Liberty Generating Station – 214MW Reciprocating Engine Powerplant Project Scoping Report

East Kentucky Power Cooperative

Liberty RICE PSR
Project No. 157785

Revision 3
09/16/2024

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Project Scoping Report

prepared for

East Kentucky Power Cooperative
Liberty RICE PSR
Liberty, Kentucky

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Revision 3
09/16/2024

prepared by

Burns & McDonnell Engineering Company, Inc.
Kansas City, Missouri

INDEX AND CERTIFICATION

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Certification

I hereby certify, as a Professional Engineer in the state of Kentucky, that the information in this document was assembled under my direct personal charge. This report is not intended or represented to be suitable for reuse by the East Kentucky Power Cooperative or others without specific verification or adaptation by the Engineer.

STATE OF KENTUCKY
DANTE
REESE
39346
LICENSED
PROFESSIONAL ENGINEER

09/16/2024

Dante Reese, P.E. (KY 39346)

Date: 9/16/2024

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LIST OF ABBREVIATIONS

Abbreviation	**Term/Phrase/Name**
AACE	Association for the Advancement of Cost Engineering
AGC	Automatic Gain Control
BAAH	Breaker-and-a-half [Switchyard Arrangement]
BACT	Best Available Control Technology
BMcD	Burns & McDonnell Engineering Corp, Inc.
BMU	Burns & McDonnell University
BOP	Balance of Plant
CEMS	Continuous Monitoring System
CM	Construction Management
CMU	Concrete Masonry Unit
CO	Carbon Monoxide
COD	Commercial Operation Date
CPU	Computer Processing Unit
CRAC	Computer Room Air Conditioning
DC	Direct Current
DOR	Division of Responsibility
EA	Environmental Assessment
EKPC	East Kentucky Power Cooperative
FNTP	Full Notice to Proceed
GA	General Arrangement
GSU	Generator Step-Up Transformer

Abbreviation	**Term/Phrase/Name**
HHV	Higher Heating Value
HMI	Human Machine Interface
HV	High Voltage
HVAC	Heating, Ventilation and Air Conditioning
I/O	Input/Output
IR	Infrared
LEL	Lower Explosion Limit
LNTP	Limited Notice to Proceed
LTSA	Long Term Service Agreement
M&R	Metering and Pressure Regulating
MCC	Motor Control Centers
MSL	Mean Sea Level
MV	Medium Voltage
NDE	Non-Destructive Evaluation
NEPA	National Environmental Policy Act
NFPA	National Fire Protection Agency
NOx	Nitrogen Oxides
O&M	Operating and Maintenance
OE	Owner’s Engineer
OEM	Original Equipment Manufacturer
Owner	East Kentucky Power Cooperative
P&ID	Piping & Instrumentation Diagram

Abbreviation	Term/Phrase/Name
PCS	Plant Control System
PEMB	Pre-Engineered Metal Building
PLC	Programmable Logic Controller
PM	Particulate Matters
PO	Purchase Order
PSC	Public Service Commission
PSR	Project Scoping Report
PWHT	Post Weld Heat Treatment
RFP	Request for Proposal
RICE	Reciprocating Engine
RUS	Rural Utility Services
SCR	Selective Catalytic Reduction
SDI	Service Deionization
ULSD	Ultra Low Sulfur Diesel
UV	Ultraviolet
VOCs	Volatile Organic Compounds

1.0 EXECUTIVE SUMMARY

East Kentucky Power Cooperative (EKPC; Owner) is reviewing the viability of a new reciprocating engine (RICE) power plant facility at greenfield location in Liberty, Kentucky (Liberty) to meet their customers' growing needs for additional energy capacity. This new facility will provide approximately 214 MW (net) of peak loaded generation by the end of 2028.

EKPC retained Burns & McDonnell Engineering Company. Inc. (BMcD) to assist in developing the scope, preliminary design, schedule, and cost estimate for the new facility. The cost estimate was developed in accordance with the Association for the Advancement of Cost Engineering (AACE) Class 3 cost estimate guidelines. This report summarizes the Project scope and presents the study results for use in EKPC's evaluation of Project feasibility and budgeting. Further, this report provides a basis document for obtaining Rural Utilities Service (RUS) funding, preparing the Kentucky Department of Environmental Protection Division of Air Quality permit application, and providing input to preparation of the Environmental Assessment (EA), project definition, cost estimate, and milestone schedule.

Wärtsilä Corporation (Wärtsilä) is the original equipment manufacturer (OEM) that is being considered for the genset technology and this basis of the cost estimate. The technology considers dual fuel engines capable of operating on natural gas or diesel fuel, capable of connecting to the grid within one minute and achieving full load within five minutes allowing a rapid response to fluctuations in power demand. The new gensets or units will include selective catalytic reduction (SCR) to meet current Best Available Control Technology (BACT) standards.

1.1 Purpose

The purpose of this report is to define the overall scope, schedule, performance, capital costs and operating and maintenance costs of the new Liberty RICE plant and provide general information to support the following activities:

- Permitting
- Internal budget appropriations
- Approval from the RUS for project financing

1.2 Project Configuration Summary

The new facility will incorporate 12 Wärtsilä gensets, model 18V50DF, which produce up to 18,132 kW each. Considering Wärtsilä as the genset OEM, the facility would be equipped with 12 gensets capable of producing a total of 214 MW (net). The gensets will be located within an enclosed engine hall. The building will house the auxiliary operating equipment for the gensets that require cold weather protection. The engines are cooled by a closed cooling water system (one per unit). Heat is rejected from the closed cooling water system by way of air-cooled heat exchangers (radiators) located outdoors.

The gensets will be designed to burn pipeline quality natural gas with ultra-low sulfur diesel (ULSD) fuel oil as a backup. A new natural gas supply pipeline, dew point heater, and metering and regulating station will be installed to the site as part of a separate project. On-site regulation and fuel gas filtering to meet the pressure and cleanliness requirements are included to meet the supply requirements of the engines. The pipeline supply pressure of 200 psig minimum will be adequate for the plant; fuel gas compression is not required due to adequate pipeline supply pressure.

To support emergency backup operation on fuel oil, the fuel oil storage tanks are designed to provide 72 hours' worth of fuel while firing all engines at full load. Two fuel oil storage tanks are located in concrete secondary containment structures with redundant offloading and forwarding pumps. All fuel oil piping outside of the containment structure are supplied with jacketed piping. Fuel oil heaters are supplied to ensure fuel oil temperature meet the engine's minimum requirements.

A new 161 kV switchyard and transmission line will be installed to interconnect the output from the generating plant to match the high voltage transmission lines located approximately one mile from the facility. The EKPC transmission group worked with BMcD to investigate the transmission system requirements for system upgrades. BMcD estimated the engineering and construction management costs associated with the system upgrades. Costs for the new switchyard, new transmission line, and transmission system upgrades are included in this estimate.

RICE generating stations require minimal raw water supply; there are no continuous users during normal operation. Raw water is needed for service and potable water supply, fire water tank supply, and closed cooling water makeup. Water supply for the facility will tap off the county potable water supply main and feed the aforementioned systems. The fire water tank is 450,000 gal.

Site storm water will be collected and directed to an on-site storm water runoff pond. The storm water runoff pond will discharge by gravity to a new outfall. No treatment or monitoring of the storm water discharge is included. The storm water pond was sized for a 100-year storm event over a 24-hour period for the facility site area.

All oily contaminated drains will collect in an oil water separator before discharging to the stormwater runoff pond. Sanitary wastewater will be collected in lift stations and pumped to a new leach field for disposal.

1.3 Contracting Approach

The selected contracting strategy for this report and basis of the estimate is an Owner's Engineer (OE) contracting approach. Under this approach, Owner will hire an Owner's Engineer to perform detailed design, develop procurement packages and administer them after award, and assist in management of on-site construction activities, including management of startup and commissioning activities. All procurements will be by Owner on Owner's paper.

In the OE approach, the Owner and OE work together to procure the project equipment, construction, and site services contracts. The procurement of long lead equipment such as the reciprocating engines and accessories, Generator Step-up (GSU) transformers, switchgear, and high voltage transformers is needed early in the project to support plant detailed design and permitting efforts. The estimate is based on procuring this major equipment under separate procurement contracts.

The OE contracting approach includes an estimated 34 equipment and material supply contracts, 3 furnish and erect contracts (for example, field erected tanks, fire protection and detection, etc.), 6 construction contracts, and 11 services contracts (for example, subsurface investigation, electrical testing, performance and emissions testing, etc.). A listing of the anticipated equipment, furnish and erect, construction, and service contracts is included in Section 5.1 and Appendix C to this report.

1.4 Schedule

For an estimated commercial operation date in December 2028, the critical path of the project is based on obtaining the Air Permit approval by December 2026 and PJM Interconnect Application approval by December of 2027. This path of activities commenced with the issuance of the PJM Interconnect Application in December 2023 and is followed by the submission of necessary permits identified in Table 1-1 to support the timeline associated with major milestones for the project. The complete schedule is shown in Appendix Q.

Table 1-1: Liberty RICE Project Milestones

Permitting Activities	Date
Submit PJM Interconnect Application	December 2023
Submit Air Permit	September 2024

Submit CPCN Application	September 2024
Submit RUS NEPA EA Application	December 2024
Engineering/Procurement	
RICE Contract Award	September 2024
LNTP Engineering for Long Lead Eq	November 2024
HV Breaker Contract Award	December 2024
GSU Contract Award	February 2025
Switchgear Contract Award	February 2025
FNTP Engineering	May 2025
Construction/Startup Period – 24 Months	
Start Construction	December 2026
Start Balance of Plant Mechanical and Electrical	August 2027
Start Major Equipment Erection	September 2027
Energize Startup Power / Startup Commissioning	March 2028
Commercial Operation	December 2028

1.5 Cost Estimate

The capital cost is approximately $500 million ($2024), excluding all escalation through the project timeline (costs are based on project starting and finishing today). This equates to approximately $2,298/kW with an average annual output of 214 MW (net). These costs include $64 million attributed to new transmission lines, a new switchyard, and various transmission line and switchyard construction ("network upgrades.") This does not account for the cost to bring a new natural gas pipeline onsite.

To reduce the risk of project cost overruns, an Owner's contingency of nearly $40 million is included in this estimate, equating to 10% of the estimated capital cost excluding Owner's Costs and network upgrades. However, it does not account for major project scope changes, nor does it account for the impact of major shifts in market conditions which may be experienced prior to the commercial operation date.

The estimated incremental additional operation and maintenance (O&M) costs are as follows. All O&M costs are represented in 2024 dollars and are based on 60% capacity factor.

Table 1-2: Annualized O&M Costs

	Wärtsilä
Fixed Operating Costs	$15.00 / kW-yr $2.85 / MWh
Levelized Genset Major Maintenance Costs	$8.39 / MWh
Non-Fuel Variable Operating Costs	$2.65 / MWh
OEM LTSA Costs	$2.46 / MWh
Combined Total O&M Costs	$16.35 / MWh

Fixed O&M costs include allowances for general maintenance activities, unscheduled maintenance activities, staffing, office and administration costs. Levelized genset major maintenance costs include accrual to perform the recommended major maintenance activities for the facility regarding cylinder inspection and replacement. Variable O&M costs include water costs, lube oil costs, urea costs, balance of plant (BOP) equipment maintenance, and Standby Power Energy Costs. OEM Long Term Service Agreement (LTSA) Costs include OEM scheduled minor maintenance costs, OEM fixed fees for maintenance planning and support, as well as safety spare parts for engines and auxiliaries.

1.6 Performance and Emissions Estimates

The Plant will have an estimated electric generating capacity and heat rate as follows, based on new and clean conditions for all major equipment.

Table 1-3: Plant Performance Summary

Estimated Total Plant Net Performance	
Engine Manufacturer	Wärtsilä
Number of RICE Generators	12
Engine Model	18V50DF
Engine Unit Electric Output (UEO)	18,132 kW
Fuel Design	Natural Gas or ULSD
NO_x Control	SCR
CO Control	Oxidation Catalyst
AVERAGE ANNUAL PERFORMANCE @ 56°F on Nat Gas	
Net Plant Output, kW	213,370
Net Plant Heat Rate, Btu/kWh (HHV)	8,423
Heat Input, MMBtu/h (HHV)	1,797
AVERAGE ANNUAL PERFORMANCE @ 56°F on ULSD	
Net Plant Output, kW	213,192
Net Plant Heat Rate, Btu/kWh (HHV)	8,817
Heat Input, MMBtu/h (HHV)	1,880
SUMMER PEAK PERFORMANCE @ 90°F on Nat Gas	
Net Plant Output, kW	213,024
Net Plant Heat Rate, Btu/kWh (HHV)	8,437
Heat Input, MMBtu/h (HHV)	1,797
SUMMER PEAK PERFORMANCE @ 90°F on ULSD	
Net Plant Output, kW	212,846
Net Plant Heat Rate, Btu/kWh (HHV)	8,831
Heat Input, MMBtu/h (HHV)	1,880

The Plant will meet emissions criteria through use of an SCR system and oxidation catalyst. The SCR will utilize urea injection to reduce NOx emissions and an oxidation catalyst to decrease CO and VOC emissions levels shown in Table 1-4.

Table 1-4: OEM Expected Exhaust Gas Emissions

Constituents	Gas Operation	Diesel Operation
Nitrogen Oxides (NO_x)	6 ppm	35 ppm
CO Emissions	15 ppm	20 ppm
Volatile Organic Compounds (VOC)	26 ppm	40 ppm

Exhaust gas emissions stated at 15% O_2 (dry) at the specified design conditions.

1.7 Project Risks

Project risks which can affect scope, schedule, budget, safety, or quality can be subdivided into three categories which include design/engineering risks, procurement risks, and construction/startup risks. Each category risk is listed below for consideration with some key risks identified. The complete risk matrix is included in Appendix P.

1.7.1 Design/Engineering Risks

Several design and engineering risks identified include the following:

- Permitting taking longer than expected. Although EKPC and BMcD have generally rule of thumb durations for the major permit applications and processes, ultimately these timelines are controlled by the permitted authorities and can vary dramatically by State or Individual.

- Finalizing foundation design. BMcD is working with EKPC to complete additional subsurface investigations and finalize foundation design underneath major equipment. For the purpose of the Project Scoping Report (PSR), the preliminary geotechnical report was used for assumptions regarding soil properties. Deep foundations and karst remediation were not included in the scope of work or cost estimates.

- Transportation study. EKPC has engaged Wärtsilä to complete a transportation study to confirm what impacts are associated with being able to deliver the Equipment to site.

- Scope/design changes or scope gaps not identified during PSR. Any design or scope changes could impact project costs and may affect multiple systems throughout the project. Additionally, should any scope gaps become apparent during detailed design, these could impact project cost and schedule to properly incorporate.

1.7.2 Procurement Risks

Some key procurement risks include:

- Late major equipment award or design changes. Key design deliverables are based on receiving certain submittals and input data from the major equipment and will be delayed if these contracts are awarded late. In addition, late design changes by these manufacturers will have ripple effects on the BOP design that could affect the project schedule and cost. Finally, late award or design changes could affect scheduled delivery dates will impact the construction schedule.

- Price escalation for equipment. As the Full Notice to Proceed (FNTP) is not until July 2025, the long project development and permitting schedule will make it harder to lock in equipment costs early and increases the risk of price escalation. To mitigate this impact, EKPC has obtained a firm pricing for the Reciprocating Engine contract however the final price is subject to currency exchange rates at the time of award.

1.7.3 Construction/Startup Risks

Several construction and startup related risks to consider are:

- Wage rate increases and/or labor issues with contractors. Similar to equipment price escalation, due to the long project duration local wage rate increases are very possible. Additionally, the local labor pool may be affected by other capital projects in the area which are out of EKPC's control.

- Change in construction sequence due to engineering changes or late equipment deliveries. Design changes or late equipment deliveries may force the construction team to revise sequences to less favorable activities which may impact costs or schedule.

- Lack of commodity materials or price escalation. Commodity prices and lead time can be affected by other projects in the region outside of EKPC's control which can impact project schedule or costs.

- Equipment/systems do not operate as designed or need to be repaired/replaced. Equipment malfunctioning or systems not behaving as expected can delay startup as these issues are troubleshot to resolve. Lack of timely vendor corrections to improperly performing equipment can negatively impact the project schedule.

- Flushing and cleaning take longer than expected. A host of variables such as pipe manufacturing, proper storage and handling, and quality of installation can affect the speed and efficiency of cleaning out the various systems to prepare for operation.

1.8 Conclusions & Recommendations

BMcD recommends EKPC evaluate the project economics and timeline based on the cost and performances presented in this report. If the project economics are favorable, then BMcD recommends EKPC proceed with awarding the engine contract and continue with project development. BMcD recommends EKPC consider the following activities to support the project schedule:

1. Solicit RFP for firm proposals, condition bids, negotiate contracts ready for award on the following equipment:
    a. GSU transformers
    b. Medium Voltage (MV) Switchgear
    c. High Voltage (HV) Breakers
2. Finalize natural gas pipeline design and permitting requirements, drawings, and costs.
3. Refine civil and structural preliminary design based on final geotechnical recommendations.

2.0 INTRODUCTION

2.1 Background

East Kentucky Power Cooperation is developing a RICE electric generation plant at a greenfield site in Liberty, KY. The proposed project would have a total net nominal plant capacity of 214 MW and utilize (12) Wärtsilä W18V50DF RICE gensets. The plant will be connected to a new on-site 161 kV substation and transmissions line which will tie existing transmission lines approximately one mile from the project location. The capacity factor for the RICE facility is planned to be approximately 60%.

EKPC retained Burns & McDonnell to provide conceptual engineering design to support an AACE Class 3 cost estimate. This report summarizes the project scoping definition and presents the results for use in the Owner's evaluation of project feasibility and budgeting. This report assumes the plant is planned for commercial operation no later than December 2028.

2.2 Scope of Study

The scope of work included preparing the following major items:

1. Project Design Site Criteria and Scope Assumptions Matrix
2. Division of Responsibility
3. Design Basis Document
4. Key Conceptual Design Documents
5. Preliminary Project Execution Plan
6. Noise Assessment
7. Permit Matix
8. Risk Matrix
9. Project Execution Schedule
10. Capital Cost Estimate
11. Owner's Cost Estimate
12. Project Annual Cash Flow
13. Operations and Maintenance Cost Estimate

2.3 Objectives

The objectives of this study were to establish the preliminary design parameters of major components of the Project to provide adequate information to support the following activities:

1. Evaluation of the economics of the Project

2. Preparation of a Project schedule
3. Support PJM Interconnect Application process
4. CPCN Application and Public Service Commission (PSC) Approval process
5. Support required federal and state permitting process

2.4 Limitations and Qualifications

The costs presented within this report are subject to:

- Final negotiation of the terms and conditions with the major equipment suppliers and construction contractors.
- Final geotechnical report findings and final foundation design.
- Final site survey and topographic information.
- Final selection of the engineered equipment and construction contractors.
- Final permitting requirements.
- Events prior to FNTP that may cause price escalation in equipment, materials, or labor beyond that included in the costs.

Estimates and projections prepared by BMcD relating to schedules, performance, construction costs, and operating and maintenance costs are based on professional experience, qualifications and judgment as a professional consultant. Since BMcD has no control over weather, cost and availability of labor, material and equipment, labor productivity, energy or commodity pricing, demand or usage, population demographics, changes in technology, construction contractor's procedures and methods, unavoidable delays, construction contractor's method of determining prices, economic conditions, government regulations and laws (including interpretation thereof), competitive bidding and market conditions or other factors affecting such estimates or projections, BMcD does not guarantee or warranty (actual, expressed, or implied) that actual results, rates, costs, performance, schedules, etc., will not vary from the estimates, analysis, projections, and recommendations prepared by BMcD and contained herein.

3.0 PROJECT DEFINITION

3.1 Project Overview

This project will include the installation of twelve (12) Wärtsilä W18V50DF RICE generators. Each engine generator set shall be installed indoors and fired on natural gas and diesel. Diesel will be required at all times as a pilot fuel even when the engines are firing natural gas. The Plant shall be available for peaking service at all times of the year but shall also be designed for continuous service. Engines and auxiliary equipment will be delivered to the Site and the engines will be delivered to the power block foundation by the engine manufacturer to support EKPC's planned schedule.

The natural gas and diesel systems shall be designed to support load change capability (ramp rate) from minimum load to maximum load of 4MW/minute/engine.

Each engine generator set, support skid, BOP equipment, and system is designed to be able to operate at a minimum electrical load of 40% of its maximum electrical rated output capacity while meeting air permit emission requirements. Engine generator set capacity, heat rates, and emissions requirements shall be as defined in Section 4.

The Project shall be capable of normal operation when connected to a public power transmission grid and isochronous operation when in island mode.

3.2 Project Scope and Design Assumptions

3.2.1 Project Scope

The site design criteria and project scope matrix which are included in Appendices A and B form the basis of the plant development effort. The site design criteria and scope matrix provide general design conditions for the plant including plant operational characteristics as well as basic engineering discipline (Architectural, Civil, Structural, Mechanical, Electrical, Switchyard, and Instrument and Control) design criteria. These documents were developed, reviewed, and revised in coordination with EKPC to provide a clear and consistent understanding of the major underlying assumptions used in development of this project.

3.2.2 Key Design Documents

In addition to the design criteria and scope matrix, the following preliminary design documents were developed to form the basis of the project preliminary design and are included in the Appendices attached to this report. These documents were reviewed with the Owner to confirm the basis of understanding of the Project.

- Appendix C: Project Division of Responsibility (DOR) Matrix
- Appendix D: Equipment List
- Appendix E: Preliminary Project Scoping Drawings
    - Site and General Arrangement (GA) Drawings
    - Switchyard Arrangement Drawings
    - Architectural Building Drawings
    - Electrical Single Line Diagrams
    - Mechanical/Process Piping & Instrumentation Diagrams
    - Control System Architecture
- Appendix I: Noise Assessment
- Appendix J: Permit Matrix
- Appendix L: Design Fuel Basis
- Appendix N: Preliminary Fire Protection Design Basis

3.3 General Design Criteria

3.3.1 Operating and Control Philosophy

The Plant is expected to be operated as a peaking asset with the capability of operating continuously as needed. The technology consists of dual fuel engines capable of operating on natural gas or diesel fuel, capable of connecting to the grid within one minute and achieving full load within five minutes allowing a rapid response to fluctuations in power demand. Reciprocating engines O&M and life span are not impacted by quantity of starts; only hours of operation.

The plant is expected to operate at a 60% capacity factor. The plant will be controlled using a new control room staffed 24 hours a day. The control room will house the plant control system (PCS) that will control all the major systems of the plant. Plant personnel will be fully qualified to operate all plant systems.

Plant automation will be designed for secure and safe operation of all equipment. Maintenance support will be supplied by on-site staff as required for routine maintenance activities.

The facility will dispatch power (3 engines at a time) through 2 GSUs to the facility switchyard, which connects to the nearby 161kV line via two tapped connections. A third GSU is installed as an online spare, and will only be energized if one of the two online GSUs experience an outage. Therefore, a maximum of two GSUs will dispatch power at any given time through the switchyard. Each of the three 3 GSU's has a line position in one of the three bays within the switchyard in the Breaker-and-a-half (BAAH) switchyard arrangement. The existing 161kV line running adjacent to the yard will be tapped into, and out of, the new 161kV switchyard.

The Plant will have dedicated full-time operations and maintenance staff. A total of approximately 23 people are expected to operate the new units.

The Plant is to have "black-start" capability. As such, the plant will utilize an emergency auxiliary generator capable of starting critical equipment and a single engine to bring the plant online without help from external power supplies.

3.3.2 Plant Location and Layout

The Liberty RICE facility will be located on a 90 acre lot at a greenfield location approximately 4 miles north of Liberty, Kentucky. Access to site is from KY-49 on Carr Sasser Road. A new site entrance with a security building and double lanes for entrance and exit will be located at approximately 528 Carr Sasser Road. The engine hall, administration building, and other major facilities will be located approximately 700 feet from the guard shack into the center of the property boundary. The site layout considers access roads for delivery of equipment and materials during construction as well as operation, while also considering the privacy and road use of the nearby landowners.

All engines will be placed in a single engine hall, with engines' axis running east and west, and a common centerline along the north and south. The generator side of the engines is on the east and the exhaust side of the engines is on the west. The arrangement was selected to provide the shortest path to a new switchyard from the engine generators and to mitigate noise pollution from the exhaust stacks and radiator sets. Adequate spacing between engines is included to allow access for maintenance and major overhauls. The Engine Hall Building will house the engine hall, mechanical room, tank room, maintenance/shop room, electrical room and battery room.

External to the Engine Hall are the engine exhaust trains (including the ductwork and SCRs), intake air filters, two common stacks, radiators for the closed cooling water system, as well as the fuel oil tanks and concrete containment. The site layout considers access roads for delivery of equipment and material during construction to the various laydown yards, as well as during operation for the warehouse and storage facility, the fuel oil containment, and the tank room.

South to the engine hall incorporates 5 acres of space for future expansion, capable of doubling the quantity of engines considered during this scoping assessment. The area will be used as a laydown during the construction of the current facility. An asphalt paved loop road is included around the current engine hall building, warehouse and admin space, as well as the future area for expansion.

On the far south side of the property, a new meter and regulating station will be installed, owned and operated by the pipeline operator. Access is provided for the pipeline operator to access their facilities without being able to access EKPC's facilities.

A new switchyard is located to the east of the new units. Two medium voltage switchgears located in medium voltage buildings will collect power from up to 6 engine generators. The two switchgears will then connect to generator step up transformers located in containments between the medium voltage buildings and the new switchyard. The new switchyard and transmission lines will then connect to existing lines further to the east of the property approximately 1 mile away.

Refer to Appendix E for Site Arrangement drawings for additional information.

3.3.3 Design Conditions

The following site ambient conditions were used as the basis for preliminary design.

1) Site Elevation: 1080 feet above mean sea level (MSL)
2) Ambient Design Conditions:
    a) Extreme Summer Maximum: 104.9°F dry bulb (db)
    Applicable design conditions for the following:
        (1) Equipment cooling (lube oil, fuel oil, generators, coolant, etc).
        (2) Motor design.
        (3) Water supply.
    b) Summer Ambient (1% °Fdb / °Fwb): 90.0°F / 72.6°F
    Applicable design conditions for the following:
        (1) Intake Air Systems.
        (2) Engine Systems

(3) Building enclosure cooling and ventilation.

c) Average Ambient (°Fdb / %RH): 55.8°F / 60.0% RH

d) Winter Design – 99.6% of time above (°Fdb): 8.8°F

Applicable design conditions for the following:

(1) Heating, Ventilation, and Air Conditioning (HVAC) indoor heating systems.

(2) Insulation systems.

e) Extreme Winter Minimum (°Fdb): -21.7°F

Applicable design conditions for the following:

(1) Freeze Protection (design conditions shall assume -15°F with 10 mph coincident wind).

(2) Material compatibility of outdoor located equipment

Additional information is provided within Appendix A.

3.3.4 Redundancy

All major systems shall achieve redundancy as follows: All systems shall be designed to allow for a single failure without impacting 50% of the availability of the facility unless otherwise specified in this document.

All failures are to be evaluated on a single contingency basis and will not be evaluated on a double contingency basis.

Where redundant mechanical equipment is supplied, the idle device shall be capable of immediately backing up the operating device. The switchover shall be accomplished automatically through the control system.

Critical Systems and sizing for plant redundancy include:

Equipment	Design Parameters	Notes
Fuel Gas Heating and Regulation – **BY GAS LINE OPERATOR**	TBD	The new RICE facility may require fuel gas heating and regulation in the event that the supply pressure from the gas line provider is greater than 225 psig. The scope of the Fuel Gas Metering and Regulating Station is the responsibility of the Gas Line Operator and outside the scope of this project.

Equipment	Design Parameters	Notes
Fuel Gas Coalescer	1 x 100%	The fuel gas coalescer is critical to plant operation; however, the filter/coalescer fails with such a low frequency that the capital cost for a 2x100% design is not economical to the project. Filter/coalescer drains to a tank which can be unloaded while the plant is online and coalescing filters can be monitored using differential pressure instrumentation to track loading of the coalescer with plant operation. It is not recommended to install a bypass, as this could allow for water to become entrained in the underground portion of the system.
Fuel Gas Engine Hall Supply Pressure Regulating Valves	2x 100%	The fuel gas pressure regulating valves provide a consistent supply pressure into the engine hall regardless of upstream pressure swings. If the normal "working" trim valve should fail, the 100% backup, which is set at a slightly higher pressure, will take over control and maintain constant pressure to the engines fuel gas train.
Fuel Gas SRV	1x100%	The fuel gas safety relief valve is required to provide overpressure protection to the Plant fuel gas system. Additional safety relief valves would only add single points of failure to the gas system.
Main Fuel Gas Slam-shut & Vent Valves	1x100%	Single fuel gas slam-shut valve and fuel gas vent valve assemblies will be installed to shut off and vent gas from the engine hall when fire and gas detection alarms trigger the need for a safety shutoff. Failure rate for an individual valve or associated solenoid remains the same, therefore there are scenarios where having two valves and solenoids in parallel is less desirable than with one. For example, if a failure of the solenoid occurs during a command to shut the main gas valve, the valve will remain open with multiple valves installed. The probability of either valve and associated solenoid failing or both failing is greater than one valve failing which is not desirable in relation to the safety function of the main gas shut off valve.

Equipment	Design Parameters	Notes
Fuel Oil Tanks	2x50%	Two tanks shall be provided in a 2x50% configuration and sized to provide fuel oil for a minimum of 3 days of plant operation at full load utilizing liquid fuel oil (ULSD) as the fuel source. Failure of a single tank is highly unlikely, however the plant is still capable of operating at full load with a single tank in operation while requiring more frequent fuel deliveries.
Fuel Oil Pumps	3x50%	The fuel oil pumps shall be provided in a 3x50% configuration. Fuel oil is required as pilot fuel during gas operation, so a minimum of one pump must operate continuously. However, two pumps are required to operate during full load in diesel operation. Redundancy is maintained in both operating cases with a single pump failure.
Fuel Oil Heaters	2x50%	Fuel oil heaters are supplied in a 2x50% capacity. This type of heater has very high reliability, and given fuel oil is utilized as a backup source, full redundancy is not considered. Should this heater fail, a second heater is capable to keep the plant online at reduced load.
Urea Tanks	2x50%	Two tanks shall be provided in a 2x50% configuration and sized to provide reagent for a minimum of 3 days of plant operation at full load utilizing liquid fuel oil (ULSD) as the fuel source, or a minimum of 7 days of plant operation at full load utilizing natural gas as the fuel source, whichever is greater. In this instance, utilizing ULSD results in larger storage requirements for a 32.5% Urea solution.
Urea Forwarding pump skid	2x100%	Redundant pumps on a single skid shall be supplied by the engine vendor to serve the plant. Urea is essential to plant operation to ensure NOx emission limits are met for the plant. Each pump shall be equipped with dedicated BPRV for maintaining pressure in the urea header.

Equipment	Design Parameters	Notes
Instrument Air Compressors	3x50%	Instrument Air is required to atomize Urea for NOx control and valve actuation. Therefore, continued plant operation is dependent on the instrument air compressors and redundancy is required. Instrument air compressors will be single speed for on/off service.
Instrument Air Dryers	2x100%	Instrument Air is required to atomize Urea for NOx control and valve actuation. Therefore, continued plant operation is dependent on the instrument air compressors and redundancy is required.
Instrument Engine Hall Supply Pressure Trim Valves	2x100%	The instrument air pressure trim valves provide a consistent supply pressure into the engine hall regardless of upstream pressure swings. If the normal "working" trim valve should fail the 100% backup, which is set at a slightly higher pressure, will take over control and maintain constant pressure to the Engine Hall.
Starting Air Compressors	3x50%	Starting air compressors are sized to reload the starting air bottles within one hour when they have been reduced to pressures lower than required for an engine start.
Starting Air Bottles (Tanks)	n_e* x 1.5 engine starts 4 total	Starting air bottles shall be sized to allow for n_e* x 1.5 engine starts without the starting air compressors operating to re-pressurize the bottles. Engine misfires and failed starts are unusual, but not unlikely events which is why storing more than one start per engine is recommended.
GSU Transformers	3x50%	GSU transformers are sized for no more than 6 engines on a transformer. Loss of transformer will result in downtime associated with switching to the transformer on standby. All three GSU transformers will be the same size.
MV Switchgear	2 for every 6 engines	MV switchgear is sized based on connected generator load and available short circuit capacity. No more than 3 generators can be placed on a single bus; any more than that will exceed the fault duty of the equipment. Failure of an MV bus will result in loss of connected generation.

Equipment	Design Parameters	Notes
Station Service Transformers & LV Switchgears	2x100% (for every 6 engines)	Liberty RICE will be sized with four station service transformers. Each Station Service Transformer will feed one LV Switchgear. There are tie breakers connected between the LV Switchgear busses to provide backup to the system in the case of transformer failure or maintenance.
Emergency Generator	1x100%	500 kW Emergency generator will be supplied to support loss of power to the facility. The emergency generator is sized for black start capabilities, capable of bringing one engine online. Only one emergency generator is contemplated because failure of the emergency generator would be considered a double contingency failure.
Plant Control System	1 x 100%	The Plant shall have a primary/secondary power source from the 125VDC panel which feeds into an active redundancy module. The 125VDC feed from the active redundancy module provides two power supplies to the Programmable Logic Controller (PLC) system. The common is equipped with redundant Computer Processing Units (CPUs). Networking/firewall equipment within the main engine panel shall be redundant and upon failure, automatically transfer to the redundant equipment to maintain panel operation. Input/Output (I/O) shall be appropriately partitioned across cards in the panel such that failure of a single card will not disable redundant equipment discussed in this section.
125V Direct Current (DC) Battery System (BOP)	1x100%	The BOP battery system consists of 2x100% chargers, vented lead-acid batteries (with accessories). Rated for minimum of four (4) hours operation.

Equipment	Design Parameters	Notes
125VDC Equipment	1x100 %	125VDC system should be designed such that the entire 125VDC system shall not have to be shut down to perform maintenance on the 125VDC breakers. Each DC breaker should have an individual connection to the DC bus. The 125VDC system should be designed so that primary feeds for equipment are grouped together on one set of breakers, and secondary feeds are grouped together on another set of breakers. A disconnect point should be provided to the primary and the secondary set of breakers to allow for de-energized maintenance on both sets of breakers.
125VDC Battery Chargers	2x100%	Redundant battery chargers should be provided in both the 125VDC and 110VDC cabinets.
120VAC UPS	1x100%	The UPS system will be fed from the plant station batteries, with an alternate source from the plant’s 480V system.
Fire/Gas Detectors	See Notes	*List of alarms/devices in the engine hall that will trip the plant during operation will be as follows:* • Gas Detectors: o Two 20% Lower Explosion Limit (LEL) alarms from two gas detectors • Fire Detection: o Two Ultraviolet (UV)/Infrared (IR) detectors in alarm o One UV/IR & one gas detector in alarm

* n_e = number of engines located at a Project site

3.3.5 Failure Mode Analysis

The plant design shall consider the following failure modes and plant response of critical electrical systems.

Failure mode	***Plant Response***	***Notes***
Loss of control of Automatic Gain Control (AGC) system to Plant	The engines will remain in their current state of operation based on last control signal. All safety shut-downs remain enabled. Local and remote alarms will indicate loss of AGC signal.	AGC setpoint will be frozen at the setpoint prior to the loss of signal. plant control system shall incorporate functionality which ignores a zero setpoint in the event of an abrupt failure. Local control system through the plat control system will remain.
Loss of remote monitoring signal to Plant	The engines will remain in their current state of operation. Local Human Machine Interface (HMI) to alarm that remote control has been lost.	Local operation shall not be lost when remote monitoring fails.
Loss of Engine specific PLC (Engine specific control panel)	If all Engine-wise PLC's lost, the plant will trip. If a single engine PLC lost - that engine will trip. Other engines shall be unaffected.	Loss of Engine-wise panel will trip associated engine. Other engines are unaffected. Each Engine-wise panel loss will send an alarm to the plant control system.
Loss of Plant Control System	If the BOP PLC is lost/fails, the Gas Valves and all Engines shut-down.	See Section 3.2.4 for Redundancy for further discussion on the reliability of the Plant Control System panel
Loss of HMI Screen	If HMI screens are lost, the engines will remain in their current state of operation	Engines will continue to run and operators will need to walk to the local control panels and manually operate or shut-down the engines from those panels.
Loss of Aux Transformer	Loss of one transformer will require operators to manually close the LV Switchgear tie breaker and switch the bus load to the secondary transformer for that bus system. Engines served by that bus will continue to run with all safety-shutdowns in place. Should the secondary transformer be lost, then the generating units should be taken off-line.	If a single Aux transformer is lost serving one of the 480V buses that are split across no more than 3 Engines, the Engines will continue to run until a safety shutdown is required (i.e. cooling water temperature reaches the high shut-down level since the radiators have stopped running due to the loss of the 480V bus).

Failure mode	***Plant Response***	***Notes***
Loss of DC Power	Loss of: -Engine OEM DC Power- Trip the engines -BOP 125VDC – Trip all engines	For the 125VDC system, a full failure will require a loss of two battery chargers and battery power to result in all engines tripping
Loss of one of the GSU transformer	Site will trip at most 6 engines	The Project incorporates an online spare GSU that can be switched into with minimal engine downtime.
Emergency Start Scenario	- Aux Emergency generator will start up - DC systems will provide power backup power	Auxiliary Emergency Generator runs on Diesel. On a loss of power, the Generator will startup and pick up load as needed to continue emergency operations.
Low or High Natural Gas header Pressure	Trip the engines	Units will alarm operator and begin to derate as gas pressure falls to minimum (trip) pressure. High pressure will also trip the engine gas valves.
Low Oil Pressure	- The engine will detect low oil pressure - Trip on low oil pressure	Low oil pressure will trip a specific engine. Each lube oil system is engine specific. There is also a start permissive for oil pressure and level required.
Urea	- Low flow Urea - The unit(s) affected will alarm and trip	The SCR system trips only on high temperature in the SCR. Most likely caused by unburnt fuel combusting in the exhaust gas stream rupturing a disk.
Loss of power to generator protection relays (SEL-700G)	- Redundant relay will continue operation	Redundant generator relays will be installed for each unit on the engine panels and a single failure will not trip an engine.
Fire & Gas Detection Alarms	Should combination of alarms described above occur, the main gas valve will trip and all Engines will shut-down.	Alarms (heat detection, gas detection, etc.) should not trip plant without a minimum of two detectors (gas or fire, not either) alarming while engines are in operation

3.3.6 Life Safety Considerations

Life and Safety requirements of the effective building code will set the minimum design considerations for the various buildings and enclosures. The list of codes and standards which may apply to the Project are included in Appendix N.

The code requirements for each building are dependent on the occupancy classification and intended use of the space. The occupancy classification then indicates and affects fire protection requirements and separation distances, maximum rated occupant use, minimum exit distances and secondary egress requirements, required plumbing fixture units, and energy code requirements.

The Administration building will house the control room, DCS room, offices, restrooms, as well as a congregation area. Due to its expected use, it was given a B (Business) occupancy rating. This occupancy classification allows for a higher density of occupants per square foot and will require sprinkler protection. Additional occupancy ratings, fire protection systems and life safety considerations are outlined in Appendix N.

3.3.7 Future Expansion

The facility incorporates space for future expansion of an additional engine hall and auxiliary buildings of the same size to the south of the planned facilities. The current design incorporates a site road encompassing the space for a future 12 additional engines, as well as has space for future fuel oil tanks. Refer to the Site Plan in Appendix E.

3.3.8 Environmental Design Criteria

The site will be a Prevention of Significant Deterioration (PSD) major source so emissions from the engines will need to meet BACT emission limitations and controls. BACT will likely be SCR for NOx and oxidation catalysts for CO and VOC emissions. In addition, the engines will be required to meet New Source Performance Standards limits at 40 CFR Part 60, Subpart IIII and potential Subpart JJJJ for compression ignition and spark ignitions engines, respectively. With the addition of the SCR and oxidation catalysts, both systems are designed to meet these limitations. Additional information regarding air permitting requirements will be provided as permitting continues.

3.3.9 Fuel

Pipeline natural gas will be used to supply fuel to the dual fuel reciprocating engines. As a separate project, EKPC will bring a new gas pipeline to the site boundary with a new fuel gas dew point heater and Metering and Pressure Regulating (M&R) station owned and operated by the gas pipeline company. This project will tie into the M&R station and bring the natural gas pipeline onsite to a new gas conditioning skid located south of the fuel oil tanks on the west side of the site. Once further filtration and regulation is completed, it will be fed to various equipment throughout the site. See Appendix E General Arrangement drawings for location of the new fuel gas equipment. An electric fuel gas heater will be located upstream of the M&R station to heat the fuel gas above dew point to prevent hydrant formation.

It is expected that the fuel gas supply pressure at the M&R station will vary from a minimum of 150 psig to a maximum 225 psig. Typical reciprocating engines require fuel gas pressure ranging from 85 psig to 125 psig. Therefore, no fuel gas compressors will be required for this project. The fuel gas conditioning equipment, such as fuel gas filter/separator and pressure regulating valves, will be used accordingly to meet fuel gas supply specifications as required by the reciprocating engines original equipment manufacturer.

The reciprocating engines will run primarily on natural gas and utilize ULSD as a backup fuel source. However, ULSD is utilized as a pilot fuel during natural gas operation, so fuel oil is continuously used. Three-days of storage of fuel oil at full load will be stored in two tanks with secondary containment structures. In a separate containment, fuel oil unloading pumps, inline heaters, and forwarding pumps will supply the necessary fuel oil to the reciprocating engines and will include full recirculation via jacketed piping. The design basis for the two different fuels is shown in Appendix L.

3.3.10 Urea Supply and Storage

Aqueous urea (32.5% solution) will be delivered by truck to the site. Trucks will include on-board unloading pumps to eliminate the need for an on-site unloading system. Two 60,000-gallon urea tanks urea will be located in the lube oil and urea containment area on the north side of the engine hall and are sized for three days of storage. Two transfer pumps will be included to transfer the aqueous urea from the storage tanks to the urea dosing units of the SCR systems with a recirculation line back to the urea storage tanks. Urea will be vaporized then mixed with air before being injected upstream of the SCR catalyst to reduce NOx emissions.

3.3.11 Water Supply

The primary source of raw water will be supplied from Lake Liberty, which is an 80-acre lake approximately 45 feet deep. Water from the lake is treated at the Liberty Water Treatment Plant. A new 4” potable water line from the local county water district will be used for site fire protection water, service water, and potable water. Once on the property, the water line will be routed to the Fire Water Tank. Fire water pumps will provide fire water to the fire protection system at system pressure. A separate branch will feed the potable and service water systems. The service water system will supply water to hose stations within the engine hall and warehouse, and provide makeup water to both cooling water maintenance tanks. Upstream of the maintenance water tanks will be service-deionization (SDI) bottles to supply high purity, deionized water to the cooling water system. The potable water system will supply water to safety shower and eye wash stations on site and all potable water needs. Incoming water pressure will be pressurized by a new booster pump skid and will be supplied with either hot water heaters or recirculation loops to maintain tepid water temperatures per Code.

The city of Liberty provides a water quality report summarizing water contaminants testing, as seen in Table 3-1 below.

Table 3-1: Liberty Water Works Water Quality Report 2022

Contaminant	MCL	MCLG	Report Level	Range of Detection	Date of Sample	Violation	Likely Source of Contamination
Asbestos (MFL)	7	7	0.205	0.205 to 0.205	Oct-20	No	Decay of asbestos cement water mains; erosion of natural deposits
Barium (ppm)	2	2	0.02	0.02 to 0.02	May-22	No	Drilling wastes; metal refineries; erosion of natural deposits
Fluoride (ppm)	4	4	0.95	0.95 to 0.95	May-22	No	Water additive which promotes strong teeth
Nitrate (ppm)	10	10	0.18	0.18 to 0.18	May-22	No	Fertiziler runoff; leaching from septic tanks; sewage; erosion of natural deposits
Disinfectants/Disinfection Byproducts and Precursors							
Total Organic Carbon (measured as ppm, but reported as a ratio)	TT*	N/A	3.54 (lowest average)	2.32 to 5.64 (monthly ratios)	2022	No	Naturally present in the environment

Chlorine (ppm)	MRDL = 4	MRDLG = 4	0.86 (highest average)	0.3 to 1.34	2022	No	Water additive used to control microbes
HAA (ppb)	60	N/A	48 (high site average)	29 to 59 (range of individual sites)	2022	No	Byproduct of drinking water disinfection
TTHM (ppb)	80	N/A	60 (high site average)	38.2 to 91.4 (range of individual sites)	2022	No	Byproduct of drinking water disinfection
Household Plumbing Contaminants							
Copper [1022] (ppm) Round 1	AL = 1.3	1.3	0.609 (90th percentile)	0.008 to 3.672	Jun-22	No	Corrosion of household plumbing systems
Copper [1022] (ppm) Round 2	AL = 1.3	1.3	0.116 (90th percentile)	0 to 0.712	Dec-22	No	Corrosion of household plumbing systems
Lead [1030] (ppb) Round 1	AL = 15	0	26 (90th percentile)	0 to 41	June-22	No	Corrosion of household plumbing systems
Lead [1030] (ppb) Round 2	AL = 15	0	5 (90th percentile)	0 to 6	Dec-22	No	Corrosion of household plumbing systems
Other Constituents							
Turbidity (NTU) TT	**Allowable Levels**		**Highest Single Measurement**		**Lowest Monthly %**	**Violation**	**Likely Source of Turbidity**
Turbidity is a measure of the clarity of the water and not a contaminant	No more than 1 NTU* Less than 0.3 NTU in 95% of monthly samples		0.09		100	No	Soil Runoff

3.3.12 Fire Protection Water

Fire protection water will be sourced from a nearby clarified and filtered raw water county supply line and stored in a new Fire Water Storage tank. It will be heated and insulated to meet the National Fire Protection Agency (NFPA) temperature requirements and will be supplied with a dedicated suction to electric and diesel fire pumps to ensure sufficient capacity for the most demanding fire protection requirements plus a 500 gpm hose allowance for a two-hour duration fire event. A new underground distribution loop will be added to supply the new fire water throughout the RICE facility. The buried loop will tie into all buildings requiring fixed piping suppression along with hydrants dispersed around the plant. Fire water will be supplied to the header system via a new electric motor driven pump backed up by a new diesel engine-driven pump. Header pressure will be maintained via a jockey pump. All fire pumps will be located in a dedicated enclosure adjacent to the Fire Water Storage tank.

3.3.13 Cooling Water

A glycol-water mixture is utilized for the closed cooling water and heat rejection system. The cooling water is used in the high temperature system for cylinder and jacket cooling, as well as the low temperature system for intake air cooling and lubricating oil cooling. Wärtsilä may utilize a propylene glycol mixture for coolant, which is less toxic than ethylene glycol however less efficient.

3.3.14 Wastewater

Storm water runoff from non-process equipment areas, such as parking lots and building roofs will be collected in a new stormwater runoff pond and discharged to existing permitted outfalls through new ditches.

Water collected from floor drains and containment areas around equipment, that may contain small amounts of oil, will be directed through a new oil/water separator. The water discharged from the oil/water separator will be sent to the stormwater pond.

Sanitary waste from showers, wash basins, and toilet facilities will be collected and discharged to a new septic leach field north of the facility for treatment and discharge.

3.3.15 Lubricating Oil

The lubricating oil system stores and provides lubricating oil to the engines. New lubricating oil shall be delivered by truck to site. Trucks are equipped with bulk transfer pumps to offload new lubricating oil into the new oil storage tank. The storage tank shall provide local and remote level indication in addition to a low oil level alarm for transfer pump control. From this tank, the lubricating oil transfer pump (stationary) shall transfer the oil to the lubricating oil sump on each engine.

3.3.16 Exhaust Gas and Seal Air

The exhaust gas system allows for gases exhausted from the engines to leave the Facility and be removed to atmosphere. The emission control system is installed within the exhaust gas system and will limit NOx, CO, and other emissions constituents to within permitted levels. A CEMS system is not required for this installation.

EPA stack test ports shall be installed in the horizontal SCR outlet ducts downstream of the treatment equipment and catalysts as required by state and federal requirements. Permanent ports will be installed to allow for each emissions test required during Performance Testing.

Separate exhaust trains for each engine will discharge into two common stacks. Engines one through six will discharge through a common stack, and engines seven through twelve will discharge through a common stack. Seal air fans will provide seal air to dampers installed in each engines exhaust train for engines that are not in service. This will prevent exhaust gas from engines in operation from entering the exhaust system of another engine not in operation.

3.3.17 HVAC

The HVAC system shall account for heat loads provided by the generating set supplier along with heat loads from BOP equipment. All heating, cooling and ventilation shall be done via mechanical or electrical means; no gas heating will be utilized.

The Engine Hall shall be designed with supply air fans and gravity exhaust to ensure a constant positive pressure is maintained whenever the system is operating. Heating will be provided via electrical unit heaters to prevent freezing within the engine hall.

Air conditioning units serving Administration building will be sized at 2x50%. The Comm/Data Room shall primarily be served by a Computer Room Air Conditioning (CRAC) unit. Air conditioning units serving Electrical and Switchgear rooms will be sized at 2x50%. The warehouse, mechanical room, and tank enclosure room will all utilize supply fans and mechanical ventilation during the summer and unit heaters during the winter. The tank drive-in lane will be equipped with an exhaust fan which will be energized when a space mounted CO / NO2 sensor detects a high alarm. If used, rooftop units shall be mounted on the ground without access platforms provided.

3.3.18 Fast Start Capabilities

To prepare for a changing market, system demands and environmental regulation, faster plant start times are becoming increasingly more important. With the varying requirements for fast start capabilities, there are many options for fast start design, depending on the specific requirements and operational considerations of the plant. The facility will be capable of syncing to the grid within one minute, and ramping from minimum load to maximum load within five minutes. This technology’s dispatch capability along with the unrestrained flexibility on allowable starts provides the greatest value to grid operators, as well as EKPC's ability to provide reliable energy to their customers.

3.3.19 Noise Criteria

The Project is not subject to specific noise requirements. As such, it will be designed to generally comply with EPA guidelines for sound emissions. Equipment selection considers low noise options in order to generally comply with the guidelines. Due to the proximity of nearby receptors, additional sound attenuating equipment such as resonators and vent silencers are also selected. A preliminary sound assessment is provided in Appendix I.

3.3.20 Aesthetics and Landscaping

Landscaping for the facility consists of temporary and permanent seeding for erosion control of disturbed areas, as well as privacy berms along the entrance road on the east portion of the facility.

3.3.21 Geotechnical Data

For the basis of the cost estimate, all foundations are assumed to use shallow mat foundations. Over-excavation and recompaction is included for the foundations in the Engine Hall and other foundation locations as needed. Additional suitable fill material as required for site preparation, backfill, and grading will be required off-site with hauling costs included in the estimate. Rock excavation was not included.

A subsurface investigation for the facility was completed in July 2024 by Consulting Services Incorporated (CSI), and preliminary findings are found in Appendix H. CSI identified in their report, that the subsurface conditions suggest although there are some surficial dropouts present at the site, no open holes in the bedrock were present. However, the site is an area underlain by rock with a medium risk for Karst potential and Karst may still be present. Additional geotechnical investigations are required to determine if Karst will impact the the civil grading and foundation design for the facility, as well as the transmission line limits of disturbance as the subsurface investigation did not cover this area. Further collaboration with CSI is necessary to determine if deep foundations are required underneath major equipment structures.

3.3.22 Construction Power

Power supply for construction will come from an existing overhead line. This new feed will supply power to a pad-mounted transformer located nearby the power pole that will step down the voltage to 480V. The transformer will be a 1000kVA transformer intended for construction power to the facility, including the construction trailer area. The 480V feed will be distributed around site to 400A power skids located throughout the construction areas to provide 480V and 120V power to welder packs and spider boxes. After installation of this temporary power system, an allowance has been provided for electrician support for general maintenance to this system during the duration of construction.

3.3.23 Electrical and Transmission Interconnection

The reciprocating engine generators output will be connected through generator step-up transformers to a new 161 kV switchyard located east of the power block. The connection from the generator step-up transformers to the new 161kV switchyard will be accomplished by overhead transmission lines. The new 161kV switchyard will be a three (3) bay, breaker-and-a-half configuration. Two (2) new 161 kV transmission lines will be constructed to connect the new 161kV switchyard to the existing 161 kV grid. The lines will tap an existing, adjacent, 161kV transmission line located to the north of the new 161kV switchyard location.

The plant startup source will be provided through auxiliary transformers for the unit connected to the new substation/switchyard. The auxiliary transformers will be supplied as two winding transformers with 480V on the low side winding.

3.3.24 Network Upgrades

Various network upgrades to the existing transmission and distribution grid is required to accommodate the additional capacity. The following projects were identified as being required to be complete prior to commercial operation of the the facility:

- Replacement of a 161/138 kV transformer with a higher rated unit at the Marion County switchyard.
- The maximum conductor operating temperature at the Casey County-Marion County 161 kV line is required to be updated to 212°F.
- The Liberty Junction-Pulaski County Junction-Cooper 161 kV line will need to be upgraded using a higher rated conductor over 26.2 miles.
- Optical ground wire will need to be installed along the South Casey County-Casey County 161 kV line.

- At the Denny Substation, the bushing current transformers associated with the Denny-Wibord Tap 69 kV line need to be upgraded.

4.0 PLANT PERFORMANCE & EMISSIONS

Tables 4-1 and 4-2 below show the estimated performance of the new RICE facility in different modes of operation. Performance estimates are given down to 50% load, however bid information received from Wärtsilä indicates that the minimum load while achieving minimum emissions compliance is 40%.

Table 4-1: Performance Estimates (Wärtsilä W18V50DF), Natural Gas Operation

Case	Winter Design	Annual Average	Summer Design	50% Load Annual Average
Quantity of Engines Operating	12	12	12	12
Ambient Temperature, °F	9	56	90	56
Unit Electrical Output, kW	18,132	18,132	18,132	9,066
Unit Heat Rate (HHV), Btu/kWh	8,260	8,260	8,260	9,420
Plant Gross Electrical Output, kW	217,584	217,584	217,584	108,792
Total Plant Auxiliary Loads, kW	4,534	4,214	4,560	3,514
Estimated Net Plant Output, kW	213,050	213,370	213,024	105,278
Estimated Net Plant Heat Rate (HHV), Btu/kWh	8,436	8,423	8,437	9,734
Total Heat Input, MMBtu/hr	1,797	1,797	1,797	1,025
Fuel Gas Flow, lb/hr	77,700	77,700	77,700	44,300

Table 4-2: Performance Estimates (Wärtsilä W18V50DF), ULSD Operation

Case	Winter Design	Annual Average	Summer Design	50% Load Annual Average
Quantity of Engines Operating	12	12	12	12
Ambient Temperature, °F	9	56	90	56
Unit Electrical Output, kW	18,132	18,132	18,132	9,066
Unit Heat Rate (HHV), Btu/kWh	8,639	8,639	8,639	8,655
Plant Gross Electrical Output, kW	217,584	217,584	217,584	108,792
Total Plant Auxiliary Loads, kW	4,538	4,392	4,738	3,792
Estimated Net Plant Output, kW	213,012	213,192	212,846	105,000
Estimated Net Plant Heat Rate (HHV), Btu/kWh	8824	8817	8831	8968
Total Heat Input, MMBtu/hr	1,880	1,880	1,880	975
ULSD Flow, lb/hr	13,623	13,623	13,623	7,065

4.1 Performance Estimate Basis

Performance estimates are based upon performance information received from Wärtsilä along with expected engine auxiliary power requirements and estimated balance of plant auxiliary power requirements during normal operation in each scenario. Note that the engine auxiliary load does not match the OEM performance guarantees provided in Appendix K. This is due to the difference between average/expected performance and minimum guaranteed performance. Balance of plant auxiliary loads are based on similar projects and may vary from actual auxiliary loads.

Degradation is expected to be minimal over the life of the unit. Wärtsilä claims that their engine is able to maintain unit capacity throughout the life of the unit (i.e., no output degradation). Heat rate degradation may occur as the unit's run hours increase. Wärtsilä claims that the heat rate degradation is less than 1% and the unit is returned to zero percent degradation after completion of a major overhaul. Performance estimates provided in this report reflect new and clean condition with no degradation.

4.2 Emissions Estimates

The emissions estimates assume that the plant is operating with the air quality control equipment operating at BACT limits for each engine. Table 4-3 includes a summary of the anticipated emission rates on PPM basis for each of the engines. Particulate emissions (PM10/PM2.5), SO2 and greenhouse gases (as carbon dioxide equivalents) will also be subject to BACT. However, there are no add-on controls that are available for these pollutants and BACT will be good combustion practices with low-sulfur fuel.

Table 4-3: Expected NOx, CO and VOC Emission Estimates

Constituents	Gas Operation	Diesel Operation
Nitrogen Oxides (NO_x)	6 ppm	35 ppm
Carbon Monoxide (CO) Emissions	15 ppm	20 ppm
Volatile Organic Compounds (VOC)	26 ppm	40 ppm

Notes:
1) Vendor -provided emission rates with SCR and oxidation catalysts

5.0 PROJECT EXECUTION PLAN

5.1 General Approach

The estimate is based on a multiple prime contracting approach by Owner. All procurements and subcontracts will be on Owner paper with support from the OE's engineering, procurement and construction staff. The estimate will be set up such that OE's cost for construction management, field engineering, and startup and commissioning can be removed from OE's cost and carried as an Owner cost, should Owner proceed as the sole construction manager for the project.

The contracting approach used as a basis for the Project cost estimate was a multiple contract approach. As shown in Table 5-1, the contracts were broken into two major categories; construction contracts and equipment contracts. This approach was selected based on EKPC's input and past experience with recent projects. Under this approach, engineered equipment will be procured directly by EKPC and turned over to the appropriate installation contractors. This approach provides the following benefits:

- Cost savings to EKPC in return for manageable increased Owner's risk.
- Facilitates early award of major equipment procurements to allow detailed design engineering to proceed expeditiously to meet the Project schedule.
- Offers the greatest flexibility for EKPC to be involved in key decisions regarding design.

Table 5-1: Project Procurement Plan

EQUIPMENT AND MATERIALS	
CONTRACT NO.	**DESCRIPTION**
5.1150	Reciprocating Engines
5.2150	Fire Pump Skid
5.2190	Miscellaneous Pumps
5.2191	Lift Stations
5.2320	General Service Piping
5.2490	Piping Specials
5.2520	Manual Valves
5.2530	Actuated and Control Valves
5.2710	Compressed Air Equipment
5.2711	Starting Air Compressors
5.2762	Fuel Gas Conditioning
5.2763	Fuel Oil Conditioning
5.2940	Oil Water Separator
5.2980	Shop Fab Tanks
5.4120	Stacks and Ductwork
5.4210	Cranes and Hoists
5.4310	Pre-Engineered Metal Buildings (PEMBs)

5.4411	Ridge Vent
5.4440	Vent Fans
5.4515	Precast Concrete Walls
5.4520	Structural Steel
5.4545	Seal Air Fans and Dampers
5.5110	Generator Step-Up Transformers
5.5240	Emergency Generator
5.5310	Major Elec Equipment
5.5340	Motor Control Centers
5.5410	Batteries & Uninterruptable Power Systems
5.5510	Electrical Cable
5.5620	Freeze Protection
5.6210	Instruments
C202	High Voltage Breakers
C203	Substation / Transmission Materials
C204	Substation Relay and Controls
C303	Substation Steel
CONSTRUCTION AND SERVICES SUBCONTRACTS	
CONTRACT NO.	**DESCRIPTION**
5.8110	Site Preparation and Site Finishes
5.8220	Foundations and Undergrounds
5.8323	Mechanical and Building Construction
5.8340	HVAC Furnish & Erect
5.8410	Electrical Installation
5.8560	Fire Protection and Detection Furnish & Erect
5.8570	Field Erected Tanks
5.9010	Subsurface Investigation
5.9020	Surveying
5.9021	Site Services
5.9110	Site Security
5.9130	Medical Services
5.9230	Electrical Testing
5.9250	Performance Testing
5.9260	Emissions Testing
5.9270	Noise Testing
5.9400	O&M Manuals and Training
5.9610	Start-up Cleaning Services
C403	Substation Construction
C501	Transmission Line OH / Civil

In the multiple contract approach, Owner and OE will work together to procure the construction and major equipment contracts. The procurement of the long lead time equipment such as the RICE equipment and materials, GSU's, switchgears, high voltage breakers, and other equipment as necessary early in the Project is needed to support detailed design. The contracting approach includes multiple equipment/material contracts and several construction contracts, as shown in Table 5-1. The equipment contracts allow Owner to reduce the cost of subcontractor markup via competitive bidding. There are alternate contracting approaches available, however these may lead to additional markups on equipment/material contracts. Additionally, the multiple subcontracting approach allows Owner more input into the equipment selection for the Project and provides more control of the quality of materials purchased.

The equipment contracts were set up in recognition of long lead time items that will need to be ordered early in the Project to support the schedule and are not impacted by the selection of other contractors. For a more detailed list of the scope being provided with each contract, refer to Appendix D – Equipment List. To assist in understanding the coordination of work between the multiple contracts, including responsibilities for design, fabrication, delivery, receipt & protection, foundations, piping, wiring, erection, commissioning and startup interfaces, refer to Appendix C – Division of Responsibility.

5.2 Construction Management

Construction Management personnel would leverage recent experience with overseeing construction, subcontract management, and schedule adherence/development, to help manage the construction and safety of the project, with limited rework, and on time for the Owner's requirements.

5.2.1 Project Controls

OE will be responsible for developing the initial Level III Project Schedule in coordination with the Owner Scope including:

- Establish, monitor, and update the overall schedule.
- Monitor design and procurement status and update accordingly.
- Develop construction and startup schedules and work with subcontractors to maintain in field during construction and commissioning activities.

5.2.2 Site Specific Project Documentation / Procedures

OE shall coordinate with Owner to develop:

- Overall Project Quality Assurance Plan.
- Site Specific Safety and Security Plan.
- Inspection Test Plan.

5.2.3 Procurement & Materials Management

OE shall create technical specifications, work with Owner to develop approved vendors lists, issue specifications for bids, provide technical evaluation of bids, assist Owner in technical and commercial negotiation of contracts, expedite and track deliverables, document control of submittals, review submittals in parallel with Owner, and coordinate/assist Owner with reviewing invoices and managing change order processes.

OE will work with Owner to develop template front end commercial documents to issue with procurement packages. OE shall track and verify receipt of Owner procured equipment submittals. Logs shall be issued to inform Owner of the receipt status.

Procurement packages will be issued for bid through Owner's processes and software tools.

5.2.4 Startup and Commissioning

The cost estimate assumes the start-up for the Project will be managed by OE, including an on-site Startup Manager provided by OE. Vendor representatives, contractors, and Owner's operating personnel will provide assistance, technicians, and craft as needed. Startup and commissioning includes work required to transition the project from construction to Owner acceptance and operation.

5.2.5 Performance and Emissions Testing

Overall net plant performance demonstrating output, heat rate, and functional tests will be managed by OE and performed by a third-party testing contractor. Plant emissions testing will be managed by OE and performed by a third-party testing contractor. Owner will witness all tests and agree to accepted results.

5.2.6 Engineering

OE will serve as the focal point for all engineering and design coordination of the Project. OE's project manager, project engineering leads, and main support staff will be located in the OE's design office. Additionally, preliminary design, procurement specification development, detailed engineering, and modeling will be performed by OE. Field Engineering will be supplied by OE for the duration of the construction and startup schedule.

5.2.7 Safety & Environmental

The project will require all on-site employees and contractors to comply with applicable governmental and local safety regulations, and site-specific safety program. Measures should be taken to provide safe and quality work in a productive manner. The site-specific safety plan will take into consideration project conditions that are potentially hazardous and implement programs that are designed to mitigate safety risks. The Project will comply with local and governmental mandates for environmental controls. Fuel containment practices and spill prevention will be utilized. Prior to mobilization, site-specific safety and environmental plans will be developed specifically for the Project.

5.2.8 Quality

A Project Quality Plan specifically tailored to the Project will be established and implemented, complying with the Quality Program Manual. The Project Quality Plan will describe the quality assurance and quality control requirements, organization, and division of responsibility for the project and the procedures to be followed to meet those requirements. Quality audits will be conducted to ensure that systems are followed and that the technical standards are achieved. The Project Quality Plan applies to all quality activities performed by the subcontractor's personnel in the management and control of facilities, products and services.

A focus on Quality throughout the construction phase of this project will be critical to the successful achievement of project goals associated with operability, cost, and schedule.

5.2.9 Subcontracts

Subcontractors will be evaluated and prequalified by the Owner and OE for safety performance, environmental performance, bonding ability and insurance required to be carried. Subcontractors that have questionable safety performance will not be selected. Multiple Contract packages will be executed to perform the construction of the project. It is anticipated that specialty contract packages will be segregated by trade and generally follow the Contracting plan. Major Contracted scopes are:

- Site Preparation and Finishes
- Underground Utilities and Foundations
- Mechanical and Building Construction
- Electrical Construction
- Field-Erected Tanks
- HVAC Installation
- Fire Protection Installation
- Substation Construction
- Transmission Line OH / Civil

5.3 Detailed Engineering

OE will execute engineering design as follows:

- During engineering and procurement phase, Owner involvement is anticipated to understand and incorporate expectations into each phase and aspect of the project.
- OE will manage all aspects of technical procurement management. Engineer will provide engineering support for procurement, contract management and submittal reviews for the OEM and long lead equipment prior to detailed engineering. During detailed engineering, OE will review all vendor engineering documentation and manage interfaces.
- Controlled project documents will be maintained in the OE's document management system. This enables all documents associated with the project to be filed in a standardized and accessible system.
- Design engineering results in finished designs, drawings, lists, and technical specifications for procurement and construction.

5.3.1 Architectural Design

The following architectural design engineering services will be performed:

- Design and coordination of pre-engineered metal buildings including plans, reflected ceiling plans, sections, elevations, details, interior walls, and door schedules.
- Design and coordination for PEMBs and enclosures including plans, reflected ceiling plans, sections, elevations, details, and door schedules.
- Design and coordination of specialty items such as precast concrete wall systems, storm shelter rated control room, and unconditioned Truck Unloading area.
- Design and coordination of Building codes, Energy Codes, life safety, code compliance analysis, and egress.
- Design of interior finishes and millwork
- Design of restroom fixtures and layout.
- Review vendor designs and drawings.
- Prepare technical specifications to support subcontracts.

5.3.2 Civil Design

The following civil design engineering services will be performed:

- Site Preparation, preliminary grading, finish grading, and site drainage design including temporary construction facilities, roads, parking lots, laydown areas, erosion control, temporary and final fencing and security.
- Design of the storm water detention pond.
- Design of the storm water network.

- Incorporation of findings from geotechnical investigations and soil borings for roadway design.
- Review vendor designs and drawings.
- Prepare technical specifications to support subcontracts.

5.3.3 Structural Design

The following structural design engineering services will be performed:

- Analysis of geotechnical investigations and soil borings for foundation design.
- Design of structures in accordance with applicable code, wind, snow, and seismic design criteria.
- Design of structures including reinforcing steel, structural steel, platforms, stairs, and enclosures.
- Design of deep and shallow foundations for equipment and structures.
- Review vendor designs and drawings.
- Prepare technical specifications to support subcontracts.

5.3.4 Mechanical Design

The following mechanical engineering services will be performed:

- Finalize site plan and balance of plant BOP equipment layout drawings.
- Prepare equipment specifications for procuring equipment and materials.
- Finalize Piping and Instrumentation Diagrams (P&IDs) for piping systems.
- Prepare detailed piping isometrics for large and small-bore pipe.
- Finalize and maintain General Arrangement drawings.
- Prepare, finalize and maintain HVAC drawings for the facility.
- Prepare and maintain pipeline, valve, and mechanical device lists.
- Review vendor designs and drawings.
- Prepare technical specifications to support equipment procurement and subcontracts

5.3.5 Electrical Design

The following electrical design engineering services will be performed:

- Finalize one-line diagrams.
- Prepare low- and medium-voltage auxiliary power system electrical one-line diagrams for metering and protective relaying systems.
- Prepare arrangement drawings for electrical cable trays, and raceways.
- Prepare grounding plans and details.
- Prepare raceway and circuit lists with the capability to provide interconnection drawings for electrical cable installation.

- Design field instrumentation cabling from the field devices to the plant control system.
- Prepare schematic and wiring diagrams for electrical equipment showing control circuits and equipment wiring to be used for generating cable schedules and raceway schedules.
- Prepare lighting plans and details for permanent facilities.
- Prepare communication block diagram for permanent facilities.
- Prepare required load flow and fault calculations to design the power system and procure electrical equipment.
- Provide design of emergency power and essential service alternating current and DC systems.
- Provide lightning protection performance specification.
- Provide freeze protection performance specification.
- Provide electrical area hazardous plans.
- Review vendor designs and drawings.
- Prepare technical specifications to support equipment procurement and subcontracts.

5.3.6 Instrumentation and Controls Design

The following instrumentation and controls engineering services will be performed:

- Finalize control system architecture drawing.
- Prepare control room layout and console sketch for console vendor.
- Prepare instrument procurement list/datasheets for BOP instruments.
- Prepare instrument list for BOP instruments including sensors, transmitters, switches, and indicators for installing contractor(s) scope.
- Prepare instrument installation details for BOP instruments for field installation.
- Prepare instrument location plans for instruments with field scope.
- Prepare initial BOP control system hardwired and datalink I/O list for OEM plant control system vendor.
- Prepare control narratives and graphic sketches for BOP equipment controlled/monitored by OEM plant control system (DCS/PLC).
- Prepare network wiring diagrams for field installed network cables for plant control system.
- Review vendor designs and drawing submittals.
- Prepare technical specifications to support equipment procurement and subcontracts.

5.3.7 Cyber Security Design

The following cyber security design engineering services will be performed:

- Assist Owner in complying with NERC CIP low impact facility requirements.

- Review of vendor designs and drawings.

5.3.8 Project Tools

OE will use its standard engineering tools to design the facility. A three-dimensional computer model of the plant will be developed. Major OEM models will be imported into the model as required to complete design. Physical drawings will be produced by extracting information from the model. The design tools will provide for automatic detection of physical interferences and checks for consistency between documents, as well as also create a useful tool for operation and constructability reviews througout the project allowing personnel to do a virtual walk through to view access availability for valves, operating areas, maintenance equipment and other similar characteristics. Drawings generated by OE will be provided in AutoCAD format to the Owner at the end of the project.

5.4 Constructability

Constructability reviews are an integral part of the overall project execution. Early involvement by the Owner's and OE's construction management team will provide for a solid integration of the design parameters and construction philosophy. The focus will be on project optimization and the following primary constructability issues:

- Master project schedule noting site area constraints, winter work, seasonal road and waterway restrictions, building enclosure, etc.
- Site access
- Erection sequences
- Safety during erection
- Heavy lifts and construction access issues
- Laydown requirements and areas needed
- Delivery sequence of equipment
- Prefabrication areas
- Procurement procedures
- Quality control
- Inspections
- Vendor services

5.5 Contract List

Reference Appendix C for the list of contracts, interface schedules and responsibilities.

5.6 Procurement Execution

OE procurement personnel will leverage recent experience with procuring equipment, materials and subcontracts for other power plants of similar scope and size, with the goal of reducing timeframe necessary to conform and award contracts Owner's relationships and master purchase agreements with key suppliers will be leveraged when possible.

5.6.1 Critical Equipment & Materials

Owner will be responsible for procuring all materials and equipment. Significant procurement activities must occur immediately to support the project schedule, beginning with the procurement of the following equipment and materials:

- Reciprocating Engines and Accessories
- Generator Step-Up Transformers
- Medium Voltage Switchgear
- High Voltage Breakers

5.6.2 Procurement Summary

The OE's procurement team will be responsible for daily execution of procurement activities throughout the course of the project. Major responsibilities of the team include:

- Provide technical specifications to bid all procurements per plan.
- Provide technical evaluations of all bid packages.
- Update Primavera P6 procurement schedule.
- Coordinate supplier/contractor pre-qualifications.
- Support expediting, logistics and materials management functions.
- Provide quality support with shop inspections and pre-shipment delivery inspections.
- Tracking receipt and control of materials.
- Assist Owner in reviewing invoices.

5.6.3 Procurement Status Reporting

OE will use a procurement schedule which is integrated with the Primavera P6 schedule for the entire project. Data reported in the procurement schedule includes specification/requisition dates, request for proposal (RFP) issuance, contract award, and fabrication/delivery durations for each procurement agreement. Initial input comes from integrated construction and engineering schedules and will be updated appropriately throughout the life of the project. All updates (actual dates achieved) are fed back to the Project Schedule, with any discrepancies addressed and resolved to support the needs of the project.

5.7 Construction Planning

A Construction Execution Plan will be developed to support the December 2028 COD date.

Project execution planning begins well before the Subcontractors will mobilize to the site. Once the project is awarded, OE will engage its Pre-Construction team to begin reviewing the preliminary project documents as well as the project risks to begin looking for efficiencies to allow for safe and efficient execution of the project. The Pre-Construction team would work in parallel with the project team to outline and deploy the optimized execution strategies into the project design through the mobilization phase.

Daily coordination meetings would outline the upcoming work for the following day and allow an open forum for OE and Subcontract leads to safely plan and coordinate the work for each day on site. Communication by all parties would continue throughout the project lifecycle to allow for well-coordinated interface points between all Subcontractors and stakeholders.

OE would hold a weekly progress meeting to review the plan with each Subcontractor. During the weekly progress meetings, an in-depth review of the Subcontractor metrics would be reviewed. Metrics include safety, quality, cost, and schedule performance. This time would also be used to follow-up on any outstanding action items required for the efficient execution of each Subcontract. The client would typically attend these update meetings and would have the opportunity to engage in the planning activities that occur.

5.7.1 Facility Logistics Plan

The proposed site facility layout drawing has been developed during the Project Scoping Phase in a manner that allows for safe egress on to the site for all site personnel. Personnel walk paths have been laid out considering vehicular traffic and access to the site. The site layout allows for safe foot access to the project footprint without having to cross traffic routes. The craft break trailer location is within proximity to the Workfront and will allow for efficient break times without having any of the craft workers walking long distances over break times. Once the administration building is erected, Owner, OE and OEM field personally will staff the area with temporary offices until the station becomes operational.

Appendix E provides the general arrangement site layout for the Project.

5.7.1.1 Craft Parking

The craft parking lot was developed during the Project Scoping Phase to allow direct access into the lot without driving through the project site near the craft work area. The layout would not include fencing around the parking lot. The full craft parking lot is shown on the site facility layout drawing.

5.7.1.2 Laydown Area

The proposed site facility layout drawing incorporates several laydown areas. The primary laydown area has been developed to allow for an unobstructed lane to and from the laydown yard for equipment deliveries. Other laydown areas have been identified for OEM genset pre-construction activities as well as general storage and handling activities next to proposed work areas. The space identified for future expansion also serves as a laydown area and includes temporary power connections to allow subcontractors to utilize this area for preservation activities as well as pre-fabrication activities off the site footprint. The total laydown area provided for the project was sized appropriately in comparison to similar, historical projects. The laydown areas are all within the site security fencing.

5.7.2 Mobilization and Utilities

Mobilization would include the delivery and placement of the trailer area. OE will mobilize the trailer complex for the site staff team. OE, Owner, and the selected OEM will eventually utilize the admin space as temporary offices once constructed. As the Subcontractors mobilize to site, OE will assist in the placement of the trailers, help set up the site craft break trailers, and will assign tool crib areas and Subcontractor lay down space, as required. Once the trailer complex is in place, the site preparation will begin, and power block and BOP underground activities will commence.

5.7.3 Civil Work

Civil work planned for this Project includes site preparation and site finishing. Major civil work starts with site preparation. This work would include site clearing (stripping), rough cutting the site to subgrade elevation in the power block area, onsite storage of the spoils, preparing the site roads for use during construction, and preparing the privacy berms along the site roadway. Once the power block area has been prepared it will be bathtub excavated to accommodate construction of underground utilities, the storm water network, and other subgrade site work. After the bathtub grading has been built back up to grade and the entire power block area has been adjusted to the finish grade elevation, the craft parking lot and surrounding laydown areas will be cut to subgrade elevation and surfaced for use by the Subcontractors. Once the site is surfaced, temporary and permanent fencing would be installed to secure the project site. Additionally, Carr Sasser Rd will require repavement and widening to allow for equipment access and deliveries.

After all major construction activities have been completed, the site finishing Subcontractor will mobilize to site to perform the final grade adjustments, pave the permanent plant roads, and restore the areas disturbed by the construction activities.

5.7.4 Structural

The foundations and underground contractor will excavate, backfill, form, set rebar, set cast-in-place anchors, etc. for all foundations on-site. The engine hall foundation typically gets installed first to allow PEMB erection to begin. Exhaust train foundations for charge air, SCR, stacks, and radiators follow to allow for major structural steel erection to begin. Miscellaneous and ancillary foundations get installed in sequence to support erection and setting of other steel, equipment, or tanks. The mechanical contractor will be responsible for erecting structural steel and installing post-installed anchors. Erection will be sequenced to support the construction schedule. Typically, major structural steel for the exhaust train system is installed first followed by miscellaneous pipe and tray supports.

5.7.5 Major Equipment Installation

Building, steel, and major pieces of equipment would be received and installed or temporarily stored. Smaller components, if not installed immediately, would be received, inventoried, and safely stored and maintained in one of the dedicated storage areas until they are to be installed. Foundations would be complete before the site begins the receiving process for all major equipment. Major equipment would be planned to be delivered and immediately placed on the associated foundation to eliminate double handling. All engines would be rough set by the OEM. Final alignment activities on all the equipment would be the responsibility of the Major Mechanical Subcontractor.

After the major equipment, auxiliary equipment and accessories will undergo final alignment by either the major mechanical or major electrical Subcontractors. The centerline equipment (gensets) will be the starting point for all the major equipment with the auxiliary equipment and balance of plant (BOP) equipment following.

5.7.6 Mechanical & Electrical BOP

After the Project P&IDs and Electrical One Line Diagrams are established, the OE and home office startup team will scope Mechanical and Electrical Systems and review with the Construction team. Procurement delivery sequences and Subcontractor construction system turnovers will be finalized and integrated into the Subcontract Agreements for each Subcontract on the project. Mechanical and Electrical system turnovers are sequenced to support the startup and commissioning schedule.

Large-bore piping would be reviewed by the Preconstruction and Mechanical-Piping teams to identify and optimize field weld locations. Large bore piping would then be prefabricated and spooled off-site and shipped to the site for installation following the placement of the associated major equipment. Small-bore piping would be prefabricated and spooled off-site as much as possible and will follow the delivery of the large bore piping while keeping the project schedule in mind. Piping installation would take place as soon as the associated major equipment is placed, and general areas become available.

Major long lead electrical cable would be prioritized by system and procured to align with the Subcontract construction turnover schedule. As the cable tray and conduit raceway installations are completed, cable pulls would commence. Cables would be installed by area until about sixty percent of the schedule is complete. Cable pulls would then shift to the systems required for back feed of the plant. OE will make the determination when enough work is completed to allow for the back feed milestone and allow for the safe working conditions for the remainder of the work to be completed.

5.8 Start-up and Commissioning

Start-up is one of the phases with the most risk. Planning for start-up and commissioning defines the systems or sub-systems to be commissioned by scope identification on the P&ID’s and electrical one-lines. The Startup Manager works with the subcontractors and OEM suppliers to define the isolations required to start up separate areas of the plant to sequence the workflow. During the planning stage, the Startup Manager, working with the OEM suppliers, would also define the processes for bringing auxiliary power and major flushing and cleaning, and would oversee the turnover process to make sure the facility turnover is meticulously documented in the turnover packages.

Project start-up and commissioning provides for documented, safe, timely, and orderly testing, start-up and transfer of packages, systems, and facilities. Engineering, procurement, and construction planning would support early commissioning of as many start-up packages as practical. Early checkout and testing of as many packages as possible would distribute the start-up workload more efficiently, reducing the risks and uncertainties associated with facility start-up and commissioning.

Checkout of each system or sub-system would be completed utilizing Owner’s Operations staff and handed over to Operations once all are completed. At this time, Owner would operate each system as permanent plant equipment with support from the RICE equipment supplier and OE on any issues that arise with the equipment. Startup is complete when Performance and Emissions Testing is finished and Commercial Operation with full acceptance by the Owner is achieved.

Start-up and commissioning planning will begin in the engineering stage with the definition of start-up packages. Engineering, procurement, and construction planning will support early commissioning of as many start-up packages as practical. Early checkout and testing of as many packages as possible will distribute the start-up workload more efficiently, reducing the risks and uncertainties associated with facility start-up and commissioning.

Planning for start-up and commissioning defines the systems or sub-systems to be commissioned by scope identification on the P&ID's and electrical one-lines. The Startup Manager works with Engineering to define the isolations required to startup separate areas of the plant in order to sequence the workflow. During the planning stage the Startup Manager will define the processes for bringing auxiliary power on-line, major flushing and cleaning, and define documentation requirements for the turnover packages.

Checkout of each system or sub-system will be completed utilizing Owner Operations staff, and handed over to Operations, system-by-system, as they are completed. At this time, Owner will operate each system as permanent plant equipment with support from contractors on any issues that arise with the equipment. Startup finishes when Performance Testing is completed, and Commercial Operation with full acceptance by the Owner is achieved. The principal start-up activities include the following:

- Preparation and planning
- Start-up and commissioning process
- Operator training

5.9 Project Closeout Plan

5.9.1 Engineering Completion and Project Closeout

OE would maintain a set of all field changes. At the completion of construction and startup, the field staff would return a copy of the record set to the design team along with the subcontractor's record sets. The design team would incorporate the changes into a set of "Conformed to Construction Records" documents.

As the plant begins the operation phase, OE would demobilize its field operations staff from the project site. Once the demobilization phase is complete, a member of the project team would stay engaged with the project until the warranty period has expired, and the Prime Contract requirements have been fulfilled between Owner and OE.

Field staff will maintain a set of all construction drawings and lists, and will require contractors to maintain a record of all field changes on the documents. At the completion of construction and startup, the field staff will return a copy of the record set to the design team along with the contractor's record sets. The design team will incorporate the changes into a set of Conformed to Construction Records documents.

6.0 PROJECT SCHEDULE

6.1 General

The project schedule is based on a Commercial Operation date of December 2028 and is included in Appendix Q to this report. The schedule encompasses activities from permitting through commercial operation. The schedule reflects a 24 month plan for the construction and commissioning period. The schedule reflects the multi-prime contracting approach. Table 6-1 reflects the major milestones for the project.

Table 6-1: Project Milestones

PJM Interconnect & Permitting Activities	**Date**
Interconnect Application Submitted	November 2023
Air Permit Application Submitted	September 2024
CPCN Application Submitted	September 2024
RUS NEPA EA Application Submitted	December 2024
Anticipated CPCN Order from PSC	May 2025
Anticipated RUS NEPA EA Application Approval	October 2026
Air Permit Application Approval	December 2026
Interconnect Application Approval	December 2027
Engineering and Construction	
Award Reciprocating Engines Contract	October 2024
LNTP Engineering for Early Procurement Activities	November 2024
Begin Detailed Design	May 2025
FNTP Procurement for Equipment and Materials	July 2025
Site Mobilization	December 2026
Begin Foundations and Undergrounds	February 2027
Erect Engine Hall	June 2027
Above Ground Installation of Mechanical and Electrical	August 2027
Engine Delivery and Installation Complete	November 2027
Begin Startup and Commissioning	March 2028
Commercial Operation Achieved	December 2028

6.2 Permitting

Currently, several permitting activities must be achieved as to not delay project timeline.

- The air permit application approval is required to begin construction. The overall duration to obtain the air permit is approximately 24 months between submittal and approval. Once the air permit is received, mobilization can occur.

- The interconnect application approval is required for dispatching power to the grid, as well as for backfeed for commissioning activities.

6.3 Engineering

The engineering for the project is outlined in Section 3.0. An engineering timeframe has been included in the project schedule that supports issuing construction documents that are fully complete at construction contract award to minimize rework and revisions in the field. Engineering is required to be nearly complete at the time of FNTP. This results in the necessity to issue several LNTPs to support early BOP equipment procurement prior to FNTP in order to complete engineering without placing any scope on "hold." The schedule represents a conservative approach in which equipment submittals are required for all equipment prior to engineering completion.

6.4 Major Equipment

The project schedule is based on current delivery lead times including 12-14 months for the reciprocating engines, and 36 months for the GSUs. It will be necessary to issue LNTPs for long lead equipment as well as several LNTPs for BOP equipment to support the project schedule.

6.5 Construction

Construction is planned to begin with construction facilities, site prep, and underground utilities in December 2026. This work is expected to continue into late spring 2027. Piling is currently not in the scope of work, however the schedule currently holds one month for the activity should it become necessary. Construction of the engine hall will follow foundations. The engine hall will be enclosed by October 2027 to allow for installation of the gensets. Engine equipment deliveries are scheduled for November 2027 with above grade construction to follow into 2028. Tanks, administration building, medium voltage enclosures, and fueling equipment construction also begins in Summer 2027 and will finish in early 2028.

6.6 Startup

Preliminary startup and commissioning activities will be performed using construction power which will be fed from the new substation connecting the site to the nearest local utility substation. Major startup and commissioning activities will commence with energizing of the Plant switchyard in order to back-energize the plant auxiliary electrical system. The Plant electrical and mechanical systems are commissioned in a sequence to support commissioning of the engines. System operations continue with synchronization, then ramping the engines up to full load with each fuel type, and tuning of the plant and systems to prepare for performance and emissions compliance testing. Once the Plant is capable of reliable full load operation, performance testing is performed in accordance with the ASME Performance Test Codes.

6.7 Critical Path

Two critical paths have been identified with the assumption that the full notice to proceed will occur in July of 2025. The first critical path lies with air permit approval. Without air permit approval, construction activities cannot commence. Once the air permit is approved, the critical path will move through underground foundations and utilities, then construction of the Engine Hall, Electrical Room, Electrical I&C and then startup.

The second critical path is associated with long lead electrical equipment; namely the HV Breakers. Without bid and award of the HV Breakers, the Electrical and I&C construction/startup will push. In short, the critical path is HV Breaker Bid/Award, Fab & Delivery, AG Electrical I&C, and startup. The HV breakers, as well as the MV switchgear and GSU transformers will be contracted as early as practical to mitigate these schedule constraints. This is shown in Appendix Q.

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7.2 Cost Estimating Methodology and Assumptions

Burns & McDonnell performed a detailed cost estimate in a "bottoms up" fashion based on a multi-prime contracting methodology. The following describes the methodology used in the development of the cost estimate:

- Estimates are based on the assumptions and project scope described in this Report. Design parameters and scope typically defined by these studies are estimated based on information provided by EKPC, preliminary calculations and BMcD experience.
- Contracting Methodology: Estimate assumes a multi-prime subcontractor approach with all equipment procured by EKPC. Overhead and fees were estimated based on current market conditions and assuming all scope, schedule, performance, payment, and warranty risk will be covered by EKPC.
- Major Engineered and Balance of Plant Equipment: Budgetary quotes and in-house information from similar projects were utilized.
- Construction Estimates: Construction commodities were estimated using recent pricing from similar projects, and budgetary vendor quotes. Quantify take-offs were performed for each discipline specific to this project and supplied to a variety of Subcontractors to confirm erection and installation pricing and approach.
- Project will be executed with durations similar to those shown on the Project schedule with the objective of achieving the Project milestone dates. It is assumed the Project will be executed with a schedule sufficient to minimize overtime. A 50-hour workweek was assumed as a means of providing an incentive to attract labor. This includes 40 hours of straight time and 10 hours of overtime for normal construction periods. A 60-hour workweek was assumed during commissioning and start-up. No additional overtime is included to accommodate a compressed work schedule.

- Labor Rates: Labor rates and productivity factors were developed based on BMcD in-house information. Labor rates were adjusted to match subcontractor budgetary bids.
- Project Indirects: Estimates are based on Burns & McDonnell's experience and executing projects as OE of similar scope.
- Several major assumptions were used in developing the capital cost estimate. These assumptions include the following:
    - Commercial operation of the equipment is assumed to be December 2028.
    - Labor is assumed to be a combination of union and nonunion labor and available without excessive hourly incentives or incentive packages. However, per diem was included for several trades based on subcontractor feedback.
    - Estimate is based on the availability of housing being in the Project area (e.g., trailer parks, campgrounds, local housing, and local hotels).
    - Contingency is included at 10% for Project estimate contingency. Owner's contingency for discretionary expenditures is included in Owner's Costs.
    - Cost for Builder's Risk Insurance was based on 1% of the total project costs.
    - No sales tax was included.
    - No financing fees or interest during construction was included.

7.3 Direct Cost Basis

7.3.1 Engineered Equipment

The equipment supply includes the procurement of all major equipment by the Owner. Refer to the Project DOR included in Appendix C for a listing of anticipated equipment and material supply contracts. The equipment supply cost includes the supply of specified equipment as well as the transportation cost to the site, technical field advisers, and training. Refer to Table 7-2 below for a listing of all contract packages utilized in development of the cost estimate including how each contract cost was sourced.

Table 7-2: Equipment and Subcontract Pricing Source

Contract No.	Contract Name	Target Price Source
5.1150	Reciprocating Engines	**Bid – Firm**
5.2150	Fire Pump Skid	**Bid - Budgetary**
5.2190	Miscellaneous Pumps	**Bid - Budgetary**
5.2191	Lift Stations	**Bid - Budgetary**
5.2320	General Service Piping	**In-House**
5.2490	Piping Specials	**In-House**

5.2520	Manual Valves	**In-House**
5.2530	Actuated and Control Valves	**EQ (Email Quote)**
5.2710	Compressed Air Equipment	**Bid - Budgetary**
5.2711	Starting Air Compressors	**Bid - Budgetary**
5.2762	Fuel Gas Conditioning	**Bid - Budgetary**
5.2763	Fuel Oil Conditioning	**Bid - Budgetary**
5.2940	Oil Water Separator	**Bid - Budgetary**
5.2980	Shop Fab Tanks	**Bid - Budgetary**
5.4120	Stacks and Ductwork	**EQ (Email Quote)**
5.4210	Cranes and Hoists	**EQ (Email Quote)**
5.4310	Pre-Engineered Metal Buildings	**Bid - Budgetary**
5.4411	Ridge Vent	**Bid - Budgetary**
5.4440	Vent Fans	**Bid - Budgetary**
5.4515	Precast Concrete Walls	**EQ (Email Quote)**
5.4520	Structural Steel	**EQ (Email Quote)**
5.4545	Seal Air Fans and Dampers	**EQ (Email Quote)**
5.5110	Generator Step-Up Transformers	**Bid - Budgetary**
5.5240	Emergency Generator	**Bid - Budgetary**
5.5310	Major Elec Equipment	**Bid - Budgetary**
5.5340	Motor Control Centers	**Bid - Budgetary**
5.5410	Batteries & Uninterruptable Power Systems	**Bid - Budgetary**
5.5510	Electrical Cable	**In-House**
5.5620	Freeze Protection	**In-House**
5.6210	Instruments	**In-House**
C202	High Voltage Breakers	**Bid - Budgetary**
C203	Substation / Transmission Materials	**Bid - Budgetary**
C204	Substation Relay and Controls	**Bid - Budgetary**
C303	Substation Steel	**Bid - Budgetary**
5.8110	Site Preparation and Site Finishes	**Bid - Budgetary**
5.8220	Foundations and Undergrounds	**Bid - Budgetary**
5.8323	Mechanical and Building Construction	**Bid - Budgetary**
5.8340	HVAC Furnish & Erect	**Bid - Budgetary**
5.8410	Electrical Installation	**Bid - Budgetary**
5.8560	Fire Protection and Detection Furnish & Erect	**Bid - Budgetary**
5.8570	Field Erected Tanks	**Bid - Budgetary**
5.9010	Subsurface Investigation	**In-House**
5.9020	Surveying	**In-House**
5.9021	Site Services	**In-House**
5.9110	Site Security	**In-House**
5.9130	Medical Services	**In-House**
5.9230	Electrical Testing	**In-House**
5.9250	Performance Testing	**In-House**
5.9260	Emissions Testing	**In-House**

5.9270	Noise Testing	**In-House**
5.9400	O&M Manuals and Training	**In-House**
5.9610	Start-up Cleaning Services	**In-House**
C403	Substation Construction	**Bid - Budgetary**
C501	Transmission Line OH / Civil	**Bid - Budgetary**

7.3.2 Site Development

The site development scope includes site preparation along with construction laydown, trailer, and parking areas. The civil scope also includes development of the on-site storm water retention and road widening and re-pavement of Carr Sasser Road. This scope also includes the estimated quantities for the structural excavation and backfill required for the foundation construction. Underground pipe supply and installation is not included in civil costs (piping costs). Site finishes including paving and gravel are included. No costs for dewatering and disposing of groundwater were included.

The civil scope of work material quantities were derived from a preliminary site grading sketch developed from the site GA and general topography data. The labor rate, production rates, and material prices were constructed from BMcD previous project metrics and estimates for construction in the project area.

7.3.3 Concrete

The concrete scope includes cast-in-place concrete for the support of equipment, containment, PEMBs, structural steel, and precast columns and walls. This scope also includes estimated quantities for the structural excavation and backfill required for foundation construction. For reinforcing steel, a density of rebar per unit of concrete was provided by engineering for internal estimating purposes. For formwork quantities, basic quantity information was developed relative to the type of concrete such as mats, walls, slabs, etc. from which were estimated formwork quantities.

7.3.4 Piling

Piling is not included in the project costs. The preliminary geotechnical report indicates that piles may be necessary. This is to be confirmed prior to beginning detailed design.

7.3.5 Structural Steel

The structural steel scope of work includes the exhaust train steel for charge air filters, SCRs, resonators, silencers, and radiators. Tray and pipe supports or racks provided as required. Miscellaneous steel such as platforms, grating, handrail, stairs and ladders are included for structure access that is not otherwise provided as part of the equipment contracts. Structural steel for pre-engineered buildings is included in the architectural scope.

The structural steel scope of work was estimated from conceptual layout of the site and past project experience. The density method was used to estimate steel tonnage and member type/weight breakdown. A takeoff was performed to capture the items. The miscellaneous structural productivity rates, wage rates, and material pricing were based on BMcD previous project history for construction in the area..

7.3.6 Architectural

The architectural scope of work includes the supply and installation of pre-engineered metal buildings, precast concrete walls and concrete masonry unit (CMU) structures. This also includes the supply and installation of primary and secondary framing, walls, plumbing, building insulation, windows, doors, flashing, gutters, and building finishes.

The buildings are sized per the General Arrangement and Architectural Drawings in Appendix D to accommodate the equipment and spaces as defined in the Design Basis. The building sizes and pricing were based on budgetary quotes for the PEMBs and precast concrete walls as well as recent projects and in house pricing for the finishes. Pricing for the HVAC equipment was based on previous Burns & McDonnell projects and budgetary quotes. Electrical lighting, convenience power, and communication are included in electrical cost. Productivity factors, wage rates, and material costs were derived from BMcD previous project estimates and rates for projects in the area.

7.3.7 Painting & Coatings

The painting scope includes field touch up painting of factory coated equipment to repair damage during construction. The painting of the building steel is included in the architectural scope. Outdoor structural steel is hot-dip galvanized, not painted. Indoor structural steel is finished painted. Pipe priming is assumed to be applied in the shop and estimated as material cost.

7.3.8 Piping

The piping scope of work includes above and below ground piping supply and installation. Vendor supplied pipe is included in the equipment installation cost. The piping scope covers purchase of pipe, fittings, flanges, valves, specials, bolt-up kits, cathodic protection, supports, and pre-fabricated pipe. The piping scope of work does not include trenches (civil scope), heat trace (electrical scope), insulation (insulation scope); touch up painting or pipe labeling (mechanical). The piping scope of work does include applicable non-destructive evaluation (NDE), pre and post weld heat treatment (PWHT), and hydrotesting.

The piping estimate was based on a takeoff from the general arrangement with P&IDs. Using these quantities, pricing for bulk material, valves, pipe fabrication was based on BMcD recent project pricing and budgetary quotes. The labor estimate was based on rates in the area.

7.3.9 Insulation

The insulation scope of work includes the installation of thermal, personnel protection, and freeze protection insulation. The insulation scope does not include any equipment insulation, soundproofing insulation or building insulation.

7.3.10 Electrical

The electrical scope includes supply and installation of all raceway including underground duct bank, above grade rigid conduit and the cable tray system with grounding and all required supports. It also includes the installation of all cable and terminations. Cable material costs are carried in the equipment pricing. Terminations include wire labels, cable tags, connectors, continuity testing, and Hi-Pot testing. Temporary construction power includes installation, lighting, and maintenance. Equipment includes motor control centers (MCC's) and switchgear, transformers, emergency generator, heat trace, communications systems, and lightning protection. The electrical estimate was completed using take off quantities that were derived from a combination of one-line drawings and the equipment layout.

7.3.11 Instrumentation & Controls

The instrumentation scope of work is primarily wrapped into the Electrical scope. The OEM will provide their own plant control system. A CEMS is not required for the facility. Most instruments are supplied by the equipment vendors and by the BOP systems. All other instrumentation is provided under contract 5.6210. The instrumentation installation estimate was completed based on installation rates in conjunction with instrument budgetary email quotes and in-house information from similar projects.

7.3.12 Switchyard & Transmission

The 161kV breaker-and-a half (BAAH) switchyard scope includes below and above grade infrastructure and protection, control and communication systems.

Supply and installation costs include the following:

- Below grade drilled pier and pad foundations for equipment
- Conduit and cable trench
- Control, power and communication yard cabling and terminations
- Ground grid.

- Circuit breakers
- Disconnect switches
- Instrument transformers
- Structural steel
- Surge Arresters
- Insulators
- Bus work.
- Costs were also included for A-frame, deadend structures and disconnect switches at each of the GSU transformers.

The protection, controls and communication systems will be in an enclosed, prefabricated control enclosure. Enclosure will include the following:

- Control enclosure shell
- Auxiliary AC and DC power supply systems
- Relay and control panels
- Remote Terminal Unit (RTU),
- Communication racks,
- Wire, cable, and terminations.

The 161kV Transmission Line scope will consist of constructing two new transmission lines to tap the existing 161kV line running adjacent to the North of the new switchyard location. The existing 161kV line is located approximately 0.4 miles from the new switchyard.

BMcD worked with EKPC to understand the direct costs associated with the Network Upgrades:

- Installation of a 161/138 kV transformer with a higher rated unit at the Marion County switchyard along with purchasing a spare.
- Replacement of the conductor for the Casey County-Marion County 161 kV line over 4 miles.
- Replacement of the conductor for the Liberty Junction-Pulaski County Junction-Cooper 161 kV line over 26.2 miles. *Note the costs for this project are shared amongst other projects. This estimate currently holds approximately 50% of the costs for the work.*
- Optical ground wire will need to be installed along the South Casey County-Casey County 161 kV line over 6.2 miles.

- At the Denny Substation, the bushing current transformers associated with the Denny-Wibord Tap 69 kV line will be replaced with new current transformers.

7.3.13 Miscellaneous Directs

Miscellaneous Directs include the following estimated costs:

- Subcontractor indirect costs, including mobilization, construction management, construction facilities, home office costs, and P&P bonds.
- Craft per diem: The estimate was based on tradesmen and professional staff all receiving a per diem of $120/day.
- Scaffolding for all craft
- Crane rentals
- Start-up craft support: Craft labor required for all start-up activities
- Start-up subcontracts

7.4 Indirect Cost Estimate Basis

The following methods were used for indirects:

- The construction management (CM), startup management, and construction indirects were estimated based on the project field staffing plan, the project execution schedule, and project historical indirect costs. Construction management includes field engineering cost. Also included are the CM staff expenses including travel, living expenses, and site offices.
- Engineering costs are based on the staffing plan required for detailed design, procurement support, and project management from the office. The engineering estimate includes expenses for site travel, lodging and a technology fee.
- Construction permits including electrical and building permits are not included.
- It is assumed builders risk insurance is provided by Owner and captured in Owner's Costs.

7.4.1 Taxes

Sales and use tax are not included in the estimate.

7.4.2 Construction Labor Basis

The estimate was developed on the basis of using a mix of local labor and travelers and compared/confirmed using subcontractor pricing.

7.4.2.1 Labor Wage Rates & Expenses

Wage rates were taken from building trade contracts through 2024 for the area and compared against budgetary pricing received for each scope of work. The wage rates include wages, fringes, general liability and workers compensation insurance and overtime. The wages range from \$55 – \$85 / hour inclusive.

7.4.2.2 Work Hours

The estimate assumes construction shifts are 50-hour work weeks with anything over 40 hours as premium time at 1.5 times the base wage rate to attract labor.

Startup shifts are assumed to be 60-hour work weeks (6 days at 10-hours/day) for the first 4-5 months, then increase to 84-hour weeks (7 days at 12-hours/day) for the remainder of the Startup period (approximately 4 months).

7.4.2.3 Labor Housing

The estimate is based on housing being available in the Project area (trailer parks, camp grounds, local housing, and local hotels).

7.4.2.4 Labor Per Diem

Craft per diem is included in Miscellaneous Direct costs.

7.4.2.5 Retention Plan

Subcontractors will manage the labor turnover. No funds were added to the estimate for excessive labor turnover rate.

7.4.3 Escalation

Escalation has not been included in the capital cost estimate.

7.4.4 Project Contingency

Contingency was included to cover accuracy of pricing, commodity estimates, and omissions from the defined project scope. Typically, the level of contingency is set by the amount of scope definition provided, the amount of engineering and estimating conducted prior to providing cost certainty on the project price, and the amount of risk born by the installing subcontractors (performance, schedule, scope, payment, etc). This contingency is not intended to cover changes in the general project scope (i.e. addition of buildings, addition of redundant equipment, addition of systems, etc.) nor major shifts in market conditions that could result in significant increases in contractor margins, major shortages of qualified labor, significant increases in escalation, or major changes in the cost of money (interest rate on loans). Deviations that may cause the project costs to exceed the estimated costs inclusive of contingency include excessive inflation (>3%), extreme high demand for major equipment due to proposed regulations, extreme shortage of qualified labor, extreme shortage of qualified construction contractors, change in contracting approach, and other similar changes. A 10% contingency was included based on the level of project scoping and engineering completed during the PSR and EKPC input.

Owner's contingency has been excluded from project contingency and is included as a part of Owner's costs.

7.4.5 Owner's Costs & Contingency

Owner's costs as provided by EKPC are included in the estimate. Appendix R includes a buildup of the Owner's cost. These costs generally include Owner's project development and management staff, operations and startup personnel, temporary utilities used during construction, permitting and licensing fees, any site upgrades to support the project, initial consumable fill costs and startup costs, site security, spare parts, permanent equipment and furnishings for the new buildings, Builder's Risk insurance, and Owner's contingency. These are also listed in Table 7-1.

7.5 Risk Analysis

A project risk matrix was developed to highlight potential risks to the project as well as assumed mitigation. Major risks include labor uncertainty, late equipment delivery, adverse weather conditions, etc. The risk matrix is shown in Appendix P.

7.6 Cash Flow

A cash flow based on the Project schedule, contracting approach, and the cost estimate was developed and is included in Appendix S.

7.7 Operations & Maintenance Estimates

Table 1-2 shows a summary of the non-fuel fixed and variable O&M cost estimates for the Plant in 2024 dollars. Unless noted, the costs are based on the annual average plant output. A more detailed summary of these costs is included in Appendix T. O&M costs are based upon the assumptions included in the following paragraphs.

7.7.1 Plant Operation & Fuel

O&M estimates are based upon the plant operating at average ambient output conditions. No consideration has been included for part load operation which would increase the O&M costs. O&M costs also exclude emission allowance costs and operational fuel costs. O&M costs are based on a 20% capacity factor and operation with natural gas at 90% of the total hours of operation, and operation with ULSD 10% of the total hours of operation.

7.7.2 Plant Staffing

The major fixed operating cost is the expected staffing for the Plant. This cost equates to approximately $2,530,000 per year for the staff of 23. Average staffing cost is assumed to be $110,000 per person per year.

7.7.3 Other Fixed O&M Costs

Additional fixed O&M costs include office and administration costs for additional staffing as required to support dispatching, budgeting and other management duties, labor indirect costs (i.e. employee training, safety, phones and other communications, computers, software, supplies, uniforms, travel, mileage, shipping, and similar expenses, environmental monitoring and annual permitting costs, buildings and grounds maintenance, and control room expenses). These costs also include warehouse equipment, fire system testing, and unplanned maintenance work. Fixed O&M costs also include standby energy costs to supply essential service power to systems to keep the facility on hot standby for quick dispatch.

7.7.4 Major Maintenance Costs

Levelized OEM major maintenance costs are estimated based on the indicative LTSA provided by Wärtsilä. Reciprocating engine costs major maintenance intervals are based on operating hours and not starts.

7.7.5 Variable Operating Costs

Variable operating cost estimates include costs that vary with operation of the Plant including the following:

- Water consumption costs
- Urea consumption costs
- Lubricating oil consumption costs
- Routine maintenance of equipment (excluding costs associated with the LTSAs)
- SCR and CO/VOC catalyst replacement

7.7.6 Water Treatment and Wastewater Discharge

Water treatment is not considered for this facility. Sanitary waste is sent to a leach field. Stormwater runoff is directed towards a stormwater pond before discharging through a permitted outfall.

7.7.7 Qualifications

BMcD's estimates, analysis, and recommendations contained in this report are based on professional experience, qualifications, and judgment. BMcD has no control over weather; cost and availability of labor, material, and equipment; labor productivity; energy or commodity pricing; demand or usage; population demographics; market conditions; changes in technology; and other economic or political factors affecting such estimates, analysis, and recommendations. Therefore, BMcD makes no guarantee or warranty (actual, expressed, or implied) that actual results will not vary, perhaps significantly, from the estimates, analysis, and recommendations contained herein.

8.0 CONCLUSIONS AND RECOMMENDATIONS

8.1 Conclusions

BMcD recommends EKPC evaluate the project economics and timeline based on the cost and performances presented in this report. If the project economics are favorable, then BMcD recommends EKPC proceed with awarding the engine contract and continue with project development. BMcD recommends EKPC consider the following activities to support the project schedule:

1. Solicit RFP for firm proposals, condition bids, negotiate contracts ready for award on the following equipment:
    a. GSU transformers
    b. Medium Voltage Switchgears
    c. High Voltage Transformers
2. Finalize natural gas pipeline design and permitting requirements, drawings, and costs.
3. Refine civil and structural preliminary design based on final geotechnical recommendations.

APPENDIX A – SITE DESIGN CONDITIONS AND CODES & STANDARDS

SECTION 1.1 – SITE DESIGN CONDITIONS

SITE CONDITIONS:

A. Ambient Conditions:
   1. Site Elevation: 956 feet Above Mean Sea Level.
   2. Barometric Pressure: 14.11 psi-a
B. HVAC Design Criteria:

HVAC Design Conditions						
Location	Stuart Powell Field, Kentucky			ASHRAE Weather Station #		720448
Ambient Design Conditions						
Summer (F)		Winter (F)		50 Year Extreme Conditions (F)		
0.4%, DB/MCWB	1%, DB/MCWB	99.6%, DB	99%, DB	Min, DB	Max, DB	Max, WB
91.2 / 72.6	90.0 / 72.6	8.8	13.6	-21.7	104.9	81.3
Dehumidification (F)						
0.4%, DP/HR/MCDB	1%, DP/HR/MCDB[4]					
73.1 / 127.8 / 81.1	72.5 / 124.9 / 80.1					
HVAC Design Parameters						
		Indoor Design Temperatures[3]		Outdoor Design Conditions		System Type
Building/Room Type		Summer, F	Winter, F	Summer	Winter	
Occupied Areas						
	Offices (Admin) [2]	78	70	1%	99%	HVAC
	Laboratories[2]					
	Critical Control Room[2]	77	70	Extreme	Extreme	HVAC
Equipment Areas, Unoccupied						
	Engine Hall	122	45			
	Non-Critical Elec.		45	0.4%	99.6%	HV
	General Equipment					
	Battery Rooms[1]	77	77	0.4%	99.6%	HVAC
	Critical Elec.	77	70	Extreme	Extreme	HVAC

[1] 1% & 2% Hydrogen alarms, Dual Setpoint.
[2] Design maximum relative humidity 65% at 1% Summer MCWB.
[3] Indoor design temperature based on associated outdoor design conditions.

C. Outdoor Design Climate Data:
   1. Extreme Ambient Dry Bulb Temperature:
      a. Maximum: 104.9°F.
      b. Minimum: -21.7°F.
      c. Equipment located outdoors shall be designed for these extreme ambient dry bulb temperatures.
   2. Rainfall:
      a. Annual Average: 54.1 inches.
      b. 100-year, 24-hour total: 7.20 inches
D. Freeze protection shall be provided in the form of electric heat trace and insulation on all outdoor liquid containing lines subject to freezing ambient conditions.
E. Seismic Design shall be in accordance with the 2018 Kentucky Building Code and the following:
   1. Risk Category: III

2. Site Class: D (assumed)
3. Seismic Design Category: C
4. Seismic Importance Factor: 1.25
5. Spectral Response Acceleration at Short Period, S_S: 0.202g
6. Spectral Response Acceleration at 1-Second Period, S_1: 0.109g

F. Wind Design shall be in accordance with the 2018 Kentucky Building Code and the following:
   1. Risk Category: III
   2. Basic Design Wind Speed: 120 mph
   3. Exposure Category: C

G. Snow Loading shall be in accordance with the 2018 Kentucky Building Code and the following:
   1. Risk Category: III
   2. Ground Snow Load: 15 psf
   3. Terrain Category: C
   4. Snow Importance Factor: 1.10

H. Plant Site Frost Depth: 24 inches.

I. Miscellaneous Steel Requirements:
   1. All grating, kickplates, guardrails, stairs and ladders shall be galvanized. Ladders, kickplates, and guardrail shall be coated safety yellow.
   2. All outdoor structural steel shall be galvanized. All indoor structural steel shall be coated.
   3. Structural steel material shall meet the following requirements:
      a. Wide flange shapes and sections cut from wide flange shapes shall be ASTM A992.
      b. Structural steel channels, angles and plates shall be ASTM A36, ASTM A529, or ASTM A572 Grade 50.
      c. Hollow Structural Sections shall conform to ASTM A500, Grade B
      d. Pipe for Structural Uses, Guardrail, and Handrail ASTM A53, Type E or S, Grade B, or ASTM A106, Grade B.
      e. Connection Bolts shall be A325 and galvanized.
      f. Welding electrodes shall have a minimum specified tensile strength of 70,000 psi.

J. Elevated Platforms:
   1. Shall be designed for 100 psf load minimum.
   2. Grating shall be rated for 100 psf.
   3. Indoor grating shall be plain type and outdoor grating shall be serrated type.

ELECTRICAL

1. Equipment and motors shall be designed to operate using the following electrical system voltages.
   - 4160V system voltage and 4160V motor voltage for motors 251HP and above.
   - 480V system voltage and 460V motor voltage for motors from 3/4HP to 250 HP and motor-operated valves.
   - 208/120 VAC, 3-phase, 4-wire, for space heaters.
   - 208/120 VAC, 3-phase, 4-wire for lighting.
   - 120 VAC system voltage and 115 VAC motor voltage for motors 1/2 hp and below.
   - 120 VAC, single phase, UPS power.

- 125 VDC for protection systems, switchgear, breaker controls, UPS input power and emergency lubrication oil pump motors less than 30 HP.
- 24 VDC for DCS instrumentation and controls.

CODES AND REGULATIONS

A. Buildings, enclosures, Equipment, materials, design, fabrication, inspection, start-up, and tests shall be furnished in accordance with the latest editions of all Applicable Laws in force at the time of Contract execution.

B. ADA: ADA design criteria is not applicable to the main industrial plant areas of the Site/Project on the basis that these areas are essentially service spaces where able-bodied personnel will be employed to operate, inspect and maintain the equipment and systems. For the Site/Project, exceptions to this include all areas of the Administration Building which shall be subject to ADA design criteria.

C. All Work in accordance with the requirements of the following codes and standards:

1. Air Moving and Conditioning Association, Inc.
2. American Association of State Highway and Transportation Officials Standard Methods of Test (AASHTO).
3. American Bearing Manufacturers Association (ABMA).
4. American Concrete Institute (ACI).
5. American Gas Association (AGA).
6. American Gear Manufacturers Association (AGMA).
7. American Institute of Steel Construction (AISC).
8. American National Standards Institute (ANSI).
9. American Petroleum Institute (API).
10. American Society of Civil Engineers (ASCE).
11. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE).
12. American Society of Mechanical Engineers (ASME).
13. American Society for Non-Destructive Testing (ASNT).
14. American Society for Testing and Materials (ASTM).
15. American Water Works Association (AWWA).
16. American Welding Society (AWS).
17. ASTM International (ASTM).
18. Crane Manufacturers Association of America (CMAA).
19. Environmental Protection Agency (EPA).
20. Factory Mutual Standards (FM).
21. Federal Highway Administration (FHWA).
22. Heat Exchange Institute (HEI).
23. Hoist Manufacturers Institute (HMI).
24. Hydraulic Institute (HI).
25. Insulated Cable Engineer's Association(ICEA)
26. Illuminating Engineering Society (IES).
27. Institute of Electrical and Electronics Engineers (IEEE).
28. International Society of Automation (ISA).
29. Manufacturers Standardization Society of the Valve and Fitting Industry (MSS).
30. Metal Building Manufacturers Association (MBMA).
31. National Association of Architectural Metal Manufacturers (NAAMM).
32. National Electrical Code (NEC).
33. National Electric Safety Code (NESC).
34. National Electrical Manufacturers Association (NEMA).
35. National Electric Reliability Council (NERC)

36. National Fire Protection Association (NFPA) Edition as adopted by the AHJ.
37. NFPA 1, Uniform Fire Code.
38. NFPA 10, Standard for Portable Fire Extinguishers.
39. NFPA 12, Standard on Carbon Dioxide Extinguishing Systems.
40. NFPA 13, Standard for the Installation of Sprinkler Systems.
41. NFPA 15, Standard for the Installation of Fixed Water Spray Systems.
42. NFPA 24, Standard for the Installation of Private Fire Water Service Mains and Their Appurtenances.
43. NFPA 30, Flammable and Combustible Liquids Code.
44. NFPA 56, Standard for Fire and Explosion Prevention During Cleaning and Purging of Flammable Gas Piping Systems.
45. NFPA 68, Standard on Explosion Protection By Deflagration Venting.
46. NFPA 69, Standard on Explosion Prevention Systems.
47. NFPA 70, National Electric Code.
48. NFPA 70E, Standard for Electrical Safety in the Workplace.
49. NFPA 72, National Fire Alarm and Signaling Code.
50. NFPA 85, Boiler and Combustion Systems Hazard Code.
51. NFPA 101, Life Safety Code.
52. NFPA 220, Standard on Types of Building Construction.
53. NFPA 850, Recommended Practice for Fire Protection for Electric Generating Plants.
54. NFPA 2001, Standard on Clean Agent Fire Extinguishing Systems.
55. NFPA 5000, Building Construction and Safety Code.
56. Occupational Safety and Health Administration (OSHA).
57. Pipe Fabrication Institute (PFI).
58. Scientific Apparatus Makers Association (SAMA).
59. Sheet Metal and Air Conditioning Contractors National Association, Inc., "Duct Manual and Sheet Metal Construction."
60. Society for Protective Coatings (SSPC).
61. Steel Structures Painting Council (SSPC).
62. Tubular Exchanger Manufacturer’s Association (TEMA).
63. Underwriters Laboratory (UL).

SOUND LEVEL REQUIREMENTS

Near Field: Equipment shall be guaranteed to meet a standard eighty-five (85) dB(A) sound pressure level as measured three (3) feet from the machine, five (5) feet above the operating floor and averaged around the entire noise boundary periphery.

END OF SECTION 1.1

APPENDIX B – SCOPE MATRIX

BURNS McDONNELL

		Y/N	Number	% Capacity (per Unit)	Notes
GENERAL PROJECT INFORMATION					
Project Description		-	-	-	New 12x18 MW Reciprocating Internal Combustion Engine (RICE) Generator plant including all auxiliary equpment. Gross output with all engines at 100% capacity at summer design conditions shall be 217 MW . Engines and most equipment will be stored indoors.
	Project Location	-	-	-	Near Liberty, KY
	Site Description	-	-	-	Greenfield site
	Design Fuel	-	-	-	New natural gas pipeline feed with fuel oil storage tanks on site for backup
	Operation	-	-	-	Peaking as required, but can be utilized for continuous service
	Capacity Factor	-	-	-	60%
	Contracting Approach	-	-	-	OE (Procurement managed by BMcD, on Owner books)
	Labor	-	-	-	Union or Non-Union
	Project Liquidated Damages	-	-	-	Schedule and performance for each contract
	Project Bonding /LOC	-	-	-	100% Bonding.
	Project COD Dates	-	-	-	December 2028
	Project Expansion	-	-	-	Future Expansion space considered to the south of the proposed building location. Equipment not sized for future expansion.
	Future Fuels Consideration	-	-	-	N/A
MECHANICAL SYSTEMS/EQUIPMENT					
CLOSED COOLING WATER					
	Cooling/Maintenance Water Tank	Y	2	100%	
	Cooling Water Transfer pump	Y	2	100%	
	Radiators	Y	12	100%	5 blocks per engine
	Expansion Vessels	Y	12	100%	1 x 100% per generator
COMPRESSED AIR					
	Instrument Air Compressors	Y	3	50%	
	Starting Air Compressors	Y	3	50%	Sized to reload starting air bottles within 1.5 hours
	Air Dryers	Y	2	100%	
	Wet Receiver	Y	1	100%	
	Dry Receiver	Y	2	100%	
	Starting Air Receivers	Y	4	33%	Sized for 2 engine starts per Engine for facility (assuming starting air compressors not operating)
	Engine Hall Pressure Regulating Valves	Y	2	100%	
EXHAUST					
	Exhaust Gas Module (EGM)	Y	12	100%	1 x 100% per generator
	Selective Catalytic Reducer (SCR)	Y	12	100%	1 x 100% per generator
	Exhaust Gas Probe	Y	12	100%	1 x 100% per generator
	Exhaust Gas (NOx) Analyzer	Y	12	100%	1 x 100% per generator
	NOx Sensor System	Y	12	100%	1 x 100% per generator
	Exhaust Gas Dampers	Y	12	100%	1 x 100% per generator
	Seal Air Fans	Y	4	50%	2 Seal air fans supplied in a 2x100% configuration for one exhaust stack system. 2 systems total
	Exhaust Silencer/Stack	Y	2	50%	Common Stack for up to 6 engines
FIRE PROTECTION SYSTEM					
	Design Basis	Y	-	-	NFPA 850, NFPA 37, and NFPA 30 recommended practices
	Insurer/special requirements	Y	-	-	FM Global
	RICE Fire Protection	Y	-	-	Water and alarm. Engine Hall to be sprinkled and supplied with fire extinguishers, detectors, and alarms
	Electrical Rooms	Y	-	-	CO2 and alarm
	Pump supply source(s)	Y	2	100%	Electric motor and Diesel driven fire pump taking suction from the Service/Fire Water Storage Tank. Jockey maintenance pump to maintian line pressure.
	Storage	Y	-	-	Fire Water Storage Tank. Insulated with immersion heater
	Fire loop	Y	-	-	Standalone fire loop, HDPE meeting NFPA
	Sprinklers	Y	-	-	Provided for occupied buildings per NFPA 13 including Engine Hall, admin/office/control rooms, restrooms, mechanical room and warehouse space.
	Fire/Gas Detection	Y	-	-	Where necessary per NFPA
FUEL GAS					
	Supply Source	-	-	-	New pipeline
	Compression	N	-	-	Transfer of custody point provides gas at 200 psig, 55 degF.
	Metering & Regulation Yard	Y	1	100%	Provided, owned and operated by Pipeline Owner. Plant designed to support load change capability (ramp rate) from minimum load to maximum load of 4 MW/min/engine.
	House Gas Regulating Skid	N	0	100%	House Gas not considered
	Dew Point Heating	Y	1	100%	Provided, owned and operated by Pipeline Owner
	Fuel Gas Filter/Coalescer Skid	Y	1	100%	Provided by BMcD
	RICE Generator Sets	Y	12	8.3%	Designed for peaking operation, but able to run continuously. Maximum 3 starts and 3 stops per day, per engine, 7 days a week. Designed to operate at 40% of maximum electrical rated output capacity while meeting air permit emission requirements. Inlcuded with modular pipe rack, auxiliary platforms, and all miscellaneous equipment
	Compact Gas Ramp	Y	12	100.0%	
	Fuel Gas Chromatograph System	Y	1	100%	Required for Wärtsilä, optional for MAN supply.
	Fuel Gas Analyzer Units	Y	1	100%	
FUEL OIL					
	Supply Source	-	-	-	Trucked
	Fuel Oil Storage Tank	Y	2	50%	Sized for 72 hrs of operation at full load (assuming no fuel gas available). Located within secondary containment structure. Provided with leak detection.
	Fuel Oil Unloading Pumps	Y	3	50%	
	Fuel Oil Forwarding Pumps	Y	3	50%	
	Fuel Oil Heater	Y	2	50%	Fuel oil will be utilized primarily when temperatures drop below 10 degF. Confirm heater sizing and fuel oil consumption.

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		Y/N	Number	% Capacity (per Unit)	Notes
HVAC SYSTEMS					
	Building electric heaters, exhaust fans and intake louvers, air-conditioning	Y	TBD	100%	As required for occupied buildings and electrical rooms
INTAKE AIR					
	Charge Air Filters	Y	24	50%	2 x 50% per generator
LUBE OIL SYSTEM					
	New Oil Tank	Y	1	100%	Includes immersion heater
	Lube Oil Filter	Y	1	100%	
	Service/Used Oil Tank	Y	1	100%	
	Waste Oil Tank	Y	1	100%	
	Lube Unloading Pumps	N	0	100%	Lube Oil Tankers have integral lube oil unloading pumps.
	Lube Oil Transfer Pumps	Y	2	100%	Provided by OEM
	Lube Oil Cooler	Y	12	100%	1 x 100% per generator
	Engine Auxiliary Module (EAM)	Y	12	100%	1 x 100% per generator
	Oil Mist Separator	Y	12	100%	1 x 100% per generator
	Mobile Lube Oil Pump	Y	1	100%	
MAKE-UP WATER					
	Supply Source	-	-	-	City potable water
	Service/Potable Water Booster Pump	Y	1	100%	
	Fire Water Storage	Y	1	100%	Firewater tank dedicated fire water capacity
	Service Water Transfer Pumps	N	0	100%	
POTABLE WATER SYSTEM					
	Supply Source	Y	-	-	City tap, assumes sufficient flow capacity
	Potable Water Bladder Tank	Y	1	100%	
	Potable Water Heater	Y	2	100%	Instantaneous Heater for SSEWs
	Emergency Eye Wash/Safety Showers	Y	5	100%	Battery Room, Unloading, Urea, Maintenance Water Tanks
SANITARY SEWER SYSTEM					
	Sanitary Lift Station	Y	1	100%	Supplied with 2 x 100% pumps
	Sanitary Treament Facility	Y	1	100%	Leach Field
UREA SYSTEM					
	Urea Flow Control Skid	Y	1	100%	
	Urea Forwarding Pump Skid	Y	2	100%	
	Urea Storage Tank	Y	2	50%	Sized for the greater of 7 days of station operation at full load on natural gas, or 3 days of operation on ULSD.
	SCR Ammonia Distribution Grid	N	0	100%	
	SCR Catalyst	Y	12	100%	1 x 100% per generator
	Leak Detection	Y	2	-	Each Tank
WASTEWATER					
	Contaminated Wastewater	Y	-	-	Drains for areas around equipment that could be contaminated with oil will be directed through an oil/water separator (OWS). Discharge OWS effluent to Stormwater pond.
	Wastewater Tank	N			
	Waste Water Sump Pump	N			
	Oil Water Separator (OWS)	Y	1	100%	
	Water Treatment Reject	N	-	-	
CATHODIC PROTECTION					
	Underground Steel Piping	Y	-	-	Cathodic protection system will be galvanic anode type, if required.
	Underground Steel Tanks	Y	-	-	
CONTROLS					
Equipment Control					
	RICE	Y	-	-	Control system provided by equipment OEM with local HMI
	Medium Voltage Switchgear	Y	-	-	Hardwire Start / Stop / Breaker Status. Soft communications for other I/O.
	Motor Control Centers	Y	-	-	Hardwire Start / Stop / Breaker Status. Soft communications for other I/O.
	Low Voltage Switchgear	Y	-	-	Hardwire Start / Stop / Breaker Status. Soft communications for other I/O.
	Plant Control System	Y	-	-	Provided system will link all RICE controllers and HMI application servers. Provided with redundant ethernet to application servers. Will utilize OEM PCS.
	Plant Historian	Y	-	-	Provided by OEM. Include Pi historian as well.
	Offsite Interfaces	Y	-	-	Dispatching, OEM Monitoring, EKPC Monitoring
Automatic Generation Control					
	Distributed Control System (DCS)	N			OEM will provide PCS with balance of plant equipment integration.
Vibration monitoring					
	RICE	Y	-	-	Probes wired to Bently Nevada; Hardwire Points between Bently Nevada and Unit Controllers
	BOP Critical and High Speed Motors	Y	-	-	Probes wired to Bently Nevada; Hardwire Points between Bently Nevada and Unit Controllers, if required.
Plant Simulator		Y	-	-	EKPC to follow up with what is included with other simulator designs within fleet.
Digital Bus					
	Foundation Fieldbus	N	-	-	
	Remote I/O	Y	-	-	
Instrumentation					
	Transmitters	Y	-	-	4-20 mA as available.
	HART	Y	-	-	Install tri-loops on valves for feedback.
	Performance Testing	Y	-	-	
	Meteorological Station	Y	-	-	Provided by OEM.
Continuous Emissions Monitoring System		N	12	100%	Not required.
Relaying Data Link		Y	-	-	Redundant relay communications network for protection and control. See Equipment Control section for equipment / relay interfaces to the control system.
Communication					
	Dispatching	Y	-	-	Automatic Generation Control through RTU communication. BMcD to include RTU in Estimate as Owner Costs.
	Off site monitoring/administrations	Y	-	-	OEM for RICE Controller Remote Connection

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		Y/N	Number	% Capacity (per Unit)	Notes
	Switchyard	Y	-	-	Communication Interface with Switchyard RTU
	Internal plant	Y	-	-	Need further discussions with EKPC IT to determine how this is handled.
	External	Y	-	-	Need further discussions with EKPC IT to determine how this is handled.
NERC CIP Requirements		Y	-	-	Low impact.
HMI		Y	-	-	Stand Alone Controllers with local HMI's. Plant Control HMI located in New Control Room and Switchgear building.
ELECTRICAL					
Generator Step-Up Transformers:					
	RICE	Y	3	100%	Three (3) three-winding GSU transformers. Each transformer services 6 RICE engines with 3 generators per secondary / tertiary winding. 2 operating, 1 spare
Auxiliary/Reserve Transformers:					
	Auxiliary Transformer	Y	4	100%	2x100% for every 6 engines.
Generator Buses:					
	13800V Switchgear	Y	4	100%	One switchgear bus per 3 generators. Switchgear connected to the associated GSU transformer via cable bus. Feeder breakers to auxiliary transformers will be provided to serve station power.
Generator Circuit Breakers:					
	RICE	Y	12	100%	Switchgear circuit breakers will serve as generator circuit breaker and provide synchronization.
Blackstart Generator(s) and Capability		Y	-	-	
Electrical Equipment Enclosures:		Y	1	100%	Most electrical equipment will be located inside electrical room in Engine Hall. Medium voltage bus housed in standalone electrical building.
Switchgear:					
	480V Switchgear	Y	4	100%	Two (2) lineups configured in a Main-Tie-Main with source transformers and buses rated to power the entire lineup during the loss of a single source
Motor Control Centers:					
	480 V MCCs	Y	-	-	Rated for operating load
Emergency Power:					
	Uninterruptible Power (UPS)	Y	-	-	A single Balance of Plant UPS system will be provided.
	DC System	Y	1	100%	Primary and secondary power source from 24 VDC panel which feeds into active redundancy module. The 24 VDC feed from the active redundancy module provides two power supplies to the PLC system. Included with 2x100% DC battery chargers
	Standby Auxiliary Generator	Y	1	100%	Sized to support loss of power to facility
Stand Alone Control Systems					
	Fire Protection/Detection	Y	-	-	See fire protection section in Mechanical for details
	Plant HVAC	Y	-	-	See HVAC section in Mechanical for details
	Building/Site Security	Y	-	-	
	Plant Communications	Y	-	-	
On-Line Battery Monitoring:		Y			
Lighting					
	Normal	Y	-	-	LED lighting; lighting required for new road and plant buildings.
	Emergency Egress	Y	-	-	Local battery pack fixtures will be provided for emergency egress.
Grounding		Y	-	-	New grounding grid
Lightning Protection		Y	-	-	A UL Master Label will be provided for the new facility.
Freeze Protection		Y	-	-	Heat tracing designed to maintain 40F for fluids subject to freezing based on size and service
Electrical Studies:					
	Load Flow, voltage drop, short circuit	Y	-	-	Identify equipment and bus loading, motor terminal voltages and available fault currents at each voltage level
	Protective coordination/relay settings	Y	-	-	
	Arc Flash	Y	-	-	
Cabling		Y	-	-	Cable tray and field routed conduit above grade, duct bank below grade
Transmission / Interconnection:		Y	-	-	Discuss in separate scope review.
CIVIL/STRUCTURAL					
Existing Facilities		N	-	-	Greenfield site. Topographic and property survey required.
Layout Considerations		Y	-	-	Sufficient room for future expansion considered. Tie-ins to new gas pipeline and transmission.
Disposal of Spoils		-	-	-	Excess spoils will be disposed of on-site, used for fill if possible. No hazardous materials accounted for in project estimate.
Soils Conditions / Stability		Y	-	-	Determined by Geotech report.
Soil Improvement		Y	-	-	Determined by Geotech report.
Subsurface Rock		Y	-	-	Determined by Geotech report.
Subsurface water		Y	-	-	Possible dewatering may be needed - geotechnical report utilize to determine.
Cut/Fill		Y	-	-	Use existing site materials to grade the site and avoid off-site borrow.
Disposal of debris		-	-	-	Disposed of on-site.
Permanent Stormwater		-	-	-	New stormwater to be collected in ditches and control surfaces, and routed to new permitted outfall
Construction Stormwater		Y	-	-	Erosion control will be in accordance with state and local guidelines and regulations and will include best management practices such as silt fence, rock check dams, slope protection, construction exits, and stormwater pond(s) for construction and permanent. A SWPPP will be prepared.
Roads		Y	-	-	All new roads for site
Surfacing		-	-	-	Main access roads shall be paved with asphaltic concrete. Maintenance roads and areas will be covered with crushed rock. Other areas top soil and seeded.
Soil Bearing Capacity		-	-	-	Determined by Geotech report.
Foundation type		-	-	-	Determined by Geotech report.
Transformer Containment		Y	-	-	Containment for oil-filled transformer will be provided with an open pit design.
Guardshack		Y	-	-	New guard shack
Enclosures					

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		Y/N	Number	% Capacity (per Unit)	Notes
	Engine Hall	Y	1	-	Building housing engines with separate rooms for electrical, administrative, mechanical, battery storage. Includes ridge vent and bridge crane.
	Warehouse	Y	1	-	PEMB adjacent to Engine Hall, approx. 50' x 100'
	Fire Pump	Y	1		
	Medium Voltage Buildings	Y	2		qty = 2
	CEMS Enclosure	N			
	Guard Shack	Y	2		Main security guard shack incorporate utilities for restrooms. Construction entrance guard shack will not.
Maintenance cranes		Y	-	-	Engine hall bridge crane
Site Security		Y	-	-	Cameras, badge access for all doors. Include costs for 24/7 security during construction
Landscaping		Y	-	-	Berm and Landscaping between plant and neighbors.
Fence		Y	-	-	New fence around perimeter of new plant facilities. Automated slide gate at facility entrance.
CONSTRUCTION					
Utilities					
	Power	Y	-	-	Construction power from aux. generators
	Communication	Y	-	-	Cellular
	Construction Water	Y	-	-	Trucked until City potable tie-in connection is commissioned
	Potable Water	Y	-	-	Trucked until City potable tie-in connection is commissioned
	Sanitary	Y	-	-	Portable facilities provided by construction contractors
Parking		Y	-	-	New permanent parking adjacent to engine hall. Temporary construction parking to be identified.
Gate Entry					
	Main	Y	-	-	New guard shack
	Personnel/Craft	Y	-	-	New main gate/construction entrance
	Delivery	Y	-	-	New slide gate for construction and operation entrances
Construction Field Office / Trailers					
	Owner	Y	-	-	Will include Trailers in Owners Costs sheet.
	Engineer	Y	-	-	Will include Trailers in Owners Costs sheet.
	Vendors	Y	-	-	Will include Trailers in Owners Costs sheet.
	Contractors	N	-	-	Will include Trailers in Owners Costs sheet. Contractors provide their own Trailers.
	Site Services	Y	-	-	Cleaning, snow removal, dumpsters, etc.
Laydown area		Y	-	-	On site areas to be identified with easements located
Warehouses		Y	-	-	Contractor will provide necessary storage space during construction.
OWNER COSTS / MISC.					
Permits					
	See Permit Matrix	Y	-	-	BMcD to include
Owner's Costs					
	Project Development	Y	-	-	Allowance to be included
	Owner's Operations Personnel	Y	-	-	Allowance to be included
	Owner's Project Management	Y	-	-	Allowance to be included
	Owner's Engineer	N			
	Owner's Legal Counsel	Y	-	-	Allowance to be included
	Political Concessions / Area Development Fees	Y	-	-	Allowance to be included
	Permitting & License Fees	Y	-	-	Allowance to be included
	Land	Y	-	-	Allowance to be included
	Water Rights Costs	Y	-	-	Allowance to be included
	Water Infrastructure and Supply to Site	Y	-	-	New City potable water for supply
	Natural Gas Infrastructure and Supply to Site	N	-	-	New pipeline, captured in separate project scope costs.
	Labor Camp	N			
	Permanent Plant Operating Spare Parts	Y	-	-	Allowance to be included
	Maintenance Tools & Equipment	Y	-	-	Allowance to be included
	Permanent Plant Equipment & Furnishings	Y	-	-	Allowance to be included
	Sales Tax	Y	-	-	Sales tax is excluded, other than for non-permanent consumables and supplies
	Escalation	Y	-	-	Allowance to be included
	Owner's Contingency	Y	-	-	Allowance to be included
	Interest During Construction	N			Excluded
	Temporary Utilities	Y	-	-	Included in EPC costs
	Startup Testing Fuels and Consumables	Y	-	-	Allowance to be included
	Operator training	Y	-	-	Allowance to be included
	Site Security	Y	-	-	Allowance to be included
EXCLUSIONS					
Taxes			-	-	Sales, use, gross receipts, property, and other types.
Insurance			-	-	All insurance other than General Liability being carried as a project cost
Sound abatement above normal supply			-	-	Performing a sound analysis to help determine necessity.
Aesthetic landscaping other than erosion control			-	-	Included in landscaping costs.
High escalation assocated with extreme market			-	-	
Financing fees			-	-	
Interest during construction			-	-	

APPENDIX C – PROJECT DIVISION OF RESPONSIBILITY

LIBERTY RICE
Division of Responsibility

Contract No.	Description	Design Criteria / Functional Design	Technical Specification RFP / BOM / BOQ	Detailed Design	Procure / Supply	Fabricate / Deliver	Receive / Maintenance	Erect / Install	Power Wiring	Control Wiring	Testing	Start-up	Commissioning	Remarks
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
BMcD	**BMcD (Contractor)**													
	Temporary Services	-	-	-	-	-	-	-	-	-	-	-	-	
	Dumpsters / Refuse / Recyclables	-	-	-	BMcD	BMcD	BMcD	-	-	-	-	-	-	for all Subcontractors Work
	Temporary Toilets	-	-	-	BMcD	BMcD	BMcD	-	-	-	-	-	-	for all Subcontractors Work
	Construction Trailers	-	-	-	BMcD	BMcD	BMcD	-	-	-	-	-	-	for all Subcontractors Supervsion and Craft Break Trailers
	Electrical Distribution Panels to Work	Subcontractors	Subcontractors	Subcontractors	Subcontractors	Subcontractors	Subcontractors	Subcontractors	Subcontractors	Subcontractors	Subcontractors	Subcontractors	Subcontractors	
	Parking	Owner	Owner	Owner	Owner	Owner	Owner	Owner	Owner	Owner	Owner	Owner	Owner	
	BMcD Construction Trailer	-	-	-	-	-	-	-	-	-	-	-	-	
	Trailer(s)				BMcD / Subcontractors	BMcD / Subcontractors	BMcD / Subcontractors							Subcontractors to provide trailers for their staff as necessary. BMcD will provide trailers for BMcD and Owner's staff.
	Card Readers / Security Entrance and Exit				Owner	Owner	Owner							
	Badges				Subcontractors	Subcontractors	Subcontractors							Subcontractors to provide badges with appropriate contract tracing requirements
	Gate Access Equipment (including call box stand)				Owner	Owner	Owner							
	Communication Phone/Internet				BMcD / Subcontractors	BMcD / Subcontractors	BMcD / Subcontractors							Each subcontractor to provide hot spots as needed for their on-site staff.
	Janitorial Services				BMcD	BMcD	BMcD							
	Potable Water				BMcD / Subcontractors	BMcD / Subcontractors	BMcD / Subcontractors							Each to supply water for their own employees
	Office Consumables				BMcD / Subcontractors	BMcD / Subcontractors	BMcD / Subcontractors							Each to supply office supplies for their own staff employees
Common	**Common Areas - Shared Site Items and Services**													
	Temporary Services	-	-	-	-	-	-	-	-	-	-	-	-	
	Dumpsters / Refuse / Recyclables				8220 / 8320	8220 / 8320	8220 / 8320							8220 will supply and maintain for all Project subcontractors until 8320 takes over and maintain for all Project subcontractors until Substantial Completion
	Hand Wash Stations				BMcD	BMcD	BMcD							
	Temporary Toilets				BMcD	BMcD	BMcD							
	Heated Bathroom Trailer (by Break Trailers)				BMcD	BMcD	BMcD							
	Miscellaneous				-	-	-							
	Snow Removal				8220 / 8320	8220 / 8320	8220 / 8320							Common Areas Only Work Areas by each Subcontractor
	Temporary Bussing				8320/8410	8320/8410	8320/8410							As needed pending outage/owner park lot overflow. BMcD will call out time frame when this will apply.
Owner	**Owner Supplied**													
	Taxes	-	-	-	-	-	-	-	-	-	-	-	-	Owner to provide tax exemption certificate to BMcD and BMcD to provide to Suppliers and Subcontractors
	Insurance	BMcD	-	-	Supplier / Subcontractor	Supplier / Subcontractor	-	-	-	-	-	-	-	Each Supplier and Contractor to provide their own insurance.
	Bu lders Risk	Owner	Owner	Owner	Owner	Owner	Owner	Owner	Owner	Owner	Owner	Owner	Owner	
	Permitting	-	-	-	-	-	-	-	-	-	-	-	-	
	Transmission Permitting	-	-	-	Owner	-	-	-	-	-	-	-	-	
	Transmission Right of Way	-	-	-	Owner	-	-	-	-	-	-	-	-	
	Natural Gas Supply Permitting	-	-	-	Owner	-	-	-	-	-	-	-	-	
	Water Rights	-	-	-	Owner	-	-	-	-	-	-	-	-	
	Building Permits	-	-	-	Owner	-	-	-	-	-	-	-	-	
	LOTO's	Owner / BMcD / Subcontractors	-	-	-	-	-	-	-	-	-	-	-	BMcD's LOTO program will be met unt l the system is turned over to the plant.
	Hot Work Permits	Owner / BMcD / Subcontractors	-	-	-	-	-	-	-	-	-	-	-	
	Initial Fi ls & Consumables	-	-	-	Owner	-	-	8320	-	-	-	-	-	8320 to Support first fills
	Water treatment chemicals	-	-	-	Owner	-	-	8320	-	-	-	-	-	8320 to Support first fills
	Lubricating Oil	-	-	-	Owner	-	-	8320	-	-	-	-	-	8320 to Support first fills
	Urea	-	-	-	Owner	-	-	8320	-	-	-	-	-	8320 to Support first fills
	Carbon Dioxide	-	-	-	Owner	-	-	8320	-	-	-	-	-	8320 to Support first fills
	Diesel Fuel	-	-	-	Owner	-	-	8320	-	-	-	-	-	8320 to Support first fills
	Natural Gas	-	-	-	Owner	-	-	-	-	-	-	-	-	
	Startup Power	-	-	-	Owner	-	-	-	-	-	-	-	-	
	Startup Water	-	-	-	Owner	-	-	-	-	-	-	-	-	
	Test Power Sales & Grid Coordination	-	-	-	Owner	-	-	-	-	-	-	-	-	
	Transmission and Substation Upgrades	-	-	-	Owner	-	-	-	-	-	-	-	-	
	Plant Switchyard	-	-	-	Owner	-	-	-	-	-	-	-	-	
	Communications / Security Equipment	-	-	-	Owner	-	-	-	-	-	-	-	-	See Site Security Below
	Communications / Security Infrastructure	-	-	-	Owner	-	-	-	-	-	-	-	-	See Site Security Below
	Maintenance Shop Tools & Test Equipment	-	-	-	Owner	Owner	Owner	Owner	-	-	-	-	-	
	Warehouse Shelves	-	-	-	Owner	Owner	Owner	Owner	-	-	-	-	-	
	Mobile Equipment / Vehicles	-	-	-	Owner	Owner	Owner	Owner	-	-	-	-	-	
	Laboratory Equipment and Furniture	-	-	-	Owner	Owner	Owner	Owner	-	-	-	-	-	
	Operating Spare Parts	-	-	-	Owner	Owner	Owner	Owner	-	-	-	-	-	
	Landscaping	-	-	-	Owner	Owner	Owner	Owner	-	-	-	-	-	
	Signage (Plant exterior permanent signage)	-	-	-	Owner	Owner	Owner	Owner	-	-	-	-	-	
	Construction Power Cost (metered)	-	-	-	Owner	-	-	-	-	-	-	-	-	
	Fuel Gas Heater Skid	-	-	-	Owner	-	-	-	-	-	-	-	-	

Contract No.	Description	Design Criteria / Functional Design	Technical Specification RFP / BOM / BOQ	Detailed Design	Procure / Supply	Fabricate / Deliver	Receive / Maintenance	Erect / Install	Power Wiring	Control Wiring	Testing	Start-up	Commissioning	Remarks
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1150	**Engine Supply**													
	110V DC Rectifiers & Battery System	1150	1150	1150	1150	1150	8410	8410	8410	8410	BMcD/1150	1150	1150	
	Aux Module Mounted Control Panels	1150	1150	1150	1150	1150	8410	8410	8410	8410	BMcD/1150	1150	1150	8320 / 8410 to coordinate installation
	Aux Module Platforms	1150	1150	1150	1150	1150	8320	8320	-	-	BMcD/1150	1150	1150	Handrail sleeves to be field welded to platform steel.
	Charge Air Filter and Weather Hood	1150	1150	1150	1150	1150	8320	8320	-	-	BMcD/1150	1150	1150	
	Common Control Panel	1150	1150	1150	1150	1150	8410	8410	8410	8410	BMcD/1150	1150	1150	
	Compact Gas Ramp	1150	1150	1150	1150	1150	8320	8320	8410	8410	BMcD/1150	1150	1150	
	Dosing Unit	1150	1150	1150	1150	1150	8320	8320	8410	8410	BMcD/1150	1150	1150	
	Engine Genset	1150	1150	1150	1150	1150	1150	1150	8410	8410	BMcD/1150	1150	1150	8320 provide craft labor to support coupling of the generator and engine.
	Engine Auxiliary Module	1150	1150	1150	1150	1150	8320	8320	8410	8410	BMcD/1150	1150	1150	
	Engine Control Panels	1150	1150	1150	1150	1150	8410	8410	8410	8410	BMcD/1150	1150	1150	
	Engine Hall Access Platforms	1150	1150	1150	1150	1150	8320	8320	-	-	BMcD/1150	1150	1150	Handrail sleeves to be field welded to platform steel
	Engineering Workstation	1150	1150	1150	1150	1150	1150	1150	8410	8410	BMcD/1150	1150	1150	
	Engine-Mounted Flex Connectors	1150	1150	1150	1150	1150	8320	8320	-	-	BMcD/1150	1150	1150	
	Exhaust Gas (NOx) Analyzers	1150	1150	1150	1150	1150	8320	8320	8410	8410	BMcD/1150	1150	1150	
	Exhaust Gas Module	1150	1150	1150	1150	1150	8320	8320	8410	8410	BMcD/1150	1150	1150	
	Exhaust Gas Module Support Steel	1150	1150	1150	1150	1150	8320	8320	-	-	BMcD/1150	1150	1150	
	Exhaust Gas Resonators	1150	1150	1150	1150	1150	8320	8320	-	-	BMcD/1150	1150	1150	
	Exhaust Gas Silencer / Stack	1150	1150	1150	1150	1150	8320	8320	-	-	BMcD/1150	1150	1150	
	Exhaust Gas Ventilation Fan	1150	1150	1150	1150	1150	8320	8320	8410	8410	BMcD/1150	1150	1150	
	Exhaust System Bellows	1150	1150	1150	1150	1150	8320	8320	-	-	BMcD/1150	1150	1150	1150 supplying all bellows for exhaust gas system
	Expansion Vessels	1150	1150	1150	1150	1150	8320	8320	8410	8410	BMcD/1150	1150	1150	
	Generator Air Exhasut Duct	1150	1150	1150	1150	1150	8320	8320	-	-	BMcD/1150	1150	1150	
	Generator Neutral Grounding Resistors	1150	1150	1150	1150	1150	8410	8410	8410	8410	BMcD/1150	1150	1150	
	Genset Control Panel (CFE Pane)	1150	1150	1150	1150	1150	8410	8410	8410	8410	BMcD/1150	1150	1150	
	Maintenance Water Tank & Appurtenances	1150	1150	1150	1150	1150	8320	8320	-	-	BMcD/1150	1150	1150	
	Cooling Water Transfer Pumps	1150	1150	1150	1150	1150	8320	8320	8410	8410	BMcD/1150	1150	1150	
	Lube Oil Cooler	1150	1150	1150	1150	1150	8320	8320	-	-	BMcD/1150	1150	1150	
	Lube Oil Transfer Pump Skid	1150	1150	1150	1150	1150	8320	8320	8410	8410	BMcD/1150	1150	1150	
	Mixing Duct	1150	1150	1150	1150	1150	8320	8320	-	-	BMcD/1150	1150	1150	
	Mobile Lube O l Pump Dolly	1150	1150	1150	1150	1150	8320	8320	-	-	BMcD/1150	1150	1150	
	Modular Pipe Rack	1150	1150	1150	1150	1150	8320	8320	8410	8410	BMcD/1150	1150	1150	
	Oil Mist Separator Skid	1150	1150	1150	1150	1150	8320	8320	8410	8410	BMcD/1150	1150	1150	
	Pipe Spools (Field Assembled)	1150	1150	1150	1150	1150	8320	8320			8320	1150	1150	
	Rack-mounted Workstations	1150	1150	1150	1150	1150	8410	8410	8410	8410	BMcD/1150	1150	1150	
	Radiator Banks	1150	1150	1150	1150	1150	8320	8320	8410	8410	BMcD/1150	1150	1150	
	Radiator VFDs	1150	1150	1150	1150	1150	8410	8410	8410	8410	BMcD/1150	1150	1150	
	Radiator Distribution Panels (BJP Panel)	1150	1150	1150	1150	1150	8410	8410	8410	8410	BMcD/1150	1150	1150	
	Radiator Railings & Ladders	1150	1150	1150	1150	1150	8320	8320	-	-	BMcD/1150	1150	1150	
	SCR Catalyst	1150	1150	1150	1150	1150	8320	8320	-	-	BMcD/1150	1150	1150	
	Selective Catalytic Reducer (SCR)	1150	1150	1150	1150	1150	8320	8320	-	-	BMcD/1150	1150	1150	
	Server Rack (CFR Panel)	1150	1150	1150	1150	1150	8410	8410	8410	8410	BMcD/1150	1150	1150	
	Silencers and Stacks	1150	1150	1150	1150	1150	8320	8320	-	-	BMcD/1150	1150	1150	
	Exhaust Duct	1150	1150	1150	1150	1150	8320	8320	-	-				
	Springpacks	1150	1150	1150	1150	1150	8320	8320	-	-	BMcD/1150	1150	1150	
	Urea Supply Pump Skid	1150	1150	1150	1150	1150	8320	8320	8410	8410	BMcD/1150	1150	1150	
	480V Engine MCC	1150	1150	1150	1150	1150	8410	8410	8410	8410	BMcD/1150	1150	1150	
	BOP 125VDC Battery & UPS	1150	1150	1150	1150	1150	8410	8410	8410	8410	BMcD/1150	1150	1150	
2150	**Fire Water Pumps**													
	Electric Fire Water Pump	BMcD	BMcD	2150	2150	2150	8320	8320	8410	8410	BMcD	BMcD	BMcD	
	Diesel Fire Water Pump	BMcD	BMcD	2150	2150	2150	8320	8320	8410	8410	BMcD	BMcD	BMcD	
	Jockey Pump	BMcD	BMcD	2150	2150	2150	8320	8320	8410	8410	BMcD	BMcD	BMcD	
2190	**Miscellaneous Pumps**													
	Fuel Oil Unloading Pumps	BMcD	BMcD	2190	2190	2190	8320	8320	8410	8410	BMcD	BMcD	BMcD	
	Fuel Oil Forwarding Pumps	BMcD	BMcD	2190	2190	2190	8320	8320	8410	8410	BMcD	BMcD	BMcD	
2191	**Lift Stations**													
	Sanitary Lift Station	BMcD	BMcD	2191	2191	2191	8220	8220	8410	8410	BMcD	BMcD	BMcD	
2320	**General Service Pipe**													
	BOP Pipe	BMcD	BMcD	BMcD	8320	8320	8320	8320	-	-	-	-	-	
2340	**Pipe Supports**													
	Pipe Supports	BMcD	BMcD	BMcD	8320	8320	8320	8320	-	-	-	-	-	
	Charge Air Duct Hangers	BMcD	BMcD	BMcD	8320	8320	8320	8320	-	-	-	-	-	
2490	**Miscellaneous Piping Specials**													
	Piping Specials (Relief Valves regulators etc)	BMcD	BMcD	2490	2490	2490	8320	8320	-	-	BMcD	BMcD	BMcD	
	Potable Water Booster Pump	BMcD	BMcD	2490	2490	2490	8320	8320	8410	8410	BMcD	BMcD	BMcD	
	Potable Water Instantaneous Water Heaters	BMcD	BMcD	2490	2490	2490	8320	8320	8410	8410	BMcD	BMcD	BMcD	
	Safety Shower and Eye Wash Stations	BMcD	BMcD	2490	2490	2490	8320	8320	8410	8410	BMcD	BMcD	BMcD	
	Lube Oil Tank Heaters	BMcD	BMcD	2490	2490	2490	8320	8320	8410	8410	BMcD	BMcD	BMcD	
	Lube Oil Cartridge Filter	BMcD	BMcD	2490	2490	2490	8320	8320	-	-	BMcD	BMcD	BMcD	
2491	**Below Grade Piping Specials**													
	Fire Hydrants	BMcD	BMcD	2491	2491	2491	8220	8220	-	-	BMcD	BMcD	BMcD	
	Post Indicator Valves	BMcD	BMcD	2491	2491	2491	8220	8220	-	-	BMcD	BMcD	BMcD	
	Buried Valves	BMcD	BMcD	2491	2491	2491	8220	8220	-	-	BMcD	BMcD	BMcD	
2520	**Valves**													
	Manual Valves	BMcD	BMcD	2520	2520	2520	8320	8320	-	-	BMcD	BMcD	BMcD	

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–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Actuated Valves	BMcD	BMcD	2520	2520	2520	8320	8320	8410	8410	BMcD	BMcD	BMcD	
2530	**Control Valves**													
	Control Valves (Natural Gas)	BMcD	BMcD	2530	2530	2530	8320	8320	-	-	BMcD	BMcD	BMcD	
2570	**Long Lead Valves**													
	Emergency Stop and Vent Valves (Actuated)	BMcD	BMcD	2570	2570	2570	8320	8320	-	8410	2570	BMcD	BMcD	
	Manual Valves	BMcD	BMcD	2570	2570	2570	8320	8320	-	-	2570	BMcD	BMcD	
2710	**Compressed Air Equipment**													
	Instrument Air Compressor	BMcD	BMcD	2710	2710	2710	8320	8320	8410	8410	2710/BMcD	2710 / BMcD	2710 / BMcD	
	Instrument Air Dryer	BMcD	BMcD	2710	2710	2710	8320	8320	8410	8410	2710/BMcD	2710 / BMcD	2710 / BMcD	
	Central Controller for Air Compressors	BMcD	BMcD	2710	2710	2710	8320	8320	8410	8410	2710/BMcD	2710 / BMcD	2710 / BMcD	
2711	**Starting Air Compressors**													
	Starting Air Compressor	BMcD	BMcD	2711	2711	2711	8320	8320	8410	8410	2711 / BMcD	2711 / BMcD	2711 / BMcD	
2762	**Fuel Gas Conditioning**													
	Gas Filter/Coalescer Skid	BMcD	BMcD	2762	2762	2762	8320	8320	8410	8410	BMcD	BMcD	BMcD	
2762	**Fuel Gas Conditioning**													
	Fuel Oil Heater Skid	BMcD	BMcD	2763	2763	2763	8320	8320	8410	8410	BMcD	BMcD	BMcD	
2940	**Oil/Water Separator**													
	Oil Water Separator	BMcD	BMcD	2940	2940	2940	8220	8220	8410	8410	2940	BMcD	BMcD	
	Tank Risers and Accessories	BMcD	BMcD	2940	2940	2940	8220	8220	-	-	2940	BMcD	BMcD	Shipped loose
	Control Panels & Instrumentation	BMcD	BMcD	2940	2940	2940	8220	8220	8410	8410	2940	BMcD	BMcD	Shipped loose
2980	**Shop Fabricated Metallic Tanks**													
	New Oil Tank & Appurtenances	BMcD	BMcD	2980	2980	2980	8320	8320	-	-	BMcD	BMcD	BMcD	
	Service Oil Tank & Appurtenances	BMcD	BMcD	2980	2980	2980	8320	8320	-	-	BMcD	BMcD	BMcD	
	Waste Water Tank & Appurtenances	BMcD	BMcD	2980	2980	2980	8320	8320	-	-	BMcD	BMcD	BMcD	
	Dry Air Receivers	BMcD	BMcD	2980	2980	2980	8320	8320	-	-	BMcD	BMcD	BMcD	
	Wet Air Receiver	BMcD	BMcD	2980	2980	2980	8320	8320	-	-	BMcD	BMcD	BMcD	
	Starting Air Receivers	BMcD	BMcD	2980	2980	2980	8320	8320	-	-	BMcD	BMcD	BMcD	
4120	**Steel Stack and Ductwork**													
	Exhaust Gas Stacks	BMcD	BMcD	4120	4120	4120	8320	8320	-	-	-	-	-	
	Exhaust Gas Ducts with Emissions Ports	BMcD	BMcD	4120	4120	4120	8320	8320	-	-	-	-	-	
	Exhaust Gas Header Duct fasteners/hardware	BMcD	BMcD	4120	4120	4120	8320	8320	-	-	-	-	-	
	Ductwork Supports	BMcD	BMcD	4120	4120	4120	8320	8320	-	-	-	-	-	
	Charge Air Ductwork [SS]	BMcD	BMcD	4120	4120	4120	8320	8320	-	-	-	-	-	
4310	**Pre-Engineered Metal Buildings**													
	Architectural Buildings & Structures													
	Engine Hall Building	BMcD	BMcD	4310	4310	4310	8320	8320	-	-	-	-	-	8320 to temporarily support/brace Engine Hall building steel during erection prior to installation of Precast Concrete Walls (Supply by 4515)
	Warehouse Building	BMcD	BMcD	4310	4310	4310	8320	8320	-	-	-	-	-	
	MV Switchgear Enclosure Buildings	BMcD	BMcD	4310	4310	4310	8320	8320	-	-	-	-	-	
	Building Shell & Appurtenances													
	Main Frame Building Steel & Appurtenances	BMcD	BMcD	4310	4310	4310	8320	8320	-	-	-	-	-	
	Metal Wall Panel(s) & Appurtenances	BMcD	BMcD	4310	4310	4310	8320	8320	-	-	-	-	-	
	Standing Seam Metal Roof Curbs & Appurtenances	BMcD	BMcD	4310	4310	4310	8320	8320	-	-	-	-	-	
	Gutter(s) & Downspout(s)	BMcD	BMcD	4310	4310	4310	8320	8320	-	-	-	-	-	8220 to install transition and appurtenances to U/G storm sewer system.
	Entry Door Canopy(s)	BMcD	BMcD	4310	4310	4310	8320	8320	-	-	-	-	-	
	Engine Hall Overhead Crane - Support Steel	BMcD	BMcD	4310	4310	4310	8320	8320	-	-	-	-	-	
	Engine Hall Monorail Crane - Support Steel	BMcD	BMcD	4310	4310	4310	8320	8320	-	-	-	-	-	
	Roof Penetrations & Curbs													
	Roof Access Curb	BMcD	BMcD	4310	4310	4310	8320	8320	-	-	-	-	-	All roof curbs are furnished and installed by 4310
	Misc. Roof penetrations	BMcD	BMcD	4310	4310	4310	8320	8320	-	-	-	-	-	All roof penetrations to be flashed and sealed by 8320
	Auxiliary Steel													
	Ancillary Steel - per 4310 ancillary steel plan drawings	BMcD	BMcD	4310	4310	4310	8320	8320	-	-	-	-	-	
	Cable Tray Arm(s)	BMcD	BMcD	4310	4310	4310	8320	8320	-	-	-	-	-	
	Portal Frame & Cross Bracing	BMcD	BMcD	4310	4310	4310	8320	8320	-	-	-	-	-	
4312	**Bridge Crane**													
	6-ton Bridge Crane	BMcD	BMcD	4312	4312	4312	8320	8320	8410	-	8320	8320 / BMcD	8320 / BMcD	Crane may be used during construction for assembly within the engine hall (re-test upon turnover to Contractor).
	1-ton Monorail Crane	BMcD	BMcD	4312	4312	4312	8320	8320	8410	-	8320	8320 / BMcD	8320 / BMcD	Crane may be used during construction for assembly within the engine hall (re-test upon turnover to Contractor).
	Runway Electrification System (all cranes)	BMcD	BMcD	4312	4312	4312	8410	8410	8410	-	8410	8320 / BMcD	8320 / BMcD	8410 to install electrification system.
4440	**Vent Fans**													
	Gen-Side Fans	BMcD	BMcD	BMcD	4440	4440	8320	8320	8410	8410	4440	4440 / BMcD	4440 / BMcD	
	Gen-Side Fan VFDs	BMcD	BMcD	BMcD	4440	4440	8320	8320	8410	8410	4440	4440 / BMcD	4440 / BMcD	
	Aux-Side Fans	BMcD	BMcD	BMcD	4440	4440	8320	8320	8410	8410	4440	4440 / BMcD	4440 / BMcD	
4441	**Gravity Ridge Vent**													
	Ridge Vent Gravity Hood	BMcD	BMcD	4441	4441	4441	8320	8320	8410	8410	8320	8320 / BMcD	8320 / BMcD	
4515	**Pre-cast Concrete Firewalls**													
	Pre-cast concrete firewall panels and columns (GSUs)	BMcD	BMcD	4515	4515	4515	8320	8320	-	-	-	-	-	
	Precast Wall Panel(s) & Appurtenances	BMcD	BMcD	4515	4515	4515	8320	8320	-	-	-	-	-	
4520	**Major Structures/Piperack Steel**													
	Cable Bus Support Steel	BMcD	BMcD	BMcD	4520	4520	8320	8320	-	-	-	-	-	
	Charge air filter support steel Stairs Grating & Guard/Handra l	BMcD	BMcD	BMcD	4520	4520	8320	8320	-	-	-	-	-	

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—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	High Voltage Bus Support Steel	BMcD	BMcD	BMcD	4520	4520	8320	8320	-	-				
	Exhaust Duct downstream of SCR/Resonator	BMcD	BMcD	BMcD	4520	4520	8320	8320	-	-	-	-	-	
	Exhaust Duct Supports	BMcD	BMcD	BMcD	4520	4520	8320	8320	-	-	-	-	-	
	Misc Pipe/Cable Tray supports	BMcD	BMcD	BMcD	4520	4520	8320	8320	-	-	-	-	-	
	GSU Transformer Platforming Structures	BMcD	BMcD	BMcD	4520	4520	8320	8320						
	Oil/Urea Pipe & Cable Tray Rack	BMcD	BMcD	BMcD	4520	4520	8320	8320	-	-	-	-	-	
	Radiator Support Steel Stairs Grating & Guard/Handrail	BMcD	BMcD	BMcD	4520	4520	8320	8320	-	-	-	-	-	
	SCR Support Steel Stairs Grating & Guard/Handrail	BMcD	BMcD	BMcD	4520	4520	8320	8320	-	-	-	-	-	
	Tank Enclosure support steel grating ladders & guardrail	BMcD	BMcD	BMcD	4520	4520	8320	8320	-	-	-	-	-	
4525	**Rebar Supply**													
	Rebar for Foundations	BMcD	BMcD	4525	4525	4525	8220	8220	-	-	-	-	-	
4540	**Ductwork and Breeching**													
	Charge Air Ducts	BMcD	BMcD	BMcD	4540	4540	8320	8320	-	-	-	-	-	2 per unit
4545	**Seal Air Fans and Dampers**													
	Seal Air Fans	BMcD	BMcD	BMcD	4545	4545	8320	8320	8410	8410	8320	8320 / BMcD	8320 / BMcD	4 total
	Dampers	BMcD	BMcD	BMcD	4545	4545	8320	8320	8410	8410	8320	8320 / BMcD	8320 / BMcD	1 per unit
4550	**Ductwork Expansion Joints**													
	Metal Bellows	BMcD	BMcD	BMcD	4550	4550	8320	8320	-	-	-	-	-	2 per unit
5110	**Generator Step-up Transformers**													
	13.8kV - 161kV Split Secondary Winding	BMcD	BMcD	5110	5110	5110	5110	5110	8410	8410	5110/9230	BMcD	BMcD	
5240	**Emergency Generator**													
	Auxi iary Generator	BMcD	BMcD	5240	5240	5240	8410	8410	8410	8410	BMcD / 5240 / 9230	BMcD / 5240	BMcD / 5240 / 9230	
5310	**Medium Voltage & Low Voltage Switchgear & Relay Panels**													
	MV Switchgear Lineups & Plenums	BMcD	BMcD	5310	5310	5310	8410	8410	8410	8410	BMcD / 5310/ 9230	BMcD / 5310/ 9230	BMcD / 5310/ 9230	
	GSU protection Breaker Control & Networking Cabinets	BMcD	BMcD	5310	5310	5310	8410	8410	8410	8410	BMcD / 5310/ 9230	BMcD / 5310/ 9230	BMcD / 5310/ 9230	
	LV Switchgear Lineups & Plenums	BMcD	BMcD	5310	5310	5310	8410	8410	8410	8410	BMcD / 5310/ 9230	BMcD / 5310/ 9230	BMcD / 5310/ 9230	
	Auxi iary Transformers	BMcD	BMcD	5310	5310	5310	8410	8410	8410	8410	BMcD / 5310/ 9230	BMcD / 5310/ 9230	BMcD / 5310/ 9230	
	Cable Bus 15kV	BMcD	BMcD	5310	5310	5310	8410	8410	8410	8410	BMcD / 5310/ 9230	BMcD / 5310/ 9230	BMcD / 5310/ 9230	
	Cable Bus 480V	BMcD	BMcD	5310	5310	5310	8410	8410	8410	8410	BMcD / 5310/ 9230	BMcD / 5310/ 9230	BMcD / 5310/ 9230	
5311	**Panelboards and Transformers**													
	Panelboards and Small Transformers	BMcD	BMcD	5311	5311	5311	8410	8410	8410	8410	8410	BMcD	BMcD	
	Switchboards for engines	BMcD	BMcD	5311	5311	5311	8410	8410	8410	8410	8410	BMcD	BMcD	
5330	**480V Motor Control Centers**													
	MCC Lineups	BMcD	BMcD	5330	5330	5330	8410	8410	8410	8410	9230	BMcD	BMcD	
5350	**Protective Relay Panels**													
	GSU & T-Line Panels	BMcD	BMcD	5350	5350	5350	8410	8410	8410	8410	9230	BMcD	BMcD	
5430	**125VDC Batteries, Charger & UPS**													
	125VDC Batteries Disconnects Switchboard Bypass Transformer & Chargers	BMcD	BMcD	5430	5430	5430	8410	8410	8410	8410	BMcD/5430	BMcD/5430	BMcD/5430	
	UPS Inverter & Bypass Switch	BMcD	BMcD	5430	5430	5430	8410	8410	8410	8410	BMcD/5430	BMcD/5430	BMcD/5430	
5500	**Medium and Low Voltage Cable**													
	Cable - 15 kV	BMcD	BMcD	5500	5500	5500	8410	8410	8410	8410	9230	BMcD	BMcD	
	Cable - 5 kV	BMcD	BMcD	5500	5500	5500	8410	8410	8410	8410	9230	BMcD	BMcD	
	Cable - 600V Power and Control	BMcD	BMcD	5500	5500	5500	8410	8410	8410	8410	8410	BMcD	BMcD	
	Cable - 600V Instrument	BMcD	BMcD	5500	5500	5500	8410	8410	8410	8410	8410	BMcD	BMcD	
	Cable - 600V Power and Control (161kV Take Off Structure Juction Box to the Generation Facility)	BMcD	BMcD	5500	5500	5500	8410	8410	8410	8410	8410	BMcD	BMcD	
5520	**High Voltage Cable**													
	High Voltage Conductor (Cable) for 161kV T-Lines	Owner	Owner	Owner	5520	5520	Owner	Owner	Owner	-	8411	Owner	Owner	
5530	**Communications Cable**													
	OPGW ADSS	BMcD	BMcD	BMcD	5530	5530	8410	8410	8410	-	8410	BMcD	BMcD	
5620	**Freeze Protection**													
	Heat Trace and Freeze Protection System	BMcD	BMcD	BMcD	5620	5620	8410	8410	8410	8410	8410	BMcD	BMcD	
	Heat Trace Panels	BMcD	BMcD	BMcD	5620	5620	8410	8410	8410	8410	8410	BMcD	BMcD	
5670	**Plant Communications**													
	GaiTronics Equipment	BMcD	BMcD	BMcD	5670	5670	8410	8410	-	-	5670	5670	BMcD / Owner	
	GaiTronics Cable	BMcD	BMcD	BMcD	5670	5670	8410	8410	8410	8410	-	-	-	
	GaiTronics Fiber Optic Jumpers & Terminations	BMcD	BMcD	BMcD	8410	8410	8410	Owner	-	Owner	Owner	5670	BMcD / Owner	
6210	**Instruments**													
	Instruments	BMcD	BMcD	6210	6210	6210	8320	8320	8410	8410	BMcD / 6210	BMcD	BMcD	Calibrated in Factory
6211	**Fuel Gas Chromatograph**													
	Fuel Gas Chromatograph System	BMcD	BMcD	6211	6211	6211	8320	8320	8410	8410	BMcD / 6211	BMcD	BMcD	Calibrated in Factory
7200	**Substation Package**													
	H-Frame Dead End Structure Steel	Owner	Owner	Owner	Owner	Owner	Owner	Owner	-	-	-	-	-	
	Cast-in-place anchor bolts (H-Frame)	Owner	Owner	Owner	Owner	Owner	Owner	Owner	-	-	-	-	-	
	CCVT Steel Structure	Owner	Owner	Owner	Owner	Owner	Owner	Owner	-	-	-	-	-	
	Surge Arrestors	Owner	Owner	Owner	Owner	Owner	Owner	Owner	Owner	-	Owner	Owner	Owner	
	Capacitor Voltage Transformers (CCVT)	Owner	Owner	Owner	Owner	Owner	Owner	Owner	Owner	Owner	Owner	Owner	Owner	

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—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Disconnect Switches	Owner	Owner	Owner	Owner	Owner	Owner	Owner	Owner	-	Owner	Owner	Owner	
	Insulators (Substation)	Owner	Owner	Owner	Owner	Owner	Owner	Owner	-	-	-	-	-	
	Conductor (HV Cable in Substation)	Owner	Owner	Owner	Owner	Owner	Owner	Owner	-	-	-	-	-	
	Terminals Connectors & Bus Supports	Owner	Owner	Owner	Owner	Owner	Owner	Owner	-	-	-	-	-	
	CCVT Junction Box Assemblies	Owner	Owner	Owner	Owner	Owner	Owner	Owner	Owner	Owner	-	-	-	
	T-Line Insulators	Owner	Owner	Owner	Owner	Owner	Owner	Owner	-	-	-	-	-	
7300	**Transmission Line Steel Structures**													
	Dead End & Intermediate Structure Steel	Owner	Owner	Owner	Owner	Owner	Owner	Owner	-	-	-	-	-	
	Cast-in-place anchor bolts	Owner	Owner	Owner	Owner	Owner	Owner	Owner	-	-	-	-	-	
8110	**Site Preparation**													
	Temporary Services	-	-	-	-	-	-	-	-	-	-	-	-	
	Construction Water	-	-	-	8110	8110	8110	8110	-	-	-	-	-	for Subcontractors Work from Contractor furnished terminal point.
	Construction Temporary Power & Maintenance	-	-	-	8110	8110	8110	8110	-	-	-	-	-	Temporary Power to be provided by subcontractor via generators until the temporary power is available from Owner. Temp Power will be shared by all subcontractors onsite when they mobilize. Subcontractor is responsible for temp power for Subcontractors Work from Contractor furnished terminal point.
	Construction Trailers	-	-	-	8110	8110	8110	-	-	-	-	-	-	for all Subcontractors Supervsion
	Civil Work													
	Clearing stripping and stock piling - including all trees limbs stumps and brush.	BMcD	BMcD	BMcD	8110	8110	8110	8110	-	-	-	-	-	
	Stabilized Construction Entrance(s)	BMcD	BMcD	BMcD	8110	8110	8110	8110	-	-	8110	-	-	
	Temporary Roads: Heavy Haul Laydown Parking Trailers Engine storage and assembly	BMcD	BMcD	BMcD	8110	8110	8110	8110	-	-	8110	-	-	To remain in place at end of project. All areas to be re-dressed skimmed leveled and graded to drain (as required) upon completion.
	Mass Earthwork and Grading	BMcD	BMcD	BMcD	8110	8110	8110	8110	-	-	8110	-	-	Materials assumed to be non-hazardous.
	Rough and Final Grading & Drainage	BMcD	BMcD	BMcD	8110	8110	8110	8110	-	-	8110	-	-	Materials assumed to be non-hazardous.
	Jack and Bore Pit and Services	BMcD	BMcD	BMcD	8110	8110	8110	8110	-	-	8110	-	-	
	Excavation(s)	BMcD	BMcD	BMcD	8110	8110	8110	8110	-	-	8110	-	-	
	Trenching bedding engineered fill excavation compaction backfill	BMcD	BMcD	BMcD	8110	8110	8110	8110	-	-	8110	-	-	
	Storm Sewer Ditches	BMcD	BMcD	BMcD	8110	8110	8110	8110	-	-	8110	-	-	
	Vapor barrier(s)	BMcD	BMcD	BMcD	8110	8110	8110	8110	-	-	-	-	-	
	Site Maintenance	-	-	-	-	-	-	-	-	-	-	-	-	
	Dust Control	-	-	-	-	-	8110	8110	-	-	-	-	-	While onsite Responsibility will be turned over to 8320 following their mobilization.
	Erosion control and SWPPP	BMcD	BMcD	BMcD	8110	8110	8110	8110	-	-	-	-	-	While onsite; Responsibility w ll be turned over to 8320 following 8110 demobilization.
	Site Finishes													
	Site Restoration	BMcD	BMcD	BMcD	8110	8110	8110	8110	-	-	-	-	-	
	Seeding (Permanent and Temporary)	BMcD	BMcD	BMcD	8110	8110	8110	8110	-	-	-	-	-	All disturbed areas to be resorted.
	Pavement / surfacing subgrade preparation	BMcD	BMcD	BMcD	8110	8110	8110	8110	-	-	8110	-	-	
	HMA (light and heavy duty) Pavement	BMcD	BMcD	BMcD	8110	8110	8110	8110	-	-	8110	-	-	HMA to be installed in two (2) phases **Phase 1** - HMA binder coarse utilized as construction roads/access during project **Phase 2** - HMA surface coarse; installed during site finishing efforts after 8110 remobilization
	Concrete Surfacing including sidewalks curbs and approach slabs	BMcD	BMcD	BMcD	8110	8110	8110	8110	-	-	8110	-	-	
	Road Bases and Aggregate Surfacing	BMcD	BMcD	BMcD	8110	8110	8110	8110	-	-	8110	-	-	
	Riprap	BMcD	BMcD	BMcD	8110	8110	8110	8110	-	-	-	-	-	
	Geogrid and Geotextile Fabric	BMcD	BMcD	BMcD	8110	8110	8110	8110	-	-	-	-	-	
	Signs and Roadway Markings	BMcD	BMcD	BMcD	8110	8110	8110	8110	-	-	-	-	-	
	Concrete Wheel Stops	BMcD	BMcD	BMcD	8110	8110	8110	8110	-	-	-	-	-	
	Pipe Bollards	BMcD	BMcD	BMcD	8110	8110	8110	8110	-	-	-	-	-	
	Fencing - Temporary including gates	BMcD	BMcD	BMcD	8110	8110	8110	8110	-	-	-	-	-	
8220	**Foundations and Underground Utilities**													
	Temporary Services													
	Construction Water	-	-	-	8220	8220	8220	8220	-	-	-	-	-	for Subcontractors Work from Contractor furnished terminal point.
	Construction Temporary Power & Maintenance	-	-	-	8220	8220	8220	8220	-	-	-	-	-	Temp Power wi l be shared/turned over to 8320 and 8410 contractors when they mobilize.
	Construction Trailers	-	-	-	8220	8220	8220	-	-	-	-	-	-	for all Subcontractors Supervsion
	Snow Removal	-	-	-	-	-	8220	8220	-	-	-	-	-	Main site entrance road plant roads and for Subcontractors Work Snow Removal responsibility will be turned over to 8320 following their mobilization.
	Barricades	-	-	-	8220	8220	8220	8220	-	-	-	-	-	
	Miscellaneous													
	Testing: Compaction Concrete Grout	BMcD	BMcD	-	8220	-	-	-	-	-	8220	-	-	
	Licensing	-	-	-	8220	8220	8220	-	-	-	-	-	-	for Subcontractors Work
	Survey & Layout including setting permanent benchmarks	BMcD	BMcD	8220	8220	8220	-	8220	-	-	-	-	-	Responsible for establishing site monuments & benchmarks. Establish one control drawing for project.

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Contract No.	Description	Design Criteria / Functional Design	Technical Specification RFP / BOM / BOQ	Detailed Design	Procure / Supply	Fabricate / Deliver	Receive / Maintenance	Erect / Install	Power Wiring	Control Wiring	Testing	Start-up	Commissioning	Remarks
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Civil Work													
	Trenching bedding engineered fill excavation compaction backfill	BMcD	BMcD	BMcD	8220	8220	8220	8220	-	-	8220	-	-	
	Foundations - formwork shoring/bracing hardware fasteners appurtenances embeds cast in mechanical / electrical utilities cast-in-place anchor bolts curing sealing	-	-	-	-	-	-	-	-	-	-	-	-	
	Engine Hall Building and Apron(s)	BMcD	BMcD	BMcD	8220	8220	8220	8220	-	-	8220	-	-	
	HVAC North & South Engine Hall Fan Foundations	BMcD	BMcD	BMcD	8220	8220	8220	8220	-	-	8220	-	-	
	RTU (HVAC units) & Station Transformer Foundations	BMcD	BMcD	BMcD	8220	8220	8220	8220	-	-	8220	-	-	
	Aux Generator Foundation	BMcD	BMcD	BMcD	8220	8220	8220	8220	-	-	8220	-	-	
	Stack Foundation	BMcD	BMcD	BMcD	8220	8220	8220	8220	-	-	8220	-	-	
	Exterior Tank Foundations	BMcD	BMcD	BMcD	8220	8220	8220	8220	-	-	8220	-	-	
	Gas Conditioning Station Foundation(s)	BMcD	BMcD	BMcD	8220	8220	8220	8220	-	-	8220	-	-	
	MV Switchgear (PCM) Enclosure Foundation	BMcD	BMcD	BMcD	8220	8220	8220	8220	-	-	8220	-	-	
	GSU Transformer Foundation	BMcD	BMcD	BMcD	8220	8220	8220	8220	-	-	8220	-	-	
	Dead End Structure Breaker & T-line Intermediate Pole Foundation(s)	BMcD	BMcD	BMcD	8220	8220	8220	8220	-	-	8220	-	-	
	Stair and Ladder Landing Pads	BMcD	BMcD	BMcD	8220	8220	8220	8220	-	-	8220	-	-	
	Pipe Support Foundation(s)	BMcD	BMcD	BMcD	8220	8220	8220	8220	-	-	8220	-	-	
	Switchgear leveling channels	BMcD	BMcD	BMcD	8220	8220	8220	8220	-	-	-	-	-	
	Roadway lighting piers	BMcD	BMcD	BMcD	8220	8220	8220	8220	-	-	8220	-	-	
	Mechanical Underground(s) - piping fittings valves specialties accessories appurtenances supports vaults from existing tie-ins to A/G terminal point.	-	-	-	-	-	-	-	-	-	-	-	-	
	Sanitary Sewer (SS) System	BMcD	BMcD	BMcD	8220	8220	8220	8220	-	-	8220	8220	8220	
	Service Water (WSW) and Potable Water (WPO) System	BMcD	BMcD	BMcD	8220	8220	8220	8220	-	-	8220	8220	8220	
	Connection to Site Potable Water Main	BMcD	BMcD	BMcD	8220	8220	8220	8220	-	-	8220	8220	8220	Including Hot Tap; Inspection/permit cost by BMcD
	Oil Contaminated Drains (DOC) System	BMcD	BMcD	BMcD	8220	8220	8220	8220	-	-	8220	8220	8220	
	Fuel Gas (FGS) System	BMcD	BMcD	BMcD	8220	8220	8220	8220	-	-	8220	8220	8220	8220 - system to be "Pigged" and piping to receive a nitrogen purge and blanket following hydrostatic testing.
	Fire Protection (FPW) System	BMcD	BMcD	BMcD	8220	8220	8220	8220	-	-	8220	8220	8220	
	Connection to Site Fire Protection Water Main	BMcD	BMcD	BMcD	8220	8220	8220	8220	-	-	8220	8220	8220	
	Cooling Water (CWC) System	BMcD	BMcD	BMcD	8220	8220	8220	8220	-	-	8220	8220	8220	8220 - system to be cleaned and piping to receive a nitrogen purge and blanket following hydrostatic testing.
	Fire Hydrants	BMcD	BMcD	BMcD	8220	8220	8220	8220	-	-	8220	8220	8220	
	Storm Sewer System for down spouts and GSU drainage	BMcD	BMcD	BMcD	8220	8220	8220	8220	-	-	8220	8220	8220	
	Electrical Underground(s)	-	-	-	-	-	-	-	-	-	-	-	-	
	Duct bank(s) electrical conduit turn-ups vaults manholes	BMcD	BMcD	BMcD	8220	8220	8220	8220	-	-	8220	8220	8220	
	Grounding Grid	BMcD	BMcD	BMcD	8220	8220	8220	8220	-	-	8220	8220	8220	
	Roadway lighting conduit(s)	BMcD	BMcD	BMcD	8220	8220	8220	8220	-	-	8220	8220	8220	
	Cathodic Protection System	BMcD	BMcD	BMcD	8220	8220	8220	8220	-	-	8220	8220	8220	
8320	**Mechanical Installation**													
	Temporary Services													
	Construction Water	-	-	-	8320	8320	8320	8320	-	-	-	-	-	for Subcontractors Work from Contractor furnished terminal point.
	Construction Temporary Power & Maintenance	-	-	-	8320	8320	8320	8320	-	-	-	-	-	
	Construction Trailers	-	-	-	8320	8320	8320	-	-	-	-	-	-	for all Subcontractors Supervsion
	Snow Removal	-	-	-			8320	8320	-	-	-	-	-	Main plant entrance road plant roads and for Subcontractors Work
	Miscellaneous	-	-	-	-	-	-	-	-	-	-	-	-	
	Survey & Layout	BMcD	BMcD	BMcD	8320	8320	8320	8320	-	-	8320	8320	8320	
	SWPPP Maintenance	BMcD	BMcD	BMcD	8320	8320	8320	8320	-	-	8320	8320	8320	Take over from 8110
	Dust Control	-	-	-	-	-	8320	8320	-	-	-	-	-	Take over from 8110 after 8110 demobilizes
	Initial Fills & Consumables	-	-	-	Owner	-	8320	-	-	-	-	8320	8320	8320 to Support first fills for chemicals oils gases and fuels
	Field Painting - Touch up	BMcD	BMcD	BMcD	8320	8320	8320	8320	-	-	-	-	-	
	Post-Installed Anchor Bolts	-	-	-	-	-	-	-	-	-	-	-	-	
	Equipment	BMcD	BMcD	BMcD	8320	8320	8320	8320	-	-	-	-	-	
	Pipe Supports & Supplemental Steel	BMcD	BMcD	BMcD	8320	8320	8320	8320	-	-	-	-	-	
	Electrical Supports	BMcD	BMcD	BMcD	8320	8320	8320	8320	-	-	-	-	-	
	Building Framed Openings	BMcD	BMcD	BMcD	8320	8320	8320	8320	-	-	-	-	-	
	Mechanical Aboveground(s) - piping fittings vents drains accessories appurtenances auxiliary steel hangers supports anchors hardware to / from tie-in(s) to / from terminal point(s)	-	-	-	-	-	-	-	-	-				
	Instrument Air (ACI) System	BMcD	BMcD	BMcD	8320	8320	8320	8320	-	-	8320	BMcD	BMcD	
	Starting Air (ACS) System	BMcD	BMcD	BMcD	8320	8320	8320	8320	-	-	8320	BMcD	BMcD	
	Urea (AAU) System	BMcD	BMcD	BMcD	8320	8320	8320	8320	-	-	8320	BMcD	BMcD	
	Charge Air (CAE) System	BMcD	BMcD	BMcD	8320	8320	8320	8320	-	-	8320	BMcD	BMcD	
	Charge Air Intake Ductwork	BMcD	BMcD	BMcD	8320	8320	8320	8320	-	-	8320	BMcD	BMcD	
	Cooling Water (CWC) System	BMcD	BMcD	BMcD	8320	8320	8320	8320	-	-	8320	BMcD	BMcD	
	Cooling Water Flush	BMcD	BMcD	BMcD	8320	8320	8320	8320	-	-	8320	BMcD	BMcD	
	Maintenance Water Tank Transfer Pump	BMcD	BMcD	BMcD	8320	8320	8320	8320	8410	8410	8320	BMcD	BMcD	
	Oily Drains (DOC) System	BMcD	BMcD	BMcD	8320	8320	8320	8320	-	-	8320	BMcD	BMcD	
	Oily Drain Pneumatic Pumps	BMcD	BMcD	BMcD	8320	8320	8320	8320	-	8410	8320	BMcD	BMcD	
	Fuel Gas (FGS) System	BMcD	BMcD	BMcD	8320	8320	8320	8320	-	-	8320	BMcD	BMcD	

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–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Fuel Oil System	BMcD	BMcD	BMcD	8320	8320	8320	8320	-	-	8320	BMcD	BMcD	
	Seal Air System	BMcD	BMcD	BMcD	8320	8320	8320	8320	-	-	8320	BMcD	BMcD	
	Lubricating Oil (LOT) System	BMcD	BMcD	BMcD	8320	8320	8320	8320	-	-	8320	BMcD	BMcD	
	Lube Oil Flush	BMcD	BMcD	BMcD	8320	8320	8320	8320	-	-	8320	BMcD	BMcD	
	Exhaust Gas (CAE) System	BMcD	BMcD	BMcD	8320	8320	8320	8320	-	-	8320	BMcD	BMcD	
	Sanitary Sewer (SS) System	BMcD	BMcD	BMcD	8320	8320	8320	8320	-	-	8320	BMcD	BMcD	
	Water (WSW) or Potable Water (WPO) System	BMcD	BMcD	BMcD	8320	8320	8320	8320	-	-	8320	BMcD	BMcD	
	Service Water Bladder Tank	BMcD	BMcD	BMcD	8320	8320	8320	8320	8410	8410	8320	BMcD	BMcD	
	Potable Water Booster Pump	BMcD	BMcD	BMcD	8320	8320	8320	8320	8410	8410	8320	BMcD	BMcD	
	Potable Water Heater	BMcD	BMcD	BMcD	8320	8320	8320	8320	8410	8410	8320	BMcD	BMcD	
	Emergency Eye Wash/Safety Shower	BMcD	BMcD	BMcD	8320	8320	8320	8320	8410	8410	8320	BMcD	BMcD	
	Pipe Supports & Supplemental Steel	BMcD	BMcD	BMcD	8320	8320	8320	8320	-	-	-	BMcD	BMcD	
	Instrument Tubing, fittings, valves	BMcD	BMcD	BMcD	8320	8320	8320	8320	-	-	8320	BMcD	BMcD	As required for Instrument and actuated valve installations.
	Grouting	-	-	-	-	-	-	-	-	-	-	-	-	
	Structural steel	BMcD	BMcD	BMcD	8320	8320	8320	8320	-	-	BMcD	-	-	
	Pipe Supports	BMcD	BMcD	BMcD	8320	8320	8320	8320	-	-	BMcD	-	-	
	Equipment	BMcD	BMcD	BMcD	8320	8320	8320	8320	-	-	BMcD	-	-	
	Field Painting - final coatings touch up galvanizing	BMcD	BMcD	BMcD	8320	8320	8320	8320	-	-	-	-	-	
	Piping & Ductwork Insulation / Personal Protection	-	-	-	-	-	-	-	-	-	-	-	-	
	Piping Insulation / Personal Protection	BMcD	BMcD	BMcD	8320	8320	8320	8320	-	-	-	-	-	
	RICE SCR & Ductwork Insulation / Personal Protection	BMcD	BMcD	BMcD	8320	8320	8320	8320	-	-	-	-	-	
	RICE Stack Personal Protection	BMcD	BMcD	BMcD	8320	8320	8320	8320	-	-	-	-	-	
	Building Shell & Appurtenances	-	-	-	-	-	-	-	-	-	-	-	-	
	Masonry Wall System(s) & Appurtenances	BMcD	BMcD	BMcD	8320	8320	8320	8320	-	-	-	-	-	
	Perforated Metal Wall System(s) & Appurtenances	BMcD	BMcD	BMcD	8320	8320	8320	8320	-	-	-	-	-	
	Partition Wall System(s) & Appurtenances	BMcD	BMcD	BMcD	8320	8320	8320	8320	-	-	-	-	-	
	Light Fixture Weather Tight Seal	BMcD	BMcD	BMcD	8320	8320	8320	8320	-	-	-	-	-	
	Catwalk for Ridge Vent	BMcD	BMcD	BMcD	8320	8320	8320	8320	-	-	-	-	-	
	Roof Access Platform Ladder & Scuttle	BMcD	BMcD	BMcD	8320	8320	8320	8320	-	-	-	-	-	
	Building Penetrations (Interior & Exterior)													
	Through-Wall Penetration - Mechanical Penetrations	BMcD	BMcD	BMcD	8320	8320	8320	8320	-	-	-	-	-	8320 is responsible for all penetrations as shown on the contract drawings. Misc. penetrations not shown on the contract drawings are by the respective subcontractor installing the Work or requiring the penetration
	Through-Wall Penetration -Electrical / Control Penetrations	BMcD	BMcD	BMcD	8410	8410	8410	8410	-	-	-	-	-	8410 is responsible for all penetrations as shown on the contract drawings. Misc. penetrations not shown on the contract drawings are by the respective subcontractor installing the Work or requiring the penetration.
	Engine Entrance Location (Temporary & Permanent Installation)	BMcD	BMcD	BMcD	8320	8320	8320	8320	-	-	-	-	-	Engine entrance will be installed in two (2) phases: **Phase 1** - temporary wall installation / removal prior to engine installation **Phase 2** - permanent wall installation following engine installation.
	Interior wall - All fire stopping sealing and caulking Misc. items	BMcD	BMcD	8320	8320	8320	8320	8320	-	-	-	-	-	All installed Work by 8320/8410 shall be sealed by 8320/8410. All penetrations by other subcontractors shall be sealed by the respective subcontractor.
	Architectural Finishes													
	Room Finishes per schedule	BMcD	BMcD	BMcD	8320	8320	8320	8320	-	-	-	-		including 2-Hour Rated Wall & Ce ling Systems
	Plumbing Schedules	BMcD	BMcD	BMcD	8320	8320	8320	8320	-	-	8320	-	-	
	In-Wall Blocking / fixture carriers (as required)	BMcD	BMcD	8320	8320	8320	8320	8320	-	-	-	-	-	
	Miscellaneous Accessories (Furniture Control Room)	Owner	Owner	Owner	Owner	Owner	Owner	Owner	-	-	-	-	-	
	Doors Windows and Hardware per schedule	BMcD	BMcD	BMcD	8320	8320	8320	8320	-	-	-	-	-	
	Over head coiling door(s) per schedule	BMcD	BMcD	BMcD	8320	8320	8320	8320	8410	8410	8320	8320	-	
	Interior Signage per schedule	BMcD	BMcD	BMcD	8320	8320	8320	8320	-	-	-	-	-	
	Painting	BMcD	BMcD	BMcD	8320	8320	8320	8320	-	-	-	-	-	All paint coating colors to be selected by owner.
	Miscellaneous - Equipment Installation	-	-	-	-	-	-	-	-	-	-	-	-	
	Shop Fab Tank 1/2" Asphalt Impregnated Felt Pads	BMcD	BMcD	BMcD	8320	8320	8320	8320	-	-	-	-	-	To be installed beneath all FRP and Steel Shop Fabricated Tank(s).
8340	**Space Conditioning**													
	Temporary Services													
	Construction Water	-	-	-	8410	8410	8410	8410	-	-	-	-	-	for Subcontractors Work from Contractor furnished terminal point.
	Construction Temporary Power & Maintenance	-	-	-	8410	8410	8410	8410	-	-	-	-	-	
	Construction Trailers	-	-	-	8410	8410	8410	-	-	-	-	-	-	for all Subcontractors Supervision
	HVAC	-	-	-	-	-	-	-	-	-	-	-	-	
	Packaged air handler units (AHUs) Ground mounted	BMcD	BMcD	BMcD	8340	8340	8340	8340	8410	8340	8340	8340	8340	Ground mounted including motors disconnects starters drain piping equipment supports and appurtenances
	Louvers / Roof hoods	BMcD	BMcD	BMcD	8340	8340	8340	8340	8410	8340	8340	8340	8340	
	Supply Fans	BMcD	BMcD	BMcD	8340	8340	8340	8340	8410	8340	8340	8340	8340	
	Electric Unit Heaters	BMcD	BMcD	BMcD	8340	8340	8340	8340	8410	8340	8340	8340	8340	

LIBERTY RICE
Division of Responsibility

Contract No.	Description	Design Criteria / Functional Design	Technical Specification RFP / BOM / BOQ	Detailed Design	Procure / Supply	Fabricate / Deliver	Receive / Maintenance	Erect / Install	Power Wiring	Control Wiring	Testing	Start-up	Commissioning	Remarks
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	HVAC Ductwork	BMcD	BMcD	BMcD	8340	8340	8340	8340	-	-	-	-	-	Including controls VAVs diffusers registers sensors dampers TAB and appurtenances. 8320 to include operator and crane support for the installation of this ductwork.
	Ventilating Units Ducting (w/ flex connections)	BMcD	BMcD	8340	8340	8340	8340	8340	-	-	-	-	-	Remote control wiring by 8410 (from Ventilating Unit local control panel to plant operating system)
	Exhaust Fans	BMcD	BMcD	BMcD	8340	8340	8340	8340	8410	8340	8340	8340	8340	
	House Gas - Above grade piping hangers supports valves fittings specialties appurtenances etc.	-	-	-	-	-	-	-	-	-	-	-	-	
	House Gas System	-	-	-	-	-	-	-	-	-	-	-	-	
	Plumbing - Above grade piping hangers supports valves fittings specialties appurtenances insulation etc.	-	-	-	-	-	-	-	-	-	-	-	-	8320 - furnish and install floor drains cleanouts and stub-ups to A/G sanitary system terminal point(s).
	Domestic Water System	BMcD	BMcD	BMcD	8340	8340	8340	8340	-	-	8340	8340 / BMcD	8340 / BMcD	System to be sanitized.
	Sanitary System (including vents drains)	BMcD	BMcD	BMcD	8340	8340	8340	8340	-	-	8340	8340	8340	
	House Gas System	-	-	-	-	-	-	-	-	-	-	-	-	<2psi House/Domestic Gas
	Plumbing Fixtures	BMcD	BMcD	BMcD	8340	8340	8340	8340	-	-	8340	8340	8340	
	Water Heater System	BMcD	BMcD	BMcD	8340	8340	8340	8340	-	-	8340	8340	8340	
	Miscellaneous													
	Building Automation System (BAS)	BMcD	BMcD	8340	8340	8340	8340	8340	8410	8340	8340	8340	8340	
	HVAC Controls	BMcD	BMcD	8340	8340	8340	8340	8340	8410	8340	8340	8340	8340	
	Exterior building penetrations (wall & roof) - Including all fire stopping sealing and caulking	BMcD	BMcD	BMcD	8340 / 8250	8340 / 8250	8340 / 8250	8340 / 8250	-	-	-	-	-	All exterior penetrations shown on architectural reference drawings are cut and sealed by 8320. Any other exterior wall penetrations for 8340 Work that not shown on the architectural drawings are cut and sealed by 8340.
	Interior building penetrations - Including all fire stopping sealing and caulking	BMcD	BMcD	BMcD	8340	8340	8340	8340	-	-	-	-	-	
8410	**Electrical Installation**													
	Temporary Services	-	-	-	-	-	-	-	-	-	-	-	-	
	Construction Water	-	-	-	8410	8410	8410	8410	-	-	-	-	-	for Subcontractors Work from Contractor furnished terminal point.
	Construction Temporary Power	-	-	-	8410	8410	8410	8410	8410	-	8410 (for initial main power connections)	BMcD (for initial main power connections)	BMcD (for initial main power connections)	Temp Power wi l be shared by all subcontractors onsite when they mobilize. Subcontractor is responsible for temp power for Subcontractors Work from Contractor furnished terminal point.
	Construction Trailers	-	-	-	8410	8410	8410	-	-	-	-	-	-	for all Subcontractors Supervsion
	Wiring / Raceway / Accessories & Appurtenances	-	-	-	-	-	-	-	-	-	-	-	-	
	Above Grade Grounding & Bonding	BMcD	BMcD	BMcD	8410	8410	8410	8410	-	-	8410	-	-	
	Emergency Lighting	BMcD	BMcD	BMcD	8410	8410	8410	8410	8410	8410	8410	BMcD	BMcD	
	Outdoor Lighting Fixtures & Poles	BMcD	BMcD	BMcD	8410	8410	8410	8410	8410	8410	8410	BMcD	BMcD	
	Above Ground Roadway Lighting	BMcD	BMcD	BMcD	8410	8410	8410	8410	8410	8410	8410	BMcD	BMcD	
	Indoor Lighting Fixtures	BMcD	BMcD	BMcD	8410	8410	8410	8410	8410	8410	8410	BMcD	BMcD	
	High Bay Lighting Fixtures	BMcD	BMcD	BMcD	8410	8410	8410	8410	8410	8410	8410	BMcD	BMcD	
	Outdoor Lighting Fixtures (as indicated)	BMcD	BMcD	BMcD	8410	8410	8410	8410	8410	8410	8410	BMcD	BMcD	
	Indoor Lighting Fixtures (as indicated)	BMcD	BMcD	BMcD	8410	8410	8410	8410	8410	8410	8410	BMcD	BMcD	
	Lightning Protection	BMcD	BMcD	8410	8410	8410	8410	8410	8410	8410	8410	BMcD	BMcD	
	MV Cable Terminations	BMcD	BMcD	BMcD	8410	8410	8410	8410	8410	8410	8410	BMcD	BMcD	
	Cable tray and supports	BMcD	BMcD	BMcD	8410	8410	8410	8410	8410	8410	-	-	-	
	Misc. Local Starters	BMcD	BMcD	BMcD	8410	8410	8410	8410	8410	8410	8410	BMcD	BMcD	
	Panelboards and Small Transformers	BMcD	BMcD	BMcD	8410	8410	8410	8410	8410	8410	8410	BMcD	BMcD	
	Raceway and supports	BMcD	BMcD	8410	8410	8410	8410	8410	8410	8410	-	-	-	
	Security conduit	BMcD	BMcD	8410	8410	8410	8410	8410	-	-	-	-	-	
	GaiTronics Conduit	BMcD	BMcD	BMcD	8410	8410	8410	8410	-	-	5670	5670	BMcD/Owner	
	Cable Tray Wall Penetration Seals	BMcD	BMcD	BMcD	8410	8410	8410	8410	-	-	-	-	-	
	Fiber Patch Panels	BMcD	BMcD	BMcD	8410	8410	8410	8410	-	8410	8410 / Owner	BMcD	BMcD	
	Disconnect Switches	BMcD	BMcD	BMcD	8410	8410	8410	8410	-	-	-	-	-	
	Architectural Finishes	-	-	-	-	-	-	-	-	-	-	-	-	
	Light fixtures / receptacles / switches / electrical devices	BMcD	BMcD	BMcD	8410	8410	8410	8410	8410	8410	8410	BMcD	BMcD	
	Fire interlock wiring	BMcD	BMcD	BMcD	8410	8410	8410	8410	-	8410	8410	BMcD	BMcD	
	Site Security	-	-	-	-	-	-	-	-	-	-	-	-	
	Security Panels (Large/Small)	BMcD	BMcD	BMcD	Owner	Owner	8410	8410	8410	8410/Owner	Owner	Owner	Owner	
	Card Readers	Owner	BMcD	BMcD	8410	8410	8410	8410	8410	8410	8410	BMcD/Owner	BMcD/Owner	
	Video Surveillance Equipment / Cameras	Owner	BMcD	BMcD	8410	8410	8410	8410	8410	8410	8410	BMcD/Owner	BMcD/Owner	
	Access Control Equipment	Owner	BMcD	BMcD	8410	8410	8410	8410	8410	8410	8410	BMcD/Owner	BMcD/Owner	
	Security Servers & Licensing	Owner	Owner	Owner	Owner	Owner	Owner	Owner	-	-	Owner	Owner	Owner	
	Communication Cabinets	Owner	Owner	Owner	8410	8410	8410	8410	8410	8410/Owner	-	-	-	8410 to procure the comms cabinets Owner to provide equipment to be housed in communications cabinets.
	Gate Phones	Owner	Owner	Owner	Owner	Owner	Owner	Owner	8410	8410	Owner	Owner	Owner	
	Exit Loops	BMcD	BMcD	BMcD	8410	8410	8410	8410	8410	8410	Owner	Owner	Owner	
	NEMA 4X Enclosures/Backplates (gate closure system)	BMcD	BMcD	BMcD	8410	8410	8410	8410	8410	8410/Owner	Owner	Owner	Owner	Owner to provide equipment to be located inside enclosures. BMCD to pull cables back to enclosure and provide power to enclosures.
	Door Contacts (Overhead & Magnetic)	Owner	Owner	Owner	Owner	Owner	Owner	Owner	8410	8410/Owner	Owner	Owner	Owner	8410 to install door security wiring per owner's typical install detail. Owner to provide door contacts and install.
	PTZ/Bullet/Dome Cameras and mounts	BMcD	BMcD	BMcD	Owner	Owner	8410	8410	8410	8410	Owner	Owner	Owner	

Contract No.	Description	Design Criteria / Functional Design	Technical Specification RFP / BOM / BOQ	Detailed Design	Procure / Supply	Fabricate / Deliver	Receive / Maintenance	Erect / Install	Power Wiring	Control Wiring	Testing	Start-up	Commissioning	Remarks
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Wall Mount Cabinets rack angles cable manager	BMcD	BMcD	BMcD	8410	8410	8410	8410	8410	8410	Owner	Owner	Owner	These will be installed in Urea Storage Room
	Power transfer hinges	BMcD	BMcD	BMcD	8410	8410	8410	8410	8410	8410	Owner	Owner	Owner	
C503	**Transmission Line & Substation Installation**													
	Foundations - Drilled shafts hardware fasteners appurtenances curing sealing	-	-	-	-	-	-	-	-	-	-	-	-	
	T-Line Structure Foundations	Owner	Owner	Owner	Owner	Owner	Owner	Owner	-	-	Owner	-	-	
	Substation Structure Foundations	Owner	Owner	Owner	Owner	Owner	Owner	Owner	-	-	Owner	-	-	
	Wiring / Raceway / Accessories & Appurtenances	-	-	-	-	-	-	-	-	-	Owner	-	-	
	Above Grade Grounding & Bonding	Owner	Owner	Owner	Owner	Owner	Owner	Owner	-	-	Owner	-	-	
	Cable - 115 kV	Owner	Owner	Owner	Owner	Owner	Owner	Owner	Owner	Owner	Owner	-	Owner	
	Cable - 600V Power and Control	Owner	Owner	Owner	Owner	Owner	Owner	Owner	Owner	Owner	Owner	-	Owner	
	Cable - 600V Instrument	Owner	Owner	Owner	Owner	Owner	Owner	Owner	Owner	Owner	Owner	-	Owner	
	Cable - ADSS Fiber	Owner	Owner	Owner	Owner	Owner	Owner	Owner	-	-	-	-	-	
	Cable - Existing Substation Cable demo/de-term	Owner	Owner	Owner	-	-	-	Owner	Owner	Owner	Owner	-	Owner	
	Major Electrical Equipment Installation and Grounding	-	-	-	-	-	-	-	-	-	-	-	-	
	Transmission Line Poles	Owner	Owner	Owner	Owner	Owner	Owner	Owner	-	-	Owner	-	-	
	Substation Structures-H-Frame Structures	Owner	Owner	Owner	Owner	Owner	Owner	Owner	Owner	Owner	Owner	-	Owner	
	Substation Equipment Installation - Switches Insulators CCVTs HV Conductor	Owner	Owner	Owner	Owner	Owner	Owner	Owner	Owner	Owner	Owner	-	Owner	
	Transmission Line Hardware and Conductors (phase OPGW and shield wire)	Owner	Owner	Owner	Owner	Owner	Owner	Owner	Owner	Owner	Owner	-	Owner	
8560	**Fire Protection and Detection**													
	Temporary Services													
	Construction Water	-	-	-	8560	8560	8560	8560	-	-	-	-	-	for Subcontractors Work from Contractor furnished terminal point.
	Construction Temporary Power & Maintenance	-	-	-	8560	8560	8560	8560	-	-	-	-	-	Temporary Power to be provided by subcontractor via generators until the temporary power is available from Owner. Temp Power will be shared by all subcontractors onsite when they mobilize. Subcontractor is responsible for temp power for Subcontractors Work from Contractor furnished terminal point.
	Construction Trailers	-	-	-	8560	8560	8560	-	-	-	-	-	-	for all Subcontractors Supervsion
	Fire Protection													
	Piping supports auxiliary steel fittings couplings valves specialties	BMcD	BMcD	8560	8560	8560	8560	8560	-	-	-	-	-	
	Wall penetrations sleeves seals	BMcD	BMcD	8560	8560	8560	8560	8560	-	-	-	-	-	
	Fire-department connections tie-ins	BMcD	BMcD	8560	8560	8560	8560	8560	-	-	-	-	-	
	Sprinklers	BMcD	BMcD	8560	8560	8560	8560	8560	-	-	-	-	-	
	Monitoring Alarm devices	BMcD	BMcD	8560	8560	8560	8560	8560	-	8560	8560	8560	8560	
	Pressure gauges	BMcD	BMcD	8560	8560	8560	8560	8560	-	-	8560	-	-	Calibrated in Factory
	Inspector's test valving piping	BMcD	BMcD	8560	8560	8560	8560	8560	-	-	-	-	-	
	Drain valves piping	BMcD	BMcD	8560	8560	8560	8560	8560	-	-	-	-	-	
	Fire Alarm System	-	-	-	-	-	-	-	-	-	-	-	-	
	Panel(s) / Communication Devices	BMcD	BMcD	8560	8560	8560	8560	8560	8410	8560	8560	8560	8560	
	Fire Panel Remote Monitoring System	BMcD	BMcD	8560	8560	8560	8560	8560	8410	8560	8560	8560	8560	
	Fire Alarm Control Unit (FACU)	BMcD	BMcD	8560	8560	8560	8560	8560	8410	8560	8560	8560	8560	
	Notification Circuit Power (NAC)	BMcD	BMcD	8560	8560	8560	8560	8560	8410	8560	8560	8560	8560	
	Digital Alarm Communicator Transmitter (DACT)	BMcD	BMcD	8560	8560	8560	8560	8560	8410	8560	8560	8560	8560	
	Gas Detection Panels (GDP)	BMcD	BMcD	8560	8560	8560	8560	8560	8410	8560	8560	8560	8560	
	Secondary Power Supply / Batter Back-up	BMcD	BMcD	8560	8560	8560	8560	8560	8410	8560	8560	8560	8560	
	Initiating Devices	-	-	-	-	-	-	-	-	-	-	-	-	
	Linear / Heat detectors	BMcD	BMcD	8560	8560	8560	8560	8560	8560	8560	8560	8560	8560	
	Smoke detectors	BMcD	BMcD	8560	8560	8560	8560	8560	8560	8560	8560	8560	8560	Detection shall be installed within the MV Switchgear Enclosure after installation of building at site.
	In Duct smoke detectors	BMcD	BMcD	8560	8560	8560	8560	8560	8560	8560	8560	8560	8560	
	Natural gas detectors	BMcD	BMcD	8560	8560	8560	8560	8560	8560	8560	8560	8560	8560	Engine hall detectors to be installed after internal platforming is installed. Detectors to be located immediately above Compact Gas Ramp.
	Hydrogen detectors	BMcD	BMcD	8560	8560	8560	8560	8560	8560	8560	8560	8560	8560	In Battery Room
	Manual Fire Alarm Pull Stations	BMcD	BMcD	8560	8560	8560	8560	8560	8560	8560	8560	8560	8560	
	Notification Appliances	-	-	-	-	-	-	-	-	-	-	-	-	
	Horns	BMcD	BMcD	8560	8560	8560	8560	8560	8560	8560	8560	8560	8560	
	Strobes	BMcD	BMcD	8560	8560	8560	8560	8560	8560	8560	8560	8560	8560	
	Accessories	-	-	-	-	-	-	-	-	-	-	-	-	
	Test chart instructions	BMcD	BMcD	8560	8560	8560	8560	8560	8560	8560	8560	8560	8560	
	Addressable Input Modules (AIMs)	BMcD	BMcD	8560	8560	8560	8560	8560	8560	8560	8560	8560	8560	
	Addressable Output Modules (AOMs)	BMcD	BMcD	8560	8560	8560	8560	8560	8560	8560	8560	8560	8560	
	Surge protection devices / Surge suppressors (SS)	BMcD	BMcD	8560	8560	8560	8560	8560	8560	8560	8560	8560	8560	
	Fire Extinguishers and Cabinets	BMcD	BMcD	BMcD	8560	8560	8560	8560	-	-	-	-	-	
8570	**Field Erected Tanks**													
	Temporary Services		-	-	-	-	-	-	-	-	-	-	-	
	Construction Trailers	-	-	-	8570	8570	8570	-	-	-	-	-	-	for all Subcontractors Supervsion
	Hydrotest Water - From Tie Point	BMcD	BMcD	8570	8570	8570	8570	8570	8570	-	-	-	-	
	Maintenance Dust Control & Snow Removal for Work Area	BMcD	BMcD	8570	8570	8570	8570	8570	8570	-	-	-	-	

LIBERTY RICE
Division of Responsibility

Contract No.	Description	Design Criteria / Functional Design	Technical Specification RFP / BOM / BOQ	Detailed Design	Procure / Supply	Fabricate / Deliver	Receive / Maintenance	Erect / Install	Power Wiring	Control Wiring	Testing	Start-up	Commissioning	Remarks
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Spill Prevention Control and Countermeasures for Work Area	BMcD	BMcD	8570	8570	8570	8570	8570	8570	-	-	-	-	8570 to meet any plant SPCC requirements and develop an SPCC for 8570's Work.
	Dumpsters / Refuse / Recyclables	BMcD	BMcD	8570	8570	8570	8570	8570	8570	-	-	-	-	
	Temporary barricades fencing signage etc.	BMcD	BMcD	8570	8570	8570	8570	8570	8570	-	-	-	-	
	Confined Space Entry for Tank Coating	BMcD	BMcD	8570	8570	8570	8570	8570	8570	8570	8570	8570	8570	
	Conditioning of Tank for Coatings (heating ventilation protection dehumidification etc.) as required	BMcD	BMcD	8570	8570	8570	8570	8570	8570	8570	8570	8570	8570	
	Miscellaneous	-	-	-	-	-	-	-	-	-	-	-	-	
	Survey & Layout for Subcontractors Work	BMcD	BMcD	BMcD	8570	8570	8570	8570	-	-	8570	8570	8570	
	Grading and Excacvating as required from as-provided condition	BMcD	BMcD	8570	8570	8570	8570	8570	-	-	8570	-	-	
	Backfil ing and rough grading at Work Area	BMcD	BMcD	8570	8570	8570	8570	8570	-	-	8570	-	-	
	Finish Grading Work Area	BMcD	BMcD	8570	8570	8570	8570	8570	-	-	8570	-	-	
	Tank Foundations - formwork shoring/bracing reinforcing hardware fasteners appurtenances embeds cast in mechanical / electrical utilities cast-in place anchor bolts curing sealing	BMcD	BMcD	8570	8570	8570	8570	8570	-	-	8570 / 9210	-	-	
	Deep Foundations / Piling (if required)	BMcD	BMcD	8570	8570	8570	8570	8570	-	-	8570	-	-	
	Tanks	BMcD	-	-	-	-	-	-	-	-	-	-	-	
	Fire Water Tank	BMcD	BMcD	8570	8570	8570	8570	8570	-	-	8570	BMcD	BMcD	
	Immersion Heaters	BMcD	BMcD	8570	8570	8570	8570	8570	8410	8410	8570	BMcD	BMcD	
	Fuel Oil Tank	BMcD	BMcD	8570	8570	8570	8570	8570	-	-	8570	BMcD	BMcD	
	Immersion Heaters	BMcD	BMcD	8570	8570	8570	8570	8570	8410	8410	8570	BMcD	BMcD	
	Grounding	BMcD	BMcD	8570	8570	8570	8570	8570	-	-	8570	-	-	
	Lightning Protection	BMcD	BMcD	8570	8570	8570	8570	8570	8410	8410	8570	8570	8570	
	Insulation/Lagging	BMcD	BMcD	8570	8570	8570	8570	8570	-	-	-	-	-	
	Raceway	BMcD	BMcD	8570	8570	8570	8570	8570	-	-	-	-	-	For 8570 supplied instruments.
	Electrical Systems including power controls instrumentation ighting etc. to a common junction box for Contractor's tie-in	BMcD	BMcD	8570	8570	8570	8570	8570	-	-	8570 / 9230	8570	8570	
	Lighting	BMcD	BMcD	8570	8570	8570	8570	8570	8570	8570	8570	8570	8570	Light required to access tank
	Tank Level Instrumenation (Redundant)	BMcD	BMcD	8570	8570	8570	8570	8570	8570	8570	8570	-	-	
	Pipe supports	BMcD	BMcD	8570	8570	8570	8570	8570	8570	8570	8570	-	-	To designated tie-point
	Spiral Stair Access and Roof Access Platform	BMcD	BMcD	8570	8570	8570	8570	8570	-	-	-	-	-	To level detection instrumentation
	Coatings	BMcD	BMcD	8570	8570	8570	8570	8570	-	-	8570	-	-	
9010	**Subsurface Investigation**													
	Geotechnical Investigation	-	-	-	-	-	-	-	-	-	9010	-	-	
9020	**Surveying**													
	Surveying	-	-	-	-	-	-	-	-	-	9020	-	-	
9230	**Electrical Testing**													
	Electrical Testing	-	-	-	-	-	-	-	-	-	9230	-	-	
9400	**Operator Manuals/Training**													
	Operator Manuals / Training Manuals	BMcD	BMcD	BMcD	9400	9400	-	-	-	-	-	-	-	
	Training	BMcD	BMcD	BMcD	9400	9400	-	-	-	-	-	-	-	
9610	**Startup Cleaning Services**													
	Lube Oil Flush (RICE)	BMcD	BMcD	BMcD	9610	9610	9610	9610	-	-	-	-	-	
	Cooling Water Flush (RICE)	BMcD	BMcD	BMcD	9610	9610	9610	9610	-	-	-	-	-	
	Fuel Gas Pigging (RICE)	BMcD	BMcD	BMcD	9610	9610	9610	9610	-	-	-	-	-	

APPENDIX D – EQUIPMENT LIST

157785 - Liberty RICE
Equipment List - Wartsila Option

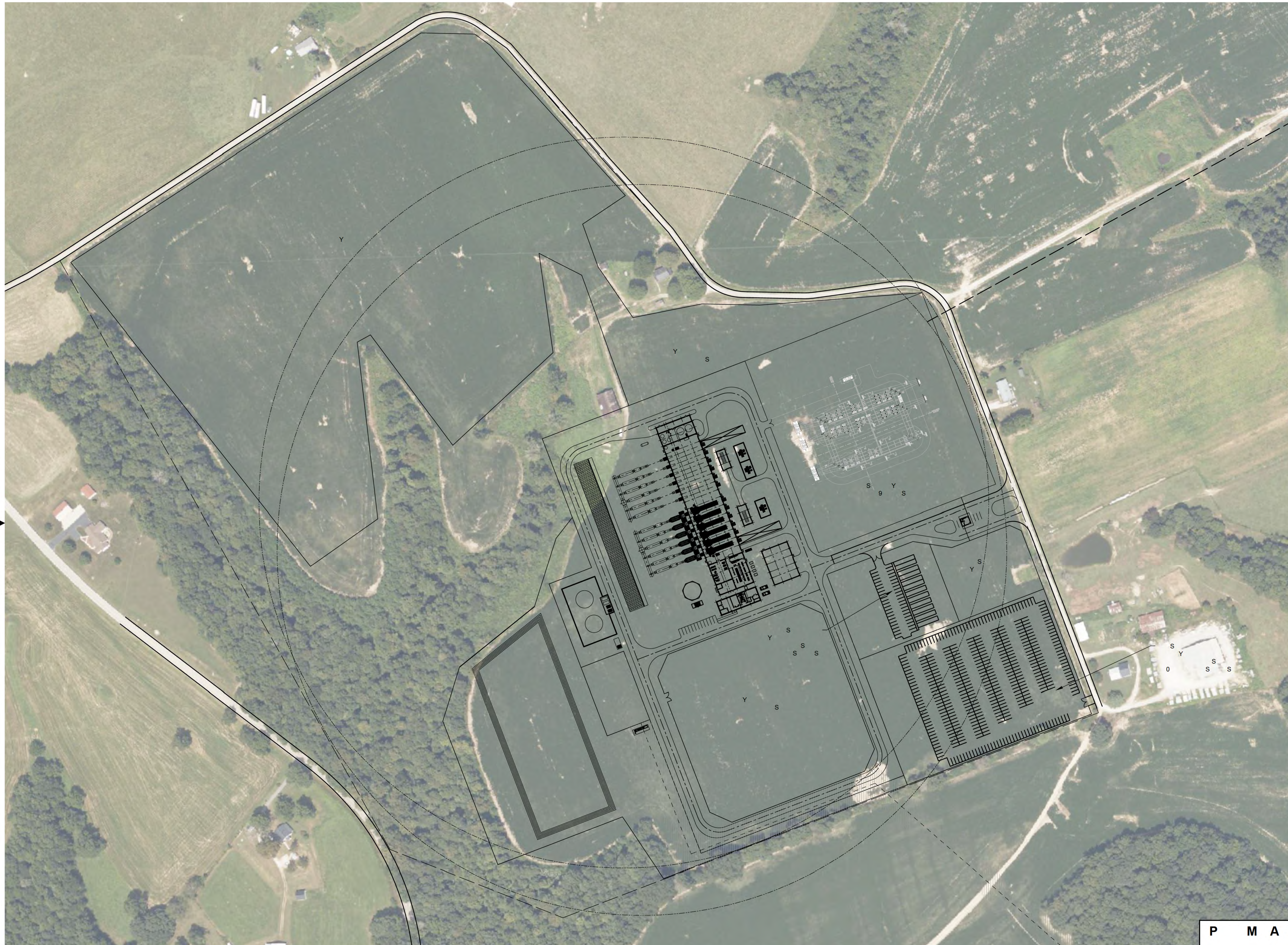
Equipment Name/Description	Supply Contract	Install Contract	Indoor / Outdoor	# Qty	Ins. Thick	Heat Trace	Recv'd By	Power Wiring	Control Wiring	Anchor Bolts	Grout	Notes
Reciprocating Internal Combustion Engine (RICE)												
Charge Air Filter	5.1150	5.8320	Outdoor	12	0"	N	8320	N/A	N/A	Bolted	N/A	Mounts on Filter Support Structure and Platforming
Charge Air Silencer	5.1150	5.8320	Indoor	24	0"	N	8320	N/A	N/A	Bolted	N/A	Mounts on EGM
Compact Gas Ramp	5.1150	5.8320	Indoor	12	0"	N	8320	8410	8410	Bolted	N/A	Mounts on Engine Auxiliary Area Platforming
Dosing Unit	5.1150	5.8320	Indoor	12	0"	N	8320	8410	8410	N/A	N/A	Mounts on EGM Steel and Platforming
Engine Genset	5.1150	5.1150	Indoor	12	0"	N	1150	8410	8410	N/A	No	Genset is mounted on spring packs that rest on the foundation.
Engine Auxilary Area Platforms	5.1150	5.8320	Indoor	12	0"	N	8320	N/A	N/A	Post-installed	No	
Engine Auxiliary Module (EAM)	5.1150	5.8320	Indoor	12	0"	N	8320	8410	8410	Post-installed	No	
Engine Fuel Oil Booser Skids	5.1150	5.8320	Indoor	12	0"	N	8320	8410	8410	Post-installed	No	
Engine Platforms	5.1150	5.8320	Indoor	12	0"	N	8320	N/A	N/A	Post-installed	1.25"	
Exhaust Gas (Nox) Analyzer	5.1150	5.8320	Outdoor	12	0"	N	8320	8410	8410	N/A	N/A	Mounts inside EH
Exhaust Gas Probe	5.1150	5.8320	Outdoor	12	0"	N	8320	8410	8410	N/A	N/A	Mounts to flange on SCR
Exhaust Gas Module (EGM)	5.1150	5.8320	Indoor	12	*	N	8320	8410	8410	Bolted	No	Mounts on EGM Steel and Platforming *Insulation is shipped loose for field installation for ductwork
Exhaust Gas Module Support Steel	5.1150	5.8320	Indoor	12	0"	N	8320	N/A	N/A	Post-installed	1.5"	
Exhaust Gas Ventilation Fan	5.1150	5.8320	Indoor	12	0"	N	8320	8410	8410	N/A	N/A	Shipped Loose connects to EGM and mounts on Engine Platform
Exhaust Gas Resonator	5.1150	5.8320	Outdoor	12	0"	N	8320	N/A	N/A	Bolted	No	Mounts on SCR and Resonator Support Structures and Platforming
Exhaust Gas Silencer	5.1150	5.8320	Outdoor	12	0"	N	8320	N/A	N/A	Bolted	No	Mounts on Silencer and Ductwork Support Structures and Platforming
Expansion Vessels	5.1150	5.8320	Indoor	12	0"	N	8320	8410	8410	N/A	N/A	Mounts on top of EGM
Fuel Gas Analyzer Unit	5.1150	5.8320	Indoor	1	0"	N	8320	8410	8410	N/A	N/A	
Generator Duct	5.1150	5.8320	Indoor	12	0"	N	8320	N/A	N/A	N/A	N/A	Shipped in pieces; connects directly to generator.
Lube Oil Cooler	5.1150	5.8320	Indoor	12	0"	N	8320	8410	8410	Post-installed	No	
Lube Oil Transfer Pumps	5.1150	5.8320	Indoor	12	0"	N	8320	8410	8410	Bolted	N/A	Mounts on Tank Enclosure Platform Steel.
Mixing Duct	5.1150	5.8320	Indoor	12	4"	N	8320	N/A	N/A	Bolted	N/A	Mounts on EGM Support Steel and Mix Duct Support Structure
Mobile Lube Oil Pump	5.1150	5.8320	Indoor	2	0"	N	8320	N/A	N/A		N/A	
Modular Pipe Rack	5.1150	5.8320	Indoor	12	0"	N	8320	8410	8410	Post-installed	No	
Nox Sensor System	5.1150	5.8320	Indoor	12	0"	N	8320	8410	8410	N/A	N/A	Mounts inside EH to flange on Mixing Duct.
Oil Mist Separator Unit	5.1150	5.8320	Indoor	12	0"	N	8320	8410	8410	N/A	N/A	Mounts on top of Pipe Rack
Radiator Bank	5.1150	5.8320	Outdoor	60	0"	N	8320	8410	8410	N/A	N/A	12X5
Selective Catalytic Reducer (SCR)	5.1150	5.8320	Outdoor	12	8"	N	8320	8410	8410	N/A	N/A	
Urea Supply Pump Skid	5.1150	5.8320	Indoor	1	0"	N	8320	8410	8410	N/A	N/A	Mounted on Tank Enclosure Platform Steel. 2X100% PUMPS
Cooling Water Transfer Pump	5.1150	5.8320	Indoor	2	0"	N				Post-installed	1.5"	Rated Capacity 45 GPM, Rated Head 45 FT
Maintenance Water Tank	5.1150	5.8320	Indoor	2	0"	N	8320	N/A	8410	Post-installed	No	
480V Engine 1 MCC	5.1150	5.8410	Indoor	1			8410	8410	8410			
480V Engine 2 MCC	5.1150	5.8410	Indoor	1			8410	8410	8410			
480V Engine 3 MCC	5.1150	5.8410	Indoor	1			8410	8410	8410			
480V Engine 4 MCC	5.1150	5.8410	Indoor	1			8410	8410	8410			
480V Engine 5 MCC	5.1150	5.8410	Indoor	1			8410	8410	8410			
480V Engine 6 MCC	5.1150	5.8410	Indoor	1			8410	8410	8410			
480V Engine 7 MCC	5.1150	5.8410	Indoor	1			8410	8410	8410			
480V Engine 8 MCC	5.1150	5.8410	Indoor	1	*	N	8410	8410	8410	Bolted	No	* See Spec Section 48 59 45
480V Engine 9 MCC	5.1150	5.8410	Indoor	1			8410	8410	8410			
480V Engine 10 MCC	5.1150	5.8410	Indoor	1			8410	8410	8410			
480V Engine 11 MCC	5.1150	5.8410	Indoor	1			8410	8410	8410			
480V Engine 12 MCC	5.1150	5.8410	Indoor	1			8410	8410	8410			
BOP 125VDC Battery & UPS	5.1150	5.8410	Indoor	1	0"	N	8410	8410	8410	Bolted	No	Mounts to rupture disk flanges
CFA, CFC, BJA Panels	5.1150	5.8410	Indoor									
Fire Water Pumps and Enclosure												
Electric Fire Water Pump	5.2150	5.8320	Indoor	1								
Diesel Fire Water Pump	5.2150	5.8320	Indoor	1								
Jockey Pump	5.2150	5.8320	Indoor	1								
Miscellaneous Pumps												
Fuel Oil Unloading Pumps	5.2190	5.8320	Outdoor	3			8320	8410	8410	Post-installed	1.5"	
Fuel Oil Forwarding Pumps	5.2190	5.8320	Outdoor	3			8320	8410	8410	Post-installed	1.5"	
Control Valves												
Gas Pressure Regulators	5.2530	5.8320	Outdoor	4			8320	8410	8410			
Compressed Air Equipment												
Instrument Air Compressors	5.2710	5.8320	Indoor	3	0"	N	8320	8410	8410	Post-installed	1.5"	
Instrument Air Dryer	5.2710	5.8320	Indoor	2	0"	N	8320	8410	8410	Post-installed	1.5"	
Starting Air Compressors												
Starting Air Compressors	5.2711	5.8320	Indoor	3	0"	N	8320	8410	8410	Post-installed	1.5"	Duplex Skid
Fuel Gas Conditioning												
Gas Filter/Coalescer Skid	5.2762	5.8320	Outdoor	1	2"	HT	8320	8410	8410	Post-installed	1.5"	Shipped with nitrogen blanket, to be maintained by 8320
Fuel Gas Heating												
~~Fuel Gas Heater Skid~~	~~5.2763~~	~~5.8320~~	~~Outdoor~~	~~1~~								
Fuel Oil Heater Skid	5.2763	5.8320	Outdoor	2	2"	HT	8320	8410	8410	Post-installed	1.5"	
Oil/Water Separator												
Oil/Water Separator	5.2940	5.8220	Outdoor	1			8320	8410	8410			Set on below grade slab
Oil/Water Separator Pumps	5.2940	5.8220	Outdoor	2			8320	8410	8410			N/A
Shop Fabricated Metallic Tanks												
New Oil Tank	5.2980	5.8320	Indoor	1	0"	N	8320	N/A	8410	Post-installed	No	Set on asphalt impregnated felt pad
Service/Used Oil Tank	5.2980	5.8320	Indoor	1	0"	N	8320	N/A	8410	Post-installed	No	Set on asphalt impregnated felt pad
Waste Water Tank	5.2980	5.8320	Indoor	1	0"	N	8320	N/A	8410	Post-installed	No	Set on asphalt impregnated felt pad
Dry Air Receiver	5.2980	5.8320	Indoor	2	0"	N	8320	N/A	N/A	Post-installed	No	
Wet Air Receiver	5.2980	5.8320	Indoor	1	0"	N	8320	N/A	N/A	Post-installed	No	
Starting Air Receiver	5.2980	5.8320	Indoor	4	0"	N	8320	N/A	N/A	Post-installed	No	
Sanitary Treament System												
Sanitary Treament System	5.3430	5.8320	Indoor	1								
Pre-Engineered Metal Building												Leach Field

Equipment Name/Description	Supply Contract	Install Contract	Indoor / Outdoor	# Qty	Ins. Thick	Heat Trace	Recv'd By	Power Wiring	Control Wiring	Anchor Bolts	Grout	Notes
Engine Hall	5.4310	5.8320	Outdoor	1								
Electrical Equipment Enclosures	5.4310	5.8320	Outdoor	2								
Warehouse	5.4310	5.8320	Outdoor	1								
Bride Crane												
6-ton Bridge Crane	5.4312	5.8320	Indoor	1								
1-ton Monorail Crane	5.4312	5.8320	Indoor	1								
Vent Fans												
Generator Side Fans	5.4440	5.8320	Indoor	12								
Auxiliary Side Fans	5.4440	5.8320	Indoor	12								
Gravity Ridge Vent												
Engine Hall Ridge Vent	5.4441	5.8320	Indoor	1								
Precast Concrete Firewalls												
Concrete Firewalls around GSU Transformers	5.4515	5.8320	Outdoor	-	0"	N	8320	N/A	N/A	Cast-in-place	N/A	
Structural Steel												
Cable Bus Support Steel	5.4520	5.8320	Both	-	0"	N	8320	N/A	N/A	Bolted	No	Mounts to piles
Charge Air Filter & Mix Duct Support Structures and Platforming	5.4520	5.8320	Outdoor	-	0"	N	8320	N/A	N/A	Bolted	No	Mounts to piles
SCR and Resonator Support Structures and Platforming	5.4520	5.8320	Outdoor	-	0"	N	8320	N/A	N/A	Bolted	No	Mounts to piles
Silencer & Ductwork Support Structure and Platforming	5.4520	5.8320	Outdoor	-	0"	N	8320	N/A	N/A	Bolted	No	Mounts to piles
Radiator Support Structures and Platforming	5.4520	5.8320	Outdoor	-	0"	N	8320	N/A	N/A	Bolted	No	Mounts to piles
Tank Enclosure Platforming Structures	5.4520	5.8320	Indoor	-	0"	N	8320	N/A	N/A	Post-installed	1.5"	
Pipe Rack Structures	5.4520	5.8320	Both	-	0"	N	8320	N/A	N/A	Bolted	No	Mounts to piles
High Voltage Breaker Support Structures	5.4520	5.8320	Outdoor	-	0"	N				Bolted	No	Mounts to piles
Generating Step-Up Transformer Platforming Structures	5.4520	5.8320	Outdoor	-	0"	N				Post-installed	1.5"	
SCR exhaust ducts	5.4520	5.8320	Outdoor	7	*	N				Bolted	No	
Header exhaust ducts	5.4520	5.8320	Outdoor	2	*	N				Bolted	No	
Rupture disk cages (Weather Covers)	5.4520	5.8320	Outdoor	20	0"	N				Bolted	No	Mounts to rupture disk flanges
Misc Pipe and Cable Tray Supplemental Steel Supports	5.4520	5.8320	Both	-	0"	N	8320	N/A	N/A	Post-installed?	1.5" / No	
Ductwork and Breeching												
Charge Air Ducts	5.4540	5.8320	Indoor	24								
Dampers and Seal Air Fans												
Seal Air Fan Skid A	5.4545	5.8320	Indoor	2	0"	N	8320	8410	8410	Post-installed	1.5"	2 fans per skid
Seal Air Fan Skid B	5.4545	5.8320	Indoor	2	0"	N	8320	8410	8410	Post-installed	1.5"	2 fans per skid
Seal Air Dampers	5.4545	5.8320	Outdoor	11	8"	T	8320	N/A	N/A	N/A	N/A	
Ductwork Expansion Joints												
Metal Bellows	5.4550	5.8320	Indoor	24	*	N	8320	N/A	N/A	N/A	N/A	
Generator Step-up Transformers												
Generator Step-Up Transformer 1	5.5110	5.5110	Outdoor	1	0"	N	8320	N/A	N/A	Bolted	No	Mounts to piles
Generator Step-Up Transformer 2	5.5110	5.5110	Outdoor	1	0"	N	8320	N/A	N/A	Bolted	No	Mounts to piles
Generator Step-Up Transformer 3	5.5110	5.5110	Outdoor	1	0"	N	8320	N/A	N/A	Bolted	No	Mounts to piles
Emergency Generator												
Auxiliary Generator	5.5240	5.8410	Outdoor	1	0"	N	8320	8410	8410	Post-installed	1.5"	
Medium Voltage & Low Voltage Switchgear & Relay Panels												
13.8kV Generator Switchgear 1	5.5310	5.8410	Indoor	1	0"	N	8320	N/A	N/A	Bolted	No	Mounts to piles
13.8kV Generator Switchgear 2	5.5310	5.8410	Indoor	1	0"	N	8320	N/A	N/A	Bolted	No	Mounts to piles
13.8kV Generator Switchgear 3	5.5310	5.8410	Indoor	1	0"	N	8320	N/A	N/A	Bolted	No	Mounts to piles
13.8kV Generator Switchgear 4	5.5310	5.8410	Indoor	1	0"	N	8320	N/A	N/A	Post-installed	1.5"	
Station Auxiliary Transformer 1	5.5310	5.8410	Outdoor	1	0"	N	8320	N/A	N/A	Bolted	No	Mounts to piles
Station Auxiliary Transformer 2	5.5310	5.8410	Outdoor	1	0"	N				Bolted	No	Mounts to piles
Station Auxiliary Transformer 3	5.5310	5.8410	Outdoor	1	0"	N				Post-installed	1.5"	
Station Auxiliary Transformer 4	5.5310	5.8410	Outdoor	1	*	N				Bolted	No	
480V Switchgear 1	5.5310	5.8410	Indoor	1								
480V Switchgear 2	5.5310	5.8410	Indoor	1								
480V Switchgear 3	5.5310	5.8410	Indoor	1								
480V Switchgear 4	5.5310	5.8410	Indoor	1								
480V Motor Control Centers												
480V BOP MCC 1	5.5330	5.8410	Indoor	1								
480V BOP MCC 2	5.5330	5.8410	Indoor	1								
125VDC Batteries, Charger & UPS												
125VDC Batteries, Disconnects, Switchboard, Bypass Transformer & Chargers	5.5430	5.8410	Indoor	-								
UPS, Inverter & Bypass Switch	5.5430	5.8410	Indoor	-								
Instruments												
Instruments	5.6210	5.8320	Indoor / Outdoor	-								
5.8320 Mechanical Construction (Misc. Pumps, Specials, HVAC)												
Service Water Bladder Tank	5.8320	5.8320	Indoor	1	0"	N	8320			N/A	N/A	Installed on Pipe
Potable Water Booster Pump	5.8320	5.8320	Indoor	1	0"	N	8320	8410	8410	Bolted	1.5"	
Potable Water Heater	5.8320	5.8320	Indoor	2	0"	N	8320	8410	8410	Post Installed	N/A	
Emergency Eye Wash / Safety Shower	5.8320	5.8320	Indoor	5	0"	N	8320	8410	8410	Bolted	1/5"	
Lift Station	5.8220	5.8220	Outdoor	2	0"	N	8320	8410	8410	N/A	N/A	
Lube Oil Cartridge Filter	5.8320	5.8320	Indoor	1	0"	N	8320					
Lube Oil Tank Heater	5.8320	5.8320	Indoor	2	0"	N	8320					
5.8340 Space Conditioning												
Admin Room(s) Air Handling Units	5.8340	5.8340	Outdoor	2								
Admin Room(s) Air Terminal Units	5.8340	5.8340	Indoor	20								
Electrical Room Air Handling Units	5.8340	5.8340	Outdoor	2								
Building Intake Louvers	5.8340	5.8340	Indoor	15								

157785 - Liberty RICE
Equipment List - Wartsila Option

Equipment Name/Description	Supply Contract	Install Contract	Indoor / Outdoor	# Qty	Ins. Thick	Heat Trace	Recv'd By	Power Wiring	Control Wiring	Anchor Bolts	Grout	Notes
Building Vent Fans	5.8340	5.8340	Indoor	8								
Building Electric Heaters	5.8340	5.8340	Indoor	25								
5.8570 Field Erected Tanks												
Fire Water Tank	5.8570	5.8570	Outdoor	1								
Tank Immersion Heater	5.8570	5.8570	Outdoor	2			8570	8410	8410			Mounted on tank flange
Fuel Oil Tank	5.8570	5.8570	Outdoor	2								
Fuel Oil Tank Immersion Heater	5.8570	5.8570	Outdoor	2			8570	8410	8410			Mounted on tank flange
Urea Storage Tanks	5.8570	5.8570	Indoor	2								Bolted FRP Tanks

APPENDIX E – PRELIMINARY PROJECT SCOPING DRAWINGS



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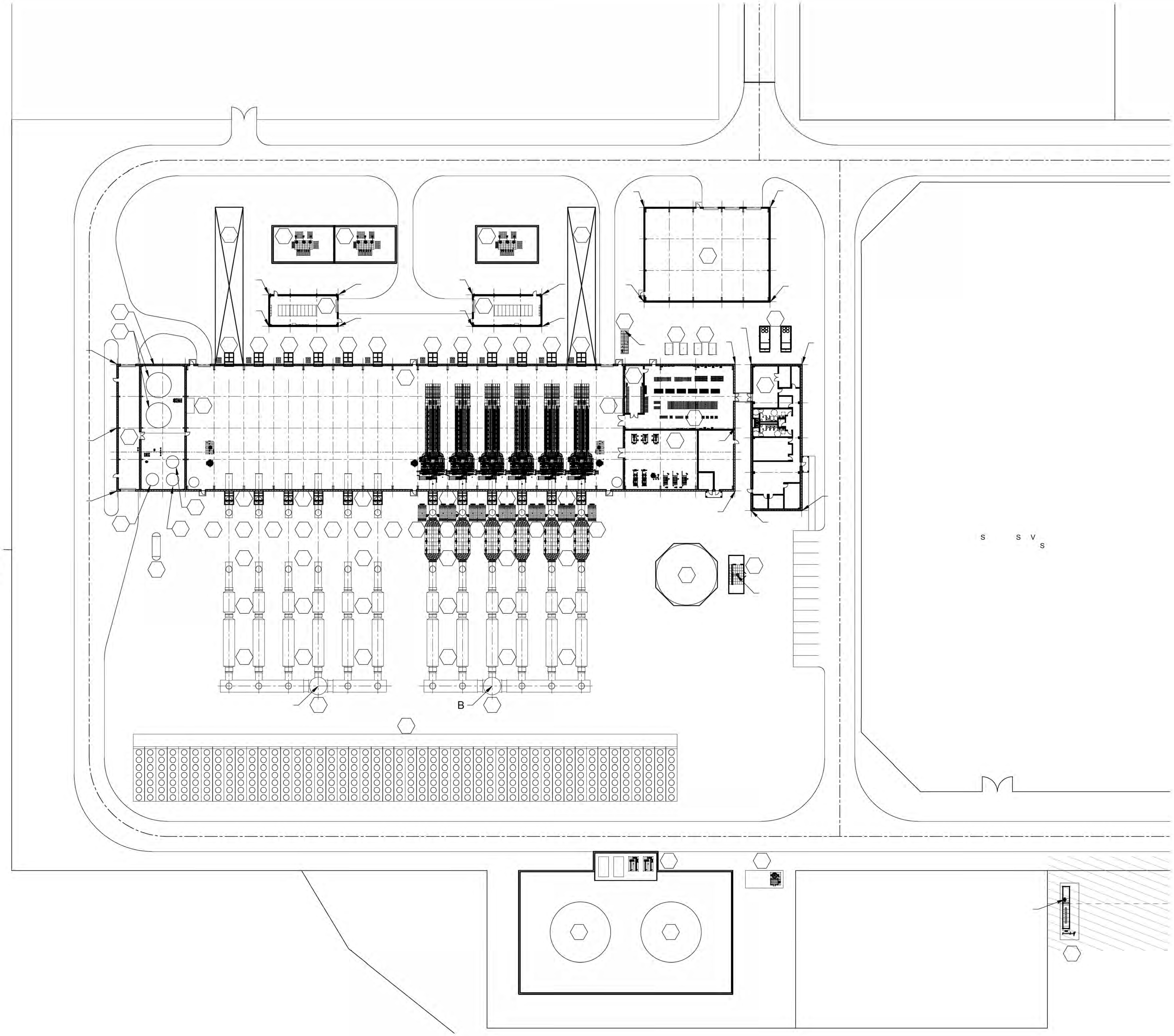

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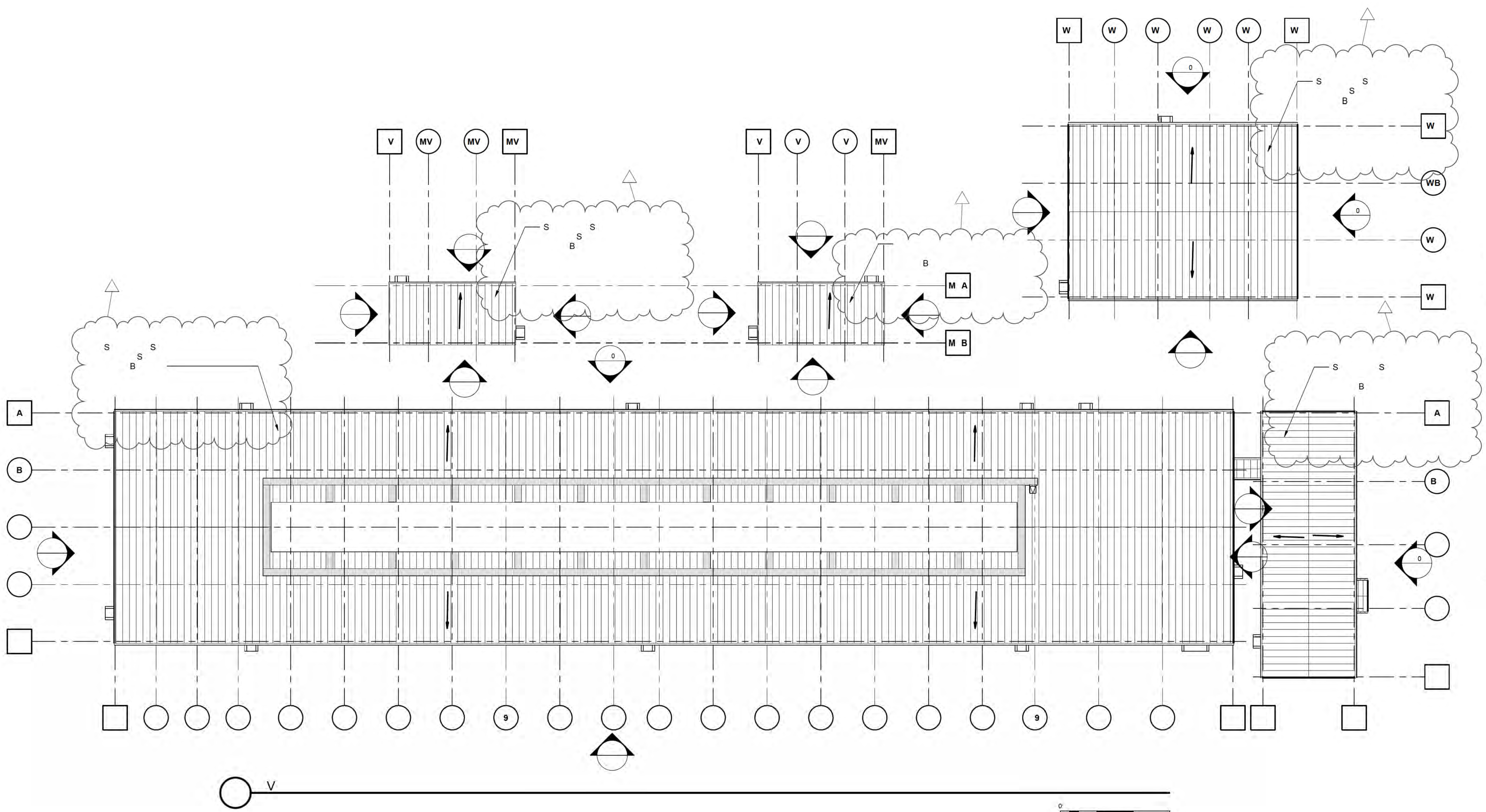

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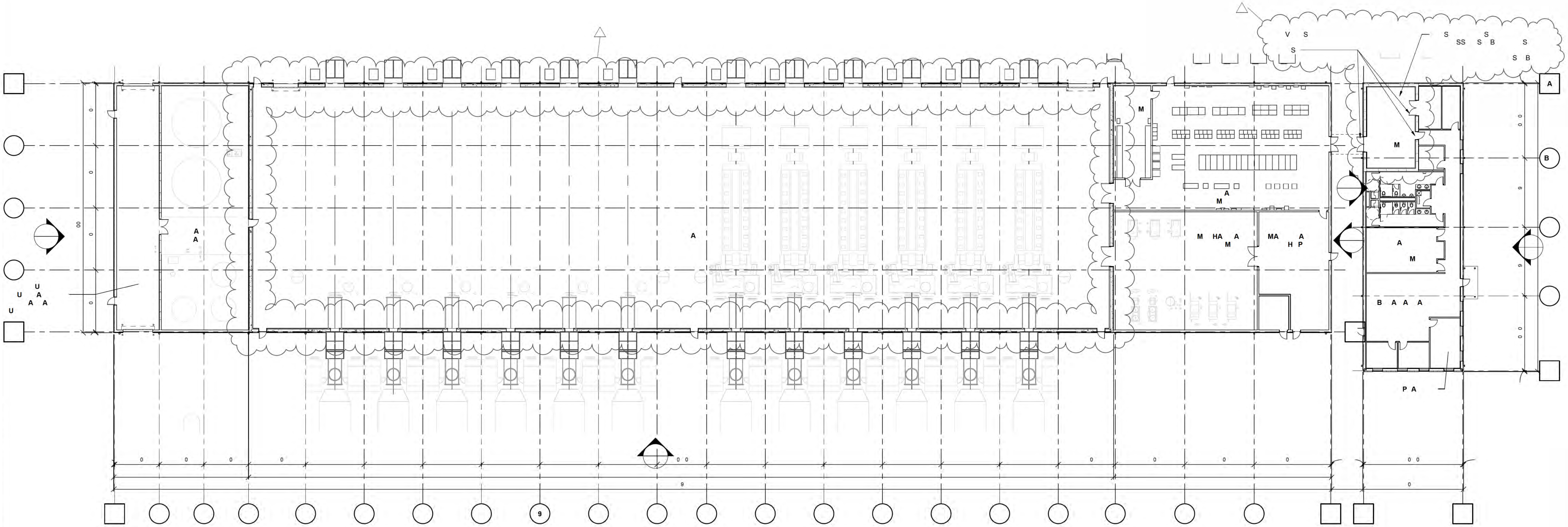

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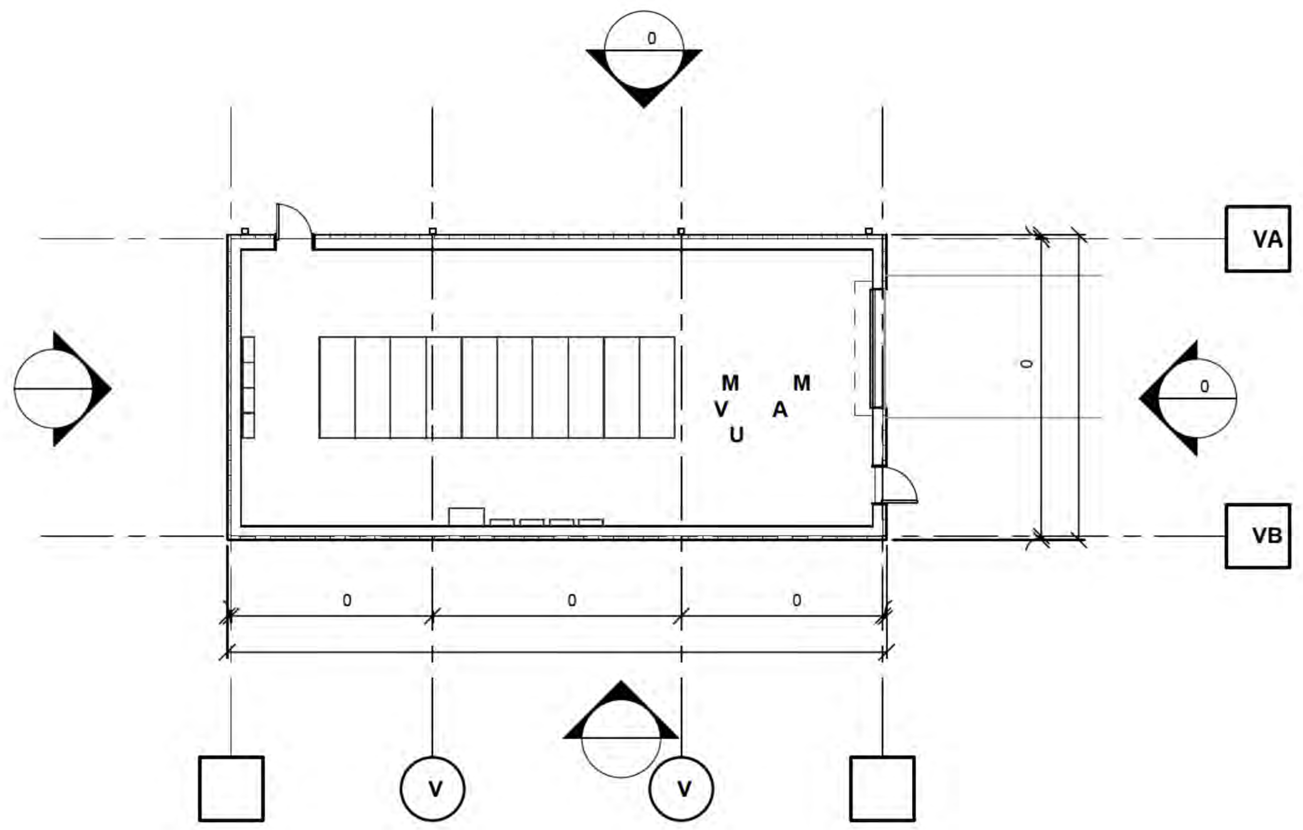

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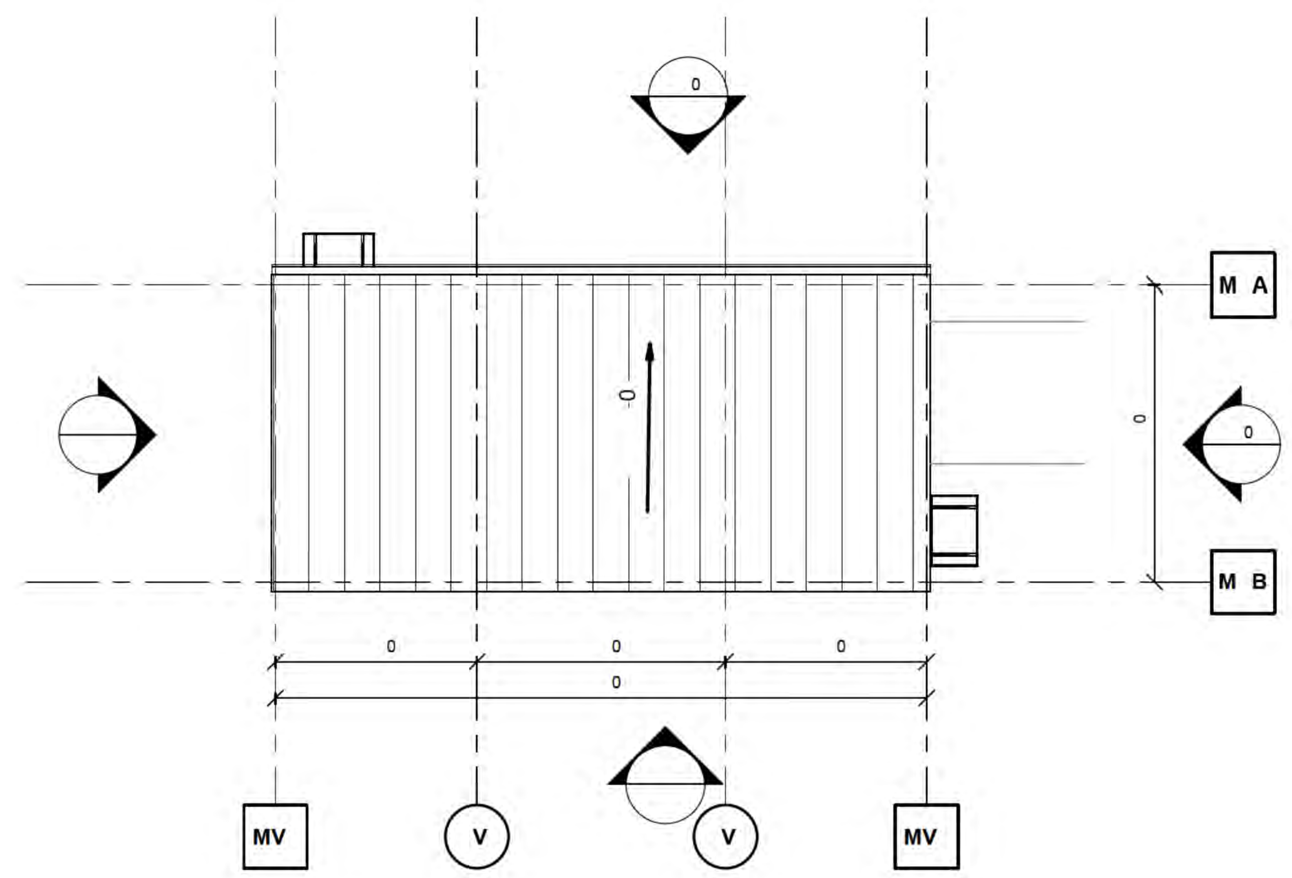

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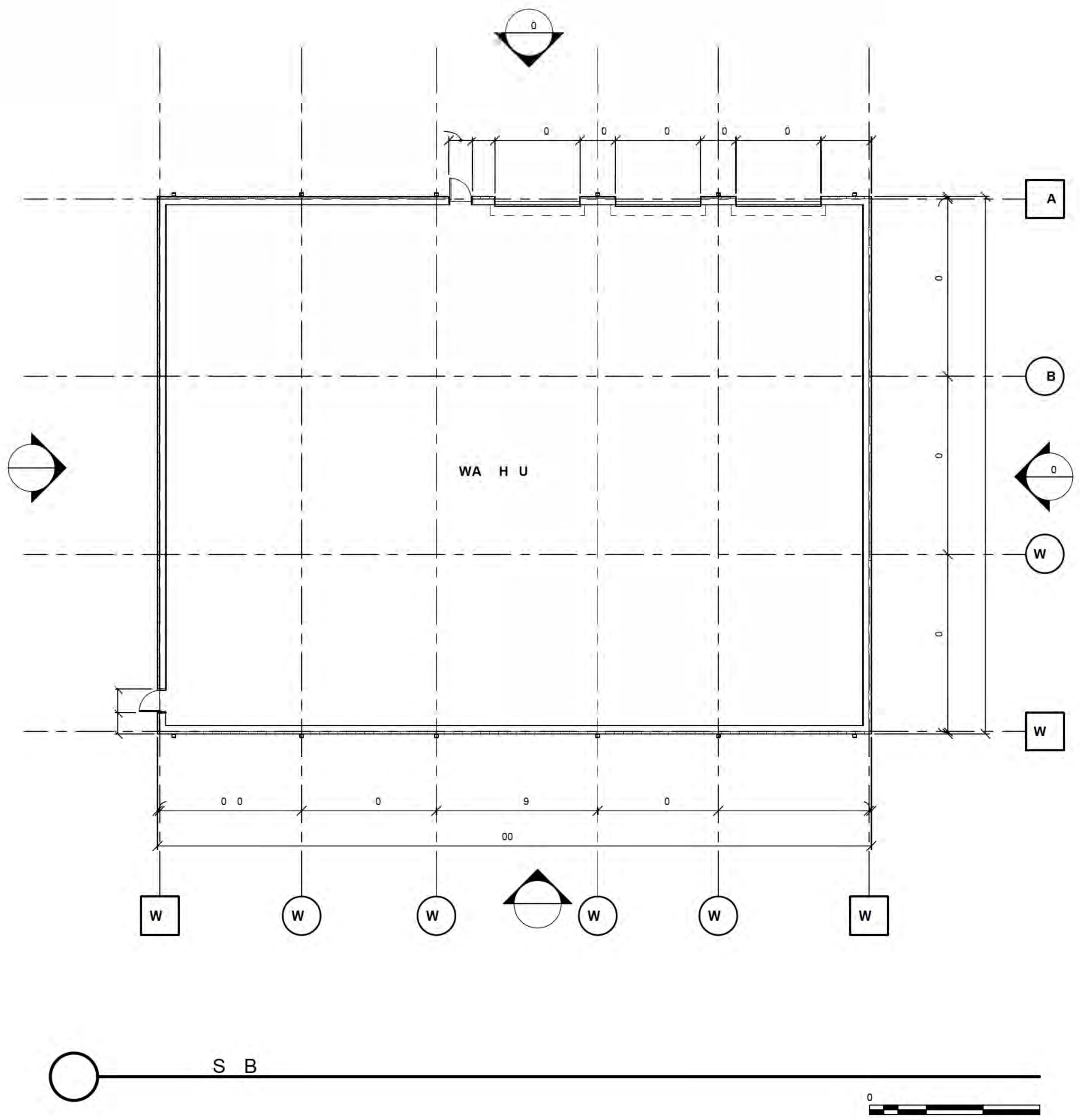

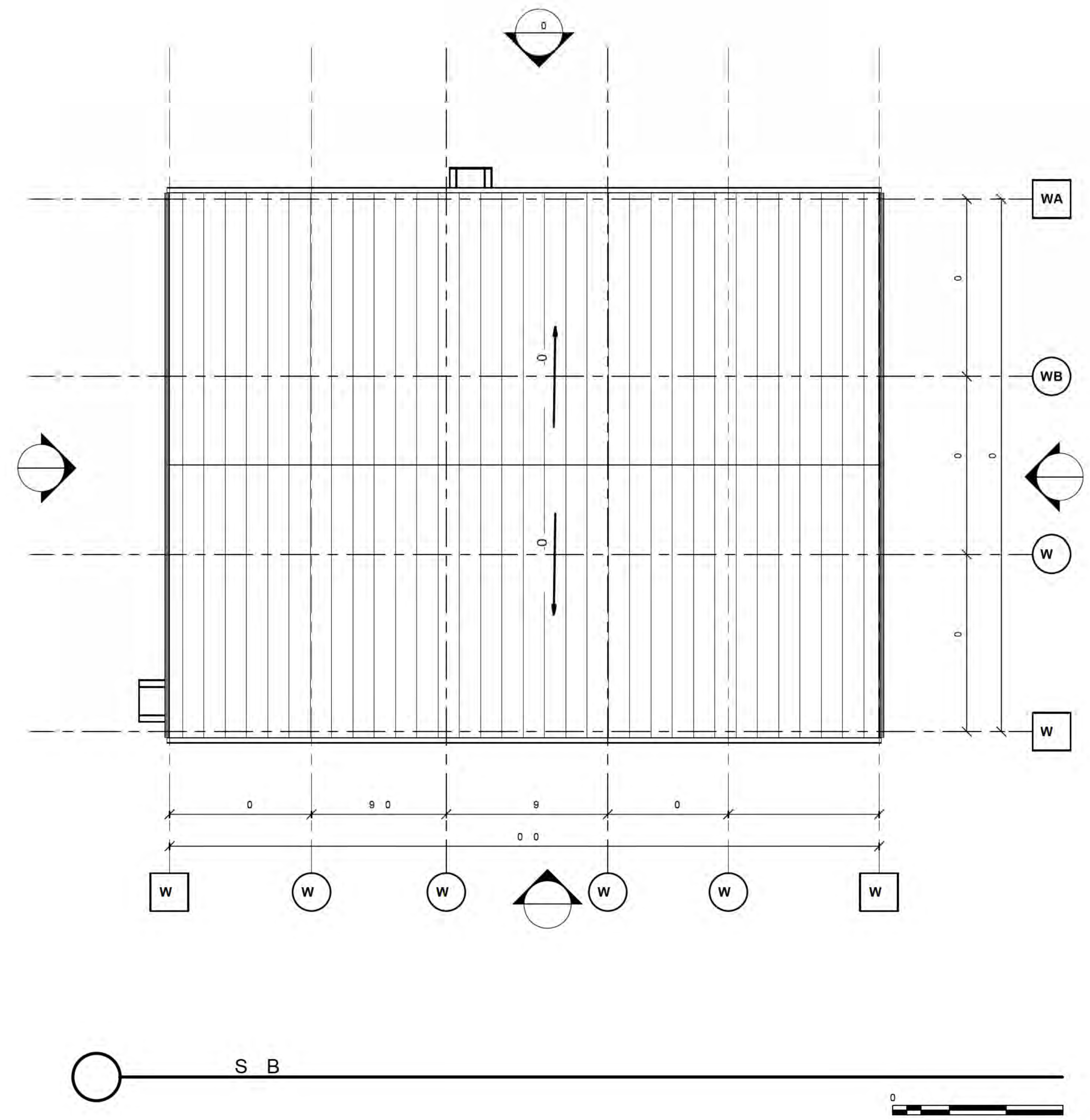

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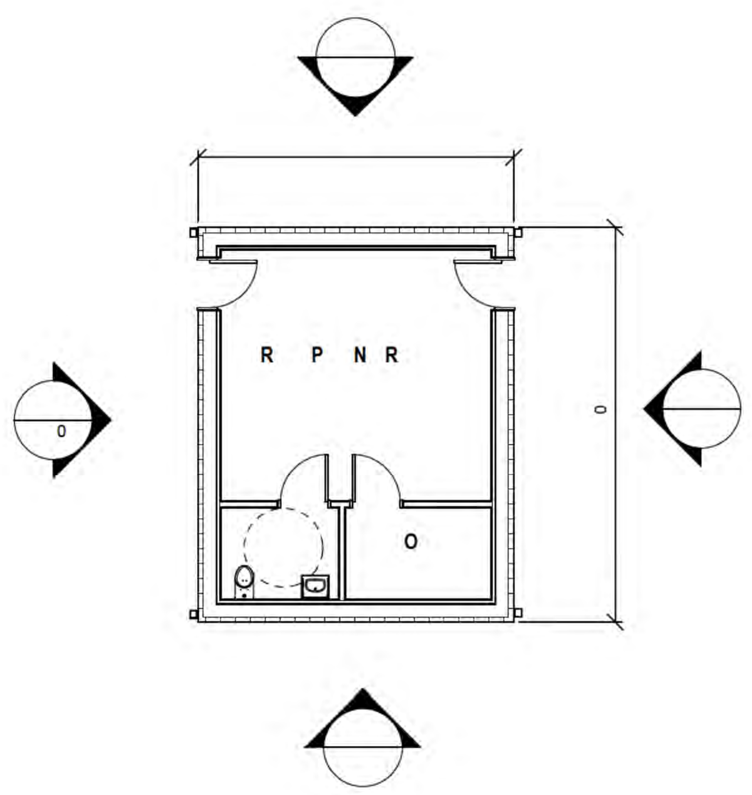

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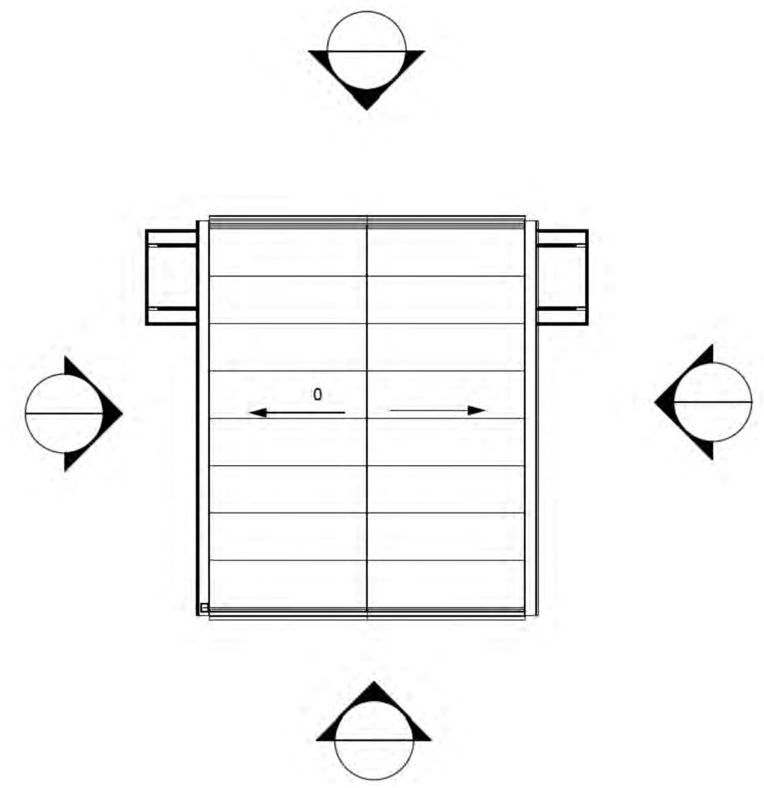

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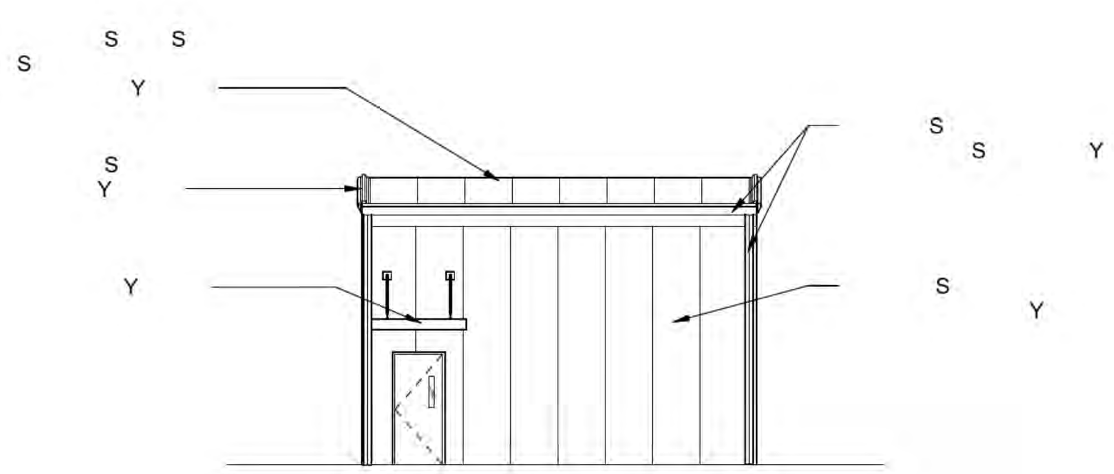

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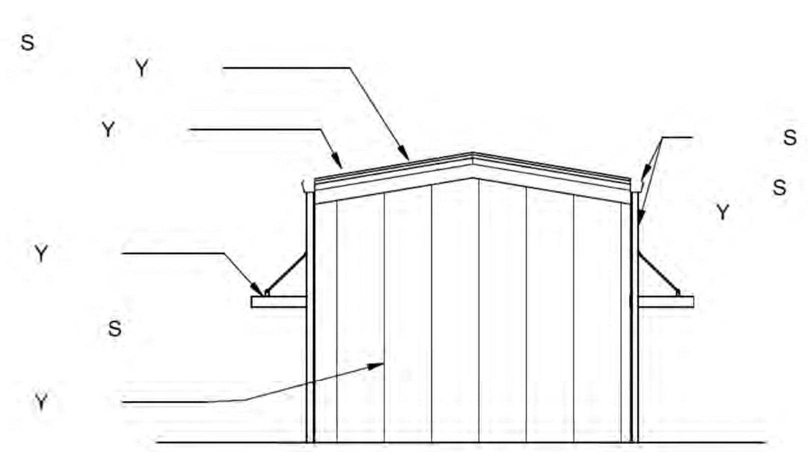

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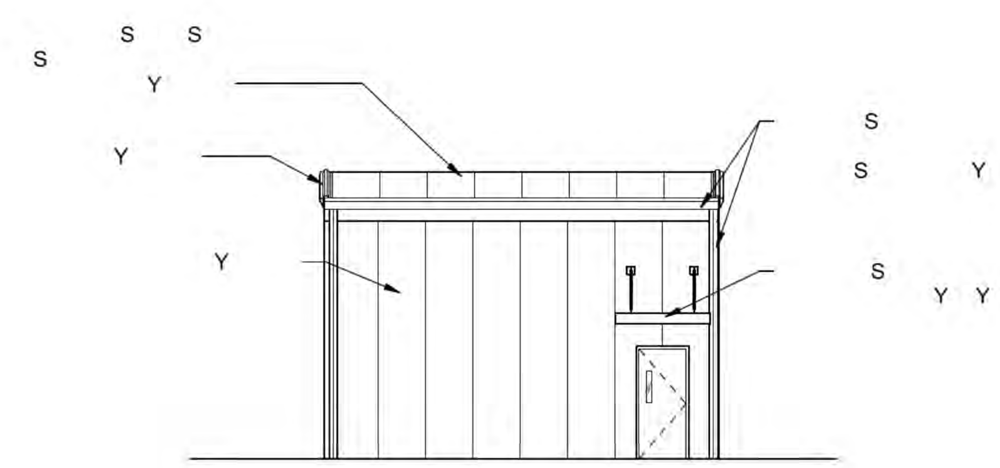

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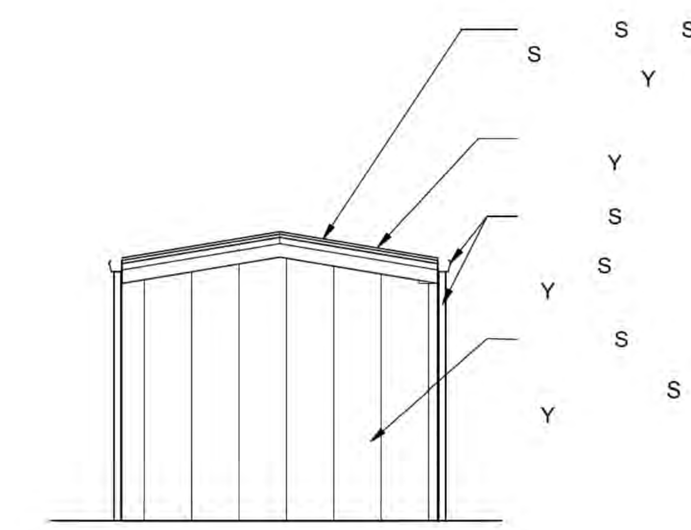

S Y

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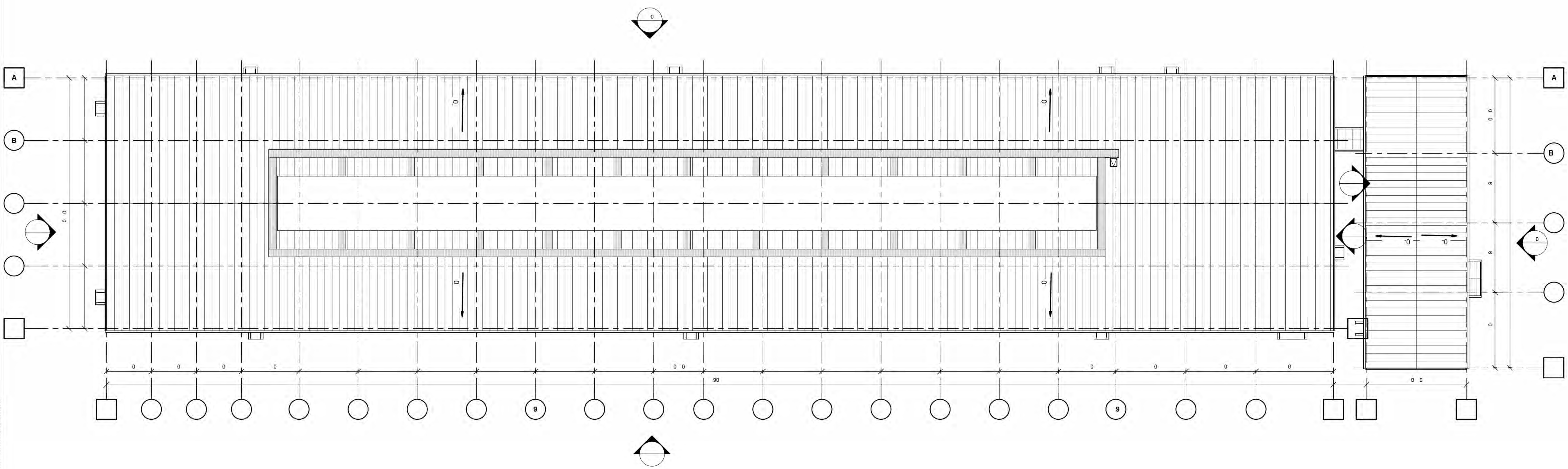
P R NU PR

S B

A



B S B

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Y

BURNS McDONNELL

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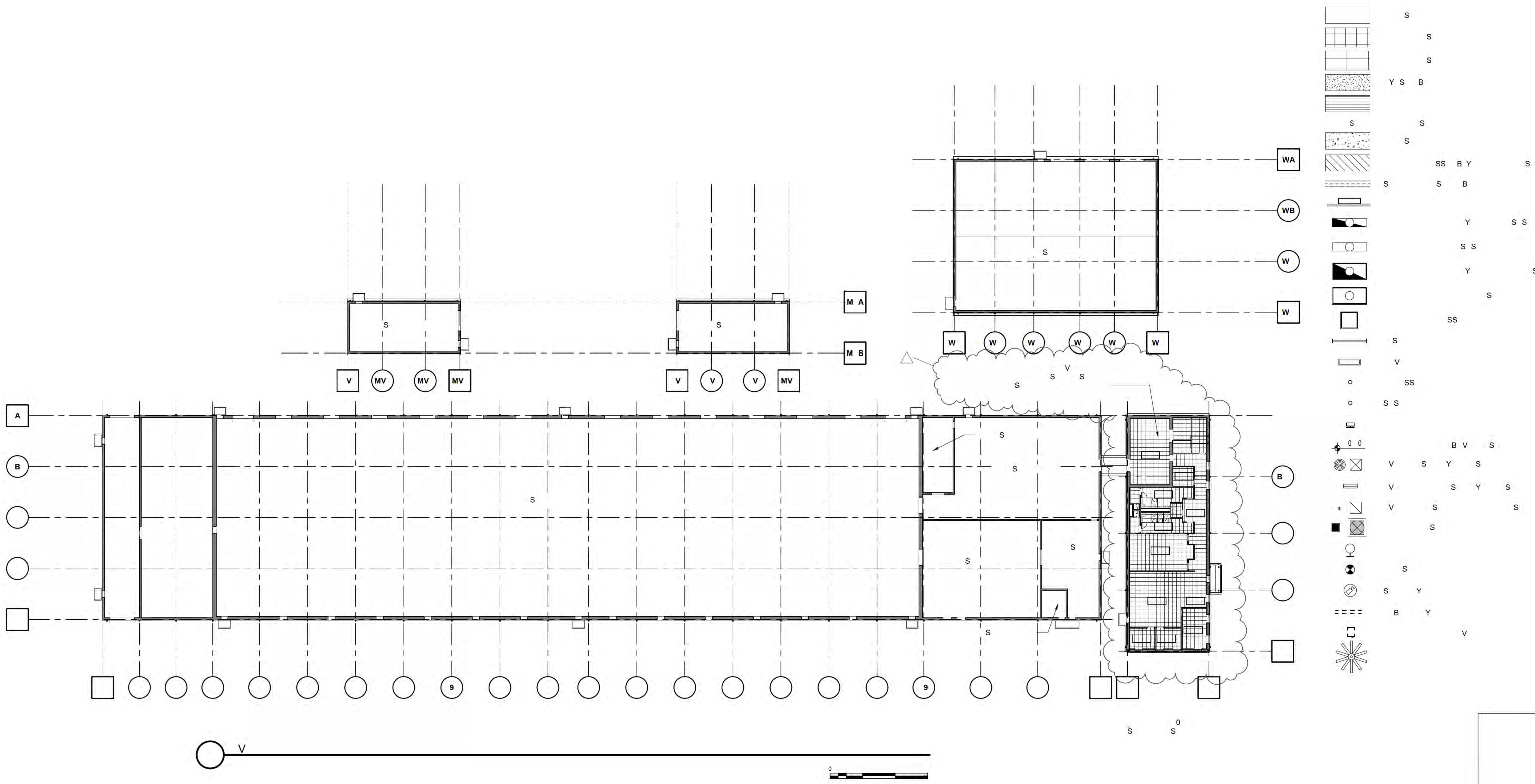
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WB
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B
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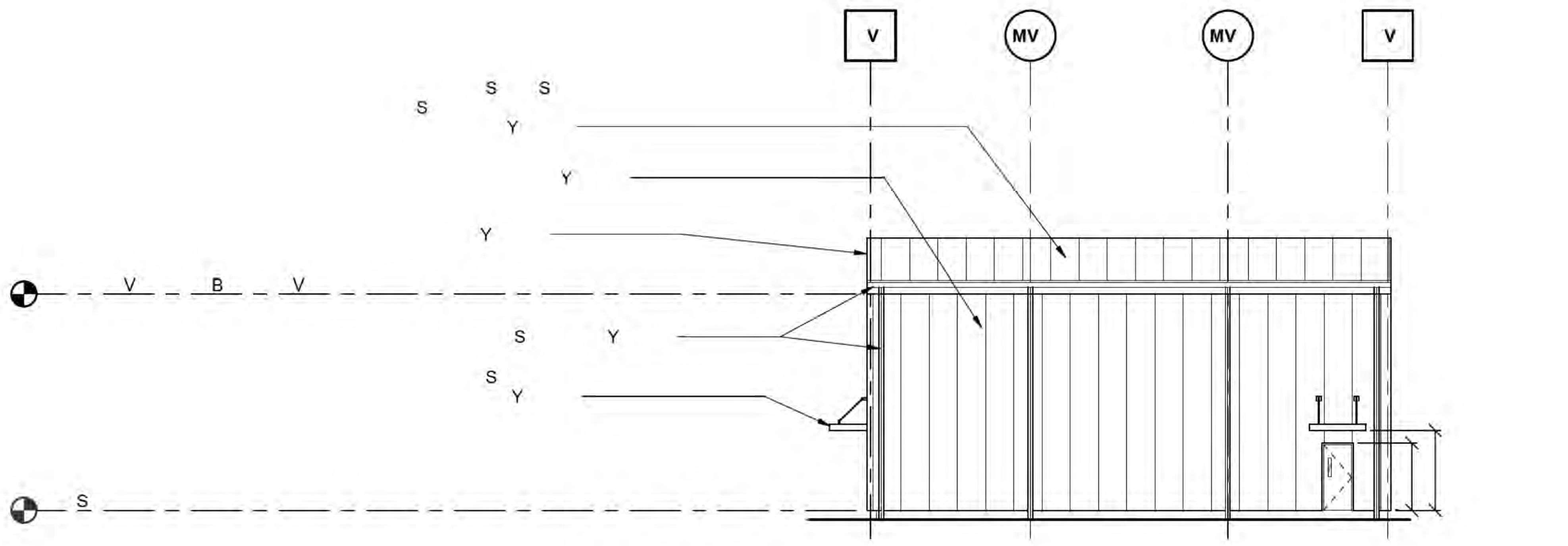

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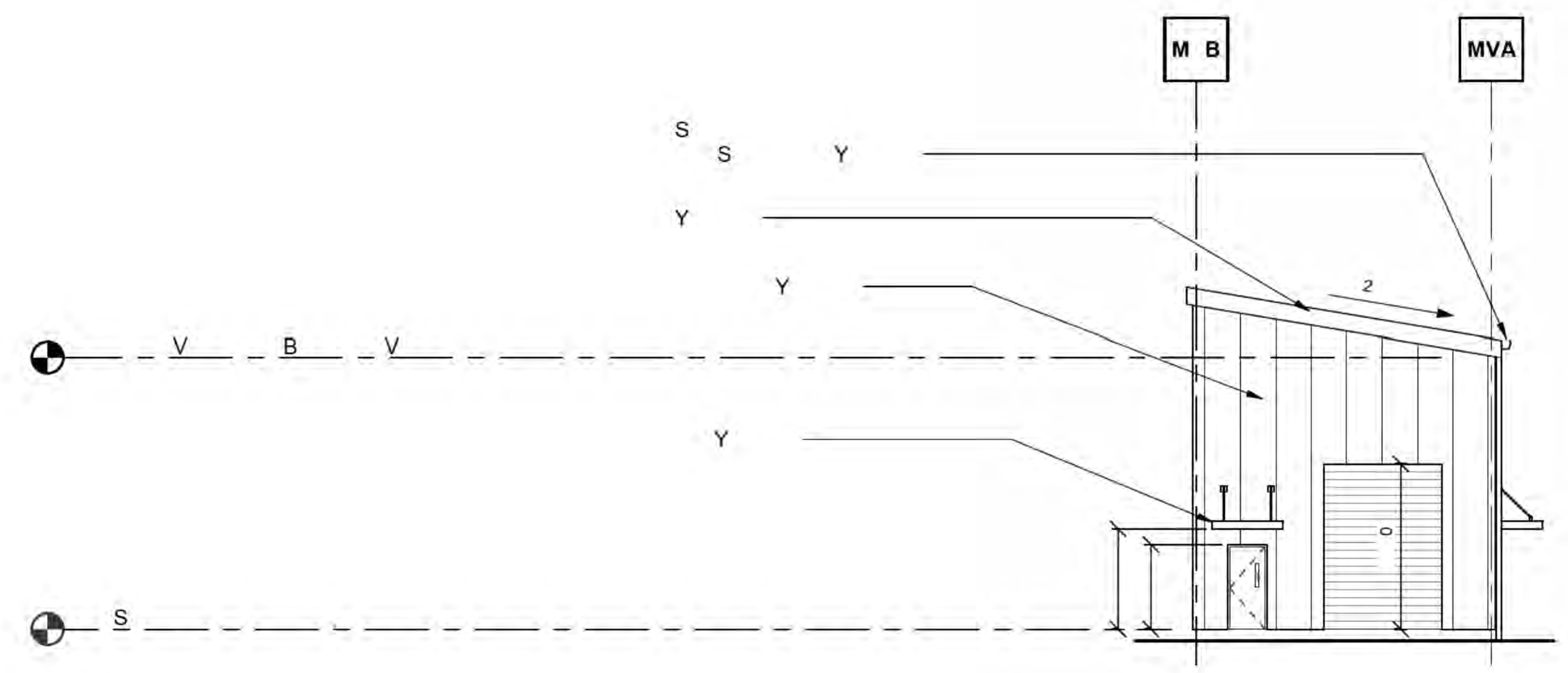

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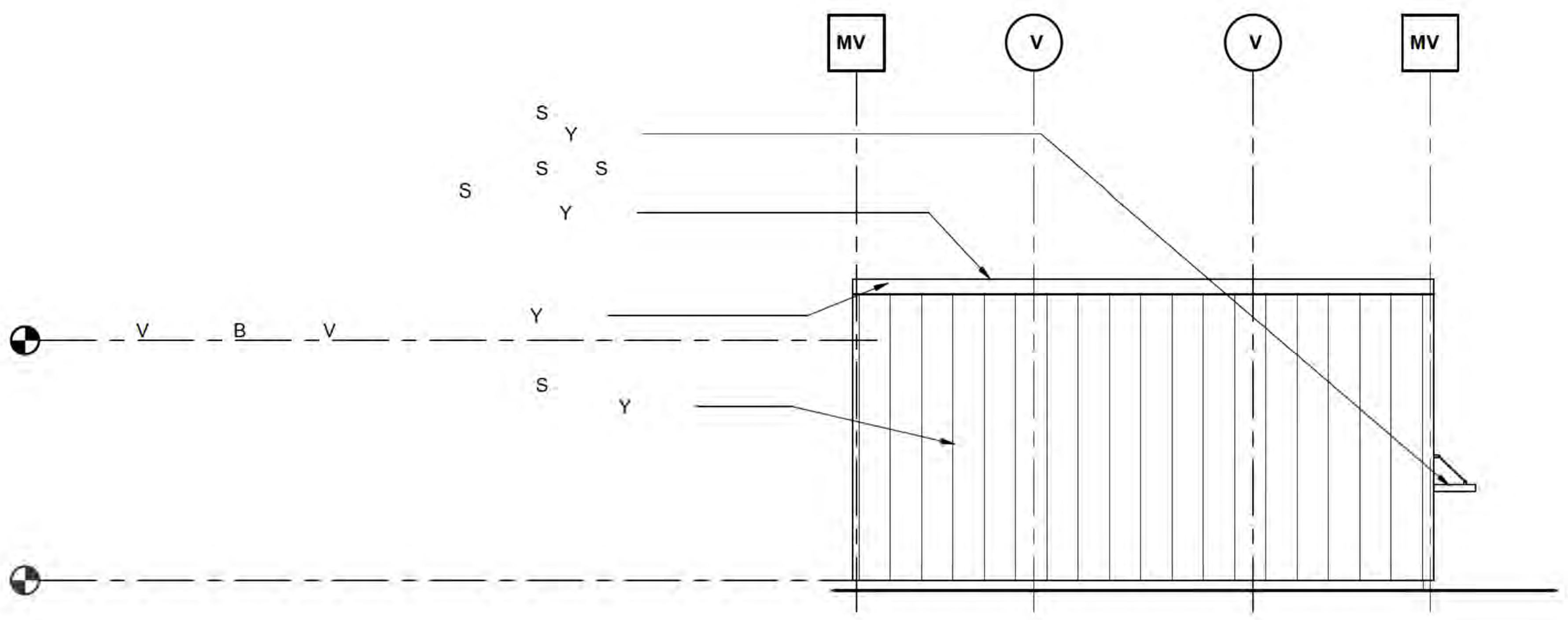

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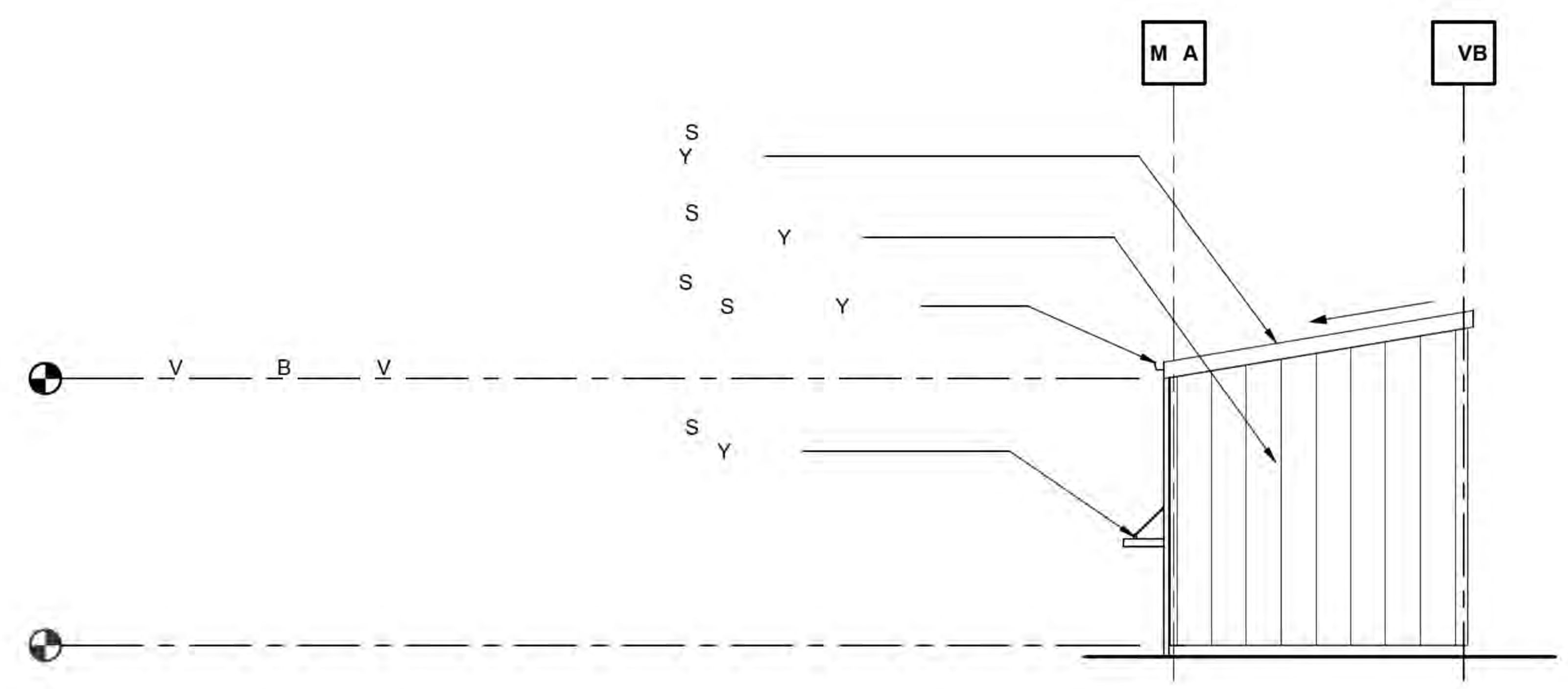


V B S V

S Y

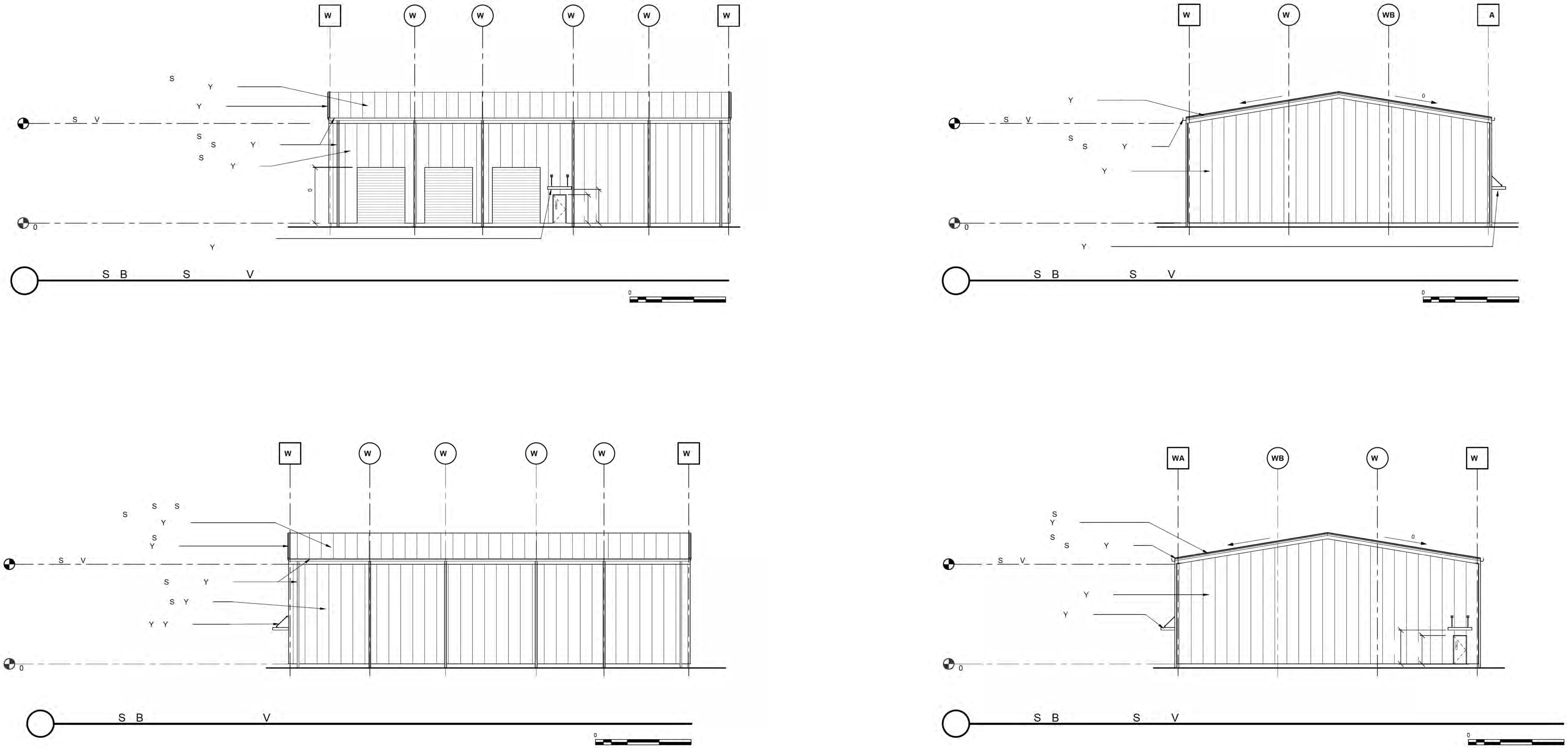
BURNS McDONNELL

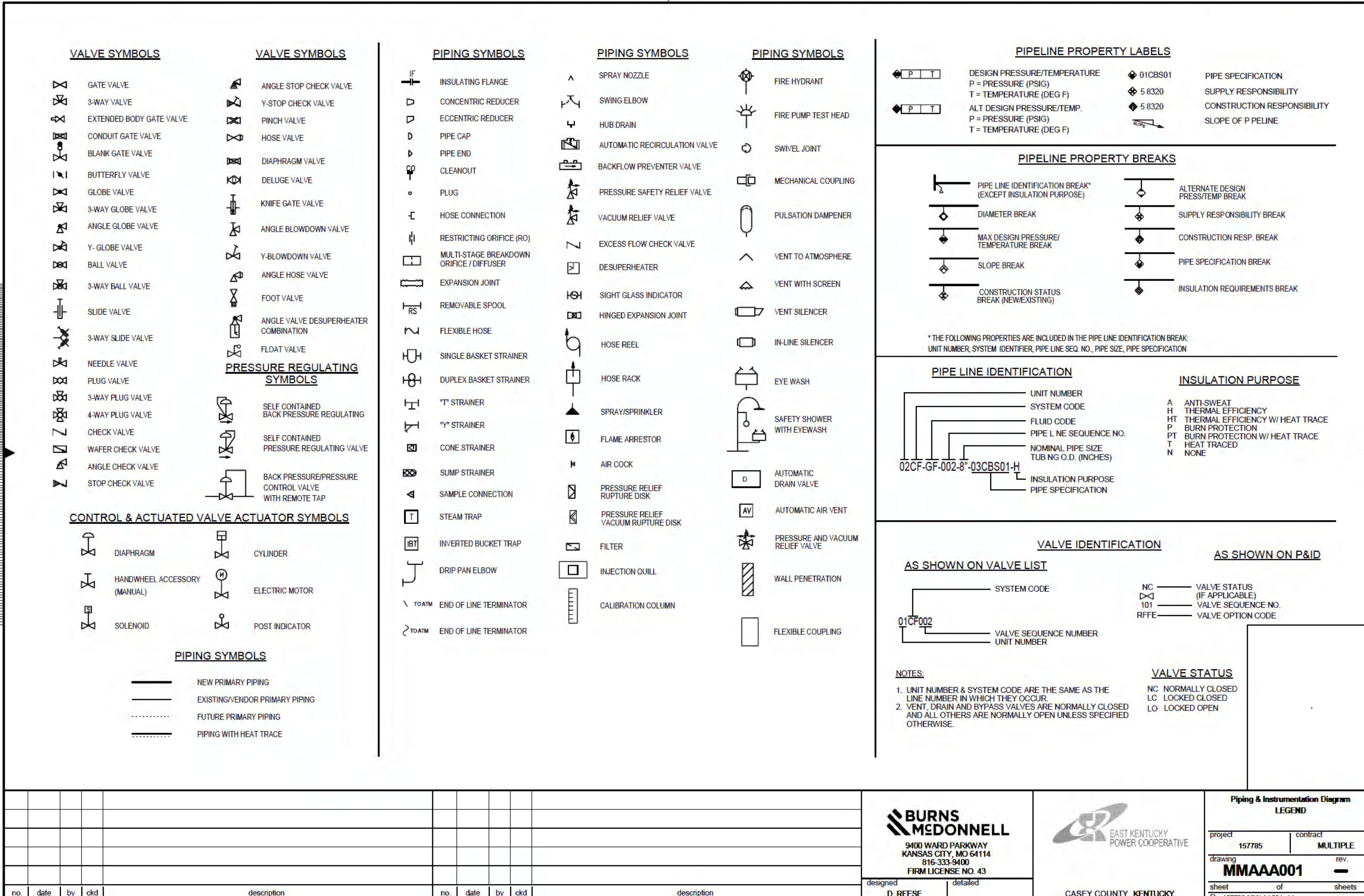
9 0 Y
S S 9 00
B 0 0
S

P R NU PR

S Y Y Y

B V S





VALVE SYMBOLS
GATE VALVE
3-WAY VALVE
EXTENDED BODY GATE VALVE
CONDUIT GATE VALVE
BLANK GATE VALVE
BUTTERFLY VALVE
GLOBE VALVE
3-WAY GLOBE VALVE
ANGLE GLOBE VALVE
Y- GLOBE VALVE
BALL VALVE
3-WAY BALL VALVE
SLIDE VALVE
3-WAY SLIDE VALVE
NEEDLE VALVE
PLUG VALVE
3-WAY PLUG VALVE
4-WAY PLUG VALVE
CHECK VALVE
WAFER CHECK VALVE
ANGLE CHECK VALVE
STOP CHECK VALVE
VALVE SYMBOLS
ANGLE STOP CHECK VALVE
Y-STOP CHECK VALVE
PINCH VALVE
HOSE VALVE
DIAPHRAGM VALVE
DELUGE VALVE
KNIFE GATE VALVE
ANGLE BLOWDOWN VALVE
Y-BLOWDOWN VALVE
ANGLE HOSE VALVE
FOOT VALVE
ANGLE VALVE DESUPERHEATER COMBINATION
FLOAT VALVE
PRESSURE REGULATING SYMBOLS
SELF CONTAINED BACK PRESSURE REGULATING
SELF CONTAINED PRESSURE REGULATING VALVE
BACK PRESSURE/PRESSURE CONTROL VALVE WITH REMOTE TAP
CONTROL & ACTUATED VALVE ACTUATOR SYMBOLS
DIAPHRAGM
CYLINDER
HANDWHEEL ACCESSORY (MANUAL)
ELECTRIC MOTOR
SOLENOID
POST INDICATOR
PIPING SYMBOLS
NEW PRIMARY PIPING
EXISTING/VENDOR PRIMARY PIPING
FUTURE PRIMARY PIPING
PIPING WITH HEAT TRACE
PIPING SYMBOLS
IF
INSULATING FLANGE
CONCENTRIC REDUCER
ECCENTRIC REDUCER
PIPE CAP
PIPE END
CLEANOUT
PLUG
HOSE CONNECTION
RESTRICTING ORIFICE (RO)
MULTI-STAGE BREAKDOWN ORIFICE / DIFFUSER
EXPANSION JOINT
RS
REMOVABLE SPOOL
FLEXIBLE HOSE
SINGLE BASKET STRAINER
DUPLEX BASKET STRAINER
"T" STRAINER
"Y" STRAINER
CONE STRAINER
SUMP STRAINER
SAMPLE CONNECTION
T
STEAM TRAP
IBT
INVERTED BUCKET TRAP
DRIP PAN ELBOW
TO ATM
END OF LINE TERMINATOR
TO ATM
END OF LINE TERMINATOR
PIPING SYMBOLS
SPRAY NOZZLE
SWING ELBOW
HUB DRAIN
AUTOMATIC RECIRCULATION VALVE
BACKFLOW PREVENTER VALVE
PRESSURE SAFETY RELIEF VALVE
VACUUM RELIEF VALVE
EXCESS FLOW CHECK VALVE
DESUPERHEATER
SIGHT GLASS INDICATOR
HINGED EXPANSION JOINT
HOSE REEL
HOSE RACK
SPRAY/SPRINKLER
FLAME ARRESTOR
AIR COCK
PRESSURE RELIEF RUPTURE DISK
PRESSURE RELIEF VACUUM RUPTURE DISK
FILTER
INJECTION QUILL
CALIBRATION COLUMN
PIPING SYMBOLS
FIRE HYDRANT
FIRE PUMP TEST HEAD
SWIVEL JOINT
MECHANICAL COUPLING
PULSATION DAMPENER
VENT TO ATMOSPHERE
VENT WITH SCREEN
VENT SILENCER
IN-LINE SILENCER
EYE WASH
SAFETY SHOWER WITH EYEWASH
D
AUTOMATIC DRAIN VALVE
AV
AUTOMATIC AIR VENT
PRESSURE AND VACUUM RELIEF VALVE
WALL PENETRATION
FLEXIBLE COUPLING
PIPELINE PROPERTY LABELS
P T
DESIGN PRESSURE/TEMPERATURE
P = PRESSURE (PSIG)
T = TEMPERATURE (DEG F)
P T
ALT DESIGN PRESSURE/TEMP.
P = PRESSURE (PSIG)
T = TEMPERATURE (DEG F)
01CBS01
PIPE SPECIFICATION
5 8320
SUPPLY RESPONSIBILITY
5 8320
CONSTRUCTION RESPONSIBILITY
SLOPE
SLOPE OF P PELINE
PIPELINE PROPERTY BREAKS
PIPE LINE IDENTIFICATION BREAK* (EXCEPT INSULATION PURPOSE)
DIAMETER BREAK
MAX DESIGN PRESSURE/ TEMPERATURE BREAK
SLOPE BREAK
CONSTRUCTION STATUS BREAK (NEW/EXISTING)
ALTERNATE DESIGN PRESS/TEMP BREAK
SUPPLY RESPONSIBILITY BREAK
CONSTRUCTION RESP. BREAK
PIPE SPECIFICATION BREAK
INSULATION REQUIREMENTS BREAK
* THE FOLLOWING PROPERTIES ARE INCLUDED IN THE PIPE LINE IDENTIFICATION BREAK:
UNIT NUMBER, SYSTEM IDENTIFIER, PIPE LINE SEQ. NO., PIPE SIZE, PIPE SPECIFICATION
PIPE LINE IDENTIFICATION
UNIT NUMBER
SYSTEM CODE
FLUID CODE
PIPE L NE SEQUENCE NO.
NOMINAL PIPE SIZE TUB NG O.D. (INCHES)
02CF-GF-002-8"-03CBS01-H
INSULATION PURPOSE
PIPE SPECIFICATION
INSULATION PURPOSE
A ANTI-SWEAT
H THERMAL EFFICIENCY
HT THERMAL EFFICIENCY W/ HEAT TRACE
P BURN PROTECTION
PT BURN PROTECTION W/ HEAT TRACE
T HEAT TRACED
N NONE
VALVE IDENTIFICATION
AS SHOWN ON VALVE LIST
SYSTEM CODE
01CF002
VALVE SEQUENCE NUMBER
UNIT NUMBER
AS SHOWN ON P&ID
NC
VALVE STATUS (IF APPLICABLE)
101
VALVE SEQUENCE NO.
RFFE
VALVE OPTION CODE
NOTES:
1. UNIT NUMBER & SYSTEM CODE ARE THE SAME AS THE LINE NUMBER IN WHICH THEY OCCUR.
2. VENT, DRAIN AND BYPASS VALVES ARE NORMALLY CLOSED AND ALL OTHERS ARE NORMALLY OPEN UNLESS SPECIFIED OTHERWISE.
VALVE STATUS
NC NORMALLY CLOSED
LC LOCKED CLOSED
LO LOCKED OPEN
no. date by ckd description
no. date by ckd description
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detailed
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CASEY COUNTY, KENTUCKY
Piping & Instrumentation Diagram
LEGEND
project 157785
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drawing MMAAA001
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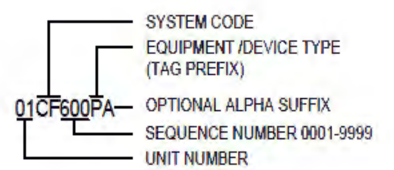
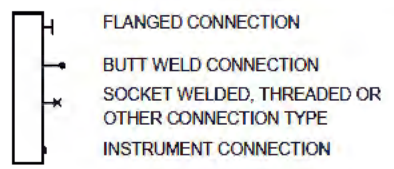
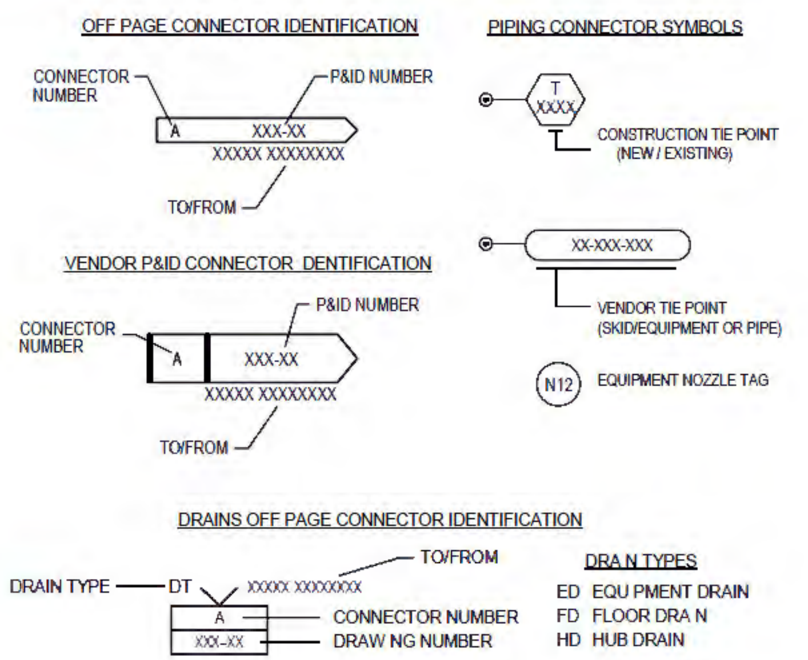
EQUIPMENT AND PIPING SPECIALS IDENTIFICATION



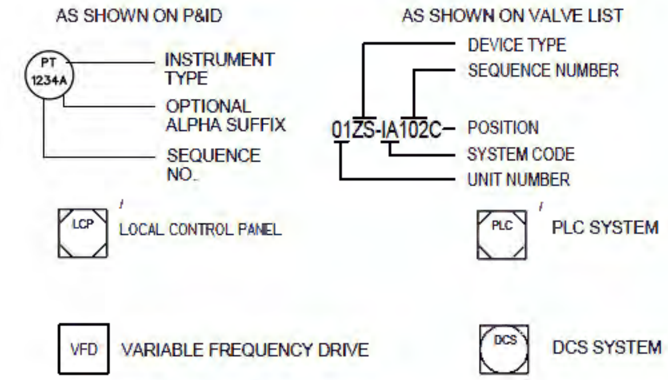
EQUIPMENT TO PIPING CONNECTORS



CONNECTOR SYMBOLS



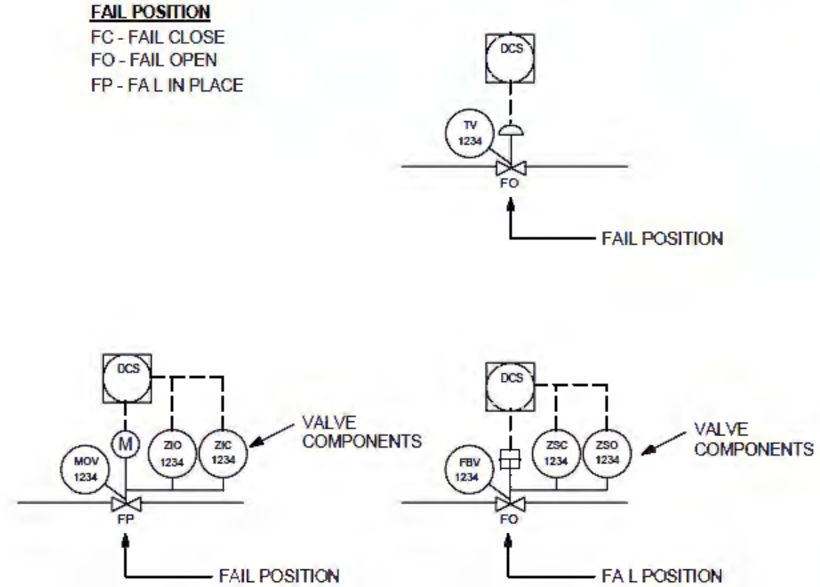
INSTRUMENT IDENTIFICATION



NOTE: UNIT NUMBER & SYSTEM CODE ARE THE SAME AS THE L NE NUMBER IN WHICH THEY OCCUR BUT ARE NOT SHOWN ON THE P& D BUT IN THE NSTRUMENT LIST.

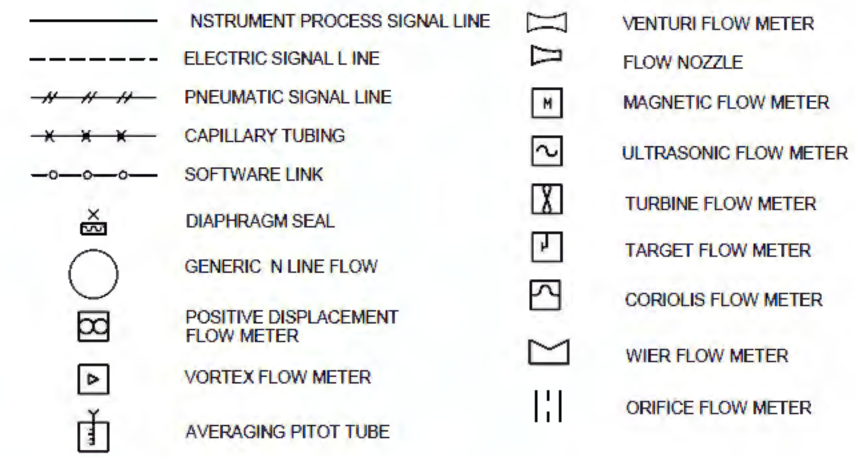
POWER OPERATED VALVE COMPONENT TAGGING EXAMPLE

FAIL POSITION
FC - FAIL CLOSE
FO - FAIL OPEN
FP - FA L IN PLACE



NOTE: UNIT NUMBER & SYSTEM CODE ARE THE SAME AS THE L NE NUMBER IN WHICH THEY OCCUR BUT ARE NOT SHOWN ON THE P&ID BUT IN THE NSTRUMENT LIST.

INSTRUMENT SYMBOLS



INSTRUMENT FUNCTION DESIGNATION

AE	ANALYSIS SENSING ELEMENT	PRV	PRESSURE OPERATED RELIEF VALVE / PRESSURE REDUC NG VALVE
AI	ANALYSIS INDICATOR	PS	PRESSURE SWITCH
AIT	ANALYSIS INDICATING TRANSMITTER	PSH	PRESSURE SWITCH HIGH
AT	ANALYZER TRANSMITTER	PSHH	PRESSURE SWITCH HIGH HIGH
AV	ANALYSIS CONTROL VALVE	PSL	PRESSURE SWITCH LOW
AY	ANALYZER TRANSDUCER	PSLL	PRESSURE SWITCH LOW LOW
CD	CONTROL DRIVE	PT	PRESSURE TRANSMITTER
DT	DENSITY TRANSMITTER	PV	PRESSURE CONTROL VALVE
FBV	FLOW BLOCK VALVE	PY	PRESSURE TRANSDUCER
FC	FLOW CONTROLLER	SRV	SAFETY OR RELIEF VALVE
FE	FLOW ELEMENT	ST	SPEED TRANSMITTER
FI	FLOW INDICATOR	SV	SOLENO D VALVE
FIT	FLOW INDICATING TRANSMITTER	SY	SPEED TRANSDUCER
FS	FLOW SWITCH	TBV	TEMPERATURE BLOCK VALVE
FSH	FLOW SWITCH HIGH	TC	TEMPERATURE CONTROLLER
FSL	FLOW SWITCH LOW	TE	TEMPERATURE ELEMENT
FT	FLOW TRANSMITTER	TI	TEMPERATURE NDICATOR
FQI	FLOW TOTALIZ NG INDICATOR	TIS	TEMPERATURE NDICATING SWITCH
FV	FLOW CONTROL VALVE	TIT	TEMPERATURE NDICATING TRANSMITTER
FY	FLOW TRANSDUCER	TPV	TR P VALVE
LBV	LEVEL BLOCK VALVE	TS	TEMPERATURE SWITCH
LC	LEVEL CONTROLLER	TSH	TEMPERATURE SWITCH HIGH
LCS	LEVEL CONTROL STATION	TSHH	TEMPERATURE SWITCH HIGH HIGH
LE	LEVEL ELEMENT	TSL	TEMPERATURE SWITCH LOW
LG	LEVEL GAUGE 2	TSLL	TEMPERATURE SWITCH LOW LOW
LI	LEVEL INDICATOR	TT	TEMPERATURE TRANSMITTER
LIT	LEVEL INDICATING TRANSMITTER	TV	TEMPERATURE CONTROL VALVE
LS	LEVEL SWITCH	TW	THERMOWELL
LSH	LEVEL SWITCH HIGH	TY	TEMPERATURE TRANSDUCER
LSHH	LEVEL SWITCH HIGH HIGH	TZ	TEMPERATURE SHUTDOWN
LSL	LEVEL SWITCH LOW	VE	VIBRATION ELEMENT
LSLL	LEVEL SWITCH LOW LOW	VS	VIBRATION SWITCH
LSM	LEVEL SWITCH MEDIUM	VT	VIBRATION TRANSMITTER
LT	LEVEL TRANSMITTER	2 XS	LEAK DETECTOR
LV	LEVEL CONTROL VALVE	ZI	POSITION INDICATOR
LY	LEVEL TRANSDUCER	ZIC	POSITION INTERMEDIATE OR CLOSED
MOV	MOTOR OPERATED VALVE	ZIO	POSITION INTERMEDIATE OR OPENED
NOXS	NOX SENSOR	ZIT	POSITION INDICATING TRANSMITTER
PBV	PRESSURE BLOCK VALVE	2 ZP	PILOT REGULATOR
PC	PRESSURE CONTROLLER	ZS	POSITION SWITCH
PDI	PRESSURE DIFFERENTIAL INDICATOR	ZSC	POSITION SWITCH CLOSED
PDIS	PRESSURE DIFFERENTIAL INDICATING SWITCH	ZSH	POSITION SWITCH HIGH
PDS	PRESSURE DIFFERENTIAL SWITCH	ZSL	POSITION SWITCH LOW
PDT	PRESSURE DIFFERENTIAL TRANSMITTER	ZSO	POSITION SWITCH OPENED
PI	PRESSURE INDICATOR	ZST	POSITION SWITCH TRANSMITTER
PIS	PRESSURE INDICATING SWITCH	ZT	POSITION TRANSMITTER
PIT	PRESSURE INDICATING TRANSMITTER	ZY	POSITION TRANSDUCER
PDIT	PRESSURE DIFFERENTIAL INDICATING TRANSMITTER		

no.	date	by	ckd	description	no.	date	by	ckd	description

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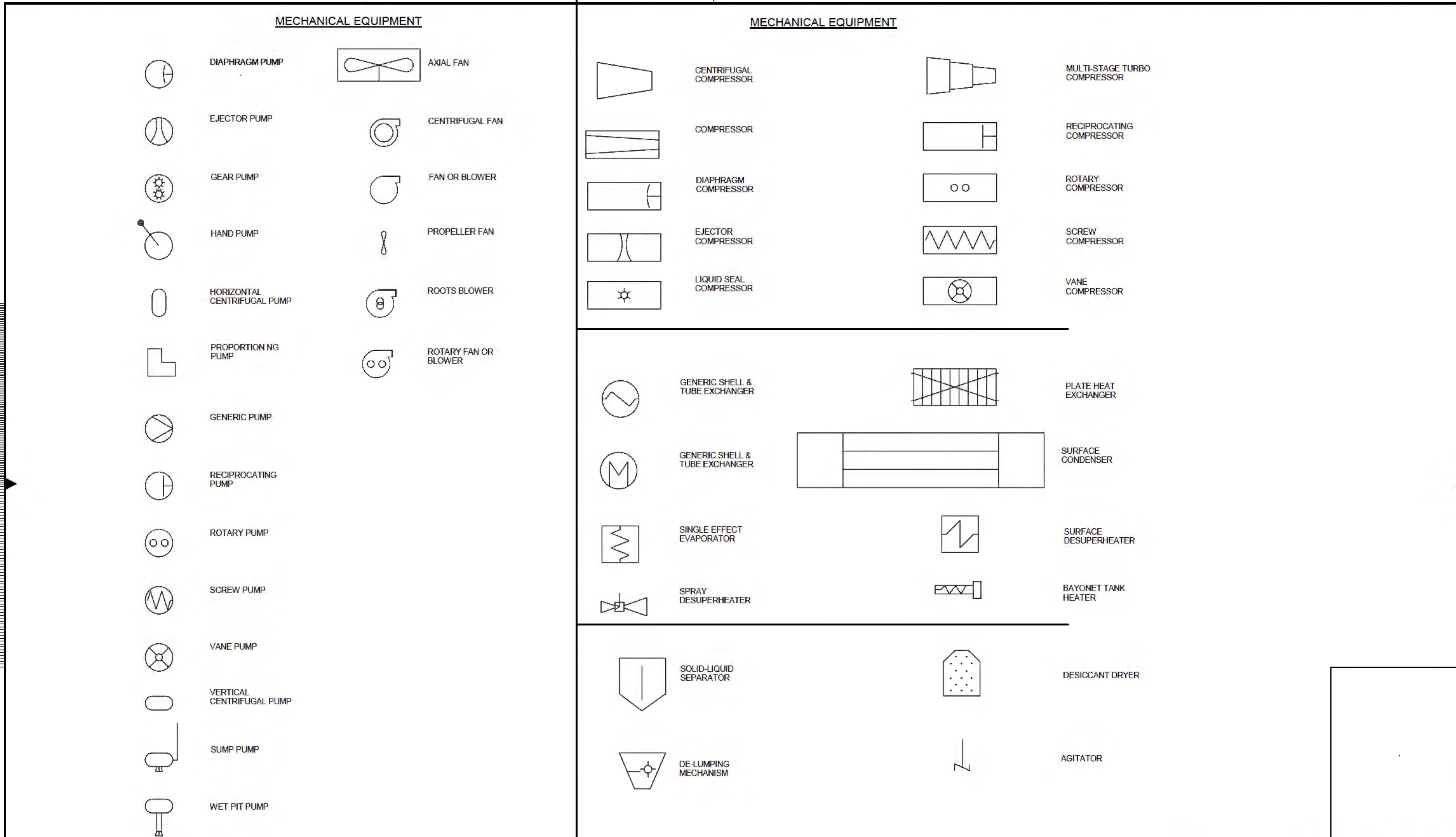
CASEY COUNTY, KENTUCKY

Piping & Instrumentation Diagram
LEGEND

project 157785
contract MULTIPLE
drawing MMAAA002
rev. —
sheet of sheets
file 157785-MMAAA002 pid



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Piping & Instrumentation Diagram
LEGEND

project: 157785
contract: MULTIPLE
drawing: MMAAA003
rev.: —
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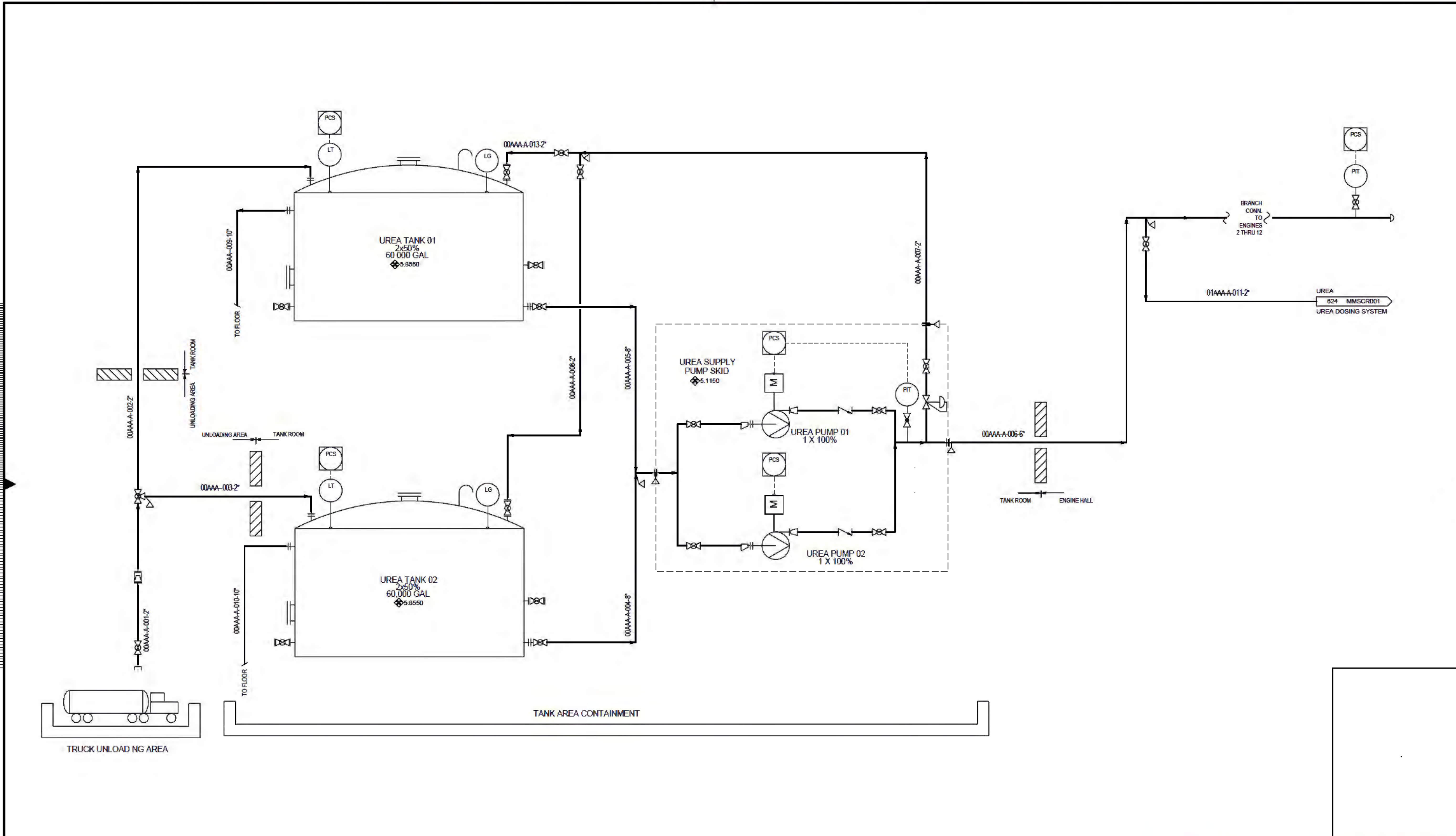

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Piping & Instrumentation Diagram
UREA SYSTEM

project 157785 | contract C8320

drawing **MMAAU001** | rev. — **A**

sheet | of | sheets

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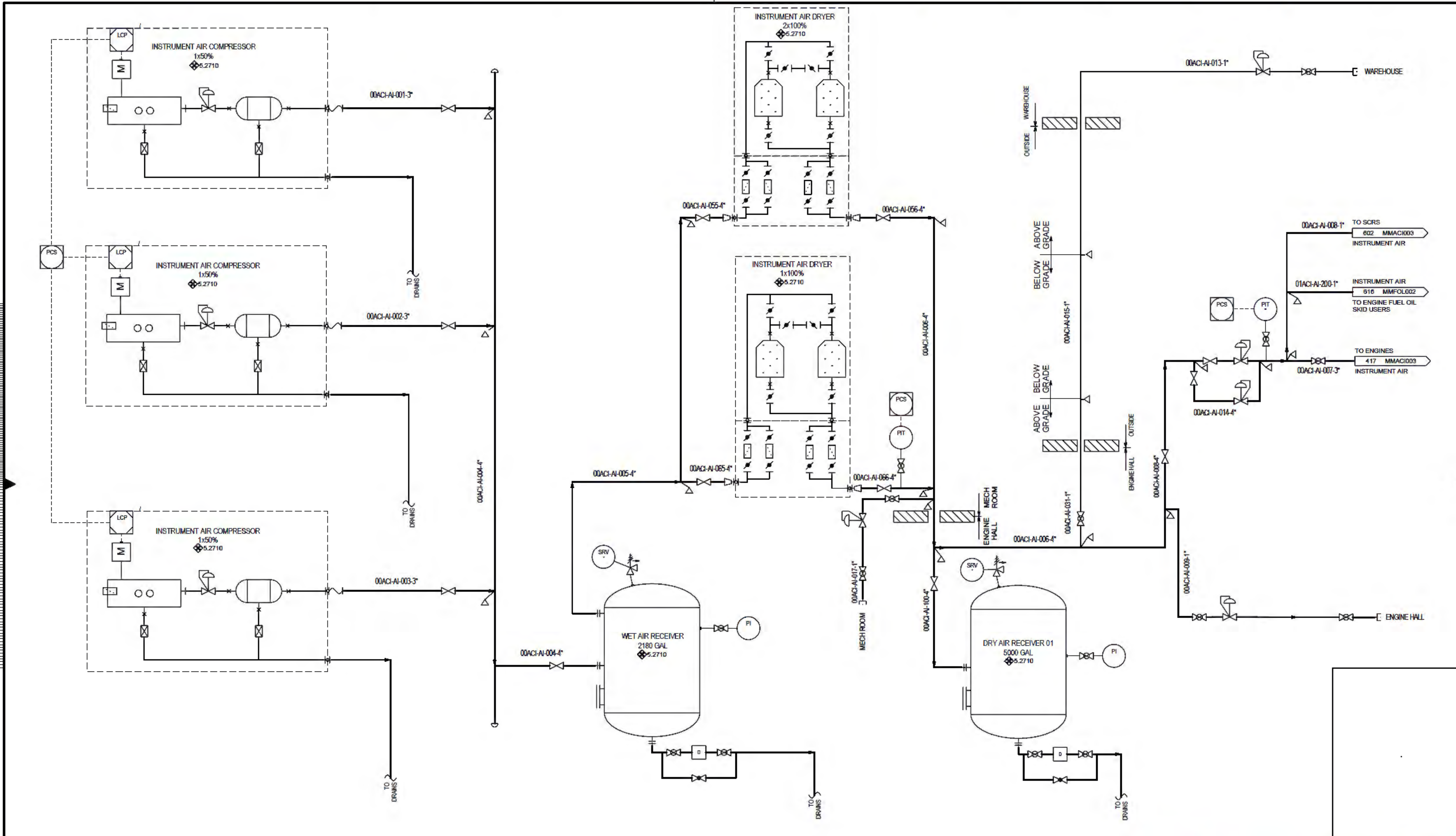

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Piping & Instrumentation Diagram
INSTRUMENT AIR SYSTEM

project 157785
contract MULTIPLE
drawing MMACI001
rev. — A
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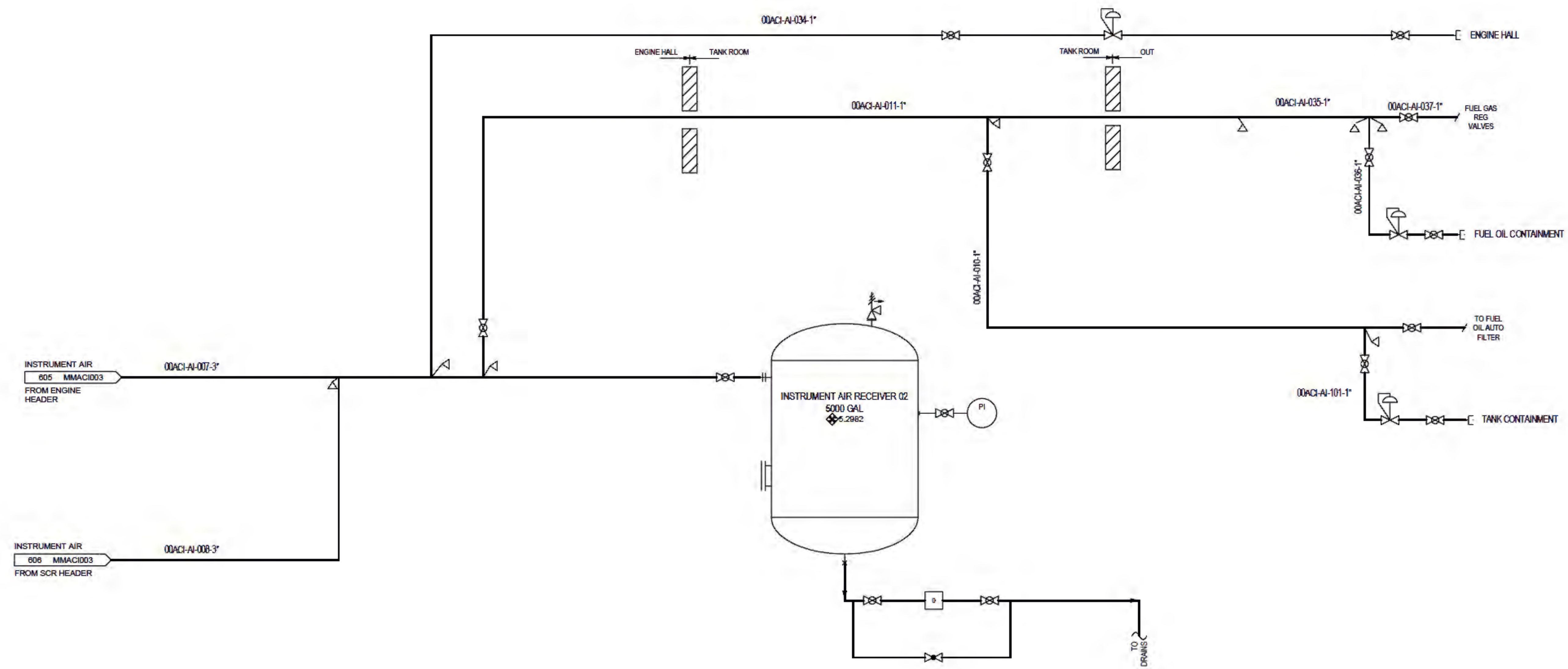
file 157785-MMAC 001 pid



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detailed:

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Piping & Instrumentation Diagram
INSTRUMENT AIR SYSTEM

project: 157785
contract:
drawing: **MMACI002**
rev.: **A**
sheet of sheets
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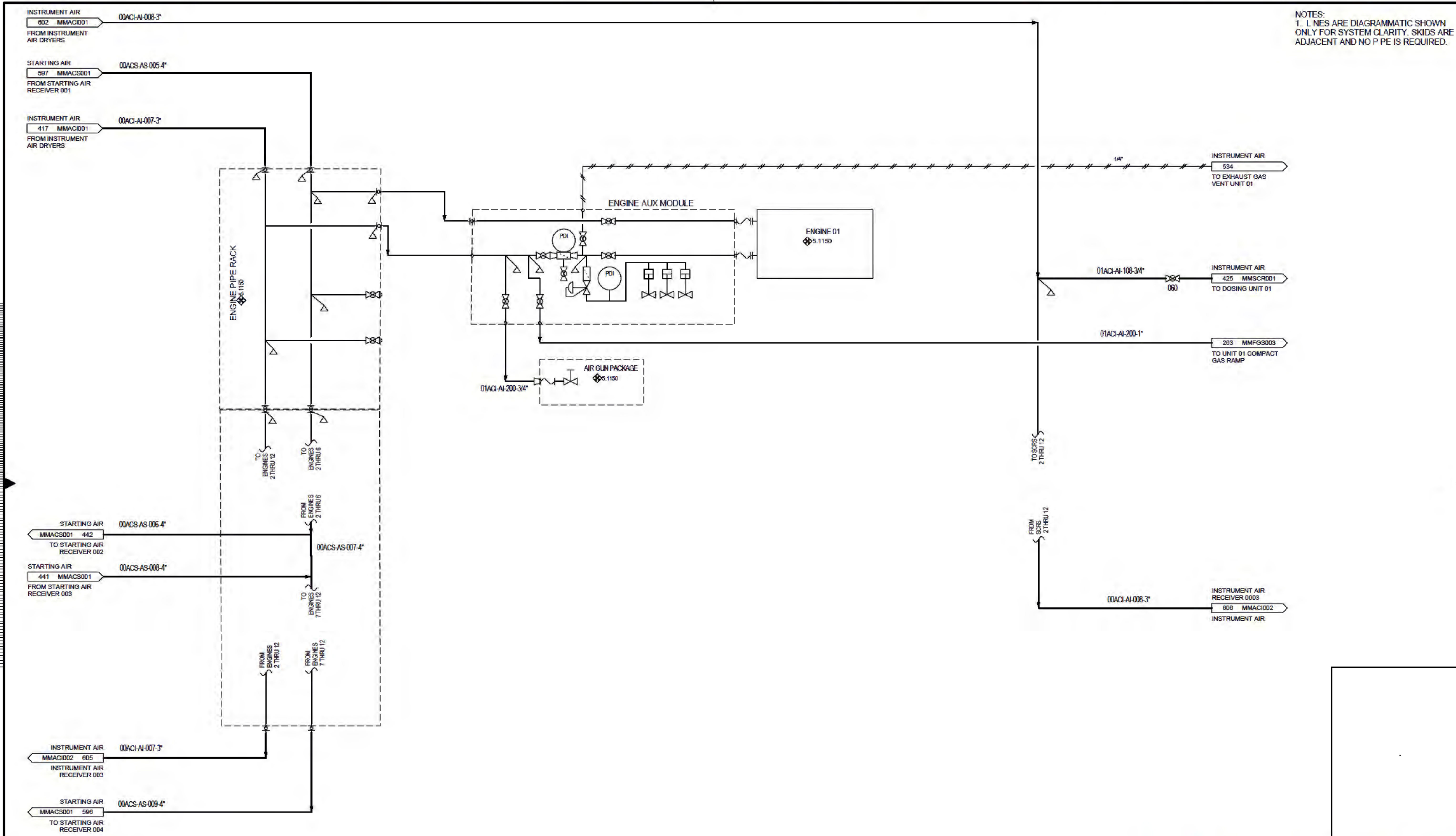

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detailed:

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Piping & Instrumentation Diagram
INSTRUMENT AIR SYSTEM

project: 157785
contract:
drawing: MMACI003
rev. A
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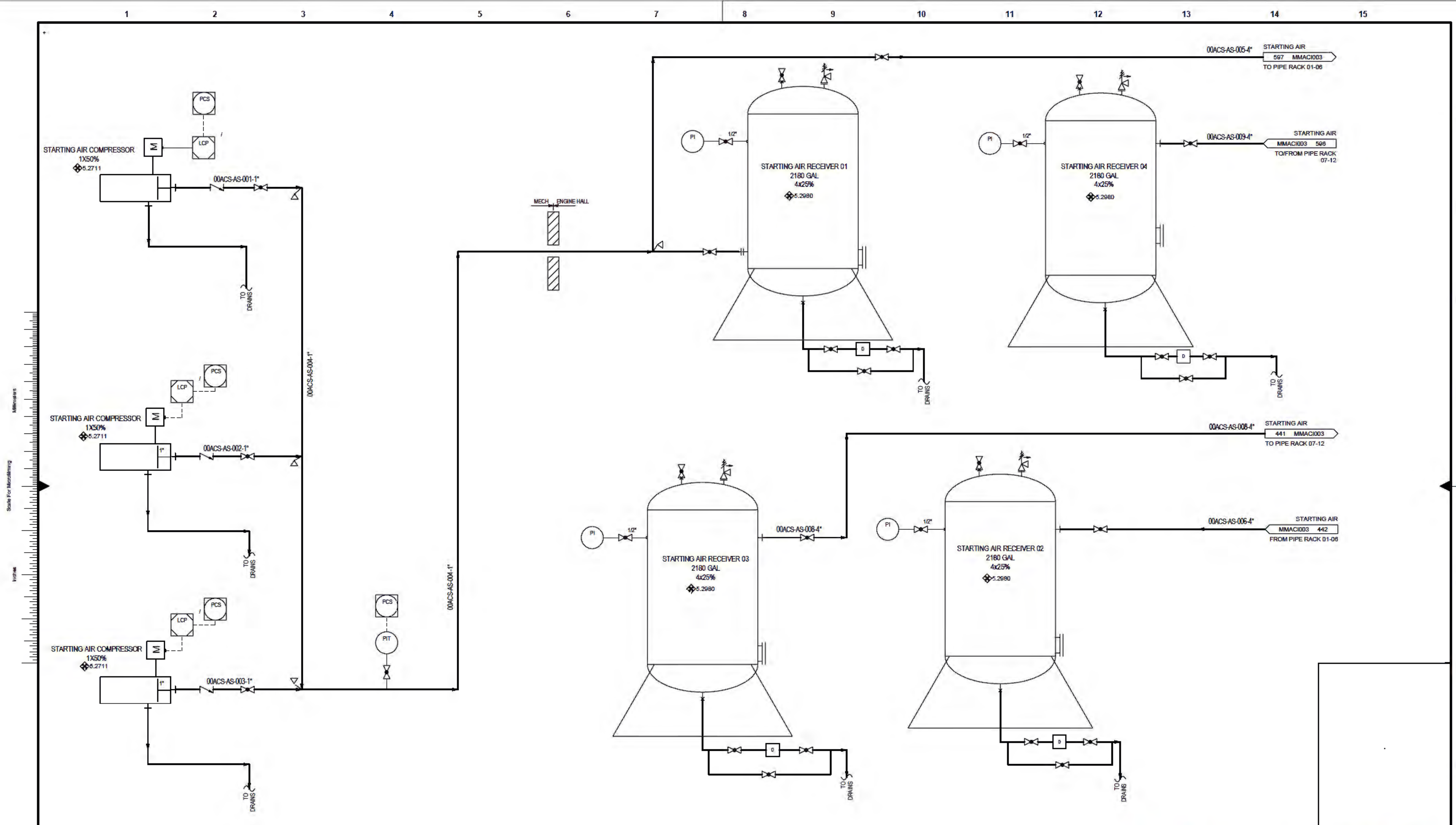
file 157785-MMAC 003 pid



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detailed:

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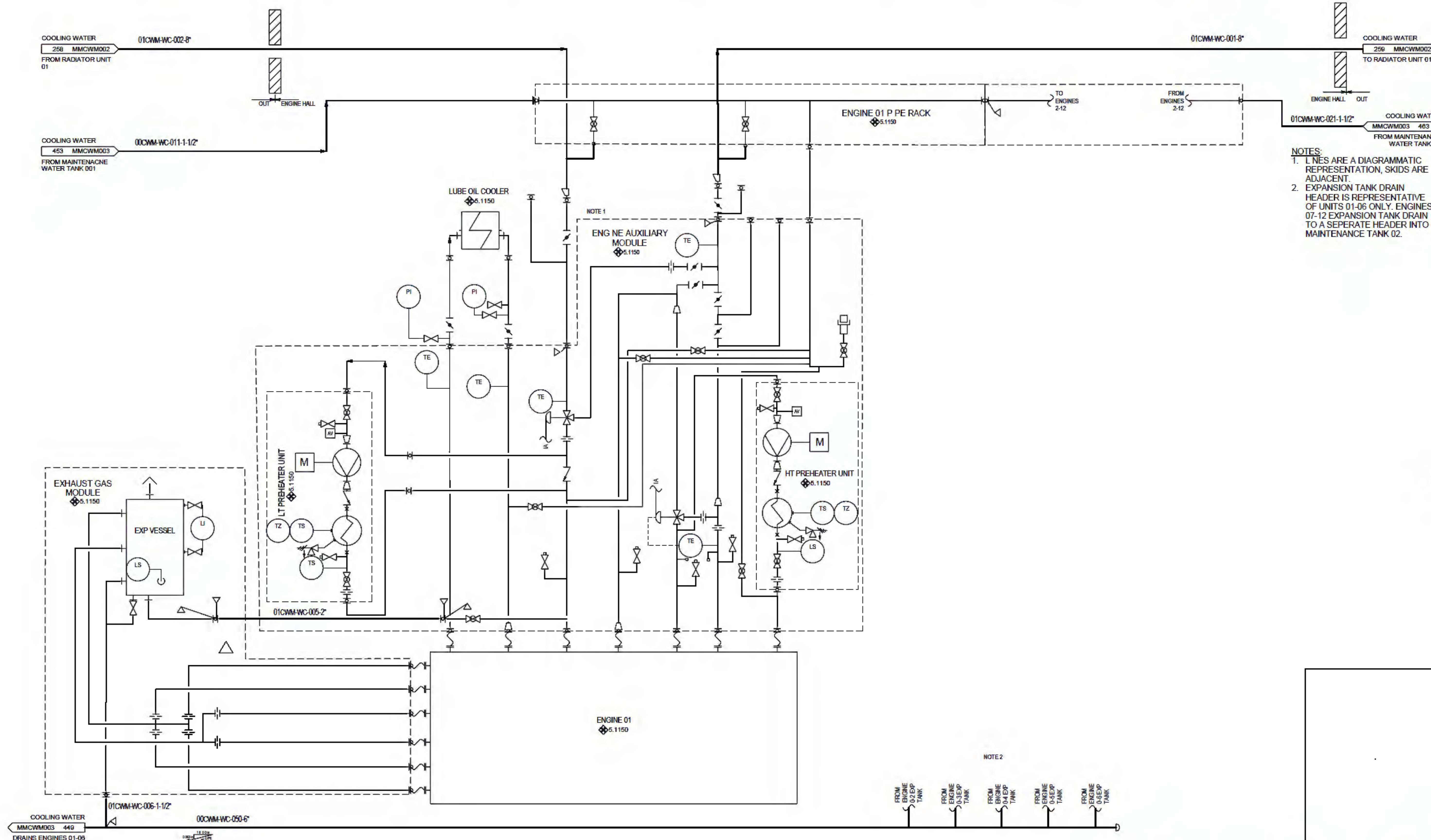
Piping & Instrumentation Diagram
STARTING AIR SYSTEM

project: 157785
contract:
drawing: MMACS001
rev.: A
sheet — of — sheets
file 157785-MMACS001.pid



NOTES:
1. LINES ARE A DIAGRAMMATIC REPRESENTATION, SKIDS ARE ADJACENT.
2. EXPANSION TANK DRAIN HEADER IS REPRESENTATIVE OF UNITS 01-06 ONLY. ENGINES 07-12 EXPANSION TANK DRAIN TO A SEPERATE HEADER INTO MAINTENANCE TANK 02.

no.	date	by	ckd	description	no.	date	by	ckd	description
A	01/02/24	JLB	DSR	PRELIMINARY - IFOR					

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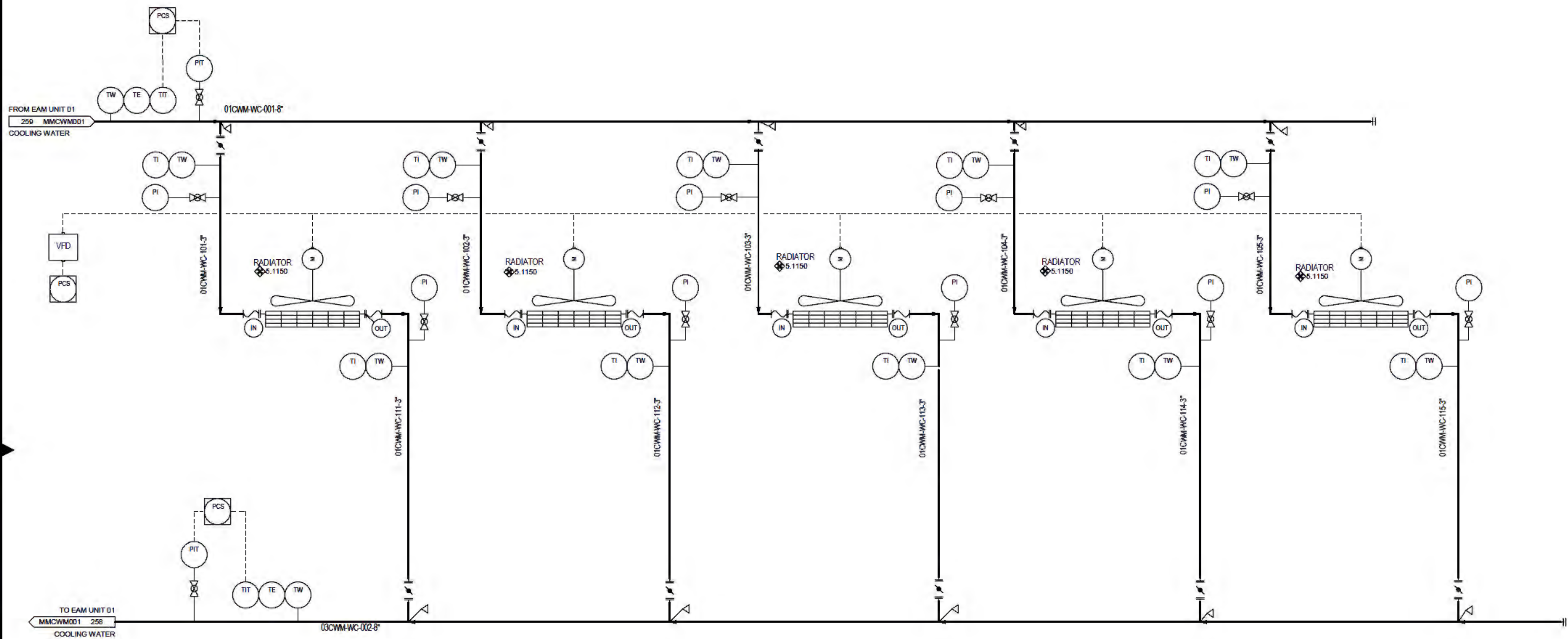
Piping & Instrumentation Diagram
COOLING WATER SYSTEM

project: 157785
contract:
drawing: MMCWM001
rev.: A
sheet of sheets
file 157785-MMCWM001.pid

NOTES:
1. THERE ARE 5 FANS PER RADIATOR.



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detailed:

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Piping & Instrumentation Diagram
COOLING WATER SYSTEM

project: 157785
contract:
drawing: **MMCWM002**
rev.: — A
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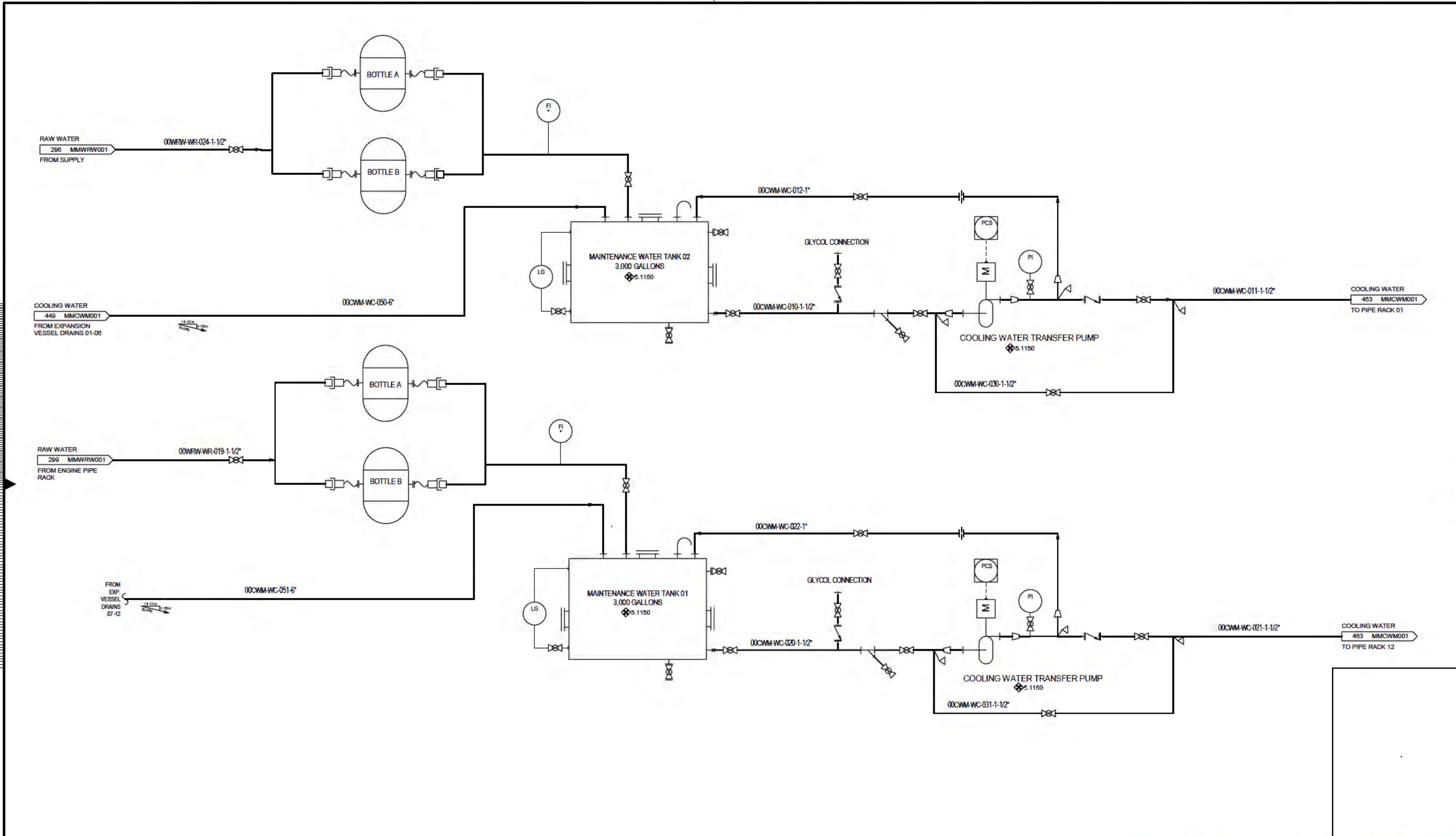

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designed: D. REESE
detailed:

EAST KENTUCKY POWER COOPERATIVE
CASEY COUNTY, KENTUCKY

Piping & Instrumentation Diagram
COOLING WATER SYSTEM

project: 157785
contract:
drawing: **MMCWM003**
rev. **— A**
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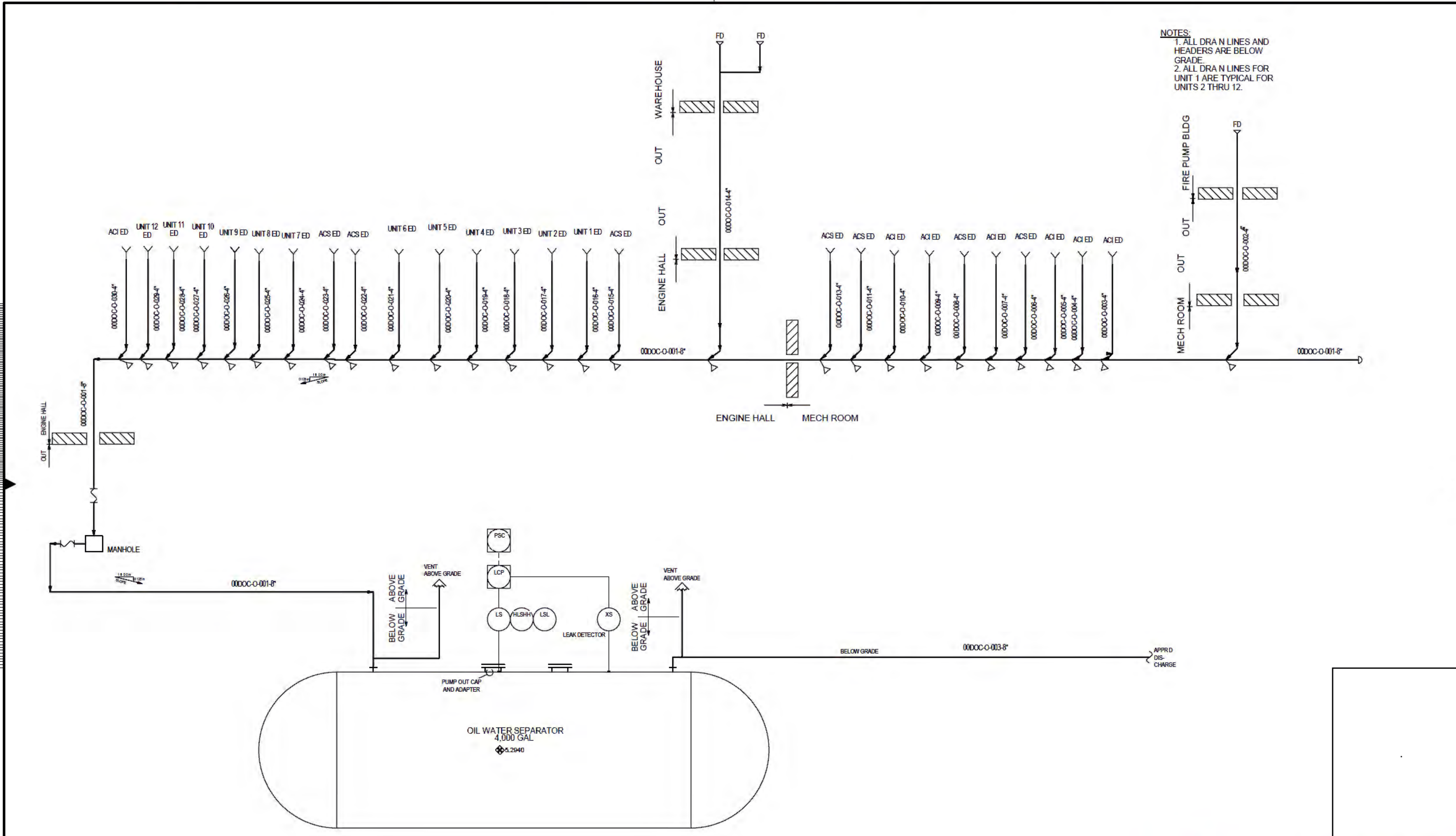

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BURNS McDONNELL
9400 WARD PARKWAY
KANSAS CITY, MO 64114
816-333-9400
FIRM LICENSE NO. 43

designed: J. BAUGHMAN
detailed:

EAST KENTUCKY POWER COOPERATIVE
CASEY COUNTY, KENTUCKY

Piping & Instrumentation Diagram
OILY DRAINS SYSTEM

project: 157785
contract: 5.8220
drawing: MMDOC001
rev.: A
sheet / of / sheets
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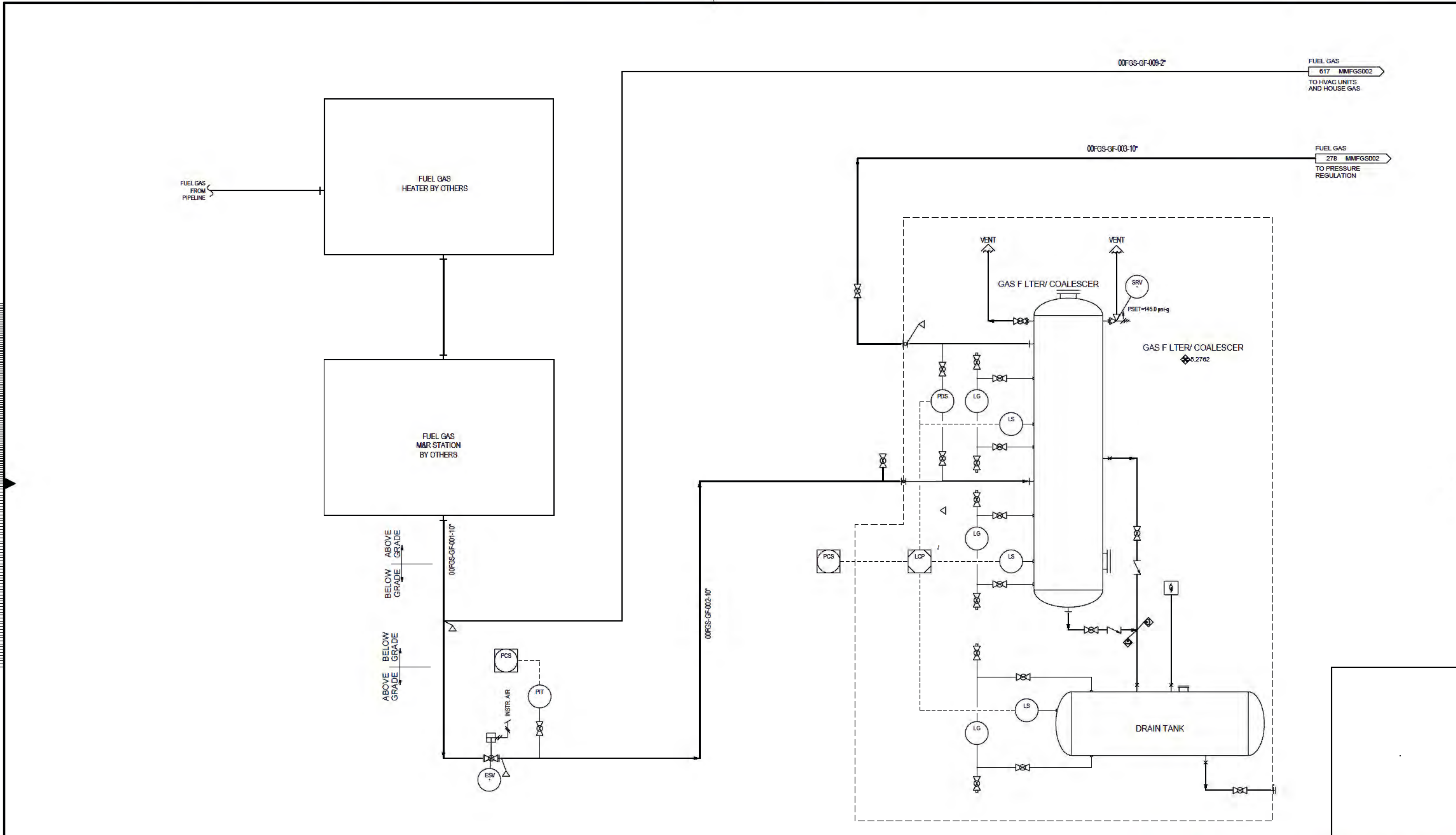

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KANSAS CITY, MO 64114
816-333-9400
FIRM LICENSE NO. 43

designed: J. BAUGHMAN | detailed:

EAST KENTUCKY POWER COOPERATIVE

CASEY COUNTY, KENTUCKY

Piping & Instrumentation Diagram
FUEL GAS SYSTEM

project	contract
157785	C8320

drawing: **MMFGS001** rev. **— A**

sheet of sheets

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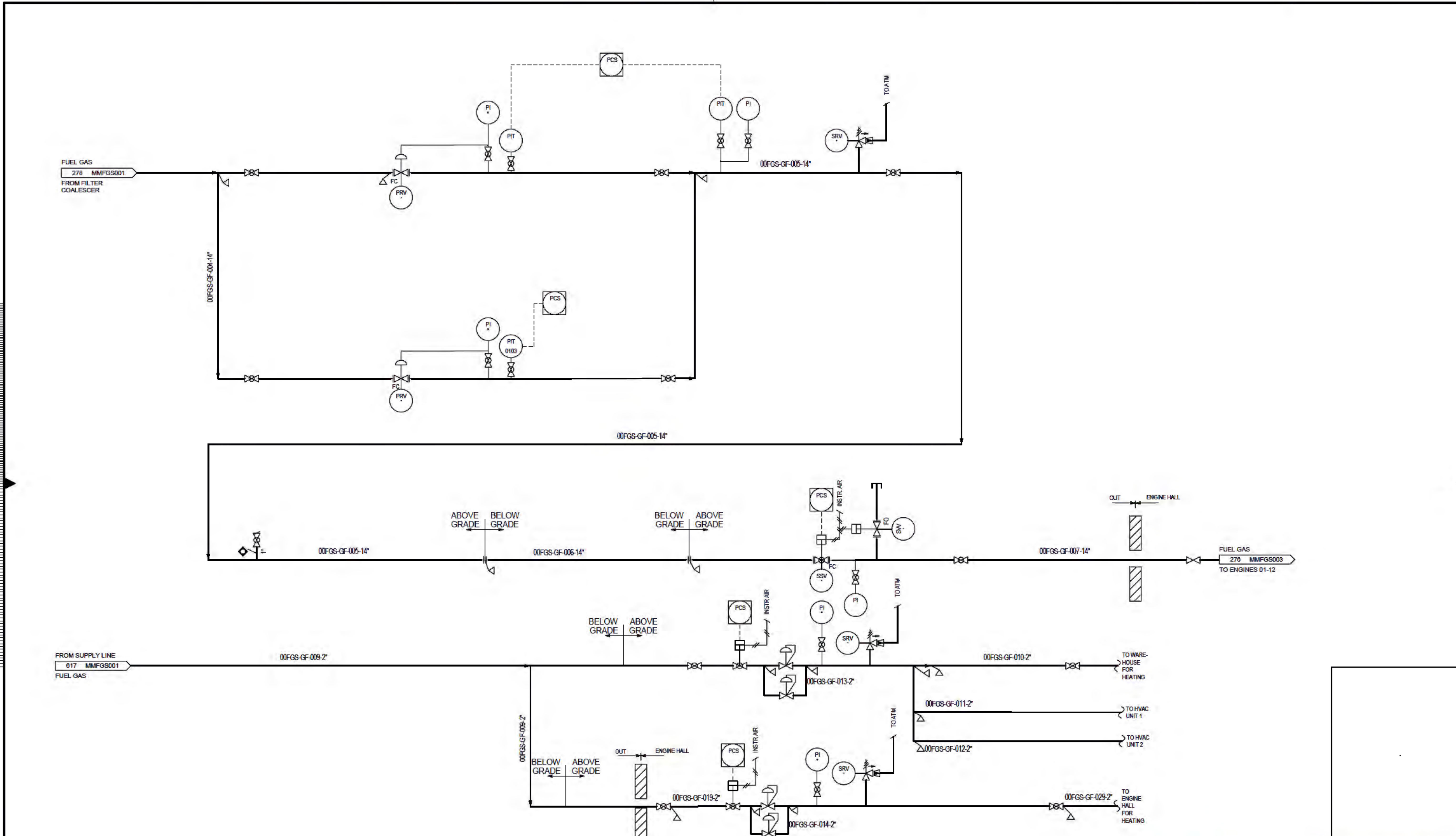

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9400 WARD PARKWAY
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816-333-9400
FIRM LICENSE NO. 43

designed: J. BAUGHMAN
detailed

EAST KENTUCKY POWER COOPERATIVE
CASEY COUNTY, KENTUCKY

Piping & Instrumentation Diagram
FUEL GAS SYSTEM

project: 157785
contract: MULTIPLE
drawing: MMFGS002
rev.: A
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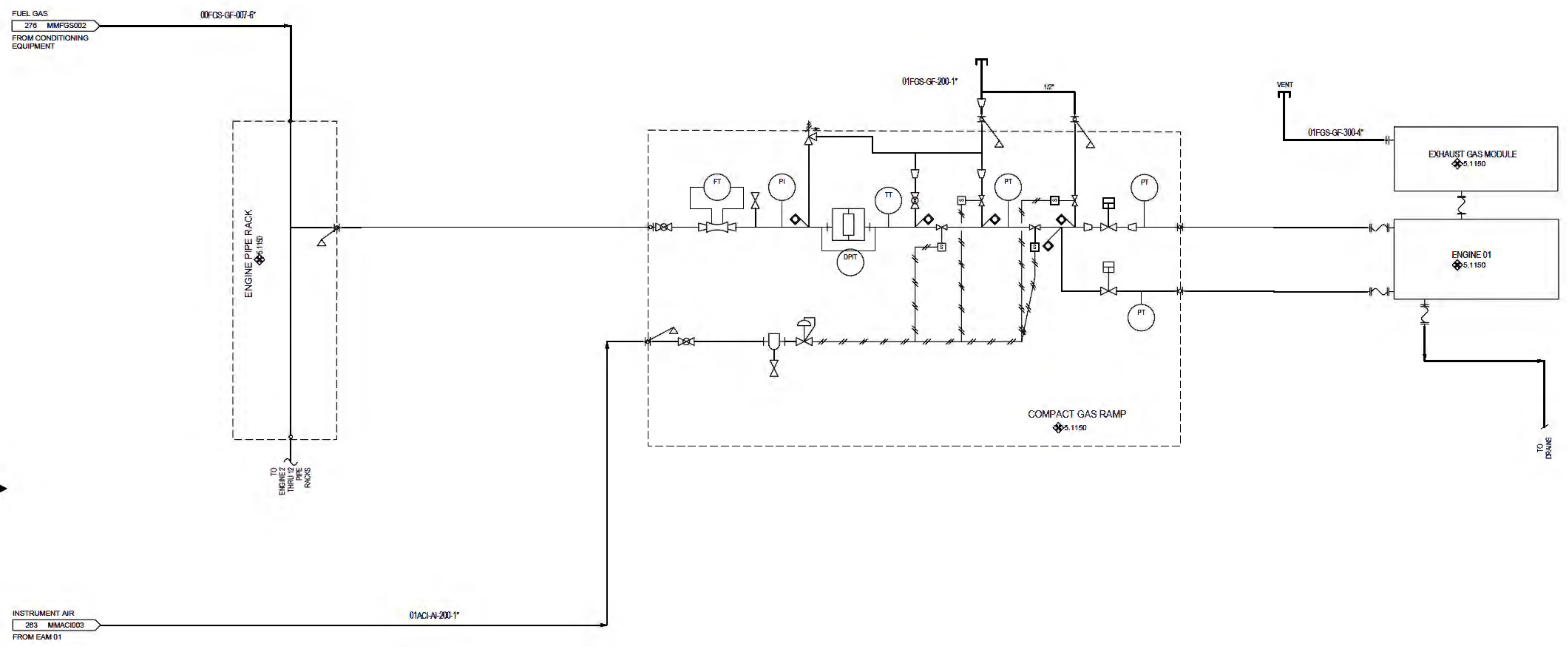

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BURNS McDONNELL
9400 WARD PARKWAY
KANSAS CITY, MO 64114
816-333-9400
FIRM LICENSE NO. 43

designed: J. BAUGHMAN
detailed:

EAST KENTUCKY POWER COOPERATIVE

CASEY COUNTY, KENTUCKY

Piping & Instrumentation Diagram
FUEL GAS SYSTEM

project: 157785
contract: C8320
drawing: MMFGS003
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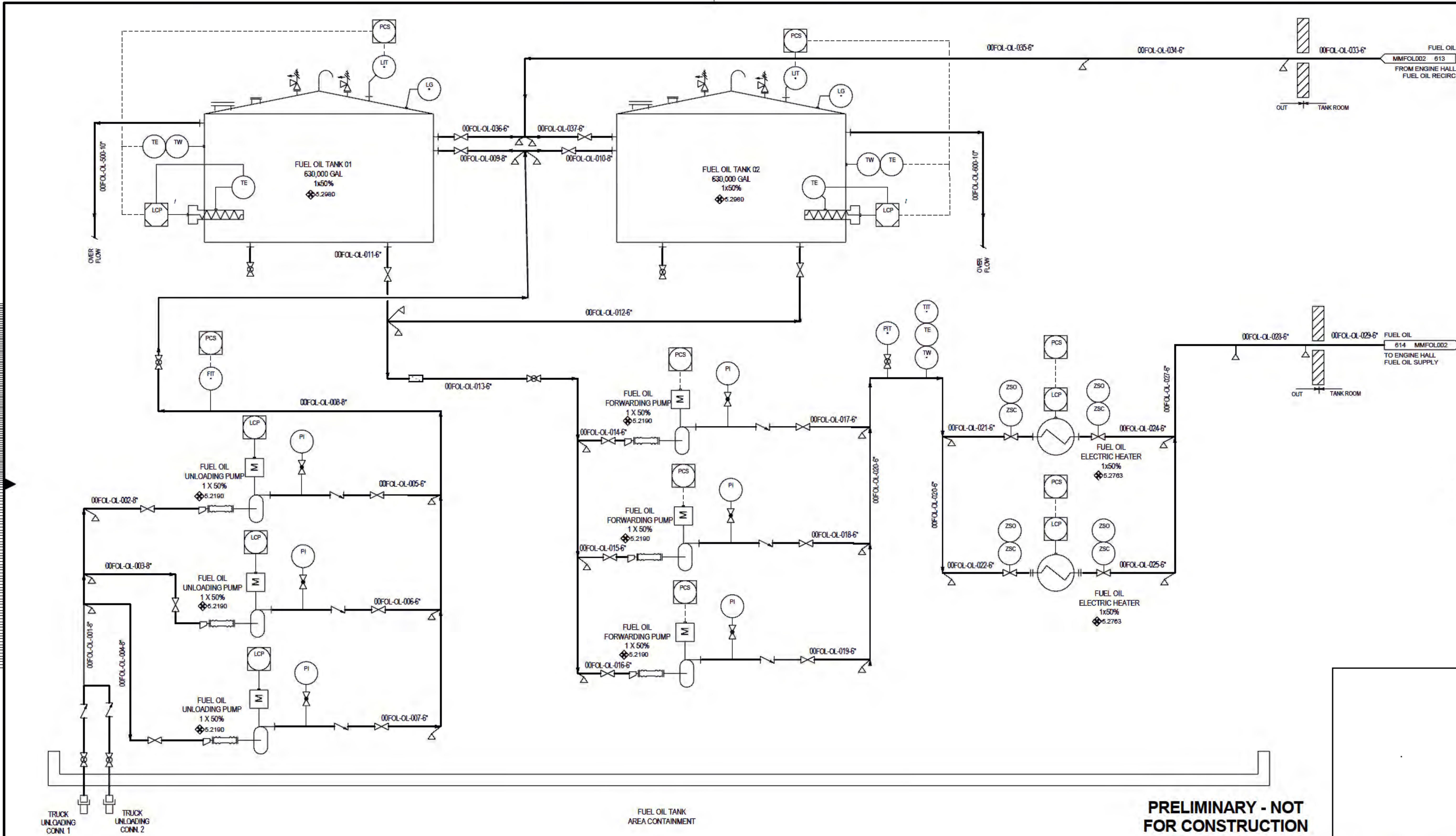

PRELIMINARY - NOT FOR CONSTRUCTION

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BURNS McDONNELL
9400 WARD PARKWAY
KANSAS CITY, MO 64114
816-333-9400
FIRM LICENSE NO. 43

designed: J. BAUGHMAN
detailed:

EAST KENTUCKY POWER COOPERATIVE
CASEY COUNTY, KENTUCKY

Piping & Instrumentation Diagram
FUEL OIL SYSTEM

project: 157785
contract:
drawing: MMFOL001
rev.: — A
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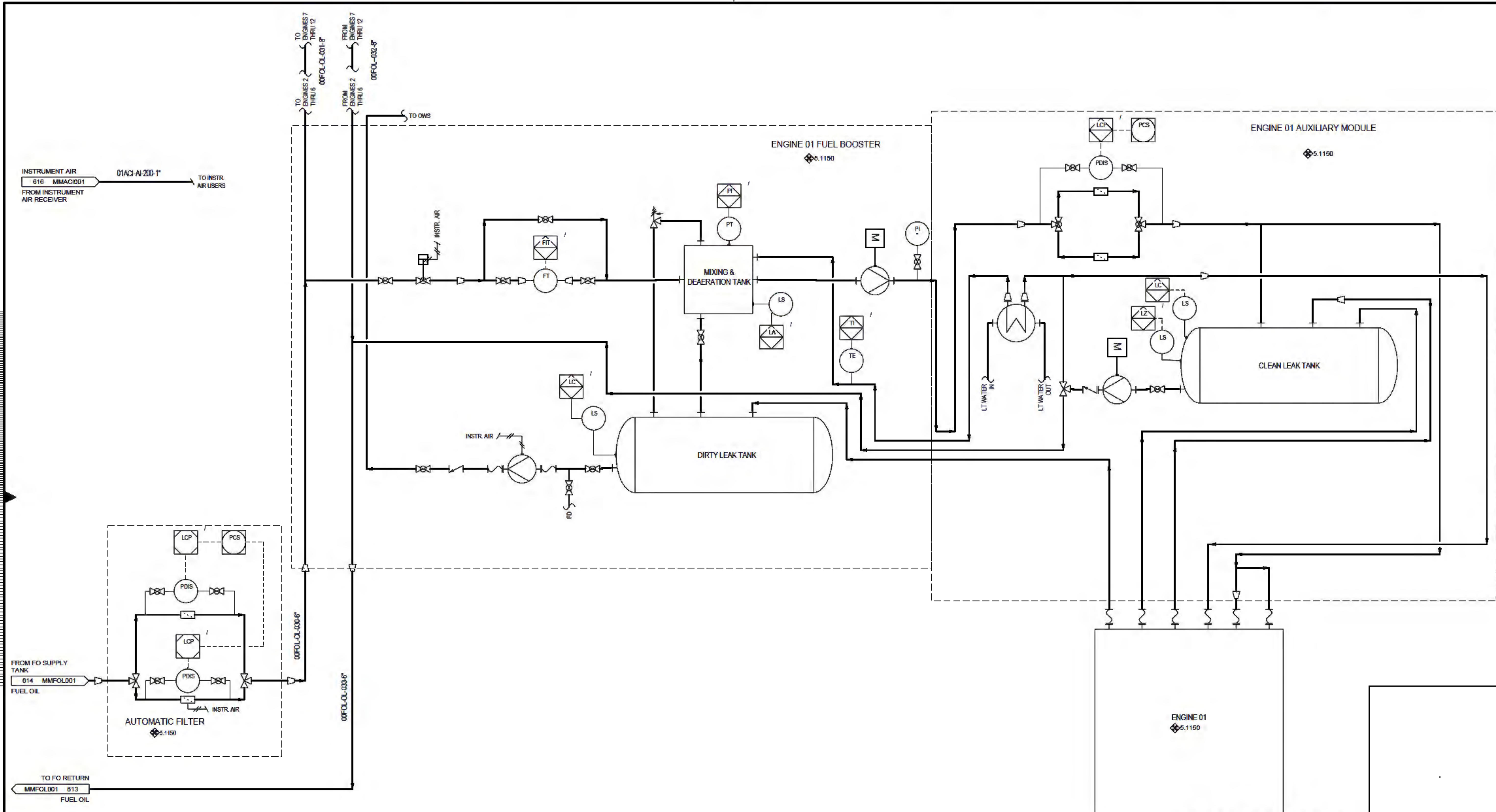

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BURNS McDONNELL
9400 WARD PARKWAY
KANSAS CITY, MO 64114
816-333-9400
FIRM LICENSE NO. 43

designed: J. BAUGHMAN
detailed:

EAST KENTUCKY POWER COOPERATIVE
CASEY COUNTY, KENTUCKY

Piping & Instrumentation Diagram
FUEL OIL SYSTEM

project: 157785
contract:
drawing: MMFOL002
rev.: A
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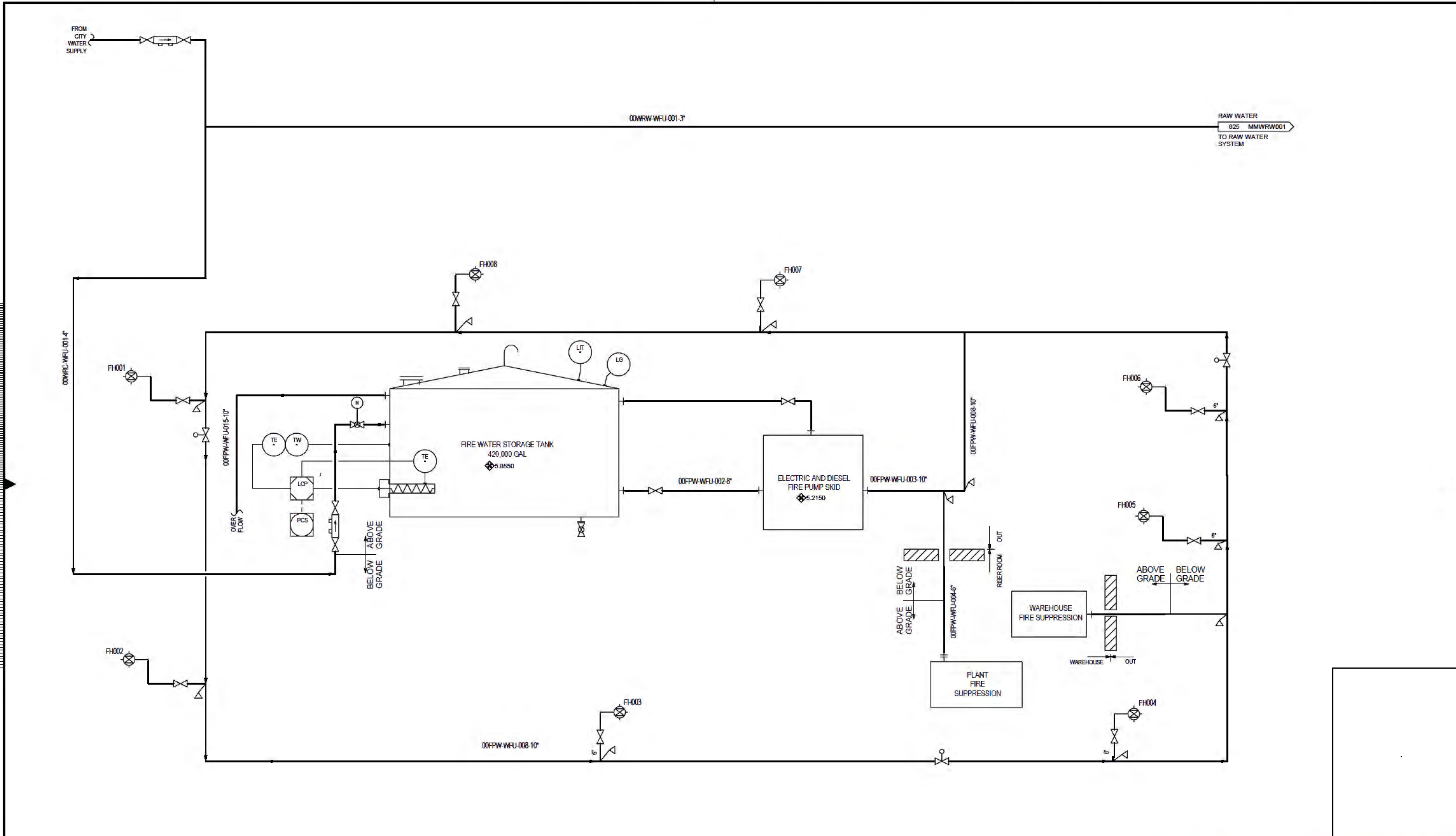

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BURNS McDONNELL
9400 WARD PARKWAY
KANSAS CITY, MO 64114
816-333-9400
FIRM LICENSE NO. 43

designed: J. BAUGHMAN
detailed:

EAST KENTUCKY POWER COOPERATIVE
CASEY COUNTY, KENTUCKY

Piping & Instrumentation Diagram
FIRE PROTECTION WATER SYSTEM

project: 157785
contract: 5.8220
drawing: MMFPW001
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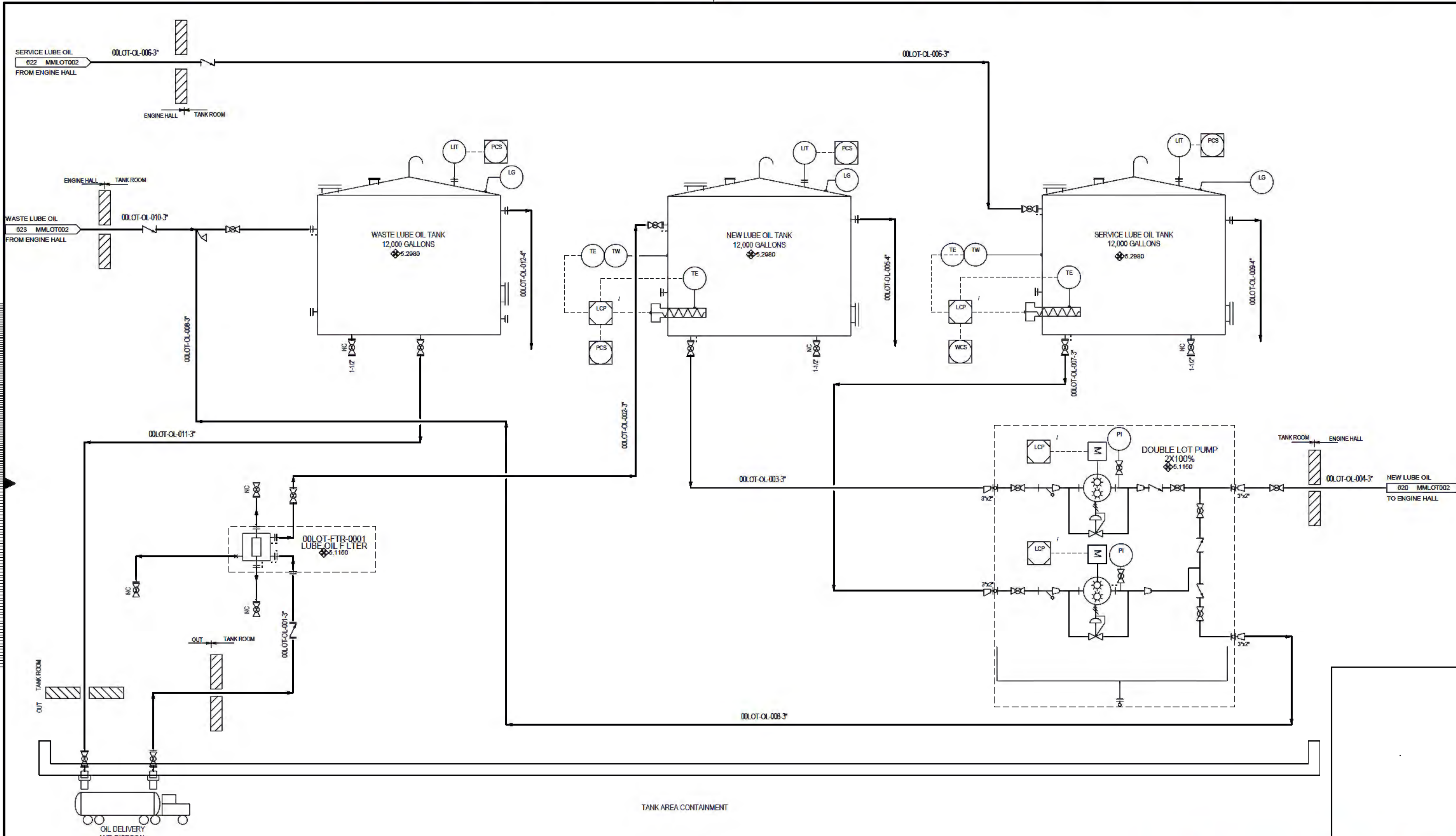

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A	01/02/24	JLB	DSR	PREL MINARY - IFOR					

BURNS McDONNELL
9400 WARD PARKWAY
KANSAS CITY, MO 64114
816-333-9400
FIRM LICENSE NO. 43

designed: J. BAUGHMAN
detailed:

EAST KENTUCKY POWER COOPERATIVE
CASEY COUNTY, KENTUCKY

Piping & Instrumentation Diagram
LUBRICATING OIL SYSTEM

project: 157785
contract: C8320
drawing: MMLOT001
rev.: B
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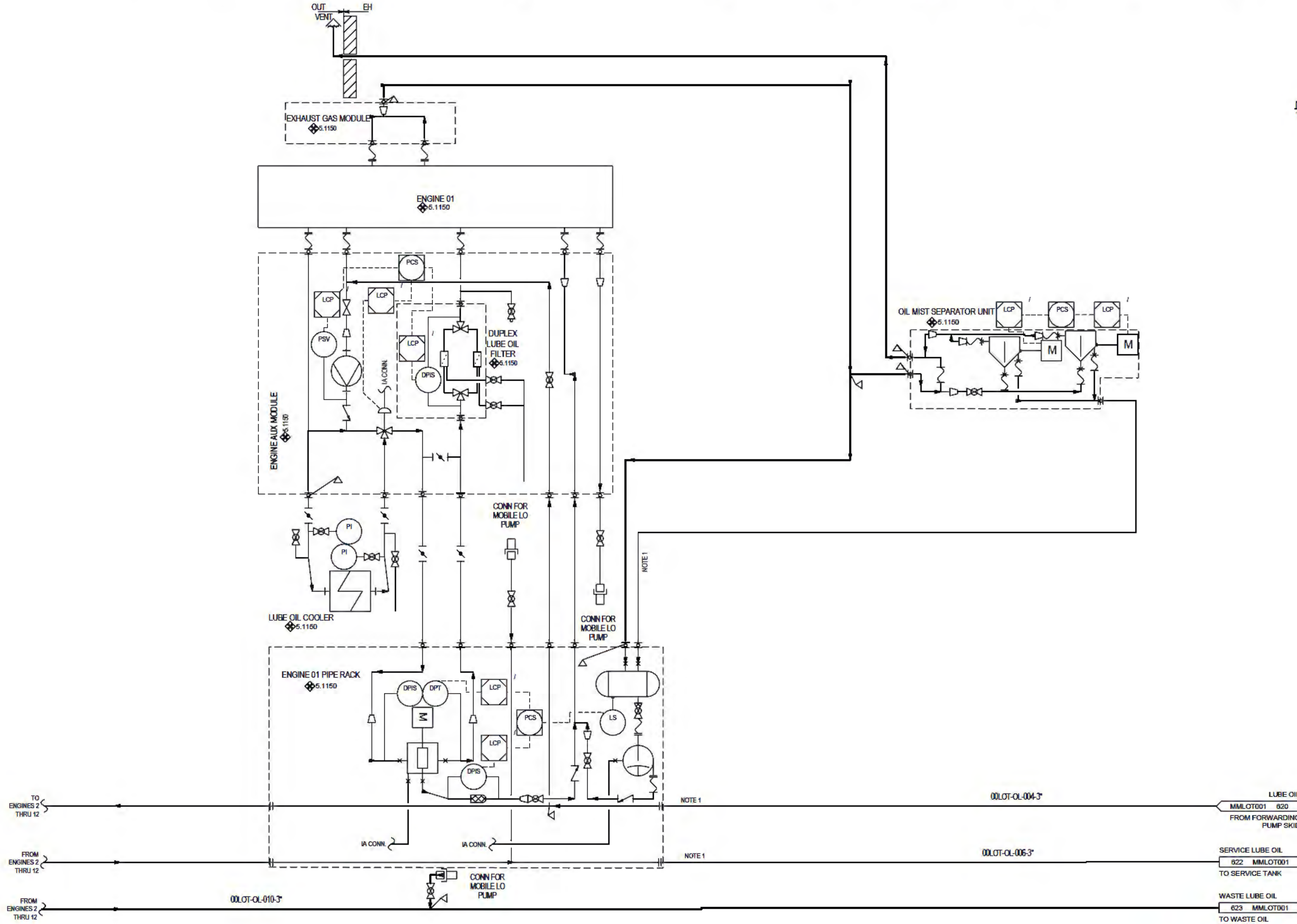

NOTES:
1. LINES ARE A DIAGRAMMATIC REPRESENTATION, SKIDS ARE ADJACENT.

no.	date	by	ckd	description	no.	date	by	ckd	description
A	01/02/24	JLB	DSR	PRELIMINARY - IFOR					

BURNS McDONNELL
9400 WARD PARKWAY
KANSAS CITY, MO 64114
816-333-9400
FIRM LICENSE NO. 43

designed: J. BAUGHMAN
detailed:

EAST KENTUCKY POWER COOPERATIVE
CASEY COUNTY, KENTUCKY

Piping & Instrumentation Diagram
LUBRICATING OIL SYSTEM

project: 157785
contract: C8320
drawing: MMLOT002
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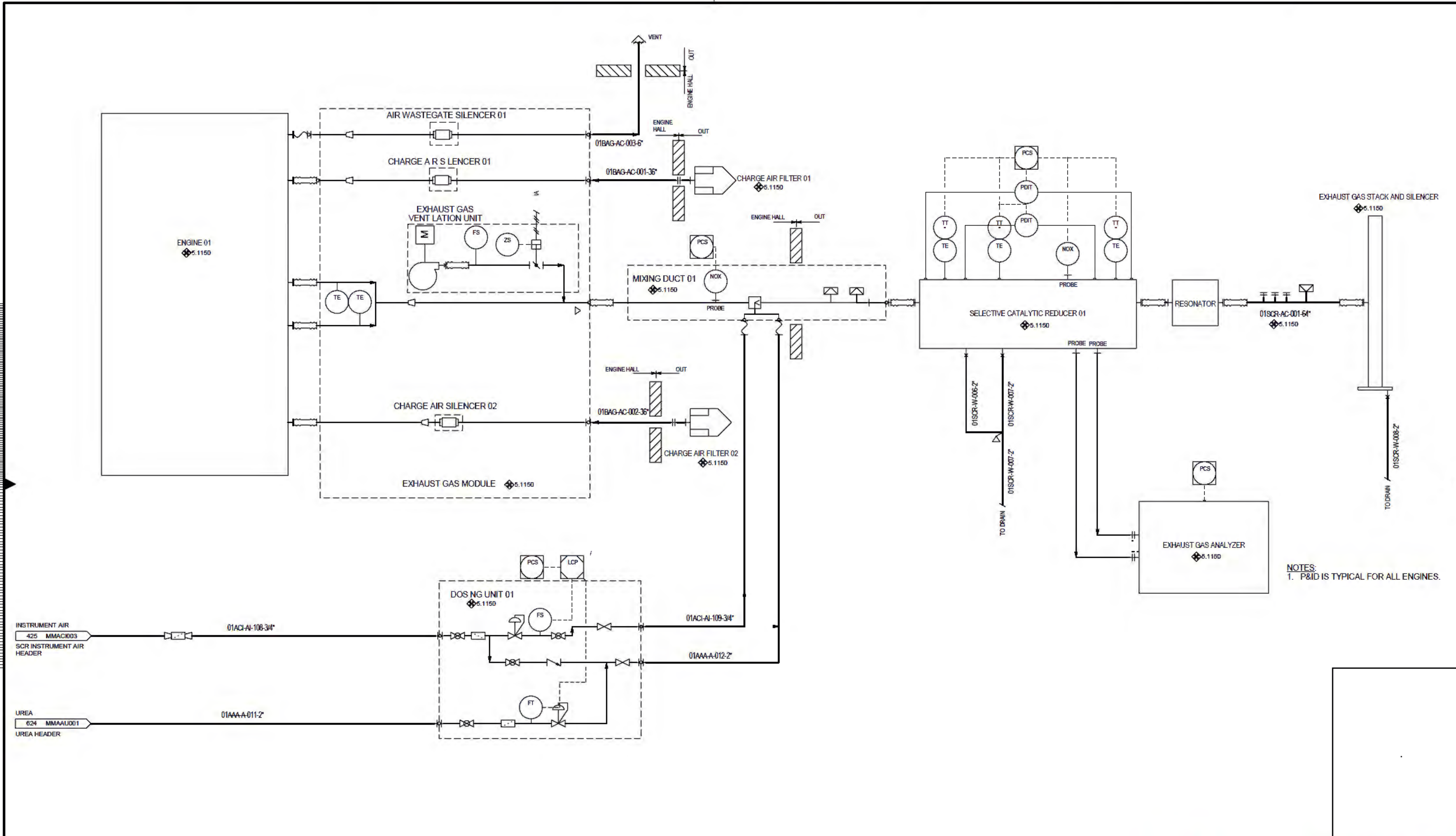

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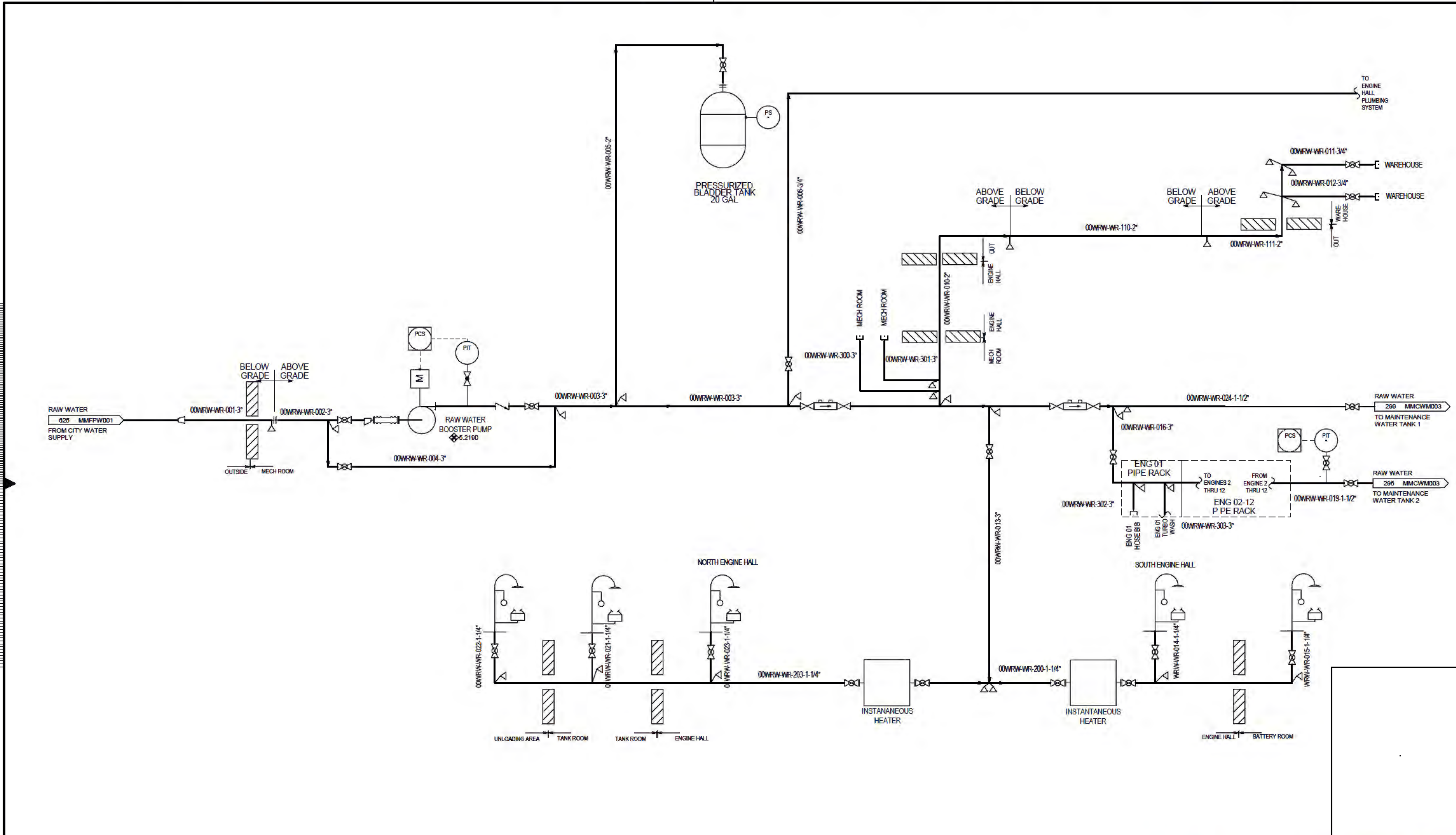
9400 WARD PARKWAY
KANSAS CITY, MO 64114
816-333-9400
FIRM LICENSE NO. 43

designed: D. REESE
detailed:

EAST KENTUCKY POWER COOPERATIVE
CASEY COUNTY , KENTUCKY

Piping & Instrumentation Diagram
EXHAUST GAS AND CHARGE AIR SYSTEM

project: 157785
contract:
drawing: MMSCR001
rev.: A
sheet of sheets
file 157785-MMSCR001.pid



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KANSAS CITY, MO 64114
816-333-9400
FIRM LICENSE NO. 43

designed: J. BAUGHMAN
detailed

EAST KENTUCKY POWER COOPERATIVE
CASEY COUNTY, KENTUCKY

Piping & Instrumentation Diagram
RAW WATER SYSTEM

project: 157785
contract: MULTIPLE
drawing: MMWRW001
rev. — A
sheet / of / sheets
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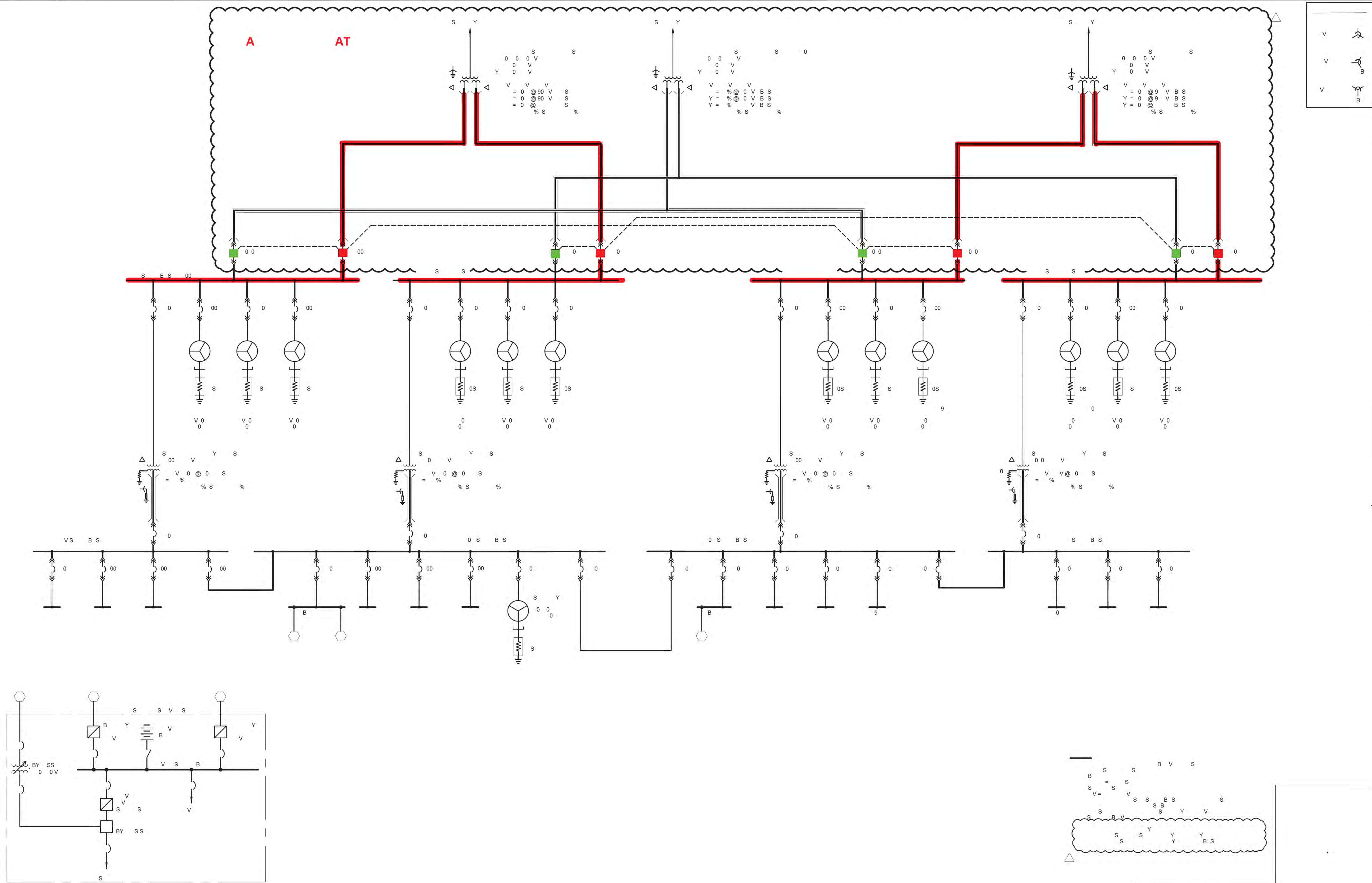

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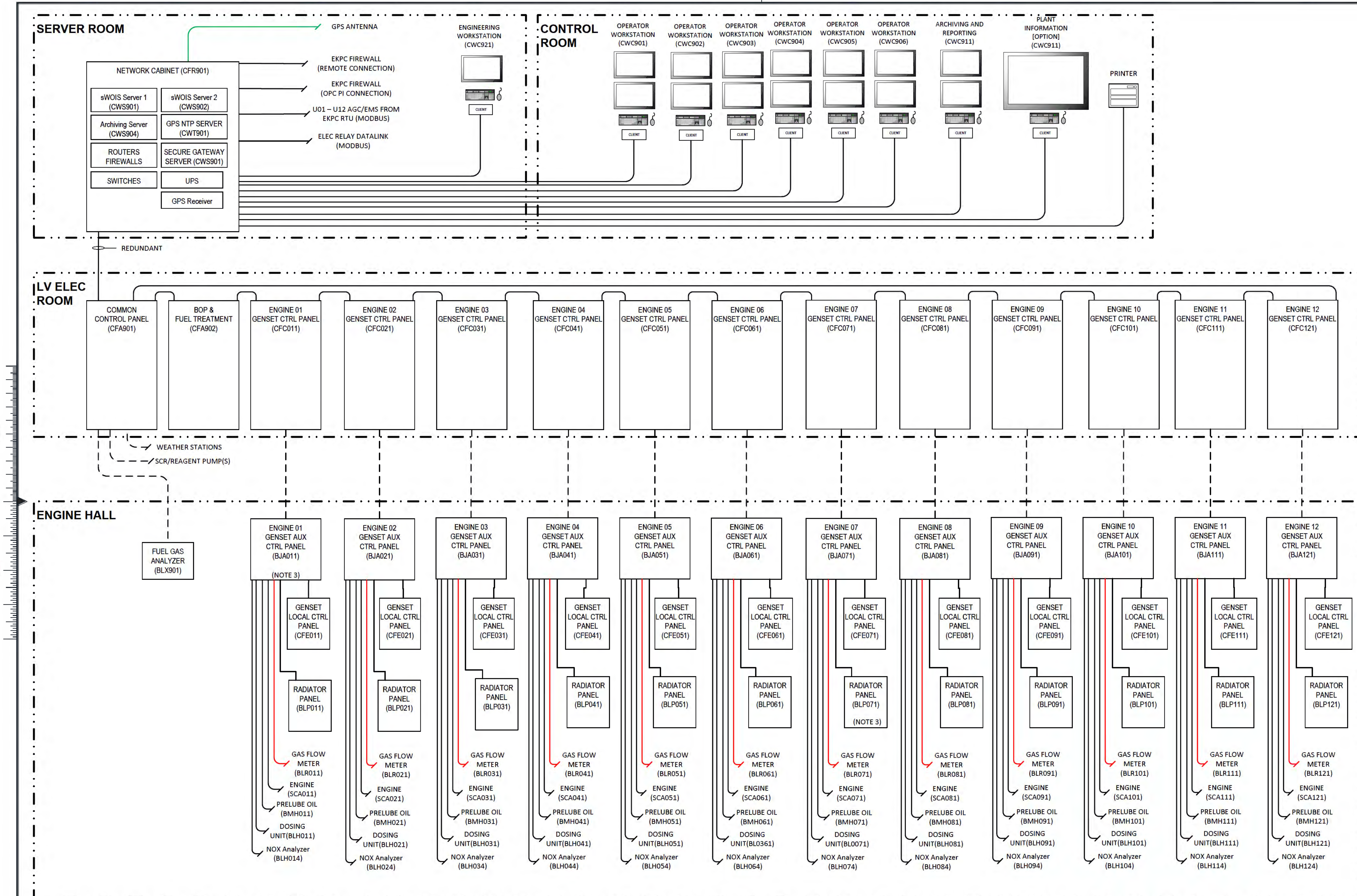

NOTES

1. ACTUAL QUANTITY OF DCS CABINETS AND HARDWARE NOT REPRESENTED.
2. PI OPC INTERFACE TO BE CONFIGURED BY EKPC
3. INTERNAL CONNECTIONS FOR NETWORK & CONTROL CABINETS NOT SHOWN

LEGEND

- FIBER OPTIC
- ETHERNET CABLE
- SERIAL DATA RS485
- COAX. CABLE RG58

PRELIMINARY – NOT FOR CONSTRUCTION

no.	date	by	ckd	description
A	2/16/24	SRL	BO	PRELIMINARY - IFOR

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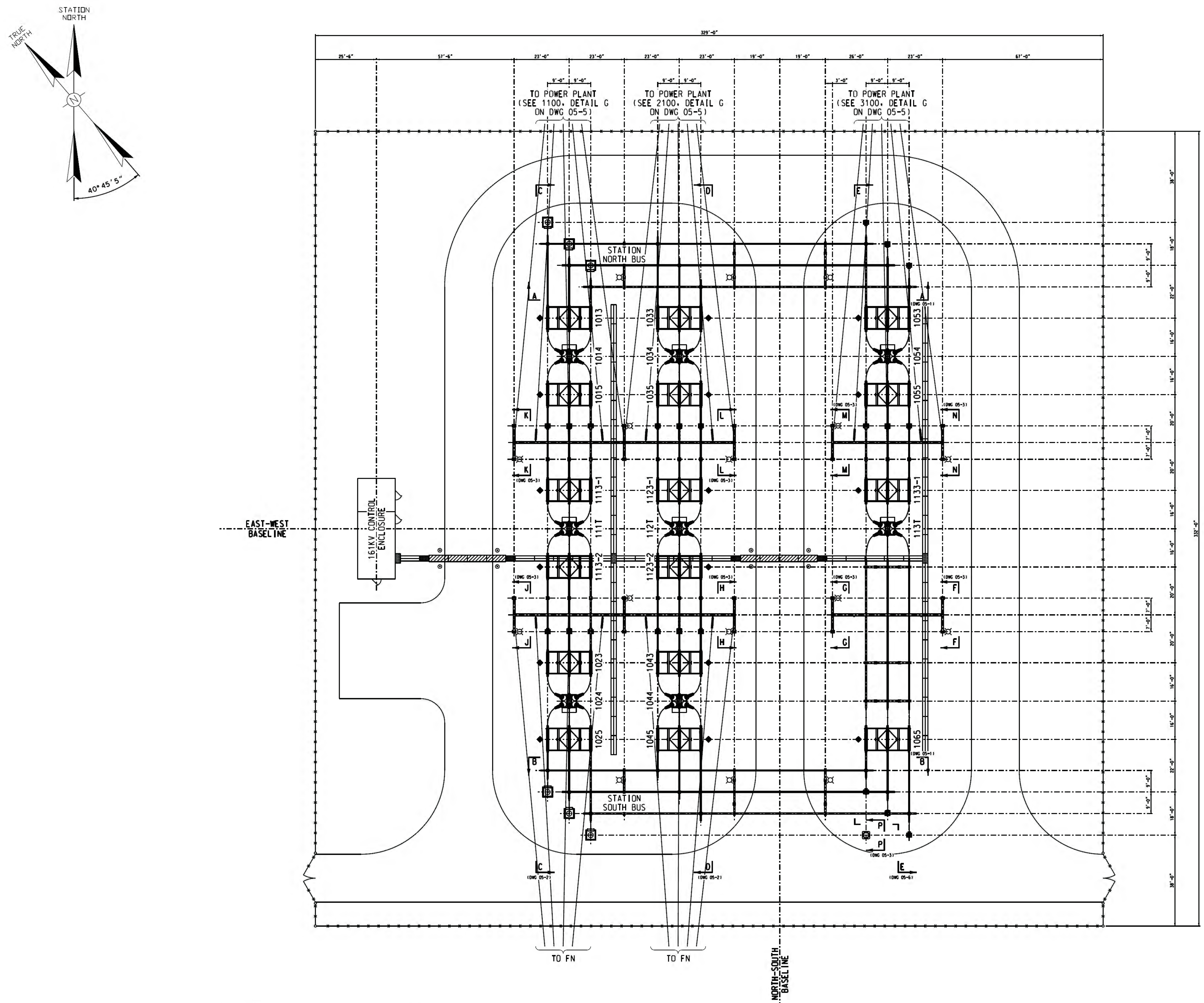
KANSAS CITY, MO 64114
816-333-9400
FIRM LICENSE NO. 43

designed S. LANIGAN
detailed

EAST KENTUCKY POWER COOPERATIVE
CASEY COUNTY, KENTUCKY

CONTROL SYSTEM ARCHITECTURE

project 157785
contract 5.1150
drawing
rev. A
sheet 1 of 1 sheets
file



NOTES:

1.) INSTALL 954 KCMIL ACSR DAMPING CABLE INSIDE ALL HORIZONTAL RUNS OF 5" BUS.
2.) INSTALL 1/4" DIAMETER WEEP HOLE EVERY 5' IN ALL HORIZONTAL RUNS & IN THE CORONA PLUG OF ALL VERTICAL RUNS OF BUS.
3.) FOR SWITCHYARD CONNECTIONS TO COOPER POWER PLANT, SEE DETAIL G ON DWG 05-5.

LEGEND:

- DISCONNECT SWITCH OPERATOR MECHANISM
- YARD LIGHT
- BOLLARD
- PEDESTRIAN CABLE TRENCH
- PEDESTRIAN CABLE TRENCH (UNIVERSAL CHANNEL)
- PEDESTRIAN CABLE TRENCH (TRANSITION CHANNEL)
- HEAVY TRAFFIC CABLE TRENCH W/ POLYMER COVER (32,000 LB. SINGLE AXLE LOAD)

REFERENCE DRAWINGS:

CAMP-05-1 - SECTIONS A-A & B-B
CAMP-05-2 - SECTIONS C-C & D-D
CAMP-05-3 - SECTIONS F-F, G-G, H-H, J-J, K-K, L-L, M-M, N-N, & P-P
CAMP-05-4 - SECTIONS R-R, S-S, V-V, & DETAILS
CAMP-05-5 - SECTIONS T-T, U-U, & DETAILS
CAMP-05-6 - SECTION E-E
CAMP-06-1 - BUS ARRANGEMENT PLAN
CAMP-06-2 - BUS CUTTING PLAN
CAMP-07-1 - FOUNDATION PLAN
CAMP-07-3 - FENCE MATERIAL PLAN
CAMP-09-1 - GROUNDING PLAN
CAMP-11-1 - ELECTRICAL MATERIAL LISTS
CAMP-13-1 - CONDUIT PLAN

OUTDOOR ELECTRICAL SUBSTATION CLEARANCES FOR RIGID & NON-RIGID CONDUCTORS

VOLTAGE CLASS	BIL	EKPC RIGID CONDUCTOR MINIMUM				RUS 1724E RIGID CONDUCTOR MINIMUM				EKPC NON RIGID	
		MINIMUM PHASE TO GROUND (IN)	MINIMUM PHASE TO PHASE (METAL- METAL) (IN)	CLEARANCE ABOVE GRADE - PEDESTRIAN (FT)	CLEARANCE ABOVE GRADE - DRIVEWAY (FT)	MINIMUM PHASE TO GROUND (IN)	MINIMUM PHASE TO PHASE (IN)	CLEARANCE ABOVE GRADE - PEDESTRIAN (FT)	CLEARANCE ABOVE GRADE - DRIVEWAY (FT)	MINIMUM PHASE TO GROUND (IN)	MINIMUM PHASE TO PHASE (METAL- METAL) (IN)
161	750	62	72	14	26	58	72	14	26	93	108

REVISIONS	DATE	DWN	APP	REVISIONS	DATE	DWN	APP
1.	X/X/XX	---	---	5.	X/X/XX	---	---
2.	X/X/XX	---	---	6.	X/X/XX	---	---
3.	X/X/XX	---	---	7.	X/X/XX	---	---
4.	X/X/XX	---	---	8.	X/X/XX	---	---

DRAWN CAS-BMcD 3/1/24
DESIGNED CAS-BMcD 3/1/24
CHECKED DED-BMcD 3/1/24
APPROVED

FOR BIDDING ONLY
NOT APPROVED FOR CONSTRUCTION

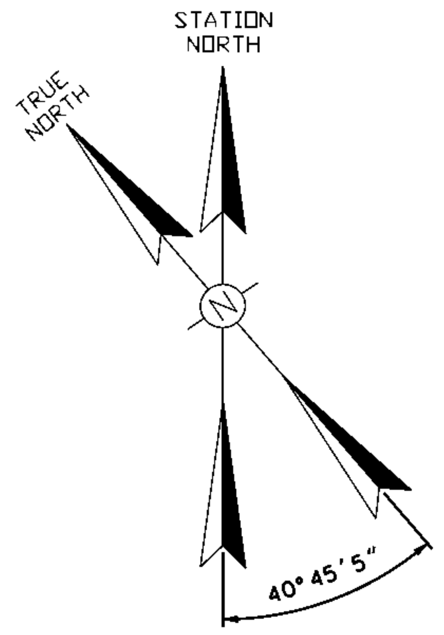
EAST KENTUCKY POWER COOPERATIVE
A Touchstone Energy Cooperative
4775 LEXINGTON RD., PO BOX 707
WINCHESTER, KY 40392

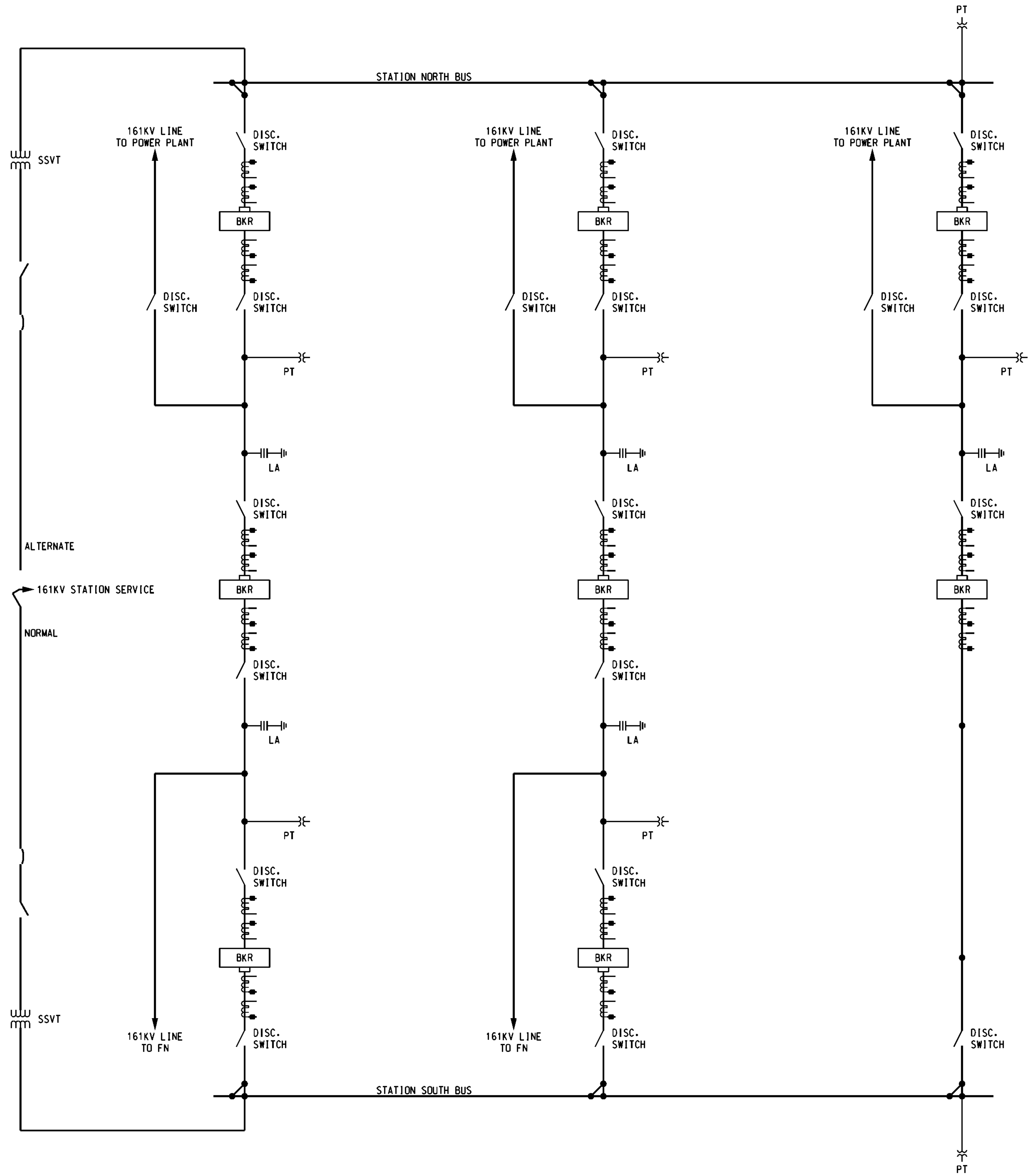
LIBERTY 161KV SWITCHING STATION ELECTRICAL ARRANGEMENT PLAN

BMcD REVISION BLOCK

	REVISIONS	DATE	DWN	APP
0	ORIGINAL ISSUE	2/12/24	CAS	DED
1	ADDED LINE FOR NEW GSU.	3/1/24	CAS	DED
2	---	---	---	---
3	---	---	---	---
4	---	---	---	---
5	---	---	---	---

SCALE: 1" = 20'-0"
DWG NO CAMP-04-1
REV 0





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CAMP-04-1 - ELECTRICAL ARRANGEMENT
CAMP-07-1 - FOUNDATION PLAN
CAMP-09-1 - GROUNDING PLAN
CAMP-13-1 - CONDUIT PLAN

BMcO REVISION BLOCK

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1	ADDED LINE FOR NEW GSU.	3/1/24	CAS	DED
2	---	---	---	---
3	---	---	---	---
4	---	---	---	---
5	---	---	---	---
	REVISIONS	OATE	DWN	APP

FOR BIDDING ONLY
NOT APPROVED FOR CONSTRUCTION

1.	X/X/XX	---	---	5.	X/X/XX	---	---
2.	X/X/XX	---	---	6.	X/X/XX	---	---
3.	X/X/XX	---	---	7.	X/X/XX	---	---
4.	X/X/XX	---	---	8.	X/X/XX	---	---
REVISIONS	DATE	DWN	APP	REVISIONS	DATE	DWN	APP

DRAWN	CAS-BMcD	3/1/24
DESIGNED	CAS-BMcD	3/1/24
CHECKED	DED-BMcD	3/1/24
APPROVED		

EAST KENTUCKY POWER COOPERATIVE
A Touchstone Energy Cooperative
4775 LEXINGTON RD., PO BOX 707
WINCHESTER, KY 40392

LIBERTY 161KV SWITCHING STATION
ONE LINE DIAGRAM

SCALE:NONE
DWG NO CAMP-03-1
REV Ø

APPENDIX F – NOT USED

APPENDIX G – NOT USED

APPENDIX H – PRELIMINARY SUBSURFACE INVESTIGATION

Report of Geotechnical Exploration
Gas RECIP Engine Plant
Liberty, Kentucky
CSI Project No. LX240063

Prepared for :

East Kentucky Power Cooperative

Winchester, Kentucky

July 17, 2024

CONSULTING SERVICES INCORPORATED

Geotechnical & Materials Engineering | IBC Special Inspection | Material Testing

July 17, 2024

East Kentucky Power Cooperative
4475 Lexington Road
Winchester, Kentucky 40391

Attention: Mr. Donovan Ward, EIT
E-mail: donvan.ward@ekpc.coop

Subject: **Geotechnical Exploration**
Gas RECIP Engine Plant - Liberty
Liberty, Kentucky
CSI Project No. LX240063

Dear Mr. Ward:

Consulting Services Incorporated of Kentucky (CSI) is pleased to present our report for the geotechnical services completed for your proposed Gas RECIP Engine Plant to be constructed in Liberty, Kentucky.

Our report represents information provided to us, readily available published data relevant to the site and site area, our observations and subsurface conditions encountered and our opinion of primary geotechnical conditions (discussion and recommendations) affecting design, construction and performance of the proposed earth and/or rock supported portions of the project.

We appreciate the opportunity to provide our geotechnical services to you and the design team. Please do not hesitate to contact us for questions or comments about the information contained herein.

Cordially,

STATE OF KENTUCKY
BARRY F. BISHOP
36777
LICENSED
PROFESSIONAL ENGINEER

7.17.24

STATE OF KENTUCKY
BRUCE L. HATCHER
14,527
LICENSED
PROFESSIONAL ENGINEER

7-17-24

Barry F. Bishop, PE
Vice President
Licensed 36,777

Bruce L. Hatcher, PE
Chief Engineer
Licensed KY 14,527

TABLE OF CONTENTS

APPENDICES, FIGURES, PHOTOS AND TABLES

APPENDICES: Site Location Plan
Boring Location Plan
Boring Logs
Field Testing Procedures
Summary of Laboratory Tests
Specific Laboratory Test Tables
Laboratory Testing Procedures
Geophysical Survey

List of Figures

List of Photos

List of Tables

INTRODUCTION

1 SCOPE OF THE GEOTECHNICAL EXPLORATION

As proposed, we conducted geotechnical services which are summarized in the following report. Our services included a review of the project information provided, conducting a subsurface exploration that used soil borings, soundings (borings without sampling) and rock coring to obtain samples for modeling the soil/rock conditions at the subject site, an analysis of the data and information obtained, and providing recommendations for the earth and/or rock supported portions of the site as listed in our proposal. Additionally, we completed a geophysical survey of the site to better assess the Karst potential as well as measure soil resistivity parameters.

2 PROVIDED INFORMATION

Project information was provided to us via e-mail correspondence with you on March 20, 2024. You supplied us with a pdf file titled "20240322 EKPC Liberty RECIP - Geotech SOW (missing Coordinates)". The Statement of Work (SOW) included detailed information about the project, as well as a Site Plan with proposed boring locations. Coordinates were provided at a later date prior to our fieldwork.

The project site is located on Carr Sasser Road outside of Liberty, Kentucky. Specifically, the site area is located on the south side of Carr Sasser Road, approximately ½ mile to the northeast of the Carr Sasser Road - State Road 49 intersection. Please reference our *Site Location Plan* in the Appendix for specific details.

We understand construction will include a new 12x18MW Gas Reciprocating Engine Plant. This will consist of a large building containing the engines, administration offices, and equipment areas. Additionally, there will be various tanks, silencer stacks, selective catalytic reducers, radiators, associated buildings, and transformers. An electrical switchyard is planned to the east of the power block area and a stormwater pond is planned to the west of the power block area. New transmission line poles are also planned to connect the new switchyard to the existing transmission line.

We were not supplied with specific structural information for this project. However, we were supplied with a site survey indicating existing grades. Existing grades vary from approximately 1060 feet to 1090 feet. We were supplied an FFE of 1085 feet. Based on the preliminary topographic information the majority of the site will earthwork will consist of shallow cuts to less than 10 feet of fill.

Some preliminary structural loading information was provided to us in the Scope of Work for the project. The following structural loading information was supplied or assumed.

- Foundation Pressures than 600 to 3000 psf (provided);
- Continuous foundations loads no greater than 4 klf (assumed);
- Floor slab live loads of 250 psf (assumed).

If any of this information is incorrect, please let us know so we can reassess our scope of services needed and provide best fit recommendations for the project.

3 AREA/SITE INFORMATION

3A AREA TOPOGRAPHY/PHYSIOGRAPHY

The site is located in the Western Knobs region of Central Kentucky. This area consists of gently rolling topography and rich, fertile soils. Published topographic mapping by the United States Geological Survey (USGS) indicates the elevations in the site vicinity range from 1,000 feet to 1,100 feet. Below is a figure of the location of the site with respect to the regional physiography. Figure 1 shows the location of the site with respect to the regional physiography.

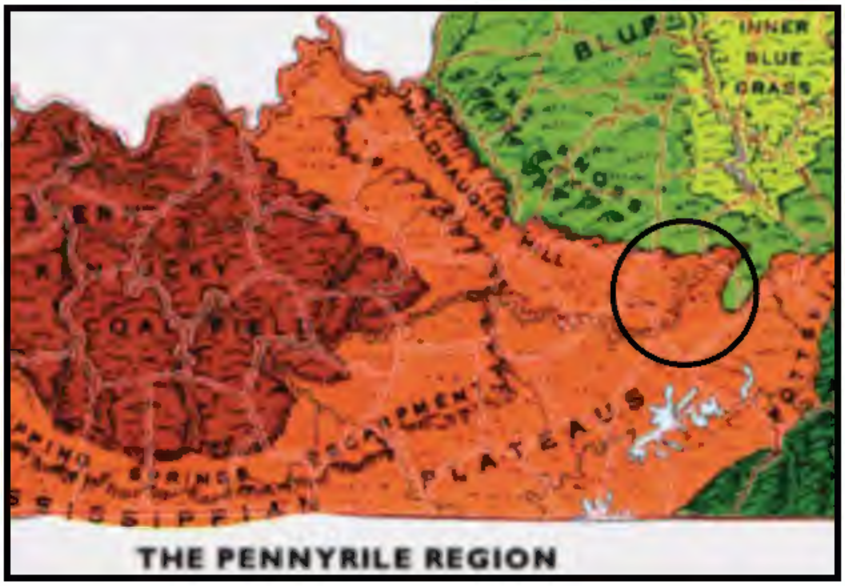


Figure 1. Kentucky Physiographic Map (site vicinity shown in the circle)

3B SITE GEOLOGY

A review of the USGS Geologic Map of the Liberty Quadrangle (dated 1971) indicates that the project site is partially underlain by the Salem and Warsaw Formations of Mississippian aged rock deposits.

The Salem and Warsaw Formations consist of limestone, siltstone, shale and sandstone. The following list details each description:

- Limestone is medium gray to bluish gray to medium dark gray. It is fine to coarse grained, but mostly medium grained. It is medium to thick bedded, locally crossbedded. It is cherty and very fossiliferous.

- Siltstone and Shale are medium gray to greenish gray, calcareous, and fossiliferous. The siltstone and shale interfingers with limestone and contains thin lenses of limestone and chert.

- Sandstone and quartzose are reddish-brown, fine to coarse grained. It is medium bededded, crossbedded, and locally calcareous.

The geologic dip in the area is less than 1 percent to the west. There are no faults mapped within or near the project site area the project site. Figure 2 shows the USGS geologic mapping in the site vicinity.

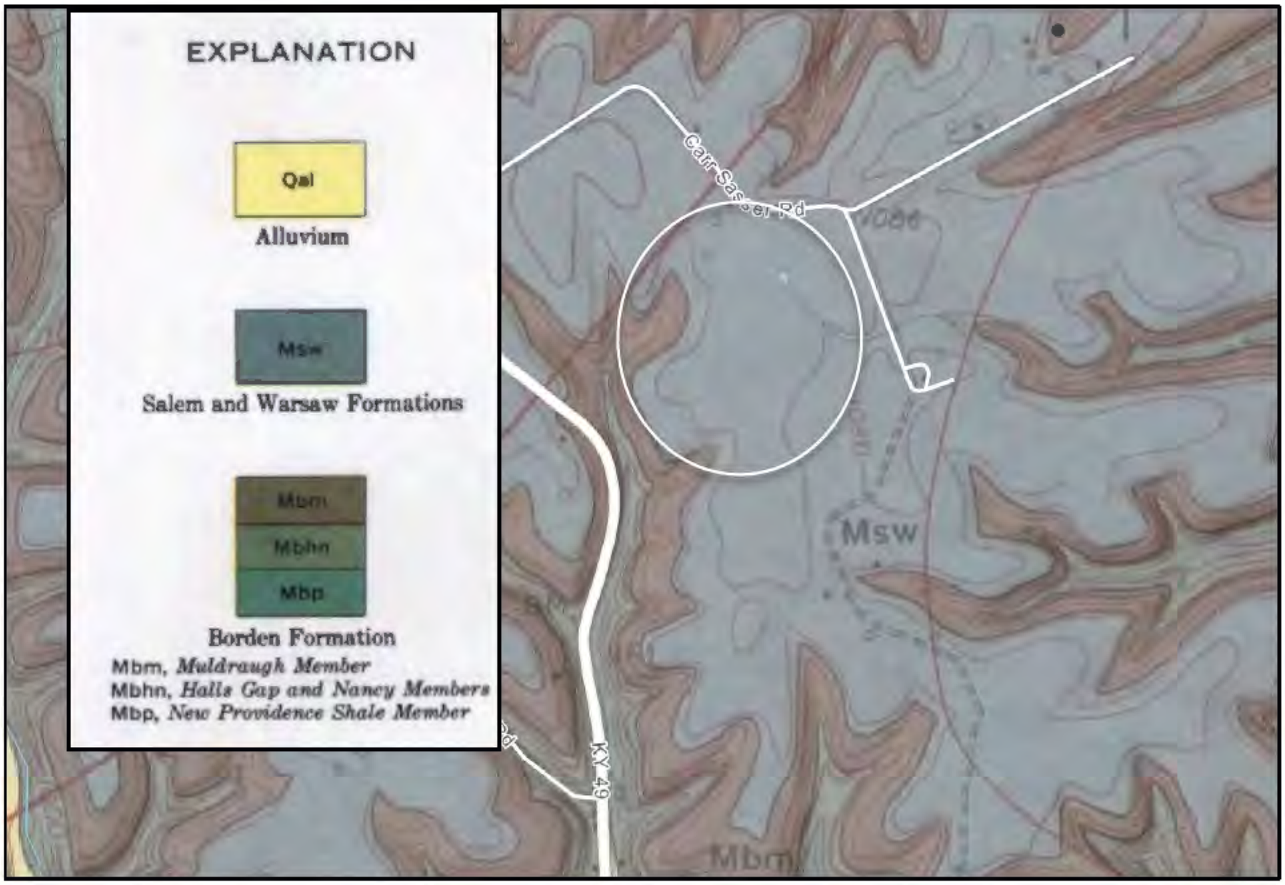


Figure 2. USGS Liberty Quadrangle (1971) with site vicinity shown in circle

As with most of the geology of this portion of Kentucky, Karst (sinkholes, weathered bedrock, caverns, erratic bedrock, etc.) is associated with the site geology. No closed depressions were mapped within or near the project site. The Karst Occurrence in Kentucky map published by the Kentucky Geological Survey (KGS) indicates that the project site is in an area underlain by rock with medium potential for Karst development. The KGS map depicting Karst potential is shown in Figure 3.

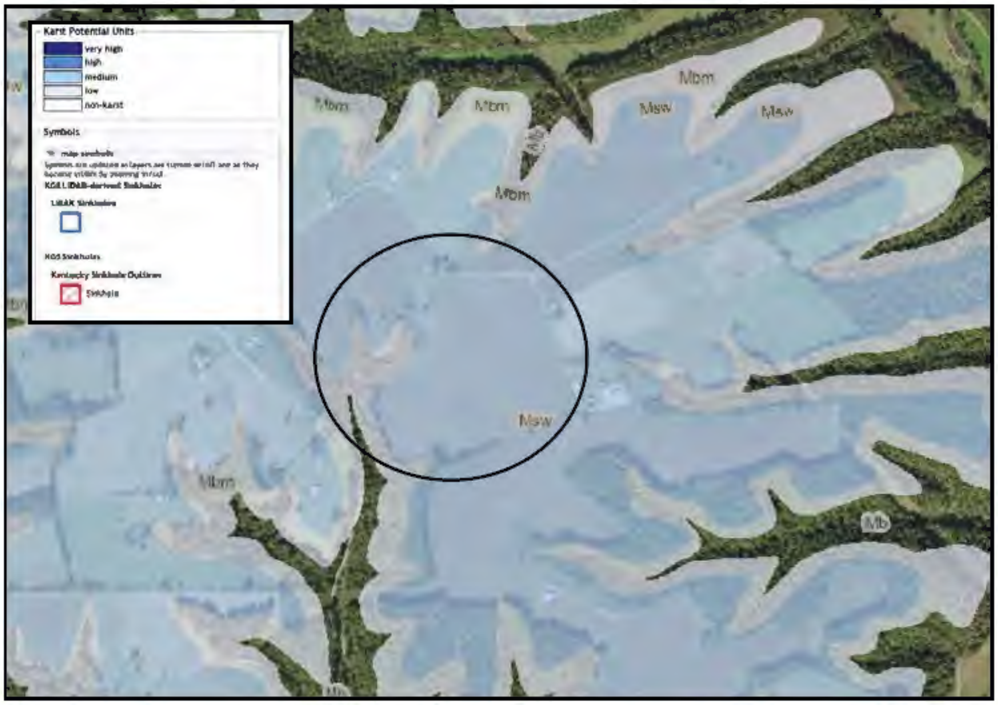


Figure 3.Karst Areas Map, KGS (site vicinity shown in circle)

3C PUBLISHED SITE SOIL CONDITIONS

According to the USDA Soil Survey of Casey County (NRCS website), the soils underlying the project site consist of the following series:

- FkC—Frankstown silt loam, 6 to 12 percent slopes;
- FkD—Frankstown silt loam, 12 to 20 percent slopes;
- GaF—Garmon silt loam, 30 to 60 percent slopes;
- PrB—Pricetown silt loam, 2 to 6 percent slopes;
- TeB—Teddy silt loam, 2 to 6 percent slopes.

The following Table 1: Web Soil Survey Attributes describes the soil series characteristics and limitations with respect to construction.

Table 1: Web Soil Survey Attributes						
Soil Type	Depth to Lithic Bedrock (inches)	Depth To Water Table (inches)	Drainage Class	Dwellings Without Basements	Shallow Excavations	Local Roads and Streets
FkC	41	>80	Well Drained	Somewhat Limited	Somewhat Limited	Somewhat Limited
FkD	41	>80	Well Drained	Very Limited	Very Limited	Very Limited
GaF	28	>80	Well Drained	Very Limited	Very Limited	Very Limited
PrB	>80	>80	Well Drained	Not Limited	Somewhat Limited	Somewhat Limited
TeB	>80	20	Moderately Well Drained	Somewhat Limited	Very Limited	Somewhat Limited

Particular issues affecting construction include shrink-swell, depth to hard bedrock, low strength, soluble bedrock and slope. Figure 4 depicts the project site with respect to the mapped soil survey information.

Figure 4. USDA Soil Survey Map of the Project Site (site vicinity shown in green border)

3D OTHER PUBLISHED SITE INFORMATION

We have reviewed available aerial photographs, dated as far back as March, 1997. The site has existed as farmland from the date of our earliest researched aerial photograph. The most recent photograph (March 2021), depicts the area as farmland, which is how the site currently exists. Please note, the aerial photographs prior to 2008 are of poor quality, thus minor details cannot be easily determined. Please reference the following aerial photographs.

Figure 5. Aerial Photo dated March, 1997 (Google Earth)

Figure 6. Aerial Photo dated October, 2008 (Google Earth)

Figure 7. Aerial Photo dated April, 2016 (Google Earth)

Figure 8. Aerial Photo dated March, 2021 (Google Earth)

FINDINGS

4 SITE SURFACE OBSERVATIONS

Mr. Barry Bishop, PE and other CSI personnel of CSI performed a field reconnaissance, logged soil borings and rock cores, and directed field operations within the proposed project area on March 28 through April 16, 2024.

The project site currently exists as farmland. The ground cover was mostly exposed soil with the remnants of harvested corn and sparse ankle high grass. The site area has a small area of woods along the western perimeter of the site area. A few residential structures lie to east of the site just beyond Carr Sasser Road. A business (gate company) lies to the southeast of the site area. A large drainage swale (vegetated) lies in the northwestern corner of the site. It should be noted that the surface conditions were relatively stable during the dry periods of the project. However, after any significant rain events, the surficial soils became highly unstable and traversing the site became difficult.

The project site topography varies greatly across the project site ranging from 1060 to about 1090 feet. The site's highest elevation is near the north and east of the site and slopes downward towards the west and the south. Also a small drainage swale exists in the southern portion of the site area.

An area of possible Karst development was observed. The area lies within the northeast region of the site between the power block area and the switchyard. The area lies in a low spot where surface drainage flows from all the surrounding areas forming a small bowl. The area had sparse vegetation, and there were several small dropouts approximately 1 foot in diameter near the lowest elevation part of the area. Please reference the following photographs as examples of the site conditions as they existed at the time of our exploration.

Photo 1. View across the site from the east looking west.

Photo 2. View from the southwest looking northeast across the site.

Photo 3. View from the northwest looking southeast across the site.

Photo 4. View of the southern perimeter from the west looking east across the site.

Photo 5. View of area exhibiting Karstic behavior

Photo 6. View of the western perimeter from the northeast

5 SUBSURFACE CONDITIONS

The subsurface conditions encountered at each of our soil boring locations are shown on the *Boring Logs* in the Appendix. It should be noted that our soil borings were sampled according to the procedures presented in the Appendix. The *Boring Logs* represent our interpretations of the subsurface conditions based on field logs, visual examination of field samples, and tests of the samples collected. The letters in parentheses following the soil descriptions are the soil and rock classifications in accordance with the Unified Soil Classification System. It should be noted that the stratification lines shown on the soil boring logs represent approximate transitions between material types. In-situ stratum changes could occur gradually or at slightly different depths.

5A SOIL CONDITIONS

We performed 39 borings as proposed for this project (labelled B-1 to B-32 and SW-1 to SW-7). Offset borings were performed at several boring locations to collect relatively undisturbed samples (Shelby tubes). The general overburden subsurface conditions consisted of topsoil, overlying a till zone, overlying residual soils, overlying bedrock. The topsoil consisted of a dark brown silty lean clay with roots.

The till zone consisted of a lean clay with some fine roots. The till zone is similar in appearance to topsoil, but has less organic content and is silty. Till zone typically fails proofroll and foundation inspections. The till zone may be stripped and reused for engineered fill. However, it may be more difficult to achieve the required compactive effort.

The residual soils varied from low plasticity to high plasticity soils. Please note that unless specific laboratory testing was performed, the soils were classified as residual soil because of the similarity between the samples (i.e.- color, general composition, etc.). Additionally, because of the high moisture content in zones, the samples were difficult to differentiate visually. The low plasticity soils consisted of Lean Clay (CL), Silt (ML), and Silty Clay (CL-ML). The high plasticity soils consisted of Fat Clay (CH) and Elastic Silt (MH). Although samples from each category (i.e. - low plasticity vs. high plasticity) were different, samples within each category (i.e. - Lean Clay vs. Silt) were very similar and only varied slightly in laboratory parameters. All of the soils were generally gray, orange, or tan with mottling in places. The residual soil was cherty in places with some interbedding of chert. Please note that the chert contained in the soil matrix may have *artificially inflated* some SPT blow counts. Specific details are summarized in Table 2:

Table 2. General Overburden Conditions Observed

Boring No.	Topsoil (in)	Till Zone (ft)	Residual Soil (ft)	Weathered Rock (ft)	Auger Refusal (ft)
B-1	6	N/A	14.8	0.7	16.0
B-2	18	N/A	8.4	0.6	10.5
B-3	9	2.2	11.2	0.4	14.5
B-4	6	1.0	18.1	0.6	20.2
B-5	8	1.8	20.7	N/A	23.2
B-6	8	2.7	13.6	0.1	17.1
B-7	6	2.0	19.4	N/A	21.9
B-8	6	2.5	10.1	0.7	13.8
B-9	7	2.4	11.4	0.3	14.7
B-10	8	0.8	19.2	1.0	21.7

Table 2. General Overburden Conditions Observed

Boring No.	Topsoil (in)	Till Zone (ft)	Residual Soil (ft)	Weathered Rock (ft)	Auger Refusal (ft)
B-11	6	1.0	19.8	0.2	21.5
B-12	8	1.8	17.2	0.3	20.0
B-13	11	1.1	17.7	0.3	20.0
B-14	6	1.0	18.6	0.4	20.5
B-15	8	1.3	16.6	1.2	19.8
B-16	6	1.0	21.0	0.2	22.7
B-17	8	1.3	16.7	N/A	18.7
B-18	6	2.5	15.7	0.1	18.8
B-19	8	2.8	16.1	0.3	19.9
B-20	12	0.5	20.5	N/A	22.0
B-21	6	1.5	18.9	N/A	20.9
B-22	8	N/A	13.7	0.3	14.7
B-23	6	1.0	15.9	0.1	17.5
B-24	8	1.3	19..7	N/A	21.7
B-25	6	1.0	16.3	0.1	17.9
B-26	5	1.1	15.0	0.1	16.6
B-27	7	2.4	16.0	0.8	19.8
B-28	8	0.7	12.8	0.2	14.4
B-29	5	1.1	14.3	0.5	16.3
B-30	9	0.7	15.5	N/A	16.9
B-31	6	1.0	12.0	N/A	13.5
SW-1	8	2.3	11.1	0.9	15.0
SW-2	6	1.5	13.1	N/A	14.1
SW-3	5	2.0	18.0	N/A	20.4

Table 2. General Overburden Conditions Observed					
Boring No.	Topsoil (in)	Till Zone (ft)	Residual Soil (ft)	Weathered Rock (ft)	Auger Refusal (ft)
SW-4	10	1.6	20.1	N/A	22.5
SW-5	8	2.3	16.9	0.6	20.5
SW-6	8	2.3	19.9	0.5	23.4
SW-7	8	1.8	26.4	N/A	28.9
SW-8	8	1.8	18.7	0.2	21.4

5B GROUNDWATER CONDITIONS

Ground water was observed in 25 of our 39 borings at depths ranging from 6.8 to 20.0 feet. We performed 118 moisture content tests on representative samples for this project. _Of the 118 samples tested, 57 were measured as wet._ The moisture content for the wet samples ranged from _30.0 to 71.5 percent at depths ranging from 1.5 to over 14 feet_. Our borings were immediately backfilled with bentonite chips as per the project requirements.

This site contained large areas of consistently wet soils. However, water conditions that usually affect construction and performance of projects consist of trapped/perched water zones which occur in variable areas in the soil mass, at or near existing or former structures, at or near the bedrock bedding planes, or at or near the soil/rock interface. Perched water sources are often not linked to the more continuous relatively stable ground water table that typically occurs at greater depths. Site excavation activities or ground disturbance can expose these features and the resulting seepage can vary greatly. Finally, water issues are also dependent upon recent rainfall activity and surface and subsurface drainage patterns in the area.

5C BEDROCK INFORMATION

Auger refusal was encountered in all of our soil test borings at depths ranging from 10.5 to 28.9 feet. We have interpreted auger refusal as the top of hard bedrock (unless otherwise noted). Twenty-one (21) rock cores were obtained across the site area for this project. The rock cores obtained generally consisted of siltstone with some interbedded limestone and chert. No voids or core water loss were observed during coring activities or in our recovered rock core samples. The recovery for the rock samples obtained ranged from 52 to 100 percent. The recovered rock core samples had poor to excellent engineering quality with Rock Quality designation (RQDs) ranging from 45 to 100 percent. Unconfined compressive strength tests were performed on 4 representative samples across the site. The unconfined compressive strengths ranged from 549 ksf (boring B-25 at 28.4 feet) to 1472 ksf (boring B-8 at 14.0 feet). Please reference Table 3 and our *Boring Logs* for specific details regarding collected rock core samples.

Table 3. Bedrock Conditions Observed							
Boring No.	Auger Refusal Depth (ft)	Strata Depth (ft)	Bedrock Strata	Notes	Run	Recovery (%)	RQD (%)
B-1	16.0	16.0-41.0	Siltstone	Thin Lenses of Limestone Thin Lenses of Shale Few Quartzite Inclusions	1	93	65
					2	100	88
					3	100	90
					4	100	100
					5	100	100
B-3	14.5	14.5-39.5	Siltstone	Thin Lenses of Limestone Shale Partings Few Quartzite Inclusions	1	98	98
					2	100	100
					3	99	88
					4	94	94
					5	100	100
B-5	23.2	23.2-48.2	Siltstone	Thin Lenses of Limestones Few Quartzite Inclusions	1	85	85
					2	98	87
					3	100	95
					4	97	87
					5	100	100
B-8	13.8	13.8-49.6	Siltstone	Interbedded Limestone and Chert Quartzite Inclusions	1	98	98
		49.6-50.6	Shale		2	98	85
		50.6-52.0	Limestone	Siltstone Laminations	3	100	88
		52.0-53.8	Shale		4	98	98

Table 3. Bedrock Conditions Observed

Boring No.	Auger Refusal Depth (ft)	Strata Depth (ft)	Bedrock Strata	Notes	Run	Recovery (%)	RQD (%)
B-10	21.7	21.7-46.7	Siltstone	Layers of Limestone Layers of Hard Chert Quartzite Partings and Inclusions	1	90	53
					2	100	97
					3	100	100
					4	100	100
					5	90	77
B-12	20.0	20.0-45.0	Siltstone	Quartzite Inclusions	1	98	98
					2	93	88
					3	93	72
					4	100	73
					5	100	72
B-14	20.5	20.5-57.5	Siltstone	Shale Partings and Quartzite Inclusions	1	98	98
					2	98	95
		57.5-58.7	Shale		3	97	92
					4	100	100
		58.7-61.5	Limestone	Siltstone Laminations	5	96	96
B-16	22.7	22.7-26.7	Limestone	Few Siltstone Partings	1	88	87
					2	98	78
					3	100	80
		26.7-47.7	Siltstone	Layers of Hard Chert Shale Lenses Quartzite Inclusions	4	98	88
					5	98	97

Table 3. Bedrock Conditions Observed							
Boring No.	Auger Refusal Depth (ft)	Strata Depth (ft)	Bedrock Strata	Notes	Run	Recovery (%)	RQD (%)
B-18	18.8	18.8-43.8	Siltstone	Interbedded Limestone and Shale Quartzite Inclusions	1	98	82
					2	98	95
					3	95	87
					4	100	100
					5	100	100
B-20	22.0	22.0-62.0	Siltstone	Interbedded Hard Chert Layers Layers of Green Shale	1	97	97
					2	100	88
					3	98	95
					4	100	100
					5	100	100
B-22	14.7	14.7-24.7	Siltstone	Few Limestone Partings	1	95	95
					2	96	76
B-23	17.5	17.5-42.5	Siltstone	Few Limestone Partings Quartzite Inclusions	1	87	85
					2	98	80
					3	92	53
					4	100	73
					5	100	95
B-25	17.9	17.9-20.9	Limestone	Shale Partings	1	92	90
					2	100	77
					3	100	82
		20.9-42.9	Siltstone	Limestone Partings Quartzite Inclusions	4	100	97
					5	100	100

Table 3. Bedrock Conditions Observed

Boring No.	Auger Refusal Depth (ft)	Strata Depth (ft)	Bedrock Strata	Notes	Run	Recovery (%)	RQD (%)
B-26	16.6	16.6-20.2	Interbedded Siltstone and Limestone		1	99	99
					2	100	97
		20.2-36.6	Siltstone	Quartzite Inclusions	3	100	89
					4	100	100
B-27	19.8	19.8-31.0	Limestone	Quartzite Inclusions Some Interbedded Siltstone	1	98	98
					2	100	100
		31.0-39.8	Siltstone	Few Limestone Partings	3	95	80
					4	100	88
B-28	16.9	16.9-26.9	Siltstone	Mud Seam in top 2 feet Limestone Partings	1	97	93
					2	95	68
B-30	16.9	14.4-24.4	Siltstone	Mud Seam Some Interbedded Limestone	1	95	92
					2	95	92
SW-1	15.0	15.0-17.4	Limestone		1	100	90
					2	100	87
		17.4-40.0	Siltstone	Quartzite Inclusions	3	100	85
					4	90	90
					5	52	52
SW-5	25.0	20.5-20.9	Limestone		1	95	84
					2	100	88
		20.9-45.5	Siltstone	Few Limestone Layers Quartzite Inclusions	3	93	77
					4	100	83
					5	90	87

Table 3. Bedrock Conditions Observed							
Boring No.	Auger Refusal Depth (ft)	Strata Depth (ft)	Bedrock Strata	Notes	Run	Recovery (%)	RQD (%)
SW-7	28.9	28.9-29.9	Limestone		1	97	88
					2	100	78
		29.9-53.9	Siltstone	Few Layers of Limestone Quartzite Inclusions	3	97	93
					4	100	100
					5	97	87
SW-8	21.4	21.4-21.9	Mud Seam		1	68	45
		21.9-41.9	Siltstone	Layers of Hard Interbedded Chert Shale Partings	2	100	100
					3	100	97
					4	92	83

5D GEOPHYSICAL STUDY

A Geophysical Survey was requested to help identify any Karst related activity as well as Soil Resistivity parameters. As requested we performed an Electrical Resistivity (ER) survey, a Multichannel Analysis of Surface Waves (MASW) survey, and a Soil Resistivity survey at requested locations across the site area.

Based on the ER profiles, the low-resistive surface depression is likely associated with higher resistive, less porous, and less permeable material such as chert, dolomite, indurated limestone, or dry siltstone. Furthermore, this area may act as an aquitard, resulting in overburdened soils having higher moisture content and possibly pooled surface water. A low-resistivity anomalous area is present within the bedrock unit in a few of the profiles. This anomalous area is interpreted to likely be the result of a zone of fracturing or enhanced permeability.

We coordinated with S&ME to create a confirmatory drilling plan based upon the results of the ER survey, as well as our surficial observations. We performed 8 borings for the confirmatory drilling (labeled B-101 through B-108). Rock depths were observed as being normal relative to the rock depths in the surrounding borings. Additionally no dark stained, sandy, or organic laden soils were observed near the soil/rock interface. Soils did have increased moisture contents near the soil/ rock interface, but moisture contents varied greatly across the site in general.

6 LABORATORY TESTING

Laboratory tests were performed on selected recovered samples from our borings. Detailed descriptions of these tests and the results of our testing are included in the Appendix. Tests performed included:

- Natural moisture contents
- Atterberg limits tests
- Percent fines analyses
- Full Gradation Analyses (including hydrometer)
- Unconfined compressive strength (soil)
- Unconfined compressive strength (rock)
- Specific gravity
- Standard Proctor Compaction
- Swell Pressure Test
- In-situ Permeability Tests (from Shelby tube samples)
- Thermal Resistivity
- Chemical Analyses
  - pH
  - Soluble Sulfates
  - Chloride Ion
  - Electrical Resistivity
  - Redox Potential
  - Sulfides

GEOTECHNICAL DISCUSSION AND RECOMMENDATIONS

7 DISCUSSION-GEOTECHNICAL ISSUES

Based on our experience with similar projects and the conditions observed during our subsurface exploration, we believe that this site can be adapted for the proposed construction.

However ***the project budget should take into account specialized earthwork*** because of observed soft/wet conditions and high plasticity soils (CH and MH). The primary geotechnical concerns are:

- Previous Site Development
- Thick Topsoil/Till Zone
- Silty Soils
- Wet Soils/Settlement Concerns
- Possible Expansive Soils
- Karst Geology

The following sections discuss each issue. However, recommendations to address the issues are contained in later sections of the report.

7A PREVIOUS SITE DEVELOPMENT

The project site is currently occupied by farm land. There is an existing barn near the northwest corner of the proposed development area. Although not encountered in our borings, expect that old fill and deleterious materials will be encountered during construction. Your budget should include a contingency for the remediation of any encountered old fill and deleterious material as well as utility relocations.

7B THICK TOPSOIL/TILL ZONE

Topsoil and root zone was encountered at all of our borings. The depth of the topsoil varied from 5 to 18 inches. Thus, it is likely that thick topsoil will be encountered across the majority of the project site. As previously discussed, Till Zone underlies the topsoil. The Till Zone consists of natural clays underlying the topsoil that are generally dark stained from water infiltration (topsoil appearance). The Till Zone has less organic content (generally 3 to 5 percent) and is generally silty. The Till Zone may be difficult to discern from the overlying topsoil and may be over cut/ wasted when it may not be necessary. Till Zone typically fails proofroll and foundation inspections. Till Zone may be reused for engineered fill, but may be more difficult to achieve the required compactive effort. A qualified CSI geotechnical engineer should be present during site stripping to ensure that adequate (but not excessive) topsoil removal is performed.

7C SILTY SOILS

Our experience in the area, as well as published site geology, and our laboratory testing indicate silty soils present at the site. Nine (9) full grain size analyses (including hydrometers) have been performed. Silt contents were measured between 23.1 and 59.8 percent. Silty soils are prone to degradation and become highly unstable during wet periods of the year and/or under heavy construction traffic. Our support trucks experienced significant difficulty traversing the site during the drilling phase of the project when the soils were wet.

Care must be taken and exercised during earthwork and in areas where construction traffic is expected to minimize repetitive traffic one there site soils. The repetitive traffic will cause the soils to become unstable; therefore, filling operations should only use enough comparative effort to achieve stability and job site requirements for compaction. Also, undercutting and recompaction of these soils usually proves futile (the soil matrix is usually degraded).

During wet periods of weather, undercutting and remedial efforts should be expected. Construction excavations or earthwork operations should be avoided during wetter seasons of the year. Again, recompaction of silty soils is problematic and other means of stabilization should be considered.

7D WET SOILS/SETTLEMENT CONCERNS

As previously discussed, groundwater (water on the SPT sampler) was observed in 25 of our 39 borings at depths ranging from 6.8 to 20.0 feet. We performed 118 moisture content tests on representative samples for this project. *Of the 118 samples tested, 57 were measured as wet (beyond 30 percent moisture content).* The moisture content for the wet samples ranged from *30.0 to 71.5 percent at depths ranging from 1.5 to over 14 feet*. Please note that the soft/wet zones were erratic around the site. There was not a particular horizon or area that the soft/wet zones were observed.

The depths and high moisture contents often intersect with anticipated foundation elevations. These soils will create inconsistent bearing conditions and likely increase the risk of foundation settlement, particularly differential settlement. Remedial efforts such as undercutting the soft/wet soils and replacing with engineered fill, geogrid/stone stabilization, ground improvement techniques such as Geopiers, or deep foundations will likely be necessary for structures/ foundations that have heavy loads or low tolerance for settlement.

The observed soft/wet conditions will likely increase the workability of the soil and difficulty of the project earthwork. Failing proofrolls during construction for subgrade approval prior to engineered fill placement are likely. Utilizing granular fill as well as ground improvement techniques such as lime/cement stabilization may be necessary for mass grading activities. Otherwise remedial efforts such as undercutting and replacing will likely be increased as well as delays in schedule.

7E POSSIBLE EXPANSIVE SOILS

Atterberg limits testing was performed on 33 representative residual soil samples. Of the 33 tested samples, 11 samples measured as Fat Clay (CH) soils, and 4 of the tested samples measured as Elastic Silt (MH) soils. Our laboratory testing indicated Plasticity Indices (PI's) for the Fat Clay soils measured between 24 and 56 percent. The laboratory testing indicated PI's for the Elastic Silt soils measured between 28 and 37 percent. Please reference Table 4 as well as our Boring Logs , and Laboratory Summary for specific details.

Table 4: Summary of Atterberg Limits							
Sample No.	Depth (ft)	Sample Type	USCS Classification	Liquid Limit	Plastic Limit	Plasticity Index	Swell Pressure (psf)
B-4	0.0	SS	CL	38	22	16	
B-4	1.5	SS	CH	56	26	30	
B-4	3.0	BULK	CH	52	26	26	
B-4	6.5	ST	MH	70	36	34	
B-4	11.5	SS	MH	64	36	28	
B-5	3.0	BULK	CH	55	26	29	
B-9A	3.0	ST	CH	65	30	35	
B-13	1.5	SS	CL	46	23	23	
B-13	6.5	ST	CL	45	21	24	
B-13A	4.0	ST	CL	46	24	22	
B-16	4.0	SS	CH	94	38	56	1750
B-16	6.5	SS	ML	43	28	15	
B-17	1.5	SS	CL	31	19	12	
B-17	4.0	SS	CL	30	19	11	
B-17	9.0	ST	CH	69	29	40	
B-18	3.0	BULK	CL	29	19	10	
B-20	3.0	BULK	CH	56	29	27	
B-21	3.0	BULK	CL	49	25	24	
B-23	1.5	SS	CL	25	17	8	
B-23	4.0	SS	CL	33	19	14	
B-23	6.5	SS	CH	57	27	30	
B-23A	3.0	ST	CL-ML	26	21	5	
B-24A	2.0	ST	CL	40	23	17	
B-27	1.5	SS	CL	33	22	11	
B-27	4.0	SS	ML	47	28	19	
B-27	9.0	SS	ML	NP	NP	NP	
INF-1	3.0	BULK	CH	52	28	24	
INF-1	6.0	SS	MH	74	37	37	
INF-2	4.0	SS	MH	71	36	35	
SW-1	0.0	BULK	CL	32	21	11	

Table 4: Summary of Atterberg Limits							
Sample No.	Depth (ft)	Sample Type	USCS Classification	Liquid Limit	Plastic Limit	Plasticity Index	Swell Pressure (psf)
SW-2A	2.0	ST	CL	34	21	13	
SW-7	4.0	SS	CH	76	34	42	
SW-7A	2.0	ST	CH	71	32	39	
SW-8	3.0	BULK	CL	38	22	16	

Soils with a PI greater than 50 are generally highly susceptible to volume change. Soils with a PI above 30 percent can have a tendency to shrink/swell with changes in moisture content. Additionally, we performed a swell potential test on a bulk sample collected from near B-16 and measured a swell pressure of **1750 psf**. This measured swell pressure of **1750 psf** could easily crack and heave a concrete slab, and potentially heave a shallow spread foundation bearing on soil, or mat foundation bearing on soil. Table 5 summarizes the soil types susceptibility to swell potential. Additional results are located in the Appendix of this report.

Table 5: Summary of Swell Pressure Risk by Soil Type			
Soil Type	Number of Tested Samples	PI Range (%)	Susceptibility to Swell Potential
Lean Clay (CL)	15	8 to 24	Low
Fat Clay (CH)	10	24 to 56	Low to Very High
Silt (ML)	3	Non Plastic to 19	Low
Elastic Silt (MH)	4	28 to 37	Low to Medium
Silty Clay (CL-ML)	1	5.0	Low

Shrinking and swelling of foundation and bearing soils are generally not as severe in the central Kentucky area as in other areas because long periods of excessively wet or dry weather do not normally occur. However, if site grading takes place during the dry summer or fall months, significant drying of the exposed subgrade soils may occur. If these soils re-saturate after completion of construction, structural distress may be experienced. Also, moisture content loss typically results in settlement of soil supported structure components. Where the soil moisture fluctuates, movement may be ongoing throughout the structure's life, resulting in deterioration and structure distress. Strength loss may also affect structure components, but is more likely to adversely affect parking lots - especially flexible asphalt pavements. Accumulation of water beneath pavement followed by repeated traffic loads, may result in the failure of both pavement and the subgrade materials. Therefore, the volume change potential of the soils should be considered for this project.

Generally, methods to control the adverse effects of these soils include soil modification methods (i.e.- undercut/replace, lime stabilization, etc.), providing efficient drainage around the structure and pavements, geogrid reinforcement of the pavement subgrade, and implementing more stringent fill specifications for new fill placement. Please reference the later sections of this report for specific details pertaining to these highly plastic soils.

7F KARST GEOLOGY

Karst is common in this area of Kentucky and typically includes, sinkholes, caverns, erratic/ irregular (pinnacle and rock channels) bedrock surfaces, and "floater" type boulders or rock cobbles in the native soil overburden. There was no Karst related activity observed in our auger cuttings, soil samples, or rock core. However, due to geologic formations in the area, there is an inherent risk associated with Karst-related issues for this project site. It should be noted that slots/troughs in the bedrock are common in Karst terrain.

An in-depth Karst study was performed for this exploration. The results of this study are discussed in the *Geophysical Section* of this report. The results suggest that although there are some surficial dropouts present at the site, no open holes in the bedrock were present. Again, this does **not** guarantee that Karst related issues will not be encountered during construction. The geologic mapping also did not show mapped sinkholes within ½ mile of the site. However, mud seams, core water loss, and some small void spaces were observed during coring operations. Also, we encountered relatively thick weathered rock zones in some areas. This site is in an area underlain by rock with a medium risk for Karst potential. Thus, due to geologic formations in the area there is an inherent risk associated with Karst-related issues for this project site.

Based on our knowledge of the area geology, sinkholes could be exposed during grading activities and foundation and utility construction. Detailed site proofrolling and foundation observations are frequently utilized in an attempt to locate incipient soil dropouts. Sinkholes must be evaluated and treated on an individual basis. A CSI geotechnical engineer should be retained for remediation recommendations if a sinkhole is exposed during construction. Treatment of depressions will likely involve monitoring by the geotechnical engineer during earthwork operations to observe indications of sinkhole throats and conduits after stripping of topsoil from the site and soil cutting activities are complete.

8 EARTHWORK

Earthwork will be difficult for this project. Historically, more change orders (in total number and costs) occur during the earthwork portion of construction than in almost any other part of the project. Further, the site preparation phase of construction always affects the future performance of project structures. Add into this, the fact that earthwork is the portion of work most influenced by wet weather and unknown conditions and time-wise, this section of the report could be the most important to prevent and minimize delays and costs during construction and for the life of the project.

The observed on-site soils are silty. Silt contents were measured between 23.1 and 59.8 percent. Silty soils are prone to degradation and become highly unstable during wet periods of the year and/or under heavy construction traffic. Our support trucks experienced significant difficulty traversing the site during the drilling phase of the project when the soils were wet.

Thus, we expect that construction equipment will have issues traversing, and placing on-site soils.

As previously discussed, groundwater (water on SPT sampler) was observed in 25 of our 39 borings at depths ranging from 6.8 to 20.0 feet. We performed 118 moisture content tests on representative samples for this project. *Of the 118 samples tested, 57 were measured as wet.* The moisture content for the wet samples ranged from *30.0 to 71.5 percent at depths ranging from 1.5 to over 14 feet*.

Atterberg limits testing was performed on 34 representative residual soil samples. Of the 33 tested samples, 11 samples measured as Fat Clay (CH) soils, and 4 of the tested samples measured as Elastic Silt (MH) soils. Our laboratory testing indicated Plasticity Indices (PI's) for the Fat Clay soils measured between 24 and 56 percent. The laboratory testing indicated PI's for the Elastic Silt soils measured between 28 and 37 percent. Special construction considerations will be recommended with respect to the high plasticity soils.

Please review the concerns listed in section 7 prior to reading the following recommendations. If problems occur that the recommendations do not address or do not adequately remedy, please contact CSI as soon as possible.

8A SITE PREPARATION (WORK PRIOR TO FILLING)

- The site should be cleared/grubbed removing all brush, trees, and debris. These materials should be wasted off-site. Trees, shrubs, and their root structures (roots larger than 1/2 inch in diameter) will require removal. The voids left when the root mass is removed will need to be backfilled in accordance with sections 8B, 8C, and 8D;
- All topsoil and organic materials should be removed (stripped) from the construction area and all structural fill areas. These materials should be wasted from the site or stockpiled for use as topsoil in landscape areas. **CSI engineering personnel must be on-site during stripping operations to ensure that adequate (and not excessive) topsoil stripping is performed**;
- The Till Zone should be stripped and may be reused as structural fill;
- Areas ready to receive new fill should be proofrolled (where applicable) with a heavily loaded dump truck (GVW of 80,000 pounds) or similar equipment judged acceptable by a CSI geotechnical engineer.
- The level of proofroll should be determined by a CSI geotechnical engineer on a case-by-case basis.
- Perform the proofrolling after a suitable period of dry weather to avoid degrading the subgrade.
- Areas which pump, rut, or wave during proofrolling may require undercutting or other remedial technique, depending on the location of the area and the use of the area, so the geotechnical engineer should be contacted for guidance.
- Backfill of undercut areas should be performed in accordance with sections 8B and 8C.

- Retain CSI to observe the proofrolling operations and make recommendations for any unstable or unsuitable conditions encountered. This can save time on the construction schedule and save unnecessary undercutting.
- We recommend that site grading should take place between about late April to early November. Earthwork taking place outside this time period will likely encounter wet conditions and weather conditions that will provide little to no assistance with drying the soils.

We recommend that site grading should take place between about late April to early November. Earthwork taking place outside this time period will likely encounter wet conditions and weather conditions that will provide little to no assistance with drying the soils.

8B NEW FILL OPERATIONS

Our laboratory testing indicated that 11 samples measured as Fat Clay (CH) soils, and 4 of the tested samples measured as Elastic Silt (MH) soils. Plasticity Indices (PI's) for the Fat Clay soils measured between 24 and 56 percent. The laboratory testing indicated PI's for the Elastic Silt soils measured between 28 and 37 percent. A remolded swell test was performed on the highest PI soil (CH measured at 56 percent) collected bulk sample and indicated a swell pressure of 1750 psf.

Thus, we recommend using 2 feet of select fill such as densely graded aggregate (DGA) in the top 2 feet of subgrade within the structure footprints (plus a horizontal margin of 5 feet) - OR - Fat Clay (CH) soil can be used to subgrade then treated to 16 inches below slab subgrade with lime stabilization. We expect lime stabilization or select fill will be used in the structure pads or exterior slab-on-grade concrete locations. Lime stabilization may be considered in both the power block and switch yard areas. However, the Owner must understand and accept the risk (i.e. - possible increased maintenance costs, shorter pavement life span, damage such as cracking) if remedial efforts are not made.

Lime stabilization methods could be implemented in order to reduce the shrink/swell potential of on-site swelling clay soils. Soil stabilization is the permanent physical and chemical alteration of soils to enhance their physical properties. Stabilization can increase the shear strength of a soil and/or control the shrink-swell properties of a soil, thus improving the load-bearing capacity of a sub-grade to support floor slabs, pavements, or foundations. Proper design and testing is an important component of any stabilization project. This allows for the establishment of design criteria as well as the determination of the proper chemical additive and admixture with similar projects, we recommend that 5 percent lime (or kiln dust) be added to the final 16 inches of soil below subgrade elevation in the new structure area (and to at least 5-feet outside the site improvements in each direction). The lime or kiln dust should be placed using a lime spreader machine. Other equipment involved in the stabilization processes could also include: soil mixers (reclaimers), portable pneumatic storage containers, water trucks, deep lift compactors, and motor graders.

In-place mixing is usually used to add the appropriate amount of lime or kiln dust to soil, mixed to an appropriate depth. Pulverization and mixing is used to thoroughly combine the lime (or kiln dust) and soil. For high plasticity clays, preliminary mixing may be followed by 24 to 48 hours (or more) of moist curing, followed by final mixing. Proper compaction is necessary for maximum development of strength and durability.

Note that an open graded stone such as No. 57 stone is **not** recommended for the select fill due to Karst potential in the area. If off-site fill material is imported to the project site, representative samples should be obtained of the proposed fill material to determine the moisture-density relationship and overall classification of the material. Select fill may also be crushed stone (DGA, non-spec DGA, crushed shot rock, or screenings).

Untreated on-site soil can be used as structural fill material in the building pads (at elevations under 2 feet below subgrade elevation as previously mentioned), in pavement areas, or non-structural areas. However, more stringent compaction and moisture conditioning must be implemented.

Expansive soils (on-site) can be used as fill material in deep fills. However, we recommend using lean clay (CL), screenings, or crushed stone (DGA) in the top 2 feet below subgrade beneath any concrete slab-on-grade or mat foundations. **Soils (on-site or off-site) with a plasticity index (PI) greater than 25 percent should not be used for select fill**. If off-site fill material is imported to the project site, representative samples should be obtained of the proposed fill material to determine the moisture-density relationship and overall classification of the material. Note that an open graded stone such as No. 57 stone is **not** recommended for the select fill due to the observed silty soils as well as the Karst potential in the area.

After the subgrade has been approved to receive new fill, the fill may commence with the following procedures and guidelines recommended:

- Place fill in maximum 8-inch thick loose lifts;
- Fill lifts should be compacted to at least 98 percent of the soil's maximum dry density (ASTM D698) and maintain the moisture content of compacted fill within 2 percent of optimum moisture;
- Off-site soils with a plasticity index (PI) of greater than 25 percent should not be used as new fill;
- Fill compaction requirements should be extended to at least 5 feet outside the structure footprints and pavement areas;
- Maximum particle size of the soil should be limited to 4 inches in any dimension with no concentrations of large fragments;
- Density testing should be performed as a means to verify percent compaction and moisture content of the material as it is being placed and compacted;
- Observation of fill "stability" is also critical, so it is recommended to observe the operation of the filling equipment traversing over the new fill to document movement (similar to proofrolling);

- Soils should not be “overcompacted” and construction traffic should be kept to minimum to assure compaction is achieved and that the soil is not allowed to “break down”;
- Retain a representative of CSI to observe and document fill placement and compaction operations.

8C NEW FILL OPERATIONS - GRANULAR FILL

We expect that any imported fill for the project will likely be granular fill, either consisting of DGA, non-spec DGA, or possibly shot rock fill. Please note that we do <u>not</u> recommend the use of an open graded crushed stone (such as No. 57 stone) as structural fill for this project. DGA can be used as a cushion between the bedrock and bottom of foundations in areas that require a cushion for “soil” bearing foundations. CSI personnel are required to be on-site full time to monitor fill placement and ensure compaction and moisture content meet our specifications. In some instances, a proofroll may be the basis for approval if density testing results do not generate meaningful results.

<u>DGA/Non spec DGA</u>

As previously discussed, we expect DGA/Non spec DGA to be imported for this project. After the subgrade has been approved by CSI personnel to receive new fill, the fill may commence with the following procedures and guidelines recommended:

- Place fill in maximum 8-inch thick loose lifts;
- Structure pad fill compaction requirements should extend 5 feet beyond the perimeter footing line;
- Fill lifts should be compacted to at least 95 percent of the materials's maximum dry density (ASTM D 698);
- Maintain the moisture content of the compacted granular material within an acceptable range. When using dry granular material, this may not be possible, thus a CSI geotechnical engineer should be consulted for direction;
- Density testing should be performed as a means to verify percent compaction and moisture content of the material as it is being placed and compacted. When using dry granular material, the basis for approval should be determined by a CSI geotechnical engineer;
- Retain a representative of CSI to observe and document fill placement and compaction operations.

<u>Shot Rock Fill</u>

Shot rock fill could be selected for use beneath the structure areas (not expected). If properly placed and compacted, shot rock fills can offer great strength with minimal settlement of the rock mass itself. This is due to rock-to-rock contact creating the strength without substantial movement due to typical loading conditions.

Suitable shot rock fill is considered to be composed of clean (i.e., soil content less than 10%), excavated durable bedrock with a mixed particle-size range to enable a smooth blend to compact into a stable fill mass. Our experience indicates that the presence of soil in the rock fill tends to cushion the rock pieces, resulting in reduced fill strength. Thus, mixtures should not be used within the structure footprint or within the top 2 feet of pavements.

The following criteria are recommended for shot-rock fill construction:

- The subgrade must be free of ponded water and stable prior to and during rock fill placement;
- Prior to rock fill placement, the subgrade should be deemed stable by a CSI geotechnical engineer;
- Limit the maximum particle thickness to about 18 inches in any dimension to facilitate a maximum 18-inch-thick lift thickness. Occasional 24 inch pieces may be used (less than 18 inches thick). Regardless, larger pieces should be "seated" and not allowed "rock" in-place;
- Considerations for site utility and other shallow excavations should be made when sizing the rock fill;
- All rock fill should have adequate rock fines to effectively "choke" the larger rock pieces filling all voids or open spaces. The larger rock pieces should lie flat and not overlap each other. The percentage of soil in the fill should be limited to a maximum of 10 percent (minimal visible to the naked eye);
- Adequate compaction of shot rock fill normally requires several passes of heavy construction equipment in two directions on the fill surface. The rock fill material should be bladed, back-bladed, and tracked to produce a fill mass with minimal nesting of large rock fragments and/or voids;
- We recommend that in addition to bulldozers and dump trucks, that a heavy self-propelled sheepsfoot roller (similar to a CAT 815 or 825) be used to assist in compaction of the shot-rock fill mass;
- Positive drainage of the rock fill layer must be provided to prevent water accumulation in any layer of the rock fill mass;
- Shot-rock fill should not be used as backfill material in utility trenches or as backfill against below-grade walls/structures.

8D BACKFILL OPERATIONS (FOUNDATION WALLS, UTILITIES, ETC.)

These materials are placed in more confined areas than mass earthwork materials or pavement materials and therefore cannot be placed in full compliance with sections 8A and 8B. The following are general recommendations for backfill areas:

- Fill lift thicknesses will vary dependent on compaction equipment available and material types, but in no case should exceed 8 inches;
- For crushed stone/aggregate backfills in trenches or wall backfill and when using smaller compaction equipment (such as a plate compactor or trench compactor or similar) the lift thickness should not exceed 4 inches;
- Do not use open graded crushed stone (such as No. 57 stone) for use as backfill.

8E GENERAL SLOPE RECOMMENDATIONS

A detailed slope stability analysis was beyond the scope of this report. However, we recommend any permanent cut/fill slopes not exceed a 3H:1V slope. For mowing and maintenance considerations a 4H:1V or flatter slope may be more desirable. Toes of slopes should have drainage ditches directing water away from the areas. Compaction of soil fill near the edge of a slope is generally difficult due to poor confinement. We recommend fill slopes be constructed steeper than the above recommendations and then cut the resulting slope back to the design slope. Fill placed on side slopes must be placed in horizontal lifts starting at the toe of the slope while securely benching the new fill material into the existing slope. Continue to place the fill in horizontal lifts until final proposed grade is reached.

8F GENERAL NOTES

- For all earthwork operations, positive surface drainage is prudent to keep water from ponding on the surface and to assist in maintaining surface stability.
- The surface should be sealed prior to expected wet weather. This can usually be accomplished with rubber-tired construction equipment or a steel-drum roller.
- If any fill placement problems occur, CSI should be retained to provide additional recommendations, as needed.

9 SITE DRAINAGE

As the on-site soils are silty, any ponding water will degrade the subgrade conditions, and make traversing the site with construction equipment difficult. During construction, water should not be allowed to pond in excavations or undercutting will likely be required. Additionally, allowing water to pond in excavations greatly increases the risk for activating latent Karst features. During the life of the project, slope the subgrade and other site features so that surface water flows away from the site structures. Structure roof drains (if any) should be piped away to proper storm drainage systems. Irrigation systems should not be installed near structures to avoid repeated wetting of the on-site soils beneath structure foundations due to the risk of shrink/swell potential associated with the on-site fat clay (CH) soils. Diversion ditches should be used to keep surface water from accumulating at or near site structures.

For excavations during construction, most free water could likely be removed via sump pumps and open channel flow (ditches) at or near the source of seepage. If normal dewatering measures prove insufficient due to shallow water conditions, CSI should be retained to provide recommendations on the issue.

Wet conditions are possible in excavations on-site during site construction and karst features such as springs are common to the underlying geology. Daylighting wet zones for drainage or the use of french/rock drains may be prudent or cost effective methods of de-watering wet areas of the site. Pumping with long-flexible hoses day-lighted hundreds of feet away or other types of sumping could also be utilized if necessary. CSI should be retained to observe all excavations in locations of springs or other water-bearing features.

10 FOUNDATIONS

Based on project information and our findings, we expect possible foundations to consist of shallow spread foundations bearing on soil, mat foundations bearing on soil, foundations bearing on Geopier improved soil, or drilled shaft foundations advanced into bedrock could be possible for this project. As such, each of these foundation options are discussed separately. If there are any changes in the project criteria or structure locations, CSI should be allowed to review the recommendations to determine if any modifications are required.

10A SHALLOW SPREAD FOUNDATIONS ON SOIL

Shallow spread footings bearing on soil may be sized using a **maximum allowable bearing pressure of 2,500 pounds per square foot (psf) with a minimum Factor of Safety of 3**. Foundations should bear on the stiff or better residual soil, or newly placed engineered fill.

If soft/wet soil conditions are encountered during foundation excavations, the soil should be undercut to stiff or better residual soils. If excessive undercutting (2 feet or greater) is encountered during foundation undercutting, a CSI Geotechnical Engineer should be consulted prior to additional undercuts. Backfill should then consist of dry DGA (with possible geogrid stabilization) or flowable fill (greater than 300 psi).

Additional design considerations for spread foundations bearing directly on stiff or better residual soil or newly placed fill are outlined as follows:

- Design all footings with a minimum 24 inches width;
- All footing bottoms (interior and exterior) should bear at least 36 inches below finished exterior grading (due to encountered swelling expansive soils);

- Do not use thickened slab sections or turned-down edges to support load bearing walls;
- Include control joints at suitable intervals in the walls of structures and in areas where changes in support from native soil to fill are anticipated, to help accommodate differential foundation movements.

A detailed settlement analysis was beyond the scope of this exploration. However, based on the expected structural loads, the anticipated behavior of soil types encountered during field activities, and our experience with similar projects, we expect that total settlements will not exceed 1-inch, and that differential settlements will not exceed ½-inch along continuous footing distances of 30 feet or less. We recommend the structures be designed to accommodate these magnitudes of total and differential settlements. Please note that there were zones of soft/wet soils. If any pockets of the soft/wet zones are encountered during foundation excavations, they should be remediated during the excavation. Lateral resistance for sliding should be considered 0.3.

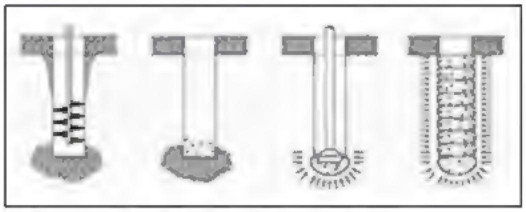
10B SHALLOW FOUNDATIONS ON SOIL - CONSTRUCTION NOTES

Any soils can lose strength if they become wet, so we recommend the foundation subgrades be protected from exposure to water. For foundation construction, we also recommend the following procedures.

- For soils that will remain exposed overnight or for an extended period of time, place a "lean" concrete mudmat over the bearing areas. The concrete should be at least 4 inches thick. Flowable fill concrete or low-strength concrete is suitable for this cover, as conditions allow.
- Disturbed soil should be removed prior to foundation concrete placement;
- Foundation bearing conditions should be benched level;
- Areas loosened by excavation operations should be recompacted prior to reinforcing steel placement;
- Loose soil, debris, and excess surface water should be removed from the bearing surface prior to concrete placement;
- Retain a CSI geotechnical engineer to observe all foundation excavations and provide recommendations for treatment of any unsuitable conditions encountered.

10C FOUNDATIONS ON GEOPIER IMPROVED SOIL

Geopier improved soil elements increases the bearing capacity of the soil as well as controls settlement given the soft/wet/silty conditions observed across the site. Any elements that have heavy loading, or particular settlement concerns such as large mat foundations should be constructed over geopier reinforced soil to reduce the chances of settlement induced damage. Geopiers increase lateral stresses in the soils surrounding the piers by producing significant lateral pre-straining and pre-stressing of the soils through a high energy compaction process. The elements are constructed by excavating drilled shafts which are between 24 and 36 inches in diameter. Well graded aggregate is placed into the excavation in approximately 1 foot thick lifts. A vertical impact ram is then driven down into the top of the aggregate, which densifies the aggregate vertically and forces the aggregate laterally into the surrounding soil matrix. The installation process is summarized in the following Figure 9:



Step 1: Excavate drilled shaft to design depth*
Step 2: Place aggregate into excavation
Step 3: Compact aggregate into 1 foot or less lifts
Step 4: Continue steps 2 and 3 until bottom of foundation elevation is reached

***Please note that if large hard objects such as boulders or concrete from previously razed structures is encountered, the Geopier™ contractor will likely require remediation of the soils before installation of the Geopier™ can be performed.**

Figure 9: Typical Geopier™ Installation Process

Shallow spread foundations bearing on Geopier™ remediated soil are suitable for the proposed project. Shallow spread footings (continuous, isolated, or combination thereof) may be sized using a maximum allowable bearing pressure of 4,000 to 5,000 pounds per square foot (psf). This design value should be confirmed by Geopier™ before the foundation designs are finalized.

Additional design considerations for project foundations are outlined as follows:

- Design all footings with a minimum 24 inches width;
- All footing bottoms should bear at least 36 inches below finished exterior grading (Due to expansive soils observed on site);
- Include control joints at suitable intervals in the walls of structures to help accommodate differential foundation movements.

10D GEOPIER™ REMEDIATED - CONSTRUCTION NOTES

Any material can lose strength if they become wet, so we recommend the foundation subgrades be protected from exposure to water. For foundations construction, we also recommend the following procedures:

- Disturbed material should be removed prior to foundation concrete placement;

- Foundation bearing conditions should be benched level;
- Areas loosened by excavation operations should be recompacted prior to reinforcing steel placement;
- Loose material, debris, and excess surface water should be removed from the bearing surface prior to concrete placement;
- Retain a CSI geotechnical engineer to observe all foundation excavations and provide recommendations for treatment of any unsuitable conditions encountered.

10E MAT FOUNDATIONS BEARING ON SOIL

We recommend any large mat foundations with loads greater than 1,000 psf be constructed over Geopier improved soil to lower the risk of settlement related issues. For a mat foundation bearing on stiff residual soil or new soil fill, we recommend a design maximum allowable bearing pressure of **2,500 psf** be used for mat foundation design with a Factor of Safety of 3.0. We also recommend a k-value (modulus of subgrade reaction) value of **100 pounds per square inch per inch (pci)** for the design of the mat foundations. The edges of the mat foundation should bear at least 36 inches below finished exterior grading (because of the swelling expansive soils). A allowable coefficient of friction for sliding of 0.3 (with a Factor of Safety of 1.5) can be used when the foundation concrete is poured directly on soil.

10F MAT FOUNDATIONS ON SOIL - CONSTRUCTION NOTES

Any soils can lose strength if they become wet, so we recommend the foundation subgrades be protected from exposure to water. For foundation construction, we also recommend the following procedures.

- For soils that will remain exposed overnight or for an extended period of time, place a "lean" concrete mudmat over the bearing areas. The concrete should be at least 4 inches thick. Flowable fill concrete or low-strength concrete is suitable for this cover, as conditions allow;
- Disturbed soil should be removed prior to foundation concrete placement;
- Foundation bearing conditions should be benched level;
- Areas loosened by excavation operations should be recompacted prior to reinforcing steel placement;
- Loose soil, debris, and excess surface water should be removed from the bearing surface prior to concrete placement;
- Do not use of an open graded crushed stone (such as No. 57 stone) as structural fill for this project;

- Retain a CSI geotechnical engineer to observe all foundation excavations and provide recommendations for treatment of any unsuitable conditions encountered.

10G DRILLED SHAFT FOUNDATIONS

The following sections provide design and construction recommendations for drilled shaft foundations. After the grading plan has been developed, applicable soil depths and depths to top of rock should be interpolated using our data and proposed final grades.

Design Considerations for Rock-Bearing Foundations

The drilled shafts may be sized for an allowable end-bearing pressure of 40,000 pounds per square foot (**40 ksf**) for drilled shafts bearing on siltstone bedrock. This allowable bearing pressure is based on the assumption that the bearing material for each drilled shaft will be observed, evaluated with a test hole, and approved by a CSI geotechnical engineer. The drilled shafts should bear at least 2 feet into siltstone bedrock (rock socket) for end-bearing performance under gravity loading conditions. Please note that we did not encounter any mud seams, void spaces, and core water loss during coring rock activities. Thus, competent bedrock would be defined as rock below any encountered mud seam or void space. We recommend a minimum drilled shaft diameter of 30 inches be used in the design to allow down-hole inspection of the bedrock. Table 6 presents our recommended LPILE design parameters.

Table 6. Drilled Shaft Design Parameters (LPILE)

Description	Allowable Skin Friction (psf)	Allowable End Bearing Pressure with FS = 3.0 (psf)	Allowable Passive Pressure (psf)	Soil Cohesion (psf)	Rock Unconfined Compression Strength (psf)	Strain (ε50)	Lateral Modulus (pci)
0 - 2.0	Ignore	Ignore	Ignore	Ignore	-	Ignore	Ignore
2.0 - varies (Residual Soil)	200	N/A	1,000	1,400	-	0.01	100
varies + (Bedrock)	5,000	40,000	10,000	-	549,000	N/A	N/A

NOTES:

1. The above table assumes unit weights of 120 pcf and 140 pcf for the encountered soil overburden and bedrock, respectively;
2. The upper 2 feet of overburden soil at each location should be ignored due to desiccation.

Additional design considerations for drilled shaft foundations are as follows:

- Skin friction can be applied to resist the uplift by multiplying the side surface area by the full skin friction value and applying the appropriate factor of safety. Neglect the upper 2 feet of the soil overburden for the skin friction calculation;

- Neglect the upper 2 feet of the bedrock (rock socket) for all resistance calculations;

- The allowable uplift capacity of the drilled shaft should be no more than 2/3 of the allowable shaft resistance for axial loading;

- Perform lateral load analyses using the geotechnical parameters provided above. These parameters may be used to perform analyses using LPILE. Some of the parameters may not be required, depending on the version of the program being used. Lateral capacity analysis for foundation elements was beyond the scope of our services and have not been conducted. Rock socket depths as shown in this report may need to be adjusted depending on the lateral capacity requirements or poor quality bedrock;

Rock Excavation

The amount of rock excavation in drilled shafts can have a major impact on the final cost of installed foundations. CSI's experience indicates general drilled shaft construction and delineation of "rock" in the excavation is greatly facilitated if suitable drilling equipment is used. The use of a drill capable of producing at least 500,000 inch·pounds of torque and 35,000 pounds of downward force is recommended. Additionally, CSI recommends that rock be defined as material which cannot be penetrated by a heavy duty earth auger with hardened teeth at a rate in excess of 3 inches per minute.

10H DRILLED SHAFT FOUNDATIONS - CONSTRUCTION NOTES

General Considerations for Construction of Drilled Shafts

- Provide a minimum drilled shaft diameter of 30 inches to reasonably enter the drilled shaft excavation for cleaning, bottom preparation and inspection;
- Clean the foundation bearing area so it is nearly level or suitably benched and is free of ponded water or loose material;
- Install a temporary protective steel casing to prevent sidewall collapse, prevent excessive mud and water intrusion, and to allow workers to safely enter, clean and inspect the drilled shaft;
- Make provisions for groundwater removal from the drilled shaft excavation. Groundwater flow may require the use of special procedures to achieve a satisfactory foundation installation. Concrete placement may require the use of a tremie pipe or concrete pumping equipment;
- Clean the socket "face" prior to concrete placements. Cleaning will require hand cleaning or washing if mud smear forms on the face of the rock. A CSI geotechnical engineer should approve the rock socket surface prior to concrete placement.

10I DRILLED SHAFT FOUNDATIONS - INSTALLATION MONITORING

It is recommended that the drilled shaft construction be observed by a CSI geotechnical engineer. The observation should address the following items:

- Top location within tolerances;
- Correct plan dimensions;
- Plumbness within tolerances;
- Materials excavated agree with borings;
- Statement of bottom cleanliness;
- Construction procedure.

Drilled shafts with diameters of 30 inches or greater are large enough to allow a down-hole inspection of the bearing conditions. At least one, 1½- to 2-inch diameter probe hole must be drilled at least two times the shaft diameter (5 feet minimum) into the bedrock for each drilled shaft due to the possibility of voids or mud seams in the limestone bedrock. These probe holes are usually drilled with a pneumatic percussion drill. Larger diameter probe holes will be allowed; however, they will require filling to the bottom of the drilled shaft elevation with high strength, non-shrink grout.

A CSI geotechnical engineer will check the probe hole using a hooked-end steel feeler rod to assess the rock continuity. If this check indicates a void or a discontinuous/compressible seam in the bedrock, the drilled shaft should be excavated deeper. Additional probe holes may be required by the CSI geotechnical engineer if the results indicate inconsistent bedrock conditions. In these cases, the side friction will need to be calculated. A side friction of 5,000 psf (pounds per square foot) may be used to calculate the generated side friction to support the specific axial load. Significant deviations from the specified or anticipated conditions should be reported to the owner's representative and to the foundation designer.

11 SEISMIC SITE CLASSIFICATION

The latest edition of the Kentucky Building Code (KBC) was reviewed to determine the Site Seismic Classification. Based on our review of geologic data, our experience, and subsurface conditions encountered, and the measured shear wave velocity values ($V_s = 2,125$ *ft/s*) collected in our borings, we recommend a Seismic **SITE CLASS "C"** for foundations bearing on residual soils or new soil fill. We recommend a Seismic **SITE CLASS "B"** for rock bearing foundations socketed into bedrock.

A detailed geotechnical earthquake engineering analysis was not performed since it was beyond the scope of our authorized work. However, based on a review of published literature and our experience with similar subsurface conditions, we believe the potential for slope instability, liquefaction, and surface rupture due to faulting or lateral spreading resulting from earthquake motions is low. However, this potential could be elevated during wet periods of the year unless adequate drainage is provided.

12 GRADE SUPPORTED SLABS

A grade supported floor slab is suitable for the proposed structures provided all new fill is placed as recommended in this report and observed by CSI. We recommend 2 feet of select fill within the structure footprint (plus a horizontal margin of 5 feet) - OR- lime treat the subgrade. We recommend a *Modulus of Subgrade Reaction (k-value)* of 100 pci for the subgrade construction material for the slab areas. Additionally, all soils (residual or new fill) must pass a level of proofrolling recommended by a CSI geotechnical engineer.

The following features are recommended as part of the concrete slab construction:

- Provide isolation joints between the slab and columns along footing supported walls;
- Do not use thickened slab sections or turned-down edges to support load bearing walls;
- Adequate joint patterns (ACI and ICC guidelines) should be used to permit slab movement due to normal settlement, normal subgrade disturbance and material expansion/contraction;
- Place a minimum of 4 inches of compacted dense graded crushed stone beneath the slab to provide a working base. The actual thickness of the crushed stone layer should be based on design requirements;
- Keep the crushed stone or gravel moist, but not wet, immediately prior to slab concrete placement to minimize curling of the slab due to differential curing conditions between the top and bottom of the slab;
- Retain CSI to review the actual subgrade conditions prior to slab construction and make recommendations for any unsuitable conditions encountered.

Note: Slab subgrade conditions are also considered earthwork areas and the recommendations contained in the Earthwork section of the report. See Section 8 of this report for specific details.

13 LATERAL EARTH PRESSURES

We have not been informed if any retaining walls or below grade structures are part of the project at the time of this report. If present, these walls or structures will be subjected to lateral earth pressures due to the backfill behind them. Retaining walls should be designed to provide sufficient drainage at the rear of the wall to relieve hydrostatic pressure. Additionally, we offer the following design criteria for each of the specific wall types:

- We recommend the walls be backfilled using a compacted, open-graded, granular material such as No. 57 stone. The granular material should be clean and free draining. To utilize the following granular material earth pressure values, the granular material must occupy a minimum backfill zone of ⅗ the height of the wall between the back face of the wall and the soil backfill. This minimum 2 foot wide zone starts at the base of the wall and extends the height of the wall to the finished subgrade elevation.

- The No. 57 stone backfill zone should be drained using a perforated pipe placed near the base of the foundation. The perforated pipe should be placed at the lowest elevation where water would accumulate. The perforated pipe should be directed through a solid pipe to daylight, to the storm sewer system, or to a sump/sump pump system;

- A geotextile material (i.e. – filter fabric) must be used as a separator between the granular backfill material and the surrounding soils to prevent soil piping. Please note that the fabric is not required in the structure footprint where granular material is utilized for structural fill.

The following table presents granular backfill, earth pressure design parameters for Equivalent Hydrostatic Pressures (EHP) and Earth Pressure coefficients. The values given assume the backfill surface is level, the backfill is drained, the zone of backfill conforms to the minimum zone size given above, and no surcharge is placed on the backfill. No. 57's are suggested, and the following EHP values assume a unit weight value of 100 pcf.

Table 7. Granular Material Equivalent Hydrostatic Pressures (EHP) and Earth Pressure Coefficients

Condition	EHP (pcf)	Coefficients
Active	30	$K_a = 0.30$
At Rest	50	$K_o = 0.50$
Passive	300*	$K_p = 3.00$
*unfactored		

In the event a **<u>soil backfill</u>** is used for structures (such as vaults), the following table presents soil backfill, earth pressure design parameters for Equivalent Hydrostatic Pressures (EHP) and Earth Pressure coefficients. The values given assume the backfill surface is level, the backfill is undrained, and no surcharge is placed on the backfill. The soil, and the following EHP values assume a unit weight value of 125 pcf.

Table 8. Soil Material Equivalent Hydrostatic Pressures (EHP) and Earth Pressure Coefficients

Condition	EHP (pcf)	Coefficients
Active	49	$K_a = 0.39$
At Rest	70	$K_o = 0.56$
Passive	224*	$K_p = 1.79$
*unfactored		

All temporary slopes should be in compliance with OSHA and any other applicable safety regulations. During construction, temporary slopes should be regularly evaluated for signs of movement or unstable conditions. Soil slopes should be covered for protection from rain, and surface runoff should be diverted away from the slopes.

14 PAVEMENT RECOMMENDATIONS

We were not supplied expected traffic loadings for this project. Based on our experience with similar projects, we expect that the traffic in the light-duty pavement areas will be limited primarily to automobiles. Delivery trucks and an occasional garbage trucks are expected for heavy-duty pavement areas. We also expect light duty pavement will be limited to parking stalls, while heavy duty pavement will be utilized for entrances/exits and drive lanes. Please refer to the recommendations contained in the Earthwork section of this report for subgrade preparation. Again, we do not expect lime stabilization or select fill will be used in pavement areas due to the cost.

Adequate soil/subgrade support is critical for any pavement area. Please refer to the recommendations contained in the Earthwork section of this report for subgrade preparation. Also, prior to stone base placement, areas to be paved with asphalt must be proofrolled at the direction of CSI. Soft or wet areas not "passing" proof roll criteria at that time must be stabilized at our direction.

Adequate drainage and slope of the pavement subgrade and pavement section should be provided to promote adequate drainage. Edges of the pavement should be provided a means of water outlet by extending the aggregate base course through to side ditches or providing drain pipes and weep holes at catch basin walls.

The following pavement recommendations are based on our experience with similar materials and loading conditions. The recommendations are based on the assumption that the soil subgrade will be compacted and/or remediated according to the recommendations contained in this report.

14A ASPHALT PAVEMENT

Typically, pavement design is based on supplied traffic loads and California Bearing Ratio (CBR) values. We understand the truck access areas must be capable of supporting 100,000 equivalent, 18-kip axle loads. Our laboratory testing indicated CBR value of 6.7 and 6.9 percent for the on-site soils. Thus, we used a CBR value of 6 for our pavement design calculations. Additionally, we recommend a Resilient Modulus (M_r) value of 7,200 psi. Generalized pavement designs for light duty and heavy duty pavement are given in Table 7 and Table 8.

Table 9. Light Duty Asphalt Pavement Section	
Pavement Section Component	Thickness (in)
Bituminous Surface Course	1.5
Bituminous Binder Course	1.5
Dense Graded Aggregate (DGA)*	8.0*
**DGA to be placed in 6 inch thick maximum, compacted lifts*	

Table 10. Heavy Duty Asphalt Pavement Section	
Pavement Section Component	Thickness (in)
Bituminous Surface Course	1.5
Bituminous Binder Course	3.5
Dense Graded Aggregate (DGA)*	10.0*
**DGA to be placed in 6 inch thick maximum, compacted lifts*	

The dense graded aggregate (DGA) should be placed and compacted in accordance with Kentucky Department of Highways Standard Specifications, latest edition. The asphalt should be mixed, placed, and compacted in accordance with Kentucky Department of Highways Standard Specifications, latest edition. It is common practice to place the base stone and binder course prior to completion of construction without placing the surface course. It should be noted that repeated passes of heavily loaded construction traffic on the binder course will decrease the service life of your pavement.

14B RIGID PAVEMENT (CONCRETE)

We anticipate reinforced concrete pavement will be used in areas where the pavement is subjected to high stresses may be part of the project design. Prior to stone base placement, we recommend an additional heavy proofroll of the subgrade be performed to verify subgrade conditions. Recommendations for undercutting/repair of the subgrade can be made at that time by a CSI geotechnical engineer.

Again, no expected traffic loadings were supplied to us for this project. As with the concrete slab-on-grade recommendations, we recommend a *Modulus of Subgrade Reaction (k-value)* of 100 pci for material underlying the concrete pavement areas. As such, we recommend a minimum DGA thickness of 8 inches beneath the new concrete pavement and a minimum concrete thickness of 8 inches for new pavement areas. We also recommend that the concrete pavement be reinforced with heavy welded wire fabric or reinforcing steel. For dumpster pads and refuse container pads, the concrete pads should be large enough to accommodate both the refuse container and all axles of the truck.

15 NOTES ON THE REPORT AND RECOMMENDATIONS

We recommend that this complete report be provided to the various design team members, the contractors and the project Owner. Potential contractors should be informed of this report in the "Instructions to Bidders" section of the bid documents. A geotechnical exploration, such as the one we performed, uses widely spaced borings to attempt to model the subsurface conditions at the site. Because no exploration contains complete data or a complete model, there is always a possibility that conditions between borings will be different from those at specific boring locations. Thus, it is possible that some subsurface conditions will not be as anticipated by the project team or contractor. If this report is included or referenced in the actual contract documents, **it shall be explicitly understood that this report is for informational purposes only**. CSI shall not be responsible for the opinions of, or conclusions drawn by, others.

It has been our experience that the construction process often disturbs soil conditions and this process, no matter how much experience we use to anticipate construction methodology, is not completely predictable. Therefore, changes or modifications to our recommendations are likely needed due to these possible variances. Experienced CSI geotechnical personnel should be used to observe and document the construction procedures and the conditions encountered. Unanticipated conditions and inadequate procedures should be reported to the design team along with timely recommendations to solve the problems created. We recommend that the Owner retain CSI to provide this service based upon our familiarity with the project, the subsurface conditions and the intent of our recommendations.

This report is based on the supplied project information, the subsurface conditions observed at the time of the report, and our experience with similar conditions. As such, it cannot be applied to other project sites, types, or combinations thereof. If the Project Information section in this report contains incorrect information or if additional information is available, you should convey the correct or additional information to us and retain us to review our recommendations. Our recommendations may then require modification.

No section or portion of this report (including Appendix information) can be used as a stand alone article to make distinct changes or assumptions. The entire report and Appendix should be used together as one resource.

While this report deals with samples of subsurface materials and some comments on water conditions at the site, no assessment of site environmental conditions or the presence of contaminants were performed.

We wish to remind you that our exploration services include storing the soil and rock core samples collected and making them available for inspection for 30 days. The soil and rock core samples are then discarded unless you request otherwise. Please inform us if you wish to keep any of the obtained samples.

APPENDIX

Site Location Plan

Boring and Sounding Location Plan

Key to Symbols and Descriptions

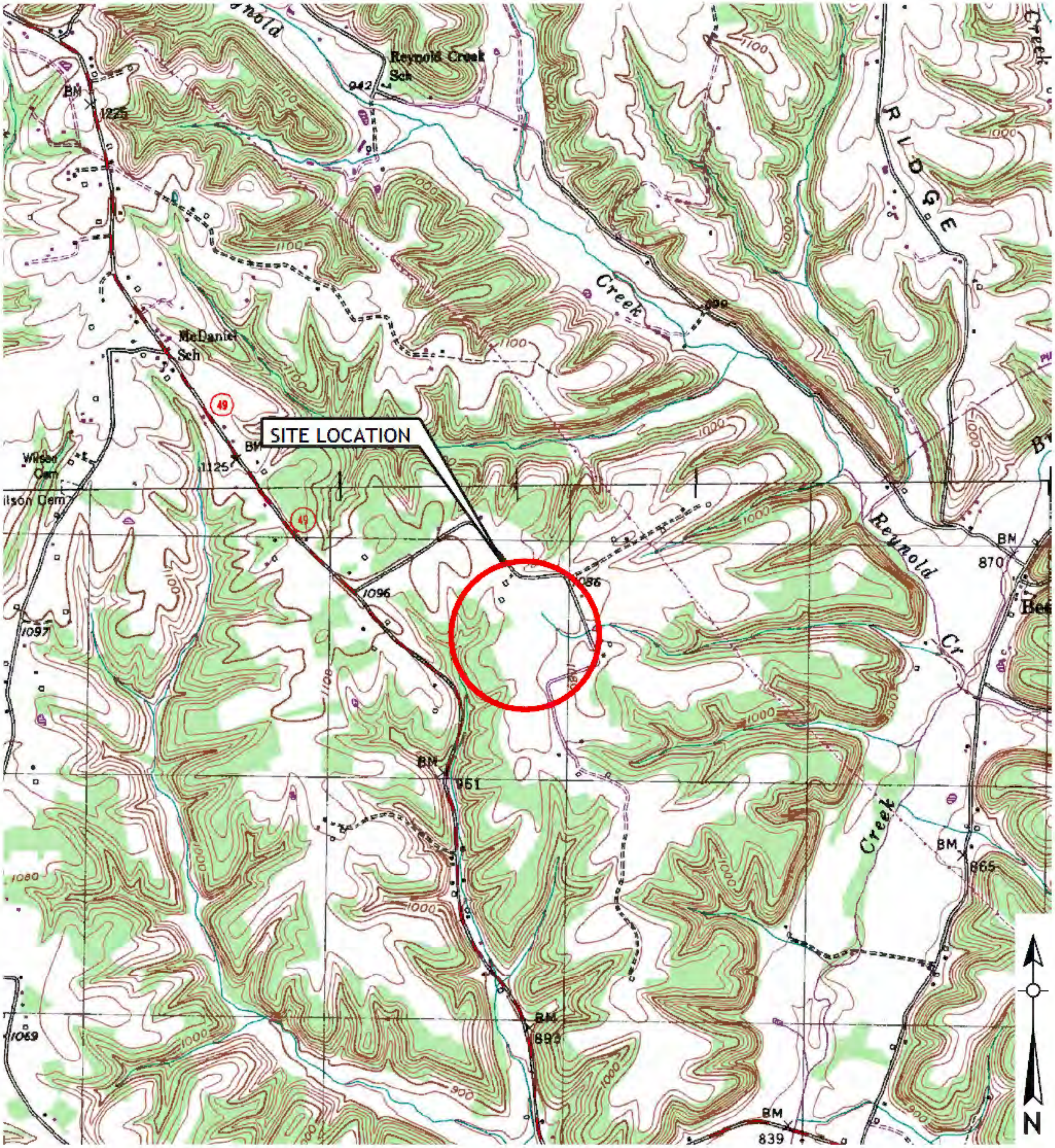
Boring Logs

Field Testing Procedures

Summary of Lab Testing Table(s) and Lab Testing Sheets

Laboratory Testing Procedures

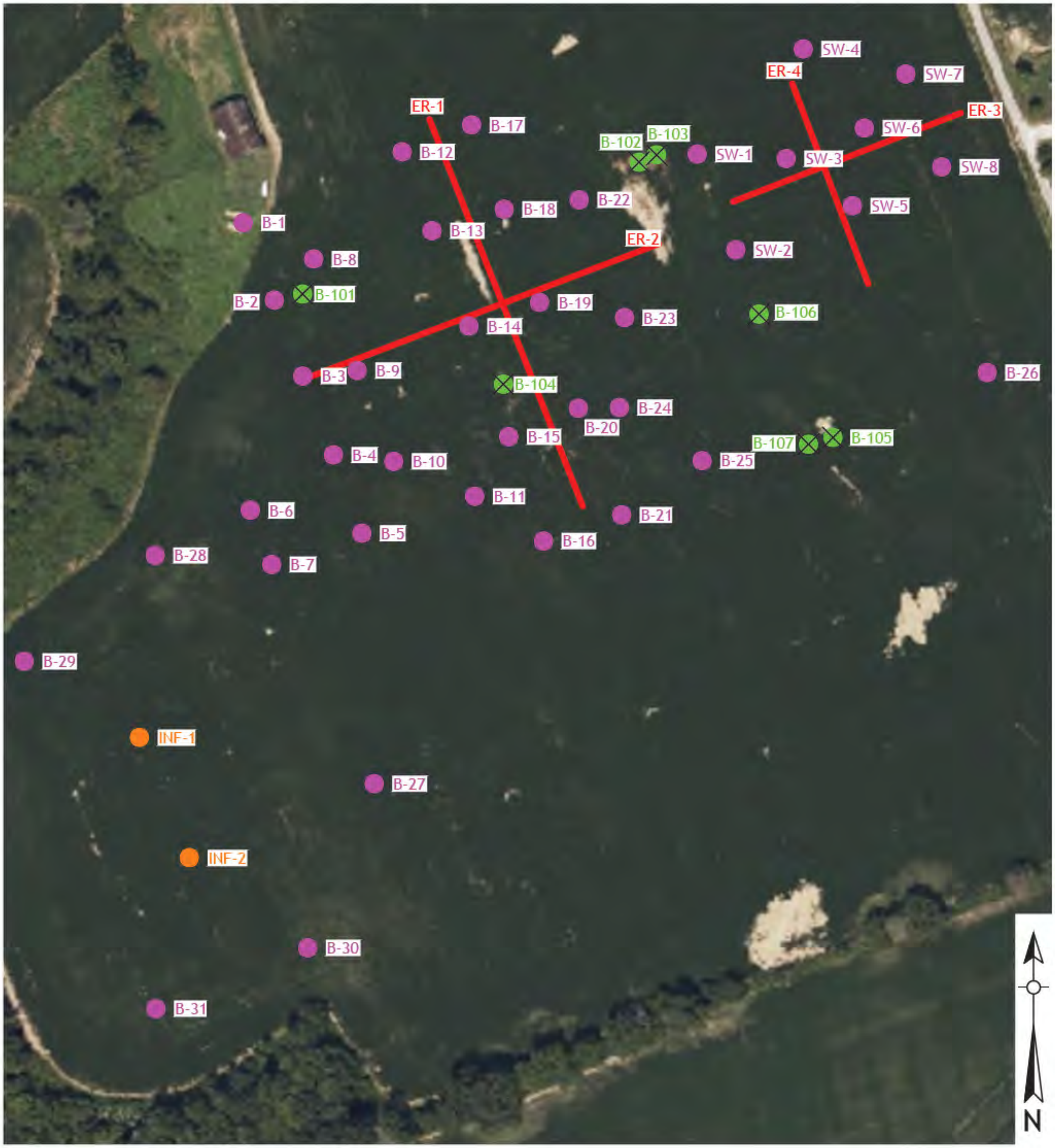
Geophysical Survey



Site Location Plan adapted from USGS Liberty,KY and Ellisburg, KY, Kentucky Topographic Quadrangle map (dated 1952 with Photo Revision in 1987), with further adaptation by CSI personnel.

FOR ILLUSTRATION PURPOSES ONLY

Consulting Services Incorporated of Kentucky 858 Contract Street Lexington, Kentucky 40505 859.309.6021 Office|888.792.3121 Fax www.csikentucky.com	SITE LOCATION PLAN	Project No: LX240063	Drawn By: SM
	EKPC Liberty Liberty, Kentucky	Date: 7/17/2024	Checked By: BH
		Scale: Not To Scale	Drawing No: SLP - 1



Boring Location Plan adapted from provided Aerial View, dated June 4, 2024, and aerial imagery, with further adaptation by CSI personnel.
Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

LEGEND	
HA-XXX	HAND AUGER LOCATIONS
B-XXX	BORING LOCATIONS

FOR ILLUSTRATION PURPOSES ONLY

Consulting Services Incorporated of Kentucky 858 Contract Street Lexington, Kentucky 40505 859.309.6021 Office|888.792.3121 Fax www.csikentucky.com	BORING LOCATION PLAN	Project No: LX240063	Drawn By: SM
	EKP Liberty Liberty, Kentucky	Date: 7/17/2024	Checked By: BH
		Scale: Not To Scale	Drawing No: BLP - 1

Consulting Services Incorporated
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Geotechnical Boring Information Sheet

Sample Type Symbols

- Splitspoon (SPT)
- Shelby Tube
- Grab
- Rock Core
- Auger Cuttings

Surface Symbols

- Topsoil
- Asphalt
- Concrete
- Lean Clay
- Fat Clay
- Glacial Till
- Sandy Clay
- Silt
- Elastic Silt
- Lean Clay to Fat Clay
- Gravelly Clay
- Sandy Silt
- Gravelly Silt
- Sand
- Gravel
- Fill
- Limestone
- Sandstone
- Shale/Siltstone
- Weathered Rock

Samples Strength Descriptors

Cohesive Soils:	**N**
Very Soft	0-1
Soft	2-4
Firm	5-8
Stiff	9-15
Very Stiff	16-30
Hard	31+
Non-cohesive Soils:	
Very Loose	0-4
Loose	5-10
Firm	11-20
Very Firm	21-30
Dense	30-50
Very Dense	51+

Definitions

SPT-"Splitspoon" or standard penetration test. Blow counts are number of drops required for a 140 lb hammer dropping 30 inches to drive the sampler 6 inches.

N-value is the addition of the last two intervals of the 18-inch sample.

Shelby tubes are often called "undisturbed samples". They are directly pushed into the ground, twisted, allowed to rest for a small period of time and then pulled out of the ground. Tops and bottoms are cleaned and then sealed.

Sample classification is done in general accordance with ASTM D2487 and 2488 using the Unified Soil Classification System (USCS) as a general guide.

Soil moisture descriptions are based on the recovered sample observations. The descriptors are dry, slightly moist, moist, very moist and wet. These are typically based on relative estimates of the moisture condition of a visual estimation of the soils optimum moisture content (EOMC). Dry is almost in a "dusty" condition usually 6 or more percent below EOMC. Slightly moist is from about 6 to 2 percent below EOMC at a point at which the soil color does not readily change with the addition of water. Moist is usually 2 percent below to 2 percent above EOMC and the point at which the soil will tend to begin forming "balls" under some pressure in the hand. Very moist is usually from about 2 percent to 6 percent above EOMC and also the point at which it's often considered "muddy". Wet soil is usually 6 or more percent above EOMC and often contains free water or the soil is in a saturated state.

Silt or Clay is defined at material finer than a standard #200 US sieve (<0.075mm) Sand is defined as material between the size of #200 sieve up to #4 sieve. Gravel is from #4 size sieve material to 3". Cobbles are from 3" to 12". Boulders are over 12".

Rock hardness is classified as follows:

Very Soft:	Easily broken by hand pressure
Soft:	Ends can be broken by hand pressure; easily broken with hammer
Medium:	Ends easily broken with hammer; middle requires moderate blow
Hard:	Ends require moderate hammer blow; middle requires several blows
Very Hard:	Many blows with a hammer required to break core

Rock Quality Designation (RQD) is defined as total combined length of 4" or longer pieces of core divided by the total core run length; defined in percentage.

Water or cave-in observed in borings is at completion of drilling each boring unless otherwise noted.

Strata lengths shown on borings represents a rough estimate. Transition may be more abrupt or gradual. Soil borings are representative of that estimated location at that time and are based on recovered samples. Conditions may be different between borings and between sample intervals. Boring information is not to be considered stand alone but should be taken in context with comments and information in the geotechnical report and the means by which the borings are logged, sampled and drilled.

BORING LOG

Consulting Services Incorporated
858 Contract Street
Lexington, Kentucky 40505
Phone: 859.309.6021
Fax: 888.792.3121

BORING: **B-1**

Project Number: LX240063	Weather: Cloudy, 60's	Contractor: Strata Group
Name: EKPC Liberty	*Elevation (ft): 973.6	Drill Rig: CME-550
Client: East Kentucky Power Cooperative	Date Started: 4/1/24	Method: SFA
Location: Liberty, Kentucky	Date Completed: 4/1/24	Hole Size (in): 4
Logged By: B. Bishop, PE	Checked By: B. Hatcher, PE	

Elev. (ft)	Depth (ft)	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
		Topsoil - 6 inches									
972	2	Residual Soil - STIFF with VERY STIFF zone, gray, with orange mottling, with silt, moist	5-5-5 (10)	6							Dry upon completion of soil augering
			6-10-10 (20)	18							
970–968	4–6		4-8-11 (19)	18							
966	8		14-50/1"	5							
964	10		5-6-6 (12)	0							
962	12	Residual Soil - STIFF, brown, with silt, chert fragments, black oxide nodules, and sand, wet	2-4-10 (14)	12							
960	14		4-8-50/0"	8							
958	16	WEATHERED ROCK									
956–952	16–22	Auger Refusal at 16.0 feet Begin Coring at 16.0 feet SILTSTONE - light gray to greenish gray, with few fossils, thin lenses of limestone, chert, few shale lenses starting at 24 feet, and few quartzite inclusions starting at 31 feet		56							No core water loss observed REC (%) - 93 RQD (%) - 65
950–948	24–26			60							REC (%) - 100 RQD (%) - 88
946–944	28			60							REC (%) - 100 RQD (%) - 90

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

Left Photo: Photo of Approximate Boring Location
Right Photo: Photo of Boring

BORING LOG

Consulting Services Incorporated
858 Contract Street
Lexington, Kentucky 40505
Phone: 859.309.6021
Fax: 888.792.3121

BORING: **B-1 (cont.)**

Project Number: LX240063 Name: EKPC Liberty Client: East Kentucky Power Cooperative Location: Liberty, Kentucky Logged By: B. Bishop, PE	Weather: Cloudy, 60's *Elevation (ft): 973.6 Date Started: 4/1/24 Date Completed: 4/1/24 Checked By: B. Hatcher, PE	Contractor: Strata Group Drill Rig: CME-550 Method: SFA Hole Size (in): 4

Elev. (ft)	Depth (ft)	Symbol	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
942	32		Auger Refusal at 16.0 feet Begin Coring at 16.0 feet SILTSTONE - light gray to greenish gray, with few fossils, thin lenses of limestone, chert, few shale lenses starting at 24 feet, and few quartzite inclusions starting at 31 feet(continued)									
940	34				60							REC (%) - 100 RQD (%) - 100
938	36											
936	38				60							REC (%) - 100 RQD (%) - 100
934	40											
932	42		Coring Terminated at 41.0 feet									
930	44											
928	46											
926	48											
924	50											
922	52											
920	54											
918	56											
916	58											
914												

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

Left Photo: Photo of Approximate Boring Location
Right Photo: Photo of Boring

BORING LOG

Consulting Services Incorporated
858 Contract Street
Lexington, Kentucky 40505
Phone: 859.309.6021
Fax: 888.792.3121

BORING: **B-2**

Project Number: LX240063 Name: EKPC Liberty Client: East Kentucky Power Cooperative Location: Liberty, Kentucky Logged By: B. Bishop, PE	Weather: Cloudy, 60's *Elevation (ft): 967.8 Date Started: 4/2/24 Date Completed: 4/2/24 Checked By: B. Hatcher, PE	Contractor: Strata Group Drill Rig: CME-550 Method: SFA Hole Size (in): 4

Elev. (ft)	Depth (ft)	Symbol	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
			Topsoil - 18 inches	4-4-4 (8)	8	19.1						Dry upon completion of soil augering
966	2		Residual Soil - gray, with orange mottling, silt, black oxide nodules, and chert fragments starting at 2.5 feet, damp to wet	3-7-29 (36)	16	14.4				48		
964	4			12-14-14 (28)	18	30.5				68		
962	6		Residual Soil - orange, with chert fragments, sand, silt, wet	5-5-7 (12)	16	67.3						
960	8											
958	10			4-50/4"	4	33.9						
			WEATHERED ROCK									
			Auger Refusal at 10.5 feet									
956	12											
954	14											
952	16											
950	18											
948	20											
946	22											
944	24											
942	26											
940	28											
938												

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

Left Photo: Photo of Approximate Boring Location
Right Photo: Photo of Boring

BORING LOG

Consulting Services Incorporated
858 Contract Street
Lexington, Kentucky 40505
Phone: 859.309.6021
Fax: 888.792.3121

BORING: **B-3**

Project Number: LX240063	Weather: Cloudy, 60's	Contractor: Strata Group
Name: EKPC Liberty	*Elevation (ft): 970.8	Drill Rig: CME-550
Client: East Kentucky Power Cooperative	Date Started: 4/2/24	Method: SFA
Location: Liberty, Kentucky	Date Completed: 4/2/24	Hole Size (in): 4
Logged By: B. Bishop, PE	Checked By: B. Hatcher, PE	

Elev. (ft)	Depth (ft)	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
970		Topsoil - 10 inches	3-3-5 (8)	12							Dry upon completion of soil augering
968	2	Till Zone - 26 inches	4-3-5 (8)	14							
966	4	Residual Soil - VERY STIFF, gray, with orange mottling, silt, chert fragments, black oxide nodules, moist	5-7-10 (17)	18							
964	6		7-10-15 (25)	6							
962	8										
960	10		5-9-8 (17)	8							
958	12		7-9-12 (21)	18							
956	14	WEATHERED ROCK	50/1"	1							
		Auger Refusal at 14.5 feet Begin Coring at 14.5 feet									No core water loss observed
954	16	SILTSTONE - light gray to greenish gray, with few fossils, thin lenses of lime stone, chert, some shale partings at 29.5 feet, and some quartzite inclusion at 32 feet		59							REC (%) - 98 RQD (%) - 98
952	18										
950	20										
948	22			60							REC (%) - 100 RQD (%) - 100
946	24										
944	26			59.5							REC (%) - 99 RQD (%) - 88
942	28										

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

Left Photo: Photo of Approximate Boring Location
Right Photo: Photo of Boring

BORING LOG

Consulting Services Incorporated
858 Contract Street
Lexington, Kentucky 40505
Phone: 859.309.6021
Fax: 888.792.3121

BORING: **B-3 (cont.)**

Project Number: LX240063 Name: EKPC Liberty Client: East Kentucky Power Cooperative Location: Liberty, Kentucky Logged By: B. Bishop, PE	Weather: Cloudy, 60's *Elevation (ft): 970.8 Date Started: 4/2/24 Date Completed: 4/2/24 Checked By: B. Hatcher, PE	Contractor: Strata Group Drill Rig: CME-550 Method: SFA Hole Size (in): 4

Elev. (ft)	Depth (ft)	Symbol	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
940			Auger Refusal at 14.5 feet Begin Coring at 14.5 feet									
938	32		SILTSTONE - light gray to greenish gray, with few fossils, thin lenses of lime stone, chert, some shale partings at 29.5 feet, and some quartzite inclusion at 32 feet(continued)		56.5							REC (%) - 94 RQD (%) - 94
936	34											
934	36				60							REC (%) - 100 RQD (%) - 100
932	38											
930	40		Coring Terminated at 39.5 feet									
928	42											
926	44											
924	46											
922	48											
920	50											
918	52											
916	54											
914	56											
912	58											

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

Left Photo: Photo of Approximate Boring Location
Right Photo: Photo of Boring

BORING LOG

Consulting Services Incorporated
858 Contract Street
Lexington, Kentucky 40505
Phone: 859.309.6021
Fax: 888.792.3121

BORING: **B-4**

Project Number: LX240063	Weather: Cloudy, 50's	Contractor: Strata Group
Name: EKPC Liberty	*Elevation (ft): 975.1	Drill Rig: CME-550
Client: East Kentucky Power Cooperative	Date Started: 4/3/24	Method: SFA
Location: Liberty, Kentucky	Date Completed: 4/3/24	Hole Size (in): 4
Logged By: B. Bishop, PE	Checked By: B. Hatcher, PE	

Depth (ft)	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
0–0.5	Topsoil - 6 inches	2-2-4 (6)	18	23.3	38	22	17	84		
0.5–1.5	Till Zone - 12 inches									
1.5–6.5	FAT CLAY (CH) - VERY STIFF, orange, with gray mottling, silt, moist to wet	3-7-10 (17)	16	21.9	56	26	30	89		
		7-9-10 (19)	18	43.5						
6.5–11	ELASTIC SILT (MH) - STIFF, orange, with gray mottling, wet	3-5-7 (12)	18	38.5	70	36	34	92	▼	Water on observed tools at 6.8 feet
		3-5-7 (12)	18	42.1						
11–19.9	ELASTIC SILT (ML) - VERY STIFF to STIFF, dark brown, with sand, silt, black oxide nodules, weathered rock fragments, wet	3-6-12 (18)	18	41.1	64	36	28	68		
		6-5-4 (9)	10	28.4						
		1-50/1"	0							
19.9–20.2	WEATHERED ROCK									
20.2	Auger Refusal at 20.2 feet									

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

Left Photo: Photo of Approximate Boring Location
Right Photo: Photo of Boring

BORING LOG

Consulting Services Incorporated
858 Contract Street
Lexington, Kentucky 40505
Phone: 859.309.6021
Fax: 888.792.3121

BORING: **B-5**

Project Number: LX240063 Name: EKPC Liberty Client: East Kentucky Power Cooperative Location: Liberty, Kentucky Logged By: B. Bishop, PE	Weather: Cloudy, 50's *Elevation (ft): 978.3 Date Started: 4/3/24 Date Completed: 4/4/24 Checked By: B. Hatcher, PE	Contractor: Strata Group Drill Rig: CME-550 Method: SFA Hole Size (in): 4

Elev. (ft)	Depth (ft)	Symbol	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
978			Topsoil - 8 inches	2-3-4 (7)	18	20.7						
			Till Zone - 22 inches									
976	2			6-9-11 (20)	16							
974	4		FAT CLAY (CH) - VERY STIFF to FIRM with STIFF zone, orange, with gray mottling, silt, and sandy chert zone at 6.5 to 8 feet, moist to wet	5-9-12 (21)	18							
972	6											
970	8			6-8-10 (18)	18	27.7						
968	10			2-5-3 (8)	18	44.8						
											▼	Water on observed tools at 11.0 feet
966	12											
964	14			3-5-4 (9)	0							
962	16											
960	18											
958	20			3-4-2 (6)	0							
956	22											
954	24		Auger Refusal at 23.2 feet Begin Coring at 23.2 feet SILTSTONE - light gray to greenish gray, with few fossils, thin lenses of limestone, chert, and some quartzite inclusions									No core water loss observed REC (%) - 85 RQD (%) - 85
952	26				51							
950	28											

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

Left Photo: Photo of Approximate Boring Location
Right Photo: Photo of Boring

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BORING: **B-5 (cont.)**

Project Number: LX240063 Name: EKPC Liberty Client: East Kentucky Power Cooperative Location: Liberty, Kentucky Logged By: B. Bishop, PE	Weather: Cloudy, 50's *Elevation (ft): 978.3 Date Started: 4/3/24 Date Completed: 4/4/24 Checked By: B. Hatcher, PE	Contractor: Strata Group Drill Rig: CME-550 Method: SFA Hole Size (in): 4

Elev. (ft)	Depth (ft)	Symbol	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
948			Auger Refusal at 23.2 feet Begin Coring at 23.2 feet SILTSTONE - light gray to greenish gray, with few fossils, thin lenses of limestone, chert, and some quartzite inclusions(continued)		58.5							REC (%) - 98 RQD (%) - 87
946	32											
944	34											
942	36				60							REC (%) - 100 RQD (%) - 95
940	38											
938	40				58							REC (%) - 97 RQD (%) - 87
936	42											
934	44											
932	46				60							REC (%) - 100 RQD (%) - 100
930	48		Coring Terminated at 48.2 feet									
928	50											
926	52											
924	54											
922	56											
920	58											

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

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BORING: **B-6**

Project Number: LX240063	Weather: Cloudy, 50's	Contractor: Strata Group
Name: EKPC Liberty	*Elevation (ft): 791.8	Drill Rig: CME-550
Client: East Kentucky Power Cooperative	Date Started: 4/3/24	Method: SFA
Location: Liberty, Kentucky	Date Completed: 4/4/24	Hole Size (in): 4
Logged By: S. Mills, EIT	Checked By: B. Hatcher, PE	

Elev. (ft)	Depth (ft)	Symbol	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
			Topsoil - 10 inches	2-2-3 (5)	10							
790	2		Till Zone - 32 inches	6-8-10 (18)	18							
788	4		Residual Soil - VERY STIFF to STIFF, gray, with orange mottling, silt, and rock fragments, moist	6-8-13 (21)	18							
786	6											
784	8			6-10-16 (26)	18							
782	10			11-9-21 (30)	16						▼	
780	12			11-9-5 (14)	18							Water on observed tools at 11.1 feet
778	14			5-7-2 (9)	18							
776	16											
774	18		WEATHERED ROCK Auger Refusal at 17.1 feet Begin Coring at 17.1 feet									No core water loss observed
772	20		SILTSTONE - light gray to greenish gray, with 4 inch quartz layer at 20.8 feet, thin layers of limestone and chert, and quartzite inclusions		60							REC (%) - 100 RQD (%) - 93
770	22											
768	24				60							REC (%) - 100 RQD (%) - 87
766	26											
764	28											
762					60							REC (%) - 100

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

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BORING: **B-6 (cont.)**

Project Number: LX240063	Weather: Cloudy, 50's	Contractor: Strata Group
Name: EKPC Liberty	*Elevation (ft): 791.8	Drill Rig: CME-550
Client: East Kentucky Power Cooperative	Date Started: 4/3/24	Method: SFA
Location: Liberty, Kentucky	Date Completed: 4/4/24	Hole Size (in): 4
Logged By: S. Mills, EIT	Checked By: B. Hatcher, PE	

Elev. (ft)	Depth (ft)	Symbol	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
			Auger Refusal at 17.1 feet Begin Coring at 17.1 feet									RQD (%) - 100
760	32		SILTSTONE - light gray to greenish gray, with 4 inch quartz layer at 20.8 feet, thin layers of limestone and chert, and quartzite inclusions(continued)									
758	34				60							REC (%) - 100 RQD (%) - 87
756	36											
754	38											
752	40				60							REC (%) - 100 RQD (%) - 100
750	42		Coring Terminated at 42.1 feet									
748	44											
746	46											
744	48											
742	50											
740	52											
738	54											
736	56											
734	58											
732												

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

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BORING: **B-6A**

Project Number: LX240063	Weather: Cloudy, 50's	Contractor: Strata Group
Name: EKPC Liberty	*Elevation (ft): 791.8	Drill Rig: CME-550
Client: East Kentucky Power Cooperative	Date Started: 4/3/24	Method: SFA
Location: Liberty, Kentucky	Date Completed: 4/4/24	Hole Size (in): 4
Logged By: S. Mills, EIT	Checked By: B. Hatcher, PE	

Elev. (ft)	Depth (ft)	Symbol	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
			Sounding									Dry upon completion of soil augering
790	2		Shelby Tube		24							
788	4		Boring Terminated at 4.0 feet									
786	6											
784	8											
782	10											
780	12											
778	14											
776	16											
774	18											
772	20											
770	22											
768	24											
766	26											
764	28											
762												

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

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BORING: **B-7**

Project Number: LX240063	Weather: Cloudy, 50's	Contractor: Strata Group
Name: EKPC Liberty	*Elevation (ft): 975.8	Drill Rig: CME-550
Client: East Kentucky Power Cooperative	Date Started: 4/3/24	Method: SFA
Location: Liberty, Kentucky	Date Completed: 4/4/24	Hole Size (in): 4
Logged By: S. Mills, EIT	Checked By: B. Hatcher, PE	

Elev. (ft)	Depth (ft)	Symbol	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
			Topsoil - 6 inches	3-2-3 (5)	12							
974	2		Till Zone - 24 inches	4-8-10 (18)	18							
972	4		Residual Soil - VERY STIFF to STIFF to FIRM, gray, with orange mottling, with silt, and rock fragments, moist	7-9-10 (19)	18							
970–968	6–8			7-9-11 (20)	16							
966	10			11-10-8 (18)	3							
964	12			4-6-10 (16)	16							
962	14			5-5-7 (12)	18							
960–958	16–18										▼	Water on observed tools at 16.5 feet
956	20			3-4-2 (6)	0							
954	22		Auger Refusal at 21.9 feet									
952	24											
950	26											
948	28											
946												

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

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BORING: **B-8**

Project Number: LX240063 Name: EKPC Liberty Client: East Kentucky Power Cooperative Location: Liberty, Kentucky Logged By: B. Bishop, PE	Weather: Rainy, 60's *Elevation (ft): 972.3 Date Started: 4/10/24 Date Completed: 4/10/24 Checked By: B. Hatcher, PE	Contractor: Strata Group Drill Rig: Acker Method: SFA Hole Size (in): 4

Elev. (ft)	Depth (ft)	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
972		Topsoil - 6 inches									
		Till Zone - 30 inches	WH-WH-2	10							WH = Weight of hammer
970	2		3-4-5 (9)	18							
968	4	Residual Soil - STIFF, tan, with gray mottling, with silt, moist									
		Residual Soil - STIFF with VERY STIFF zone, oragnge, with gray mottling, silt, and chert fragments starting at 6.5 feet, moist	4-7-8 (15)	18							
966	6		6-9-13 (22)	10							
964	8										
962	10		6-8-4 (12)	16						▼	Water on observed tools at 10.7 feet
960	12	Residual Soil - STIFF, brown, with silt, chert and weathered rock fragments, moist	5-8-3 (11)	18							
		WEATHERED ROCK									
958	14	Auger Refusal at 13.8 feet Begin Coring at 13.8 feet SILTSTONE - light gray to greenish gray, few fossils, with some interbeded limestone and chert, quartzite inclusions starting at 28 feet									No core water loss observed REC (%) - 98 RQD (%) - 98
956	16										
954	18			118							
952	20										
950	22										
948	24										
946	26										REC (%) - 98 RQD (%) - 85
944	28			118							

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

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BORING: **B-8 (cont.)**

Project Number: LX240063	Weather: Rainy, 60's	Contractor: Strata Group
Name: EKPC Liberty	*Elevation (ft): 972.3	Drill Rig: Acker
Client: East Kentucky Power Cooperative	Date Started: 4/10/24	Method: SFA
Location: Liberty, Kentucky	Date Completed: 4/10/24	Hole Size (in): 4
Logged By: B. Bishop, PE	Checked By: B. Hatcher, PE	

Elev. (ft)	Depth (ft)	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
942		Auger Refusal at 13.8 feet Begin Coring at 13.8 feet SILTSTONE - light gray to greenish gray, few fossils, with some interbeded limestone and chert, quartzite inclusions starting at 28 feet(continued)									
940	32										
938	34										
936	36										REC (%) - 100 RQD (%) - 88
934	38			120							
932	40										
930	42										
928	44										
926	46										REC (%) - 98 RQD (%) - 98
924	48			118							
922	50	SHALE - greenish black, hard									
		LIMESTONE - light gray, fine to medium grained, hard, with few fossils, siltstone laminations									
920	52	SHALE - greenish black, hard									
918	54	Coring Terminated at 53.8 feet									
916	56										
914	58										

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

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BORING: **B-9**

Project Number: LX240063 Name: EKPC Liberty Client: East Kentucky Power Cooperative Location: Liberty, Kentucky Logged By: C. Gibbs	Weather: Cloudy, 40's *Elevation (ft): 972.7 Date Started: 4/9/24 Date Completed: 4/9/24 Checked By: B. Hatcher, PE	Contractor: Strata Group Drill Rig: Geo Probe Method: HSA Hole Size (in): 2.25

Elev. (ft)	Depth (ft)	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
972.7–972.1	0–0.6	Topsoil - 7 inches									Dry upon completion of soil augering
		Till Zone - 29 inches	1-1-1 (2)	11	24.0						
			1-2-2 (4)	15	21.7						
		FAT CLAY (CH) - VERY STIFF to STIFF to FIRM, brown, with some sand, chert fragments, and black oxide nodules, moist to wet	5-12-7 (19)	10	34.1						
			7-8-6 (14)	13	33.0						
			5-4-3 (7)	12	49.2						
			50/5"	4							
		WEATHERED ROCK									
		Auger Refusal at 14.7 feet									

No Photo Available

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

Left Photo: Photo of Approximate Boring Location
Right Photo: Photo of Boring

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BORING: **B-9A**

Project Number: LX240063	Weather: Cloudy, 40's	Contractor: Strata Group
Name: EKPC Liberty	*Elevation (ft): 972.7	Drill Rig: Geo Probe
Client: East Kentucky Power Cooperative	Date Started: 4/9/24	Method: HSA
Location: Liberty, Kentucky	Date Completed: 4/9/24	Hole Size (in): 2.25
Logged By: C. Gibbs	Checked By: B. Hatcher, PE	

Elev. (ft)	Depth (ft)	Symbol	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
972			Sounding									Dry upon completion of soil augering
970	2											
968	4		Shelby Tube		14	33.4	65	30	35	100 99 96 93		
			Boring Terminated at 4.5 feet									
966	6											
964	8											
962	10											
960	12											
958	14											
956	16											
954	18											
952	20											
950	22											
948	24											
946	26											
944	28											

No Photo Available

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

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Right Photo: Photo of Boring

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BORING: **B-10**

Project Number: LX240063	Weather: Cloudy, 60's	Contractor: Strata Group
Name: EKPC Liberty	*Elevation (ft): 976.4	Drill Rig: CME-550
Client: East Kentucky Power Cooperative	Date Started: 4/9/24	Method: SFA
Location: Liberty, Kentucky	Date Completed: 4/9/24	Hole Size (in): 4
Logged By: B. Bishop, PE	Checked By: B. Hatcher, PE	

Elev. (ft)	Depth (ft)	Symbol	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
976			Topsoil - 8 inches	3-2-4 (6)	16							
			Till Zone - 10 inches									
974	2		Residual Soil - VERY STIFF to STIFF, orange, with gray mottling, silt, chert fragments, moist	6-10-11 (21)	18							
972	4			4-10-8 (18)	16							
970	6			7-5-7 (12)	18							
968	8		Residual Soil - SOFT to FIRM, orange with silt, wet									
966	10			3-2-2 (4)	18							
964	12			3-4-4 (8)	12						▼	Water on observed tools at 12.7 feet
962	14		Residual Soil - STIFF, gray, with orange mottling, silt, chert, wet	4-5-7 (12)	10							
960	16											
958	18											
956	20		WEATHERED ROCK	2-3-7 (10)	10							
954	22		Auger Refusal at 21.7 feet Begin Coring at 21.7 feet									No core water loss observed
952	24		SILTSTONE - light gray to greenish gray, with few fossils, layers of medium grained limestone, layers of recrystalized limestone at 31.7 to 35.7 feet, and quartzite partings and incluisons starting at 35 feet		58							REC (%) - 97 RQD (%) - 85
950	26											
948	28				60							REC (%) - 100 RQD (%) - 100

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

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BORING: **B-10 (cont.)**

Project Number: LX240063	Weather: Cloudy, 60's	Contractor: Strata Group
Name: EKPC Liberty	*Elevation (ft): 976.4	Drill Rig: CME-550
Client: East Kentucky Power Cooperative	Date Started: 4/9/24	Method: SFA
Location: Liberty, Kentucky	Date Completed: 4/9/24	Hole Size (in): 4
Logged By: B. Bishop, PE	Checked By: B. Hatcher, PE	

Elev. (ft)	Depth (ft)	Symbol	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
946			Auger Refusal at 21.7 feet Begin Coring at 21.7 feet SILTSTONE - light gray to greenish gray, with few fossils, layers of medium grained limestone, layers of recrystalized limestone at 31.7 to 35.7 feet, and quartzite partings and incluisons starting at 35 feet(continued)									
944	32											
942	34				60							REC (%) - 100 RQD (%) - 95
940	36											
938	38				60							REC (%) - 100 RQD (%) - 100
936	40											
934	42											
932	44				60							REC (%) - 100 RQD (%) - 100
930	46		Coring Terminated at 46.7 feet									
928	48											
926	50											
924	52											
922	54											
920	56											
918	58											

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

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BORING: **B-11**

Project Number: LX240063	Weather: Sunny, 60's	Contractor: Strata Group
Name: EKPC Liberty	*Elevation (ft): 977.8	Drill Rig: CME-550
Client: East Kentucky Power Cooperative	Date Started: 3/29/24	Method: SFA
Location: Liberty, Kentucky	Date Completed: 3/29/24	Hole Size (in): 4
Logged By: B. Bishop, PE	Checked By: B. Hatcher, PE	

Elev. (ft)	Depth (ft)
976	2
974	4
972	6
970	8
968	10
966	12
964	14
962	16
960	18
958	20
956	22
954	24
952	26
950	28
948	

Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
Topsoil - 6 inches	3-2-3 (5)	14							
Till Zone - 12 inches									
Residual Soil - , VERY STIFF with STIFF zone, gray, with orange mottling, silt, chert fragments, hard object at 8.5 feet, moist	6-10-12 (22)	18							
	6-11-11 (22)	18							
	3-4-5 (9)	18							
	2-3-24 (27)	18							
SILT - STIFF, gray, with orange mottling, clay, moist	4-6-6 (12)	14							
Residual Soil - VERY STIFF, dark brown, with sand, silt, rock and chert fragments, moist	4-6-10 (16)	18							
								▼	Water on observed tools at 18.5 feet
	50/2"	0							
WEATHERED ROCK									
Auger Refusal at 21.5 feet									

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

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BORING: **B-11A**

Project Number: LX240063 Name: EKPC Liberty Client: East Kentucky Power Cooperative Location: Liberty, Kentucky Logged By: B. Bishop, PE	Weather: Sunny, 60's *Elevation (ft): 977.8 Date Started: 3/29/24 Date Completed: 3/29/24 Checked By: B. Hatcher, PE	Contractor: Strata Group Drill Rig: CME-550 Method: SFA Hole Size (in): 4

Elev. (ft)	Depth (ft)	Symbol	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
976	2		Sounding									Dry upon completion of soil augering
974	4		Shelby Tube		24							PP = 2.7 TSF TV = 4.5 kg/cm^2
972	6		Boring Terminated at 5.0 feet									
970	8											
968	10											
966	12											
964	14											
962	16											
960	18											
958	20											
956	22											
954	24											
952	26											
950	28											
948												

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

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BORING: **B-12**

Project Number: LX240063 Name: EKPC Liberty Client: East Kentucky Power Cooperative Location: Liberty, Kentucky Logged By: B. Bishop, PE	Weather: Cloudy, 60's *Elevation (ft): 979.5 Date Started: 4/1/24 Date Completed: 4/1/24 Checked By: B. Hatcher, PE	Contractor: Strata Group Drill Rig: CME-550 Method: SFA Hole Size (in): 4

Elev. (ft)	Depth (ft)	Symbol	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
			Topsoil - 8 inches	3-4-4 (8)	16							
978	2		Till Zone - 22 inches	3-5-8 (13)	18							
976	4		Residual Soil - STIFF to VERY STIIF to HARD, tannish gray, with orange mottling, silt, chert fragments starting at 5 feet, weathered rock from 14.5 to 15 feet, moist									
974	6			6-9-13 (22)	18							
972	8			2-4-50/1"	10							
970	10			6-17-16 (33)	18							
968	12			8-8-15 (23)	14							
966	14			30-15-30 (45)	12							
964	16										▼	Water on observed tools at 16.2 feet
962	18											
960	20		WEATHERED ROCK	20-50/2"	5							
			Auger Refusal at 20.0 feet Begin Coring at 20.0 feet									No core water loss observed
958	22		Siltstone - light gray to greenish gray, few fossils, with thin lenses of limestone and chert, with quartzite inclusions at 35 to 40 feet		59							REC (%) - 98 RQD (%) - 98
956	24											
954	26											
952	28				56							REC (%) - 93 RQD (%) - 88
950												

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

Left Photo: Photo of Approximate Boring Location
Right Photo: Photo of Boring

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BORING: **B-12 (cont.)**

Project Number: LX240063 Name: EKPC Liberty Client: East Kentucky Power Cooperative Location: Liberty, Kentucky Logged By: B. Bishop, PE	Weather: Cloudy, 60's *Elevation (ft): 979.5 Date Started: 4/1/24 Date Completed: 4/1/24 Checked By: B. Hatcher, PE	Contractor: Strata Group Drill Rig: CME-550 Method: SFA Hole Size (in): 4

Elev. (ft)	Depth (ft)	Symbol	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
948–935	31–45		Auger Refusal at 20.0 feet Begin Coring at 20.0 feet Siltstone - light gray to greenish gray, few fossils, with thin lenses of limestone and chert, with quartzite inclusions at 35 to 40 feet(continued)		56							REC (%) - 93 RQD (%) - 72
					60							REC (%) - 100 RQD (%) - 73
					60							REC (%) - 100 RQD (%) - 72
934.5	45		Coring terminated at 45.0 feet									

Elevation scale: 948, 946, 944, 942, 940, 938, 936, 934, 932, 930, 928, 926, 924, 922, 920
Depth scale: 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

Left Photo: Photo of Approximate Boring Location
Right Photo: Photo of Boring

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BORING: **B-12A**

Project Number: LX240063 Name: EKPC Liberty Client: East Kentucky Power Cooperative Location: Liberty, Kentucky Logged By: B. Bishop, PE	Weather: Cloudy, 60's *Elevation (ft): 979.5 Date Started: 4/1/24 Date Completed: 4/1/24 Checked By: B. Hatcher, PE	Contractor: Strata Group Drill Rig: CME-550 Method: SFA Hole Size (in): 4

Elev. (ft)	Depth (ft)	Symbol	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
978	2		Sounding									Dry upon completion of soil augering
976	4		Shelby Tube		24							
974	6		Boring Terminated at 5.0 feet									
972	8											
970	10											
968	12											
966	14											
964	16											
962	18											
960	20											
958	22											
956	24											
954	26											
952	28											
950												

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

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BORING: **B-13**

Project Number: LX240063	Weather: Cloudy, 60's	Contractor: Strata Group
Name: EKPC Liberty	*Elevation (ft): 977.6	Drill Rig: CME-550
Client: East Kentucky Power Cooperative	Date Started: 4/1/24	Method: SFA
Location: Liberty, Kentucky	Date Completed: 4/1/24	Hole Size (in): 4
Logged By: B. Bishop, PE	Checked By: B. Hatcher, PE	

Elev. (ft)	Depth (ft)	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
		Topsoil - 10 inches	3-3-3 (6)	16	19.9						
976	2	Till Zone - 14 inches									
		LEAN CLAY (CL) - VERY STIFF with HARD zone, gray, with orange mottling, silt, moist to wet	4-7-10 (17)	18	21.0	46	23		85		
974	4										
972	6		7-11-13 (24)	18							
970	8		10-14-23 (37)	18	16.3	45	21		60		
968	10		4-11-23 (34)	18	32.6						
966	12		8-8-11 (19)	18	30.1						
964	14		4-7-11 (18)	18	31.8						
962	16									▼	Water on observed tools at 16.0 feet
960	18										
958	20	WEATHERED ROCK	2-50/2"	0							
		Auger Refusal at 20.0 feet									
956	22										
954	24										
952	26										
950	28										
948											

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

Left Photo: Photo of Approximate Boring Location
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BORING: **B-13A**

Project Number: LX240063 Name: EKPC Liberty Client: East Kentucky Power Cooperative Location: Liberty, Kentucky Logged By: B. Bishop, PE	Weather: Cloudy, 60's *Elevation (ft): 977.6 Date Started: 4/1/24 Date Completed: 4/1/24 Checked By: B. Hatcher, PE	Contractor: Strata Group Drill Rig: CME-550 Method: SFA Hole Size (in): 4

Elev. (ft)	Depth (ft)	Symbol	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
976	2		Sounding									Dry upon completion of soil augering
974	4		Shelby Tube		24	20.2	46	24		100 99 97 96 87		Qu (psf) = 7249
972	6		Boring Terminated at 6.0 feet									
970	8											
968	10											
966	12											
964	14											
962	16											
960	18											
958	20											
956	22											
954	24											
952	26											
950	28											
948												

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

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BORING: **B-14**

Project Number: LX240063	Weather: Cloudy, 70's	Contractor: Strata Group
Name: EKPC Liberty	*Elevation (ft): 977.0	Drill Rig: CME-550
Client: East Kentucky Power Cooperative	Date Started: 4/17/24	Method: SFA
Location: Liberty, Kentucky	Date Completed: 4/17/24	Hole Size (in): 4
Logged By: S. Mills, EIT	Checked By: B. Hatcher, PE	

Elev. (ft)	Depth (ft)	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
976		Topsoil - 6 inches	WH-1-2 (3)	18							WH = Weight of hammer
		Till Zone - 12 inches									
974	2	CLAY - STIFF to VERY STIFF, orange, with gray mottling, silt, chert fragments starting at 6.5 feet, moist	2-5-8 (13)	18							
972	4		5-7-9 (16)	18							
970	6		5-7-18 (25)	18							
968	8		7-7-9 (16)	18							
966	10										
964	12		5-7-9 (16)	12							
962	14	CLAY - STIFF, brown, with silt, chert fragments, and weathered rock fragments, moist	4-6-5 (11)	10							
960	16									▼	Water on observed tools at 16.0 feet
958	18										
	20		4-1-50/1"	12							
956		WEATHERED ROCK									No core water loss observed
954	22	Auger Refusal at 20.5 feet Begin Coring at 20.5 feet Siltstone - light gray to greenish gray, few fossils, with some interbedded limstone and chert, shale parting at 36 feet, with quartzite inclusions starting at 36 feet		59							REC (%) - 98 RQD (%) - 98
952	24										
950	26										
948	28			59							REC (%) - 98 RQD (%) - 95

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

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Right Photo: Photo of Boring

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BORING: **B-14 (cont.)**

Project Number: LX240063	Weather: Cloudy, 70's	Contractor: Strata Group
Name: EKPC Liberty	*Elevation (ft): 977.0	Drill Rig: CME-550
Client: East Kentucky Power Cooperative	Date Started: 4/17/24	Method: SFA
Location: Liberty, Kentucky	Date Completed: 4/17/24	Hole Size (in): 4
Logged By: S. Mills, EIT	Checked By: B. Hatcher, PE	

Elev. (ft)	Depth (ft)	Symbol	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
946 – 918	32 – 58		Auger Refusal at 20.5 feet Begin Coring at 20.5 feet Siltstone - light gray to greenish gray, few fossils, with some interbedded limstone and chert, shale parting at 36 feet, with quartzite inclusions starting at 36 feet(continued)		116							REC (%) - 97 RQD (%) - 92
					120							REC (%) - 100 RQD (%) - 100
					115							REC (%) - 96 RQD (%) - 95
			SHALE - greenish black, hard									

Elevation scale: 946, 944, 942, 940, 938, 936, 934, 932, 930, 928, 926, 924, 922, 920, 918
Depth scale: 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

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BORING: **B-14 (cont.)**

Project Number: LX240063	Weather: Cloudy, 70's	Contractor: Strata Group
Name: EKPC Liberty	*Elevation (ft): 977.0	Drill Rig: CME-550
Client: East Kentucky Power Cooperative	Date Started: 4/17/24	Method: SFA
Location: Liberty, Kentucky	Date Completed: 4/17/24	Hole Size (in): 4
Logged By: S. Mills, EIT	Checked By: B. Hatcher, PE	

Elev. (ft)	Depth (ft)	Symbol	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
916	62		LIMESTONE - light gray, fine to medium grained, hard, with few fossils, siltstone liminations(continued)									
914			Coring terminated at 60.5 feet									
912	64											
910	66											
908	68											
906	70											
904	72											
902	74											
900	76											
898	78											
896	80											
894	82											
892	84											
890	86											
888	88											

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

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BORING: **B-15**

Project Number: LX240063	Weather: Cloudy, 40's	Contractor: Strata Group
Name: EKPC Liberty	*Elevation (ft): 978.3	Drill Rig: Geo Probe
Client: East Kentucky Power Cooperative	Date Started: 4/9/24	Method: HSA
Location: Liberty, Kentucky	Date Completed: 4/9/24	Hole Size (in): 2.25
Logged By: C. Gibbs	Checked By: B. Hatcher, PE	

Elev. (ft)	Depth (ft)	Symbol	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
978			Topsoil - 8 inches	1-1-1 (2)	10							Dry upon completion of soil augering
			Till Zone - 16 inches									
976	2		CLAY - FIRM with STIIF zone, orange, with sand and chert fragments, moist	1-4-3 (7)	18							
974	4			4-3-3 (6)	17							
972	6			3-2-6 (8)	6							
970	8			2-1-11 (12)	8							
968	10											
966	12											
964	14			4-3-3 (6)	12							
962	16											
960	18											
			WEATHERED ROCK									
958	20		Auger Refusal at 19.8 feet									
956	22											
954	24											
952	26											
950	28											

No Photo Available

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

Left Photo: Photo of Approximate Boring Location
Right Photo: Photo of Boring

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BORING: **B-16**

Project Number: LX240063	Weather: Cloudy, 70's	Contractor: Strata Group
Name: EKPC Liberty	*Elevation (ft): 977.5	Drill Rig: CME-550
Client: East Kentucky Power Cooperative	Date Started: 4/8/24	Method: SFA
Location: Liberty, Kentucky	Date Completed: 4/8/24	Hole Size (in): 4
Logged By: B. Bishop, PE	Checked By: B. Hatcher, PE	

Elev. (ft)	Depth (ft)	Symbol	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
			Topsoil - 6 inches Till Zone - 12 inches	4-2-5 (7)	16	20.5						
976	2		FAT CLAY (CH) - STIFF to VERY STIFF, brown, with red mottling, silt, and chert fragments, moist to wet	5-5-8 (13)	10	27.5						
974	4											
972	6			5-8-9 (17)	18	38.0	94	38	56	98		
970	8		SILT (ML) - STIFF to FIRM, brown, with red mottling, chert fragments, sandy, wet	4-5-6 (11)	18	33.5	43	28	15	60		
968	10			4-5-6 (11)	16	43.6						
966	12			2-4-5 (9)	12	53.5						
964	14			2-2-6 (8)	12	54.2						
962	16										▼	Water on observed tools at 16.0 feet
960	18		FAT CLAY (CH) - VERY STIFF, orange, with silt, weathered rock and chert fragments, wet									
958	20			11-15-12 (27)	10							
956	22											
954	24		WEATHERED ROCK Auger Refusal at 22.7 feet Begin Coring at 22.7 feet LIMESTONE - light gray, fine grained with coarse grained bands, with fossils, with few silt partings									No core water loss observed REC (%) - 88 RQD (%) - 87
952	26				53							
950	28											
948												REC (%) - 98

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

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BORING: **B-16 (cont.)**

Project Number: LX240063	Weather: Cloudy, 70's	Contractor: Strata Group
Name: EKPC Liberty	*Elevation (ft): 977.5	Drill Rig: CME-550
Client: East Kentucky Power Cooperative	Date Started: 4/8/24	Method: SFA
Location: Liberty, Kentucky	Date Completed: 4/8/24	Hole Size (in): 4
Logged By: B. Bishop, PE	Checked By: B. Hatcher, PE	

Elev. (ft)	Depth (ft)	Symbol	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
946	32		SILTSTONE - greenish gray, some weathering, few fossils, layers of recrystalized limestone at 35.7 to 37.7 feet, shale lenses at 40 feet, quartzite inclusions at 41 feet(continued)		59							RQD (%) - 78
944	34											
942	36				60							REC (%) - 100 RQD (%) - 80
940	38											
938	40				59							REC (%) - 98 RQD (%) - 88
936	42											
934	44											
932	46				59							REC (%) - 98 RQD (%) - 97
930	48		Coring Terminated at 47.7									
928	50											
926	52											
924	54											
922	56											
920	58											
918												

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

Left Photo: Photo of Approximate Boring Location
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BORING: **B-17**

Project Number: LX240063 Name: EKPC Liberty Client: East Kentucky Power Cooperative Location: Liberty, Kentucky Logged By: B. Bishop, PE	Weather: Cloudy, 60's *Elevation (ft): 977.3 Date Started: 4/1/24 Date Completed: 4/1/24 Checked By: B. Hatcher, PE	Contractor: Strata Group Drill Rig: CME-550 Method: SFA Hole Size (in): 4

Elev. (ft)	Depth (ft)	Symbol	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
			Topsoil - 8 inches	3-3-3 (6)	16	21.2						Dry upon completion of soil augering
			Till Zone - 16 inches									
			LEAN CLAY (CL) - STIFF to VERY STIFF to HARD, gray, with orange mottling, silt, chert fragments, moist	4-5-4 (9)	14	22.0	31	19		77		
				6-10-12 (22)	18	20.3	30	19		80		
				9-21-22 (43)	18	16.5						
			FAT CLAY (CH) - VERY STIFF to STIFF, gray, with orange motttling, silt, chert fragments, wet with moist zone	4-7-11 (18)	18	30.0	69	29		81		
				8-10-13 (23)	18	29.0						
				12-7-5 (12)	10	30.4						
			Auger Refusal at 18.7 feet									

Elevation scale (ft): 976, 974, 972, 970, 968, 966, 964, 962, 960, 958, 956, 954, 952, 950, 948
Depth scale (ft): 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

Left Photo: Photo of Approximate Boring Location
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BORING: B-18

Project Number: LX240063	Weather: Rainy, 70's	Contractor: Strata Group
Name: EKPC Liberty	*Elevation (ft): 975.9	Drill Rig: CME-550
Client: East Kentucky Power Cooperative	Date Started: 4/17/24	Method: SFA
Location: Liberty, Kentucky	Date Completed: 4/17/24	Hole Size (in): 4
Logged By: S. Mills, EIT	Checked By: B. Hatcher, PE	

Elev. (ft)	Depth (ft)	Symbol	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
974	2		Topsoil - 6 inches Till Zone - 30 inches	2-3-3 (6)	12							Dry upon completion of soil augering
				2-4-6 (10)	18							
972 / 970	4 / 6		LEAN CLAY (CL) - VERY STIFF, gray, with tan and orange mottling, silt, moist	9-12-11 (23)	16							
968	8		CLAY - HARD to VERY STIFF, orange, with tan and gray mottling, silt, chert fragments, moist	8-12-22 (34)	18							
966	10			6-23-17 (40)	18							
964 / 962	12 / 14			7-11-18 (29)	18							
960 / 958	16 / 18		CLAY - STIFF, gray, with orange and tan mottling, silt, and chert fragments, moist	6-7-6 (13)	18							
956 / 954 / 952	20 / 22 / 24		WEATHERED ROCK Auger Refusal at 18.8 feet Begin Coring at 18.8 feet SILTSTONE - greenish gray, with interbedded limestone and shale, qurtzite inclusions, medium grained		59							No core water loss observed REC (%) - 98 RQD (%) - 82
950 / 948	26 / 28				59							REC (%) - 98 RQD (%) - 95

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

Left Photo: Photo of Approximate Boring Location
Right Photo: Photo of Boring

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BORING: **B-18 (cont.)**

Project Number: LX240063 Name: EKPC Liberty Client: East Kentucky Power Cooperative Location: Liberty, Kentucky Logged By: S. Mills, EIT	Weather: Rainy, 70's *Elevation (ft): 975.9 Date Started: 4/17/24 Date Completed: 4/17/24 Checked By: B. Hatcher, PE	Contractor: Strata Group Drill Rig: CME-550 Method: SFA Hole Size (in): 4

Elev. (ft)	Depth (ft)	Symbol	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
			Auger Refusal at 18.8 feet Begin Coring at 18.8 feet SILTSTONE - greenish gray, with interbedded limestone and shale, qurtzite inclusions, medium grained(continued)									
944	32				57							REC (%) - 95 RQD (%) - 87
942	34											
940	36				60							REC (%) - 100 RQD (%) - 100
938	38											
936	40											
934	42				60							REC (%) - 100 RQD (%) - 100
932	44											
930	46				60							REC (%) - 100 RQD (%) - 100
928	48											
			Coring Terminated at 48.8 feet									
926	50											
924	52											
922	54											
920	56											
918	58											

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

Left Photo: Photo of Approximate Boring Location
Right Photo: Photo of Boring

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BORING: **B-19**

Project Number: LX240063 Name: EKPC Liberty Client: East Kentucky Power Cooperative Location: Liberty, Kentucky Logged By: S. Mills, EIT	Weather: Sunny, 70's *Elevation (ft): 976.8 Date Started: 4/16/24 Date Completed: 4/16/24 Checked By: B. Hatcher, PE	Contractor: Strata Group Drill Rig: CME-550 Method: SFA Hole Size (in): 4

Elev. (ft)	Depth (ft)	Symbol	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
976			Topsoil - 8 inches	3-2-3 (5)	12							Dry upon completion of soil augering
974	2		Till Zone - 34 inches	3-2-2 (4)	10							
972	4		CLAY - VERY STIFF, tan, with gray mottling, silt, moist	3-6-10 (16)	14							
970	6		CLAY - VERY STIFF, orange, with gray and tan mottling, silt, and chert fragments, moist	5-7-9 (16)	16							
968	8											
966	10			6-21-50/5"	16							
964	12			5-15-50/4"	12							
962	14			6-12-14 (26)	16							
960	16											
958	18			50/2"	2							Water on observed tools at 17.0 feet
956	20		WEATHERED ROCK									
			Auger Refusal at 19.9 feet									
954	22											
952	24											
950	26											
948	28											

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

Left Photo: Photo of Approximate Boring Location
Right Photo: Photo of Boring

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BORING: **B-19A**

Project Number: LX240063 Name: EKPC Liberty Client: East Kentucky Power Cooperative Location: Liberty, Kentucky Logged By: S. Mills, EIT	Weather: Sunny, 70's *Elevation (ft): 976.8 Date Started: 4/16/24 Date Completed: 4/16/24 Checked By: B. Hatcher, PE	Contractor: Strata Group Drill Rig: CME-550 Method: SFA Hole Size (in): 4

Elev. (ft)	Depth (ft)	Symbol	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
976.8–972.8	0–4		Sounding									Dry upon completion of soil augering
972.8–970.8	4–6		Shelby Tube		24							
	6		Boring Terminated at 6.0 feet									

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

Left Photo: Photo of Approximate Boring Location
Right Photo: Photo of Boring

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BORING: **B-20**

Project Number: LX240063 Name: EKPC Liberty Client: East Kentucky Power Cooperative Location: Liberty, Kentucky Logged By: B. Bishop, PE	Weather: Cloudy, 50's *Elevation (ft): 978.8 Date Started: 4/12/24 Date Completed: 4/12/24 Checked By: B. Hatcher, PE	Contractor: Strata Group Drill Rig: CME-550 Method: SFA Hole Size (in): 4

Elev. (ft)	Depth (ft)	Symbol	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
978			Topsoil - 12 inches	1-2-2 (4)	14							
976	2		Till Zone - 6 inches	5-8-10 (18)	18							
974	4		FAT CLAY (CH) - VERY STIFF to STIFF to FIRM, gray, with orange mottling, silt, chert fragments at 4 feet, wet	6-7-8 (15)	14							
972	6			4-5-7 (12)	18							
970	8											
968	10			4-3-3 (6)	18							
966	12			1-3-4 (7)	16							
964	14			9-3-3 (6)	18							
962	16										▼	Water on observed tools at 16.0 feet
960	18		FAT CLAY (CH) - VERY STIFF, brown, with silt, weathered rock and chert fragments, wet									
958	20			3-10-9 (19)	14							
956	22		Auger Refusal at 22.0 feet Begin Coring at 22.0 feet									No core water loss observed
954	24		SILTSTONE - light gray to greenish gray, with few fossils, becoming cherty, with interbedded chert layers starting at 27 feet, layers of green shale at 59 to 60 feet		58							REC (%) - 97 RQD (%) - 97
952	26											
950	28				60							REC (%) - 100

No Photo Available

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

Left Photo: Photo of Approximate Boring Location
Right Photo: Photo of Boring

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BORING: **B-20 (cont.)**

Project Number: LX240063	Weather: Cloudy, 50's	Contractor: Strata Group
Name: EKPC Liberty	*Elevation (ft): 978.8	Drill Rig: CME-550
Client: East Kentucky Power Cooperative	Date Started: 4/12/24	Method: SFA
Location: Liberty, Kentucky	Date Completed: 4/12/24	Hole Size (in): 4
Logged By: B. Bishop, PE	Checked By: B. Hatcher, PE	

Elev. (ft)	Depth (ft)	Symbol	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
948			Auger Refusal at 22.0 feet Begin Coring at 22.0 feet SILTSTONE - light gray to greenish gray, with few fossils, becoming cherty, with interbedded chert layers starting at 27 feet, layers of green shale at 59 to 60 feet(continued)									RQD (%) - 88
	32											
946												
	34											REC (%) - 98 RQD (%) - 95
944												
	36											
942					117							
	38											
940												
	40											
938												
	42											
936												
	44											REC (%) - 100 RQD (%) - 100
934												
	46											
932					120							
	48											
930												
	50											
928												
	52											
926												
	54											REC (%) - 100 RQD (%) - 100
924												
	56											
922					120							
	58											
920												

No Photo Available

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

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BORING: **B-20 (cont.)**

Project Number: LX240063 Name: EKPC Liberty Client: East Kentucky Power Cooperative Location: Liberty, Kentucky Logged By: B. Bishop, PE	Weather: Cloudy, 50's *Elevation (ft): 978.8 Date Started: 4/12/24 Date Completed: 4/12/24 Checked By: B. Hatcher, PE	Contractor: Strata Group Drill Rig: CME-550 Method: SFA Hole Size (in): 4

Elev. (ft)	Depth (ft)	Symbol	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
918												
	62		Coring Terminated at 62.0 feet									
916												
	64											
914												
	66											
912												
	68											
910												
	70											
908												
	72											
906												
	74											
904												
	76											
902												
	78											
900												
	80											
898												
	82											
896												
	84											
894												
	86											
892												
	88											
890												

No Photo Available

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

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BORING: **B-21**

Project Number: LX240063	Weather: Cloudy, 50's	Contractor: Strata Group
Name: EKPC Liberty	*Elevation (ft): 976.0	Drill Rig: CME-550
Client: East Kentucky Power Cooperative	Date Started: 4/3/24	Method: SFA
Location: Liberty, Kentucky	Date Completed: 4/4/24	Hole Size (in): 4
Logged By: S. Mills, EIT	Checked By: B. Hatcher, PE	

Elev. (ft)	Depth (ft)	Symbol	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
			Topsoil - 6 inches	5-5-4 (9)	10							
			Till Zone - 18 inches									
974	2		LEAN CLAY (CL) - VERY STIFF, orange, silt, chert fragments, moist	8-8-10 (18)	12							
972	4			4-8-10 (18)	18							
970	6											
968	8		CLAY - FIRM to STIFF with VERY STIFF zone, gray, with orange mottling, silt, chert fragments, moist	2-3-5 (8)	18						▼	Water on observed tools at 9.0 feet
966	10			10-5-6 (11)	18							
964	12			9-7-9 (16)	16							
962	14			3-5-9 (14)	12							
960	16											
958	18											
956	20			4-5-8 (13)	0							
			Auger Refusal at 20.9 feet									
954	22											
952	24											
950	26											
948	28											

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

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BORING: B-22

Project Number: LX240063	Weather: Sunny, 50's	Contractor: Strata Group
Name: EKPC Liberty	*Elevation (ft): 972.3	Drill Rig: CME-550
Client: East Kentucky Power Cooperative	Date Started: 3/28/24	Method: SFA
Location: Liberty, Kentucky	Date Completed: 3/28/24	Hole Size (in): 4
Logged By: B. Bishop, PE	Checked By: B. Hatcher, PE	

Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
Topsoil - 8 inches	3-3-3 (6)	8							
CLAY - FIRM to STIFF, brown, with silt, weathered rock and chert fragments, wet	4-4-5 (9)	6							
SILT - VERY STIFF, gray, with little orange, some clay, moist	5-7-12 (19)	18							
CLAY - HARD to VERY STIFF to STIFF, gray, with orange, silt, sandy, weathered rock and chert fragments, moist to wet	5-14-27 (41)	16							
	5-11-13 (24)	18							
	4-5-7 (12)	14						▼	Water on observed tools at 12.0 feet
	50/4"	2							
WEATHERED ROCK									
Auger Refusal at 14.7 feet Begin Coring at 14.7 feet SILTSTONE - dark gray, hard, few limestone partings		57							No core water loss observed REC (%) - 95 RQD (%) - 95
		57.5							REC (%) - 96 RQD (%) - 76
Coring Terminated at 24.7 feet									

Elev. (ft): 972, 970, 968, 966, 964, 962, 960, 958, 956, 954, 952, 950, 948, 946, 944

Depth (ft): 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

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BORING: **B-22A**

Project Number: LX240063	Weather: Sunny, 50's	Contractor: Strata Group
Name: EKPC Liberty	*Elevation (ft): 972.3	Drill Rig: CME-550
Client: East Kentucky Power Cooperative	Date Started: 3/28/24	Method: SFA
Location: Liberty, Kentucky	Date Completed: 3/28/24	Hole Size (in): 4
Logged By: B. Bishop, PE	Checked By: B. Hatcher, PE	

Elev. (ft)	Depth (ft)	Symbol	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
972			Sounding									Dry upon completion of soil augering
970	2											
			Shelby Tube									PP = 2.5 TSF TV = 4.5 kg/cm^2
968	4				24							
			Boring Terminated at 4.5 feet									
966	6											
964	8											
962	10											
960	12											
958	14											
956	16											
954	18											
952	20											
950	22											
948	24											
946	26											
944	28											

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

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BORING: **B-23**

Project Number: LX240063 Name: EKPC Liberty Client: East Kentucky Power Cooperative Location: Liberty, Kentucky Logged By: B. Bishop, PE	Weather: Sunny, 40's *Elevation (ft): 975.1 Date Started: 3/29/24 Date Completed: 3/29/24 Checked By: B. Hatcher, PE	Contractor: Strata Group Drill Rig: CME-550 Method: SFA Hole Size (in): 4

Elev. (ft)	Depth (ft)	Symbol	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
974			Topsoil - 6 inches Till Zone - 12 inches	3-2-4 (6)	12	21.2						Dry upon completion of soil augering
972	2		LEAN CLAY (CL) - STIFF to VERY STIFF, gray, with orange mottling, with silt, moist	3-5-7 (12)	18	19.3	25	17		81		
970	4			8-13-13 (26)	18	18.0	33	19		82		
968	6		FAT CLAY (CH) - HARD, gray, with orange mottling, silt, with chert fragments, moist	10-16-24 (40)	18	21.8	57	27		67		
966	8			50/1"	4	25.8						
964	10											
962	12			20-19-33 (52)	18	25.1						
960	14		FAT CLAY (CH) - HARD to VERY STIFF, orange, with silt, sandy, pebbles, chert fragments, moist to wet	4-8-10 (18)	12	38.1						
958	16											No core water loss observed
956	18		WEATHERED ROCK Auger Refusal at 17.5 feet Begin Coring at 17.5 feet									
954	20		SILTSTONE - light to dark gray, hard, limestone partings in top 5 feet, quartzite inclusion at 26.4		52							REC (%) - 87 RQD (%) - 85
952	22											
950	24				58.5							REC (%) - 98 RQD (%) - 80
948	26											
946	28											REC (%) - 92

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

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BORING: **B-23 (cont.)**

Project Number: LX240063	Weather: Sunny, 40's	Contractor: Strata Group
Name: EKPC Liberty	*Elevation (ft): 975.1	Drill Rig: CME-550
Client: East Kentucky Power Cooperative	Date Started: 3/29/24	Method: SFA
Location: Liberty, Kentucky	Date Completed: 3/29/24	Hole Size (in): 4
Logged By: B. Bishop, PE	Checked By: B. Hatcher, PE	

Elev. (ft)	Depth (ft)	Symbol	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
944	32		Auger Refusal at 17.5 feet Begin Coring at 17.5 feet SILTSTONE - light to dark gray, hard, limestone partings in top 5 feet, quartzite inclusion at 26.4(continued)		55							RQD (%) - 84
942	34											
940	36				60							REC (%) - 100 RQD (%) - 73
938	38											
936	40				60							REC (%) - 100 RQD (%) - 95
934	42											
932	44		Coring Terminated at 42.5 feet									
930	46											
928	48											
926	50											
924	52											
922	54											
920	56											
918	58											
916												

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

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BORING: **B-23A**

Project Number: LX240063 Name: EKPC Liberty Client: East Kentucky Power Cooperative Location: Liberty, Kentucky Logged By: B. Bishop, PE	Weather: Sunny, 40's *Elevation (ft): 975.1 Date Started: 3/29/24 Date Completed: 3/29/24 Checked By: B. Hatcher, PE	Contractor: Strata Group Drill Rig: CME-550 Method: SFA Hole Size (in): 4

Elev. (ft)	Depth (ft)	Symbol	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
	0–3		Sounding									Dry upon completion of soil augering
	3–4.5		Shelby Tube		16	17.2	26	21	6	100 99 98 95 84		Qu (psf) = 5643 PP = 3.0 TSF TV = 4.5 kg/cm^2
	4.5		Boring Terminated at 4.5 feet									

Elevation scale (ft): 974, 972, 970, 968, 966, 964, 962, 960, 958, 956, 954, 952, 950, 948, 946
Depth scale (ft): 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

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BORING: **B-24**

Project Number: LX240063 Name: EKPC Liberty Client: East Kentucky Power Cooperative Location: Liberty, Kentucky Logged By: S. Mills, EIT	Weather: Sunny, 70's *Elevation (ft): 977.4 Date Started: 4/16/24 Date Completed: 4/16/24 Checked By: B. Hatcher, PE	Contractor: Strata Group Drill Rig: CME-550 Method: SFA Hole Size (in): 4

Elev. (ft)	Depth (ft)	Symbol	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
976			Topsoil - 8 inches	3-3-3 (6)	8	21.1						
	2		Till Zone - 16 inches									
974			LEAN CLAY (CL) - VERY STIFF to STIFF, orange, with tan and gray mottling, with silt, chert fragments, moist to wet	5-7-9 (16)	12	25.4						
972	4			8-8-12 (20)	18	25.3						
970	6			3-6-7 (13)	18	40.3						
968	8		CLAY - STIFF to FIRM, gray, with tan and orange mottling, silt, chert fragments, wet	4-7-7 (14)	18	40.2						
966	10			6-5-4 (9)	18	41.1						
964	12			6-5-6 (11)	4	36.4						
962	14											
960	16											
958	18			3-4-4 (8)	4							
956	20											
954	22		Auger Refusal at 21.7 feet								▼	Water on observed tools at 21.7 feet
952	24											
950	26											
948	28											

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

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BORING LOG

BORING: **B-24A**

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Project Number: LX240063 Name: EKPC Liberty Client: East Kentucky Power Cooperative Location: Liberty, Kentucky Logged By: S. Mills, EIT	Weather: Sunny, 70's *Elevation (ft): 977.4 Date Started: 4/16/24 Date Completed: 4/16/24 Checked By: B. Hatcher, PE	Contractor: Strata Group Drill Rig: CME-550 Method: SFA Hole Size (in): 4

Elev. (ft)	Depth (ft)	Symbol	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
	0–2		Sounding									Dry upon completion of soil augering
	2–4		Shelby Tube		20	19.7	40	23	17	100 99 98 95 88		
	4		Boring Terminated at 4.0 feet									

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

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BORING: **B-25**

Project Number: LX240063	Weather: Cloudy, 60's	Contractor: Strata Group
Name: EKPC Liberty	*Elevation (ft): 973.6	Drill Rig: CME-550
Client: East Kentucky Power Cooperative	Date Started: 4/1/24	Method: SFA
Location: Liberty, Kentucky	Date Completed: 4/1/24	Hole Size (in): 4
Logged By: B. Bishop, PE	Checked By: B. Hatcher, PE	

Elev. (ft)	Depth (ft)	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
		Topsoil - 6 inches	2-2-2 (4)	12							
972		Till Zone - 12 inches									
	2	CLAY - VERY STIFF, tan, with gray mottling, silt, moist	5-9-9 (18)	10							
970	4		4-9-13 (22)	14							
968	6	CLAY - VERY STIFF, orange, with gray mottling, silt, chert fragments, moist									
966	8		5-8-10 (18)	18							
964	10		5-7-11 (18)	18							
962	12	CLAY - VERY STIFF to STIFF, gray, with little orange, silt, sand, chert and weathered rock fragments, moist	4-9-10 (19)	12							
960	14		7-6-4 (10)	6						▼	Water on observed tools at 15.0 feet
958	16										No core water loss observed
956	18	WEATHERED ROCK									
954	20	Auger Refusal at 17.9 feet Begin Coring at 17.9 feet		55							REC (%) - 92 RQD (%) - 98
952	22	LIMESTONE - light gray, fine grained, hard, with few shale partings and fossils									
950	24	SILTSTONE - greenish gray, with few layers of limestone, quartzite inclusions									
948	26			60							REC (%) - 100 RQD (%) - 77
946	28										
944											

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

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BORING: **B-25 (cont.)**

Project Number: LX240063 Name: EKPC Liberty Client: East Kentucky Power Cooperative Location: Liberty, Kentucky Logged By: B. Bishop, PE	Weather: Cloudy, 60's *Elevation (ft): 973.6 Date Started: 4/1/24 Date Completed: 4/1/24 Checked By: B. Hatcher, PE	Contractor: Strata Group Drill Rig: CME-550 Method: SFA Hole Size (in): 4

Elev. (ft)	Depth (ft)	Symbol	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
942–932	32–42		SILTSTONE - greenish gray, with few layers of limestone, quartzite inclusions(continued)		60							REC (%) - 100 RQD (%) - 82
					60							REC (%) - 100 RQD (%) - 97
					60							REC (%) - 100 RQD (%) - 100
930–914	44–58		Coring Terminated at 42.9 feet									

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

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BORING: **B-26**

Project Number: LX240063 Name: EKPC Liberty Client: East Kentucky Power Cooperative Location: Liberty, Kentucky Logged By: B. Bishop, PE	Weather: Sunny, 50's *Elevation (ft): 970.2 Date Started: 3/28/24 Date Completed: 3/28/24 Checked By: B. Hatcher, PE	Contractor: Strata Group Drill Rig: CME-550 Method: SFA Hole Size (in): 4

Elev. (ft)	Depth (ft)	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
970		Topsoil - 5 inches	2-3-4 (7)	16							
		Till Zone - 13 inches									
968	2	CLAY - VERY STIFF to HARD, orange, with gray mottling, silt, limestone fragments at 6.5 feet, moist	7-14-12 (26)	18							
966	4		5-12-12 (24)	18							
964	6		32-50/2"	8							
962	8										
960	10		29-21-24 (45)	6							
958	12	CLAY - VERY STIFF to FIRM, gray and orange, with silt, some sandy layers, chert fragments, moist	10-15-7 (22)	10							
956	14		2-3-2 (5)	0						▼	Water on observed tools at 14.0 feet
954	16										No core water loss observed
		WEATHERED ROCK									
952	18	Auger Refusal at 16.6 feet Begin Coring at 16.6 feet		59.5							REC (%) - 99 RQD (%) - 99
950	20	interbedded limestone and siltstone, light to dark gray, hard									
948	22	SILTSTONE - light gray, hard, with quartzite inclusions, weathered zone from 30.6 to 30.8 feet									
946	24			60							REC (%) - 100 RQD (%) - 97
944	26										
942	28			60							REC (%) - 100 RQD (%) - 82

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

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BORING: **B-26 (cont.)**

Project Number: LX240063 Name: EKPC Liberty Client: East Kentucky Power Cooperative Location: Liberty, Kentucky Logged By: B. Bishop, PE	Weather: Sunny, 50's *Elevation (ft): 970.2 Date Started: 3/28/24 Date Completed: 3/28/24 Checked By: B. Hatcher, PE	Contractor: Strata Group Drill Rig: CME-550 Method: SFA Hole Size (in): 4

Elev. (ft)	Depth (ft)	Symbol	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
940			SILTSTONE - light gray, hard, with quartzite inclusions, weathered zone from 30.6 to 30.8 feet(continued)									
938	32											
936	34				60							REC (%) - 100 RQD (%) - 100
934	36											
			Coring Terminated at 36.6 feet									
932	38											
930	40											
928	42											
926	44											
924	46											
922	48											
920	50											
918	52											
916	54											
914	56											
912	58											

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

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BORING: **B-27**

Project Number: LX240063 Name: EKPC Liberty Client: East Kentucky Power Cooperative Location: Liberty, Kentucky Logged By: B. Bishop, PE	Weather: Cloudy, 70's *Elevation (ft): 976.4 Date Started: 4/8/24 Date Completed: 4/8/24 Checked By: B. Hatcher, PE	Contractor: Strata Group Drill Rig: CME-550 Method: SFA Hole Size (in): 4

Elev. (ft)	Depth (ft)	Symbol	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
976			Topsoil - 8 inches									
			Till Zone - 28 inches	3-2-3 (5)	14	21.9						
974	2			3-4-7 (11)	16	22.9	33	22	11	91		
972	4		SILT (ML) - STIFF, orange, with gray mottling, clay, moist to wet	6-7-7 (14)	18	30.6	47	28	19	73		
970 / 968	6 / 8		SILT (ML) - STIFF to FIRM, orange, with clay, degraded weathered rock, black oxide nodules, wet	3-1-11 (12)	18	60.0					▼	Water on observed tools at 7.0 feet
966	10			2-3-6 (9)	18	71.5	0	0	0	71		
964	12			2-3-5 (8)	18	62.3						
962 / 960 / 958	14 / 16 / 18		CLAY - FIRM, brown, with silt, weathered rock fragments, wet	WH-4-3 (7)	18	58.7						WH = Weight of hammer
			WEATHERED ROCK	50/1"	0							No core water loss observed
956 / 954 / 952	20 / 22 / 24		Auger Refusal at 19.8 feet Begin Coring at 19..8 feet LIMESTONE - light gray, fine grained, with medium grained bands, hard, with fossils, quartzite incluion at 28 feet, interbedded silt stone starting at 28 feet		58.5							REC (%) - 98 RQD (%) - 98
950 / 948	26 / 28				60							REC (%) - 100 RQD (%) - 100

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

Left Photo: Photo of Approximate Boring Location
Right Photo: Photo of Boring

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BORING: **B-27 (cont.)**

Project Number: LX240063 Name: EKPC Liberty Client: East Kentucky Power Cooperative Location: Liberty, Kentucky Logged By: B. Bishop, PE	Weather: Cloudy, 70's *Elevation (ft): 976.4 Date Started: 4/8/24 Date Completed: 4/8/24 Checked By: B. Hatcher, PE	Contractor: Strata Group Drill Rig: CME-550 Method: SFA Hole Size (in): 4

Elev. (ft)	Depth (ft)	Symbol	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
946												
944	32		SILTSTONE - gray to greenish gray, with few limestone partings, fossils		57							REC (%) - 95 RQD (%) - 80
942	34											
940	36											
938	38				60							REC (%) - 100 RQD (%) - 88
936	40		Coring Terminated at 39.8 feet									
934	42											
932	44											
930	46											
928	48											
926	50											
924	52											
922	54											
920	56											
918	58											

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

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BORING: **B-28**

Project Number: LX240063	Weather: Cloudy, 40's	Contractor: Strata Group
Name: EKPC Liberty	*Elevation (ft): 967.1	Drill Rig: CME-550
Client: East Kentucky Power Cooperative	Date Started: 4/5/24	Method: SFA
Location: Liberty, Kentucky	Date Completed: 4/5/24	Hole Size (in): 4
Logged By: B. Bishop, PE	Checked By: B. Hatcher, PE	

Elev. (ft)	Depth (ft)	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
967.1–966.4	0–0.7	Topsoil - 8 inches	3-3-3 (6)	14	23.0						
966.4–965.6	0.7–1.5	Till Zone - 10 inches									
965.6–952.7	1.5–14.4	CLAY - VEREY STIFF to STIFF, orange, with gray mottling, silt, sandy cherty zones starting at 4 feet, moist to wet	4-6-10 (16)	8	30.0						
			6-7-13 (20)	18	32.3						
			7-10-14 (24)	18	28.7						
			3-3-18 (21)	18	55.3					▼	Water on observed tools at 10.0 feet
			13-4-6 (10)	18	49.3						
			50/2"	2							
952.7	14.4	WEATHERED ROCK									No core water loss observed
		Auger Refusal at 14.4 feet Begin Coring at 14.4 feet									
952.7–942.7	14.4–24.4	SILTSTONE - light gray to greenish gray, with few fossils, few cherty layers, mud seam at 15.4 feet, limestone partings at 19.4 to 24.4 feet		57							REC (%) - 95 RQD (%) - 92
				57							REC (%) - 95 RQD (%) - 92
942.7	24.4	Coring Terminated at 24.4 feet									

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

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BORING: **B-29**

Project Number: LX240063 Name: EKPC Liberty Client: East Kentucky Power Cooperative Location: Liberty, Kentucky Logged By: C. Gibbs	Weather: Cloudy, 40's *Elevation (ft): 966.3 Date Started: 4/9/24 Date Completed: 4/9/24 Checked By: B. Hatcher, PE	Contractor: Strata Group Drill Rig: Geo Probe Method: HSA Hole Size (in): 2.25

Elev. (ft)	Depth (ft)	Symbol	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
966			Topsoil - 5 inches	1-2-2 (4)	17							Dry upon completion of soil augering
			Till Zone - 13 inches									
964	2		CLAY - STIFF to VERY STIFF with FIRM zones, reddish brown to brown, with some black oxide nodules, some sand and chert, moist	3-3-6 (9)	12							
962	4			4-10-15 (25)	18							
960	6											
958	8			7-8-13 (21)	15							
956	10			7-3-5 (8)	11							
954	12											
952	14			WH-WH-1	5							WH = Weight of hammer
950	16		WEATHERED ROCK									
			Auger Refusal at 16.3 feet									
948	18											
946	20											
944	22											
942	24											
940	26											
938	28											

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

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BORING: B-30

Project Number: LX240063	Weather: Cloudy, 40's	Contractor: Strata Group
Name: EKPC Liberty	*Elevation (ft): 966.3	Drill Rig: CME-550
Client: East Kentucky Power Cooperative	Date Started: 4/5/24	Method: SFA
Location: Liberty, Kentucky	Date Completed: 4/5/24	Hole Size (in): 4
Logged By: B. Bishop, PE	Checked By: B. Hatcher, PE	

Elev. (ft)	Depth (ft)	Symbol	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
966			Topsoil - 10 inches	3-3-4 (7)	18	22.2						
			Till Zone - 8 inches									
964	2		CLAY - VERY STIFF to FIRM to STIFF, orange, with gray mottling, silt, chert staring at 15 feet, moist to wet	4-8-8 (16)	18	31.7						
962	4			7-11-11 (22)	16	26.1						
960	6			10-15-13 (28)	14	33.5						
958	8											
956	10			5-10-11 (21)	18	35.2					▼	Water on observed tools at 11.0 feet
954	12			4-3-4 (7)	2	45.6						
952	14			3-6-5 (11)	6							
950	16											
948	18		Auger Refusal at 16.9 feet Begin Coring at 16.9 feet SILTSTONE - light gray to greenish gray, few fossils, with interbedded limestone, small mudseams at 21.5 feet									No core water loss observed
946	20				58							REC (%) - 97 RQD (%) - 93
944	22											
942	24				57							REC (%) - 95 RQD (%) - 68
940	26											
938	28		Coring Terminated at 26.9 feet									

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

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BORING: **B-31**

Project Number: LX240063 Name: EKPC Liberty Client: East Kentucky Power Cooperative Location: Liberty, Kentucky Logged By: C. Gibbs	Weather: Cloudy, 40's *Elevation (ft): 959.4 Date Started: 4/9/24 Date Completed: 4/9/24 Checked By: B. Hatcher, PE	Contractor: Strata Group Drill Rig: Geo Probe Method: HSA Hole Size (in): 2.25

Elev. (ft)	Depth (ft)	Symbol	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
			Topsoil - 6 inches	1-3-3 (6)	12							Dry upon completion of soil augering
958			Till Zone - 12 inches									
	2		CLAY - STIFF with VERY STIFF zone, reddish brown, with chert and some sand, moist	3-5-9 (14)	18							
956	4			13-12-9 (21)	15							
954	6											
952	8			6-6-5 (11)	16							
950	10			10-5-3 (8)	7							
948	12											
946	14		Auger Refusal at 13.5 feet									
944	16											
942	18											
940	20											
938	22											
936	24											
934	26											
932	28											
930												

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

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BORING: **INF-1**

Project Number: LX240063	Weather: Cloudy, 40's	Contractor: Strata Group
Name: EKPC Liberty	*Elevation (ft): 974.6	Drill Rig: Geo Probe
Client: East Kentucky Power Cooperative	Date Started: 4/9/24	Method: HSA
Location: Liberty, Kentucky	Date Completed: 4/9/24	Hole Size (in): 2.25
Logged By: C. Gibbs	Checked By: B. Hatcher, PE	

Elev. (ft)	Depth (ft)	Symbol	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
974	0–4		Sounding									Dry upon completion of soil augering
970	4–5.3		Shelby Tube		12							
	5.3–6		Sounding									
968	6–8		Shelby Tube		17	36.6	74	37	37	100 98 93 90 88 85		
966	8		Boring Terminated at 8.0 feet									

No Photo Available

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

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BORING: **INF-2**

Project Number: LX240063	Weather: Cloudy, 40's	Contractor: Strata Group
Name: EKPC Liberty	*Elevation (ft): 971.6	Drill Rig: Geo Probe
Client: East Kentucky Power Cooperative	Date Started: 4/9/24	Method: HSA
Location: Liberty, Kentucky	Date Completed: 4/9/24	Hole Size (in): 2.25
Logged By: C. Gibbs	Checked By: B. Hatcher, PE	

Elev. (ft)	Depth (ft)	Symbol	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
	0–4		Sounding									Dry upon completion of soil augering
	4–6		Shelby Tube		19	33.6	71	36	35	100		
	6–6.5		Sounding							97 95 93 90		
	6.5–7.5		Shelby Tube		10							
	7.5		Boring Terminated at 7.5 feet									

No Photo Available

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

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BORING: **SW-1**

Project Number: LX240063	Weather: Sunny, 70's	Contractor: Strata Group
Name: EKPC Liberty	*Elevation (ft): 972.4	Drill Rig: CME-550
Client: East Kentucky Power Cooperative	Date Started: 4/15/24	Method: SFA
Location: Liberty, Kentucky	Date Completed: 4/15/24	Hole Size (in): 4
Logged By: S. Mills, EIT	Checked By: B. Hatcher, PE	

Elev. (ft)	Depth (ft)	Symbol	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
972			Topsoil - 8 inches	2-1-2 (3)	8		32	21	11			
970	2		Till Zone - 28 inches	4-7-10 (17)	8							
968	4		CLAY - STIFF to VERY STIFF, gray, with tan mottling, silt, moist	7-5-8 (13)	10							
966	6			10-13-11 (24)	12							
964	8		CLAY - VERY STIFF to STIFF, orange, with gray mottling, silt, chert fragments, moist									
962	10			4-9-16 (25)	14							Water on observed tools at 9.0 feet
960	12			5-5-7 (12)	16							
958	14			3-50/3"	0						▼	
956	16		WEATHERED ROCK Auger Refusal at 15.0 feet Begin Coring at 15.0 feet									No core water loss observed
954	18		LIMESTONE - light gray, medium grained, hard, few shale partings		60							REC (%) - 100 RQD (%) - 90
952	20		SILTSTONE - greenish gray, few layers of limestone, quartzite incluisons									
950	22				60							REC (%) - 100 RQD (%) - 87
948	24											
946	26											
944	28				60							REC (%) - 100 RQD (%) - 85

No Photo Available

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

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BORING: **SW-1 (cont.)**

Project Number: LX240063 Name: EKPC Liberty Client: East Kentucky Power Cooperative Location: Liberty, Kentucky Logged By: S. Mills, EIT	Weather: Sunny, 70's *Elevation (ft): 972.4 Date Started: 4/15/24 Date Completed: 4/15/24 Checked By: B. Hatcher, PE	Contractor: Strata Group Drill Rig: CME-550 Method: SFA Hole Size (in): 4

Elev. (ft)	Depth (ft)	Symbol	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
942–932	31–40		SILTSTONE - greenish gray, few layers of limestone, quartzite incluisons(continued)		54							REC (%) - 90 RQD (%) - 90
					52							REC (%) - 87 RQD (%) - 87
932	40		Coring Terminated at 40.0 feet									

Elevation scale: 942, 940, 938, 936, 934, 932, 930, 928, 926, 924, 922, 920, 918, 916, 914
Depth scale: 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58

No Photo Available

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

Left Photo: Photo of Approximate Boring Location
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BORING: **SW-2**

Project Number: LX240063 Name: EKPC Liberty Client: East Kentucky Power Cooperative Location: Liberty, Kentucky Logged By: S. Mills, EIT	Weather: Cloudy, 70's *Elevation (ft): 972.5 Date Started: 4/17/24 Date Completed: 4/17/24 Checked By: B. Hatcher, PE	Contractor: Strata Group Drill Rig: CME-550 Method: SFA Hole Size (in): 4

Elev. (ft)	Depth (ft)	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
972		Topsoil - 6 inches	2-3-4 (7)	10	25.1						Dry upon completion of soil augering
		Till Zone - 18 inches									
970	2	LEAN CLAY (CL) - VERY STIFF, tan, with orange and gray mottling, silty, moist	8-13-15 (28)	16	17.0						
968	4	CLAY - VERY STIFF to STIFF with HARD zone, orange, with tan and gray mottling, silt, chert fragments, moist to wet	5-10-14 (24)	18	25.3						
966	6		7-14-17 (31)	18	29.0						
964	8										
962	10		11-14-16 (30)	12	22.9						
960	12		3-7-7 (14)	1	34.4						
958	14	Auger Refusal at 14.1 feet	50/1"		21.7						
956	16										
954	18										
952	20										
950	22										
948	24										
946	26										
944	28										

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

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BORING: **SW-2A**

Project Number: LX240063	Weather: Cloudy, 70's	Contractor: Strata Group
Name: EKPC Liberty	*Elevation (ft): 972.5	Drill Rig: CME-550
Client: East Kentucky Power Cooperative	Date Started: 4/17/24	Method: SFA
Location: Liberty, Kentucky	Date Completed: 4/17/24	Hole Size (in): 4
Logged By: S. Mills, EIT	Checked By: B. Hatcher, PE	

Elev. (ft)	Depth (ft)	Symbol	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
972			Sounding									Dry upon completion of soil augering
970	2		Shelby Tube		24	19.8	34	21	13	100 99 97 89		
968	4		Boring Terminated at 4.0 feet									
966	6											
964	8											
962	10											
960	12											
958	14											
956	16											
954	18											
952	20											
950	22											
948	24											
946	26											
944	28											

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

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BORING: **SW-3**

Project Number: LX240063	Weather: Cloudy, 70's	Contractor: Strata Group
Name: EKPC Liberty	*Elevation (ft): 976.1	Drill Rig: CME-550
Client: East Kentucky Power Cooperative	Date Started: 4/17/24	Method: SFA
Location: Liberty, Kentucky	Date Completed: 4/17/24	Hole Size (in): 4
Logged By: S. Mills, EIT	Checked By: B. Hatcher, PE	

Elev. (ft)	Depth (ft)	Symbol	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
			Topsoil - 6 inches									
			Till Zone - 24 inches	2-3-2 (5)	14	23.2						Dry upon completion of soil augering
974	2			4-7-13 (20)	18	19.2						
			CLAY - VERY STIFF, tan, with gray mottling, silt, moist									
972	4		CLAY - VERY STIFF to STIFF to FIRM, orange, with gray mottling, silt, chert fragments, moist to wet	6-9-12 (21)	18	21.7						
970	6											
968	8			4-9-10 (19)	18	34.7						
966	10			5-11-9 (20)	18	37.2						
964	12			4-6-6 (12)	10	36.8						
962	14			4-3-5 (8)	2							
960	16											
958	18											
956	20			11-14-50/4"	2							
			Auger Refusal at 20.4 feet									
954	22											
952	24											
950	26											
948	28											

No Photo Available

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

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BORING: **SW-3A**

Project Number: LX240063	Weather: Cloudy, 70's	Contractor: Strata Group
Name: EKPC Liberty	*Elevation (ft): 976.1	Drill Rig: CME-550
Client: East Kentucky Power Cooperative	Date Started: 4/17/24	Method: SFA
Location: Liberty, Kentucky	Date Completed: 4/17/24	Hole Size (in): 4
Logged By: S. Mills, EIT	Checked By: B. Hatcher, PE	

Elev. (ft)	Depth (ft)	Symbol	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
			Sounding									Dry upon completion of soil augering
974	2		Shelby Tube		24							
972	4		Boring Terminated at 4.0 feet									
970	6											
968	8											
966	10											
964	12											
962	14											
960	16											
958	18											
956	20											
954	22											
952	24											
950	26											
948	28											

No Photo Available

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

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BORING: **SW-4**

Project Number: LX240063	Weather: Cloudy, 60's	Contractor: Strata Group
Name: EKPC Liberty	*Elevation (ft): 979.2	Drill Rig: CME-550
Client: East Kentucky Power Cooperative	Date Started: 4/16/24	Method: SFA
Location: Liberty, Kentucky	Date Completed: 4/16/24	Hole Size (in): 4
Logged By: S. Mills, EIT	Checked By: B. Hatcher, PE	

Elev. (ft)	Depth (ft)	Symbol	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
978			Topsoil - 10 inches	3-2-3 (5)	12	23.5						
	2		Till Zone - 20 inches	4-4-10 (14)	14	24.5						
976–974	4		CLAY - VERY STIFF to STIFF to SOFT, orange, with gray and tan mottling, silt, chert fragments, moist to wet	6-7-13 (20)	14	38.1						
972	8			5-6-10 (16)	16	41.7						
970	10			4-6-8 (14)	18	45.6						
968	12			6-6-8 (14)	18	43.3						
964	14			3-10-5 (15)	18	43.0						
962	18										▼	Water on observed tools at 18.0 feet
960	20			2-2-2 (4)	0							
956	22.5		Auger Refusal at 22.5 feet									

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

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BORING: **SW-5**

Project Number: LX240063 Name: EKPC Liberty Client: East Kentucky Power Cooperative Location: Liberty, Kentucky Logged By: B. Bishop, PE	Weather: Rainy, 60's *Elevation (ft): 976.7 Date Started: 4/10/24 Date Completed: 4/10/24 Checked By: B. Hatcher, PE	Contractor: Strata Group Drill Rig: CME-550 Method: SFA Hole Size (in): 4

Elev. (ft)	Depth (ft)	Symbol	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
976			Topsoil - 8 inches	2-2-3 (5)	18							Dry upon completion of soil augering
974	2		Till Zone - 28 inches	5-4-8 (12)	16							
972	4		CLAY - VERY STIFF, tan, with gray mottling, silt, moist	6-10-13 (23)	18							
970	6		CLAY - HARD to VERY STIFF, orange, with gray mottling, silt, chert fragments, moist	6-17-18 (35)	18							
968	8											
966	10			4-9-9 (18)	18							
964	12		CLAY - STIFF to VERY STIFF, gray, with little orange, with silt, sand, chert and weathered rock fragments, moist	4-4-11 (15)	16							
962	14			2-8-8 (16)	12							
960	16											
958	18			6-50/4"	0							
956	20		WEATHERED ROCK									
			Auger Refusal at 20.5 feet Begin Coring at 20.5 feet									
954	22		LIMESTONE - light gray, medium grained, hard, with few shale parting, and fossils		57							No core water loss observed REC (%) - 95 RQD (%) - 84
952	24											
950	26		SILTSTONE - greenish gray, few layers of limestone, quartzite inclusions									
948	28				60							REC (%) - 100 RQD (%) - 88

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

Left Photo: Photo of Approximate Boring Location
Right Photo: Photo of Boring

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BORING: **SW-5 (cont.)**

Project Number: LX240063 Name: EKPC Liberty Client: East Kentucky Power Cooperative Location: Liberty, Kentucky Logged By: B. Bishop, PE	Weather: Rainy, 60's *Elevation (ft): 976.7 Date Started: 4/10/24 Date Completed: 4/10/24 Checked By: B. Hatcher, PE	Contractor: Strata Group Drill Rig: CME-550 Method: SFA Hole Size (in): 4

Elev. (ft)	Depth (ft)	Symbol	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
946–932	31–45.5		SILTSTONE - greenish gray, few layers of limestone, quartzite inclusions(continued)		56							REC (%) - 93 RQD (%) - 77
					60							REC (%) - 100 RQD (%) - 83
					54							REC (%) - 90 RQD (%) - 87
930–918	45.5–59		Coring Terminated at 45.5 feet									

Elevation scale (ft): 946, 944, 942, 940, 938, 936, 934, 932, 930, 928, 926, 924, 922, 920, 918
Depth scale (ft): 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

Left Photo: Photo of Approximate Boring Location
Right Photo: Photo of Boring

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BORING: **SW-6**

Project Number: LX240063	Weather: Cloudy, 60's	Contractor: Strata Group
Name: EKPC Liberty	*Elevation (ft): 979.6	Drill Rig: CME-550
Client: East Kentucky Power Cooperative	Date Started: 4/16/24	Method: SFA
Location: Liberty, Kentucky	Date Completed: 4/16/24	Hole Size (in): 4
Logged By: S. Mills, EIT	Checked By: B. Hatcher, PE	

Elev. (ft)	Depth (ft)	Symbol	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
			Topsoil - 8 inches	2-3-3 (6)	14							
978	2		Till Zone - 28 inches	3-4-6 (10)	16							
976	4		CLAY - VERY STIFF, orange, with gray and tan mottling, silt, chert fragments, moist									
974				6-8-13 (21)	18							
	6											
972	8			7-9-11 (20)	18							
970	10			3-4-12 (16)	18							
968	12		CLAY - VERY STIFF, gray, with orange and tan mottling mottling, silt, chert fragments, moist	6-13-10 (23)	16							
966	14		CLAY - STIFF to VERY STIFF, tan, with gray mottling, silt, chert fragments, moist	5-7-8 (15)	14							
964	16										▼	Water on observed tools at 16.0 feet
962	18											
960	20			4-3-15 (18)	10							
958	22											
956	24		WEATHERED ROCK									
			Auger Refusal at 23.4									
954	26											
952	28											
950												

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

Left Photo: Photo of Approximate Boring Location
Right Photo: Photo of Boring

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BORING: **SW-7**

Project Number: LX240063 Name: EKPC Liberty Client: East Kentucky Power Cooperative Location: Liberty, Kentucky Logged By: S. Mills, EIT	Weather: Sunny, 70's *Elevation (ft): 981.3 Date Started: 4/15/24 Date Completed: 4/15/24 Checked By: B. Hatcher, PE	Contractor: Strata Group Drill Rig: CME-550 Method: SFA Hole Size (in): 4

Elev. (ft)	Depth (ft)	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
980		Topsoil - 8 inches	3-2-3 (5)	12	24.3				67		
	2	Till Zone - 22 inches	5-8-10 (18)	14	20.4						
978	4	CLAY - VERY STIFF, tan, with gray mottling, silt, moist									
976	6	FAT CLAY (CH) - VERY STIFF, orange, with gray mottling, silt, sand, chert fragments, moist to wet	7-9-11 (20)	10	29.2	76	34	43			
974	8		7-11-12 (23)	16	23.8						
972	10		8-7-9 (16)	0	28.1						
970	12		21-14-10 (24)	12	34.7						
968	14	FAT CLAY (CH) - STIFF, gray, with little orange, silt, sand, weathered rock and chert fragments, moist	8-6-6 (12)	18							
966	16										
964	18										
962	20		5-6-8 (14)	4						▼	Water on observed tools at 20.0 feet
960	22										
958	24										
956	26										
954	28										
952		Auger Refusal at 28.9 feet									No core water loss observed

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

Left Photo: Photo of Approximate Boring Location
Right Photo: Photo of Boring

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BORING: **SW-7 (cont.)**

Project Number: LX240063 Name: EKPC Liberty Client: East Kentucky Power Cooperative Location: Liberty, Kentucky Logged By: S. Mills, EIT	Weather: Sunny, 70's *Elevation (ft): 981.3 Date Started: 4/15/24 Date Completed: 4/15/24 Checked By: B. Hatcher, PE	Contractor: Strata Group Drill Rig: CME-550 Method: SFA Hole Size (in): 4

Elev. (ft)	Depth (ft)	Symbol	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
950	32		Begin Coring at 28.9 feet LIMESTONE - light gray, medium grained, hard, few shale partings		58							REC (%) - 97 RQD (%) - 88
948, 946	34, 36		SILTSTONE - greenish gray, few layers of limeston, quartzite inclions, vertical fractures(continued)		60							REC (%) - 100 RQD (%) - 78
944, 942, 940	38, 40, 42				58							REC (%) - 97 RQD (%) - 93
938, 936, 934	44, 46, 48				60							REC (%) - 100 RQD (%) - 100
932, 930, 928	50, 52				58							REC (%) - 97 RQD (%) - 87
926, 924, 922	54, 56, 58		Coring Terminated at 53.9 feet									

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

Left Photo: Photo of Approximate Boring Location
Right Photo: Photo of Boring

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BORING: **SW-7A**

Project Number: LX240063 Name: EKPC Liberty Client: East Kentucky Power Cooperative Location: Liberty, Kentucky Logged By: S. Mills, EIT	Weather: Sunny, 70's *Elevation (ft): 981.3 Date Started: 4/15/24 Date Completed: 4/15/24 Checked By: B. Hatcher, PE	Contractor: Strata Group Drill Rig: CME-550 Method: SFA Hole Size (in): 4

Elev. (ft)	Depth (ft)	Symbol	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
981.3–978	0–3		Sounding									Dry upon completion of soil augering
978–976	3–5		Shelby Tube		24							
	5.0		Boring Terminated at 5.0 feet									

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Right Photo: Photo of Boring

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BORING: **SW-8**

Project Number: LX240063	Weather: Sunny, 70's	Contractor: Strata Group
Name: EKPC Liberty	*Elevation (ft): 979.8	Drill Rig: CME-550
Client: East Kentucky Power Cooperative	Date Started: 4/15/24	Method: SFA
Location: Liberty, Kentucky	Date Completed: 4/15/24	Hole Size (in): 4
Logged By: S. Mills, EIT	Checked By: B. Hatcher, PE	

Elev. (ft)	Depth (ft)	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
		Topsoil - 8 inches	1-2-2 (4)	8							
		Till Zone - 10 inches									
978	2	LEAN CLAY (CL) - STIFF, red, with gray mottling, silt, moist	3-4-7 (11)	12							
976	4	CLAY - VERY STIFF, orange, with gray mottling, silt, sand, weathered rock and chert fragments, moist	4-10-11 (21)	18							
974	6										
972	8		10-12-14 (26)	18							
970	10		6-9-13 (22)	18							
968	12		14-12-18 (30)	18							
966	14		7-8-12 (20)	18						▼	
964	16										Water on observed tools at 15.5 feet
962	18	CLAY - FIRM, gray, with little orange, silt, sand, weathered rock and chert fragments, moist									
960	20		6-3-4 (7)	18							
958	22	WEATHERED ROCK									No core water loss observed
		Auger Refusal at 21.4 Begin Coring at 21.4									
956	24	MUDSEAM		41							REC (%) - 68 RQD (%) - 43
954	26	SILTSTONE - geenish gray, few layers of limestoine, quartxite inclusions, becoming cherty at 31.9 feet, few shale partings at 34 feet									
952	28			60							REC (%) - 100 RQD (%) - 100
950											

No Photo Available

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

Left Photo: Photo of Approximate Boring Location
Right Photo: Photo of Boring

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BORING: **SW-8 (cont.)**

Project Number: LX240063	Weather: Sunny, 70's	Contractor: Strata Group
Name: EKPC Liberty	*Elevation (ft): 979.8	Drill Rig: CME-550
Client: East Kentucky Power Cooperative	Date Started: 4/15/24	Method: SFA
Location: Liberty, Kentucky	Date Completed: 4/15/24	Hole Size (in): 4
Logged By: S. Mills, EIT	Checked By: B. Hatcher, PE	

Elev. (ft)	Depth (ft)	Symbol	Description	Blow Counts (N Value)	Recov. (in)	WC (%)	LL	PL	PI	%<#200	Water Level	Remarks
948	32		SILTSTONE - geenish gray, few layers of limestoine, quartxite inclusions, becoming cherty at 31.9 feet, few shale partings at 34 feet(continued)									
946	34				60							REC (%) - 100 RQD (%) - 97
944	36											
942	38				55							REC (%) - 92 RQD (%) - 83
940	40											
938	42		Corin Terminated at 41.9 feet									
936	44											
934	46											
932	48											
930	50											
928	52											
926	54											
924	56											
922	58											
920												

No Photo Available

*Elevations were determined using Real Time Kinematic Differential GPS referencing the KYCORS network.

Left Photo: Photo of Approximate Boring Location
Right Photo: Photo of Boring

FIELD TESTING PROCEDURES

Field Operations: The general field procedures employed by CSI are summarized in ASTM D 420 which is entitled "Investigating and Sampling Soils and Rocks for Engineering Purposes." This recommended practice lists recognized methods for determining soil and rock distribution and ground water conditions. These methods include geophysical and in situ methods as well as borings.

Borings are drilled to obtain subsurface samples using one of several alternate techniques depending upon the subsurface conditions. These techniques are:

a. Continuous 2-1/2 or 3-1/4 inch I.D. hollow stem augers;

b. Wash borings using roller cone or drag bits (mud or water);

c. Continuous flight augers (ASTM D 1425).

These drilling methods are not capable of penetrating through material designated as "refusal materials." Refusal, thus indicated, may result from hard cemented soil, soft weathered rock, coarse gravel or boulders, thin rock seams, or the upper surface of sound continuous rock. Core drilling procedures are required to determine the character and continuity of refusal materials.

The subsurface conditions encountered during drilling are reported on a field test boring record by the chief driller. The record contains information concerning the boring method, samples attempted and recovered, indications of the presence of various materials such as coarse gravel, cobbles, etc., and observations between samples. Therefore, these boring records contain both factual and interpretive information. The field boring records are on file in our office.

The soil and rock samples plus the field boring records are reviewed by a geotechnical engineer. The engineer classifies the soils in general accordance with the procedures outlined in ASTM D 2488 and prepares the final boring records, which are the basis for all evaluations and recommendations.

The final boring records represent our interpretation of the contents of the field records based on the results of the engineering examinations and tests of the field samples. These records depict subsurface conditions at the specific locations and at the particular time when drilled. Soil conditions at other locations may differ from conditions occurring at these boring locations. Also, the passage of time may result in a change in the subsurface soil and ground water conditions at these boring locations. The lines designating the interface between soil or refusal materials on the records and on profiles represent approximate boundaries. The transition between materials may be gradual. The final boring records are included with this report.

The detailed data collection methods using during this study are discussed on the following pages.

Soil Test Borings: Soil test borings were made at the site at locations shown on the attached Boring Plan. Soil sampling and penetration testing were performed in accordance with ASTM D 1586.

The borings were made by mechanically twisting a hollow stem steel auger into the soil. At regular intervals, the drilling tools were removed and soil samples obtained with a standard 1.4 inch I.D., 2 inch O.D., split tube sampler. The sampler was first seated 6 inches to penetrate any loose cuttings, then driven an additional foot with blows of a 140-pound hammer falling 30 inches. The number of hammer blows required to drive the sampler the final foot was recorded and is designated the "penetration resistance". The penetration resistance, when properly evaluated, is an index to the soil strength and foundation supporting capability.

Representative portions of the soil samples, thus obtained, were placed in glass jars and transported to the laboratory. In the laboratory, the samples were examined to verify the driller's field classifications. Test Boring Records are attached which graphically show the soil descriptions and penetration resistances.

Core Drilling: Refusal materials are materials that cannot be penetrated with the soil drilling methods employed. Refusal, thus indicated, may result from hard cemented soil, soft weathered rock, coarse gravel or boulders, thin rock seams or the upper surface of sound continuous rock. Core drilling procedures are required to determine the character and continuity of refusal materials.

Prior to coring, casing is set in the drilled hole through the overburden soils, if necessary, to keep the hole from caving. Refusal materials are then cored according to ASTM D 2113 using a diamond-studded bit fastened to the end of a hollow double tube core barrel. This device is rotated at high speeds, and the cuttings are brought to the surface by circulating water. Core samples of the material penetrated are protected and retained in the swivel-mounted inner tube. Upon completion of each drill run, the core barrel is brought to the surface, the core recovered is measured, the samples are removed and the core is placed in boxes for storage.

The core samples are returned to our laboratory where the refusal material is identified and the percent core recovery and rock quality designation is determined by a soils engineer or geologist. The percent core recovery is the ratio of the sample length obtained to the depth drilled, expressed as a percent. The rock quality designation (RQD) is obtained by summing up the length of core recovered, including only the pieces of core which are four inches or longer, and dividing by the total length drilled. The percent core recovery and RQD are related to soundness and continuity of the refusal material. Refusal material descriptions, recoveries, and RQDs are shown on the "Test Boring Records".

Hand Auger Borings and Dynamic Cone Penetration Testing: Hand auger borings are performed manually by CSI field personnel. This consists of manually twisting hand auger tools into the subsurface and extracting “grab” or baggie samples at intervals determined by the project engineer. At the sample intervals, dynamic cone penetration (DCP) testing is performed. This testing involves the manual raising and dropping of a 20-pound hammer, 18 inches. This “driver” head drives a solid-13⁄4 inch diameter cone into the ground. DCP “counts” are the number of drops it takes for the hammer to drive three 13⁄4 inch increments, recorded as X-Y-Z values.

Test Pits: Test pits are excavated by the equipment available, often a backhoe or trackhoe. The dimensions of the test pits are based on the equipment used and the power capacity of the equipment. Samples are taken from the spoils of typical buckets of the excavator and sealed in jars or “Ziploc” baggies. Dynamic Cone Penetration or hand probe testing is often performed in the upper few feet as OSHA standards allow. Refusal is deemed as the lack of advancement of the equipment with reasonable to full machine effort.

Water Level Readings: Water table readings are normally taken in conjunction with borings and are recorded on the "Test Boring Records". These readings indicate the approximate location of the hydrostatic water table at the time of our field investigation. Where impervious soils are encountered (clayey soils) the amount of water seepage into the boring is small, and it is generally not possible to establish the location of the hydrostatic water table through water level readings. The ground water table may also be dependent upon the amount of precipitation at the site during a particular period of time. Fluctuations in the water table should be expected with variations in precipitation, surface run-off, evaporation and other factors.

The time of boring water level reported on the boring records is determined by field crews as the drilling tools are advanced. The time of boring water level is detected by changes in the drilling rate, soil samples obtained, etc. Additional water table readings are generally obtained at least 24 hours after the borings are completed. The time lag of at least 24 hours is used to permit stabilization of the ground water table, which has been disrupted by the drilling operations. The readings are taken by dropping a weighted line down the boring or using an electrical probe to detect the water level surface.

Occasionally the borings will cave-in, preventing water level readings from being obtained or trapping drilling water above the caved-in zone. The cave-in depth is also measured and recorded on the boring records.

Summary of Laboratory Results

Borehole	Depth	Sample Type	Liquid Limit	Plastic Limit	Plasticity Index	Class-ification	Water Content (%)	Unconfined Compressive Strength (psf)	Rock QU (ksf)	Dry Density (pcf)	Wet Density (pcf)	Max. Dry Density (pcf)	Opt. Water Content (%)	Swell Pressure (psf)	pH of Soil Distilled Water	pH of Soil Calcium Carbonate	Resistivity (ohm.cm)	k (cm/sec)	% Finer #200
B-2	0.0	SS					19.1												
B-2	1.5	SS					14.4												
B-2	4.0	SS					30.5												
B-2	6.5	SS					67.3												
B-2	9.0	SS					33.9												
B-4	0.0	SS	38	22	16	CL	23.3												83.7
B-4	1.5	SS	56	26	30	CH	21.9												88.7
B-4	3.0	GRAB	52	26	26	CH	26.2								5.13	3.51	200000		83.7
B-4	4.0	SS					43.5												
B-4	6.5	SS	70	36	34	MH	38.5												92.1
B-4	9.0	SS					42.1												
B-4	11.5	SS	64	36	28	MH	41.1												67.9
B-4	14.0	SS					28.4												
B-5	0.0	SS					20.7												
B-5	3.0	GRAB	55	26	29	CH	30.6					97.3	23.8		5.69	3.69	170000		95.2
B-5	6.5	SS					27.7												
B-5	9.0	SS					44.8												
B-5	14.0	SS					43.7												
B-8	3.0	CORE							1472										
B-9	0.0	SS					24.0												
B-9	1.5	SS					21.7												
B-9	4.0	SS					34.1												
B-9	6.5	SS					33.0												
B-9	9.0	SS					49.2												
B-9A	3.0	ST	65	30	35	CH	33.4			88.6	118.3								94.2
B-13	0.0	SS					19.9												

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Fax: 888.792.3121

SS - Split Spoon Sample
GRAB - Bulk Grab Sample
k - Coefficient of Permeability
- See Attached test Results

PROJECT INFORMATION

Client: East Kentucky Power Cooperative
Project Name: EKPC Liberty
Project Number: LX240063
Project Location: Liberty, Kentucky

Summary of Laboratory Results

Borehole	Depth	Sample Type	Liquid Limit	Plastic Limit	Plasticity Index	Class-ification	Water Content (%)	Unconfined Compressive Strength (psf)	Rock QU (ksf)	Dry Density (pcf)	Wet Density (pcf)	Max. Dry Density (pcf)	Opt. Water Content (%)	Swell Pressure (psf)	pH of Soil Distilled Water	pH of Soil Calcium Carbonate	Resistivity (ohm.cm)	k (cm/sec)	% Finer #200
B-13	1.5	SS	46	23	23	CL	21.0												85.0
B-13	6.5	SS	45	21	24	CL	16.3												60.3
B-13	9.0	SS					32.6												
B-13	11.5	SS					30.1												
B-13	14.0	SS					31.8												
B-13A	4.0	ST	46	24	22	CL	20.2	7249		108.0	129.8								86.5
B-16	39.7	GRAB							1443										
B-16	0.0	SS					20.5												
B-16	1.5	SS					27.5												
B-16	2.0	GRAB	59	28	31	CH	33.6					89.5	28.8	1750					86.8
B-16	4.0	SS	94	38	56	CH	38.0												97.6
B-16	6.5	SS	43	28	15	ML	33.5												60.3
B-16	9.0	SS					43.6												
B-16	11.5	SS					53.5												
B-16	14.0	SS					54.2												
B-17	0.0	SS					21.2												
B-17	1.5	SS	31	19	12	CL	22.0												77.4
B-17	4.0	SS	30	19	11	CL	20.3												80.2
B-17	6.5	SS					16.5												
B-17	9.0	SS	69	29	40	CH	30.0												81.4
B-17	11.5	SS					29.0												
B-17	14.0	SS					30.4												
B-18	3.0	GRAB	29	19	10	CL	20.0								5.16	3.75	240000		83.5
B-20	3.0	GRAB	56	29	27	CH	30.4								4.86	3.73	370000		80.5
B-21	3.0	GRAB	49	25	24	CL	27.8								5.17	3.94	220000		89.2
B-23	0.0	SS					21.2												

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GRAB - Bulk Grab Sample
k - Coefficient of Permeability
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PROJECT INFORMATION

Client: East Kentucky Power Cooperative
Project Name: EKPC Liberty
Project Number: LX240063
Project Location: Liberty, Kentucky

Summary of Laboratory Results

Borehole	Depth	Sample Type	Liquid Limit	Plastic Limit	Plasticity Index	Class-ification	Water Content (%)	Unconfined Compressive Strength (psf)	Rock QU (ksf)	Dry Density (pcf)	Wet Density (pcf)	Max. Dry Density (pcf)	Opt. Water Content (%)	Swell Pressure (psf)	pH of Soil Distilled Water	pH of Soil Calcium Carbonate	Resistivity (ohm.cm)	k (cm/sec)	% Finer #200
B-23	1.5	SS	25	17	8	CL	19.3												80.6
B-23	4.0	SS	33	19	14	CL	18.0												82.4
B-23	6.5	SS	57	27	30	CH	21.8												66.5
B-23	9.0	SS					25.8												
B-23	11.5	SS					25.1												
B-23	14.0	SS					38.1												
B-23A	3.0	ST	26	21	5	CL-ML	17.2	5643		111.6	130.8								84.2
B-24	0.0	SS					21.1												
B-24	1.5	SS					25.4												
B-24	4.0	SS					25.3												
B-24	6.5	SS					40.3												
B-24	9.0	SS					40.2												
B-24	11.5	SS					41.1												
B-24	14.0	SS					36.4												
B-24A	2.0	ST	40	23	17	CL	19.7			106.7	127.8								87.9
B-25	28.4	CORE							549										
B-27	0.0	SS					21.9												
B-27	1.5	SS	33	22	11	CL	22.9												90.6
B-27	4.0	SS	47	28	19	ML	30.6												73.0
B-27	6.5	SS					60.0												
B-27	9.0	SS	NP	NP	NP	ML	71.5												71.1
B-27	11.5	SS					62.3												
B-27	14.0	SS					58.7												
B-28	0.0	SS					23.0												
B-28	1.5	SS					30.0												
B-28	4.0	SS					32.3												

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SS - Split Spoon Sample
GRAB - Bulk Grab Sample
k - Coefficient of Permeability
- See Attached test Results

PROJECT INFORMATION

Client: East Kentucky Power Cooperative
Project Name: EKPC Liberty
Project Number: LX240063
Project Location: Liberty, Kentucky

Summary of Laboratory Results

Borehole	Depth	Sample Type	Liquid Limit	Plastic Limit	Plasticity Index	Class-ification	Water Content (%)	Unconfined Compressive Strength (psf)	Rock QU (ksf)	Dry Density (pcf)	Wet Density (pcf)	Max. Dry Density (pcf)	Opt. Water Content (%)	Swell Pressure (psf)	pH of Soil Distilled Water	pH of Soil Calcium Carbonate	Resistivity (ohm.cm)	k (cm/sec)	% Finer #200
B-28	6.5	SS					28.7												
B-28	9.0	SS					55.3												
B-28	11.5	SS					49.3												
B-30	0.0	SS					22.2												
B-30	1.5	SS					31.7												
B-30	4.0	SS					26.1												
B-30	6.5	SS					33.5												
B-30	9.0	SS					35.2												
B-30	11.5	SS					45.6												
INF-1	3.0	GRAB	52	28	24	CH	31.1					94.4	23.9		5.29	4.04	140000		89.1
INF-1	6.0	ST	74	37	37	MH	36.6			82.7	112.9							1.17×10^{-7}	84.5
INF-2	4.0	ST	71	36	35	MH	33.6			88.0	117.5							3.32×10^{-6}	90.3
SW-1	3.0	GRAB	32	21	11	CL	22.4								5.32	3.96	250000		84.2
SW-2	0.0	SS					25.1												
SW-2	1.5	SS					17.0												
SW-2	4.0	SS					25.3												
SW-2	6.5	SS					29.0												
SW-2	9.0	SS					22.9												
SW-2	11.5	SS					34.4												
SW-2	14.0	SS					21.7												
SW-2A	2.0	ST	34	21	13	CL	19.8			107.0	128.2								89.3
SW-3	0.0	SS					23.2												
SW-3	1.5	SS					19.2												
SW-3	4.0	SS					21.7												
SW-3	6.5	SS					34.7												
SW-3	9.0	SS					37.2												

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- See Attached test Results

PROJECT INFORMATION

Client: East Kentucky Power Cooperative
Project Name: EKPC Liberty
Project Number: LX240063
Project Location: Liberty, Kentucky

Summary of Laboratory Results

Borehole	Depth	Sample Type	Liquid Limit	Plastic Limit	Plasticity Index	Class-ification	Water Content (%)	Unconfined Compressive Strength (psf)	Rock QU (ksf)	Dry Density (pcf)	Wet Density (pcf)	Max. Dry Density (pcf)	Opt. Water Content (%)	Swell Pressure (psf)	pH of Soil Distilled Water	pH of Soil Calcium Carbonate	Resistivity (ohm.cm)	k (cm/sec)	% Finer #200
SW-3	11.5	SS					36.8												
SW-4	0.0	SS					23.5												
SW-4	1.5	SS					24.5												
SW-4	4.0	SS					38.1												
SW-4	6.5	SS					41.7												
SW-4	9.0	SS					45.6												
SW-4	11.5	SS					43.3												
SW-4	14.0	SS					43.0												
SW-7	0.0	SS					24.3												
SW-7	1.5	SS					20.4												
SW-7	4.0	SS	76	34	42	CH	29.2												66.8
SW-7	6.5	SS					23.8												
SW-7	9.0	SS					28.1												
SW-7	11.5	SS					34.7												
SW-7A	2.0	ST	71	32	39	CH	36.0			86.6	117.7								95.6
SW-8	3.0	GRAB	38	22	16	CL	23.4								5.37	4.08	240000		82.9
SW-25	21.4	CORE							836										

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SS - Split Spoon Sample
GRAB - Bulk Grab Sample
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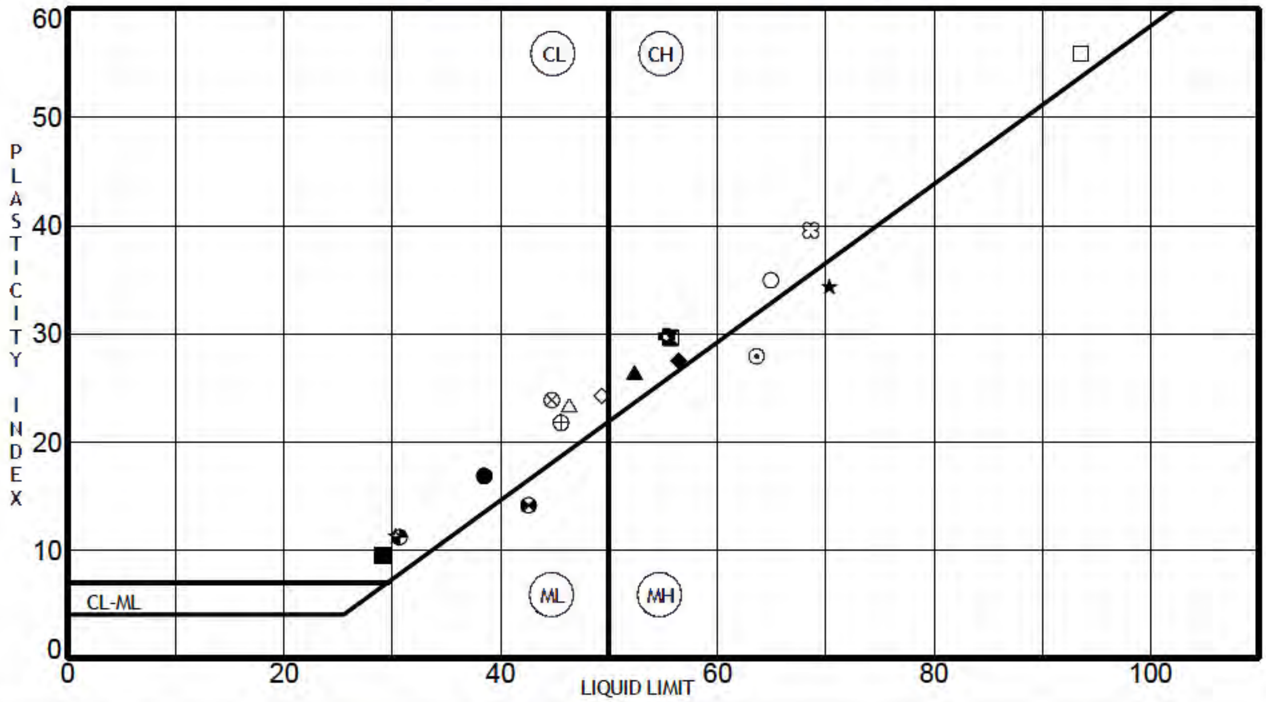
- See Attached test Results

PROJECT INFORMATION

Client: East Kentucky Power Cooperative
Project Name: EKPC Liberty
Project Number: LX240063
Project Location: Liberty, Kentucky

Liquid and Plastic Limits Test Report



	Boring	Depth (ft)	LL	PL	PI	Water Content	% < #40	% < #200	USCS	Description
●	B-4	0.0	38	22	16	23.3		83.7	CL	brown LEAN CLAY with SAND
⊠	B-4	1.5	56	26	30	21.9		88.7	CH	red brown FAT CLAY
▲	B-4	3.0	52	26	26	26.2		83.7	CH	red brown FAT CLAY with SAND
★	B-4	6.5	70	36	34	38.5		92.1	MH	light brown ELASTIC SILT
⊙	B-4	11.5	64	36	28	41.1		67.9	MH	dark brown SANDY ELASTIC SILT
✿	B-5	3.0	55	26	29	30.6	99	95.2	CH	red brown FAT CLAY
○	B-9A	3.0	65	30	35	33.4	96	94.2	CH	brown FAT CLAY
△	B-13	1.5	46	23	23	21.0		85.0	CL	light brown LEAN CLAY with SAND
⊗	B-13	6.5	45	21	24	16.3		60.3	CL	red brown SANDY LEAN CLAY
⊕	B-13A	4.0	46	24	22	20.2	96	86.5	CL	red brown LEAN CLAY
□	B-16	4.0	94	38	56	38.0		97.6	CH	red brown FAT CLAY
⊖	B-16	6.5	43	28	15	33.5		60.4	ML	red brown SANDY SILT
◕	B-17	1.5	31	19	12	22.0		77.4	CL	brown LEAN CLAY with SAND
☆	B-17	4.0	30	19	11	20.3		80.2	CL	light brown LEAN CLAY with SAND
⊞	B-17	9.0	69	29	40	30.0		81.4	CH	red brown FAT CLAY with SAND
■	B-18	3.0	29	19	10	20.0		83.5	CL	brown LEAN CLAY with SAND
◆	B-20	3.0	56	29	27	30.4		80.5	CH	red brown FAT CLAY with SAND
◇	B-21	3.0	49	25	24	27.8		89.2	CL	brown LEAN CLAY

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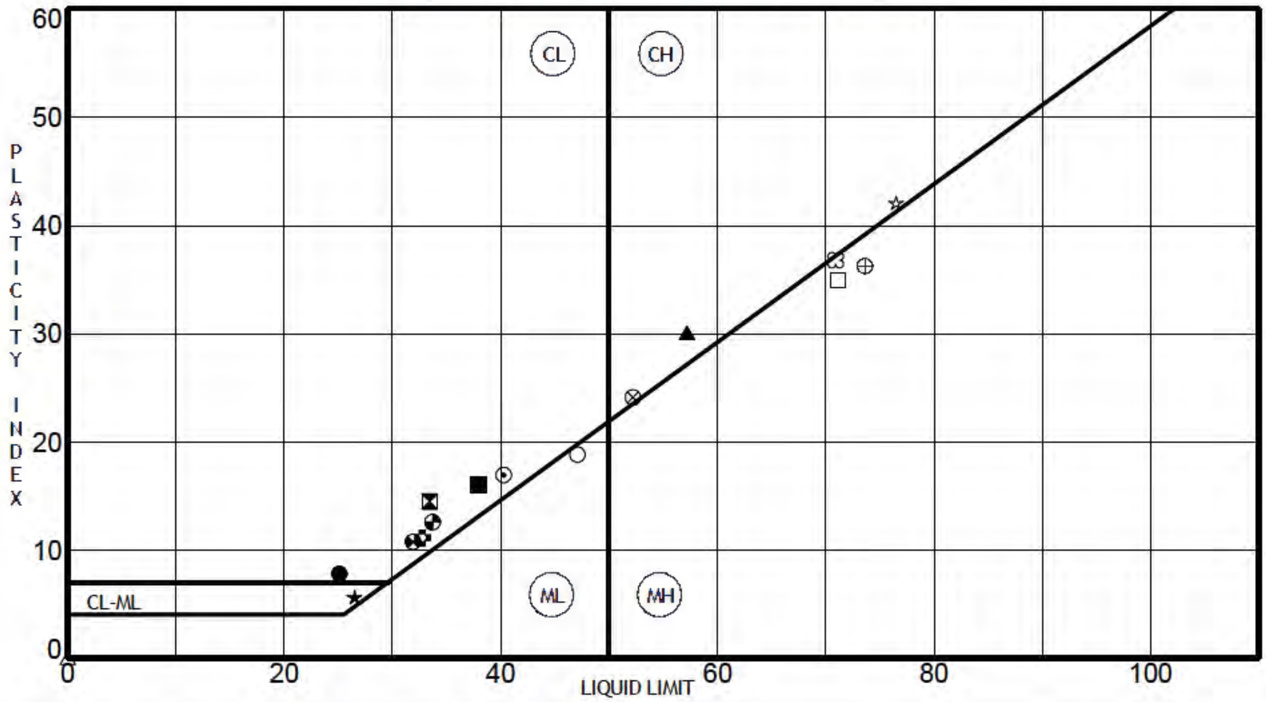
PROJECT INFORMATION

Client: East Kentucky Power Cooperative
Project Name: Liberty Gas RECIP Engine Plant
Project Number: LX240063
Project Location: Liberty, KY

Liquid and Plastic Limits Test Report



	Boring	Depth (ft)	LL	PL	PI	Water Content	% < #40	% < #200	USCS	Description
●	B-23	1.5	25	17	8	19.3		81	CL	light brown LEAN CLAY with SAND
⧗	B-23	4.0	33	19	14	18.0		82	CL	brown LEAN CLAY with SAND
▲	B-23	6.5	57	27	30	21.8		67	CH	red brown SANDY FAT CLAY
★	B-23A	3.0	26	21	5	17.2	95	84.2	CL-ML	light brown SILTY CLAY with SAND
⊙	B-24A	2.0	40	23	17	19.7	95	87.9	CL	brown LEAN CLAY
✿	B-27	1.5	33	22	11	22.9		90.6	CL	brown LEAN CLAY
○	B-27	4.0	47	28	19	30.6		73.0	ML	light brown SILT with SAND
△	B-27	9.0	NP	NP	NP	71.5		71.1	ML	light brown SILT with SAND
⊗	INF-1	3.0	52	28	24	31.1		89.1	CH	red brown FAT CLAY
⊕	INF-1	6.0	74	37	37	36.6	88	84.5	MH	red brown ELASTIC SILT with SAND
□	INF-2	4.0	71	36	35	33.6	93	90.3	MH	red brown ELASTIC SILT
◍	SW-1	0.0	32	21	11	22.4		84.2	CL	brown LEAN CLAY with SAND
◕	SW-2A	2.0	34	21	13	19.8	97	89.3	CL	brown LEAN CLAY
☆	SW-7	4.0	76	34	42	29.2		66.8	CH	brown SANDY FAT CLAY
☒	SW-7A	2.0	71	32	39	36.0	97	95.6	CH	red brown FAT CLAY
■	SW-8	3.0	38	22	16	23.4		82.9	CL	red brown LEAN CLAY with SAND

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PROJECT INFORMATION

Client: East Kentucky Power Cooperative
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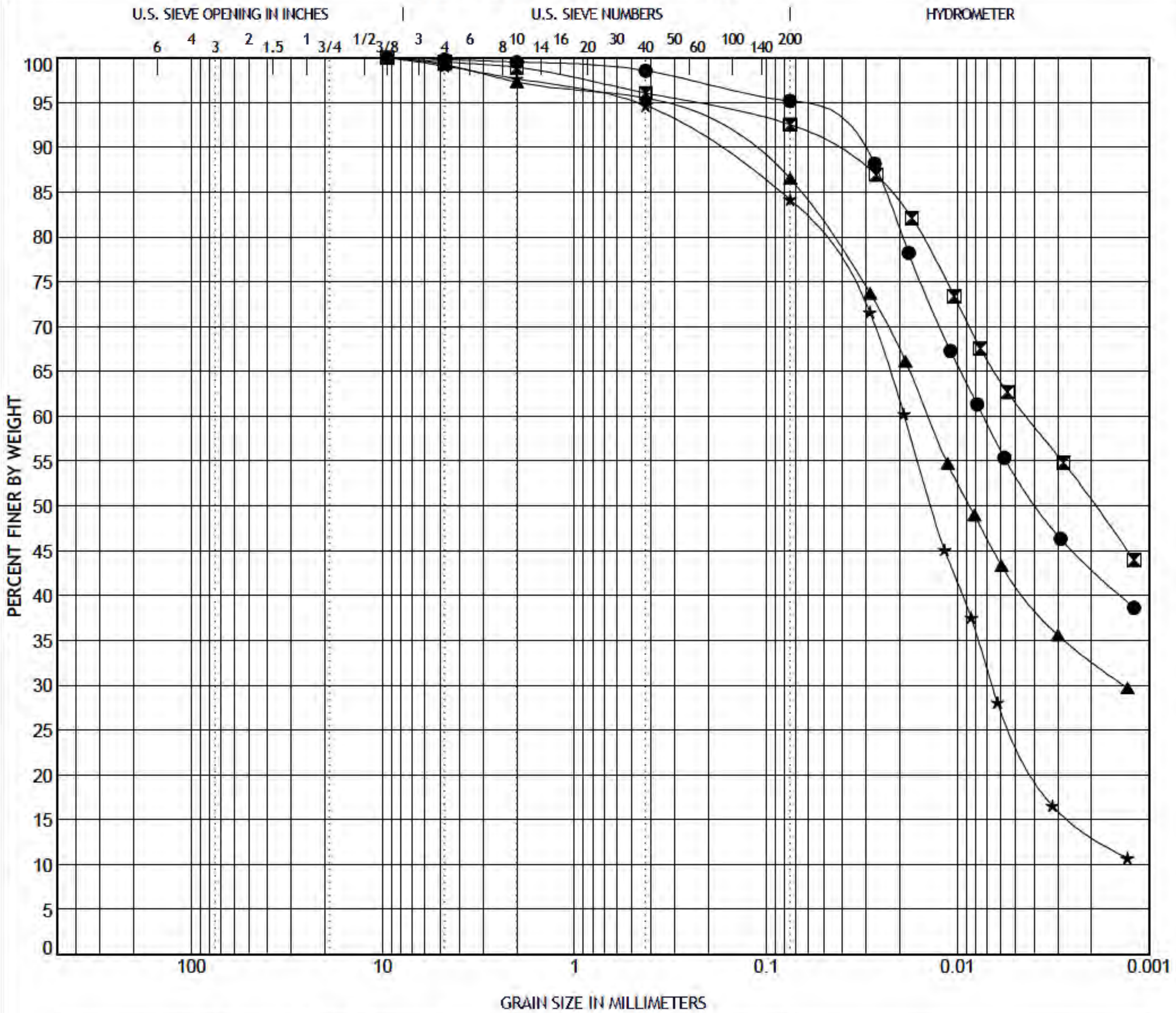
Project Number: LX240063
Project Location: Liberty, KY

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	B-5	3.0	red brown FAT CLAY(CH)	55	26	29		
⧗	B-9A	3.0	brown FAT CLAY(CH)	65	30	35		
▲	B-13A	4.0	red brown LEAN CLAY(CL)	46	24	22		
★	B-23A	3.0	light brown SILTY CLAY with SAND(CL-ML)	26	21	5		

	Boring	Depth (ft)	D95	D60	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-5	3.0	0.073	0.007	0.004			0.2	4.6	41.5	53.6
⧗	B-9A	3.0	0.251	0.004	0.002			0.5	7.0	30.9	61.6
▲	B-13A	4.0	0.385	0.014	0.009	0.001		0.8	12.7	45.1	41.4
★	B-23A	3.0	0.504	0.019	0.014	0.007		0.9	14.9	59.8	24.3

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PROJECT INFORMATION

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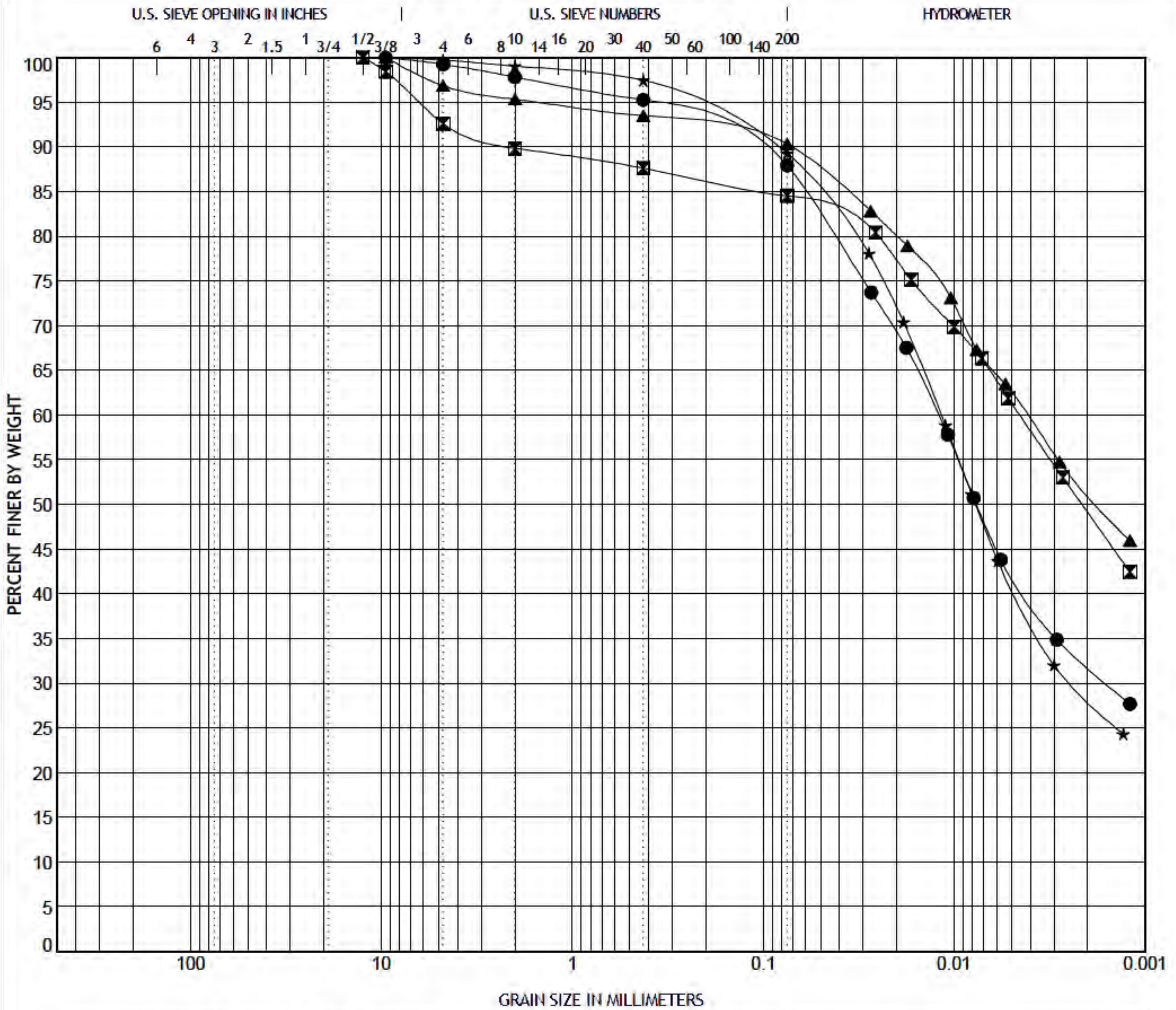
Project Number: LX240063
Project Location: Liberty, KY

GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	B-24A	2.0	brown LEAN CLAY(CL)	40	23	17		
⧗	INF-1	6.0	red brown ELASTIC SILT with SAND(MH)	52	28	37		
▲	INF-2	4.0	red brown ELASTIC SILT(MH)	71	36	35		
★	SW-2A	2.0	brown LEAN CLAY(CL)	34	21	13		

	Boring	Depth (ft)	D95	D60	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-24A	2.0	0.398	0.012	0.008	0.002		0.8	11.3	45.8	42.1
⧗	INF-1	6.0	6.322	0.005	0.002			7.4	8.1	23.1	61.4
▲	INF-2	4.0	1.518	0.004	0.002			3.2	6.5	27.9	62.5
★	SW-2A	2.0	0.252	0.012	0.008	0.002		0.3	10.4	48.5	40.8

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PROJECT INFORMATION

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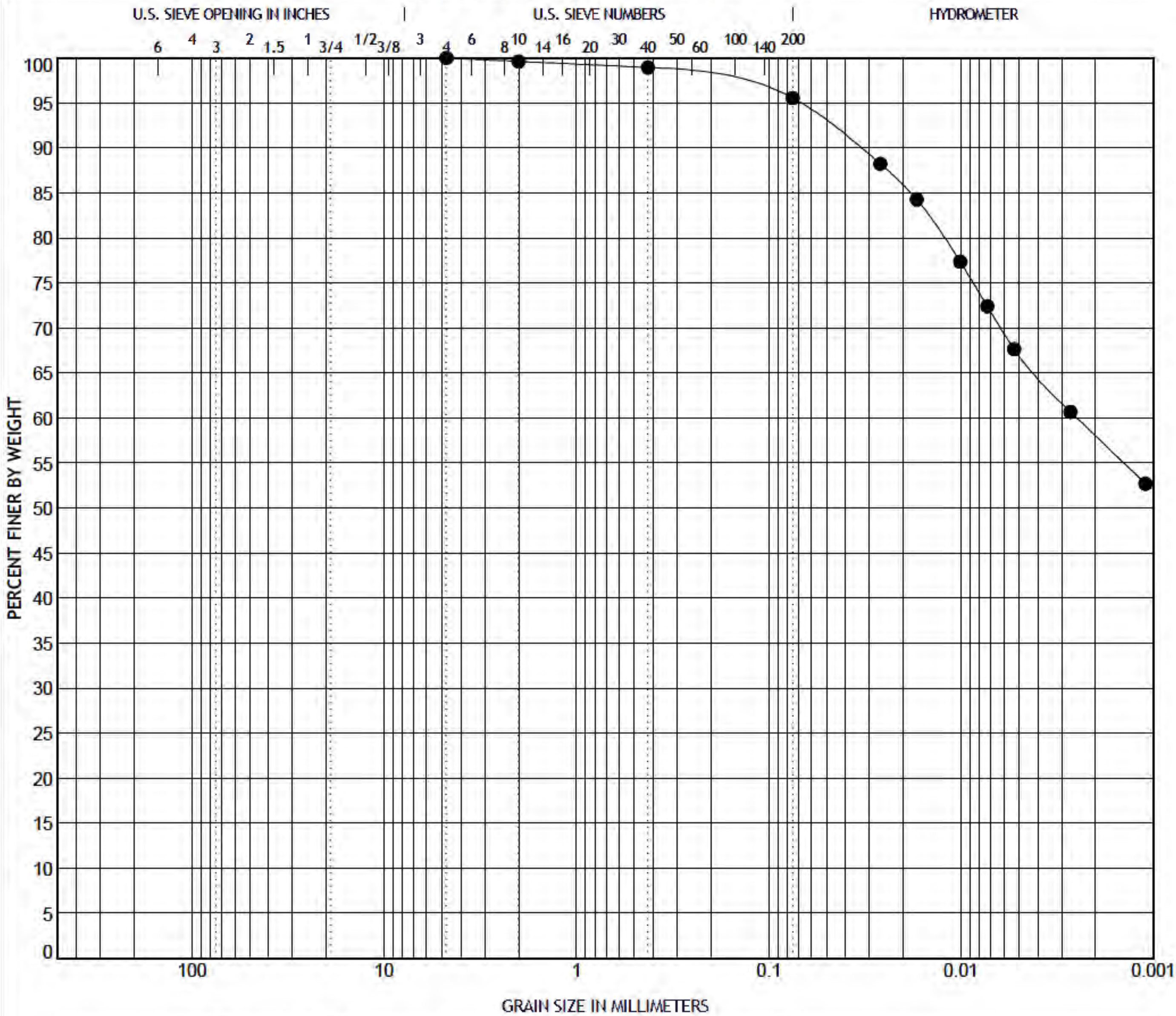
GRAIN SIZE DISTRIBUTION



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
●	SW-7A	2.0	red brown FAT CLAY(CH)	71	32	39		

	Boring	Depth (ft)	D95	D60	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	SW-7A	2.0	0.069	0.002				0.0	4.4	28.5	67.1

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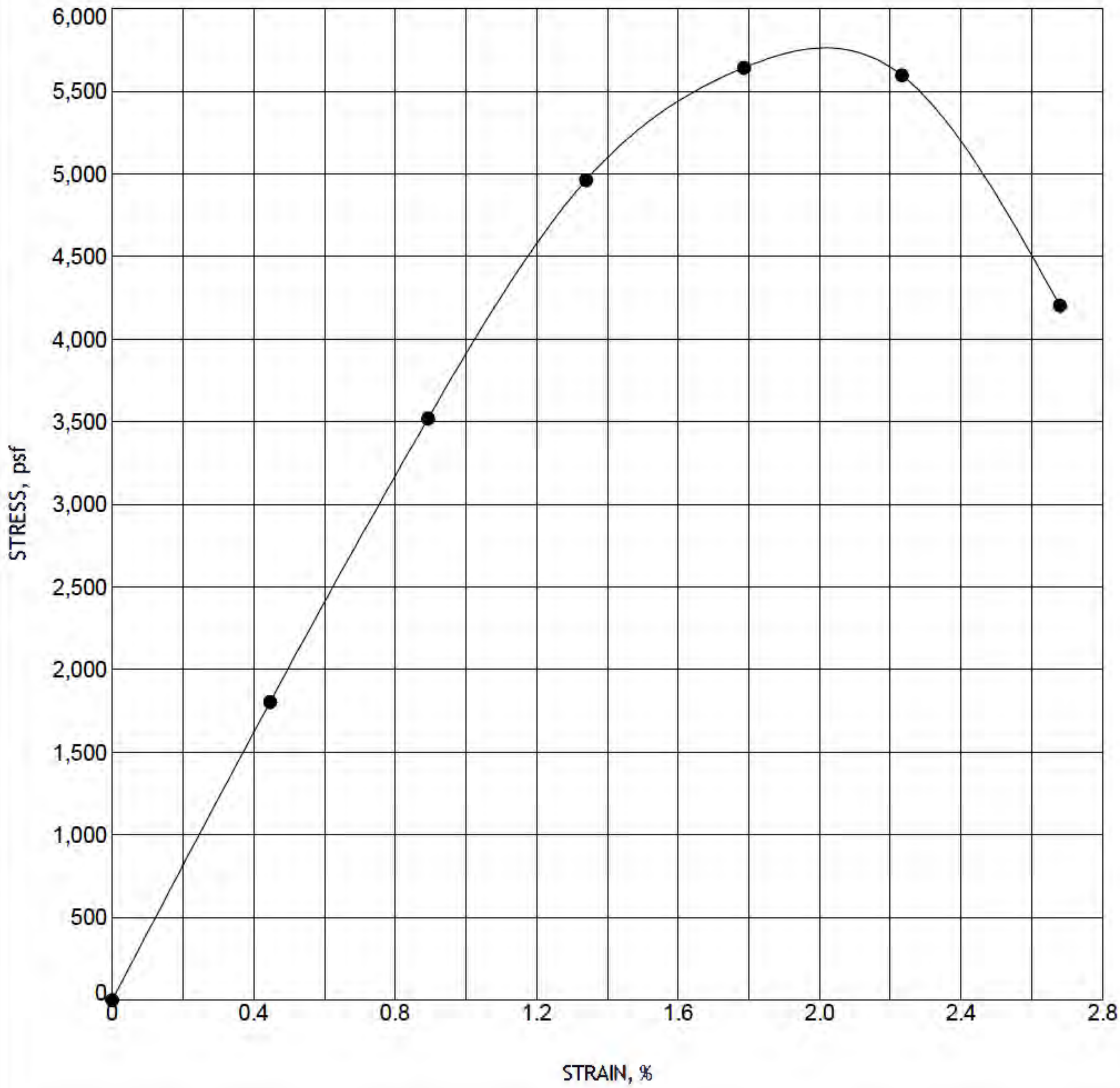
PROJECT INFORMATION

Client: East Kentucky Power Cooperative
Project Name: Liberty Gas RECIP Engine Plant
Project Number: LX240063
Project Location: Liberty, KY

UNCONFINED COMPRESSION TEST



	Specimen Identification		Description	Unconfined Compressive Strength (psf)	Failure Strain (%)	γ_d	MC%
●	B-23A	3.0	light brown SILTY CLAY w/ SAND	5643	1.8	112	17.2
			(CL-ML)				

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PROJECT INFORMATION

Client: East Kentucky Power Cooperative
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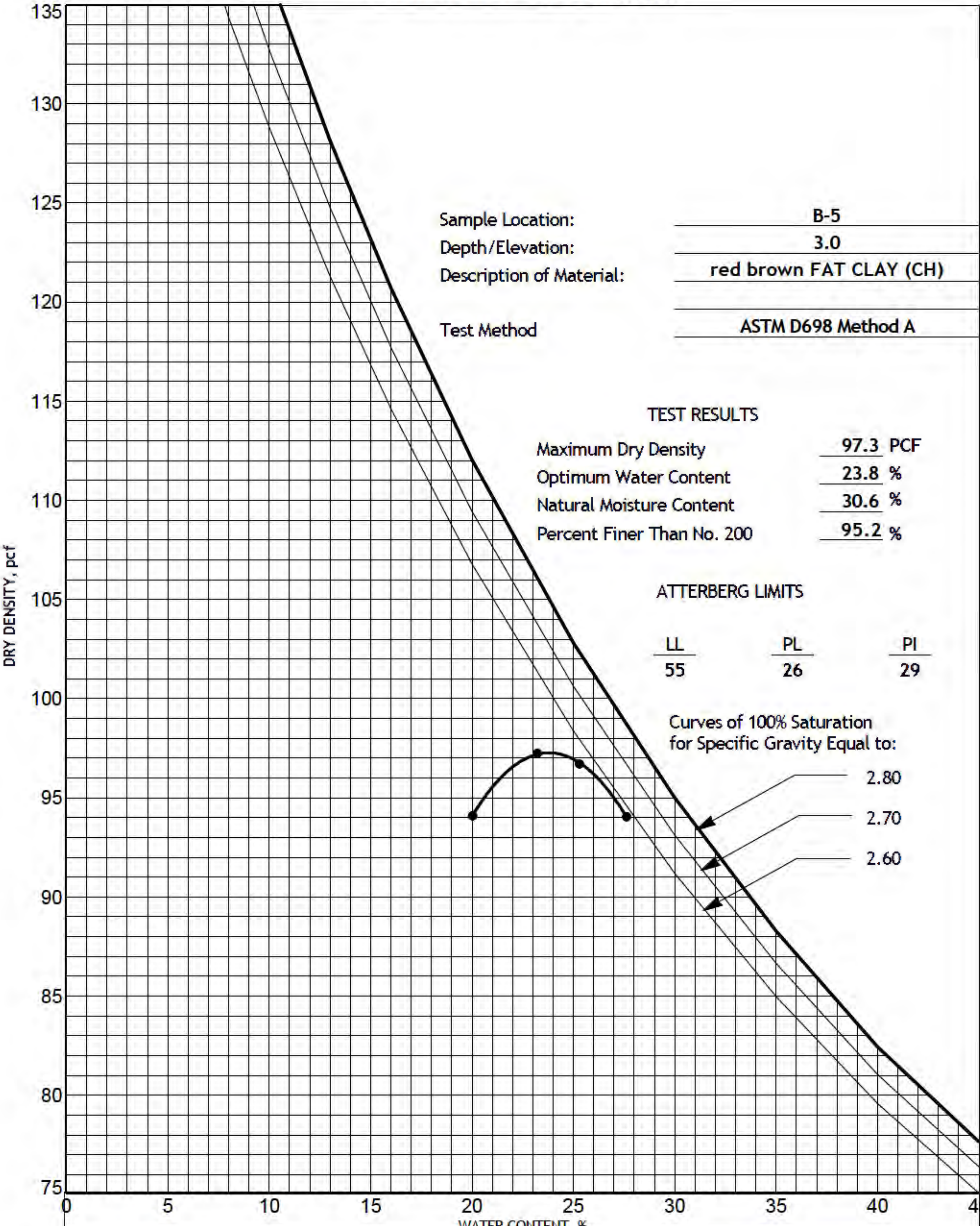
Project Number: LX240063
Project Location: Liberty, Kentucky

MOISTURE-DENSITY RELATIONSHIP



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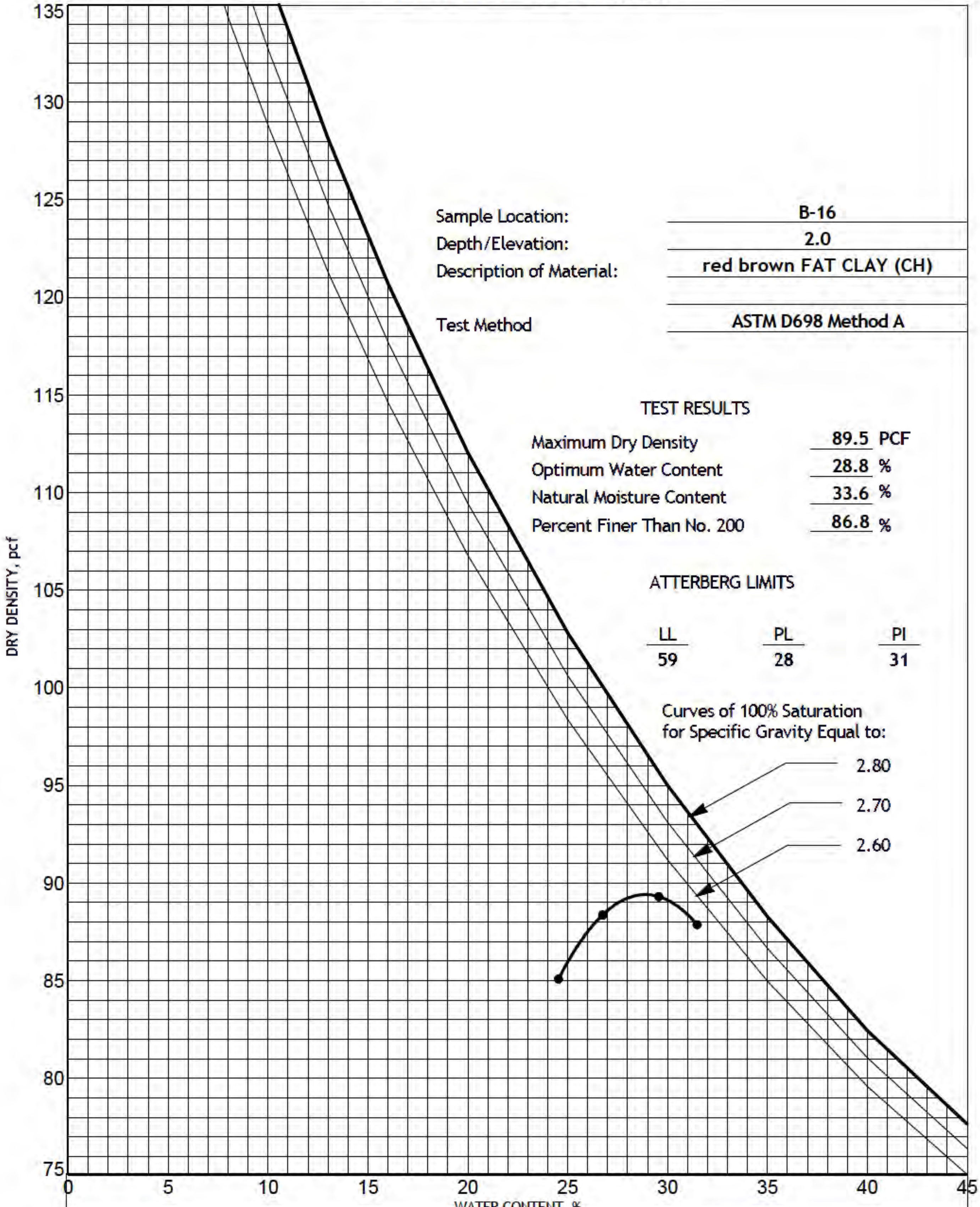
PROJECT INFORMATION

Client: East Kentucky Power Cooperative
Project Name: EKPC Liberty
Project Number: LX240063
Project Location: Liberty, Kentucky

MOISTURE-DENSITY RELATIONSHIP



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PROJECT INFORMATION

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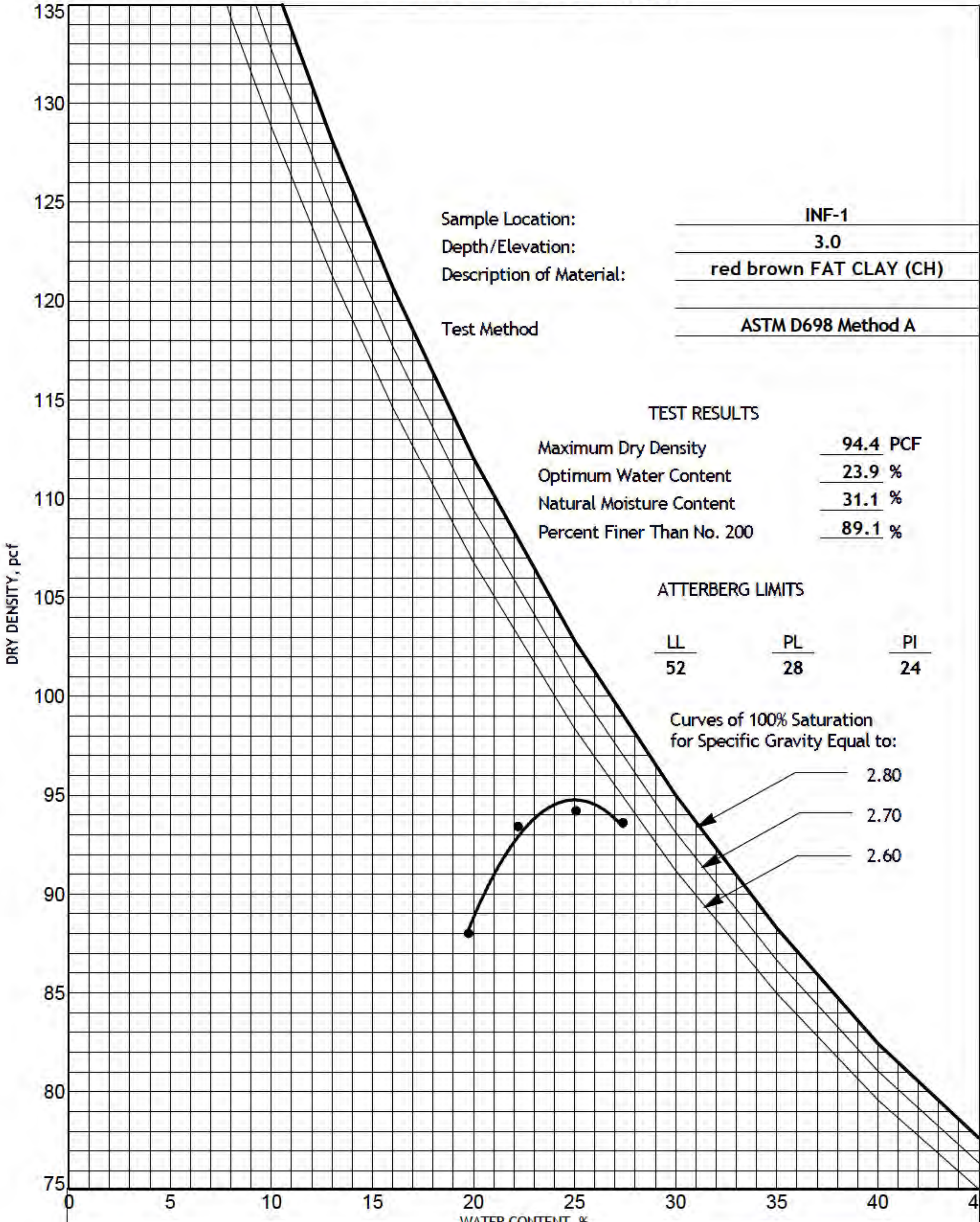
Project Location: Liberty, Kentucky

MOISTURE-DENSITY RELATIONSHIP



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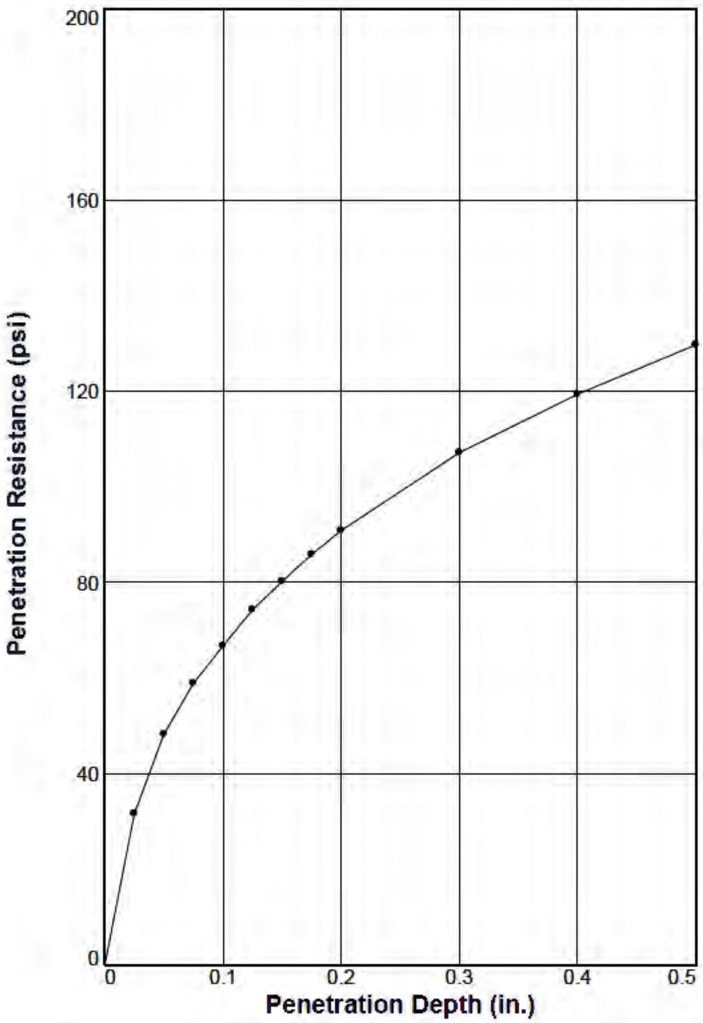
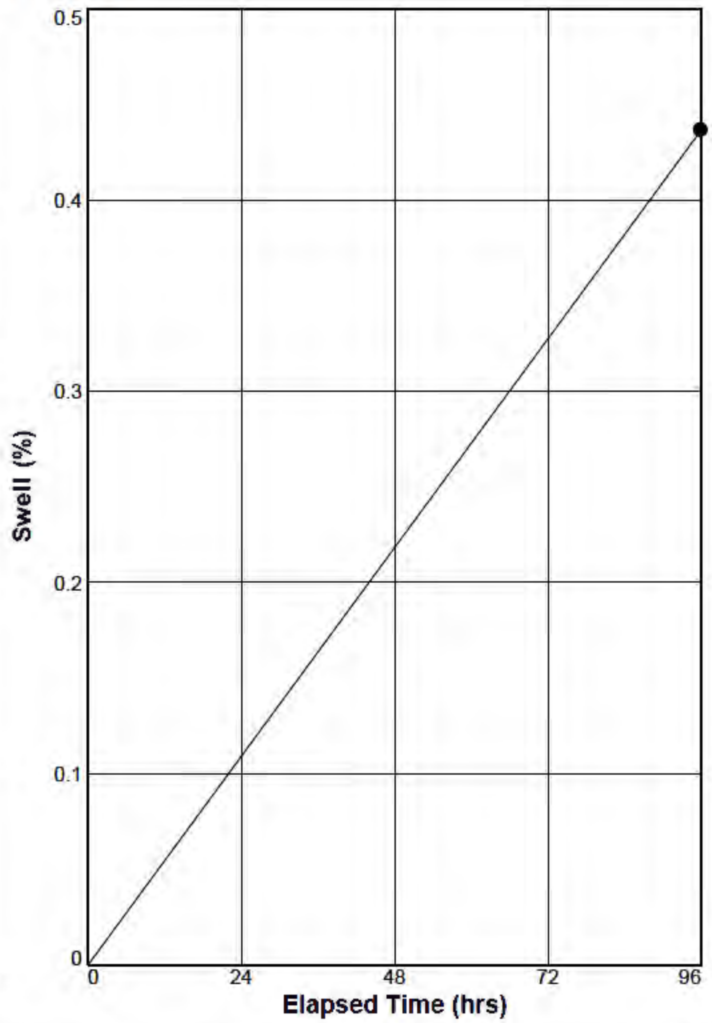
PROJECT INFORMATION

Client: East Kentucky Power Cooperative
Project Name: Liberty Gas RECIP Engine Plant
Project Number: LX240063
Project Location: Liberty, Kentucky

BEARING RATIO TEST REPORT
ASTM D1883-16





	Molded			Soaked			CBR (%)		Linearity Correction (in.)	Surcharge (lbs.)	Max. Swell (%)
	Density (pcf)	Percent of Max. Dens.	Moisture (%)	Density (pcf)	Percent of Max. Dens.	Moisture (%)	0.10 in.	0.20 in.			
1 ○	95.7	98.4	25.8	95.3	98	26.3	6.7	6.1	0.000	20	0.4
2 △											
3 □											

Material Description	USCS	Max. Dens. (pcf)	Optimum Moisture (%)	LL	PI
reddish brown FAT CLAY	CH	97.3	27.8	55	29

Project No: LX240063

Project: Liberty Gas RECIP Engine Plant

Location: Liberty, KY

Sample Number: B-5 **Depth:** 3-5

Test Description/Remarks:

BEARING RATIO TEST REPORT

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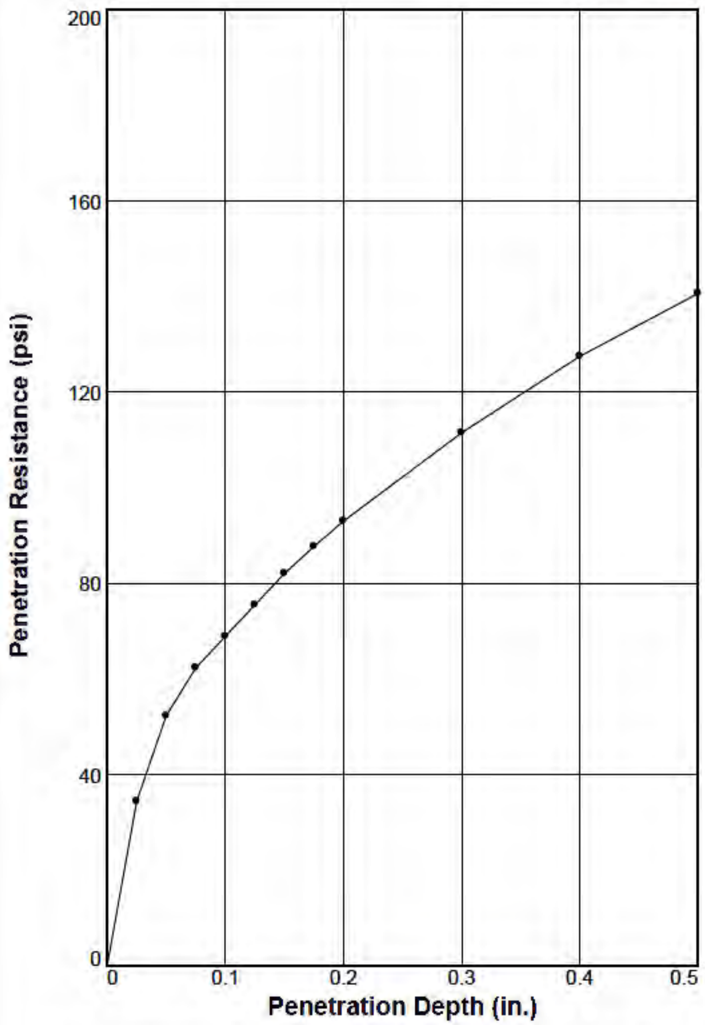
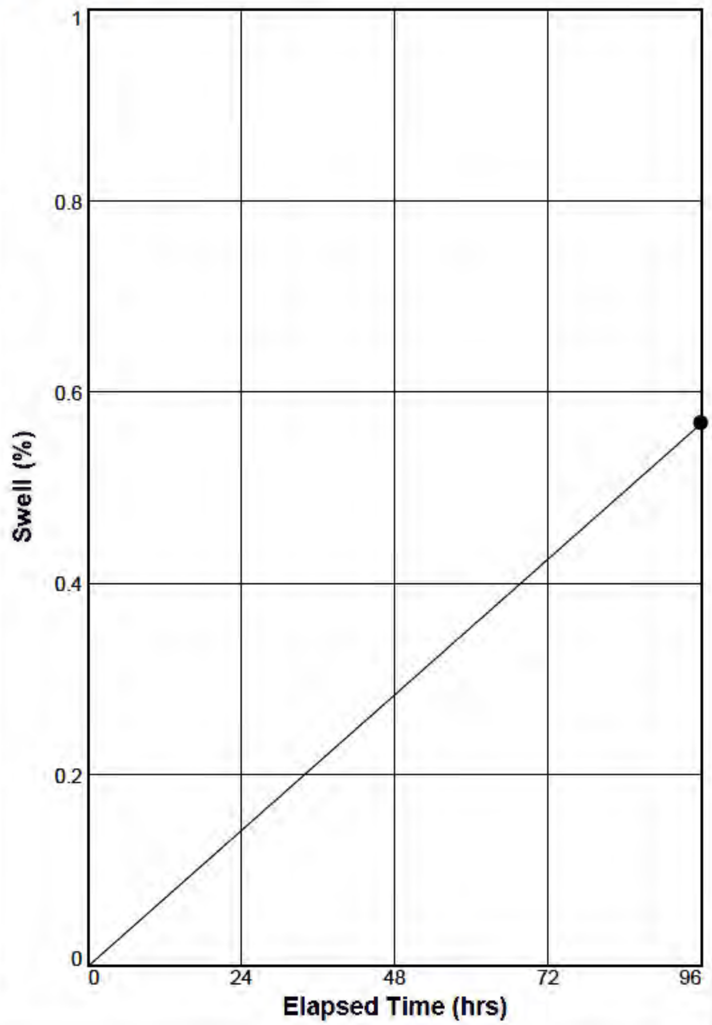
Figure ______

BEARING RATIO TEST REPORT
ASTM D1883-16





	Molded			Soaked			CBR (%)		Linearity Correction (in.)	Surcharge (lbs.)	Max. Swell (%)
	Density (pcf)	Percent of Max. Dens.	Moisture (%)	Density (pcf)	Percent of Max. Dens.	Moisture (%)	0.10 in.	0.20 in.			
1 ○	93.3	98.8	25.7	92.7	98.2	26.6	6.9	6.2	0.000	15	0.6
2 △											
3 □											

Material Description	USCS	Max. Dens. (pcf)	Optimum Moisture (%)	LL	PI
red brown FAT CLAY with SAND	CH	94.4	23.9	52	24

Project No: LX240063

Project: Liberty Gas RECIP Engine Plant - Liberty, Kentucky

Source of Sample: Borings **Depth:** 3.0

Sample Number: INF-1

Date:

Test Description/Remarks:

BEARING RATIO TEST REPORT

CSI of Kentucky

Figure ________

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HYDRAULIC CONDUCTIVITY TEST

ASTM D 5084 - 10

Project:	*Liberty Gas RECIP Engine Plant*			Job No.:	*LX240063*
Client:	*East Kentucky Power Coorerative*				
Sample:	*INF-1*	Depth:	*6.0*	Sample Type:	*Bulk*
Soil Description:	*red brown ELASTIC SILT with SAND*			USCS:	*MH*
Date Sampled:	*N/A*	Dated Tested:	*05/09/24*	Tested By:	*CM*
Lab ID:	*INF-1 6.0*	Date Checked	*05/10/24*	Checked By:	*CM*

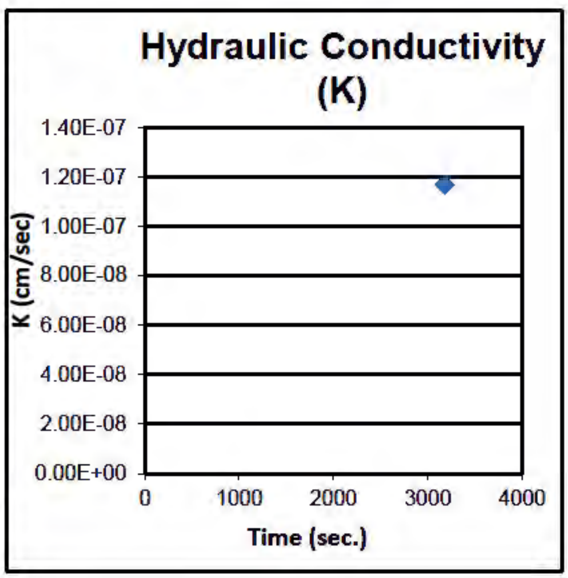
Sample Data	Initial	Final	Sample Characteristics	Initial	Final
Tare ID:					
Wt. Tare + WS (gm):	221.43	630.38	**Cross-Section (in^2):**	6.468	6.468
Wt. Tare + DS (gm):	175.65	467.66	**Cross-Section (cm^2):**	41.727	41.727
Wt. Tare (gm):	50.55	60.58	**Sample Volume (in^3):**	18.942	19.060
Moisture Content (%):	36.6%	40.0%	**Sample Volume (cm^3):**	310.402	312.345
Sample Wet Weight (gr	561.40	569.00	**Unit Wet Wt. (pcf):**	112.9	113.7
Sample Wt. (lbs):	1.238	1.254	**Unit Wet Wt. (gm/cm^3):**	1.81	1.82
Top Diameter 1 (in):	2.869	2.871	**Unit Dry Wt. (pcf):**	82.7	81.2
Middle Diameter 2 (in):	2.869	2.869	**Unit Dry Wt. (gm/cm^3):**	1.32	1.30
Bottom Diameter 3 (in)	2.871	2.869	**Wt. of Water (gm):**	150.40	162.49
Average Diameter (in):	2.870	2.870	**Wt. of Dry Sample (gm):**	411.00	406.51
Average Diameter (cm)	7.29	7.29			
Sample Length (in):	2.942	2.945	**Void Ratio (%):**	1.04	1.07
Sampled Length (in):	2.923	2.948	**Porosity (%):**	0.51	0.52
Sample Length (in):	2.921	2.948	**Pore Volume (cm3):**	158.18	161.79
Average Length (in):	2.929	2.947	**Saturation (%):**	95.1%	100.4%
Average Length (cm):	7.44	7.49			

Test Data

	Date & Time (24 - hrs)	Time (sec)	Lower Burette Reading	Upper Burette Reading	Volume/sec.
Beginning Time:	5/9/24 14:15		5.2	18.2	
Ending Time:	5/9/24 15:08	3180	5.7	17.7	
		Flow (cm^3):	-0.5	0.5	-0.000157

Test Results

Hydraultic Conductivity (cm/sec):	1.17E-07
Initial Water Content (%):	36.6%
Initial Dry Density (pcf):	82.7
Specific Gravity:	2.771
Percent Compaction [remolded] (%):	N/A
Sample Status:	Insitu
B - Parameter:	0.98
Permeant:	Deaired Water
Cell Pressure (psi):	68
Back Pressure (psi):	63
Confining Stress (psi):	5
Average Temperature (deg. C):	20.0
Flow (cm^3):	-0.5
Time (sec):	3180



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HYDRAULIC CONDUCTIVITY TEST

ASTM D 5084 - 10

Project:	Liberty Gas RECIP Engine Plant			Job No.:	LX240063
Client:	East Kentucky Power Coorerative				
Sample:	INF-2	Depth:	4.0	Sample Type:	Bulk
Soil Description:	red brown ELASTIC SILT			USCS:	MH
Date Sampled:	N/A	Dated Tested:	05/09/24	Tested By:	CM
Lab ID:	INF-2 4.0	Date Checked	05/10/24	Checked By:	CM

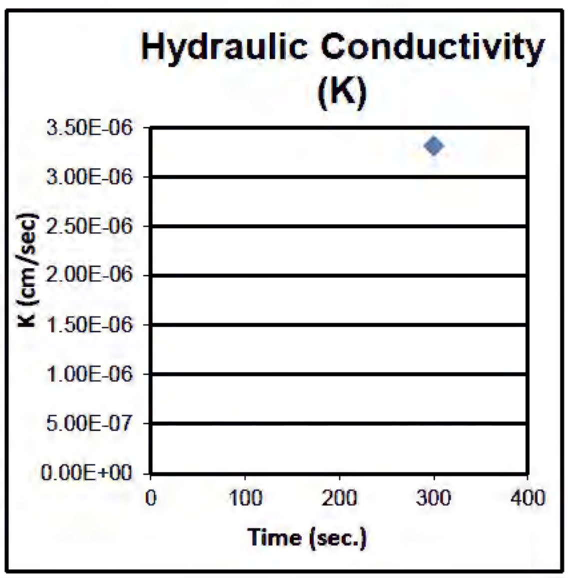
Sample Data	Initial	Final	Sample Characteristics	Initial	Final
Tare ID:					
Wt. Tare + WS (gm):	206.55	653.05	Cross-Section (in^2):	6.408	6.432
Wt. Tare + DS (gm):	167.30	505.94	Cross-Section (cm^2):	41.340	41.495
Wt. Tare (gm):	50.44	60.58	Sample Volume (in^3):	19.057	19.201
Moisture Content (%):	33.6%	33.0%	Sample Volume (cm^3):	312.284	314.646
Sample Wet Weight (gr	587.82	592.47	Unit Wet Wt. (pcf):	117.5	117.6
Sample Wt. (lbs):	1.296	1.306	Unit Wet Wt. (gm/cm^3):	1.88	1.88
Top Diameter 1 (in):	2.865	2.862	Unit Dry Wt. (pcf):	88.0	88.4
Middle Diameter 2 (in):	2.852	2.863	Unit Dry Wt. (gm/cm^3):	1.41	1.42
Bottom Diameter 3 (in)	2.852	2.860	Wt. of Water (gm):	147.79	147.11
Average Diameter (in):	2.856	2.862	Wt. of Dry Sample (gm):	440.03	445.36
Average Diameter (cm)	7.26	7.27			
Sample Length (in):	2.992	2.989	Void Ratio (%):	0.92	0.91
Sampled Length (in):	2.967	2.987	Porosity (%):	0.48	0.48
Sample Length (in):	2.963	2.980	Pore Volume (cm3):	149.31	149.70
Average Length (in):	2.974	2.985	Saturation (%):	99.0%	98.3%
Average Length (cm):	7.55	7.58			

Test Data

	Date & Time (24 - hrs)	Time (sec)	Lower Burette Reading	Upper Burette Reading	Volume/sec.
Beginning Time:	5/9/24 9:28		9.7	16.3	
Ending Time:	5/9/24 9:33	300	10.5	15.5	
		Flow (cm^3):	-0.8	0.8	-0.002667

Test Results

Hydraultic Conductivity (cm/sec):	3.32E-06
Initial Water Content (%):	33.6%
Initial Dry Density (pcf):	88.0
Specific Gravity:	2.691
Percent Compaction [remolded] (%):	N/A
Sample Status:	Insitu
B - Parameter:	0.98
Permeant:	Deaired Water
Cell Pressure (psi):	68
Back Pressure (psi):	63
Confining Stress (psi):	5
Average Temperature (deg. C):	20.0
Flow (cm^3):	-0.8
Time (sec):	300



LABORATORY TESTING PROCEDURES

Soil Classification: Soil classifications provide a general guide to the engineering properties of various soil types and enable the engineer to apply past experience to current problems. In our investigations, samples obtained during drilling operations are examined in our laboratory and visually classified by an engineer. The soils are classified according to consistency (based on number of blows from standard penetration tests), color and texture. These classification descriptions are included on our "Test Boring Records."

The classification system discussed above is primarily qualitative and for detailed soil classification two laboratory tests are necessary: grain size tests and plasticity tests. Using these test results the soil can be classified according to the AASHTO or Unified Classification Systems (ASTM D 2487). Each of these classification systems and the in-place physical soil properties provides an index for estimating the soil's behavior. The soil classification and physical properties obtained are presented in this report.

Rock Classification: Rock classifications provide a general guide to the engineering properties of various rock types and enable the engineer to apply past experience to current situations. In our explorations, rock core samples obtained during drilling operations are examined in our laboratory and visually classified by an engineer. The rock cores are classified according to relative hardness and RQD (see Guide to Rock Classification Terminology), color, and texture. These classification descriptions are included on our Test Boring Records.

Atterberg Limits: Portions of the samples are taken for Atterberg Limits testing to determine the plasticity characteristics of the soil. The plasticity index (PI) is the range of moisture content over which the soil deforms as a plastic material. It is bracketed by the liquid limit (LL) and the plastic limit (PL). The liquid limit is the moisture content at which the soil becomes sufficiently "wet" to flow as a heavy viscous fluid. The plastic limit is the lowest moisture content at which the soil is sufficiently plastic to be manually rolled into tiny threads. The liquid limit and plastic limit are determined in accordance with ASTM D 4318.

Moisture Content: The Moisture Content is determined according to ASTM D 2216.

Percent Finer Than 200 Sieve: Selected samples of soils are washed through a number 200 sieve to determine the percentage of material less than 0.074 mm in diameter.

Rock Strength Tests: To obtain strength data for rock materials encountered, unconfined compression tests are performed on selected samples. In the unconfined compression test, a cylindrical portion of the rock core is subjected to increasing axial load until it fails. The pressure required to produce failure is recorded, corrected for the length to diameter ratio of the core and reported.

Compaction Tests: Compaction tests are run on representative soil samples to determine the dry density obtained by a uniform compactive effort at varying moisture contents. The results of the test are used to determine the moisture content and unit weight desired in the field for similar soils. Proper field compaction is necessary to decrease future settlements, increase the shear strength of the soil and decrease the permeability of the soil.

The two most commonly used compaction tests are the Standard Proctor test and the Modified Proctor test. They are performed in accordance with ASTM D 698 and D 1557, respectively. Generally, the Standard Proctor compaction test is run on samples from building or parking areas where small compaction equipment is anticipated. The Modified compaction test is generally performed for heavy structures, highways, and other areas where large compaction equipment is expected. In both tests a representative soil sample is placed in a mold and compacted with a compaction hammer. Both tests have three alternate methods.

MINERAL LABS INC
MINERAL LABS INC.
Box 549
Salyersville, KY 41465
Phone (606) 349-6145
Fax (606) 349-6102

PJLA Testing
ISO/IEC 17025:2017 Accreditation #96073

Certificate of Analysis

CSI

Date/Time Collected: **4/26/2024**
Date/Time Received: **4/26/2024**
Lab Number: **014012875 950250**
Sample by: CUSTOMER
Sample type:

Site ID: **DROP OFF LX240063**
EKP LIBERTY B-21 BULK
SOIL SAMPLE 2933.5 GRAMS

Parameter	Result	Units	Method
Additional Analysis			
Chloride (Cl)	42	mg/kg	ASTM D8247
% Oxidation	94.0	%	ASTM D5263
Sulfate (SO4)	2.9	mg/kg	SW 846 9038
Sulfide (S2-)	0.28	mg/kg	SW 846 9034

This report is representative of the actual sampled submitted to our facility.

Approved By:

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Fax (606) 349-6102

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Testing

ISO/IEC 17025:2017 Accreditation #96073

Certificate of Analysis

CSI

Date/Time Collected: **4/26/2024**
Date/Time Received: **4/26/2024**
Lab Number: **014012876 950250**
Sample by: CUSTOMER
Sample type:

Site ID: **DROP OFF LX240063**
EKP LIBERTY INF-1
SOIL SAMPLE 2795.3 GRAMS

Parameter	Result	Units	Method
Additional Analysis			
Chloride (Cl)	73	mg/kg	ASTM D8247
% Oxidation	93.5	%	ASTM D5263
Sulfate (SO4)	4.1	mg/kg	SW 846 9038
Sulfide (S2-)	0.92	mg/kg	SW 846 9034

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Date/Time Collected: **4/26/2024**
Date/Time Received: **4/26/2024**
Lab Number: **014012877 950250**
Sample by: CUSTOMER
Sample type:

Site ID: **DROP OFF LX240063**
EKP LIBERTY B-18 BULK
SOIL SAMPLE 2905.7 GRAMS

Parameter	Result	Units	Method
Additional Analysis			
Chloride (Cl)	40	mg/kg	ASTM D8247
% Oxidation	92.0	%	ASTM D5263
Sulfate (SO4)	6.4	mg/kg	SW 846 9038
Sulfide (S2-)	0.81	mg/kg	SW 846 9034

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Date/Time Collected: **4/26/2024**
Date/Time Received: **4/26/2024**
Lab Number: **014012878 950250**
Sample by: CUSTOMER
Sample type:

Site ID: **DROP OFF LX240063**
EKP LIBERTY SW-1 BULK
SOIL SAMPLE 2848.1 GRAMS

Parameter	Result	Units	Method
Additional Analysis			
Chloride (Cl)	41	mg/kg	ASTM D8247
% Oxidation	92.5	%	ASTM D5263
Sulfate (SO4)	8.3	mg/kg	SW 846 9038
Sulfide (S2-)	1.2	mg/kg	SW 846 9034

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Fax (606) 349-6102

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Date/Time Collected: **4/26/2024**
Date/Time Received: **4/26/2024**
Lab Number: **014012879 950250**
Sample by: CUSTOMER
Sample type:

Site ID: **DROP OFF LX240063**
EKP LIBERTY B-5 BULK
SOIL SAMPLE 2712.4 GRAMS

Parameter	*Result*	*Units*	*Method*
Additional Analysis			
Chloride (Cl)	44	mg/kg	ASTM D8247
% Oxidation	94.0	%	ASTM D5263
Sulfate (SO4)	2.4	mg/kg	SW 846 9038
Sulfide (S2-)	0.34	mg/kg	SW 846 9034

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CSI

Date/Time Collected: 4/26/2024
Date/Time Received: 4/26/2024
Lab Number: 014012880 950250
Sample by: CUSTOMER
Sample type:

Site ID: DROP OFF LX240063
EKP LIBERTY B-4 BULK
SOIL SAMPLE 2863.3 GRAMS

Parameter		Result	Units	Method
PROXIMATE ANALYSIS	**As Received**	**Dry Basis**		
% Sulfur	0.01	0.01	%	ASTM D4239
Additional Analysis				
Chloride (Cl)		92	mg/kg	ASTM D8247
% Oxidation		96.0	%	ASTM D5263
Sulfate (SO4)		2.4	mg/kg	SW 846 9038
Sulfide (S2-)		0.41	mg/kg	SW 846 9034

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Date/Time Collected:	**4/26/2024**
Date/Time Received:	**4/26/2024**
Lab Number:	**014012881 950250**
Sample by:	CUSTOMER
Sample type:	

Site ID: **DROP OFF LX240063**
EKP LIBERTY B-20 BULK
SOIL SAMPLE 2892.2 GRAMS

Parameter	Result	Units	Method
Additional Analysis			
Chloride (Cl)	50	mg/kg	ASTM D8247
% Oxidation	94.0	%	ASTM D5263
Sulfate (SO4)	5.4	mg/kg	SW 846 9038
Sulfide (S2-)	1.06	mg/kg	SW 846 9034

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CSI

Date/Time Collected:	**4/26/2024**
Date/Time Received:	**4/26/2024**
Lab Number:	**014012882 950250**
Sample by:	CUSTOMER
Sample type:	

Site ID: **DROP OFF LX240063**
EKP LIBERTY SW-8 BULK
SOIL SAMPLE 2897.2 GRAMS

Parameter	Result	Units	Method
Additional Analysis			
Chloride (Cl)	58	mg/kg	ASTM D8247
% Oxidation	95.5	%	ASTM D5263
Sulfate (SO4)	3.6	mg/kg	SW 846 9038
Sulfide (S2-)	0.39	mg/kg	SW 846 9034

This report is representative of the actual sampled submitted to our facility.

Approved By:

Test	Metho d	Hammer Wt./ Fall	Mold Diam.	Run on Material Finer Than	No. of Layer s	No. of Blows/ Layer
Standard D 698	A	5.5 lb./12”	4”	No. 4 sieve	3	25
	B	5.5 lb./12”	4”	3/8” sieve	3	25
	C	5.5 lb./12”	6”	3/4” sieve	3	56

Test	Metho d	Hammer Wt./ Fall	Mold Diam.	Run on Material Finer Than	No. of Layer s	No. of Blows/ Layer
Modified D 15557	A	10 lb./18”	4”	No. 4 sieve	5	25
	B	10 lb./18”	4”	3/8” sieve	5	25
	C	10 lb./18”	6”	3/4” sieve	5	56

The moisture content and unit weight of each compacted sample is determined. Usually 4 to 5 such tests are run at different moisture contents. Test results are presented in the form of a dry unit weight versus moisture content curve. The compaction method used and any deviations from the recommended procedures are noted in this report.

Laboratory California Bearing Ratio Tests: The California Bearing Ratio, generally abbreviated to CBR, is a punching shear test and is a comparative measure of the shearing resistance of a soil. It provides data that is a semi-empirical index of the strength and deflection characteristics of a soil. The CBR is used with empirical curves to design pavement structures.

A laboratory CBR test is performed according to ASTM D 1883. The results of the compaction tests are utilized in compacting the test sample to the desired density and moisture content for the laboratory California Bearing Ratio test. A representative sample is compacted to a specified density at a specified moisture content. The test is performed on a 6-inch diameter, 4.58-inch-thick disc of compacted soil that is confined in a cylindrical steel mold. The sample is compacted in accordance with Method C of ASTM D 698 or D 1557.

CBR tests may be run on the compacted samples in either soaked or unsoaked conditions. During testing, a piston approximately 2 inches in diameter is forced into the soil sample at the rate of 0.05 inch per minute to a depth of 0.5 inch to determine the resistance to penetration. The CBR is the percentage of the load it takes to penetrate the soil to a 0.1 inch depth compared to the load it takes to penetrate a standard crushed stone to the same depth. Test results are typically shown graphically.

Consolidation Tests: Consolidation tests are conducted on representative soil samples to determine the change in height of the sample with increasing load. The results of these tests are used to estimate the settlement and time rate of settlement of structures constructed on similar soils. A consolidation test is performed according to ASTM D2435 on a single section of an undisturbed sample extruded from a sample tube. The sample is trimmed into a disc 2.5 inches in diameter and 0.75 inch thick. The disc is confined in a stainless steel ring and sandwiched between porous plates. It is then subjected to incrementally increasing vertical loads, and the resulting deformations are measured with a micrometer dial gauge. Void ratio are then calculated from these deformation readings. The test results are typically provided in tabular form or in the form of plots of void ratio versus applied stress (e-log p curves).

Organic Content: The Organic Content is determined according to ASTM D2974. The moisture content is first determined by drying portions of the sample at 105 degrees Celsius. The ash content is then determined by igniting the oven-dried sample from the moisture content determination in a muffle furnace at 440 degrees Celsius. The substance remaining after ignition is the ash. The organic content is expressed as a percentage by subtracting the percent ash from one hundred.

Direct Shear Tests: Direct shear tests are performed according to ASTM D3080 to determine the shear strength parameters of the soil. The specimen of soil is placed in a rigid box that is divided horizontally into two frames. The specimen is then confined under a vertical or normal stress and horizontal force is applied to fail the specimen along a horizontal plane at its mid-height.

Because drainage of the soil specimen cannot be easily controlled, undrained tests (i.e., UU and CU tests) are possible only on impervious soils and pore pressure measurements cannot be made. Drained tests (i.e., CD tests), however, are possible on all soil types. Since the drainage paths through the specimen are short and pore water pressures are dissipated fairly rapidly, the direct shear test is well suited to the CD test.

A minimum of three test specimens are required to establish the strength envelope of a soil. The soil parameters obtained are the cohesion and angle of internal friction.

Unconfined Compression Tests: The unconfined compression test is an unconsolidated-undrained triaxial shear test with no lateral confining pressure. This test is used to determine the shear strength of clayey soils. An unconfined compression test is performed according to ASTM D2166 on a single section of an undisturbed sample extruded from a sampling tube. The sample is trimmed to a length-to-diameter ratio of about 2 and placed in the testing device. Incrementally increasing vertical loads are applied until the sample fails. Test results are provided in the form of a stress-strain curve or a value representing the unconfined compressive strength of the sample.

Grain Size Tests: Grain Size Tests are performed to determine the soil classification and the grain size distribution. The soil samples are prepared for testing according to ASTM D421 (dry preparation) or ASTM D2217 (wet preparation). The grain size distribution of soils coarser than a number 200 sieve (0.074 mm opening) is determined by passing the samples through a standard set of nested sieves. Materials passing the number 200 sieve are suspended in water and the grain size distribution calculated from the measured settlement rate. These tests are conducted in accordance with ASTM D422.

Triaxial Shear Tests: Triaxial shear tests are used to determine the strength characteristics and friction angle of a given soil sample. Triaxial tests are also used to determine the elastic properties of the soil specimen. Triaxial shear tests are performed on several sections of a relatively undisturbed sample extruded from the sampling tube. The samples are trimmed into cylinders 1.4 to 2.8 inches in diameter and encased in rubber membranes. Each is then placed in a compression chamber and confined by all around water pressure. Samples are then subjected to additional axial and/or lateral loads, depending on the soil and the field conditions to be simulated. The test results are typically presented in tabular form or in the form of stress-strain curves and Mohr envelopes or p-q plots.

Three types of triaxial tests are normally performed. The most suitable type of triaxial test is determined by the loading conditions imposed on the soil in the field and the soil characteristics.

1. Consolidated-Undrained (designated as a CU or R Test).

2. Consolidated-Drained (designated as a CD or S Test).

3. Unconsolidated-Undrained (designated as a UU or Q Test).

APPENDIX I – PRELIMINARY NOISE ASSESSMENT

BURNS & McDONNELL

EAST KENTUCKY POWER COOPERATIVE

SOUND STUDY REPORT

LIBERTY RICE POWER PLANT

PROJECT NO. 157785

REVISION 1

AUGUST 2024

CONTENTS

TABLES

List of Abbreviations

Abbreviation	Term/Phrase/Name
ANSI	American National Standards Institute
BOP	Balance of Plant
CadnaA	Computer Aided Noise Abatement
dB	decibel
dBA	A-weighted decibel
dBC	C-weighted decibel
EKPC	East Kentucky Power Cooperative
Hz	Hertz
ISO	International Organization for Standardization
L_{dn}	day-night average sound level
L_{eq}	equivalent-continuous sound level
L_{10}	10-percentile exceedance sound level
L_{50}	50-percentile exceedance sound level
L_{90}	90-percentile exceedance sound level
MP	measurement point
mph	miles per hour
Project	Liberty RICE Power Plant
PWL	sound power level
RICE	Reciprocating Internal Combustion Engine
SPL	sound pressure level
USEPA	United States Environmental Protection Agency

Executive Summary

Burns & McDonnell conducted a sound study for the East Kentucky Power Cooperative (EKPC) Liberty Power Plant (Project), located in Casey County, Kentucky. The Project is a reciprocating internal combustion engine (RICE) power generation facility which is expected to include 12 Wartsila W18V50DF RICE units housed inside a building and associated balance-of-plant (BOP) equipment.

The objectives of this study were to identify the applicable noise regulations, model operational sound levels of the Project, and compare Project-generated sound levels to the applicable noise regulations. As of this version of the report, the existing ambient sound level measurements have not been completed. However, measurements were conducted at a nearby location which were used to estimate the ambient sound levels for this area.

The State of Kentucky does not have applicable noise statutes which limit noise from the Project nor does Casey County. In the absence of regulatory limits, Project sound levels were compared to industry guidelines to limit noise impacts on the surrounding community. For A-weighted sound levels, the United States Environmental Protection Agency (USEPA) has guidance to limit sound levels at nearby residential receptors to a constant sound level of less than 48.6 dBA. In the interest of potential low-frequency impacts, the American National Standards Institute (ANSI) standard, ANSI S12.9, provides guidance that low-frequency sound levels in the 16, 31.5, and 63-Hertz (Hz) octave bands less than 65 dB generally result in minimal annoyance. This would be approximately equivalent to a C-weighted sound level of 68 dBC for sources with strong low frequency content.

The Project operational sound levels are expected to be generally in-line with recommended noise criteria provided by USEPA and ANSI S12.9, with only slight exceedances at a few receptor locations. However, it should be noted that the USEPA guidelines and the ANSI document are not intended to be construed as regulatory limits as they do not consider cost or engineering feasibility associated with additional mitigation. Instead, these should be used only as guidance for minimizing the potential for noise impacts on the surrounding community.

1.0 Acoustical Terminology

The term "sound level" is often used to describe two different sound characteristics: sound power and sound pressure. Every source that produces sound has a sound power level (PWL). The PWL is the acoustical energy emitted by a sound source and is an absolute number that is not affected by the surrounding environment. The acoustical energy produced by a source propagates through media as pressure fluctuations. These pressure fluctuations, also called sound pressure levels (SPL), are what human ears hear and microphones measure.

Sound is physically characterized by amplitude and frequency. The amplitude of sound is measured in decibels (dB) as the logarithmic ratio of a sound pressure to a reference sound pressure (20 micropascals). The reference sound pressure corresponds to the typical threshold of human hearing. To the average listener, a 3-dB change in a continuous broadband sound is generally considered "just barely perceptible"; a 5-dB change is generally considered "clearly noticeable"; and a 10-dB change is generally considered a doubling (or halving, if the sound is decreasing) of the apparent loudness.

Sound waves can occur at many different wavelengths, also known as the frequency. Frequency is measured in hertz (Hz) and is the number of wave cycles per second that occur. The typical human ear can hear frequencies ranging from approximately 20 to 20,000 Hz. Normally, the human ear is most sensitive to sounds in the middle frequencies (1,000 to 8,000 Hz) and is less sensitive to sounds in the lower and higher frequencies. As such, the A-weighting scale was developed to simulate the frequency response of the human ear to sounds at typical environmental levels. The A-weighting scale emphasizes sounds in the middle frequencies and de-emphasizes sounds in the low and high frequencies. Any sound level to which the A-weighting scale has been applied is expressed in A-weighted decibels, or dBA. For reference, the A-weighted sound pressure level and subjective loudness associated with some common sound sources are listed in Table 1-1. The C-weighting scale (dBC) has more of an emphasis on low frequency content than the A-weighting scale and is generally used to describe the low frequency characteristics of sound levels (e.g., "rattling" or "rumbling" associated with sound levels).

Sound in the environment is constantly fluctuating, as when a car drives by, a dog barks, or a plane passes overhead. Therefore, sound metrics have been developed to quantify fluctuating environmental sound levels. These metrics include the exceedance sound level. The exceedance sound level is the sound level exceeded during "x" percent of the sampling period and is also referred to as a statistical sound level. Common exceedance sound level values are the 10-, 50-,90-percentile exceedance sound levels, denoted by L_{10}, L_{50}, and L_{90}. The equivalent-continuous sound level (L_{eq}) is the arithmetic average of the varying sound over a given time period and is the most common metric used to describe sound. The USEPA uses a noise metric called the day-night average sound level (L_{dn}) which is a 24-hour average sound level, with a 10-dBA penalty applied to sound measured during nighttime hours (10:00 PM to 7:00 AM).

Table 1-1: Typical Sound Pressure Levels Associated with Common Sound Sources

Sound Pressure Level (dBA)	Subjective Evaluation	Environment
140	Deafening	Jet aircraft at 75 feet
130	Threshold of pain	Jet aircraft during takeoff at a distance of 300 feet
120	Threshold of feeling	Elevated train
110	Very loud	Jet flyover at 1,000 feet
100		Motorcycle at 25 feet
90	Moderately loud	Propeller plane flyover at 1,000 feet
80		Diesel truck (40 mph) at 50 feet
70	Loud	B-757 cabin during flight
60	Moderate	Air-conditioner condenser at 15 feet
50	Quiet	Private Office
40		Farm field with light breeze, birdcalls
30	Very quiet	Quiet residential neighborhood
20		Rustling leaves
10	Just audible	--
0	Threshold of hearing	--

Sources:
(1) Adapted from *Architectural Acoustics, M. David Egan, 1988*
(2) *Architectural Graphic Standards*, Ramsey and Sleeper, 1994

2.0 Applicable Regulations & Criteria

State and local noise regulations were reviewed to determine Project noise limits. The State of Kentucky, nor Casey County, have applicable noise statutes which limit noise from the Project. In the absence of local noise limits, Project sound levels can be compared to USEPA guidelines and the ANSI S12.9 standard.

2.1 USEPA Guidelines

In 1974 the USEPA published *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety.* As part of this document, the recommended noise limit is a day-night level, L_{dn}, of 55 dBA at the nearest noise sensitive receptors (i.e., residents). This would be equal to an equivalent continuous sound level, L_{eq}, of 48.6 dBA for a constant source operating continuously (i.e., 24-hours). The USEPA notes that these recommended sound levels are not to be construed as regulatory limits as they do not account for costs or feasibility associated with meeting these target sound levels. However, they are generally appropriate levels to protect the health and welfare of the community.

2.2 ANSI S12.9 Part 4

Since there is potential for low-frequency noise to be emitted from the Project, ANSI S12.9 Part 4 provides informative guidance for sounds with strong low-frequency content. Section D.2 states the following:

> *"Generally, annoyance is minimal when octave-band sound pressure levels are less than 65 dB at 16, 31.5, and 63-Hz midband frequencies."*

For sounds with strong low-frequency content, this would be approximately equivalent to a C-weighted sound level of 65 to 70 dBC. A target sound level of 68 dBC for the Project falls within this range and should help minimize the potential for low-frequency impacts based on the guidance from the ANSI standard.

3.0 Sound Level Measurements

Ambient sound level measurements have not been conducted at the Liberty site. However, sound level measurements were conducted at the previous Campbellsville site which is approximately 22 miles northwest of the Liberty site. Since both sites are rural areas in a similar region, relatively close to each other, and both similar distances away from rural highways and major interstates, the ambient measurements at Campbellsville have been used to approximate the existing ambient sound levels at Liberty. The following Table 3-1 shows the estimated ambient sound levels at the nearby residents to the Project, based on previous measurements conducted at the Campbellsville site.

Table 3-1: Estimated Ambient Sound Levels (from Campbellsville Measurements)

Location	Average Ambient Sound Level (dBA)				Average Ambient Sound Level (dBC)			
	Daytime L_{eq}	Daytime L_{90}	Nighttime L_{eq}	Nighttime L_{90}	Daytime L_{eq}	Daytime L_{90}	Nighttime L_{eq}	Nighttime L_{90}
Nearby Residents	43	33	38	32	63	53	58	55

**Daytime hours are 7:00 AM to 10:00 PM*

4.0 Modeled Sound Levels

Operational sound levels for the proposed Project were performed using the Computer Aided Noise Abatement (CadnaA) modeling software. Equipment sound levels used for modeling were based on a combination of supplier provided data and in-house data based on experience with similar make and sized equipment. This model was used for determining expected sound levels due to the Project and the associated impacts to the existing ambient sound levels at the nearest noise sensitive receptors.

4.1 Sound Modeling Methodology and Input Parameters

Predictive noise modeling was performed using the industry-accepted sound modeling software CadnaA, version 2024. The software is a scaled, three-dimensional program, which considers air absorption, terrain, ground absorption, and reflections and shielding for each piece of noise-emitting equipment, and then predicts sound pressure levels at discrete locations and over a gridded area based on input source sound levels. The model calculates sound propagation based on International Organization for Standardization (ISO) 9613-2:1996, General Method of Calculation. ISO 9613-2 assesses the sound level propagation based on the octave band center-frequency range from 31.5 to 8,000 Hz.

The ISO standard considers sound propagation and directivity. The sound-modeling software calculates omnidirectional, downwind sound propagation using worst-case directivity factors, in tandem with user-specified directivities and propagation properties. Empirical studies accepted within the industry have demonstrated that modeling may over-predict sound levels in certain directions, and as a result, modeling results generally are considered a conservative measure of the Project's actual sound level.

The modeled atmospheric conditions were assumed to be calm, and the temperature and relative humidity were left at the program's default values. Reflections and shielding were considered for sound waves encountering physical structures. Sound levels around the site can be influenced by the sound reflections from physical structures onsite. The area surrounding the Project has mild elevation changes, which scatter and absorb the sound waves. Thus, terrain was included to account for surface effects such as ground absorption. Average ground absorption for the Project site and surrounding area was set to a value of 0.5 to account for the mix of hard pavement and soft vegetative ground. The modeling assumptions are outlined in Table 4-1. This model is exclusive of noise sources not associated with the Project (e.g., traffic noise and local fauna). Only Project sound levels have been evaluated.

The Project general is included as Figure A-1 of Appendix A. The modeled equipment octave-band sound levels for each piece of equipment are included in Appendix B. A summary of the Project's expected acoustical design is shown in Table 4-2.

Table 4-1: Sound Modeling Parameters

Model Input	Parameter Value
Ground Absorption	0.5
Number of Reflections	2
Receptor Height	5 feet above grade
Terrain	USGS topographic land data
Temperature	50 °F
Humidity	70%

Table 4-2: Project Expected Acoustical Design

Equipment	QTY	Base Sound Level[a,b]	Notes
Wartsila Equipment			
RICE Engine	12	L_w = 128 dBA	Inside RICE Hall, Roof - STC 50 Min, Walls - STC 55 Min + Absorptive Layer
RICE Exhaust Exit	2	L_w = 99 dBA	Includes SCR + Resonator + 45 dBA Silencer
RICE Exhaust Duct	12	$L_{w''}$ = 93 dBA/m	Insulated Duct
Charge Air Intake	24 (2 ea.)	L_w = 96 dBA	Intake 45 dB Silencer
Radiator	12 (1 ea.)	L_w = 96 dBA	Noise Level 4
Roof Ridge Vent	1	L_w = 108 dBA	From RICE Hall Interior Calc'd SPL w/ Ridge Vent Silencer
MAU/Relief	24	L_w = 99 dBA	From RICE Hall Interior Calc'd SPL
BOP Equipment			
GSU Transformer	3	L_p = 85 dBA at 3 feet	Estimated
Small Transformers	4	L_p = 70 dBA at 3 feet	Estimated
HVAC Units	2	L_w = 95 dBA	Estimated
Misc. Pumps, Heaters, etc.		L_p = 85 dBA at 3 feet	Estimated

(a) L_p – Sound pressure level at specified distance
(b) L_w – Sound power level, $L_{w''}$ – Sound power level per unit area

4.2 Sound Modeling Results

The Project will operate at fairly constant sound levels when operational. Therefore, steady-state sound level predictions were completed. A worst-case, full-load scenario with all 12 engines operating at 100% load was used for the modeling scenario. The predicted overall steady-state operational A-weighted sound levels, which do not include contributions from ambient sound sources, are shown with 5-dB contours in Figure A-2 of Appendix A. Predicted overall C-weighted sound levels are shown with 5-dB contours in Figure A-3 of Appendix A.

The Project-generated sound levels were calculated at the nearest residential properties. Table 4-3 includes the predicted Project sound levels at the nearest residential receptors.

Table 4-3: Modeled Sound Level Results

Location	Assumed Ambient Sound Level[a]		Model Predicted Project-Only Sound Level[b]		Project Target Noise Criteria	
	dBA	dBC	dBA	dBC	dBA	dBC
R1	32	53	48	65	48.6	68
R2	32	53	50	67	48.6	68
R3	32	53	47	64	48.6	68
R4	32	53	43	60	48.6	68
R5	32	53	42	60	48.6	68
R6	32	53	45	63	48.6	68
R7	32	53	52	71	48.6	68
R8	32	53	52	70	48.6	68

(a) Lowest of the daytime/nighttime measured sound levels from Campbellsville measurements
(b) Model-predicted Project sound level

As shown in Table 4-3, the Project sound levels during full-load operations are expected to slightly exceed the recommended noise levels from USEPA and ANSI S12.9 at only some of the receptors, but sound levels are generally consistent with the recommended levels.

5.0 Conclusions

Burns & McDonnell conducted a preliminary sound study for the proposed Liberty Project. This preliminary study consists of predictive sound modeling of the Project to analyze potential offsite sound impacts from operation of the Project. Ambient sound levels for this site have been estimated based on previous ambient monitoring of a nearby site with a similar environment near rural highways.

There were no identified regulatory noise limits for the Project. Guidance from the USEPA and ANSI S12.9 could be used as target criteria to minimize potential for A-weighted and C-weighted sound level impacts on the nearby residential receptors. The Project as currently designed is expected to contribute a maximum sound level of approximately 52 dBA and 71 dBC at the nearest residential noise sensitive receptor, R7, located west of the Project site. This is slightly above the recommended noise criteria provided by USEPA and ANSI S12.9, but as previously stated these targets are only being used as guidance and are not to be interpreted as regulatory limits. In general, the Project sound levels are consistent with the intent of the recommended guidelines as most receptors are below the recommended guidance sound levels and the few exceedances to the recommended levels are less than 5 dB above the recommended sound levels.

APPENDIX A – FIGURES

EQUIP COORDS			
ITEM	NORTHING	EASTING	HEIGHT
N	N: 2018196.704	E: 1870322.119	25'-0"
P	N: 2018684.617	E: 1870817.982	25'-0"
Q	N: 2018532.597	E: 1870463.324	15'-0"

STACK COORDS		
ITEM	NORTHING	EASTING
A	N: 2018810.858	E: 1870267.758
B	N: 2018681.917	E: 1870317.258

BUILDING HEIGHTS	
ITEM	HEIGHT
1	34'-0"
2	45'-0"
3	NOT USED
4	25'-0"
5	25'-0"
6	15'-0"

SITE KEY	
1	ENGINE HALL
2	LOW VOLTAGE ROOM
3	ADMIN-CONTROL AREA
4	MECHANICAL ROOM
5	BATTERY ROOM
6	MEDIUM VOLTAGE BLDG
7	SILENCERS - STACKS
8	SELECTIVE CATALYTIC REDUCER
9	CHARGE AIR FILTER
10	RADIATORS
11	STEP-UP TRANSFORMER AND CONTAINMENT
12	GAS CONDITIONING
13	OIL/UREA CONTAINMENT
14	UREA TANK
15	NEW LUBE OIL TANK
16	SERVICE LUBE OIL TANK
17	WASTE LUBE OIL TANK
18	OIL/UREA / AMMONIA UNLOADING STATION
19	STATION TRANSFORMER
20	HVAC UNITS
21	HEAVY HAUL
22	FIRE WATER TANK
23	FIRE PUMPS
24	FUEL PUMPS
25	LIQUID FUEL TANKS WITH CONTAINMENT
26	AUX GENERATOR
27	WAREHOUSE
28	OIL WATER SEPARATOR
29	GAS FILTER/SEPARATOR
30	RESONATOR
31	HORIZONTAL SILENCER
32	SEAL AIR FAN

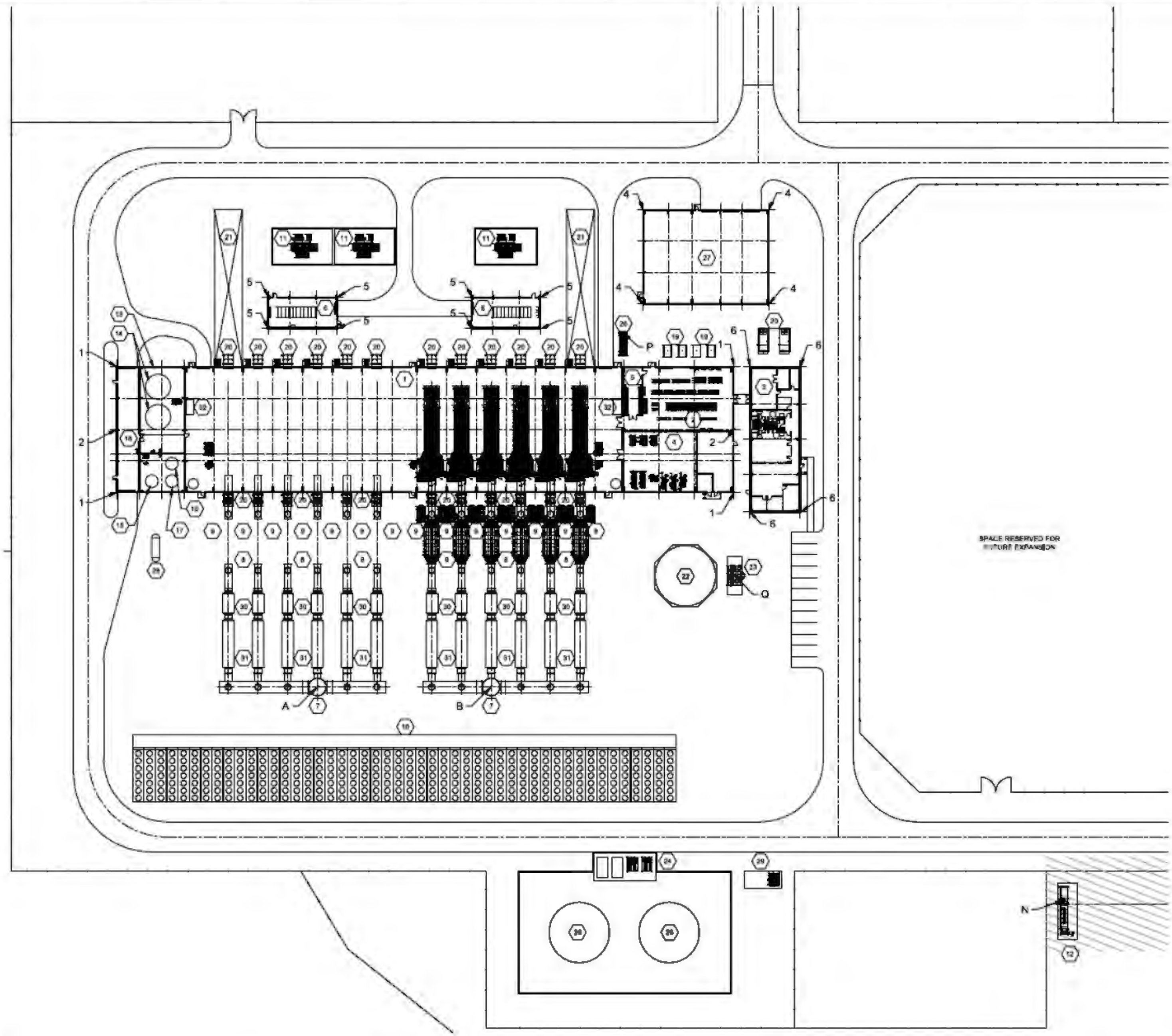


Figure A-1 General Arrangement

PRELIMINARY - NOT FOR CONSTRUCTION

no.	date	by	ckd	description
D	08/23/24	WRL		ADJUSTED PLANT LOCATION FOR 1000'-0" SETBACK
C	06/04/24	WRL		ADDED SEAL AIR FAN
B	04/29/24	WRL		ADDED COORDINATES FOR STACKS AND EQUIPMENT
A	03/04/24	WRL		PRELIMINARY MIRRORED SINGLE STACK LAYOUT

POWER BLOCK ENLARGED PLAN

TRUE NORTH

PLAN NORTH

BURNS McDONNELL

designed | detailed W. LESNIAK

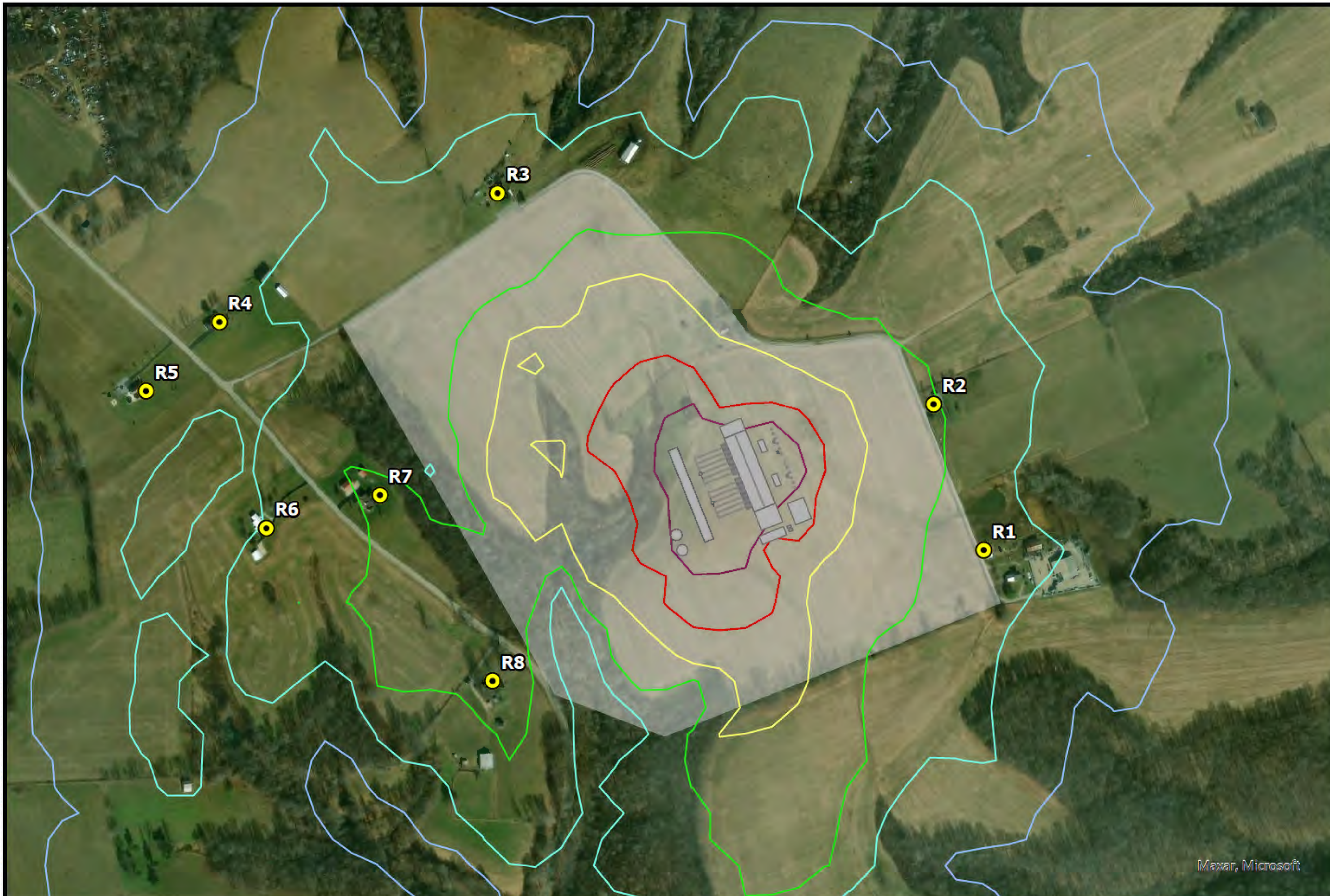
EAST KENTUCKY POWER COOPERATIVE

LIBERTY SITE 3
12 x 18MW GAS RECIP ENGINE PLANT
SINGLE STACK OPTION B
ENLARGED PLAN

project 157786 | contract

drawing GA122 — rev. D

sheet of sheets



LEGEND

40 dBA	55 dBA	Property Boundary
45 dBA	60 dBA	Structures
50 dBA	65 dBA	Receivers

REFERENCE

0 0.08 0.16 MILES

0 0.08 0.16 KILOMETERS

N

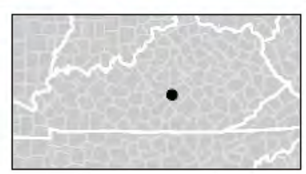


Figure A-2 - RICE 100% Load (12 Units)
Project Design Sound Level Contours (dBA)

LOCATION: Casey County, KY
CLIENT: EKPC
PROJ. NO.: 157785
CREATED: 08/28/2024

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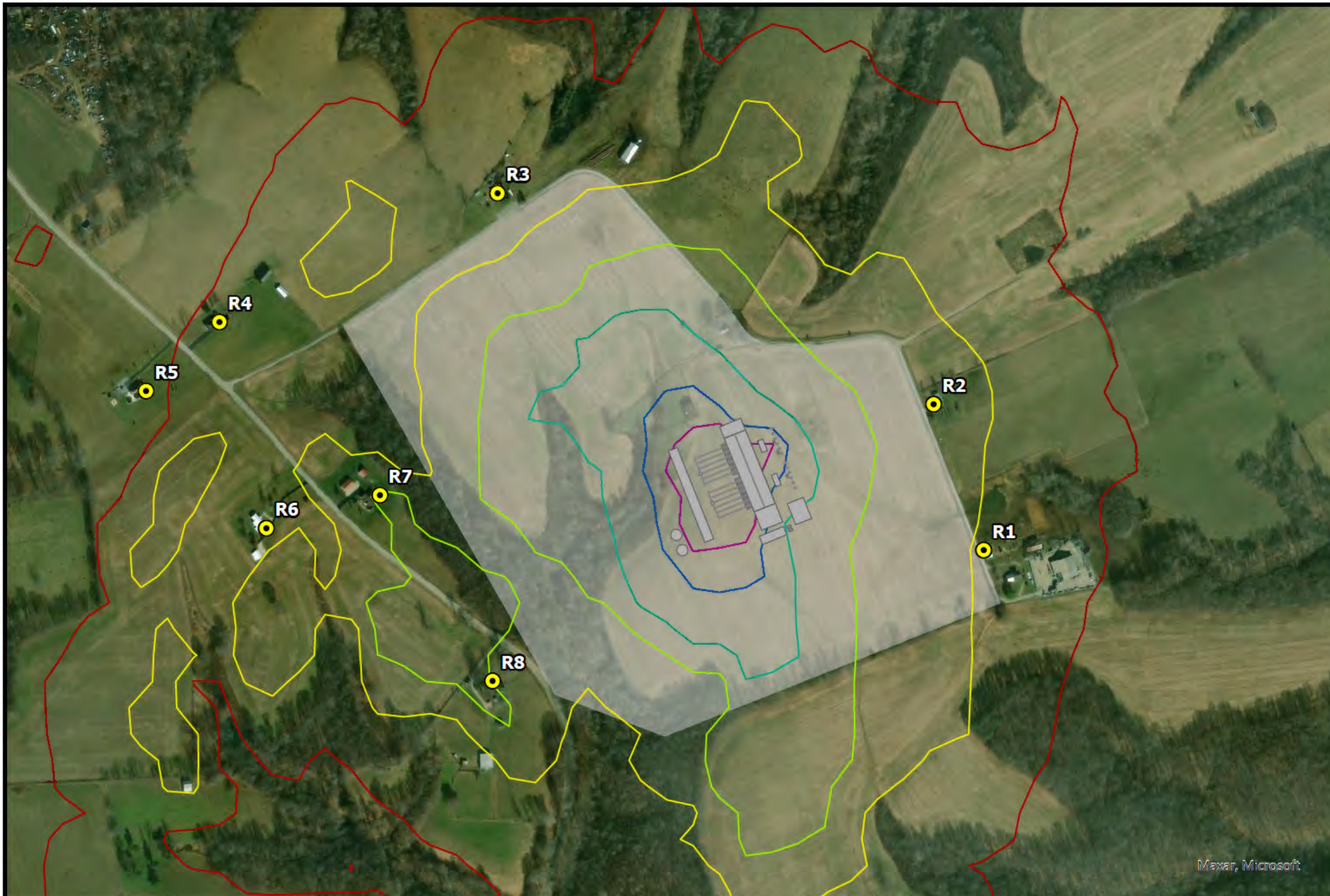
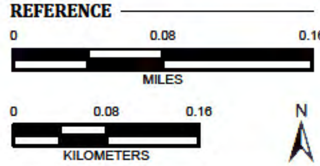
Path: Z:\Clients\ENR\EKPC\157785_RECIP\STUDY\7_Studies\Permitting\Modeling\Noise\GIS\Liberty GIS\Liberty GIS.aprx • Coordinate System • Units



LEGEND

- 60 dBC
- 65 dBC
- 70 dBC
- 75 dBC
- 80 dBC
- 85 dBC
- Property Boundary
- Structures
- Receivers

REFERENCE



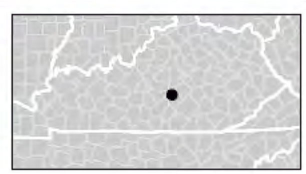


Figure A-3 - RICE 100% Load (12 Units)
Project Design Sound Level Contours (dBC)

LOCATION:	Casey County, KY
CLIENT:	EKPC
PROJ. NO.:	157785
CREATED:	08/28/2024

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APPENDIX B – MODELED SOUND POWER LEVELS

Appendix B - Base Design Modeled Sound Power Levels

EKPC

Liberty RICE - 12 Engine Layout

Name	Number of Sources	Sound Power Level (dB)[1] Octave Band Frequency (Hz)									Overall (dBA)	Notes
		31.5	63.0	125	250	500	1000	2000	4000	8000		
Fuel Pump	2	79	91	87	90	91	94	89	77	58	**97**	Estimated
Gas Heater	2	104	101	99	94	91	87	80	76	72	**93**	Estimated
MAU Intake	12	107	98	98	96	95	93	93	88	83	**99**	Calculated from interior equipment
MAU Relief	12	107	98	98	96	95	93	93	88	83	**99**	Calculated from interior equipment
Small Transformer	4	90	87	88	85	88	85	80	78	68	**90**	Estimated
Stack Exit	2	114	112	109	103	96	78	64	67	69	**99**	Wartsila Stack + Res Silencer + SCR + 45 dB Silencer
Combined Exhaust Ducts (dB/m)	4	71	70	54	46	48	42	29	33	22	**63**	Calculated from combined duct sound levels
RICE Exhaust Duct - Resonator Section (dB/m)	12	78	83	77	73	76	79	66	66	55	**91**	Wartsila Duct + Res Silencer + SCR
RICE Exhaust Duct - SCR Section (dB/m)	12	99	91	77	73	76	79	66	66	55	**91**	Wartsila Duct + SCR
RICE Exhaust Duct - Silencer Section (dB/m)	12	63	62	46	39	40	34	21	25	14	**52**	Wartsila Duct + Res Silencer + SCR + 45 dB Sil.
RICE Exhaust Duct - Pre SCR (dB/m)	12	102	97	86	85	88	91	78	78	67	**103**	Wartsila Insulated Exhaust Duct
Ridge Vent	1	108	96	91	80	77	76	83	82	79	**108**	Calculated from RICE Hall Interior Sources + Silencer
Engine Hall Roof	1	118	100	93	89	93	72	66	60	55	**91**	Calc from RICE Hall Interior (includes TL losses from roof assembly)
HVAC Unit	2	73	78	83	93	93	90	88	83	73	**95**	Estimated
Radiator (Total)	1	125	112	112	107	104	102	97	92	84	**107**	In-house sound levels
Step Up Transformer	3	103	100	101	98	101	98	93	91	81	**102**	Estimated
Engine Hall Walls	1	104	91	88	82	75	67	64	56	45	**78**	Calc from RICE Hall Interior (includes TL losses from wall assembly)
Exhaust Stack Wall	2	95	91	87	81	72	53	12	9	5	**76**	Estimated combined in-duct levels
RICE Hall	1	112	104	104	103	103	101	102	98	93	**108**	Calculated from interior equipment and wall/roof absorption
RICE Unit	12	132	124	124	124	123	122	123	119	113	**128**	In-house, housed inside building

Notes:

1. All sound levels are inclusive of mitigation included in the base design only

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APPENDIX J – PERMITTING MATRIX

Item No.	Permit/Clearance	Regulatory Agency	Details	When Required	Duration	Comments
Federal						
1	Notice of Proposed Construction or Alteration	Federal Aviation Administration (FAA)	Must notify the FAA if structures will exceed 200 feet in height or if the structures (stacks & cranes) are located within the 100:1 (distance to height) ratio from the nearest point of the nearest FAA designated airport runway. Notifying the FAA includes completing Form 7460-1 for all required structures and providing a site layout map depicting structure locations.	Prior to construction	45+ days	Need will be determined based on final design.
2	Section 7 Threatened and Endangered Species Consultation and Clearance	Kentucky Department of Fish and Wildlife Resources, Office of Kentucky Nature Preserves	If the project will potentially impact protected species or their respective habitat, or if federal financing or permit is required, then the FWS must be contacted. The FWS will determine the level of effort needed for the project to proceed (e.g., habitat assessment, species surveys, avian impact studies, etc.).	Prior to construction	30 days for initial response, additional 30 days for determination of field survey results	USFWS IPaC indicates that 16 Special Status species have potential to occur within Project Area. Habitat assessments and/or species surveys were completed to determine presence/absence of protected plant and wildlife species, including bats. No critial habitat is located within the project area. Surveys verifed that no permit was required. Seasonal tree clearing restrictions may be imposed to avoid hat roosting periods.
3	Migratory Bird Treaty Act (MBTA)/Bald and Golden Eagle Protection Act (BGEPA) Compliance	U.S. Fish & Wildlife Service (FWS), Ecological Services	Required when construction or operation of a proposed facility could impact migratory birds, their nests, and especially threatened or endangered species	Prior to construction	30 days for data request, 30-45 days for report review	Nesting period for Migratory Birds within the Project Area primarily occurs from April 1- August 31. If tree clearing must occur during this timeframe, avian nest surveys may be conducted as warranted prior to site clearing.
4	Spill Prevention, Control, and Countermeasure Plan	U.S. Environmental Protection Agency (EPA)	Required if the facility will have 1,320 gallons or more of aboveground petroleum storage capacity in 55-gallon-sized or larger containers (or 42,000 gallons in underground storage not regulated by underground storage tank rules)	Prior to storage of petroleum products onsite in excess of SPCC thresholds	Not required to submit the SPCC Plan to the EPA for review, unless requested.	EKPC will develop a SPCC plan for the Liberty Generating Station.
5	Permits under Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act	U.S. Army Corps of Engineers – Louisville District	Nationwide Permit: Less than or equal to 0.5 acre of wedand impacts Section 10 Authorization for any structures within or over any navigable waters of the U.S.	Prior to construction start and activities within waters of the U.S., applicant must apply for a permit Section 404 authorization required to dredge or place fill in a jurisdictional water, including wedands. Section 10 authorization required for crossings/activities within any navigable waterways.	60 days or so for Nationwide Permit	A wetland delineation was completed to determine the extent of wetland and stream impacts associated with the Project. If permanent impacts to wetlands and streams are less than 0.5-acre, Project should qualify for a Nationwide Permit 12. Mitigation credits will be required for cumulative permanent impacts of 0.10 acre or greater of wetlands and waterbodies. A pre-construction notification may be required. No impacts are anticipated based on the preliminary project design. EKPC will apply for a Nationwide Permit 12 and/or 57 as required. Field surveys indicate no permits are required.
6	Consultations regarding erosion and sedimentation controls and seed mixes, Farmland Protection Policy Act, and Conservation Reserve Program and Wetland Reserve Program Consultation	U.S. Department of Agriculture- Farm Service Agency and Natural Resources Conservation Service	EKPC plans to seek federal funding/grants and the project will be subject to the Farmland Protection Act. Approximately 60 acres of the Project area are prime farmland or famland of statewide importance.			A Land Evaluation and Site Assessment (LESA) will be coordinated with the NRCS Soil Scientist.
7	National Environmental Policy Act (NEPA) Review	Lead Federal agency	The applicant typically prepares a preliminary Environmental Assessment (EA). The agency reviews the document and can either attach a Finding of No Significant Impact (FONSI) or require the preparation of an Environmental Impact Statement (EIS).	Prior to construction		The EA will serve as a detailed written record of the environmental analysis completed for the proposed action, and serve as the hasis for RUS to issue a FONSI, or alternatively determine that preparation of an EIS is required. RUS has indicated an EA/FONSI are the appropriate Class of Action.
State - Kentucky						
8	Certificate of Public Convenience and Necessity	Kentucky Public Service Commission	Required for the construction of electric generating facilities	Prior to construction	120 days after the submission of a complete application	A Notice of Intent must be submitted at least 30 days prior to submitting an application for a certificate.
9	Air Quality Construction/Operating Permit (PSD)	Kentucky Department of Environmental Protection Division for Air Quality	Required for new major stationary sources of air emissions	Prior to construction	KDAQ and EPA review anticipated to be 12 -24 months	EKPC will be applying for a PSD air permit as early as September 2024.

Item No.	Permit/Clearance	Regulatory Agency	Details	When Required	Duration	Comments
10	Noise Compliance	Kentucky Public Service Commission (as a part of a larger certificate application).	Required to demonstrate that facility operation will comply with State, county, and city noise regulations. The PSC may require/request additional noise mitigation measures.	Prior to construction	180 days	City of Liberty has local regulations based on time of day and receiving land use that will need to be analyzed for the surrounding area and modeled to determine compliance. Review of County ordinances did not find any numerical noise limits. Any compressors along the pipeline and booster stations will be required to meet the FERC limit of an Ldn of 55 dBA.
11	Section 401 Water Quality Certification (WQC)	Kentucky Energy and Environment Cabinet Department of Environmental Protection Division of Water	General 401 Certification with approved USACE Nationwide Permit assuming project meets conditions listed in the Kentucky Energy and Environment Cabinet DEP *General Certification--Nationwide Permit (NWP)* document for NWP 12 and NWP 57. Individual 401 Certification required if Project is unable to meet conditions listed in the *General Certification--Nationwide Permit (NWP)* document.	Prior to construction	30 - 60 business days	While no water impacts are anticipated, based on the final project design, EKPC will apply for a Section 401 WQC as required.
12	Groundwater Protection Plan	Kentucky Energy and Environment Cabinet Department of Environmental Protection Division of Water	Required for activities that have the potential to pollute groundwater. The Groundwater Protection Plan must define best management practices for groundwater protection.	Prior to operation	Wrapped in KPDES water permit process	The Groundwater Protection Plan is not submitted for review unless requested by the State.
13	General Permit for Stormwater Discharges Associated with Construction Activities	Kentucky Energy and Environment Cabinet Department of Environmental Protection Division of Water	Required for all stormwater discharges from construction activities which will disturb one or more total acres of land. The General Permit requires the development of a Stormwater Pollution Prevention Plan (SWPPP) prior to submitting a Notice of Intent for permit coverage.	Prior to construction	7 Days	The SWPPP describes the site management practices that will be utilized to effectively minimize erosion and sediment discharges for storm up to a 2-year, 24-hour event.
14	KPDES Operational Discharge Permit	Kentucky Energy and Environment Cabinet Department of Environmental Protection Division of Water Division of Water	A KPDES Permit may be required if the proposed facility will result in a wastewater discharge to a waterway as a result of facility operation.	Prior to operation	At least 180 days	This permit is separate from the stormwater discharge. The KPDES permit is required for industrial discharges as a result of operating the proposed Liberty Facility.
15	National Historic Preservation Act – Section 106 Clearance	Kentucky Heritage Council - State Historic Preservation Office (SHPO) and Tribal Consulations	Under Section 106 of the National Historic Preservation Act, Federal agencies must work with the SHPO and federally recognized Indian tribes to address historic preservation issues when planning projects or issuing funds or permits that may affect historic properties and archaeological resources listed in or determined eligible for the National Register of Historic Places.	Prior to construction	45 Days	Archaeological and Cultural Historic field surveys have been completed. Section 106 coordination with SHPO and Tribes is in process.
County						
16	Building Permit	Casey County Clerk	May be required prior to building construction	Prior to construction	TBD	

APPENDIX K – OEM PERFORMANCE GUARANTEES

SECTION 48 59 96 APPENDIX A – PERFORMANCE GUARANTEES - WARTSILA

NOTE: See Specifications Section 48 59 96 for definitions of performance parameters, general requirements for their testing procedures and performance test site conditions.

Table 1A: Natural-Gas Fired Operating Performance Guarantees at ISO 3046 conditions

PERFORMANCE PARAMETER	UNIT		VALUE[1]	
1. Performance Guarantees				
Unit Electrical Output (UEO)	kW		18,132	
Unit Auxiliary Power (OEM only)	kW		327	
Hot-Standby Auxiliary Power (per Unit)	kW		See note 6	
Unit Heat Rate (UHR), at 100% load	BTU/kWh (LHV) measured at generator terminals		7,455	
Maximum Urea Consumption	Kg/hr		See below	
Maximum Lube Oil Consumption	grams/kWh		0.25 grams/kWh on gas mode	
2. Absolute Performance Guarantees[2]				
Minimum Unit Electrical Output	kW		95% of UEO	
Maximum Unit Heat Rate	BTU/kWh (HHV)		105% of UHR	
Genset Minimum Emissions Compliance Load Electrical Output	kW		7,253	
3. Reliability Guarantee[2]				
Reliability Factor	%		See noted exception regarding reliability guarantee	
4. Noise Guarantees[2]				
Maximum Genset Sound Power Level	dB(A)		Noise emissions guarantees provided in separate document. Exhaust silencer is not a noise generating source.	
Exhaust Silencer Sound Power Level	dB(A)			
Charge Air Inlet Sound Power Level	dB(A)			
Radiator Sound Power Level[4]	dB(A)			
Exhaust Exit Sound Power Level	dB(C)			
5. Maximum Emissions Guarantees[2(*)]				
NOx (as NO_2)	lb/hr	ppmvd[3]	*	
CO	lb/hr	ppmvd[3]	*	
VOC (as methane equivalent)	lb/hr	ppmvd[3]	*	
$PM_{2.5}$ (total filterable plus condensable)	lb/hr (HHV)[3]	ppmvd[3]	*	
PM_{10} (total filterable plus condensable)	lb/hr (HHV)[3]	ppmvd[3]	*	
Formaldehydes (CH_2O)	lb/hr	ppmvd[3]	*	0.7@100% Load
Ammonia Slip (NH_3)	lb/hr	ppmvd[3]	*	10
6. **Startup/Shutdown Duration Guarantees[2]**				
Minutes/start	minutes		5	
Minutes/shutdown	minutes		1	
Load Ramp Rate	kW/min		10,879	

Notes:

1. Missing values to be filled in by Contractor
2. Must Make Performance Guarantees. Must be met as a precondition for any other Performance Guarantees to be met
3. All emissions are corrected to 15% O_2, dry.
4. Radiator sound power levels are measured per radiator bank (estimated 5 radiator banks per Generating Set).

(*) Emission guarantees with full details are provided in attached emission statement. VOC emissions here require max VOC content of fuel gas 0.5 v-%. A correction for higher VOC content is included in the emission statement.

Table 1B: Fuel Oil Fired Operating Performance Guarantees

PERFORMANCE PARAMETER	UNIT		VALUE[1]	
7. Performance Guarantees				
Unit Electrical Output (UEO)	kW		18,132	
Unit Auxiliary Power (OEM only)	kW		327	
Hot-Standby Auxiliary Power (per Unit)	kW		See note 6	
Unit Heat Rate (UHR)	BTU/kWh (LHV) Measured at generator terminals		7,797	
Maximum Urea Consumption[5]	Kg/hr		See below	
Maximum Lube Oil Consumption[5]	Grams/kWh		0.4 grams/kWh on LFO mode	
8. Absolute Performance Guarantees[2]				
Minimum Unit Electrical Output	kW		95% of UEO	
Maximum Unit Heat Rate	BTU/kWh (HHV)		105% of UHR	
Genset Minimum Emissions Compliance Load Electrical Output	kW		7,253	
9. Reliability Guarantee[2]				
Reliability Factor	%		See noted exception regarding reliability guarantee	
10. Noise Guarantees[2]				
Maximum Genset Sound Power Level	dB(A)		Noise emissions guarantees provided in separate document. Exhaust silencer is not a noise generating source.	
Exhaust Silencer Sound Power Level	dB(A)			
Charge Air Inlet Sound Power Level	dB(A)			
Radiator Sound Power Level[4]	dB(A)			
Exhaust Exit Sound Power Level	dB(C)			
11. Maximum Emissions Guarantees[2(**)]				
NOx (as NO_2)	lb/hr	ppmvd[3]	**	
CO	lb/hr	ppmvd[3]	**	
VOC (as methane equivalent)	lb/hr	ppmvd[3]	**	
$PM_{2.5}$ (total filterable plus condensable)	lb/hr (HHV)[3]	ppmvd[3]	**	
PM_{10} (total filterable plus condensable)	lb/hr (HHV)[3]	ppmvd[3]	**	
Formaldehydes (CH_2O)	lb/hr	ppmvd[3]	**	0.7@100% Load
Ammonia Slip (NH_3)	lb/hr	ppmvd[3]	**	10
12. **Startup/Shutdown Duration Guarantees[2]**				
Minutes/start	minutes		5	
Minutes/shutdown	minutes		1	
Load Ramp Rate	kW/min		10,879	

Notes:

1. Missing values to be filled in by Contractor
2. Must Make Performance Guarantees. Must be met as a precondition for any other Performance Guarantees to be met
3. All emissions are corrected to 15% O_2, dry.
4. Radiator sound power levels are measured per radiator bank (estimated 5 radiator banks per Generating Set).
5. Values are not subject to LDs.

6. The question of auxiliary power demand for a plant in standby has a number of variables which make it difficult to state hard numbers. Under the assumption that the plant in standby is standing by for dispatch, if we start with the engine itself, we want to keep it warm. This is done with a "preheater" which has an electrically powered heater (one per engine) and a small circulation pump (one per engine) to circulate hot water through the engine block. For a Wärtsilä W18V50DF the preheating power is 110 kW, however that power is applied in stages, so it is not a steady 110 kW load. The duty cycle depends on the ambient temperature of the power house interior and how recently the engine has been running. The heater is thermostatically controlled, so if the engine has been running recently, the preheater will not be turned on when the engine stops. It will take some hours until the preheater turns on, but it is difficult to say how many. The generators themselves are fitted with anticondensation heaters; in the case of the W18V50DF this has an approximate load of 3 kW. In addition to these loads, other balance of plant loads may or may not be considered as standby loads. Plant lighting, or partial plant lighting? Difficult to say how many kW. Plant HVAC or partial HVAC? Difficult to say how many kW – very cold ambients or very hot ambients will have different demands. Finally, there will be periodic use of the prelube pump (one per engine) to circulate lubricating oil through the engine. For an W18V50DF the prelube pump motor size is approximately 30 kW. Again, it is difficult to say what the duty cycle is for these motors. All these factors combined make it rather difficult to accurately predict the standby load for a plant which is ready for dispatch.

(**) Emission guarantees with full details are provided in attached emission statement. VOC emissions here require max VOC content of fuel gas 0.5 v-%. A correction for higher VOC content is included in the emission statement.

Estimated reducing agent consumptions for one 18V50DF-D engine at full engine load:

		Gas operation	Back-up fuel operation
40 wt-% urea solution, max	l/h	70.6	370.8
	kg/h	78.3	411.4
32.5 wt-% urea solution, max	l/h	88.6	465.4
	kg/h	96.4	506.4
25 wt-% ammonia solution, max	l/h	80.6	423.4
	kg/h	71	373.3
19 wt-% ammonia solution, max	l/h	102.7	539.7
	kg/h	93.5	491.2

APPENDIX L – DESIGN FUEL BASIS

Natural gas will be delivered to site from either Columbia Golf Transmission or Tennessee Gas Pipeline. See Table 1 and Table 2, respectively.

Table 1: Columbia Golf Transmission Pipeline Gas Quality

	Units	**Guarantee Basis**	**Design Range**	
			MIN	MAX
Higher Heating Value (HHV)	Btu/lbm	1062	1045	1083
Lower Heating Value (LHV)	Btu/lbm			
Specific Gravity		0.598	0.592	0.607
Methane	%mol	92.2	90.0	93.7
Ethane	%mol	6.48	4.75	8.86
Propane	%mol	0.349	0.218	0.445
Isobutane	%mol	0.036	0.022	0.054
N-Butane	%mol	0.039	0.021	0.060
Isopentane	%mol	0.010	0.006	0.016
N-Pentane	%mol	0.005	0.003	0.011
Hexane +	%mol	0.005	0.001	0.008
Carbon Dioxide	%mol	0.548	0.226	0.905
Nitrogen	%mol	0.339	0.266	0.905
Moisture	lbs/mmcfd	0	0	7
Total Sulfur	gr/(100scf)	0	0	5

Table 2: Tennessee Gas Pipeline Gas Quality

	Units	**Guarantee Basis**	**Design Range**	
			MIN	MAX
Higher Heating Value (HHV)	Btu/lbm	1032	996	1077
Lower Heating Value (LHV)	Btu/lbm			
Specific Gravity		0.579	0.563	0.602
Methane	%mol	95.6	90.5	99.1
Ethane	%mol	3.23	0.066	8.49
Propane	%mol	0.138	0	0.418
Isobutane	%mol	0.013	0	0.847
N-Butane	%mol	0.013	0	0.078
Isopentane	%mol	0.003	0	0.028
N-Pentane	%mol	0.001	0	0.017
Hexane +	%mol	0.004	0	0.030
Carbon Dioxide	%mol	0.487	0.038	1.77
Nitrogen	%mol	0.531	0.049	2.47
Moisture	lbs/mmcfd	2.46	1.48	3.91
Total Sulfur	gr/(100scf)	0.056	0	0.063

Fuel Oil Supply Composition – Ultra Low Sulfur No. 2 Diesel (ULSD, or No. 2 MV15) in accordance with below specifications.

	Specifications		
Gravity, ºAPI (ASTM D 4052, D 287)	30 min.		
Color (ASTM D 1500, D6045)	2.5 typical[1]		
Haze Rating @ 77ºF (ASTM D 4176)	2 max.		
Flash, Pensky-Martens, ºF (ASTM D 93)	126 min.[6]		
Viscosity @ 40ºC (104ºF) cSt (ASTM D 445)	1.9 min.[5]/4.1 max.		
Sulfur, wt. ppm (ASTM D 5453, D 2622)	15		
Copper Strip Corrosion (ASTM D 130)	No. 3 max.[7]		
Ash, wt. % (ASTM D 482)	0.01 max.		
Cetane Index (ASTM D 4737-B, D 976)	40 min.		
Distillation, ºF (ASTM D 86)			
90% Recovered	540 min./640 max.		
End Point	700 max.		
Lubricity, HFRR @ 60°C, Micron (ASTM D7688)	520 max.		
Cloud Point, °F (ASTM D2500)	**Midwest**	**Southeast**	**Non-MPC Terminals**
Winter (10/1 – 2/28)	+10 max.[2]	+15 max.	See Footnote[3]
Summer (3/1 – 9/30)	_+20 max.	+20 max.	See Footnote[3]

(1)Tax exempt diesel fuel will be dyed red.
(2)Actual Cloud Point is posted at MPC equity (owned) terminals starting November 1st.
(3)Non MPC equity (owned) terminals may not post Cloud Point or meet the specifications shown above but may manage low temperature operability performance via other measures.
(4)Pour Point is typically 15 degrees lower than the Cloud Point.
(5)During the winter period of October through February, the following waiver applies when the cloud point is less than +10°F; the minimum viscosity of the fuel can be 1.7 cSt and the 90% distillation point will be waived.
(6) Marathon has a typical rack sales specification of 130 ºF minimum.
(7) Marathon Petroleum manufactured No.2 diesel typically meets a No.1B maximum rating

DISCLAIMER: Specifications refer to current revision of ASTM D975. Please consult with State regulations for applicable variances

NOTE: This product meets ASTM Specifications for D975 (Diesel Fuel) as stated above.

APPENDIX M – NOT USED

APPENDIX N – PRELIMINARY FIRE PROTECTION DESIGN BASIS AND LIFE SAFETY CONSIDERATIONS

Fire Protection and Detection System

The design basis for the fire protection systems and features are based upon the recommendations of NFPA 850, “Recommended Practice for Fire Protection for Electric Generating Plants,” NFPA 37 “Installation and Use of Stationary Combustion Engines and Gas Turbines,” NFPA 30 “Flammable and Combustible Liquids Code,” and their referenced standards. As well as the applicable Factory Mutual Datasheets. Occupancy ratings are as noted in Table 4 below.

A private fire main loop will be provided on the Liberty site and includes one electric-driven fire pump and one diesel engine-driven fire pump designed with sufficient capacity and pressure head to supply the Plant with adequate fire water per NFPA recommendations. A fire water storage tank will be provided with capacity to supply the fire water to properly account for the largest plant fire protection system demand for a minimum duration of 2 hours. The fire main system pressure will be maintained using an electric-driven pressure maintenance jockey pump located in the fire pump enclosure. Refill of the water storage tank after a fire event will be by the existing public water main, if confirmed capable of replenishing the fire water supply within 8 hours, per NFPA 850.

An addressable fire alarm and detection system will be provided for the site, in accordance with NFPA 70 and NFPA 72 “National Fire Alarm and Signaling Code”. The fire alarm system will include a main fire alarm panel in the Control Room that is networked to the various local fire alarm control/release panels serving individual site buildings and structures. The main fire alarm panel will be continuously supervised by Control Room personnel. Backup power, via dedicated batteries, will be provided for each fire alarm panel in accordance with NFPA 72 to ensure reliability and protection of the fire alarm system.

Fire resistive construction will be provided in site buildings and structures, in accordance with International Building Code (IBC) and NFPA requirements to limit the extension of possible fire scenarios and protect site property/equipment. Two-hour fire rated walls will be installed at the following locations:

- Between the Engine Hall and Electrical Room and Mechanical Room
- Between the Engine Hall and Lube Oil Area.
- Between the Mechanical Room and Electrical Room
- Between the Mechanical Room and Riser Room
- Between the Mechanical Room and Office Spaces
- Between the Battery Room and Electrical Room and Engine Hall
- Between the Office Spaces and Control Room

Standpipes and hose stations will be provided throughout the main engine hall building for manual fire fighting efforts. Fire department connections will be located at each building with a suppression system and hydrants will be located throughout the Plant yard at maximum 300ft spacing per the recommendations of NFPA 850. The private fire main will be designed and installed in accordance with NFPA 24, “Standard for the Installation of Private Fire Service Mains and Their Appurtenances” The underground fire main pipe will be high-density polyethylene (HDPE) material. This piping material is approved for private fire service mains and does not require thrust blocks, in accordance with NFPA 24.

Fire hydrants shall be protected from vehicular traffic if the potential for mechanical damage exists. The means of protection shall be arranged in a manner that does not interfere with the connection to, or operation of, the hydrants.

Post indicator sectional isolation valves will be installed in the underground portion of the system to allow for isolation of buildings, hydrants, and portions of the fire water loop, and provided with electronic tamper switches to monitor position.

Portable fire extinguishers will be provided throughout the facility, in accordance with NFPA 10.

AREA OCCUPANCY	SUPPRESSION	DETECTION	
		TYPE	ACTION
ENGINE HALL Group F-1 Occupancy (IBC)	Single-Interlock Preaction Sprinkler System FM HC-2 (Ceiling Height 30-45 ft) 0.3 gpm/ft2 over remote 2,500 ft2 per NFPA 37 (most restrictive) Portable fire extinguishers (CO2 and dry chemical) per NFPA 10	Ultra-violet / Infared detector (UV/IR) – six per five engines; sighted along either side of engine Gas level detectors – one per engine; mounted above the elevated gas skid on each engine Manual pull stations at each egress Preaction alarm pressure switch	UV/IR detector signal to FACP / preaction releasing panel. Gas level detector signal to FACP; FACP sends signal to Wartsila PLC, if two alarms are detected during engine operation or one detector alarming with no engines in operation; fuel shut-off valve for plant closes Manual pull station signal to FACP Combination fire alarm horn /strobe; signal from FACP (Note 1)
LUBE OIL TANK AREA Group H-3 Occupancy (IBC)	Single-Interlock Preaction Sprinkler System 0.3 gpm/ft^2 over 3,600 ft^2 per FM DS 3-36, HC-3 (Ceiling Height 30-45 ft) Portable fire extinguishers (Dry chemical) per NFPA 10	Ultra-violet / Infared detector (UV/IR) Manual pull stations at each egress Preaction alarm pressure switch	UV/IR detector signal to FACP / preaction releasing panel. Manual pull station signal to FACP Combination fire alarm horn /strobe; signal from FACP (Note 1)
ADMIN / CONTROL ROOMS Group B (IBC)	Wet Pipe Sprinkler System 0.10 gpm/ft^2 over remote 1,500 ft^2 per FM DS 5-32, HC-1 (Ceiling Height < 30 ft) Clean Agent Suppression System in Control Room Portable fire extinguishers (Dry chemical) per NFPA 10	Photoelectric smoke / heat detectors in control room Manual pull stations at each egress Alarm flow switch	Smoke / heat detection and manual pull station signal to FACP / clean agent releasing panel. Combination fire alarm horn /strobe; signal from FACP

AREA OCCUPANCY	SUPPRESSION	DETECTION	
		TYPE	ACTION
ELECTRICAL ROOM Group F-2 Occupancy (IBC)	Single-Interlock Preaction Sprinkler System 0.2 gpm/ft^2 over remote 2,500 ft^2, per FM DS 3-26, HC-2 (Ceiling Height 30-45 ft) Portable fire extinguishers; CO_2 (Note 2)	Photoelectric smoke detectors Manual pull stations at each egress Preaction alarm pressure switch	Smoke detector signal to FACP / preaction releasing panel. Combination fire alarm horn/strobe; signal from FACP
MV SWITCHGEAR ENCLOSURE Group F-2 Occupancy (IBC)	Portable fire extinguishers; CO_2 (Note 2)	Photoelectric smoke detectors Manual pull stations at each egress	Smoke detector and manual pull stations signal to FACP Combination fire alarm horn/strobe; signal from FACP
BATTERY ROOM Group F-2 Occupancy (IBC) (assumed lead-acid)	Single-Interlock Preaction Sprinkler System 0.2 gpm/ft^2 over remote 2,500 ft^2, per FM DS 3-26, HC-2 (Ceiling Height 30-45 ft) Portable fire extinguishers; CO_2 (Note 2)	Photoelectric smoke detectors Manual pull stations at each egress Hydrogen detection	Smoke detector, hydrogen detector and manual pull stations signal to FACP Fire alarm strobe; signal from FACP
MECHANICAL ROOM Group F-1 Occupancy (IBC)	Single-Interlock Preaction Sprinkler System 0.3 gpm/ft^2 over remote 2,500 ft^2, per NFPA 37 (most restrictive) Portable fire extinguishers (CO2 and dry chemical) per NFPA 10	Ultra-violet / Infared detector (UV/IR) Manual pull stations at each egress Preaction alarm pressure switch	UV/IR detector signal to FACP / preaction releasing panel. Alarm pressure switch and manual pull station signal to FACP Combination fire alarm horn /strobe; signal from FACP (Note 1)
WAREHOUSE Group S-2 Occupancy (IBC)	Dry Pipe Sprinkler System 20 sprinklers, K11.2 @ 16 psi (Ceiling Height <25 ft) per FM DS 8-9 Table 2. Portable fire extinguishers (Dry chemical) per NFPA 10	Alarm pressure switch Manual pull stations at each egress	Alarm pressure switch and manual pull stations signal to FACP Combination fire alarm horn/strobe; signal from FACP

AREA OCCUPANCY	SUPPRESSION	DETECTION	
		TYPE	ACTION
FIRE PUMP ENCLOSURE	Wet Pipe Sprinkler System EH2 0.4 gpm/ft^2 over enclosure area, per NFPA 13 Portable fire extinguishers (Dry chemical) per NFPA 10	Water flow switch Manual pull stations at each egress	Water flow switch and manual pull stations signal to FACP Combination fire alarm horn/strobe; signal from FACP
TRANSFORMERS	Containment and fire walls between transformers and buildings as needed, per NFPA 850	N/A	N/A
YARD AREA; BUILDING EXTERIOR	Looped underground fire main around perimeter of facility Sectional isolation valves to minimize number of systems and fire hydrants unavailable at any given time. Hydrants spaced no more than 300' apart; located to allow access to all areas of the yard, curb isolation valves to be provided for each hydrant. Fire department connections to be provided for each structure suppression system.	Tamper switches provided at Post-Indicator Valves	Supervisory Signal to FACP

NOTES:	
1	Engine hall, tank enclosure, and mechanical room will have a high output combination fire alarm / strobes; located to be visible from all areas within the buildings. Alarm / strobe will represent a detection or manual actuation.
2	(1) 20 LB CO_2 extinguisher, UL-rated 10-B:C per ten switchgear cubicles in the switchgear rooms, or (1) 20 LB dry chemical extinguisher, UL-rated 4-A:40:B:C

APPENDIX O – NOT USED

APPENDIX P – RISK MATRIX

LIBERTY RICE - PROJECT RISK REGISTER - LEVEL 1 IDENTIFICATION

East Kentucky Power Cooperative

Risk ID No. (NNN)	Key Project Risk Factors (Circumstances) ("because of")	Is Risk Controlled or Uncontrolled?	Party in Control of Risk Event	What Category of Risk Event?	Likely Risk Events due to Risk Factors	Risk Event Details ("What Can Go Wrong?)	Anticipated Impacts of Risk Event ("Enter Y for YES Enter N for No Impact")								Impact Details ("Consequences")	Planned Mitigation Activities
							Health / Safety	Environmental	Quality	Performance	Claims / Litigation	Reputation	Schedule / Time	Cost / Finances ($		
001	Late Delivery of RICE Equipment	Controlled	_3rd Party_Client	SCHEDULE RELATED	Change start/completion date	Due to logistic and manufacturing reasons, equipment delivered late may push the schedule by the length of the delay.	N	N	N	N	Y	Y	Y	Y	Miss the Client's COD date. Results in costs to Client for not being able to provide power to grid.	Help Client pick the right supplier who can meet schedule. Allow OEM to proceed with engineering on LNTP. Involve Expediter throughout project timeline of manufacturing. Add time for shop inspections of all Equipment and Materials. Award contracts as early as possible, after RUS approval. Include contract clause for late delivery.
002	Late Delivery of Switchgears and MCCs	Controlled	_3rd Party_Client	SCHEDULE RELATED	Change start/completion date	Due to logistics reasons, equipment delivered late pushing the schedule potentially up to 4 months to complete electrical construction	N	N	N	N	Y	Y	Y	Y	Miss the Client's COD date. Results in costs to Client for not being able to provide power to grid.	Help Client pick the right supplier who can meet schedule. Involve Expediter throughout project timeline of manufacturing. Add time for shop inspections of all Equipment and Materials. Award contracts as early as possible, after RUS approval.
003	Acoustic/Sound results exceed expected values	Controlled	_3rd Party_Client	PERFORMANCE RELATED	Design misjudgment, miscalculation, misinterpretation or oversight	Sound levels exceed predicted values	N	Y	N	N	Y	Y	Y	Y	Additional sound mitigation activities are required to be purchased and installed	Understand existing sound margin. Purchase low noise options when available.
004	Late Delivery of GSU Equipment.	Controlled	_3rd Party_Client	SCHEDULE RELATED	Change start/completion date	Due to logistics reasons or manufacturing the GSU delivered late	N	N	N	N	Y	Y	Y	Y	Miss the Client's COD date. Results in costs to Client for not being able to provide power to grid.	Help Client pick the right supplier who can meet schedule. Involve Expediter throughout project timeline of manufacturing. Add time for shop inspections of all Equipment and Materials.
005	Labor shortages due to other more attractive projects	Controlled	BMCD	SCHEDULE RELATED	Underestimate time required to perform work	Other Projects In The Area Make Labor Harder to Attract	Y	N	Y	Y	Y	Y	Y	Y	Falling Behind Schedule. Increased Cost.	Perform a Labor Study in the area.
006	Late Award / Material Availability for Buildings	Controlled	Client	SCHEDULE RELATED	Deliver goods/work product after due date	Overall construction, equipment delivery, and building construction are late	N	N	N	Y	Y	Y	Y	Y	Large Cost to increase staff, work overtime or put on 2nd shift. Delay Equipment installation and services. Potential to miss Client's COD.	Get design and procurement completed early in project to support undergrounds, foundations and building erection prior to winter months.
007	RUS approval delayed	Uncontrolled	Regulatory Authority	SCHEDULE RELATED	Suspend/stop work	RUS approval takes longer than anticipated	N	N	N	Y	Y	Y	Y	Y	Failure to meet Client's COD date. Results in cost to Client for not being able to produce power. Delay to detailed design, award of equipment contracts (may require increased cost or different payment terms to makeup schedule)	Current project schedule assumes 31 months to approval after submitting application March 2025, which should be conservative for an EA.
008	PSC delays or intervieners	Uncontrolled	Regulatory Authority	SCHEDULE RELATED	Suspend/stop work	Approval process takes longer than anticipated or separate party intervenes	N	N	N	Y	Y	Y	Y	Y	Failure to meet Client's COD date due to delayed start date. Results in cost to Client for not being able to produce power.	BMcD is supporting PSC process for submittal in October. Typical turnaround timeframe is 9 months based on EKPC experience. There are several months of margin between approval and project expenditures.
009	Executing A Project In An Enviornment of Inflation / Supply Chain Challenges	Uncontrolled	Uncontrolled	PRICING/FINANCIALS	Commodity/goods price increase	Due to supply chain issues, vendors might increase prices outside normal increase schedule	N	N	N	N	N	N	N	Y	Project goes over budget	Buy out as much as possible early in project. Manage as conditions change, look at other suppliers/methods to purchase equipment/commodities early, piece meal contracts to separate out problematic items. Include Allowances for Field Service Time or perceived scope changes to mitigate costs.
010	Scope item not captured in PSR scope	Controlled	BMCD	PRICING/FINANCIALS	Underbid project	Scope change or additional scope required	N	N	Y	Y	Y	Y	Y	Y	Cost increase to project and potential schedule delays.	Define as much scope as possible in PSR and carry adequate contingency to cover realistic future scope changes/misses.
011	We have witnessed a shortage or delivery delays wire, conduit, and products in past projects.	Controlled	BMCD	SCHEDULE RELATED	Change project sequence	Award materials too late	Y	N	Y	Y	Y	Y	Y	Y	Electrical Construction Falls Behind Schedule. Additonal Manpower Required LDs or additional TEA cost	Identify the long lead time materials during the design phase and buy them out prior to the award of the electrical consturction contract.
012	Can't staff site / recurring site shutdowns due to Force Majeure event	Controlled	BMCD	ENVIRONMENTAL EVENTS	Force Majeure	Direct or Indirect COVID exposure	Y	N	Y	Y	Y	Y	Y	Y	Reduced resources throughout schedule	
013	Unable to widen entrance road in time for construction activities.	Uncontrolled	BMCD	SCHEDULE RELATED	Underestimate time required to perform work	Unable to complete entrance road construction in time for equipment deliveries.	N	N	Y	N	Y	Y	Y	Y	Delays delivery of major equipment.	Incorporate multiple entrance roads for laydowns and equipment delivery to allow delivery before overall completion. Begin development for road widening after project approval.
014	Housing Availibilty	Uncontrolled	BMCD	PERFORMANCE RELATED	Interfere with activities of others	No availibility of housing for staff and craft	N	N	N	N	N	N	Y	Y	Reduces resources throughout schedule.	Incorporate per diem to attract labor in more difficult housing situations.

LIBERTY RICE - PROJECT RISK REGISTER - LEVEL 1 IDENTIFICATION

East Kentucky Power Cooperative

Risk ID No. (NNN)	Key Project Risk Factors (Circumstances) ("because of")	Is Risk Controlled or Uncontrolled?	Party in Control of Risk Event	What Category of Risk Event?	Likely Risk Events due to Risk Factors	Risk Event Details ("What Can Go Wrong?)	Anticipated Impacts of Risk Event ("Enter Y for YES Enter N for No Impact") Health / Safety	Environmental	Quality	Performance	Claims / Litigation	Reputation	Schedule / Time	Cost / Finances ($	Impact Details ("Consequences")	Planned Mitigation Activities
015	Gas line and M&R station delayed	Controlled	_3rd Party_Client	SCHEDULE RELATED	Change project sequence	Gas line and M&R yard installed later than anticipated	N	N	N	Y	Y	N	Y	Y	Delays startup resulting in failure to meet Client's COD date and/or impacts productivity of project contractors based on site access availability.	Coordinate with gas line supplier. Schedule currently includes 3 years of margin between scheduled gas available date and gas need date for project.
016	Transmission upgrade projects delayed	Controlled	_3rd Party_Client	SCHEDULE RELATED	Change start/completion date	Additional transmission upgrade projects completed later than anticipated	N	N	Y	Y	Y	N	Y	Y	Plant unable to export power to grid by Client's COD date.	EKPC to coordinate with contractors and equipment suppliers for transmission upgrades to maintain schedule margin at the front end.
017	CTG TFA hour (overruns)	Controlled	Client	SCHEDULE RELATED	Change start/completion date	Failure to achieve owner COD date	N	N	N	Y	Y	N	Y	Y	Increased TFA cost or schedule LD's	Bid TFA durations based on similar projects. Review schedule with owner equipment suppliers early to get full buy in.
018	Final geotech investigation finds more karst or other challenges	Controlled	BMCD	PRICING/FINANCIALS	Underbid project	Project needs to account for deep foundations (not currently considered) or extensive karst remediation for foundations.	N	N	N	Y	Y	Y	Y	Y	Increased engineering scope, increased cost.	Release geotech investigation early in project. Conservative foundation quantities if desig nneeds to increase. Incorporate piling into construction schedule whether or not it is needed.
019	OEM scope gap	Controlled	BMCD	PRICING/FINANCIALS	Underbid project	Required Equipment Is Not Delivered For Construction	Y	N	Y	N	Y	Y	Y	Y	Schedule Pushes Project Cost Impacts Miss the Client's COD date. Results in costs to Client for not being able to provide power to grid	Align scopes between OEM scope and BOP scope. BMcD involved in OEM Contract Negotiations and Developing the Division of Responsibility Matrix.
020	Delayed owner approval of engineering deliverables	Controlled	Client	SCHEDULE RELATED	Decide/deliver decision after due date	Rework after approvals/release	N	N	Y	Y	Y	Y	Y	Y	Schedule pushes	Provide adequate time for owner review, setup meetings to drive faster review/discussion
021	Value engineering / estimate reduction studies in parallel with detail design	Controlled	Client	SCHEDULE RELATED	Decide/deliver decision after due date	Need to evaluate many items for cost reduction opportunities	N	N	N	N	N	N	Y	Y	Engineering is delayed/late due to increased scope	PSR process has worked through a lot of options already. Manage cost reduction expectations.
022	Delayed air permit finalization	Uncontrolled	Regulatory Authority	SCHEDULE RELATED	Suspend/stop work	Permit process and approval takes longer than anticipated	N	N	N	Y	Y	Y	Y	Y	Cannot set emissions producing equipment without air permit.	Permit anticipated to be complete 2 months prior to mobilization. EKPC will get extension from state to allow for construction after 18 months.
023	FM Global involvement / requirements not well defined	Controlled	Client	SCHEDULE RELATED	Change project scope	additional technical requirements and FM Global involvement	Y	N	N	Y	Y	Y	Y	Y	additional design & review requirements that could impact engineering schedule, and material/const costs	Proactive request to clarify FM Global requirements prior to detailed engineering.
024	Environmental impact due to release of chemical/waste	Controlled	Client	ENVIRONMENTAL EVENTS	Unplanned discharge of hazardous materials	Unexpected discharge of hazardous material	Y	Y	N	Y	Y	Y	Y	Y	Potential delay to schedule and hold on construction, increased costs for cleanup/remediation and for adjusted schedule	Develop detailed plan for handling of hazardous material and minimize interaction with existing materials/plant from new project.
025	Escalation for equipment, materials, and labor	Uncontrolled	Uncontrolled	PRICING/FINANCIALS	Price escalation	Costs for labor, equipment, and material escalates more than projected/anticipated based on current indices.	N	N	N	N	Y	Y	Y	Y	Cost increase due to higher costs for labor, material, and/or equipment. Client needs to go back to Board for increased project funding.	Carrying reasonable allowance in cost estimate for escalation. Communicate changes in escalation as they are discovered. PSR cost estimate includes 4 to 5% escalation per annum for labor, equipment and materials through execution, assuming project starts today.
026	Design changes for major equipment after award	Controlled	_3rd Party_Client	PERFORMANCE RELATED	Interfere with activities of others	OEM changes design or scope of supply after award.	N	N	Y	Y	Y	Y	Y	Y	Adjust project schedule which may impact Client's COD date. May also result in increased cost for Equipment contract and contractor contracts.	Coordinate with OEMs prior to and shortly after award that scope and design are well understood by all parties.
027	Replacement / repair of equipment required after installation	Controlled	_3rd Party_Client	SCHEDULE RELATED	Deliver goods/work product after due date	Equipment requires repairs or replacement after installation	N	N	N	Y	Y	Y	Y	Y	Potential delay to schedule to wait on repair/replacement, if critical equipment, which could result in missing Client's COD date. Cost increase for prolonged contractor onsite if issue not caused by OEM	Include adequate coverage in equipment contracts to cover expenses and delays caused by equipment issues.

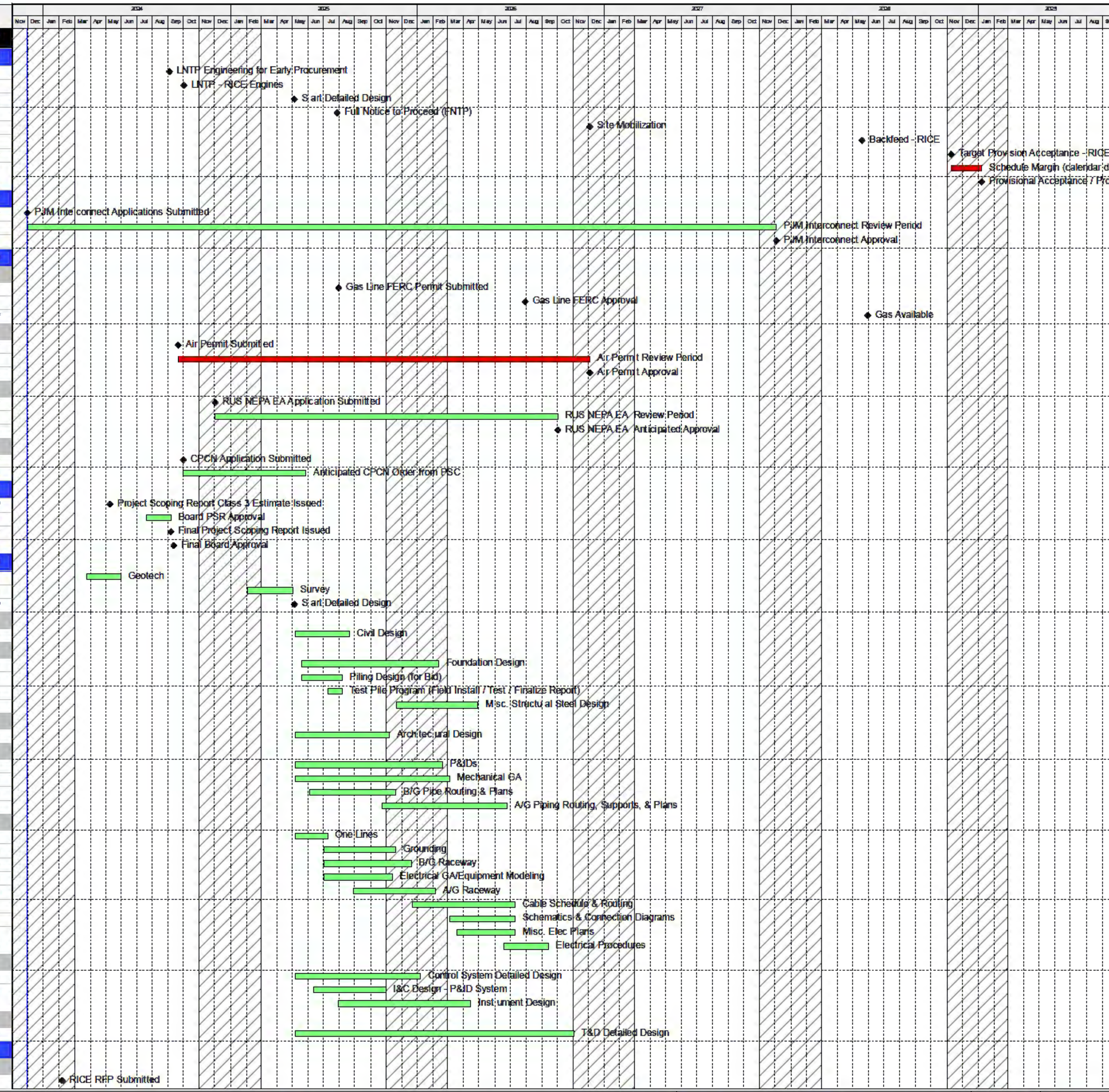
LIBERTY RICE - PROJECT RISK REGISTER - LEVEL 1 IDENTIFICATION

East Kentucky Power Cooperative

Risk ID No. (NNN)	Key Project Risk Factors (Circumstances) ("because of")	Is Risk Controlled or Uncontrolled?	Party in Control of Risk Event	What Category of Risk Event?	Likely Risk Events due to Risk Factors	Risk Event Details ("What Can Go Wrong?)	Anticipated Impacts of Risk Event ("Enter Y for YES Enter N for No Impact") Health / Safety	Environmental	Quality	Performance	Claims / Litigation	Reputation	Schedule / Time	Cost / Finances ($	Impact Details ("Consequences")	Planned Mitigation Activities
028	Controls Integration	Controlled	BMCD	PERFORMANCE RELATED	Execute less efficiently than planned (poor productivity)	Delay in programming efforts, FATs, and/or startup and commissioning	N	N	Y	Y	Y	Y	Y	Y	Delays completion of construction and startup/commissioning resulting in failure to meet Client's COD date and/or increases costs.	
029	RICE supplier need longer to help set/commission equipment	Controlled	_3rd Party_Client	SCHEDULE RELATED	Underestimate time required to perform work	Cannot meet owner COD dates with the allocated TFA time.	N	N	Y	Y	Y	Y	Y	Y	Schedule pushes due to longer set/commissioning schedule and additional TFA time financial impact.	Give Suppliers schedule before contract award so they understand and agree to planned duration onsite. True up the TFA time against the Level 3 Schedule once it is complete. This includes budgeting CMCI / Craft Support for 7 days a week
030	Care, Custody, Control - Handoff of Materials delivered in boxes but not being opened until later date for Client provided Equipment	Controlled	Client	PRICING/FINANCIALS	Don't properly pay/withhold invoice	Material is not delivered as expected but is not discovered until shipments are opened upon needing to be used, not upon delivery	N	N	Y	Y	Y	Y	Y	Y	Increased cost to procure/expedite missing material and to cover cost of extended time onsite for contractors/staff	Open and inventory OEM Equipment under OEM supervision. Open boxes early enough that if materials aren't delivered that we can react accordingly to maintain schedule
031	Care, Custody, Control - Handoff of Materials delivered in boxes but not being opened until later date for Client provided Equipment	Controlled	Client	SCHEDULE RELATED	Deliver goods/work product after due date	Material is not delivered as expected but is not discovered until shipments are opened upon needing to be used, not upon delivery	N	N	Y	Y	Y	Y	Y	Y	Delay in schedule to wait for needed material to be provided.	Open and inventory OEM Equipment under OEM supervision. Open boxes early enough that if materials aren't delivered that we can react accordingly to maintain schedule
032	Additional underground utilities require demolition or work-around	Controlled	Client	PERFORMANCE RELATED	Interfere with activities of others	Unanticipated utilities exist that need to be demo'd or avoided	Y	Y	Y	Y	Y	Y	Y	Y	Delay in schedule to complete additional work and increased cost for unanticipated work	Review all available underground utility drawings to confirm all have been accounted for in detailed design. Complete potholing as needed.
033	Shop Inspections	Controlled	BMCD	PERFORMANCE RELATED	Interfere with activities of others	Make suppliers be prepared for inspections to determine Equipment at shops and quality prior to shipment.	N	N	Y	Y	Y	Y	Y	Y	Cost and schedule impact to release of material later than planned. Aggravation to team for traveling to facilities when supplier is not ready for inspection	Defined plan for shop inspections and visits along with expected progress. Video inspection to verify proper progress prior to travel. Factor in rework for inspection findings.
034	Force Majeure weather delay	Uncontrolled	Uncontrolled	ENVIRONMENTAL EVENTS	Inclement Weather	Weather event interrupts work progress or damages equipment/material	Y	Y	Y	Y	Y	Y	Y	Y	schedule delay that could result in misisng the Client's COD date. Results in costs to Client for not being able to provide power to grid.	Include schedule margin (PSR includes 3 months of schedule margin)
035	Payment schedule of equipment and construction contracts	Controlled	Client	PRICING/FINANCIALS	Don't properly pay/withhold invoice	Equipment or Contractor payment schedule and terms are different than expected or different than typical	N	N	N	Y	Y	Y	Y	Y	May impact cashflow for project and ability to have net funds for invoices.	Confirm each contract payment terms align with EKPC and RUS requirements prior to award. Consider any contingency that should be included in PSR budget cost for additional cost needed to get supplier to accommodate payment terms.
036	Craft productivity and re-work	Controlled	_3rd Party_Client	PERFORMANCE RELATED	Execute less efficiently than planned (poor productivity)	Labor productivity worse than assumed or contractor requires re-work	N	N	Y	Y	Y	Y	Y	Y	Increased costs and potential schedule delays	Utilizing sub-contractors with knowledge of the local area and labor market and scope. Sub-contractors have indicated quality local labor available based on prevoius project history and budgetary bid process.
037	Specifications	Controlled	BMCD	CONTRACTING	Deliver goods/work product after due date	Engineered / Specified Equipments Cannot Be Purchased.	Y	N	Y	N	Y	Y	Y	Y	Schedule Delays / Cost Delays	Detailed welcome to site packet. Work packaging meeting on site. Overcommunication... If you see something, say something.
038	Storm Water Plan Phasing	Controlled	BMCD	SCHEDULE RELATED	Underbid project	Work is delayed due to wet/muddy conditions / standing water	Y	N	Y	N	Y	Y	Y	Y	Schedule / Cost impacts	Develop a plan for each phase of the project.
039	Incomplete Deliveries	Controlled	BMCD	SCHEDULE RELATED	Deliver goods/work product after due date	We are unable to complete work on schedule because vendor components are not complete.	Y	N	Y	N	Y	Y	Y	Y	Schedule / Cost impacts	Develop and follow the material management plan and complete proper expiditing.
040	Safety incident, standdown, investigation, etc.	Uncontrolled	_3rd Party_Client	SCHEDULE RELATED	Change project sequence	Delay construction	Y	N	N	Y	Y	Y	Y	Y	Schedule / Cost impacts	Use contractors with good safety records and understanding of project scope. Safety oversight throughout project.
041	Theft	Controlled	BMCD	SCHEDULE RELATED	Deliver goods/work product after due date	Theft of equipment or material prevents work from being complete on schedule	Y	N	Y	N	Y	Y	Y	Y	Schedule / Cost impacts	Add an allowance to deal with stolen equipment?

APPENDIX Q – PROJECT SCHEDULE

Activity ID	Activity Name	RD	Start	Finish
EKPC Generation Options - 12x18MW RICE - L2		1294	30-Nov-23	08-Jan-29
Milestones		1103	03-Sep-24	08-Jan-29
MS-1010	LNTP Engineering for Early Procurement	0	03-Sep-24*	
MS-1000	LNTP - RICE Engines	0		01-Oct-24*
EN-G-1020	Start Detailed Design	0		05-May-25
MS-1020	Full Notice to Proceed (FNTP)	0	28-Jul-25*	
MS-1030	Site Mobilization	0	04-Dec-26	
C1290	Backfeed - RICE	0	19-May-28	
MS-1040	Target Provision Acceptance - RICE	0		09-Nov-28*
MS-1050	Schedule Margin (calendar days)	58	10-Nov-28	08-Jan-29
MS-1060	Provisional Acceptance / Proposed COD	0		08-Jan-29
PJM Interconnect		1018	30-Nov-23	03-Dec-27
A2060	PJM Interconnect Applications Submitted	0		30-Nov-23*
A2070	PJM Interconnect Review Period	1018	01-Dec-23	03-Dec-27
A2080	PJM Interconnect Approval	0		03-Dec-27
Permitting		1349	20-Sep-24	31-May-28
Gas Line Permitting		1035	31-Jul-25	31-May-28
A1980	Gas Line FERC Permit Submitted	0		31-Jul-25*
A1990	Gas Line FERC Approval	0		31-Jul-26*
A1840	Gas Available	0		31-May-28*
Air Permitting		805	20-Sep-24	03-Dec-26
A6820	Air Permit Submitted	0		20-Sep-24*
A6830	Air Permit Review Period	805	20-Sep-24	03-Dec-26
A6840	Air Permit Approval	0		03-Dec-26
RUS NEPA EA		671	01-Dec-24	02-Oct-26
A6850	RUS NEPA EA Application Submitted	0		01-Dec-24*
A6860	RUS NEPA EA Review Period	671	01-Dec-24	02-Oct-26
A6870	RUS NEPA EA Anticipated Approval	0		02-Oct-26
CPCN		240	30-Sep-24	27-May-25
A6880	CPCN Application Submitted	0		30-Sep-24*
A6890	Anticipated CPCN Order from PSC	240	30-Sep-24	27-May-25
Project Scoping		126	09-May-24	11-Sep-24
A6900	Project Scoping Report Class 3 Estimate Issued	0		09-May-24*
A6920	Board PSR Approval	49	20-Jul-24	06-Sep-24
A6910	Final Project Scoping Report Issued	0		06-Sep-24*
A6930	Final Board Approval	0		11-Sep-24
Engineering		664	25-Mar-24	02-Nov-26
EN-G-1030	Geotech	49	25-Mar-24*	31-May-24
EN-G-1010	Survey	65	03-Feb-25*	02-May-25
EN-G-1000	Start Detailed Design	0		05-May-25*
Civil		75	06-May-25	20-Aug-25
EN-C-1200	Civil Design	75	06-May-25	20-Aug-25
Structural/Geotech		240	20-May-25	29-Apr-26
EN-S-1210	Foundation Design	185	20-May-25	11-Feb-26
EN-S-1230	Piling Design (for Bid)	55	20-May-25	06-Aug-25
EN-S-1240	Test Pile Program (Field Install / Test / Finalize Report)	20	10-Jul-25	06-Aug-25
EN-S-1220	Misc. Structural Steel Design	110	21-Nov-25	29-Apr-26
Architectural		130	06-May-25	06-Nov-25
EN-A-1230	Architectural Design	130	06-May-25	06-Nov-25
Mechanical & Process		290	06-May-25	25-Jun-26
EN-M-1250	P&IDs	200	06-May-25	18-Feb-26
EN-M-1240	Mechanical GA	210	06-May-25	04-Mar-26
EN-M-1270	B/G Pipe Routing & Plans	120	04-Jun-25	20-Nov-25
EN-M-1260	A/G Piping Routing, Supports, & Plans	170	24-Oct-25	25-Jun-26
Electrical		345	06-May-25	14-Sep-26
EN-E-1390	One Lines	45	06-May-25	09-Jul-25
EN-E-1300	Grounding	100	02-Jul-25	20-Nov-25
EN-E-1290	B/G Raceway	120	02-Jul-25	19-Dec-25
EN-E-1280	Electrical GA/Equipment Modeling	95	02-Jul-25	13-Nov-25
EN-E-1310	A/G Raceway	110	28-Aug-25	04-Feb-26
EN-E-1320	Cable Schedule & Routing	140	22-Dec-25	10-Jul-26
EN-E-1330	Schematics & Connection Diagrams	90	05-Mar-26	10-Jul-26
EN-E-1340	Misc. Elec Plans	80	19-Mar-26	10-Jul-26
EN-E-1350	Electrical Procedures	58	19-Jun-26	14-Sep-26
I&C		240	06-May-25	15-Apr-26
EN-N-1360	Control System Detailed Design	170	06-May-25	07-Jan-26
EN-N-1370	I&C Design - P&ID System	100	11-Jun-25	30-Oct-25
EN-N-1380	Instrument Design	180	31-Jul-25	15-Apr-26
T&D		380	06-May-25	02-Nov-26
EN-E-1400	T&D Detailed Design	380	06-May-25	02-Nov-26
Procurement		1132	05-Feb-24	19-Jul-28
RICE		650	05-Feb-24	25-Aug-26
PR-1150-000	RICE RFP Submitted	0		05-Feb-24*



Start Date	30-Nov-23
Finish Date	08-Jan-29
Data Date	30-Nov-23
Run Date	05-Sep-24

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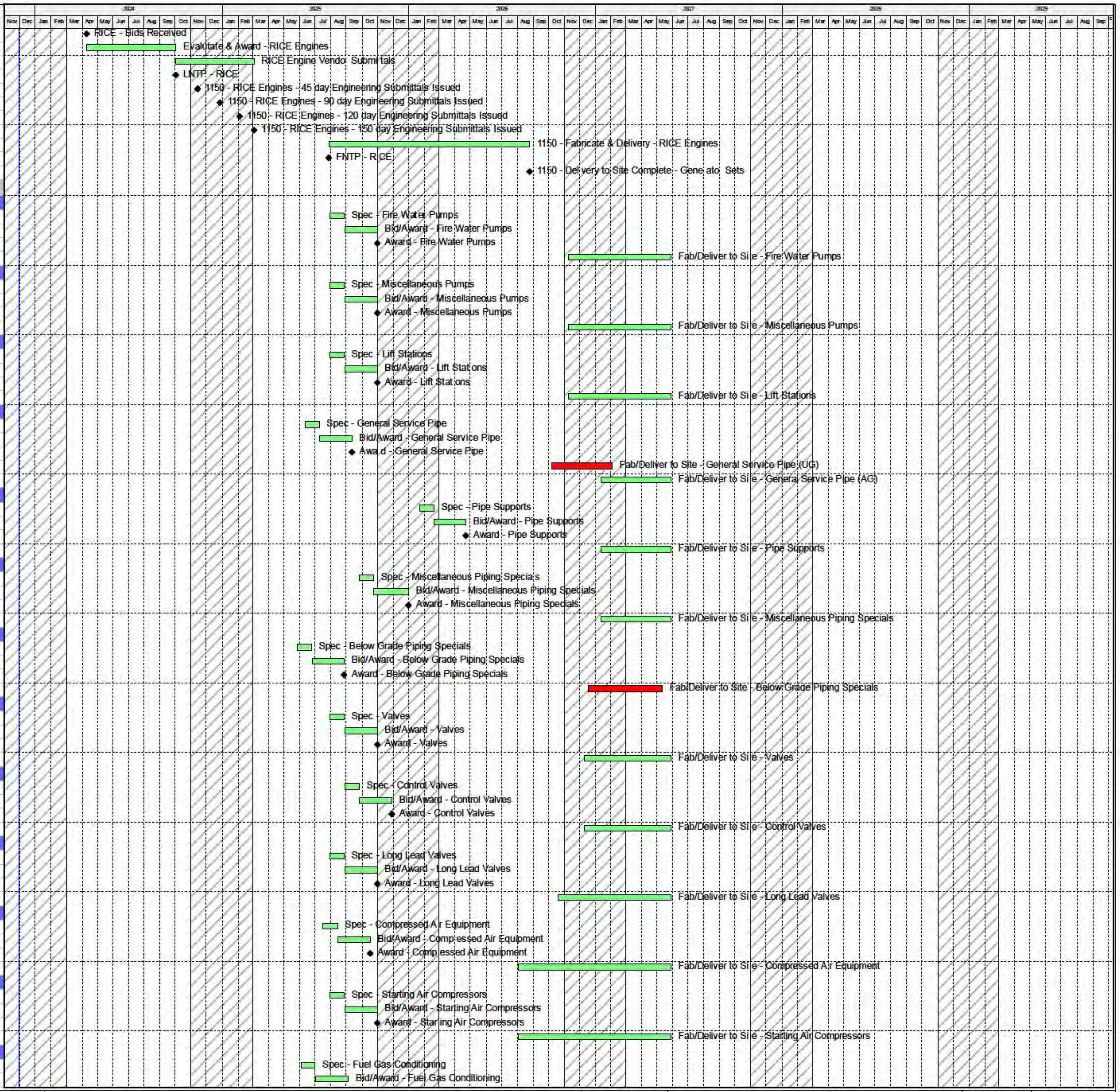
EKPC Generation Options - 12x18MW RICE - L2

Project Schedule

Date	Revision	Checked	Approved

Activity ID	Activity Name	RD	Start	Finish
PR-1150-100	RICE - Bids Received	0		09-Apr-24*
PR-1150-110	Evalutate & Award - RICE Engines	122	10-Apr-24	01-Oct-24
PR-1150-130	RICE Engine Vendor Submittals	105	02-Oct-24	03-Mar-25
PR-1150-120	LNTP - RICE	0	02-Oct-24	
PR-1150-140	1150 - RICE Engines - 45 day Engineering Submittals Issued	0		12-Nov-24
PR-1150-150	1150 - RICE Engines - 90 day Engineering Submittals Issued	0		27-Dec-24
PR-1150-160	1150 - RICE Engines - 120 day Engineering Submittals Issued	0		03-Feb-25
PR-1150-220	1150 - RICE Engines - 150 day Engineering Submittals Issued	0		03-Mar-25
PR-1150-200	1150 - Fabricate & Delivery - RICE Engines	275	28-Jul-25	25-Aug-26
PR-1150-190	FNTP - RICE	0	28-Jul-25	
PR-1150-210	1150 - Delivery to Site Complete - Generator Sets	0		25-Aug-26
Equipment Contracts		853	26-Sep-24	08-Feb-28
2150 - Fire Water Pumps		465	31-Jul-25	28-May-27
PR-2150-000	Spec - Fire Water Pumps	20	31-Jul-25	27-Aug-25
PR-2150-100	Bid/Award - Fire Water Pumps	45	28-Aug-25	30-Oct-25
PR-2150-200	Award - Fire Water Pumps	0		30-Oct-25
PR-2150-300	Fab/Deliver to Site - Fire Water Pumps	140	10-Nov-26	28-May-27
2190 - Miscellaneous Pumps		465	31-Jul-25	28-May-27
PR-2190-000	Spec - Miscellaneous Pumps	20	31-Jul-25	27-Aug-25
PR-2190-100	Bid/Award - Miscellaneous Pumps	45	28-Aug-25	30-Oct-25
PR-2190-200	Award - Miscellaneous Pumps	0		30-Oct-25
PR-2190-300	Fab/Deliver to Site - Miscellaneous Pumps	140	10-Nov-26	28-May-27
2191 - Lift Stations		465	31-Jul-25	28-May-27
PR-2191-000	Spec - Lift Stations	20	31-Jul-25	27-Aug-25
PR-2191-100	Bid/Award - Lift Stations	45	28-Aug-25	30-Oct-25
PR-2191-200	Award - Lift Stations	0		30-Oct-25
PR-2191-300	Fab/Deliver to Site - Lift Stations	140	10-Nov-26	28-May-27
2320 - General Service Pipe		500	11-Jun-25	28-May-27
PR-2320-000	Spec - General Service Pipe	20	11-Jun-25	09-Jul-25
PR-2320-100	Bid/Award - General Service Pipe	45	10-Jul-25	11-Sep-25
PR-2320-200	Award - General Service Pipe	0		11-Sep-25
PR-2320-300	Fab/Deliver to Site - General Service Pipe (UG)	80	08-Oct-26	02-Feb-27
PR-2320-310	Fab/Deliver to Site - General Service Pipe (AG)	100	11-Jan-27	28-May-27
2340 - Pipe Supports		345	22-Jan-26	28-May-27
PR-2340-000	Spec - Pipe Supports	20	22-Jan-26	18-Feb-26
PR-2340-100	Bid/Award - Pipe Supports	45	19-Feb-26	22-Apr-26
PR-2340-200	Award - Pipe Supports	0		22-Apr-26
PR-2340-300	Fab/Deliver to Site - Pipe Supports	100	11-Jan-27	28-May-27
2490 - Miscellaneous Pipe Specials		425	26-Sep-25	28-May-27
PR-2490-000	Spec - Miscellaneous Piping Specials	20	26-Sep-25	23-Oct-25
PR-2490-100	Bid/Award - Miscellaneous Piping Specials	45	24-Oct-25	30-Dec-25
PR-2490-200	Award - Miscellaneous Piping Specials	0		30-Dec-25
PR-2490-300	Fab/Deliver to Site - Miscellaneous Piping Specials	100	11-Jan-27	28-May-27
2491 - Below Grade Piping Specials		497	28-May-25	11-May-27
PR-2491-000	Spec - Below Grade Piping Specials	20	28-May-25	24-Jun-25
PR-2491-100	Bid/Award - Below Grade Piping Specials	45	25-Jun-25	27-Aug-25
PR-2491-200	Award - Below Grade Piping Specials	0		27-Aug-25
PR-2491-300	Fab/Deliver to Site - Below Grade Piping Specials	100	18-Dec-26	11-May-27
2520 - Valves		465	31-Jul-25	28-May-27
PR-2520-000	Spec - Valves	20	31-Jul-25	27-Aug-25
PR-2520-100	Bid/Award - Valves	45	28-Aug-25	30-Oct-25
PR-2520-200	Award - Valves	0		30-Oct-25
PR-2520-300	Fab/Deliver to Site - Valves	120	09-Dec-26	28-May-27
2530 - Control Valves		445	28-Aug-25	28-May-27
PR-2530-000	Spec - Control Valves	20	28-Aug-25	25-Sep-25
PR-2530-100	Bid/Award - Control Valves	45	26-Sep-25	28-Nov-25
PR-2530-200	Award - Control Valves	0		28-Nov-25
PR-2530-300	Fab/Deliver to Site - Control Valves	120	09-Dec-26	28-May-27
2570 - Long Lead Valves		465	31-Jul-25	28-May-27
PR-2570-000	Spec - Long Lead Valves	20	31-Jul-25	27-Aug-25
PR-2570-100	Bid/Award - Long Lead Valves	45	28-Aug-25	30-Oct-25
PR-2570-200	Award - Long Lead Valves	0		30-Oct-25
PR-2570-300	Fab/Deliver to Site - Long Lead Valves	155	20-Oct-26	28-May-27
2710 - Compressed Air Equipment		475	17-Jul-25	28-May-27
PR-2710-000	Spec - Compressed Air Equipment	20	17-Jul-25	13-Aug-25
PR-2710-100	Bid/Award - Compressed Air Equipment	45	14-Aug-25	16-Oct-25
PR-2710-200	Award - Compressed Air Equipment	0		16-Oct-25
PR-2710-300	Fab/Deliver to Site - Compressed Air Equipment	210	03-Aug-26	28-May-27
2711 - Starting Air Compressors		465	31-Jul-25	28-May-27
PR-2711-000	Spec - Starting Air Compressors	20	31-Jul-25	27-Aug-25
PR-2711-100	Bid/Award - Starting Air Compressors	45	28-Aug-25	30-Oct-25
PR-2711-200	Award - Starting Air Compressors	0		30-Oct-25
PR-2711-300	Fab/Deliver to Site - Starting Air Compressors	210	03-Aug-26	28-May-27
2762 - Fuel Gas Conditioning		505	04-Jun-25	28-May-27
PR-2762-000	Spec - Fuel Gas Conditioning	20	04-Jun-25	01-Jul-25
PR-2762-100	Bid/Award - Fuel Gas Conditioning	45	02-Jul-25	04-Sep-25



Start Date	30-Nov-23
Finish Date	08-Jan-29
Data Date	30-Nov-23
Run Date	05-Sep-24

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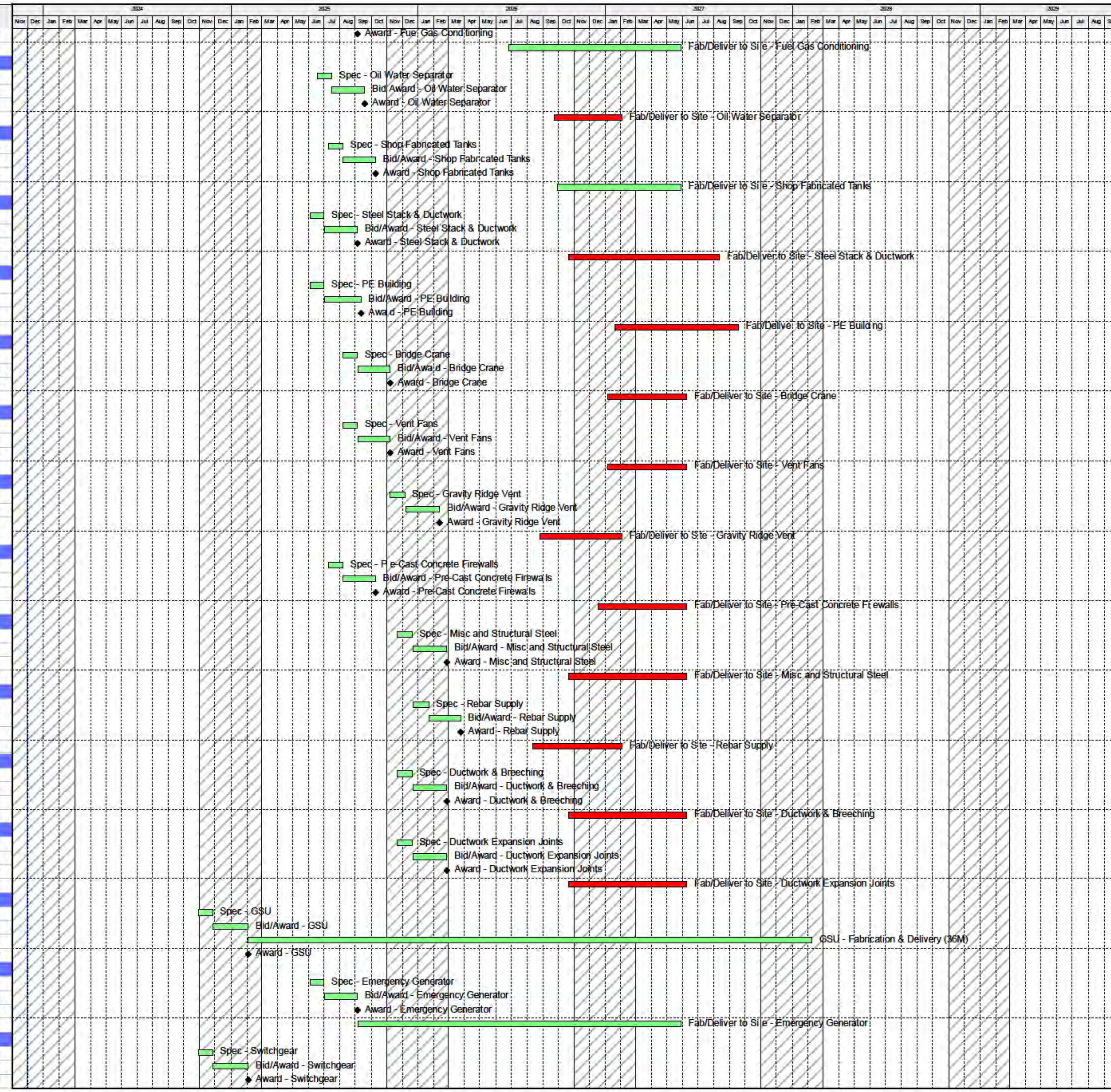
EKPC Generation Options - 12x18MW RICE - L2

Project Schedule

Date	Revision	Checked	Approved

Activity ID	Activity Name	RD	Start	Finish
PR-2762-200	Award - Fuel Gas Conditioning	0		04-Sep-25
PR-2762-300	Fab/Deliver to Site - Fuel Gas Conditioning	235	26-Jun-26	28-May-27
2940 - Oil Water Separator		412	18-Jun-25	02-Feb-27
PR-2940-000	Spec - Oil Water Separator	20	18-Jun-25	16-Jul-25
PR-2940-100	Bid/Award - Oil Water Separator	45	17-Jul-25	18-Sep-25
PR-2940-200	Award - Oil Water Separator	0		18-Sep-25
PR-2940-300	Fab/Deliver to Site - Oil Water Separator	90	24-Sep-26	02-Feb-27
2980 - Shop Fabricated Tanks		480	10-Jul-25	28-May-27
PR-2980-000	Spec - Shop Fabricated Tanks	20	10-Jul-25	06-Aug-25
PR-2980-100	Bid/Award - Shop Fabricated Tanks	45	07-Aug-25	09-Oct-25
PR-2980-200	Award - Shop Fabricated Tanks	0		09-Oct-25
PR-2980-300	Fab/Deliver to Site - Shop Fabricated Tanks	170	29-Sep-26	28-May-27
4120 - Steel Stack & Ductwork		557	04-Jun-25	12-Aug-27
PR-4120-000	Spec - Steel Stack & Ductwork	20	04-Jun-25	01-Jul-25
PR-4120-100	Bid/Award - Steel Stack & Ductwork	45	02-Jul-25	04-Sep-25
PR-4120-200	Award - Steel Stack & Ductwork	0		04-Sep-25
PR-4120-300	Fab/Deliver to Site - Steel Stack & Ductwork	205	22-Oct-26	12-Aug-27
4310 - Pre-Engineered Metal Buildings		582	04-Jun-25	17-Sep-27
PR-4310-000	Spec - PE Building	20	04-Jun-25	01-Jul-25
PR-4310-100	Bid/Award - PE Building	50	02-Jul-25	11-Sep-25
PR-4310-200	Award - PE Building	0		11-Sep-25
PR-4310-300	Fab/Deliver to Site - PE Building	170	20-Jan-27	17-Sep-27
4312 - Bridge Crane		467	07-Aug-25	09-Jun-27
PR-4312-000	Spec - Bridge Crane	20	07-Aug-25	04-Sep-25
PR-4312-100	Bid/Award - Bridge Crane	45	05-Sep-25	06-Nov-25
PR-4312-200	Award - Bridge Crane	0		06-Nov-25
PR-4312-300	Fab/Deliver to Site - Bridge Crane	110	06-Jan-27	09-Jun-27
4440 - Vent Fans		467	07-Aug-25	09-Jun-27
PR-4440-000	Spec - Vent Fans	20	07-Aug-25	04-Sep-25
PR-4440-100	Bid/Award - Vent Fans	45	05-Sep-25	06-Nov-25
PR-4440-200	Award - Vent Fans	0		06-Nov-25
PR-4440-300	Fab/Deliver to Site - Vent Fans	110	06-Jan-27	09-Jun-27
4441 - Gravity Ridge Vent		312	07-Nov-25	02-Feb-27
PR-4441-000	Spec - Gravity Ridge Vent	20	07-Nov-25	05-Dec-25
PR-4441-310	Bid/Award - Gravity Ridge Vent	45	08-Dec-25	11-Feb-26
PR-4441-100	Award - Gravity Ridge Vent	0		11-Feb-26
PR-4441-300	Fab/Deliver to Site - Gravity Ridge Vent	110	26-Aug-26	02-Feb-27
4515 - Pre-Cast Concrete Firewalls		487	10-Jul-25	09-Jun-27
PR-4515-000	Spec - Pre-Cast Concrete Firewalls	20	10-Jul-25	06-Aug-25
PR-4515-310	Bid/Award - Pre-Cast Concrete Firewalls	45	07-Aug-25	09-Oct-25
PR-4515-100	Award - Pre-Cast Concrete Firewalls	0		09-Oct-25
PR-4515-300	Fab/Deliver to Site - Pre-Cast Concrete Firewalls	120	18-Dec-26	09-Jun-27
4520 - Misc and Structural Steel		392	21-Nov-25	09-Jun-27
PR-4520-000	Spec - Misc and Structural Steel	20	21-Nov-25	19-Dec-25
PR-4520-310	Bid/Award - Misc and Structural Steel	45	22-Dec-25	25-Feb-26
PR-4520-100	Award - Misc and Structural Steel	0		25-Feb-26
PR-4520-300	Fab/Deliver to Site - Misc and Structural Steel	160	22-Oct-26	09-Jun-27
4525 - Rebar Supply		282	22-Dec-25	02-Feb-27
PR-4525-000	Spec - Rebar Supply	20	22-Dec-25	21-Jan-26
PR-4525-100	Bid/Award - Rebar Supply	45	22-Jan-26	25-Mar-26
PR-4525-200	Award - Rebar Supply	0		25-Mar-26
PR-4525-300	Fab/Deliver to Site - Rebar Supply	120	12-Aug-26	02-Feb-27
4540 - Ductwork & Breeching		392	21-Nov-25	09-Jun-27
PR-4540-000	Spec - Ductwork & Breeching	20	21-Nov-25	19-Dec-25
PR-4540-100	Bid/Award - Ductwork & Breeching	45	22-Dec-25	25-Feb-26
PR-4540-200	Award - Ductwork & Breeching	0		25-Feb-26
PR-4540-300	Fab/Deliver to Site - Ductwork & Breeching	160	22-Oct-26	09-Jun-27
4550 - Ductwork Expansion Joints		392	21-Nov-25	09-Jun-27
PR-4550-000	Spec - Ductwork Expansion Joints	20	21-Nov-25	19-Dec-25
PR-4550-100	Bid/Award - Ductwork Expansion Joints	45	22-Dec-25	25-Feb-26
PR-4550-200	Award - Ductwork Expansion Joints	0		25-Feb-26
PR-4550-300	Fab/Deliver to Site - Ductwork Expansion Joints	160	22-Oct-26	09-Jun-27
5110 - Generator Step-Up Transformers		830	29-Oct-24	08-Feb-28
PR-5110-000	Spec - GSU	20	29-Oct-24	26-Nov-24
PR-5110-100	Bid/Award - GSU	45	26-Nov-24	03-Feb-25
PR-5110-300	GSU - Fabrication & Delivery (36M)	765	03-Feb-25	08-Feb-28
PR-5110-200	Award - GSU	0		03-Feb-25*
5240 - Emergency Generator		505	04-Jun-25	28-May-27
PR-5240-000	Spec - Emergency Generator	20	04-Jun-25	01-Jul-25
PR-5240-100	Bid/Award - Emergency Generator	45	02-Jul-25	04-Sep-25
PR-5240-200	Award - Emergency Generator	0		04-Sep-25
PR-5240-300	Fab/Deliver to Site - Emergency Generator	440	05-Sep-25	28-May-27
5310 - MV/LV Switchgear & Relay Panels		736	29-Oct-24	22-Sep-27
PR-5110-410	Spec - Switchgear	20	29-Oct-24	26-Nov-24
PR-5110-420	Bid/Award - Switchgear	45	26-Nov-24	03-Feb-25
PR-5310-100	Award - Switchgear	0		03-Feb-25*



Start Date	30-Nov-23
Finish Date	08-Jan-29
Data Date	30-Nov-23
Run Date	05-Sep-24

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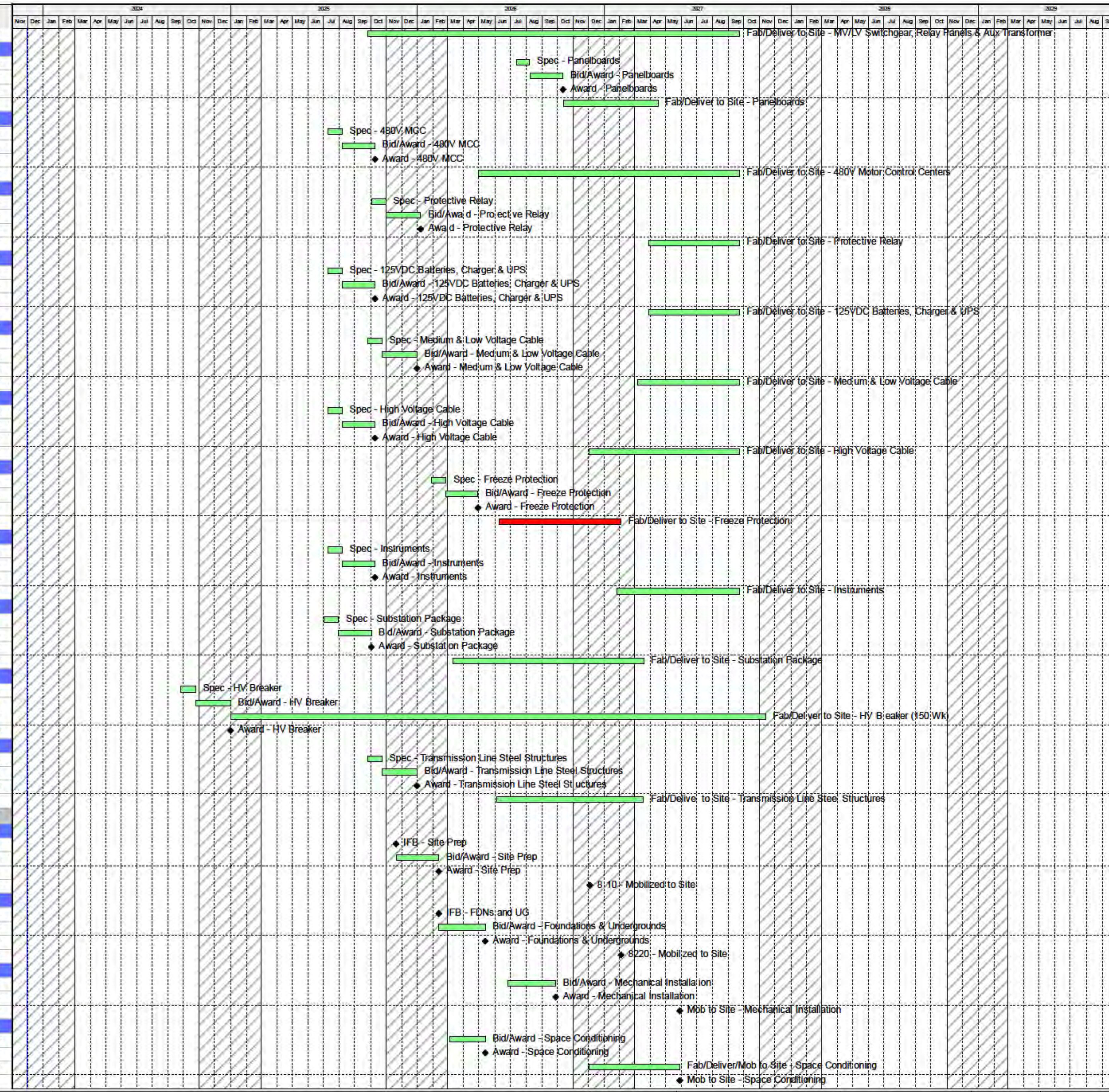
EKPC Generation Options - 12x18MW RICE - L2

Project Schedule

Date	Revision	Checked	Approved

Activity ID	Activity Name	RD	Start	Finish
PR-5310-300	Fab/Deliver to Site - MV/LV Switchgear, Relay Panels & Aux Transformer	505	26-Sep-25	22-Sep-27
5311 - Panelboards		195	13-Jul-26	16-Apr-27
PR-5311-000	Spec - Panelboards	20	13-Jul-26	07-Aug-26
PR-5311-100	Bid/Award - Panelboards	45	10-Aug-26	12-Oct-26
PR-5311-200	Award - Panelboards	0		12-Oct-26
PR-5311-300	Fab/Deliver to Site - Panelboards	130	13-Oct-26	16-Apr-27
5330 - 480V Motor Control Centers		560	10-Jul-25	22-Sep-27
PR-5311-310	Spec - 480V MCC	20	10-Jul-25	06-Aug-25
PR-5311-320	Bid/Award - 480V MCC	45	07-Aug-25	09-Oct-25
PR-5330-100	Award - 480V MCC	0		09-Oct-25
PR-5330-300	Fab/Deliver to Site - 480V Motor Control Centers	355	30-Apr-26	22-Sep-27
5350 - Protective Relay Panel		500	03-Oct-25	22-Sep-27
PR-5350-000	Spec - Protective Relay	20	03-Oct-25	30-Oct-25
PR-5350-100	Bid/Award - Protective Relay	45	31-Oct-25	07-Jan-26
PR-5350-200	Award - Protective Relay	0		07-Jan-26
PR-5350-300	Fab/Deliver to Site - Protective Relay	125	29-Mar-27	22-Sep-27
5430 - 125VDC Batteries, Charger & UPS		560	10-Jul-25	22-Sep-27
PR-5430-000	Spec - 125VDC Batteries, Charger & UPS	20	10-Jul-25	06-Aug-25
PR-5430-100	Bid/Award - 125VDC Batteries, Charger & UPS	45	07-Aug-25	09-Oct-25
PR-5430-200	Award - 125VDC Batteries, Charger & UPS	0		09-Oct-25
PR-5430-300	Fab/Deliver to Site - 125VDC Batteries, Charger & UPS	125	29-Mar-27	22-Sep-27
5500 - Medium and Low Voltage Cable		505	26-Sep-25	22-Sep-27
PR-5500-000	Spec - Medium & Low Voltage Cable	20	26-Sep-25	23-Oct-25
PR-5500-100	Bid/Award - Medium & Low Voltage Cable	45	24-Oct-25	30-Dec-25
PR-5500-200	Award - Medium & Low Voltage Cable	0		30-Dec-25
PR-5500-300	Fab/Deliver to Site - Medium & Low Voltage Cable	140	08-Mar-27	22-Sep-27
5520 - High Voltage Cable		560	10-Jul-25	22-Sep-27
PR-5520-000	Spec - High Voltage Cable	20	10-Jul-25	06-Aug-25
PR-5520-100	Bid/Award - High Voltage Cable	45	07-Aug-25	09-Oct-25
PR-5520-200	Award - High Voltage Cable	0		09-Oct-25
PR-5520-300	Fab/Deliver to Site - High Voltage Cable	205	02-Dec-26	22-Sep-27
5620 - Freeze Protection		257	29-Jan-26	02-Feb-27
PR-5620-000	Spec - Freeze Protection	20	29-Jan-26	25-Feb-26
PR-5620-100	Bid/Award - Freeze Protection	45	26-Feb-26	29-Apr-26
PR-5620-200	Award - Freeze Protection	0		29-Apr-26
PR-5620-300	Fab/Deliver to Site - Freeze Protection	165	09-Jun-26	02-Feb-27
6210 - Instruments		560	10-Jul-25	22-Sep-27
PR-6210-000	Spec - Instruments	20	10-Jul-25	06-Aug-25
PR-6210-100	Bid/Award - Instruments	45	07-Aug-25	09-Oct-25
PR-6210-200	Award - Instruments	0		09-Oct-25
PR-6210-300	Fab/Deliver to Site - Instruments	170	25-Jan-27	22-Sep-27
C202 - Substation Package		435	02-Jul-25	19-Mar-27
PR-C202-000	Spec - Substation Package	20	02-Jul-25	30-Jul-25
PR-C202-100	Bid/Award - Substation Package	45	31-Jul-25	02-Oct-25
PR-C202-200	Award - Substation Package	0		02-Oct-25
PR-C202-300	Fab/Deliver to Site - Substation Package	260	12-Mar-26	19-Mar-27
C203 - HV Breaker		795	26-Sep-24	12-Nov-27
PR-C203-340	Spec - HV Breaker	20	26-Sep-24	24-Oct-24
PR-C203-330	Bid/Award - HV Breaker	45	24-Oct-24	31-Dec-24
PR-C203-310	Fab/Deliver to Site - HV Breaker (150 Wk)	730	31-Dec-24	12-Nov-27
PR-C203-320	Award - HV Breaker	0		31-Dec-24*
C303 - Transmission Line Steel Structures		375	26-Sep-25	19-Mar-27
PR-7300-000	Spec - Transmission Line Steel Structures	20	26-Sep-25	23-Oct-25
PR-7300-100	Bid/Award - Transmission Line Steel Structures	45	24-Oct-25	30-Dec-25
PR-7300-200	Award - Transmission Line Steel Structures	0		30-Dec-25
PR-7300-300	Fab/Deliver to Site - Transmission Line Steel Structures	200	05-Jun-26	19-Mar-27
Construction Contracts		530	21-Aug-25	22-Sep-27
8110 - Site Prep		262	20-Nov-25	03-Dec-26
PR-8110-100	FB - Site Prep	0		20-Nov-25
PR-8110-000	Bid/Award - Site Prep	55	21-Nov-25	11-Feb-26
PR-8110-200	Award - Site Prep	0		11-Feb-26
PR-8110-800	8110 - Mobilized to Site	0		03-Dec-26
8220 - Foundations & Undergrounds		247	11-Feb-26	02-Feb-27
PR-8220-100	FB - FDNs and UG	0		11-Feb-26
PR-8220-000	Bid/Award - Foundations & Undergrounds	65	12-Feb-26	13-May-26
PR-8220-200	Award - Foundations & Undergrounds	0		13-May-26
PR-8220-800	8220 - Mobilized to Site	0		02-Feb-27
8320 - Mechanical Installation		235	26-Jun-26	28-May-27
PR-8320-000	Bid/Award - Mechanical Installation	65	26-Jun-26	28-Sep-26
PR-8320-200	Award - Mechanical Installation	0		28-Sep-26
PR-8320-800	Mob to Site - Mechanical Installation	0		28-May-27
8340 - Space Conditioning		315	05-Mar-26	28-May-27
PR-8340-000	Bid/Award - Space Conditioning	50	05-Mar-26	13-May-26
PR-8340-200	Award - Space Conditioning	0		13-May-26
PR-8340-300	Fab/Deliver/Mob to Site - Space Conditioning	125	02-Dec-26	28-May-27
PR-8340-800	Mob to Site - Space Conditioning	0		28-May-27



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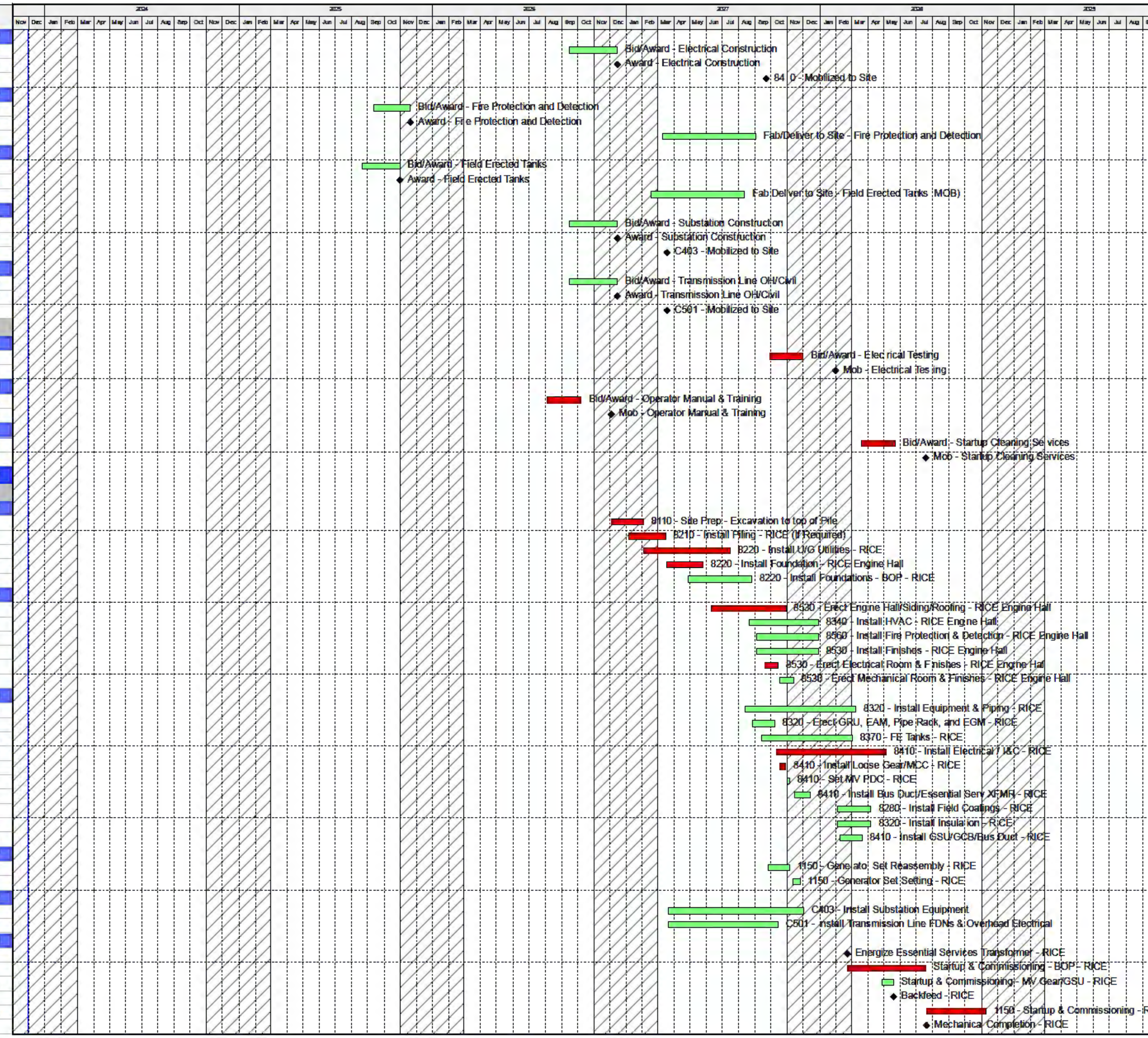
EKPC Generation Options - 12x18MW RICE - L2

Project Schedule

Date	Revision	Checked	Approved

Activity ID	Activity Name	RD	Start	Finish
[illegible]		[illegible]	[illegible]	[illegible]
PR-8410-000	Bid/Award - Electrical Construction	65	15-Sep-26	15-Dec-26
PR-8410-200	Award - Electrical Construction	0		15-Dec-26
PR-8410-800	8410 - Mobilized to Site	0		22-Sep-27
[illegible]		[illegible]	[illegible]	[illegible]
PR-8560-000	Bid/Award - Fire Protection and Detection	50	12-Sep-25	20-Nov-25
PR-8560-200	Award - Fire Protection and Detection	0		20-Nov-25
PR-8560-300	Fab/Deliver to Site - Fire Protection and Detection	125	10-Mar-27	02-Sep-27
[illegible]		[illegible]	[illegible]	[illegible]
PR-8570-000	Bid/Award - Field Erected Tanks	50	21-Aug-25	30-Oct-25
PR-8570-200	Award - Field Erected Tanks	0		30-Oct-25
PR-8570-300	Fab/Deliver to Site - Field Erected Tanks (MOB)	125	17-Feb-27	12-Aug-27
[illegible]		[illegible]	[illegible]	[illegible]
PR-8410-850	Bid/Award - Substation Construction	65	15-Sep-26	15-Dec-26
PR-8410-840	Award - Substation Construction	0		15-Dec-26
PR-8410-860	C403 - Mobilized to Site	0		19-Mar-27
[illegible]		[illegible]	[illegible]	[illegible]
PR-8410-820	Bid/Award - Transmission Line OH/Civil	65	15-Sep-26	15-Dec-26
PR-8410-810	Award - Transmission Line OH/Civil	0		15-Dec-26
PR-8410-830	C501 - Mobilized to Site	0		19-Mar-27
Services Contracts		497	05-Aug-26	19-Jul-28
[illegible]		[illegible]	[illegible]	[illegible]
PR-9230-000	Bid/Award - Electrical Testing	45	29-Sep-27	01-Dec-27
PR-9230-300	Mob - Electrical Testing	0		31-Jan-28
[illegible]		[illegible]	[illegible]	[illegible]
PR-9400-000	Bid/Award - Operator Manual & Training	45	05-Aug-26	07-Oct-26
PR-9400-300	Mob - Operator Manual & Training	0		03-Dec-26
[illegible]		[illegible]	[illegible]	[illegible]
PR-9610-000	Bid/Award - Startup Cleaning Services	45	21-Mar-28	22-May-28
PR-9610-300	Mob - Startup Cleaning Services	0		19-Jul-28
Construction & Startup		492	04-Dec-26	09-Nov-28
RICE		492	04-Dec-26	09-Nov-28
[illegible]		[illegible]	[illegible]	[illegible]
C1000	8110 - Site Prep - Excavation to top of Pile	40	04-Dec-26	02-Feb-27
C1010	8210 - Install Piling - RICE (If Required)	50	06-Jan-27	16-Mar-27
C1020	8220 - Install U/G Utilities - RICE	115	03-Feb-27	15-Jul-27
C1030	8220 - Install Foundation - RICE Engine Hall	50	17-Mar-27	25-May-27
C1040	8220 - Install Foundations - BOP - RICE	85	28-Apr-27	26-Aug-27
[illegible]		[illegible]	[illegible]	[illegible]
C1050	8530 - Erect Engine Hall/Siding/Roofing - RICE Engine Hall	100	10-Jun-27	29-Oct-27
C1070	8340 - Install HVAC - RICE Engine Hall	90	20-Aug-27	29-Dec-27
C1090	8560 - Install Fire Protection & Detection - RICE Engine Hall	80	03-Sep-27	29-Dec-27
C1100	8530 - Install Finishes - RICE Engine Hall	80	03-Sep-27	29-Dec-27
C1120	8530 - Erect Electrical Room & Finishes - RICE Engine Hall	20	20-Sep-27	15-Oct-27
C1160	8530 - Erect Mechanical Room & Finishes - RICE Engine Hall	20	18-Oct-27	12-Nov-27
[illegible]		[illegible]	[illegible]	[illegible]
C1060	8320 - Install Equipment & Piping - RICE	145	13-Aug-27	09-Mar-28
C1080	8320 - Erect GRU, EAM, Pipe Rack, and EGM - RICE	30	27-Aug-27	08-Oct-27
C1110	8370 - FE Tanks - RICE	120	13-Sep-27	02-Mar-28
C1150	8410 - Install Electrical / I&C - RICE	145	11-Oct-27	04-May-28
C1170	8410 - Install Loose Gear/MCC - RICE	10	18-Oct-27	29-Oct-27
C1140	8410 - Set MV PDC - RICE	5	01-Nov-27	05-Nov-27
C1190	8410 - Install Bus Duct/Essential Serv XFMR - RICE	20	15-Nov-27	13-Dec-27
C1210	8280 - Install Field Coatings - RICE	45	04-Feb-28	06-Apr-28
C1220	8320 - Install Insulation - RICE	45	04-Feb-28	06-Apr-28
C1200	8410 - Install GSU/GCB/Bus Duct - RICE	30	08-Feb-28	21-Mar-28
[illegible]		[illegible]	[illegible]	[illegible]
C1130	1150 - Generator Set Reassembly - RICE	30	27-Sep-27	05-Nov-27
C1180	1150 - Generator Set Setting - RICE	10	11-Nov-27	24-Nov-27
[illegible]		[illegible]	[illegible]	[illegible]
C1300	C403 - Install Substation Equipment	180	22-Mar-27	02-Dec-27
C1310	C501 - Install Transmission Line FDNs & Overhead Electrical	146	22-Mar-27	14-Oct-27
[illegible]		[illegible]	[illegible]	[illegible]
C1230	Energize Essential Services Transformer - RICE	0	22-Feb-28	
C1240	Startup & Commissioning - BOP - RICE	105	22-Feb-28	19-Jul-28
C1250	Startup & Commissioning - MV Gear/GSU - RICE	15	28-Apr-28	18-May-28
C1260	Backfeed - RICE	0	19-May-28	
C1270	1150 - Startup & Commissioning - RICE	80	20-Jul-28	09-Nov-28
C1280	Mechanical Completion - RICE	0	20-Jul-28	



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EKPC Generation Options - 12x18MW RICE - L2

Project Schedule

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APPENDIX R – CAPITAL COST ESTIMATE

PSR CAPITAL COST ESTIMATE
EKPC
Liberty
RICE - Wärtsilä
Liberty, KY
BMcD #157785

[redacted]

APPENDIX S – CASH FLOW

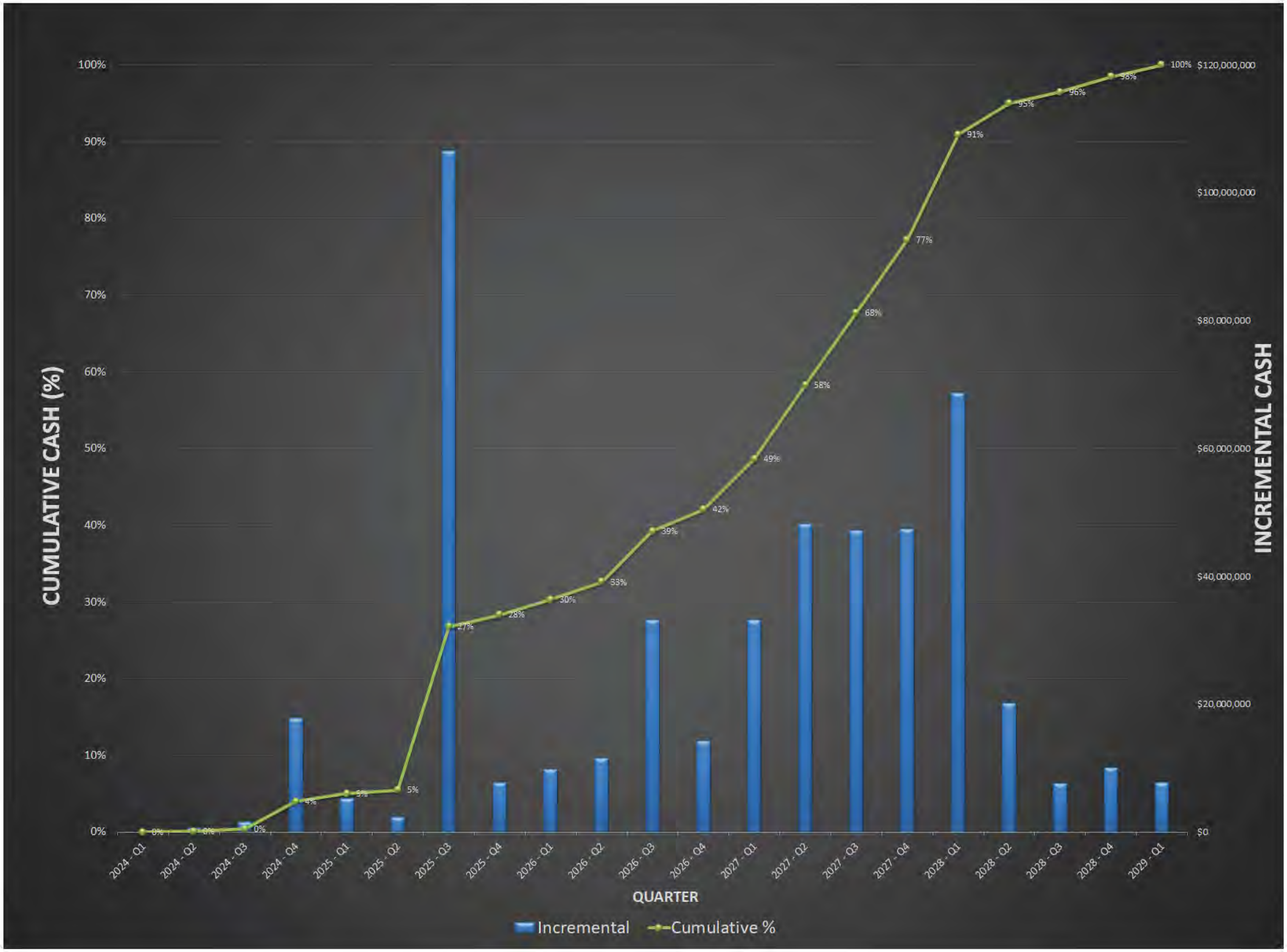
EKPC - Liberty 12x18MW RICE

Estimated Cash Flow

Quarterly Cash Flow				
Year	Incremental	Incremental %	Cumulative	Cumulative %
2024 - Q1	$0	0.0%	$0	0%
2024 - Q2	$535,789	0.1%	$535,789	0%
2024 - Q3	$1,553,684	0.3%	$2,089,474	0%
2024 - Q4	$17,720,684	3.5%	$19,810,158	4%
2025 - Q1	$5,202,684	1.0%	$25,012,842	5%
2025 - Q2	$2,333,684	0.5%	$27,346,526	5%
2025 - Q3	$106,505,643	21.3%	$133,852,169	27%
2025 - Q4	$7,677,580	1.5%	$141,529,749	28%
2026 - Q1	$9,811,223	2.0%	$151,340,972	30%
2026 - Q2	$11,547,063	2.3%	$162,888,035	33%
2026 - Q3	$33,089,720	6.6%	$195,977,755	39%
2026 - Q4	$14,184,791	2.8%	$210,162,546	42%
2027 - Q1	$33,079,442	6.6%	$243,241,988	49%
2027 - Q2	$48,060,471	9.6%	$291,302,459	58%
2027 - Q3	$47,151,631	9.4%	$338,454,089	68%
2027 - Q4	$47,428,511	9.5%	$385,882,600	77%
2028 - Q1	$68,695,992	13.7%	$454,578,592	91%
2028 - Q2	$20,096,698	4.0%	$474,675,290	95%
2028 - Q3	$7,571,358	1.5%	$482,246,648	96%
2028 - Q4	$10,025,902	2.0%	$492,272,549	98%
2029 - Q1	$7,711,395	1.5%	$499,983,944	100%
2029 - Q2	$0	0.0%	$499,983,944	100%
2029 - Q3	$0	0.0%	$499,983,944	100%
2029 - Q4	$0	0.0%	$499,983,944	100%

EKPC - Liberty 12x18MW RICE

Estimated Cash Flow



APPENDIX T – O&M COST ESTIMATE

O&M Costs - EKPC Liberty - Wärtsilä Option

Operations and Maintenance Estimate	Current Case
Plant Assumptions (Inputs in Blue)	**Current**
Basis Year	2024
Engine Model	18V50DF
Number of Engines	12
Evaluated Project Life (Years)	20
Capacity Factor (%)	60%
Hours @ Base Load	5,256
Percent Annual Hours on Backup Fuel	10%
Base Load Net Output, kW, Summer Average	213,200
Annual Net Output, MWh	1,120,749
FTE Personnel	23.0
FTE Average Burdened Salary	$110,000
General Annual Escalation Rate	0.0%
Fixed O&M	
Labor	***$2,530,000***
General Fixed O&M	***$500,000***
Office and Admin Costs	Included above
Employee Expenses/Training	Included above
Contract Labor	Included above
Environmental Expenses	Included above
Safety Expenses	Included above
Buildings, Grounds, and Painting	Included above
Other Supplies & Expenses	Included above
Communication	Included above
Water/Sewer Basic Monthly Rate	Included above
Security	Included above
Control Room/Lab Expenses	Included above
Other Fixed O&M Costs	***$0***
Property Taxes	***$0***
Property Insurance	***$0***
Unscheduled Maintenance Allowance	***$166,400***
Total Fixed O&M Annual Cost	***$3,196,400***
Non-Fuel/Power Variable O&M	
OEM Major Maintenance, $/yr (Annualized)	***$7,509,600***
Avg Frequency of Major Maintenance Activities (yrs/activity)	2.0
Engine Major Maintenance, $/hr	$119.10
Engine Major Maintenance, $/MWh	*$6.70*
Catalyst Replacement, $/yr (Annualized)	***$1,892,400***
Avg Frequency of Catalyst Replacements (yrs/replacement)	4.0
Catalyst Replacement $/MWh	*$1.69*
Consumables	***$2,239,100***
Water Consumption	$2,400
Lube Oil Consumption	$700,100
Urea Consumption	$1,536,600
Consumables $/MWh	*$2.00*
Balance of Plant O&M	***$495,100***
Includes radiators, air compressors, aux module, etc.	
Standby Power Energy Costs	***$235,500***
Auxiliary power costs for fast ramp and dispatch (Standby)	
Total Variable O&M Annual Cost	***$12,371,700***
OEM Long Term Service Agreement	
OEM Fixed Fees	***$243,600***
Fixed Monthly fee: $20,300	

OEM Swing Set (Annualized)	***$436,300***
OEM LTSA Swing Set costs incurred over first 10 years. Costs are annualized over lifetime of plant	
OEM Variable Fee (Minor Maintenance Intervals)	***$2,081,376***
$33/engine hr	
Total OEM LTSA Annual Costs	***$2,761,300***
Summary of O&M Costs	
Fixed O&M Annual Cost, $/yr	***$3,196,400***
Fixed O&M Annual Cost, $/kW-yr	*$15.00*
Fixed O&M Annual Cost, $/MWh	*$2.85*
Capital Maintenance** Annual Cost, $/yr	***$9,402,000***
Capital Maintenance, $/MWh	*$8.39*
Capital Maintenance, $/engine hr	*$149.07*
***Includes OEM Major Milestones and Catalyst Replacements.*	
Non-fuel Variable** O&M Annual Cost, $/yr	***$2,969,700***
Variable O&M, $/MWh	*$2.65*
***EXCLUDES Capital Maintenance*	
OEM LTSA Cost, $/yr	***$2,761,300***
OEM LTSA, $/MWh	*$2.46*
Combined Total O&M ($/MWh)	***$16.35***

Notes:

1. These are levelized costs over assumed assigned duration.
2. Minor maintenance includes OEM technical assistance and spare parts for scheduled minor intervals.
3. Fuel costs are excluded from O&M analysis. Lube oil and urea consumption account for replacement fluids.
4. BOP variable O&M accounts for maintenance and parts for OEM supplied equipment such as radiators, air compressors, start air bottles, building systems, etc.
5. Major maintenance includes OEM tech team and parts for scheduled major intervals.
6. Capacity factors assume all operation is at full load.

CREATE AMAZING.

Burns & McDonnell World Headquarters
9400 Ward Parkway
Kansas City, MO 64114
O 816-333-9400
F 816-333-3690
www.burnsmcd.com