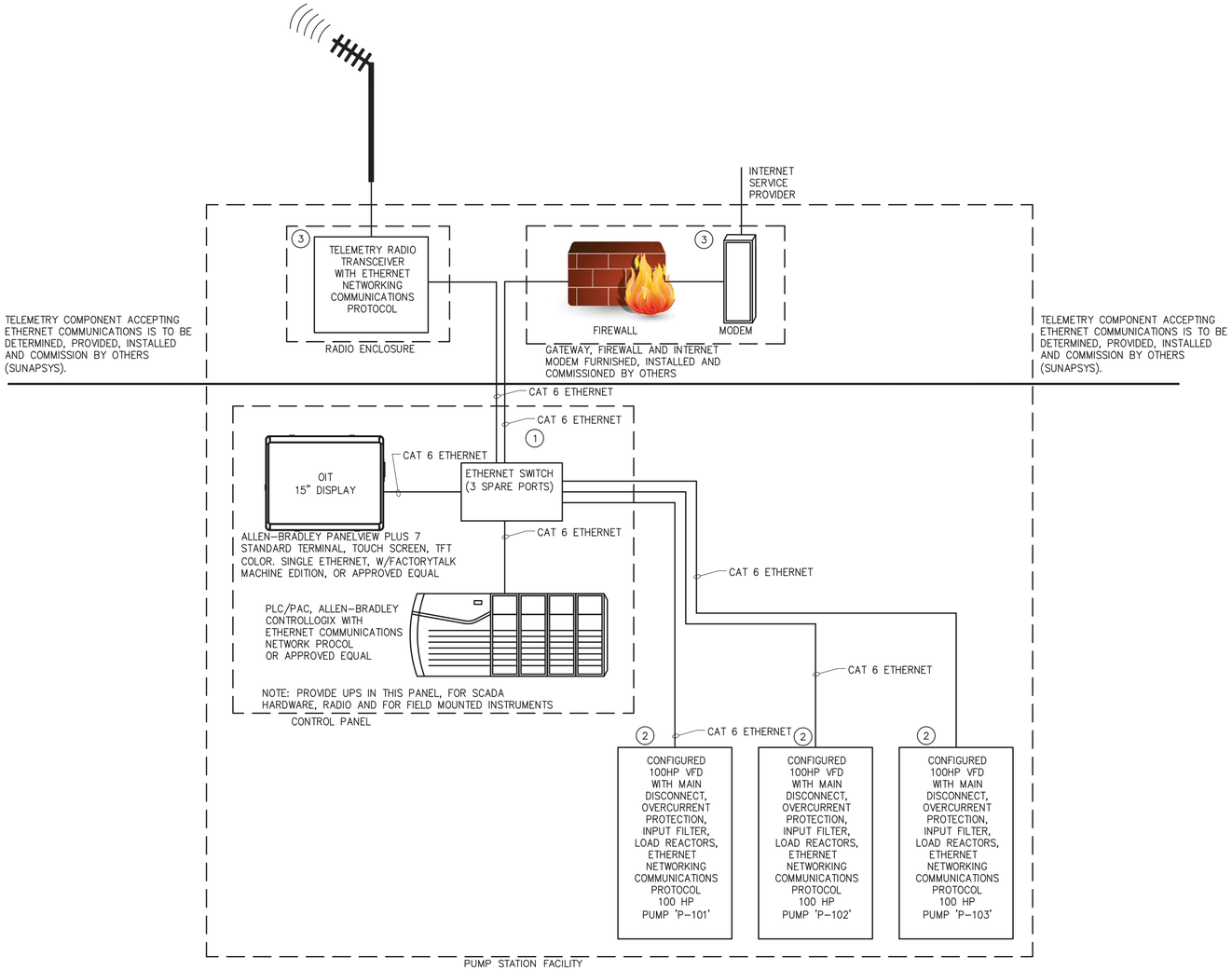
1	BID ISSUE	ETA	CTB	06/20/18

DETAILS

Designed By:	Drawn By:	Checked By:
NS	CJE	JJW
Issue Date:	Project No:	Scale:
08/01/17	27872-3002	AS SHOWN

Drawing No:

E-702



CODED NOTES

1. PLC, OPERATOR INTERFACE TERMINAL, ETHERNET SWITCH WITH UPS WITH PROGRAMMING BY PUMPING EQUIPMENT SUPPLIER, REFER TO SPECIFICATION 432113.01 – PUMPING EQUIPMENT
2. CONFIGURED PACKAGED VFD AND PROGRAMMING BY PUMPING EQUIPMENT SUPPLIER, REFER TO SPECIFICATION 432113.01 – PUMPING EQUIPMENT
3. RADIO OR INTERNET TELEMETRY (GATEWAY, FIREWALL AND MODEM) WITH UPS. DETERMINED, FURNISHED, INSTALLED AND COMMISSIONED BY OTHERS/OWNER/SUNAPSYS.

CONTROL SYSTEM ARCHITECTURE AND COMMUNICATIONS RISER DIAGRAM

SCALE: N.T.S

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BEDFORD REGIONAL WATER AUTHORITY

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ROUTE 460 PUMP STATION
BEDFORD, VA.

No.	Submittal / Revision	App'd.	By	Date
	BID ISSUE	ETA	CTB	06/20/18

CONTROL SYSTEM ARCHITECTURE

Designed By:	Drawn By:	Checked By:
MEW	MEW	JJD
Issue Date:	Project No:	Scale:
08/01/17	27872-3002	AS SHOWN

Drawing No.:
E-703

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Saved: 6/19/2018 1:55:04 PM Plotted: 6/19/2018 1:55:24 PM Current User: Wright, Mark LastSavedBy: 2830

FIELD WIRED INPUTS, OUTPUTS, INSTRUMENTS, VALVES AND DEVICES

DEVICE TAG	DEVICE DESCRIPTION	I/O SIGNAL TYPE	CONTROLLER INTERFACE	CONTROL WIRING	POWER/EXTERNAL POWER SOURCE	POWER WIRING	REMARKS
FE-101/FIT-101	FLOW ELEMENT/FLOW INDICATING TRANSMITTER - BEDFORD, 8"	AI, 4-20mA	PLC CONTROL PANEL	2 #18TSP; 3/4"C	N/A, LOOP POWERED		
FE-101/FIT-101	FLOW ELEMENT/FLOW INDICATING TRANSMITTER - FOREST, 8"	AI, 4-20mA	PLC CONTROL PANEL	2 #18TSP; 3/4"C	N/A, LOOP POWERED		
PE-101/PIT-101	PRESSURE ELEMENT/PRESSURE INDICATING TRANSMITTER - SUCTION	AI, 4-20mA	PLC CONTROL PANEL	2 #18TSP; 3/4"C	N/A, LOOP POWERED		
PE-102/PIT-102	PRESSURE ELEMENT/PRESSURE INDICATING TRANSMITTER - DISCHARGE	AI, 4-20mA	PLC CONTROL PANEL	2 #18TSP; 3/4"C	N/A, LOOP POWERED		
P-101	PUMP P-101 VFD	ETHERNET	PLC CONTROL PANEL	CAT 6; 1"C	480V/3PH, PER ONE LINE DIAGRAM		
P-102	PUMP P-102 VFD	ETHERNET	PLC CONTROL PANEL	CAT 6; 1"C	480V/3PH, PER ONE LINE DIAGRAM		
P-103	PUMP P-103 VFD	ETHERNET	PLC CONTROL PANEL	CAT 6; 1"C	480V/3PH, PER ONE LINE DIAGRAM		
V-101A	VALVE V-101, LAKES SUCTION SIDE ISOLATION, OPEN/CLOSE COMMAND	AO, 4-20mA	PLC CONTROL PANEL	2 #18TSP; 3/4"C	480V/3PH, 15A/3P C.B., HVP-2	3 #12+#12GND.; 3/4"C	
V-101B	VALVE V-101, LAKES SUCTION SIDE ISOLATION, OPEN/CLOSE POSITION FEEDBACK	AI, 4-20mA	PLC CONTROL PANEL	2 #18TSP; 3/4"C			
V-101C	VALVE V-101, LAKES SUCTION SIDE ISOLATION, CLOSED LIMIT SWITCH	DI	PLC CONTROL PANEL	2 #14AWG; 3/4"C			
V-101D	VALVE V-101, LAKES SUCTION SIDE ISOLATION, OPEN LIMIT SWITCH	DI	PLC CONTROL PANEL	2 #14AWG; 3/4"C			
V-101E	VALVE V-101, LAKES SUCTION SIDE ISOLATION, HOA, HAND POSITION	DI	PLC CONTROL PANEL	2 #14AWG; 3/4"C			
V-101F	VALVE V-101, LAKES SUCTION SIDE ISOLATION, HOA, AUTO POSITION	DI	PLC CONTROL PANEL	2 #14AWG; 3/4"C			
V-101G	VALVE V-101, LAKES SUCTION SIDE ISOLATION, OVER TORQUE	DI	PLC CONTROL PANEL	2 #14AWG; 3/4"C			
V-103A	CLA VALVE V-103-PUMP P-101 REMOTE START COMMAND	DO	PLC PANEL TO CLA VALVE PANEL	2 #14AWG; 3/4"C	120V/1Ph, 20A/1P	2 #12+#12GND.; 3/4"C	
V-103B	CLA VALVE V-103-PRESSUE SWICH FOR PUMP P-101	DI	CLA VALVE CONTROL PANEL	2 #14AWG; 3/4"C			
V-103C	CLA VALVE V-103-LIMIT SWICH FOR PUMP P-101	DI	CLA VALVE CONTROL PANEL	2 #14AWG; 3/4"C			
V-103D	CLA VALVE V-103-SOLENOID VALVE FOR PUMP P-101	DO	CLA VALVE CONTROL PANEL	2 #14AWG; 3/4"C			
V-103E	CLA VALVE V-103 PUMP P-101 START RELAY	DI	PLC PANEL FROM CLA VALVE PANEL	2 #14AWG; 3/4"C			
V-106A	CLA VALVE V-106-PUMP P-102 REMOTE START COMMAND	DO	PLC PANEL TO CLA VALVE PANEL	2 #14AWG; 3/4"C	120V/1Ph, 20A/1P	2 #12+#12GND.; 3/4"C	
V-106B	CLA VALVE V-106-PRESSUE SWICH FOR PUMP P-102	DI	CLA VALVE CONTROL PANEL	2 #14AWG; 3/4"C			
V-106C	CLA VALVE V-106-LIMIT SWICH FOR PUMP P-102	DI	CLA VALVE CONTROL PANEL	2 #14AWG; 3/4"C			
V-106D	CLA VALVE V-106-SOLENOID VALVE FOR PUMP P-102	DO	CLA VALVE CONTROL PANEL	2 #14AWG; 3/4"C			
V-106E	CLA VALVE V-106 PUMP P-102 START RELAY	DI	PLC PANEL FROM CLA VALVE PANEL	2 #14AWG; 3/4"C			
V-109A	CLA VALVE V-109-PUMP P-103 REMOTE START COMMAND	DO	PLC PANEL TO CLA VALVE PANEL	2 #14AWG; 3/4"C	120V/1Ph, 20A/1P	2 #12+#12GND.; 3/4"C	
V-109B	CLA VALVE V-109-PRESSUE SWICH FOR PUMP P-103	DI	CLA VALVE CONTROL PANEL	2 #14AWG; 3/4"C			
V-109C	CLA VALVE V-109-LIMIT SWICH FOR PUMP P-103	DI	CLA VALVE CONTROL PANEL	2 #14AWG; 3/4"C			
V-109D	CLA VALVE V-109-SOLENOID VALVE FOR PUMP P-103	DO	CLA VALVE CONTROL PANEL	2 #14AWG; 3/4"C			
V-109E	CLA VALVE V-109 PUMP P-103 START RELAY	DI	PLC PANEL FROM CLA VALVE PANEL	2 #14AWG; 3/4"C			
V-112A	VALVE V-112, BEDFORD FLOW METER CONTROL, OPEN/CLOSE COMMAND	AO, 4-20mA	PLC CONTROL PANEL	2 #18TSP; 3/4"C	480V/3PH, 15A/3P C.B., HVP-2	3 #12+#12GND.; 3/4"C	
V-112B	VALVE V-112, BEDFORD FLOW METER CONTROL, OPEN/CLOSE POSITION FEEDBACK	AI, 4-20mA	PLC CONTROL PANEL	2 #18TSP; 3/4"C			
V-112C	VALVE V-112, BEDFORD FLOW METER CONTROL, CLOSED LIMIT SWITCH	DI	PLC CONTROL PANEL	2 #14AWG; 3/4"C			
V-112D	VALVE V-112, BEDFORD FLOW METER CONTROL, OPEN LIMIT SWITCH	DI	PLC CONTROL PANEL	2 #14AWG; 3/4"C			
V-112E	VALVE V-112, BEDFORD FLOW METER CONTROL, HOA, HAND POSITION	DI	PLC CONTROL PANEL	2 #14AWG; 3/4"C			
V-112F	VALVE V-112, BEDFORD FLOW METER CONTROL, HOA, AUTO POSITION	DI	PLC CONTROL PANEL	2 #14AWG; 3/4"C			
V-112G	VALVE V-112, BEDFORD FLOW METER CONTROL, OVER TORQUE	DI	PLC CONTROL PANEL	2 #14AWG; 3/4"C			
V-113A	VALVE V-113, FOREST DISCHARGE SIDE ISOLATION/CONTROL, OPEN/CLOSE COMMAND	AO, 4-20mA	PLC CONTROL PANEL	2 #18TSP; 3/4"C	480V/3PH, 15A/3P C.B., HVP-2	3 #12+#12GND.; 3/4"C	
V-113B	VALVE V-113, FOREST DISCHARGE SIDE ISOLATION/CONTROL, OPEN/CLOSE POSITION FEEDBACK	AI, 4-20mA	PLC CONTROL PANEL	2 #18TSP; 3/4"C			
V-113C	VALVE V-113, FOREST DISCHARGE SIDE ISOLATION/CONTROL, CLOSED LIMIT SWITCH	DI	PLC CONTROL PANEL	2 #14AWG; 3/4"C			
V-113D	VALVE V-113, FOREST DISCHARGE SIDE ISOLATION/CONTROL, OPEN LIMIT SWITCH	DI	PLC CONTROL PANEL	2 #14AWG; 3/4"C			
V-113E	VALVE V-113, FOREST DISCHARGE SIDE ISOLATION/CONTROL, HOA, HAND POSITION	DI	PLC CONTROL PANEL	2 #14AWG; 3/4"C			
V-113F	VALVE V-113, FOREST DISCHARGE SIDE ISOLATION/CONTROL, HOA, AUTO POSITION	DI	PLC CONTROL PANEL	2 #14AWG; 3/4"C			
V-113G	VALVE V-113, FOREST DISCHARGE SIDE ISOLATION/CONTROL, OVER TORQUE	DI	PLC CONTROL PANEL	2 #14AWG; 3/4"C			
V-114A	VALVE V-114, FOREST SUCTION SIDE ISOLATION/CONTROL, OPEN COMMAND	DO	PLC CONTROL PANEL	2 #14AWG; 3/4"C	480V/3PH, 15A/3P C.B., HVP-2	3 #12+#12GND.; 3/4"C	
V-114B	VALVE V-114, FOREST SUCTION SIDE ISOLATION/CONTROL, CLOSE COMMAND	DO	PLC CONTROL PANEL	2 #14AWG; 3/4"C			
V-114C	VALVE V-114, FOREST SUCTION SIDE ISOLATION/CONTROL, CLOSED LIMIT SWITCH	DI	PLC CONTROL PANEL	2 #14AWG; 3/4"C			
V-114D	VALVE V-114, FOREST SUCTION SIDE ISOLATION/CONTROL, OPEN LIMIT SWITCH	DI	PLC CONTROL PANEL	2 #14AWG; 3/4"C			
V-114E	VALVE V-114, FOREST SUCTION SIDE ISOLATION/CONTROL, HOA, HAND POSITION	DI	PLC CONTROL PANEL	2 #14AWG; 3/4"C			
V-114F	VALVE V-114, FOREST SUCTION SIDE ISOLATION/CONTROL, HOA, AUTO POSITION	DI	PLC CONTROL PANEL	2 #14AWG; 3/4"C			
V-114G	VALVE V-114, FOREST SUCTION SIDE ISOLATION/CONTROL, OVER TORQUE	DI	PLC CONTROL PANEL	2 #14AWG; 3/4"C			
V-115A	VALVE V-115, LAKES DISCHARGE SIDE ISOLATION/CONTROL, OPEN COMMAND	DO	PLC CONTROL PANEL	2 #14AWG; 3/4"C	480V/3PH, 15A/3P C.B., HVP-2	3 #12+#12GND.; 3/4"C	
V-115B	VALVE V-115, LAKES DISCHARGE SIDE ISOLATION/CONTROL, CLOSE COMMAND	DO	PLC CONTROL PANEL	2 #14AWG; 3/4"C			
V-115C	VALVE V-115, LAKES DISCHARGE SIDE ISOLATION/CONTROL, CLOSED LIMIT SWITCH	DI	PLC CONTROL PANEL	2 #14AWG; 3/4"C			
V-115D	VALVE V-115, LAKES DISCHARGE SIDE ISOLATION/CONTROL, OPEN LIMIT SWITCH	DI	PLC CONTROL PANEL	2 #14AWG; 3/4"C			
V-115E	VALVE V-115, LAKES DISCHARGE SIDE ISOLATION/CONTROL, HOA, HAND POSITION	DI	PLC CONTROL PANEL	2 #14AWG; 3/4"C			
V-115F	VALVE V-115, LAKES DISCHARGE SIDE ISOLATION/CONTROL, HOA, AUTO POSITION	DI	PLC CONTROL PANEL	2 #14AWG; 3/4"C			
V-115G	VALVE V-115, LAKES DISCHARGE SIDE ISOLATION/CONTROL, OVER TORQUE	DI	PLC CONTROL PANEL	2 #14AWG; 3/4"C			
V-118A	VALVE V-118, BEDFORD FLOW METER ISOLATION, OPEN COMMAND	DO	PLC CONTROL PANEL	2 #14AWG; 3/4"C	480V/3PH, 15A/3P C.B., HVP-2	3 #12+#12GND.; 3/4"C	
V-118B	VALVE V-118, BEDFORD/FOREST ISOLATION, CLOSE COMMAND	DO	PLC CONTROL PANEL	2 #14AWG; 3/4"C			
V-118C	VALVE V-118, BEDFORD FLOW METER ISOLATION, CLOSED LIMIT SWITCH	DI	PLC CONTROL PANEL	2 #14AWG; 3/4"C			
V-118D	VALVE V-118, BEDFORD/FOREST ISOLATION, OPEN LIMIT SWITCH	DI	PLC CONTROL PANEL	2 #14AWG; 3/4"C			
V-118E	VALVE V-118, BEDFORD/FOREST ISOLATION, HOA, HAND POSITION	DI	PLC CONTROL PANEL	2 #14AWG; 3/4"C			
V-118F	VALVE V-118, BEDFORD/FOREST ISOLATION, HOA, AUTO POSITION	DI	PLC CONTROL PANEL	2 #14AWG; 3/4"C			
V-118G	VALVE V-118, BEDFORD/FOREST ISOLATION, OVER TORQUE	DI	PLC CONTROL PANEL	2 #14AWG; 3/4"C			
V-130A	VALVE V-130, BEDFORD PS BYPASS VALVE, OPEN COMMAND	DO	PLC CONTROL PANEL	2 #14AWG; 3/4"C	480V/3PH, 15A/3P C.B., HVP-2	3 #12+#12GND.; 3/4"C	
V-130B	VALVE V-130, BEDFORD PS BYPASS VALVE, CLOSE COMMAND	DO	PLC CONTROL PANEL	2 #14AWG; 3/4"C			
V-130C	VALVE V-130, BEDFORD PS BYPASS VALVE, CLOSED LIMIT SWITCH	DI	PLC CONTROL PANEL	2 #14AWG; 3/4"C			
V-130D	VALVE V-130, BEDFORD PS BYPASS VALVE, OPEN LIMIT SWITCH	DI	PLC CONTROL PANEL	2 #14AWG; 3/4"C			
V-130E	VALVE V-130, BEDFORD PS BYPASS VALVE, HOA, HAND POSITION	DI	PLC CONTROL PANEL	2 #14AWG; 3/4"C			
V-130F	VALVE V-130, BEDFORD PS BYPASS VALVE, HOA, AUTO POSITION	DI	PLC CONTROL PANEL	2 #14AWG; 3/4"C			
V-130G	VALVE V-130, BEDFORD PS BYPASS VALVE, OVER TORQUE	DI	PLC CONTROL PANEL	2 #14AWG; 3/4"C			

DISCONNECT AND CONTROLLER SCHEDULE

EQUIPMENT TAG	DESCRIPTION	LOCATION	CONTROLLER	DISCONNECT	REMARKS
EDH-1	ELECTRIC DUCT HEATER	PUMP ROOM	FURNISHED WITH UNIT	30A/3P NON-FUSIBLE	T'STAT FURNISHED WITH UNIT, PROVIDE WIRING AND RACEWAY AS REQUIRED
EF-1	EXHAUST FAN	PUMP ROOM	FURNISHED WITH UNIT	FURNISHED WITH UNIT	PROVIDE REQUIRED INTERLOCK WIRING AND RACEWAY BETWEEN EHAUST FAN AND LOUVER,T'STAT AND SUPPLY FAN
EUH-1	ELECTRIC UNIT HEATER	PUMP ROOM	FURNISHED WITH UNIT	30A/3P NON-FUSIBLE	T'STAT FURNISHED WITH UNIT, PROVIDE WIRING AND RACEWAY AS REQUIRED
EUH-2	ELECTRIC UNIT HEATER	PUMP ROOM	FURNISHED WITH UNIT	30A/3P NON-FUSIBLE	T'STAT FURNISHED WITH UNIT, PROVIDE WIRING AND RACEWAY AS REQUIRED
HP-1A/1B	DUCTLESS HEAT PUMP	ELECTRICAL/CONTROL ROOM	FURNISHED WITH UNIT	60A/3P NON-FUSIBLE	PROVIDE REQUIRED INTERLOCK AND POWER WIRING AND RACEWAY BETWEEN A/C UNIT AND CONDENSING UNIT
HP-2A/2B	DUCTLESS HEAT PUMP	ELECTRICAL/CONTROL ROOM	FURNISHED WITH UNIT	60A/3P NON-FUSIBLE	PROVIDE REQUIRED INTERLOCK AND POWER WIRING AND RACEWAY BETWEEN A/C UNIT AND CONDENSING UNIT
SF-1	SUPPLY FAN	PUMP ROOM	FURNISHED WITH UNIT	FURNISHED WITH UNIT	PROVIDE REQUIRED INTERLOCK WIRING AND RACEWAY BETWEEN EHAUST FAN AND LOUVER,T'STAT AND SUPPLY FAN

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REGIONAL WATER
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COMMONWEALTH OF VIRGINIA
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6/20/2018
PROFESSIONAL ENGINEER

ROUTE 460 PUMP STATION
BEDFORD, VA.

No.	Submittal / Revision	App'd.	By	Date
	BID ISSUE	ETA	CTB	06/20/18

FIELD WIRED I-O AND POWER OUTLET SCHEDULE

Designed By:	Drawn By:	Checked By:
MEW	MEW	JJD
Issue Date:	Project No:	Scale:
08/01/17	27872-3002	AS SHOWN

Drawing No.:

E-704

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