a PPL company

MILL CREEK GENERATING STATION
COMPRESSION FEED STUDY

JEFFERSON COUNTY, KENTUCKY

SUBMITTED REV. 0: 10/13/2023

FINAL

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SECTION 1

EXECUTIVE SUMMARY

PROJECT DESCRIPTION

This report describes the results of a preliminary cost study for Kentucky Utilities (KU/LG&E) Mill Creek Generating Station. The scope of the project consisted of hydraulic analysis of the following compression layouts:

GENERAL HYDRAULIC PARAMETERS

- Minimum Inlet Pressure from TGT = 400 PSIG
- Mill Creek Minimum Delivery Pressure:
  - MC5 = 675 PSIG
- Total Flow Requirements:
  - MC5 = 90 MMSCFD

CASE 1 – Two compressors in parallel (1 active, 1 spare)

- Both compressors installed at Mill Creek
- 2 Total Units, both identical
- 2,300 HP hydraulic power, 3,300 HP brake horsepower @ 70% efficiency
  - Option for 1,630 HP hydraulic power, 2,330 HP brake horsepower @ 70% efficiency w/ 450 PSIG minimum allowable Inlet Pressure from TGT

CASE 2 – Two compressors in parallel (1 active, 1 spare), w/ one upstream compressor

- All compressors installed at Mill Creek
- 3 Total Units; 2 identical, 1 larger upstream unit
- (2) 860 HP hydraulic power, 1,200 HP brake horsepower @ 70% efficiency units & (1) 1,400 HP hydraulic power, 2,000 HP brake horsepower @ 70% efficiency unit

The proposed compression cases would utilize a proposed 16” natural gas pipeline that will supply gas to the Mill Creek Facility from TGT. All new Mill Creek compressors are assumed to be electric motor driven (EMD). ENTRUST (“EN”, formerly EN Engineering) performed a previous FEED study in 2020/21 that investigated different pipeline sizes to supply gas to Mill Creek. A 16” pipeline was determined to be the best option, considering possible future expansion of the Mill Creek facility. Additionally, EN is performing a concurrent FEED to this study that investigates several different pipeline installation routes. This study determined that different route options will not have a significant impact on compressor sizing.

The previous investigations included working with select subcontractors to identify project requirements and estimated costs for construction, survey services and geotechnical services. The material project costs were developed using budgetary bid pricing from various equipment vendors, pipe and material manufacturers and suppliers. Project costs for similar projects and similar facilities were also used to develop the project cost estimates. For the current study, EN refreshed the costs that could be reused by applying a cost escalation or verifying with current similar project cost estimates.

COST ESTIMATE RESULTS

The cost estimates were prepared using recent project costs and can be found in Section 4 of this report. The total estimated cost of each option evaluated is listed below:

Summary of Cost Estimate Results			
Case 1			
Category		**Total**	**% of Total**
Material	$	11,808,851	36.9%
Construction	$	12,228,250	38.2%
Survey & Geotech	$	65,075	0.2%
Inspection	$	235,400	0.7%
Engineering	$	1,177,770	3.7%
AFUDC	$	127,577	0.4%
Contingency	$	6,378,837	19.9%
TOTAL COST	**$**	**32,021,760**	**100.0%**
Case 2			
Category	**Total**		**% of Total**
Material	$	10,715,919	31.3%
Construction	$	14,563,367	42.6%
Survey & Geotech	$	105,930	0.3%
Inspection	$	355,100	1.0%
Engineering	$	1,531,525	4.5%
AFUDC	$	136,360	0.4%
Contingency	$	6,817,961	19.9%
TOTAL COST	**$**	**34,226,162**	**100.0%**

PROJECT RISKS AND IMPACTS

The project has various uncertainties and risks that may impact the project costs. ENE has attempted to evaluate the impact of these risks on the project. The most significant project risks are listed below:

- Change in delivery and supply pressure and flow rates from TGT
- Future information from compression vendors which may impose additional constraints not yet considered

The total impact to the project for either of these risks is difficult to estimate both in terms of likelihood and cost of the risk.

LIMITATIONS OF THE REPORT

Cost estimates prepared by ENTRUST for this project were prepared with good faith and reasonable care and are the opinion of ENTRUST as to what the actual costs may be at the time of construction. Since there are many variables that may impact the cost of construction, materials, equipment, services for a project of this nature, the cost estimates provided in this report are ENE's best effort to determine the approximate cost of the proposed facilities.

The cost estimates contained in this report are not a guarantee of the future project costs. Additionally, the cost estimates do not include any costs internal to LGE that will be directly charged and/or allocated to the project or incidental project costs, for example: administrative costs, [unlisted] restoration costs resulting from construction, environmental permit fees, property taxes, other miscellaneous expenses, etc.

SECTION 2

HYDRAULIC ANALYSIS

OVERVIEW OF HYDRAULIC DESIGN PARAMETERS

The following table lists the project design parameters used for preliminary design.

Description	Value	Unit
Inlet flow rate	90	MMSCFD
Inlet Pressure at Interconnect	400-550	PSIG
Proposed 16” Pipeline MAOP	1000	PSIG
Minimum Delivery Pressure	675	PSIG
Source Gas Temperature	70	°F

The following additional conditions and assumptions were used in the hydraulic modeling of the pipeline system:

- 95% Pipeline Efficiency (good average conditions, accounting for pipe bends & imperfections, etc.)
- 0.600 SG sweet natural gas
- 1,060 Btu/ft^3 gas HHV
- 60 °F ambient soil temperature
- 0.2241 Btu/(hr-ft^2-°F) heat transfer coefficient for proposed lateral
- 0.91 mile long proposed 16” pipeline upstream from compressor station + 0.25 mile long proposed 16” pipeline downstream from compressor station to delivery point
    - Gas supplied by TGT
- The proposed 16” pipeline was modeled with 0.500” WT.
- 0.0018” internal pipe roughness for uncoated pipe
- 10 psi drop across the interconnect facility
- 300 MMSCFD / psi regulator constants
- Synergi 4.9.3 modelling software used
- FM Fundamental Flow Equation with flow-dependent Colebrook-White friction factor

PURPOSE OF HYDRAULIC ANALYSIS

The goal of the hydraulic analysis was to determine potential compressor sizing and arrangements to meet the 675 psig demand of Mill Creek power generation unit MC5. At the time of this report, a pipeline route study is also taking place which will have an impact on the exact length of the pipeline. For the purpose of this report, a 0.91 mile pipeline was assumed. This corresponds with Route 1 in that separate study. The other route options are not expected to have a significant impact on compressor requirements.

- Case 1 – Two compressors in parallel (1 active, 1 spare)
    - Each compressor is sized to handle the 90 MMSCFD at a suction pressure of 400 psig and discharge of 675 psig.
    - Pressure control valves will be installed upstream of the compressors to pinch down suction pressures as needed to efficiently operate the compressor.
    - Results showed that 2,300 hydraulic HP was required at the 400 to 675 psig pressure ratio.
- Case 2 – Two compressors in parallel (1 active, 1 spare), w/ one upstream compressor
    - Upstream compressor is sized to handle the 90 MMSCFD at suction pressures between 400 and 550 psig, and a discharge of 550 psig
    - Each downstream compressor is sized to handle the 90 MMSCFD at a suction pressure of 550 psig and discharge of 675 psig.
    - Pressure control valves will be installed upstream of the first compressor to pinch down suction pressure as needed to efficiently operate the compressor.
    - Results showed that 1,400 hydraulic HP was required for the upstream compressor and 860 hydraulic HP was required for the downstream compressor.

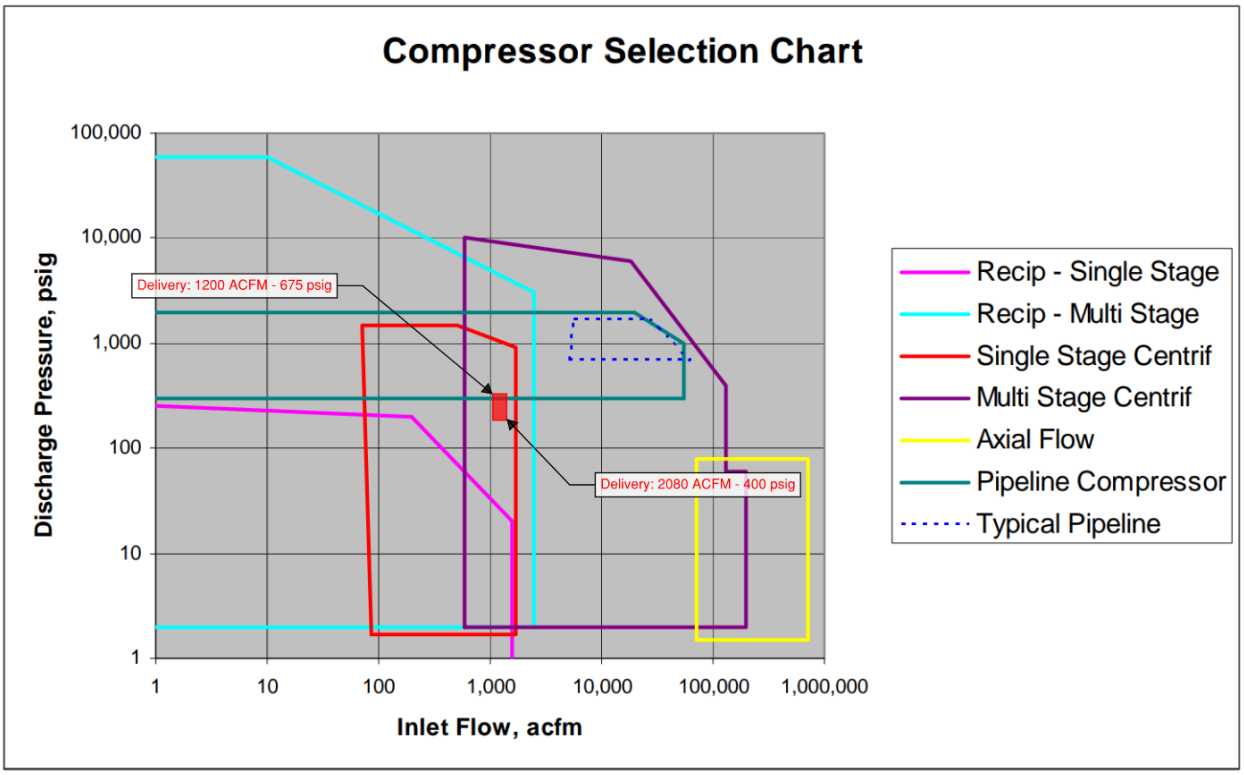
SECTION 3

COMPRESSORS

OVERVIEW OF COMPRESSION FACILITIES

It is assumed that new compression should be sized to keep up with the design flowrates analyzed for Cases 1 and 2. New compression at the Mill Creek Facility is assumed to be electric motor driven (EMD). All compression was assumed to be fully automated for remote operation.

The Mill Creek compression flowrate of 90 MMSCFD and discharge pressure of 675 psig make either reciprocating or centrifugal compressors a good fit. Refer to the following Figure B.1 from the 2010 white paper *Interstate Natural Gas Pipeline Efficiency* published by the Interstate Natural Gas Association of America (INGAA).



As highlighted in the above chart, the design flowrates and pressures Mill Creek are in the range of conditions where multi-stage reciprocating compressors or single-stage centrifugal compressors typically operate.

For this project, Dearing, an Ariel Corporation packager has been consulted to provide sizing recommendations for reciprocating compressors. It was also assumed that all proposed compression would be electric motor driven (EMD) with variable frequency drive (VFD) as opposed to combustion turbine driven. EMDs require installation of significant electrical infrastructure, but do not generate emissions that would require additional environmental permitting. It is also assumed that EMD driven centrifugal units would be too large and cost ineffective for the scale of this project, as the smallest non-custom centrifugal EMD units offered by Solar are 5,000 HP. With installation assumed to be installed at the Mill Creek power generation facility, it is also assumed that electric power availability is not a major concern.

Engine driven compressors could be installed as an alternative to the EMD units. Maintenance costs would be expected to be slightly higher for an EMD unit than for a engine driven unit. EMD units use smaller lube oil systems than engine driven units, however the need for an additional water-cooling system with a VFD more than offsets the difference in lube oil systems. CAPEX for the EMD compressor skids is lower than for comparable engine-driven compressor skids, however OPEX is typically greater for EMD units due to the difference in electric cost vs fuel gas cost. Engine driven compressors would not require high-voltage electrical infrastructure which could save several million dollars of CAPEX for the project. However, with the location of the compression at the Mill Creek power generation facility it is possible that the required electrical infrastructure is already in place for EMD units.

The following compression has been assumed for the project:

- Case 1:
  - Total Flowrate Required: 90 MMSCFD
  - Required Compression at Mill Creek: 2,300 HP
  - Rated Compression at Mill Creek: 3,300 HP
    - The required compression listed is the theoretically required compression assuming a minimum receipt pressure of 400 psig
  - The compression requirements at Mill Creek could be met by installing (2) Ariel/CAT reciprocating compressors.
    - The 2 new units would be installed with 1 active and 1 hot spare.
    - Specifics regarding compressor specifications will be updated in the future as information is made available.
- Case 2:
  - Total Flowrate Required: 90 MMSCFD
  - Required Compression at Mill Creek: 2,300 HP
  - Rated Compression at Mill Creek: 3,300 HP
    - The required compression listed is the theoretically required compression assuming a minimum receipt pressure of 400 psig
  - The compression requirements at Mill Creek could be met by installing (3) Ariel/CAT reciprocating compressors.
    - 1 new unit would be installed upstream to handle suction pressures from 400 psig up to 550 psig.
    - 2 new units would be installed downstream with 1 active and 1 hot spare to handle suction pressures greater than 550 psig.
    - Specifics regarding compressor specifications will be updated in the future as information is made available.

The following supplementary major equipment & buildings were assumed for installation of new reciprocating, EMD driven compression at Mill Creek for both Case 1 and Case 2:

- (1) Suction Filter/Separator
- (1) Unit Blowdown Silencer
- (1) Station Suction Blowdown Silencer
- (1) Station Discharge Blowdown Silencer
- (1) 2,000 gal used lube oil storage tank
- (1) Air compressor skid
- (1) Air receiver tank
- (1) Approx. 50’ x 80’ rigid compressor building w/ crane
- (1) Approx. 20’ x 60’ MCC/Comms Building
- Addt’l low voltage switchgears, transformers, and related electrical equipment
- UPS system
- Station Control and ESD panels

Discharge gas coolers were not assumed to be required. Emergency generator and associated fuel gas equipment was not assumed to be required due to the proximity to electrical infrastructure at Mill Creek.

The following additional major equipment & buildings were assumed for installation of the additional upstream compressors in Case 2:

- (1) Suction Filter/Separator
- (1) Unit Blowdown Silencer
- (1) Approx. 50’ x 40’ rigid compressor building w/ crane

To assist with understanding the system modifications that are being proposed, please refer to system retirement and installation PFDs and preliminary site layout exhibits that are included in Section 5.

CONSTRUCTION OF COMPRESSION FACILITIES

EN has worked on several EMD installation projects over the past years and has used knowledge of construction costs and estimates from contractors on these historic projects to estimate costs for the proposed work at Mill Creek.

SECTION 4

CASE #1
Two Compressors in Parallel

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Preliminary Cost Estimate - Compression Installation at Mill Creek - Case 1

PROJECT LG&E Mill Creek Compression FEED Study
Compression Installation at Mill Creek - Case 1
1,480 psig Design Pressure/MAOP, 1/8" Corrosion Allowance
Total Flow Requirements = 90 MMSCFD

LOCATION Jefferson County, KY

DATE September 1, 2023 REV A

TYPE Budget Type Estimate, +/-25% Accuracy

LINE NUM.	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT	COMMENTS
1	**MATERIAL**					
2	**COMPRESSION MATERIAL**		[redacted]			
3	EMD Driven Reciprocating Compressor Package, Ariel/CAT, 3,300 HP Rated	EACH				
4	Suction Filter/Separator, c/w Instrumentation and Spares, Vendor TBD	EACH				
	6" Becker T0 Control Valve, CL600, w/ Actuation	EACH				
5	Condensate Storage Tank, Vendor TBD, Above-ground, UL 142, c/w Instrumentation	EACH				
6	Unit Blowdown Silencer, Vendor TBD	EACH				
7	Suction Blowdown Silencer, Vendor TBD	EACH				
8	Discharge Blowdown Silencer, Vendor TBD	EACH				
9	Used Lube Oil Storage Tank, Vendor TBD, Above-ground, UL 142, c/w Instrumentation	EACH				
10	Air Compressor Skid, c/w (2) Screw-type Compressors, Motors, Filter/Dryers, and (1) Condensate Receiver, Vendor TBD	EACH				
11	Air Receiver Tank, Vendor TBD	EACH				
12	Compressor Building, Rigid Frame, c/w 15-ton Crane, HVAC System	SQ. FT				
13	MCC/Comms Building, Rigid Frame, HVAC, Fully Wired	EACH				
14	All Pipes, Valves, & Fittings	LS				
15	Medium Voltage Utility Cabinet	EACH				
16	Medium Voltage Breaker	EACH				
17	Transformer, 1500 kVA	EACH				
18	High Resistance Ground Cabinet	EACH				
19	Low Voltage Switchgear	EACH				
20	Pre-Wired MCC & Building, 480 VAC	EACH				
21	UPS System, Batteries	EACH				
22	UPS System, Battery Charger	EACH				
23	UPS System, Inverter	EACH				
24	UPS System, DC Panel	EACH				
25	UPS System, Safety Switch	EACH				
26	UPS System, Converter System	EACH				
27	Lighting Equipment	LS				
28	Cable Tray	LS				
29	Power Cabling	LS				
30	Station Control Panel	EACH				
31	ESD Panel	EACH				
32	RIO Panel	EACH				
33	Station HMI	EACH				
34	Control Cabling	LS				
35	**Compression Material Subtotal**					
36	Miscellaneous Small Diameter Pipe, Fittings, Equipment, and Instrumentation	%				

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LINE NUM.	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT	COMMENTS
37	Misc. Material Subtotal		[redacted]			
38	Sales Tax	%				
39	Sales Tax Subtotal					
40	**FREIGHT**					
41	Freight For Minor CS Materials	%				
42	Freight For Major CS Equipment & Buildings	%				
43	Freight Subtotal					
44	**TOTAL MATERIAL AND FREIGHT COST**					
45						
46	**CONSTRUCTION**					
47	Mob/Demob	LS				
48	Excavation	LS				
49	Prefabrication	LS				
50	Foundations	LS				
51	Field Installation	LS				
52	Testing & Drying	LS				
53	Field Coating	LS				
54	Building Install	LS				
55	Backfill	LS				
56	Restoration	LS				
57	Paving	LS				
58	Insulation Allowance	LS				
59	Electrical	LS				
60	Valve Commissioning	LS				
61	Compression Commissioning & Start-Up	LS				
62	Field Engineering Support	MAN/HOUR				
63	Environmental Site Monitor	MAN/HOUR				
64	**TOTAL CONSTRUCTION COST**					
65						
66	**SURVEY SERVICES**					
67	**Preliminary Survey**					
68	Project Manager	HOUR				
69	PLS	HOUR				
70	Two Person Crew with GPS	DAY				
71	Data Processor	DAY				
72	Survey Supplies	EACH				
73	Per Diem	DAY				
74	Mob/Demob	EACH				
75	Sub-Total Preliminary Survey					
76	**Pre-Construction Staking**					
77	Project Manager	HOUR				
78	Survey Supervisor	DAY				
79	Two Person Crew with GPS	DAY				
80	Data Processing	DAY				
81	Survey Supplies	EACH				

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LINE NUM.	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT	COMMENTS
82	Per Diem	DAY	[redacted]			
83	Mob/Demob	EACH				
84	**Sub-total Pre-Con Staking**					
85	**As-built Survey**					
86	Two Person Survey Crew, Day Rate	DAY				
87	**Sub-total As-built Survey**					
88	**TOTAL SURVEY SERVICES COST**					
89						
90	**LAND ACQUISITION ($ FROM GARRARD CO. PVA SYSTEM)**					
91	**Easements**					
92	**Easement & Workspace Subtotal**					
93	**TOTAL RIGHT-OF-WAY COST**					
94						
95	**ENVIRONMENTAL**					
96	**TOTAL ENVIRONMENTAL COST**					
97						
98	**GEOTECHNICAL SERVICES**					
99	Soil Borings	EACH				
100	Lab Test for SB's only	EACH				
101	Geotechnical Report Preparation	LS				
102	**TOTAL GEOTECHNICAL SERVICES COST**					
103						
104	**INSPECTION SERVICES**					
105	**Material Inspection Services**					
106	Valves, Hot Bends, Fittings, Etc.	MAN/WEEK				
107	**Material Inspection Services Subtotal**					
108	**Construction Inspection Services**					
109	Chief Inspector	MAN/WEEK				
110	Welding Inspector	MAN/WEEK				
111	Office Manager	MAN/WEEK				
112	Construction Office Expenses - Office Rental	MO				
113	Construction Office Expenses - Office Supplies	MO				
114	**Construction Inspection Services Subtotal**					
115	**TOTAL INSPECTION SERVICES COST**					
116						
117	**ENGINEERING SERVICES**					
118	Project/Design Management	HR				
119	Project Engineering	HR				
120	Construction Drafting w/ CADD Equipment	HR				
121	As-Built Drafting w/ CADD Equipment	HR				
122	Metallurgical Consulting	HR				
123	Project Controls Engineer	HR				
124	Misc. (Printing, FedEx, Travel etc.)	LS				
125	Noise Analysis	LS				
126	Thermal Stress Analysis	LS				

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LINE NUM.	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT	COMMENTS
127	Acoustic & Mechanical Analysis	LS	[redacted]			
128	Arc Flash Study	LS				
129	Engineering Subtotal					
130	TOTAL ENGINEERING SERVICES COST				$ 1,177,770.00	
131						
132	AFUDC		0.5%	$ 25,515,345.73	$ 127,577.00	
133	TOTAL PROJECT CONTINGENCY		25.0%	$ 25,515,345.73	$ 6,378,837.00	
134						
135	TOTAL PROJECT COST				$ 32,021,760	

CASE #2
Two Compressors in Parallel w/ One Upstream Compressor

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Preliminary Cost Estimate - Compression Installation at Mill Creek - Case 2

PROJECT LG&E Mill Creek Compression FEED Study
Compression Installation at Mill Creek - Case 2
1,480 psig Design Pressure/MAOP, 1/8" Corrosion Allowance
Total Flow Requirements = 90 MMSCFD

LOCATION Jefferson County, KY

DATE September 1, 2023 REV A

TYPE Budget Type Estimate, +/-25% Accuracy

LINE NUM.	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT	COMMENTS
1	**MATERIAL**					
2	**UPSTREAM COMPRESSION MATERIAL**		[redacted]			
3	EMD Driven Reciprocating Compressor Package, Ariel/CAT, 2,000 HP Rated	EACH				
4	Suction Filter/Separator, c/w Instrumentation and Spares, Vendor TBD	EACH				
	6" Becker T0 Control Valve, CL600, w/ Actuation	EACH				
5	Condensate Storage Tank, Vendor TBD, Above-ground, UL 142, c/w Instrumentation	EACH				
6	Unit Blowdown Silencer, Vendor TBD	EACH				
7	Used Lube Oil Storage Tank, Vendor TBD, Above-ground, UL 142, c/w Instrumentation	EACH				
8	Air Compressor Skid, c/w (2) Screw-type Compressors, Motors, Filter/Dryers, and (1) Condensate Receiver, Vendor TBD	EACH				
9	Air Receiver Tank, Vendor TBD	EACH				
10	Compressor Building, Rigid Frame, c/w 15-ton Crane, HVAC System	SQ. FT				
11	MCC/Comms Building, Rigid Frame, HVAC, Fully Wired	EACH				
12	All Pipes, Valves, & Fittings	LS				
13	Medium Voltage Utility Cabinet	EACH				
14	Medium Voltage Breaker	EACH				
15	Transformer, 1500 kVA	EACH				
16	High Resistance Ground Cabinet	EACH				
17	Low Voltage Switchgear	EACH				
18	Pre-Wired MCC & Building, 480 VAC	EACH				
19	UPS System, Batteries	EACH				
20	UPS System, Battery Charger	EACH				
21	UPS System, Inverter	EACH				
22	UPS System, DC Panel	EACH				
23	UPS System, Safety Switch	EACH				
24	UPS System, Converter System	EACH				
25	Lighting Equipment	LS				
26	Cable Tray	LS				
27	Power Cabling	LS				
28	Station Control Panel	EACH				
29	ESD Panel	EACH				
30	RIO Panel	EACH				
31	Station HMI	EACH				
32	Control Cabling	LS				
33	**Compression Material Subtotal**					
34	Miscellaneous Small Diameter Pipe, Fittings, Equipment, and Instrumentation	%				
35	**Misc. Material Subtotal**					
36	Sales Tax	%				

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LINE NUM.	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT	COMMENTS
37	Sales Tax Subtotal		[redacted]			
38	DOWNSTREAM COMPRESSION MATERIAL					
39	EMD Driven Reciprocating Compressor Package, Ariel/CAT, 1,200 HP Rated	EACH				
	Suction Filter/Separator, c/w Instrumentation and Spares, Vendor TBD	EACH				
	Unit Blowdown Silencer, Vendor TBD	EACH				
	Suction Blowdown Silencer, Vendor TBD	EACH				
	Discharge Blowdown Silencer, Vendor TBD	EACH				
	Compressor Building, Rigid Frame, c/w 15-ton Crane, HVAC System	SQ. FT				
	All Pipes, Valves, & Fittings	LS				
	Medium Voltage Utility Cabinet	EACH				
	Medium Voltage Breaker	EACH				
	High Resistance Ground Cabinet	EACH				
	Lighting Equipment	LS				
	Cable Tray	LS				
	Power Cabling	LS				
	ESD Panel	EACH				
	RIO Panel	EACH				
	Station HMI	EACH				
	Control Cabling	LS				
	Compression Material Subtotal					
	Miscellaneous Small Diameter Pipe, Fittings, Equipment, and Instrumentation	%				
	Misc. Material Subtotal					
	Sales Tax	%				
	Sales Tax Subtotal					
40	FREIGHT					
41	Freight For Minor CS Materials	%				
42	Freight For Major CS Equipment & Buildings	%				
43	Freight Subtotal					
44	TOTAL MATERIAL AND FREIGHT COST					
45						
46	CONSTRUCTION					
47	Mob/Demob	LS				
48	Excavation	LS				
49	Prefabrication	LS				
50	Foundations	LS				
51	Field Installation	LS				
52	Testing & Drying	LS				
53	Field Coating	LS				
54	Building Install	LS				
55	Backfill	LS				
56	Restoration	LS				
57	Paving	LS				
58	Insulation Allowance	LS				
59	Electrical	LS				

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LINE NUM.	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT	COMMENTS
60	Valve Commissioning	LS	[redacted]			
61	Compression Commissioning & Start-Up	LS				
62	Field Engineering Support	MAN/HOUR				
63	Environmental Site Monitor	MAN/HOUR				
64	**TOTAL CONSTRUCTION COST**					
65						
66	**SURVEY SERVICES**					
67	**Preliminary Survey**					
68	Project Manager	HOUR				
69	PLS	HOUR				
70	Two Person Crew with GPS	DAY				
71	Data Processor	DAY				
72	Survey Supplies	EACH				
73	Per Diem	DAY				
74	Mob/Demob	EACH				
75	**Sub-Total Preliminary Survey**					
76	**Pre-Construction Staking**					
77	Project Manager	HOUR				
78	Survey Supervisor	DAY				
79	Two Person Crew with GPS	DAY				
80	Data Processing	DAY				
81	Survey Supplies	EACH				
82	Per Diem	DAY				
83	Mob/Demob	EACH				
84	**Sub-total Pre-Con Staking**					
85	**As-built Survey**					
86	Two Person Survey Crew, Day Rate	DAY				
87	**Sub-total As-built Survey**					
88	**TOTAL SURVEY SERVICES COST**					
89						
90	**LAND ACQUISITION ($ FROM GARRARD CO. PVA SYSTEM)**					
91	**Easements**					
92	**Easement & Workspace Subtotal**					
93	**TOTAL RIGHT-OF-WAY COST**					
94						
95	**ENVIRONMENTAL**					
96	**TOTAL ENVIRONMENTAL COST**					
97						
98	**GEOTECHNICAL SERVICES**					
99	Soil Borings	EACH				
100	Lab Test for SB's only	EACH				
101	Geotechnical Report Preparation	LS				
102	**TOTAL GEOTECHNICAL SERVICES COST**					
103						
104	**INSPECTION SERVICES**					

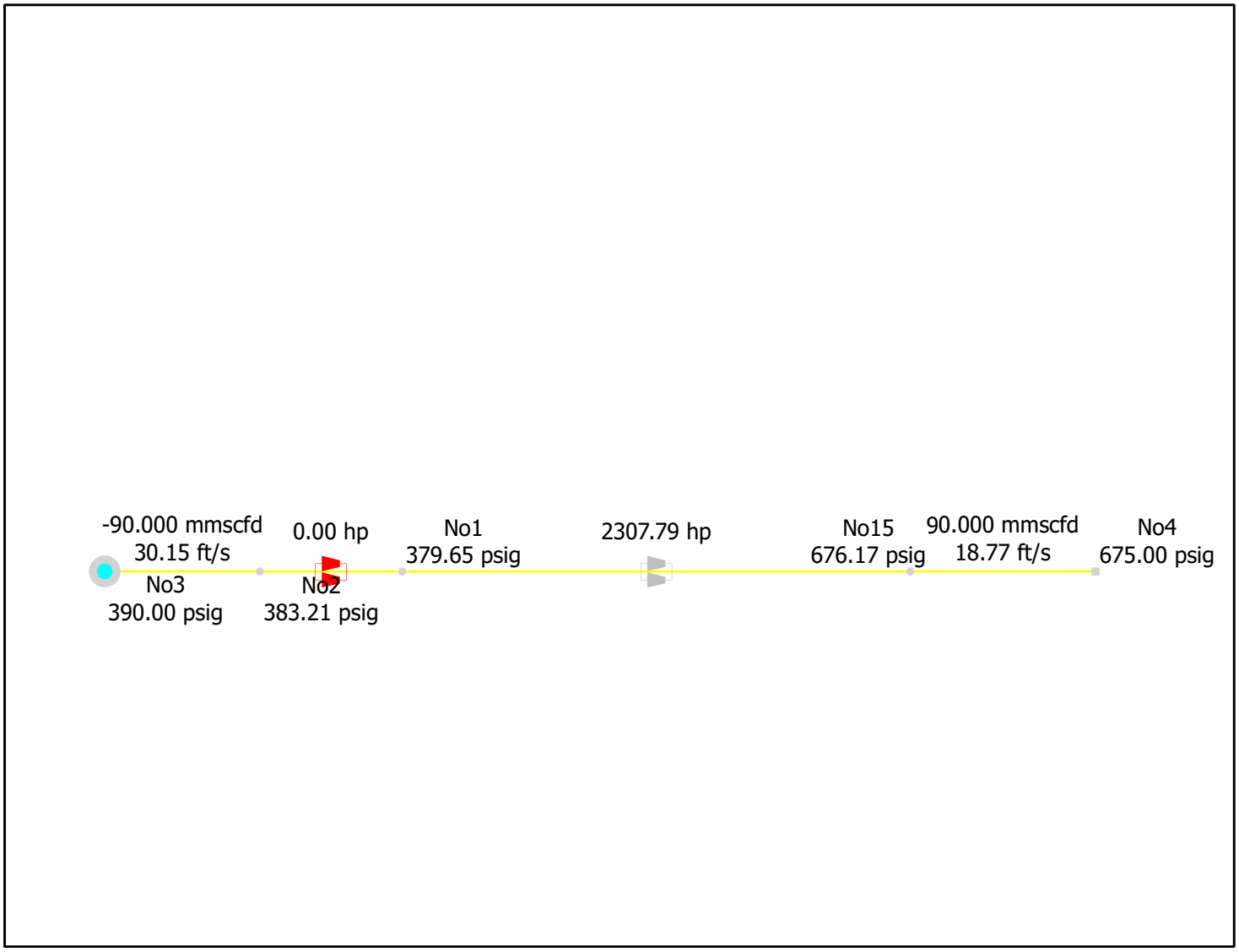
CONFIDENTIAL INFORMATION REDACTED

LINE NUM.	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT	COMMENTS
105	**Material Inspection Services**		[redacted]			
106	Valves, Hot Bends, Fittings, Etc.	MAN/WEEK				
107	**Material Inspection Services Subtotal**					
108	**Construction Inspection Services**					
109	Chief Inspector	MAN/WEEK				
110	Welding Inspector	MAN/WEEK				
111	Office Manager	MAN/WEEK				
112	Construction Office Expenses - Office Rental	MO				
113	Construction Office Expenses - Office Supplies	MO				
114	**Construction Inspection Services Subtotal**					
115	**TOTAL INSPECTION SERVICES COST**					
116						
117	**ENGINEERING SERVICES**					
118	Project/Design Management	HR				
119	Project Engineering	HR				
120	Construction Drafting w/ CADD Equipment	HR				
121	As-Built Drafting w/ CADD Equipment	HR				
122	Metallurgical Consulting	HR				
123	Project Controls Engineer	HR				
124	Misc. (Printing, FedEx, Travel etc.)	LS				
125	Noise Analysis	LS				
126	Thermal Stress Analysis	LS				
127	Acoustic & Mechanical Analysis	LS				
128	Arc Flash Study	LS				
129	**Engineering Subtotal**					
130	**TOTAL ENGINEERING SERVICES COST**				**$ 1,531,525.00**	
131						
132	**AFUDC**		0.5%	$ 27,271,840.70	**$ 136,360.00**	
133	**TOTAL PROJECT CONTINGENCY**		25.0%	$ 27,271,840.70	**$ 6,817,961.00**	
134						
135	**TOTAL PROJECT COST**				**$ 34,226,162**	

SECTION 5

ATTACHMENT #1
Synergi Hydraulic Data

Mill Creek FEED Study - Case 1A - 390 psig Interconnect



Legend

Facilities Symbols
- Default Pipe
- Default Compressor Station

Nodes Symbols
- Default Known Flow Node
- Default Known Pressure Node
- Default Known Node
- Default Supply Node

Polygons Symbols

Facilities Color By
Nodes Color By

Simulation Data:
State: Solved Feasible
Date: 8/2/2023
Time: 0.00

Model Description:

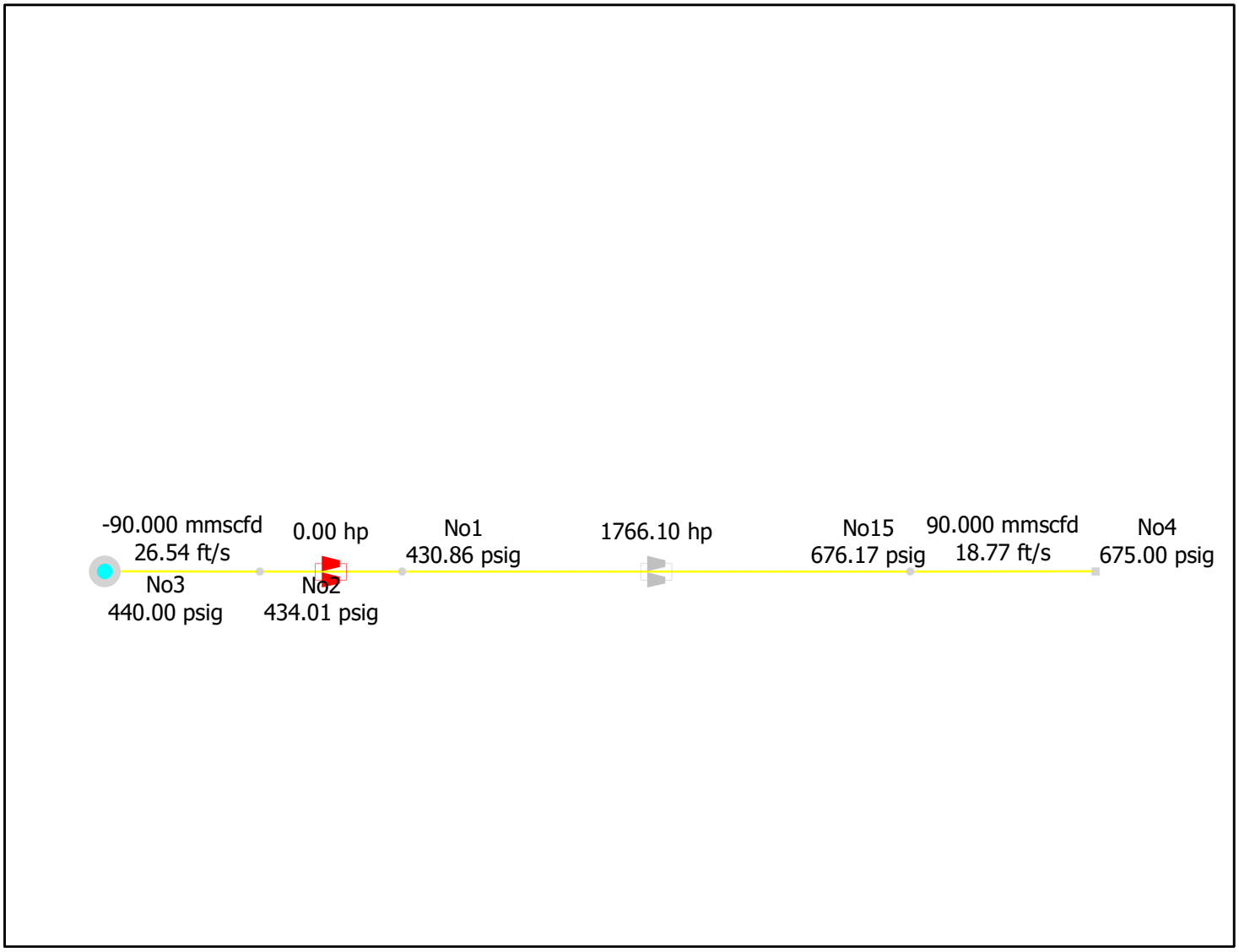
Model Name: Mill Creek 8-16

Model Coordinate System: NAD 1927 UTM Zone 18N

Synergi Gas 4.9.3 (28 Jul 2020)

9/6/2023 11:57:23 AM

Mill Creek FEED Study - Case 1A - 440 psig Interconnect



Legend

Facilities Symbols
- Default Pipe
- Default Compressor Station

Nodes Symbols
- Default Known Flow Node
- Default Known Pressure Node
- Default Known Node
- Default Supply Node

Polygons Symbols

Facilities Color By
Nodes Color By

Simulation Data:
State: Solved Feasible
Date: 8/2/2023
Time: 0.00

Model Description:

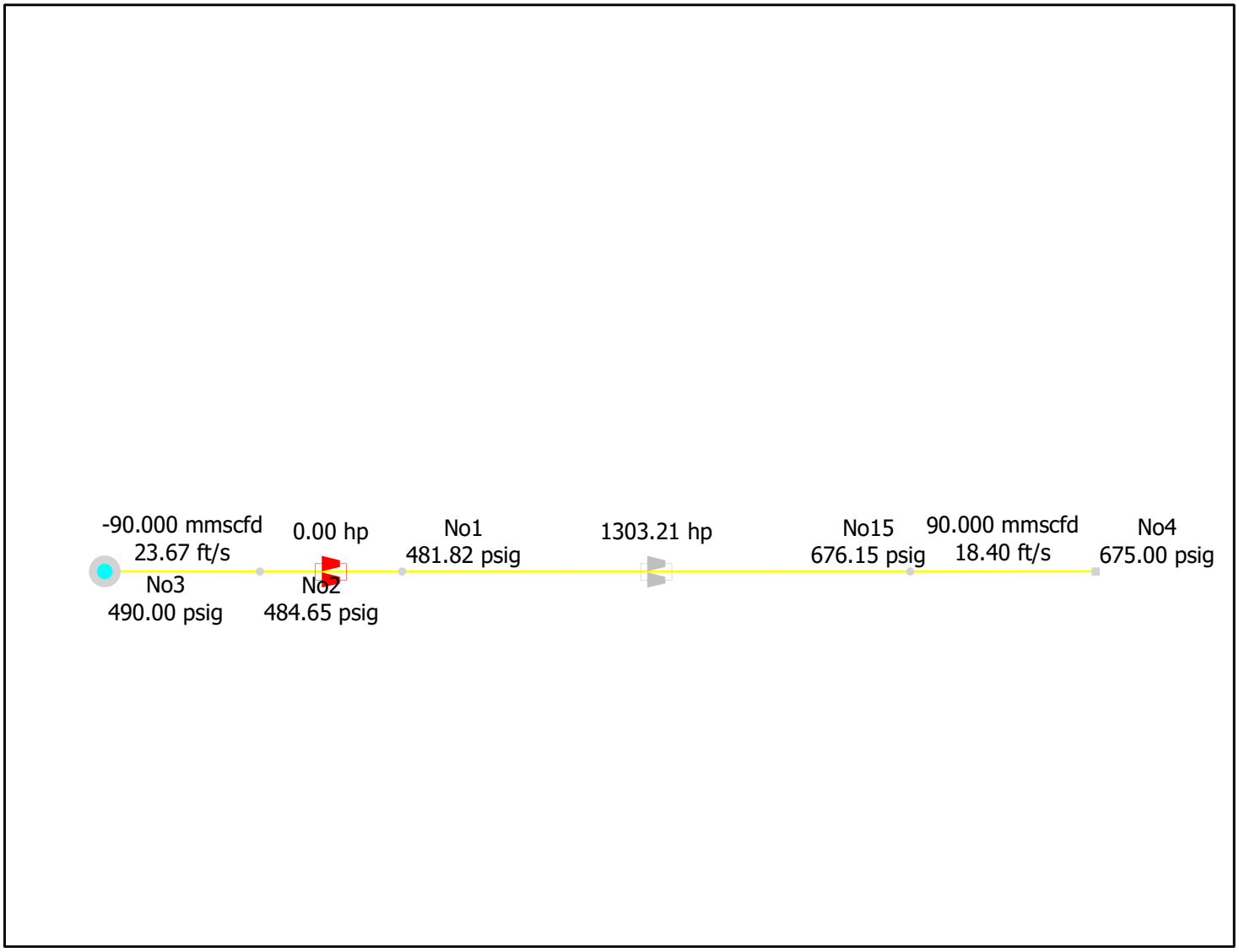
Model Name: Mill Creek 8-16

Model Coordinate System: NAD 1927 UTM Zone 18N

Synergi Gas 4.9.3 (28 Jul 2020)

9/6/2023 11:58:47 AM

Mill Creek FEED Study - Case 1A - 490 psig Interconnect



Legend

Facilities Symbols
- Default Pipe
- Default Compressor Station

Nodes Symbols
- Default Known Flow Node
- Default Known Pressure Node
- Default Known Node
- Default Supply Node

Polygons Symbols

Facilities Color By
Nodes Color By

Simulation Data:
State: Solved Feasible
Date: 8/2/2023
Time: 0.00

Model Description:

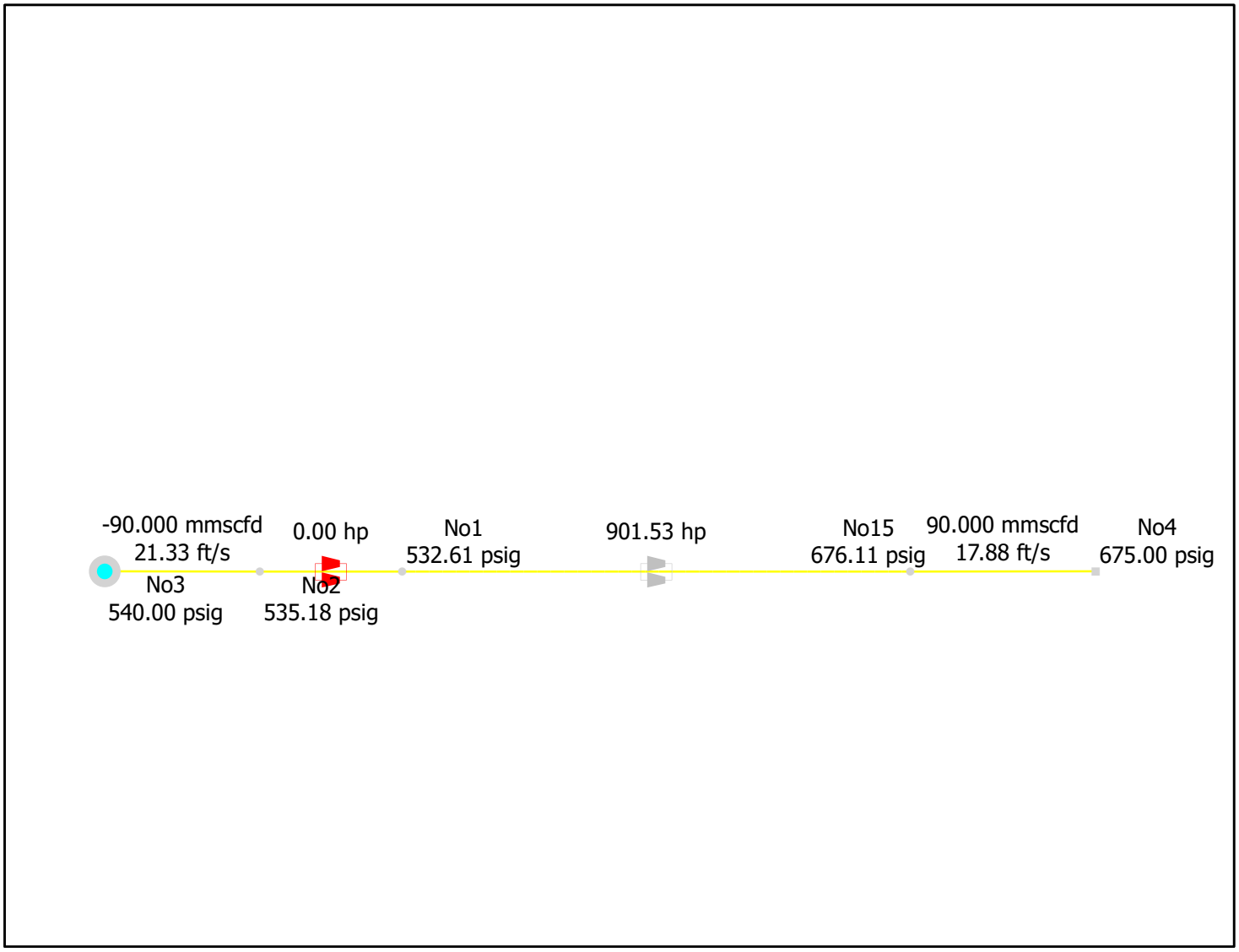
Model Name: Mill Creek 8-16

Model Coordinate System: NAD 1927 UTM Zone 18N

Synergi Gas 4.9.3 (28 Jul 2020)

9/6/2023 11:59:14 AM

Mill Creek FEED Study - Case 1A - 540 psig Interconnect



Legend

Facilities Symbols
- Default Pipe
- Default Compressor Station

Nodes Symbols
- Default Known Flow Node
- Default Known Pressure Node
- Default Known Node
- Default Supply Node

Polygons Symbols

Facilities Color By
Nodes Color By

Simulation Data:
State: Solved Feasible
Date: 8/2/2023
Time: 0.00

Model Description:

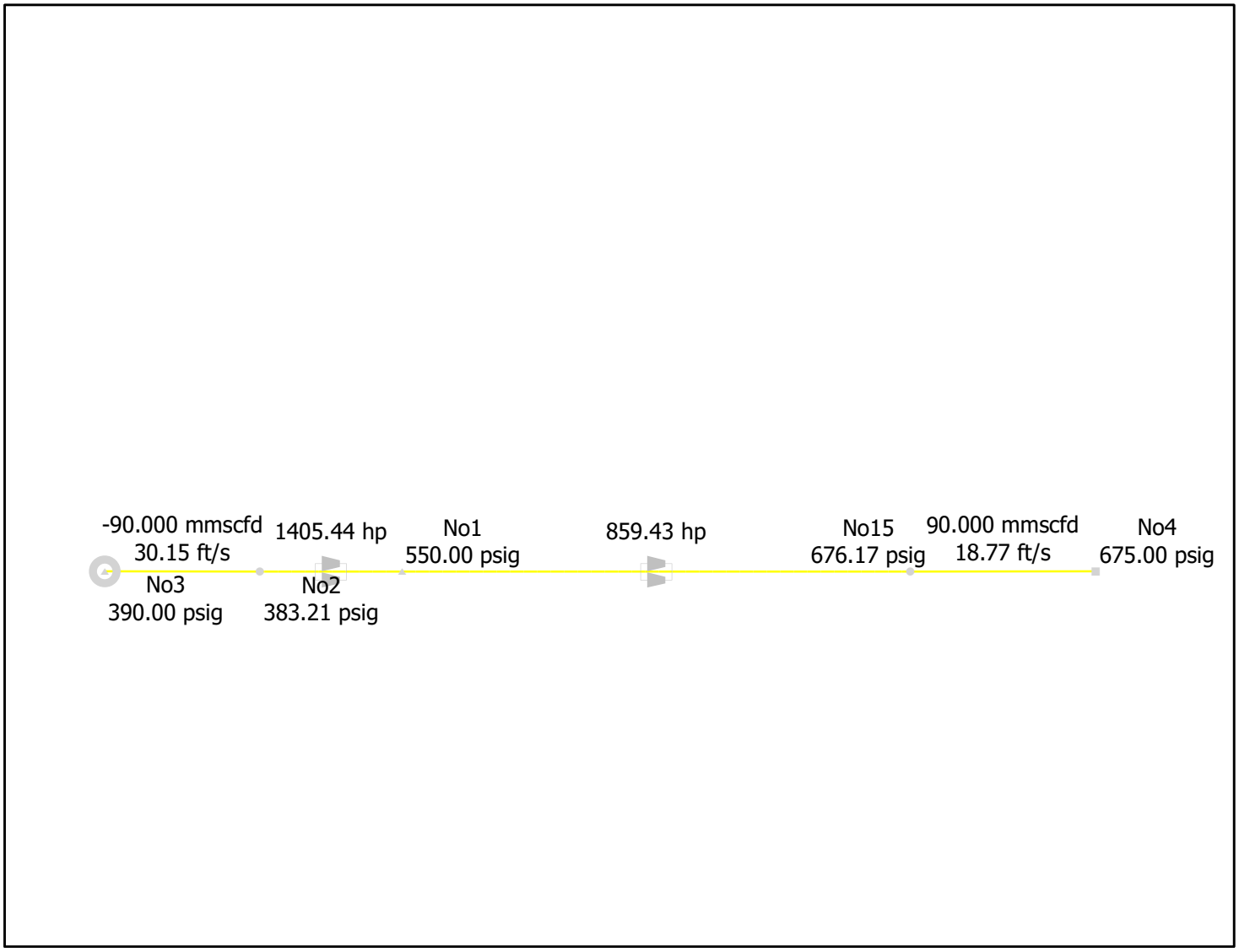
Model Name: Mill Creek 8-16

Model Coordinate System: NAD 1927 UTM Zone 18N

Synergi Gas 4.9.3 (28 Jul 2020)

9/6/2023 11:59:38 AM

Mill Creek FEED Study - Case 2A - 390 psig Interconnect



Legend

Facilities Symbols
- Default Pipe
- Default Compressor Station

Nodes Symbols
- Default Known Flow Node
- Default Known Pressure Node
- Default Known Node
- Default Supply Node

Polygons Symbols

Facilities Color By
Nodes Color By

Simulation Data:
State: Solved Feasible
Date: 8/2/2023
Time: 0.00

Model Description:

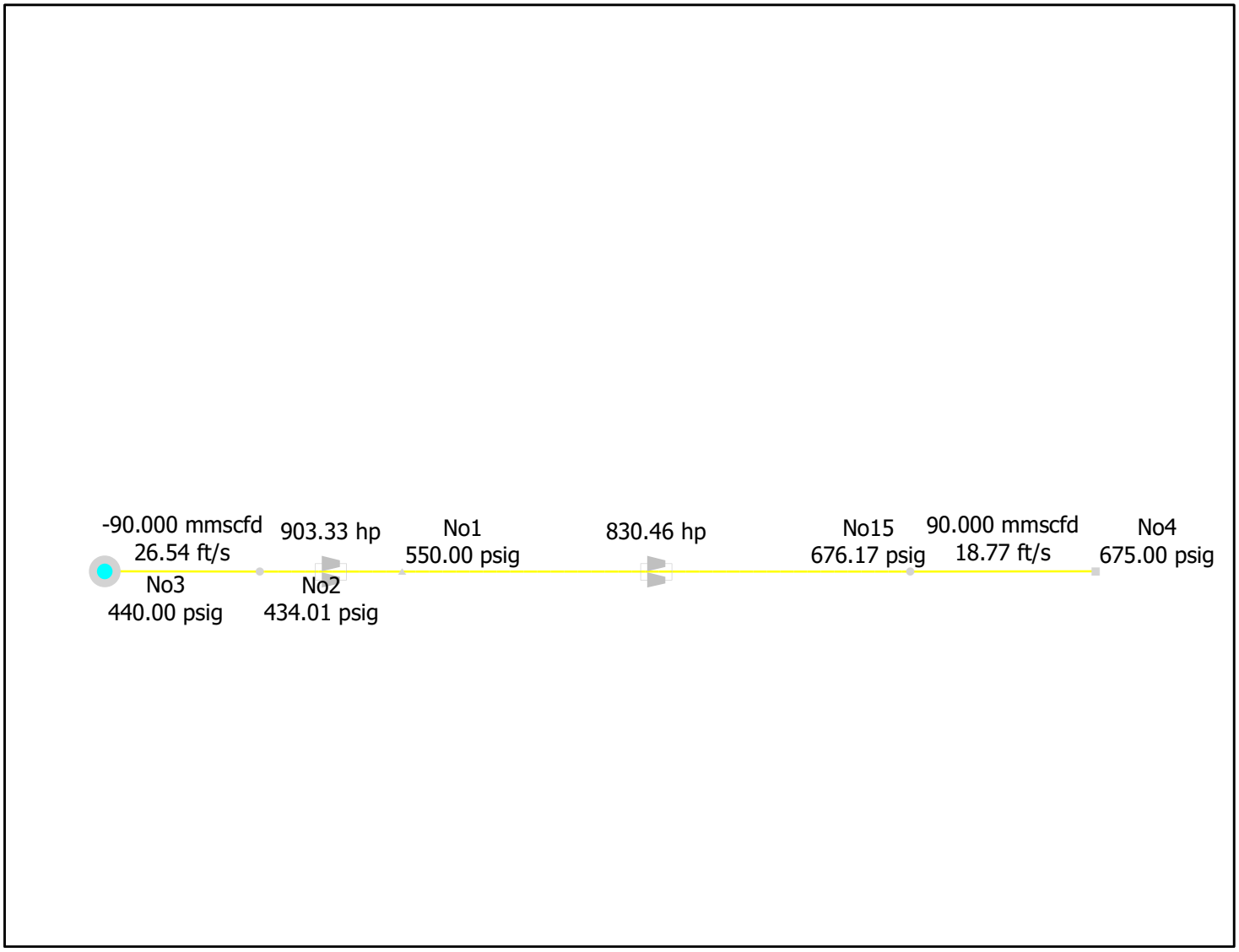
Model Name: Mill Creek 8-16

Model Coordinate System: NAD 1927 UTM Zone 18N

Synergi Gas 4.9.3 (28 Jul 2020)

9/6/2023 11:51:44 AM

Mill Creek FEED Study - Case 2A - 440 psig Interconnect



Legend

Facilities Symbols
- Default Pipe
- Default Compressor Station

Nodes Symbols
- Default Known Flow Node
- Default Known Pressure Node
- Default Known Node
- Default Supply Node

Polygons Symbols

Facilities Color By
Nodes Color By

Simulation Data:
State: Solved Feasible
Date: 8/2/2023
Time: 0.00

Model Description:

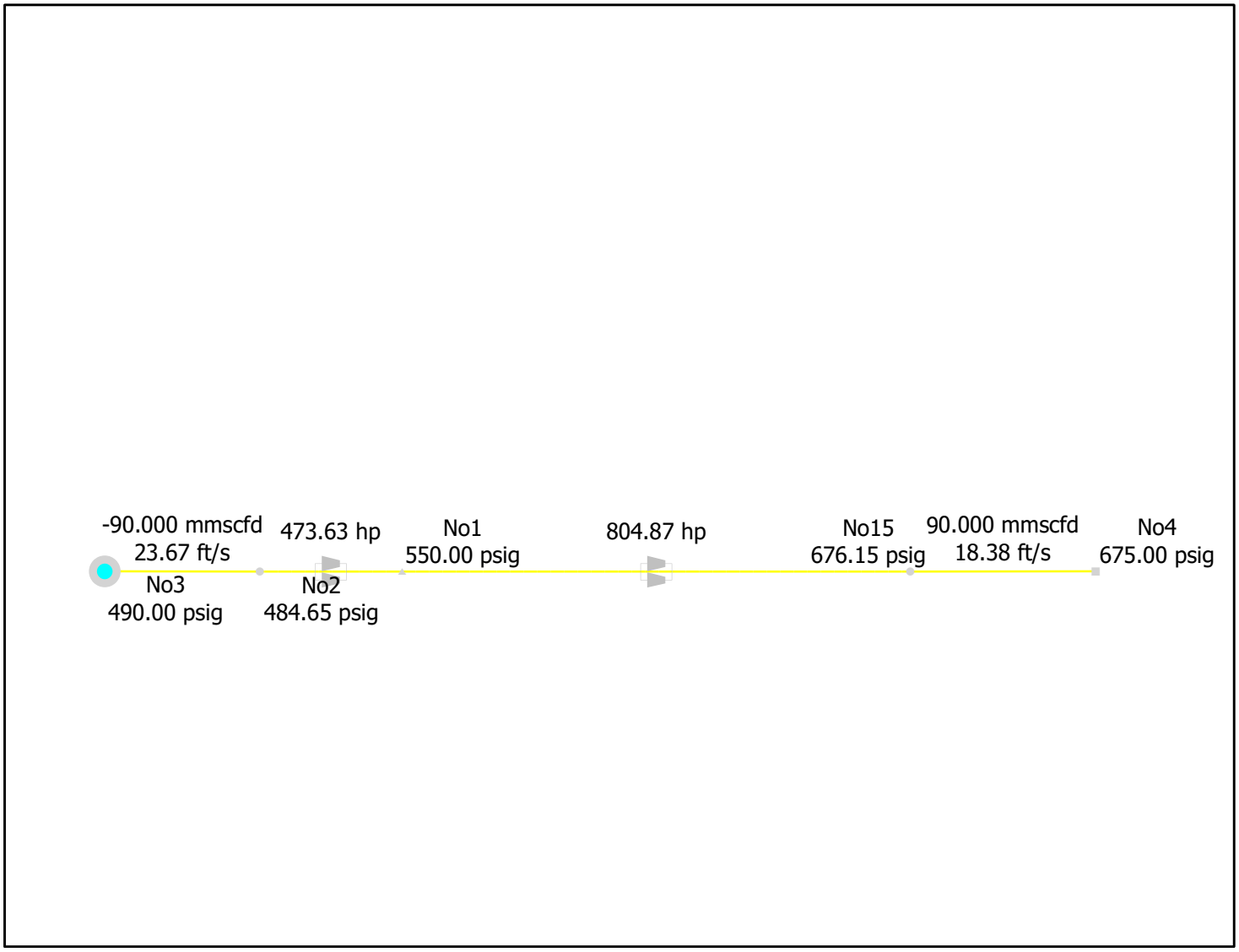
Model Name: Mill Creek 8-16

Model Coordinate System: NAD 1927 UTM Zone 18N

Synergi Gas 4.9.3 (28 Jul 2020)

9/6/2023 11:53:43 AM

Mill Creek FEED Study - Case 2A - 490 psig Interconnect



Legend

Facilities Symbols
- Default Pipe
- Default Compressor Station

Nodes Symbols
- Default Known Flow Node
- Default Known Pressure Node
- Default Known Node
- Default Supply Node

Polygons Symbols

Facilities Color By
Nodes Color By

Simulation Data:
State: Solved Feasible
Date: 8/2/2023
Time: 0.00

Model Description:

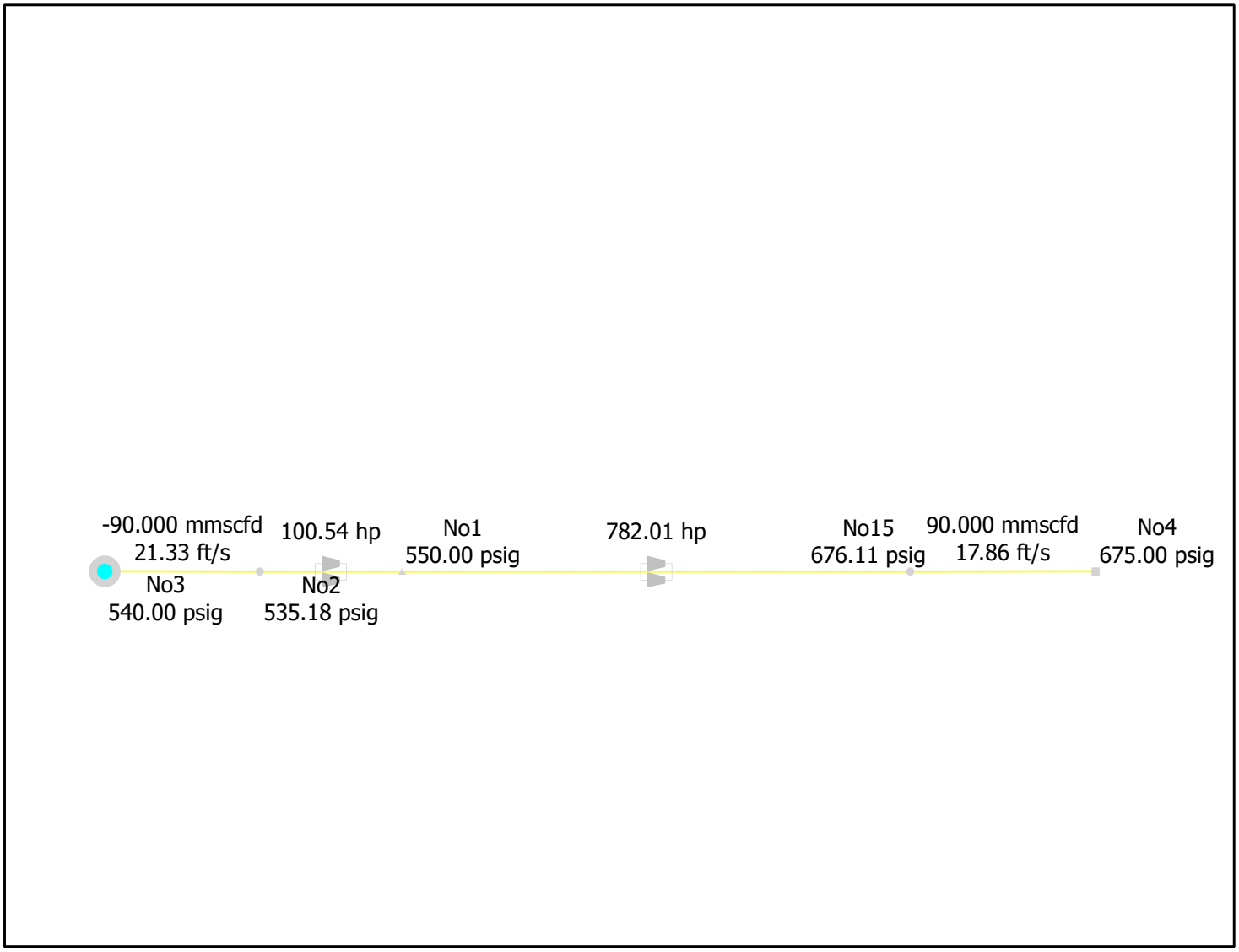
Model Name: Mill Creek 8-16

Model Coordinate System: NAD 1927 UTM Zone 18N

Synergi Gas 4.9.3 (28 Jul 2020)

9/6/2023 11:54:19 AM

Mill Creek FEED Study - Case 2A - 540 psig Interconnect



Legend

Facilities Symbols
- Default Pipe
- Default Compressor Station

Nodes Symbols
- Default Known Flow Node
- Default Known Pressure Node
- Default Known Node
- Default Supply Node

Polygons Symbols

Facilities Color By
Nodes Color By

Simulation Data:
State: Solved Feasible
Date: 8/2/2023
Time: 0.00

Model Description:

Model Name: Mill Creek 8-16

Model Coordinate System: NAD 1927 UTM Zone 18N

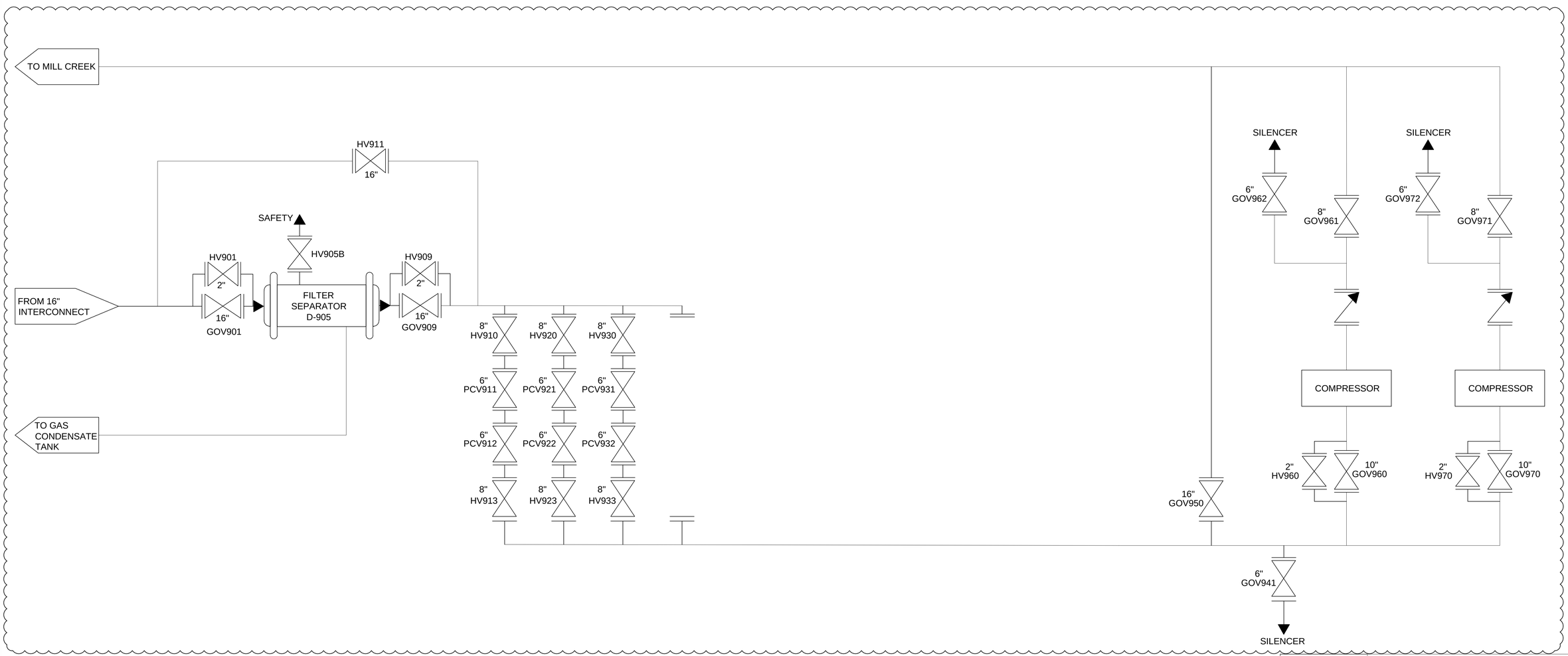
Synergi Gas 4.9.3 (28 Jul 2020)

9/6/2023 11:55:08 AM

					Compression Power										Suction Temperature		
Case		Active Compressors			HP				Inlet Flow Rate	Interconnect Outlet Pressure	Unit 1 Suction Pressure	Unit 2 Suction Pressure	Unit 3 Suction Pressure	Unit 1 Discharge Pressure	°F		
-		Unit 1	Unit 2	Unit 3	Unit 1	Unit 2	Unit 3	TOTAL	MMSCFD	PSIG	PSIG	PSIG	PSIG	PSIG	Unit 1	Unit 2	Unit 3
1	A	X	-	-	2308	-	-	2308	90	390	380	-	-	676	69	-	-
					1766	-	-	1766	90	440	431	-	-	676	69	-	-
					1303	-	-	1303	90	490	482	-	-	676	69	-	-
					902	-	-	902	90	540	533	-	-	676	69	-	-
2	A	X	-	X	859	-	1405	2265	90	390	550	-	383	676	114	-	69
					830	-	903	1733	90	440	550	-	434	676	98	-	69
					805	-	474	1279	90	490	550	-	485	676	85	-	69
					782	-	101	883	90	540	550	-	535	676	73	-	69

ATTACHMENT #2
System PFDs

MILL CREEK COMPRESSOR STATION INSTALL CASE 1



REVISIONS			
Rev.	Drawn Date	Drawn By:	Revision Made

Title
MILL CREEK PROPOSED FACILITIES – CASE 1 SIMPLIFIED DRAWING

Location and Unit:
KENTUCKY UTILITIES GENERATING STATION

Scale: None
Drawn:
Date:
Checked:
Approved:

Kentucky Utilities Company
a PPL company

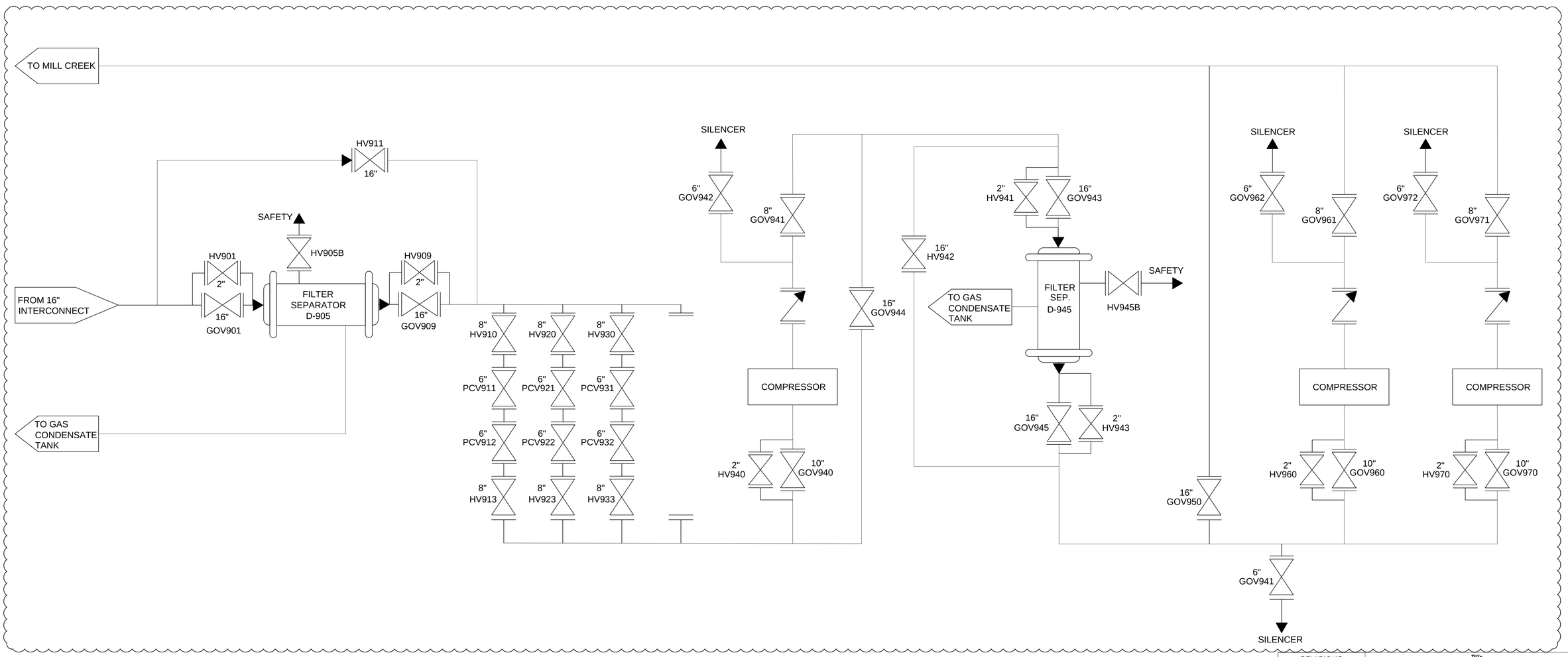
JOB NO. JOB NO. JOB NO. JOB NO.

Drawing No: FIGURE 1.1

Rev.

DMS Version 2.0

MILL CREEK COMPRESSOR STATION INSTALL CASE 2



REVISIONS			
Rev.	Drawn Date	Drawn By:	Revision Made

Title

MILL CREEK PROPOSED FACILITIES – CASE 2 SIMPLIFIED DRAWING

Location and Unit:
KENTUCKY UTILITIES GENERATING STATION

Scale: None
Drawn:
Date:
Checked:
Approved:

JOB NO. JOB NO. JOB NO. JOB NO.

Kentucky Utilities Company
a PPL company

Drawing No: FIGURE 1.2

Rev.

DMS Version 2.0

ATTACHMENT #3
Mill Creek Facility Exhibits

CONFIDENTIAL INFORMATION REDACTED

[redacted]

NO.	DATE	BY	PROJECT I.D.	DATE	BY	DESCRIPTION	ENGR.	DATE	BY
A	09/05/23	EN				ISSUED FOR REVIEW	SK	09/05/23	MW
	ISSUED			AS BUILT			APPROVED		

REVISIONS

NO.	DATE	BY	PROJECT I.D.	DATE	BY	DESCRIPTION	ENGR.	DATE	BY
	ISSUED			AS BUILT			APPROVED		

REVISIONS

ENengineering
28100 TORCH PARKWAY
WARRENVILLE, IL 60555
TEL. 630.353.4000
FAX 630.353.7777
WWW.ENENGINEERING.COM

TITLE

REFERENCE DRAWINGS

LG&E LOUISVILLE GAS & ELECTRIC

ISSUED FOR BID

ISSUED FOR CONSTRUCTION

PROJ. NO. 2313635

DRAWING SIZE D

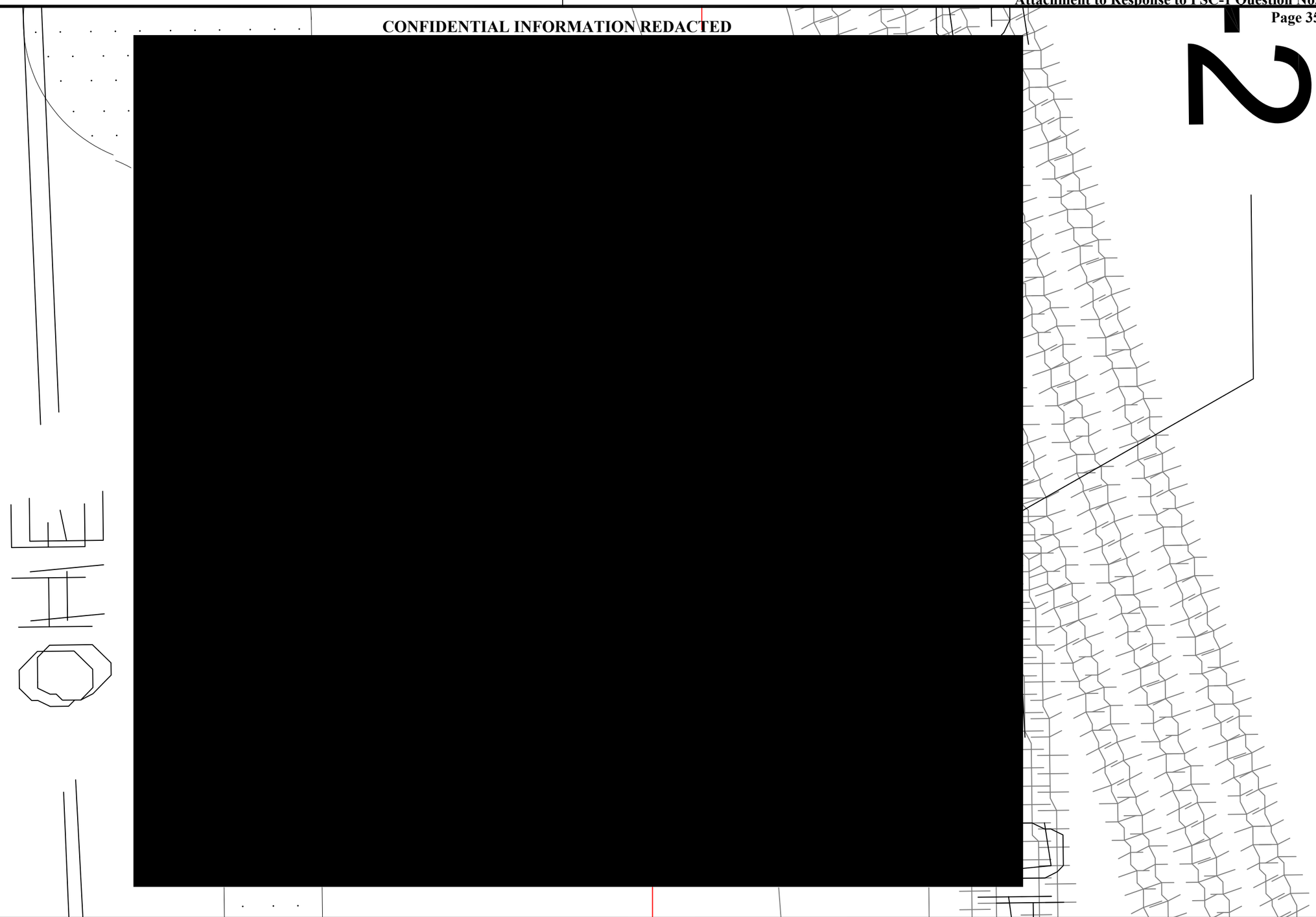
MILL CREEK
2023 COMPRESSION FEED EXHIBIT

MEADE COUNTY KY

DRAWN	CHK. DR.	SCALE	DATE
SK	MW	AS NOTED	07/31/23
PROJECT ENGR.	PROJECT MGR.	FILE NO.	
SK	MW	LGE-MC-001	

1 OF 1

CONFIDENTIAL INFORMATION REDACTED



NO.	DATE	BY	PROJECT I.D.	DATE	BY	DESCRIPTION	ENGR.	DATE	BY
	ISSUED			AS BUILT			APPROVED		
A	08/15/23	EN				ISSUED FOR REVIEW	SK	09/05/23	MW

REVISIONS

NO.	DATE	BY	PROJECT I.D.	DATE	BY	DESCRIPTION	ENGR.	DATE	BY
	ISSUED			AS BUILT			APPROVED		

REVISIONS

ENengineering
28100 TORCH PARKWAY
WARRENVILLE, IL 60555
TEL. 630.353.4000
FAX 630.353.7777
WWW.ENENGINEERING.COM

TITLE

REFERENCE DRAWINGS

LG&E LOUISVILLE GAS & ELECTRIC

ISSUED FOR BID

ISSUED FOR CONSTRUCTION

PROJ. NO. 2313635

DRAWING SIZE D

MILL CREEK
2023 COMPRESSION FEED
EXHIBIT

MEADE COUNTY KY

DRAWN	CHK. DR.	SCALE	DATE
SK	MW	1/2" = 1'-0"	07/31/23
PROJECT ENGR.	PROJECT MGR.	FILE NO.	
SK	MW	LGE-MC-002	

1 OF 1