CITY OF HOPEWELL

Hopewell Regional Wastewater Treatment Facility
Alternative 4A-1 Light Phase 2 Improvements

Results of Value Engineering Concepts Evaluation

Hopewell Nutrient Partners

HDR ENGINEERING, INC.
5700 LAKE WRIGHT DRIVE, SUITE 300
NORFOLK, VA 23502

APRIL 30, 2014

HDR | ONE COMPANY *Many Solutions*℠

Memorandum

To: City of Hopewell	
From: HDR Engineering, Inc. Bill M'Coy, P.E.	Project: HRWTF Alternative 4A-1 Light Phase 2 Improvements
CC:	
Date: April 30, 2014	Job No: 216773

1.0 Background & Purpose

On April 1, 2014, Hopewell Nutrient Partners (HNP) was presented with 13 value engineering concepts by the City to evaluate. HNP evaluated each of these concepts and submitted the results to the City and a meeting was held with the City on April 30, 2014 to review and select concepts for implementation. Based on this review, eight concepts were selected for implementation. This results memorandum is intended to document these eight concepts as amendments to the scope of work and concept design presented in Exhibit A of the Comprehensive Agreement.

2.0 Selected Value Engineering Concepts

The following value engineering concepts have been selected for inclusion in the scope of work for the Alternative 4A-1 Light Phase 2 Improvements. Attached is a description of the scope and design basis for each concept.

Concept No.	Description
GR-1	Relocate Flow Control Valves
E1-A	Electrical System Redundancy
E1-B	Power Monitoring Improvements
MB-1	Changes to Recycle Pumps for MBBR
MB-10	Review Blower Design/Turndown
MI-3	Delete Building Structure over Pump Room
XX	Change Blower CS Air Pipe to 304SS Air Piping
YY	Change Sodium Hydroxide Storage Tanks to Carbon Steel Material (Insulated and HT)

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HRWTF Alternative 4A-1 Light Phase 2
Value Engineering Study Responses

Alternative No.: GR-1
Description: **Relocate Flow Control Valves**

Hopewell Nutrient Partners

Discussion of Design Base Changes:

The current design proposed by HNP has the flow control valves located on the plant site as depicted on Drawing C-33 rev 3 entitled "Yard Piping Plan 1". Flow control valves will control Honeywell flow diversion between the new segregated MBBR treatment system and the existing Industrial headworks. A fine screen is provided to protect the MBBR treatment system. This VE alternative proposes relocating the flow control valve to a location off site in the area near the connection of RockTenn flow into the North Interceptor. The Honeywell flow will connect to the domestic influent line near Hummel Ross Road and to the North Interceptor near the Rock Tenn connection.

Scope Reductions:

1) Delete section of 28" HDPE carrying Honeywell flow from Hummel Ross Road to the terminus at the plant site.
2) Delete the MBBR influent fine screens and the associated channels, washer/compactor, etc.
3) Delete the sodium bisulfite storage and feed facility

Scope Additions:

1) Add connection of the 28" HDPE carrying Honeywell flow into the domestic influent line near Hummel Ross Road.
2) Add power/control conduit and cable from regional plant to the flow control station located near the RockTenn connection.
3) Add 0.47 MG chlorine contact.
4) Add 750kW standby generator for the MBBR Influent Pump Station.
5) Modify the existing hypo feed system to feed into the new contact tank.

Other Notes:

Under this alternative, Honeywell flow will have to be diverted to the industrial treatment side during peak domestic flows as influent flows approach the 2040 design basis based on the hydraulic capacity of the existing Domestic PTF. The hydraulic capacity under this alternative would be 29 mgd, which is the capacity of a single mechanical screen (assumes one mechanical screen out of service and no flow allowed through bar screen since MBBR must be protected). Impacts will be to the daily effluent ammonia concentration. At 2040 flows, the peak effluent ammonia concentration will increase 50% as compared to the Concept Design. See HDR's Memo on Process Evaluations for VE Concept GR-1 dated April 21, 2-14 for a discussion of this analysis. The alternative has the advantage of reducing chemical costs by eliminating dechlorination and reducing the chlorine demand by disinfecting segregated treatment effluent instead of primary effluent. The estimated cost savings will be $480,000 per year at startup flows and $940,000 per year at 2040 flows for an average cost increase of $707,600 per year over the life of the project. See HDR's Memo on Process Evaluations for VE Concept GR-1 dated April 21, 2-14 for a discussion of this analysis.

Incorporating the VE Comment GR-1 requires the following changes to the Concept Design:
1) A new Chlorine Contact Tank (CCT) would be constructed downstream of the DAFs and upstream of the Primary Clarifier Effluent Channel. The CCT would consist of two rectangular tanks measuring 260-feet long by 10-feet wide with a 12-foot side water depth.
2) Adding the new CCTs downstream of the DAFs requires the DAF effluent line to be upsized from 36-inch to 42-inch to offset the additional headloss through the CCTs. In addition, the line from the new CCTs to the Primary Clarifier Effluent Channel will be 42-inch.
3) The new CCTs will be located north of the MBBR PS. This requires the new plant access road to be moved to the northern side of the new CCT. However, grading for the plant access road requires that a new retaining wall be constructed around the Effluent Reaeration Structure. A retaining wall is sufficient for the anticipated 9-foot differential grading and would be approximately 250-linear feet. Railing would be needed around the Cast-in Place Concrete retaining wall

retaining wall.

4) The Domestic Primary Clarifier Effluent Box intended to be used for the new 36-inch MBBR PS influent line can be reduced. Level control in the existing Domestic Chlorine Contact Tanks is not as critical since these tanks will no longer be used for disinfection. Instead, the new MBBR PS influent line can connect to the existing 36-inch penetration with blind flange located at the northern end of the Primary Clarifier Effluent Channel. This penetration/blind flange was installed as part of the original plant construction. In addition, the 36-inch line should be upsized to 42-inch upstream of the MBBR PS to convey the increased design flow with the addition of the full Honeywell flow to this line.
5) The MBBR Influent line is upsized from 30-inch to 36-inch to convey the increased design flow with the addition of the full Honeywell flow to this line
6)

Flow Condition	Flow (mgd)	CL2 Dosage (mg/l)	CL2 Dose (lb/d)	HOCL Feed Rate (gpd)*	HOCL Feed Rate (gph)
Minimum Day	4.8	1.5	60	48	2.0
Design Average	19.7	10	1,643	1,314	55
Startup Average	9.0	10	751	600	25
Peak Day	33.6	15	4,203	3,363	140

*Based on 1.25 lbs CL2 per gallon HOCL

7) The existing Sodium Hypochlorite (SHC) Facility feed system has three 12,000 gallon storage tanks and four metering pumps with a capacity of 15.3 – 83.5 gph each. The existing system will be modified as follows:

a) A two-pump skid will be installed in parallel with the existing pump skid. Each diaphragm metering pump will have a capacity of 1-17.2 GPH. The skid dimensions are 75" wide x 30" deep x 60" high. Also included are two ProMinent Dulcometer DACa Controllers for automatic chlorine residual control including ORP sensors, signal converters, and cables. The proposed DACa Controllers match the existing controllers currently in use in the domestic chlorine contact tanks.

b) Two new double containment SHC feed lines need to be routed from the SHC Facility to the influent end of each CCT. Double containment piping system for each of the two feed lines consists of two (one active / one standby) 1-inch clear braded-reinforced PVC tubing as manufactured by Finger Lakes Extrusion contained in a 4-inch Schedule 80 CPVC pipe. The approximate length of each feed line is 650 linear feet and a precast chemical monitoring manhole is to be located every 100-feet for a total of 7 for each line (14 total for both lines). The precast monitoring manholes are 4-foot in diameter by approximately 4-foot in height and shall have a 30"x30" square aluminum access hatch.

c) To provide effective mixing of the sodium hypochlorite into the DAF effluent flow, two chemical induction mixers will be installed, one at the head of each tank. The mixers will be (2) Evoqua (Siemens) WT WaterChamp Model SWC20F Water Champs, one to be mounted in each tank, 20 HP each with a 460/3/60 NEMA 4X control panel and motor protection device for each unit.

8) The Sodium Bisulfite Facility will be completely eliminated.
9) The MBBR Screening Facility will be completely eliminated.
10) A new 750kW standby generator is needed at the MBBR PS. This is required to ensure domestic flow is always being disinfected in the CCTs. The generator should be installed on a 2-foot thick concrete equipment pad.
11) The Gravely Run Flow Control (GRPS FCV) Structure can be relocated to near the RockTenn connection to the North Interceptor. The new dedicated GRPS discharge line to the DPTF would connect at the existing plug valve installed in Contract 1 that is located in Hummel Ross Road. In addition, a fiber optic line needs to be run from the HRWTF Admin Building to the GRPS FCV Structure. This is approximately 3,000 linear feet.
12) Additional pavement needs to be provided west of the MBBR PS in addition to the new road way to provide a parking area for a crane to access the MBBR PS pumps for removal/installation. There is significant impervious area for this parking area that may increase the BMP requirements.

Design services associated with VE Item GR-1: Additional design effort is based on the new chlorine contact tank and retaining wall, and includes associated design documents.

Alternative No.: GR-1
Description: **Relocate Flow Control Valves**

Hopewell Nutrient Partners

Cost Summary:

Item	Capital Cost	Annual O&M Cost	Net Present Worth Cost
Design services	$134,970.00		$134,970.00
Process equipment, civil, mechanical, electrical, & I&C	$721,847.00		$721,847.00
Chemical costs	-	($707,600.00)	($8,818,000.00)
TOTAL	$856,817.00	($707,600.00)	($7,961,183.00)

Recommendations:

This alternative has been accepted by the City.

HRWTF - Phase 2

Relocate FCV Structure to North Interceptor Near Rocktenn Connection

Make smooth transition back to existing road

New Road - 20'

Potential retaining wall or slope stabilization required.

DAF / Polymer Building

Sodium Hydroxide

Blower Building

Up size to 42" Diameter

Up size to 42" Diameter

Chlorine Contact Tank - Option 1

Up size to 36" Diameter

Reuse this tee and blind flange for the line going to the MBBR PS

MBBR IPS

Sodium Bisulfite will be eliminated

We will need to pave this area so that a crane can access this area to remove the MBBR pumps.

Up size to 36" Diameter

Upsize to 42" Diameter

MBBR

20'

Make appropriate site changes to route new road as follows.

GENERAL NOTES:
1. –

KEY NOTES:
(1) –

Chlorine Contact Tank - Option 1 (280' x 30')
Approximate Location

280'-4"

30'-0"

169'-4"

EFFLUENT REAERATION
OXYCHARGER
FES-A1
OCS-A2
FES-B1
GRAVELLY RUN TRAINING CENTER
GRAVEL ROAD
ASPHALT DRIVE
SUBMERSIBLE PUMP STATION
VALVE VAULT
MONITORING MANHOLE (TYP OF 3)
DOMESTIC PRIMARY CLARIFIER NO. 1
DOMESTIC PRIMARY CLARIFIER NO. 2
DOMESTIC PRIMARY CLARIFIER NO. 3
CHLORINE CONTACT TANK NO. 1
CHLORINE CONTACT TANK NO. 2
CHLORINE CONTACT TANK NO. 3
PRIMARY CLARIFIER EFFLUENT WEIR BOX
UNOX MODIFICATION
UNOX AERATION TANKS
SECONDARY CLARIFIER 1
SECONDARY CLARIFIER 2
SECONDARY CLARIFIER 3
MH-4
MH-5
TH-1 6" HAP
TH-2 42" CONC
TH 6" HAP
28" GRFM
36" DAFE
36" CCTE
60"-UNOX
6"-NPW
3" PW
3/4" PW
30" MBBRI
14" MBBRD
1-1/2" PW
1-1/2"-DEFOAM
1/2" DEFOAMER
48" CONC OUTFALL
3"-PCA
8" O2
2"-SHC (TYP OF 6)
2"-SSFM
4"-PW
6" HAP
6" NPW
3" NPW
2-1/2"-SPD
EHH
CHH
1-1/4" W
EL 43.00

MATCH LINE – SHEET C-33

MATCH LINE – SHEET C-35

MATCH LINE – SHEET C-36

ISSUE	DATE	DESCRIPTION
B	03/12/2014	REVISED EFF. BOX & FM
A	08/26/2013	CONCEPTUAL DESIGN SUBMITTAL

HDR Engineering, Inc.
5700 Lake Wright Dr.
Suite 300
Norfolk, VA 23502

PROJECT MANAGER:	WILLIAM S. M'COY
DESIGNED BY:	D. ZIRKLE
DRAWN BY:	T. LOKEY
CHECKED BY:	
PROJECT NUMBER	

CONCEPTUAL DESIGN

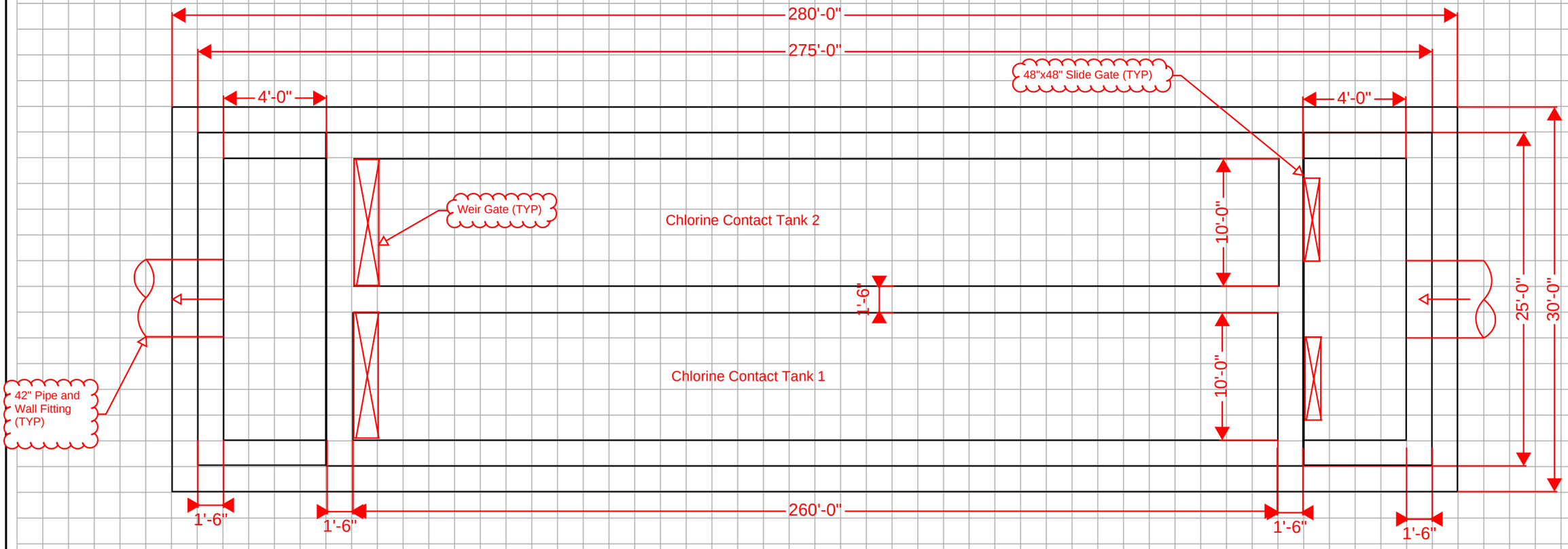
CITY OF HOPEWELL
HOPEWELL REGIONAL WASTEWATER TREATMENT FACILITY

ALTERNATIVE 4A-1 LIGHT
PHASE 2

YARD PIPING PLAN 2

0 1" 2"

FILENAME	C-34.dwg
SCALE	1"=20'
DRAWING NUMBER	C-34
SHEET	OF -



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ISSUE	DATE	DESCRIPTION

PROJECT MANAGER:	
DESIGNED BY:	
DRAWN BY:	
CHECKED BY:	
PROJECT NUMBER	70922

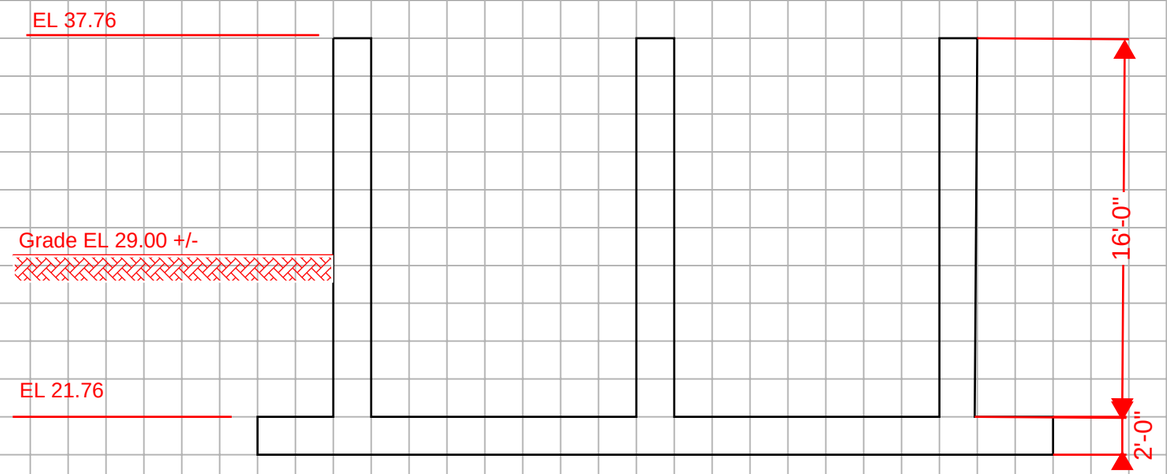
GR-1 - Chlorine Contact Tank - Option 1
Plan

0 1" 2"

FILENAME	
SCALE	

SHEET NUMBER

SHEET OF



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ISSUE	DATE	DESCRIPTION

PROJECT MANAGER:	
DESIGNED BY:	
DRAWN BY:	
CHECKED BY:	
PROJECT NUMBER	70922

GR-1 - Chlorine Contact Tank - Option 1
Section

0 1" 2"

FILENAME
SCALE

SHEET NUMBER

SHEET OF

HRWTF Alternative 4A-1 Light Phase 2
Value Engineering Study Responses

Alternative No. E1-A
Description: **Electrical System Redundancy**

Hopewell Nutrient Partners

Discussion of Design Base Changes:

The current proposed electrical design configuration does not include redundant electrical services to the critical electrical distribution and motor control equipment. This VE alternate recommends that a "main-tie-main" configuration for the new 5 kV switchgear and motor control centers to minimize single point of electrical failure.

Scope Reductions:

1) None.

Scope Additions:

1) Main Tie-Breaker Switch and appurtenances

Other Notes:

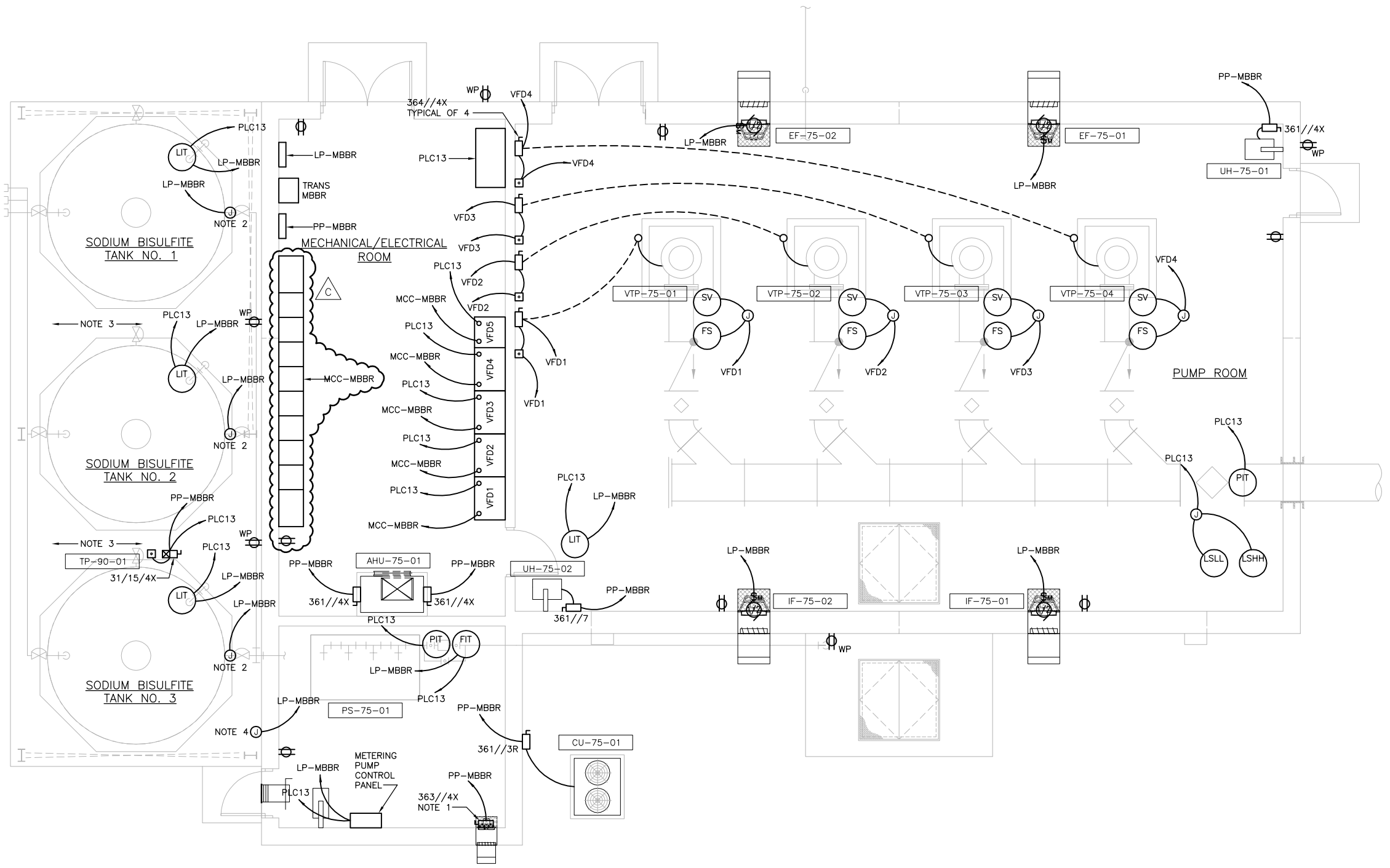
See attached drawings.

Cost Summary:

Item	Capital Cost	Annual O&M Cost	Net Present Worth Cost
Add Main Tie-Breaker Switch, associated appurtenances	$808,742.00		
TOTAL	$808,742.00		

Recommendations:

This alternative has been selected by the City.



SHEET NOTES:

1. WATER HEATER DISCONNECT. COORDINATE LOCATION AND VERIFY ELECTRICAL REQUIREMENTS WITH MANUFACTURER.
2. J-BOX FOR CONNECTION TO TANK HEAT TRACING. VERIFY ELECTRICAL REQUIREMENTS WITH MANUFACTURER.
3. STORAGE TANK AREA SHALL BE CONSIDERED A WET AREA. ALL ELECTRICAL EQUIPMENT, CONDUIT, ETC. AND ITS INSTALLATION SHALL MEET THIS AREA CLASSIFICATION.
4. J-BOX FOR CONNECTION TO EMERGENCY SHOWER/EYEWASH HEAT TRACING. COORDINATE LOCATION AND VERIFY ELECTRICAL REQUIREMENTS WITH MANUFACTURER.

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ISSUE	DATE	DESCRIPTION
C	04/18/2014	VE E-1A
B	09/20/2013	ADDED SODIUM BISULFITE PROCESS
A	08/26/2013	CONCEPTUAL DESIGN SUBMITTAL

PROJECT MANAGER:	WILLIAM S. M'COY
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DRAWN BY:	J. VAN TASSEL
CHECKED BY:	L. ANDERSON
PROJECT NUMBER	

CONCEPTUAL DESIGN

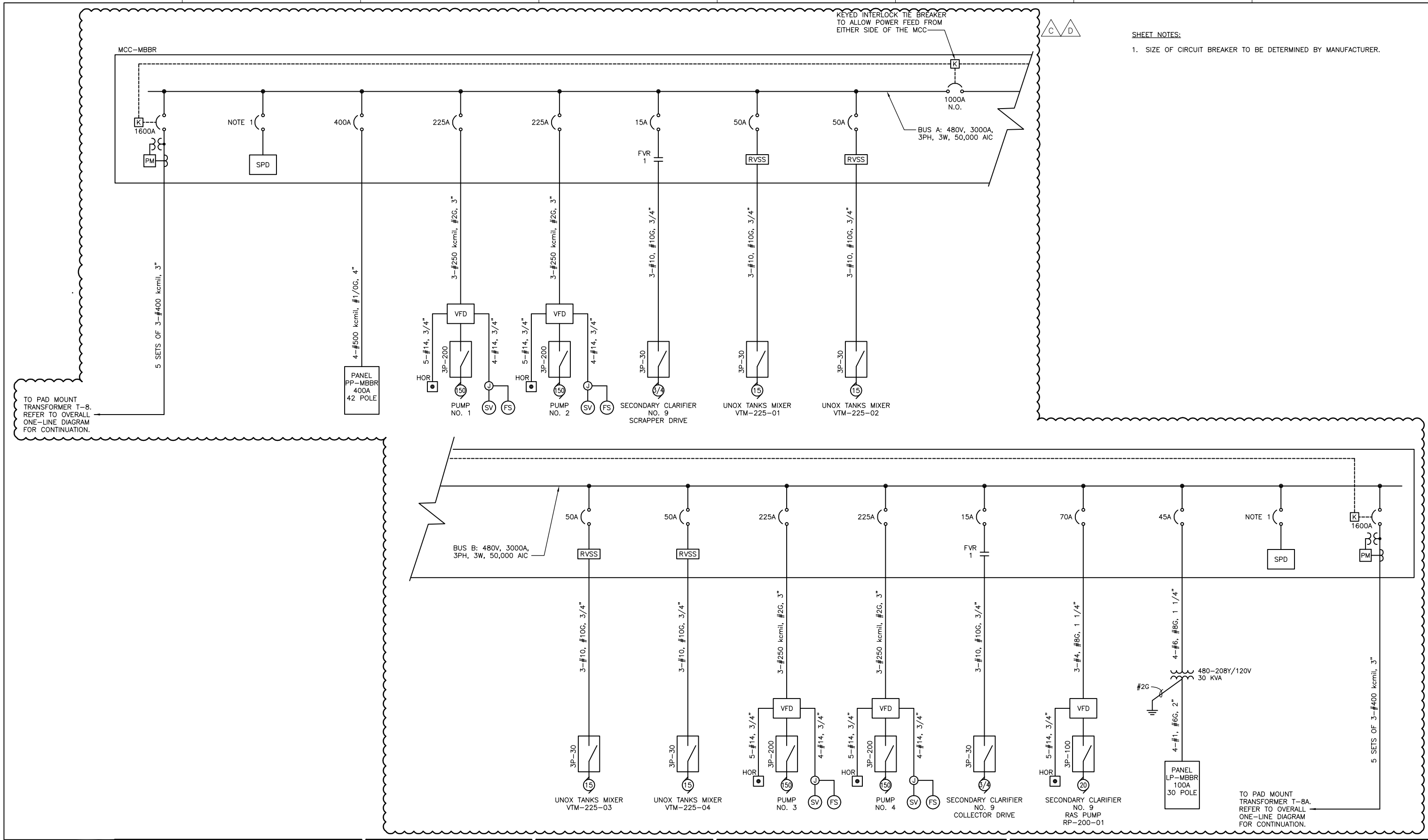
CITY OF HOPEWELL
HOPEWELL REGIONAL WASTEWATER TREATMENT FACILITY

ALTERNATIVE 4A-1 LIGHT
PHASE 2

MBBR INFLUENT PUMP STATION AND SODIUM BISULFITE FACILITY ELECTRICAL POWER PLAN

0 1" 2"

FILENAME	E-075.dwg
SCALE	1/4"=1'-0"
DRAWING NUMBER	E-75
SHEET	OF -



ISSUE	DATE	DESCRIPTION
D	04/18/2014	VE E–1A
C	03/12/2014	MIXER REVISION & VTP HP REVISION
B	09/20/2013	ADDED SODIUM BISULFITE PROCESS
A	08/26/2013	CONCEPTUAL DESIGN SUBMITTAL

HDR Engineering, Inc.
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PROJECT MANAGER:	WILLIAM S. M'COY
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CHECKED BY:	L. ANDERSON
PROJECT NUMBER	

CONCEPTUAL DESIGN

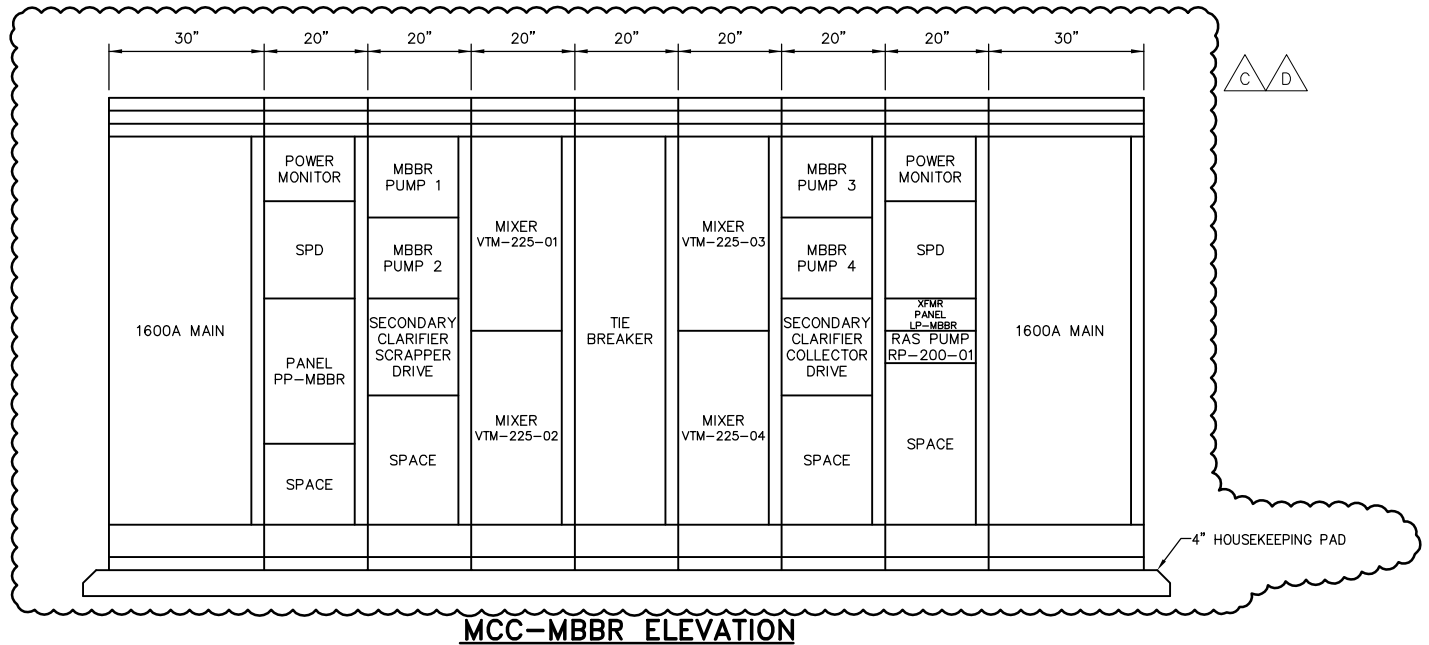
CITY OF HOPEWELL
HOPEWELL REGIONAL WASTEWATER TREATMENT FACILITY

ALTERNATIVE 4A-1 LIGHT
PHASE 2

MBBR INFLUENT PUMP STATION ELECTRICAL ONE-LINE DIAGRAM

0 1" 2"

FILENAME	E–077.dwg
SCALE	NONE
DRAWING NUMBER	E-77
SHEET	OF -



MCC-MBBR ELEVATION

NO SCALE

D	04/18/2014	VE E-1A
C	03/12/2014	MIXER REVISION
B	09/20/2013	ADDED SODIUM BISULFITE PROCESS
A	08/26/2013	CONCEPTUAL DESIGN SUBMITTAL
ISSUE	DATE	DESCRIPTION

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CONCEPTUAL DESIGN

CITY OF HOPEWELL
HOPEWELL REGIONAL WASTEWATER TREATMENT FACILITY

ALTERNATIVE 4A-1 LIGHT
PHASE 2

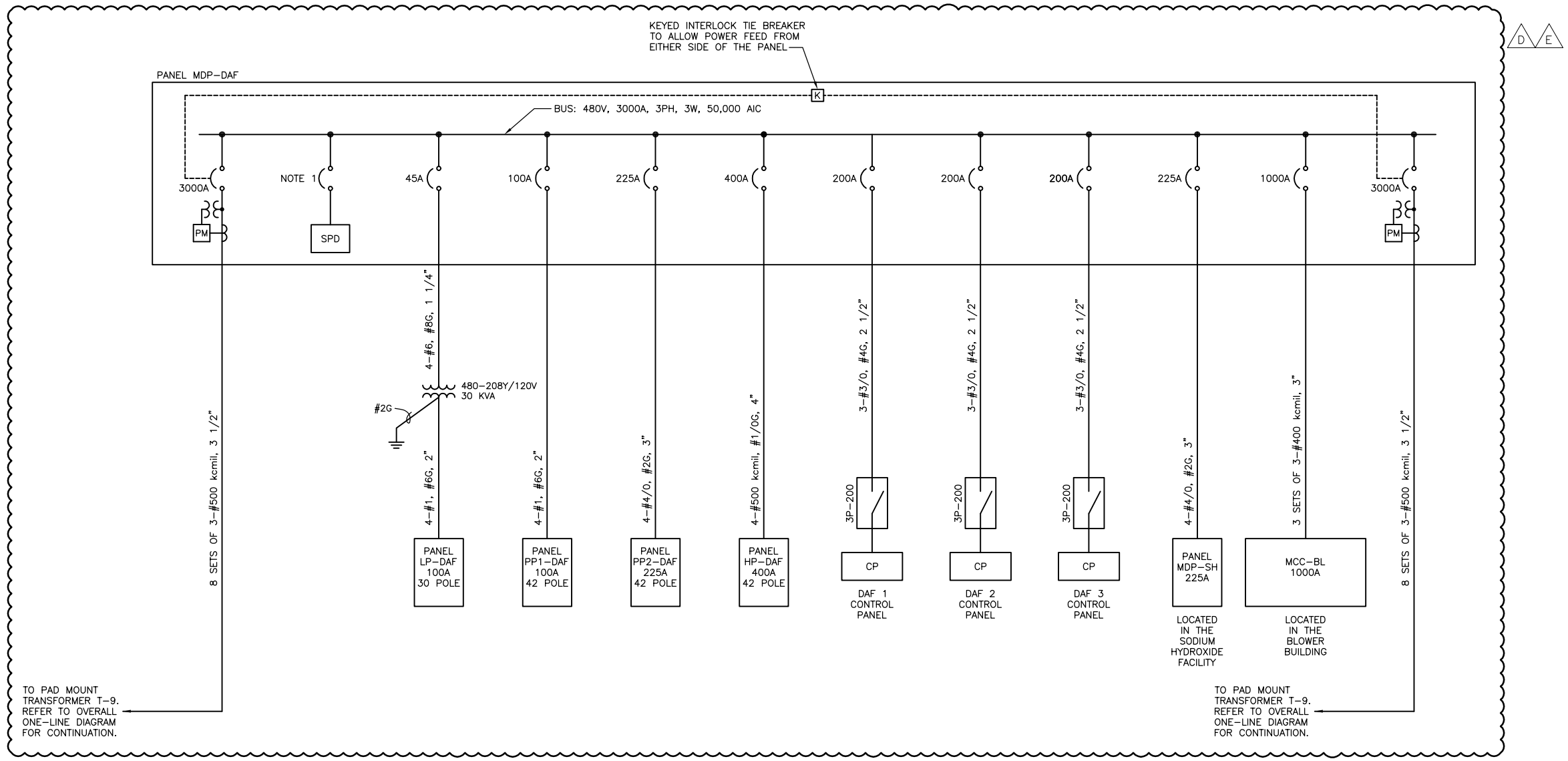
MBBR INFLUENT PUMP STATION
MCC-MBBR ELEVATION

0 1" 2"

FILENAME	E-078.dwg
SCALE	NONE
DRAWING NUMBER	E-78
SHEET	OF -

SHEET NOTES:

1. SIZE OF CIRCUIT BREAKER TO BE DETERMINED BY MANUFACTURER.



ISSUE	DATE	DESCRIPTION
E	04/18/2014	VE E–1A
D	03/12/2014	DAF NO. 4 DELETED
C	09/20/2013	ADDED BLOWER BUILDING FEED
B	08/26/2013	ADDED MOTORIZED VALVES
A	08/26/2013	CONCEPTUAL DESIGN SUBMITTAL

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PROJECT NUMBER	

CONCEPTUAL DESIGN

CITY OF HOPEWELL
HOPEWELL REGIONAL WASTEWATER TREATMENT FACILITY

ALTERNATIVE 4A-1 LIGHT
PHASE 2

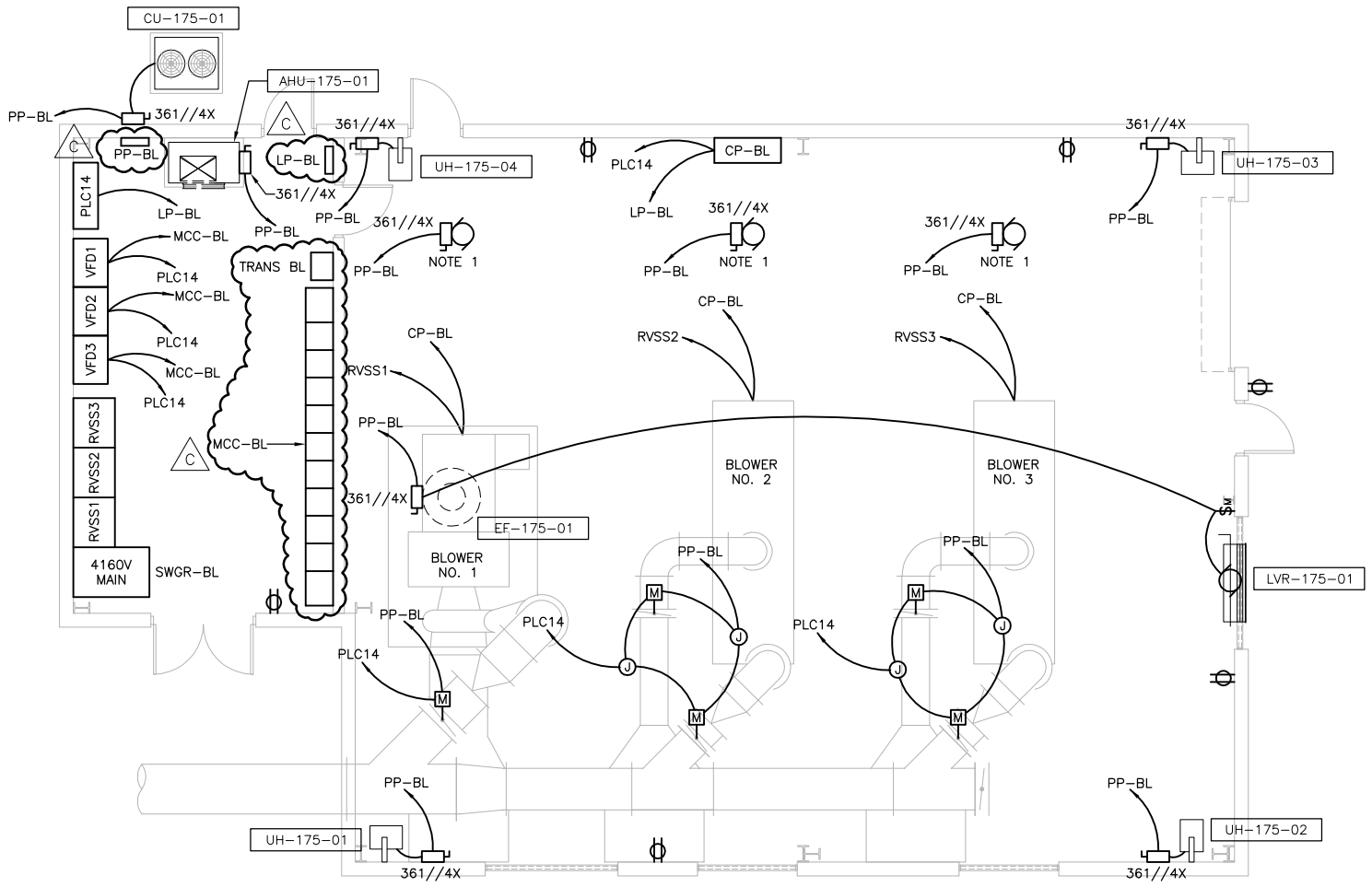
DAF BUILDING ELECTRICAL ONE-LINE DIAGRAM

0 1" 2"

FILENAME	E–129.dwg
SCALE	NONE
DRAWING NUMBER	E-129
SHEET	OF -

SHEET NOTES:

1. COORDINATE LOCATION AND ELECTRICAL REQUIREMENTS FOR MONORAIL, TYPICAL OF THREE.



PLAN

HDR Engineering, Inc.
5700 Lake Wright Dr.
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Norfolk, VA 23502

ISSUE	DATE	DESCRIPTION
C	04/18/2014	VE E-1A
B	09/20/2013	CONCEPTUAL DESIGN SUBMITTAL

PROJECT MANAGER:	WILLIAM S. M'COY
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PROJECT NUMBER	

CONCEPTUAL DESIGN

CITY OF HOPEWELL
HOPEWELL REGIONAL WASTEWATER TREATMENT FACILITY

ALTERNATIVE 4A-1 LIGHT PHASE 2

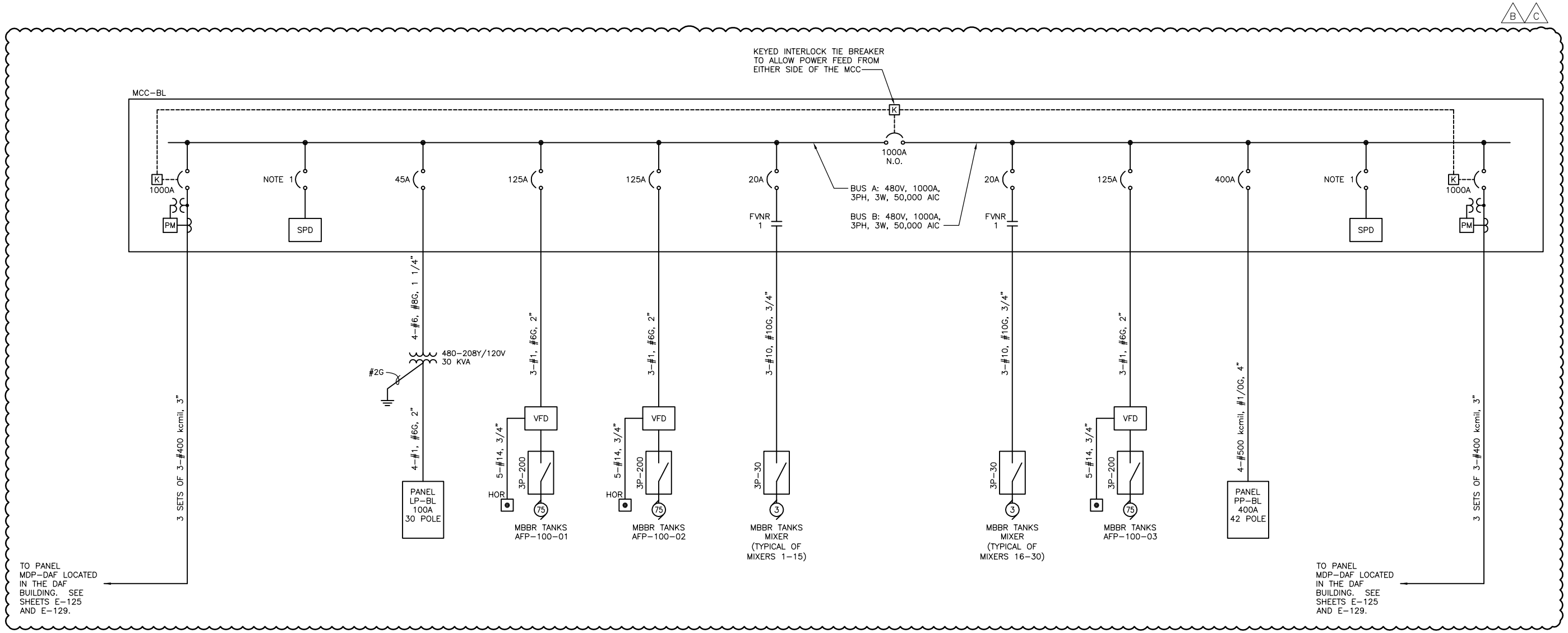
BLOWER BUILDING ELECTRICAL POWER PLAN

0 1" 2"

FILENAME	E-175.dwg
SCALE	3/16" = 1'-0"
DRAWING NUMBER	E-175
SHEET	OF -

SHEET NOTES:

1. SIZE OF CIRCUIT BREAKER TO BE DETERMINED BY MANUFACTURER.



HDR Engineering, Inc.
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ISSUE	DATE	DESCRIPTION
C	04/18/2014	VE E–1A
B	03/12/2014	VALVE AND MIXER REVISION FOR 5 TANKS
A	08/26/2013	CONCEPTUAL DESIGN SUBMITTAL

PROJECT MANAGER:	WILLIAM S. M'COY
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PROJECT NUMBER	

CONCEPTUAL DESIGN

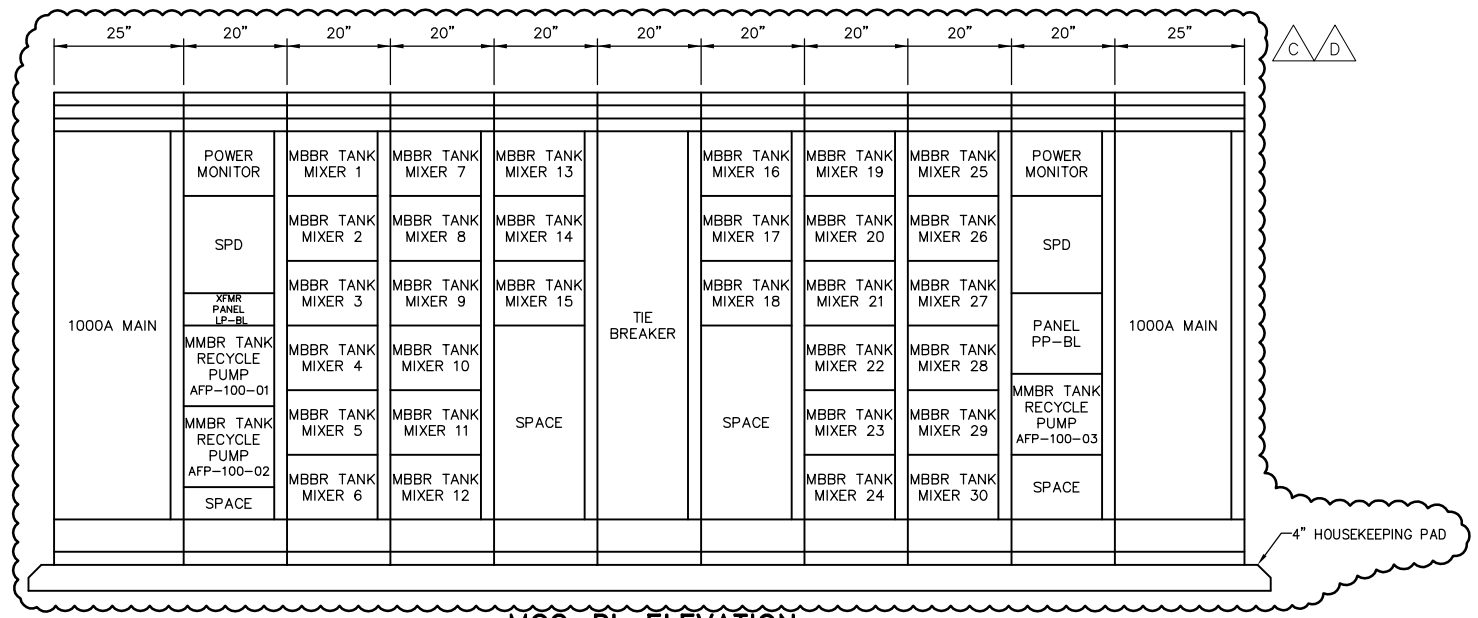
CITY OF HOPEWELL
HOPEWELL REGIONAL WASTEWATER TREATMENT FACILITY

ALTERNATIVE 4A-1 LIGHT
PHASE 2

BLOWER BUILDING ELECTRICAL ONE-LINE DIAGRAM

0 1" 2"

FILENAME	E–178.dwg
SCALE	NONE
DRAWING NUMBER	E-178
SHEET	OF -



MCC-BL ELEVATION

NO SCALE

ISSUE	DATE	DESCRIPTION
D	04/18/2014	VE E-1A
C	03/12/2014	MIXER REVISION FOR 5 TANKS
B	09/20/2013	ADDED DRAWING

PROJECT MANAGER:	WILLIAM S. M'COY
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CONCEPTUAL DESIGN

CITY OF HOPEWELL
HOPEWELL REGIONAL WASTEWATER TREATMENT FACILITY

ALTERNATIVE 4A-1 LIGHT
PHASE 2

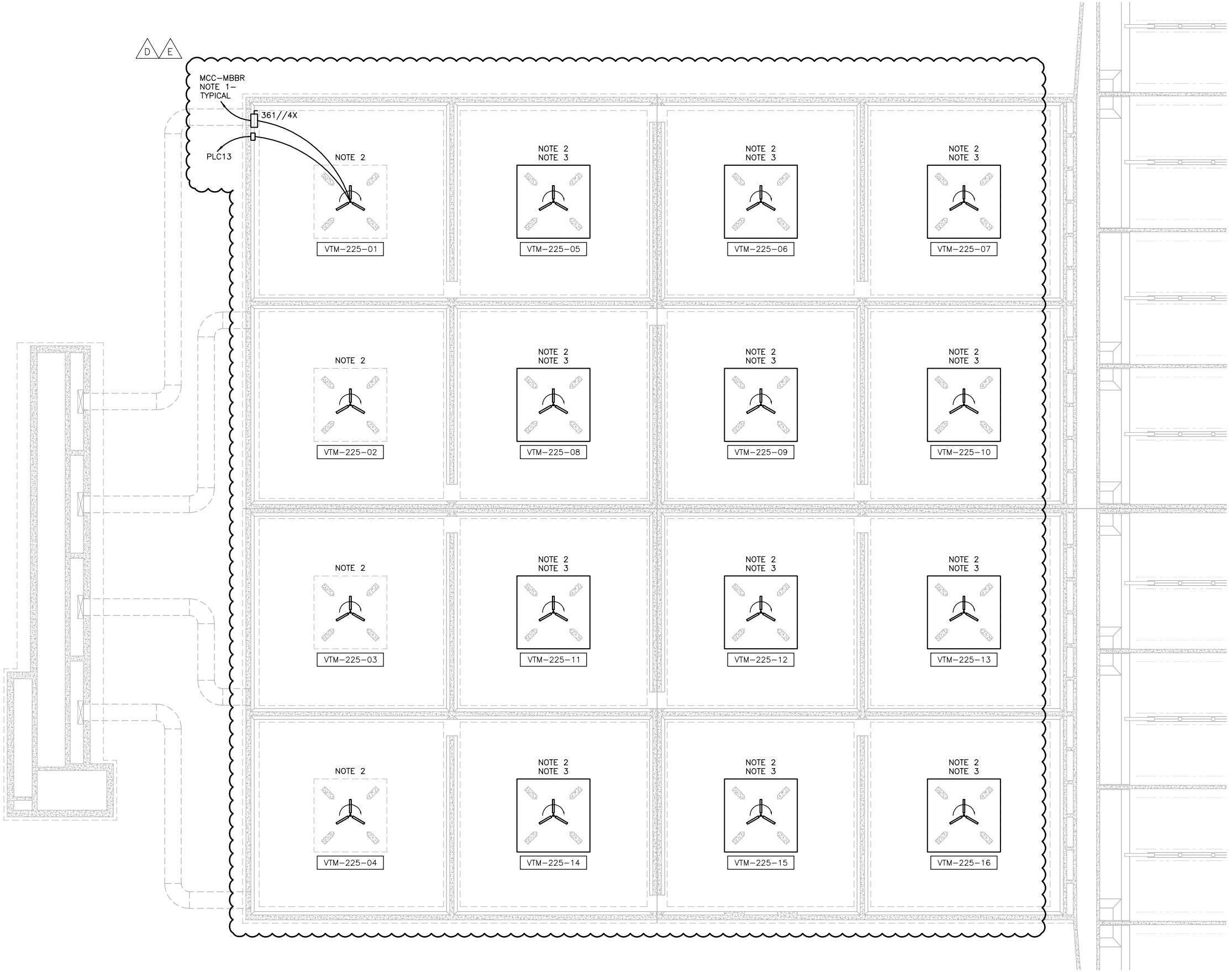
BLOWER BUILDING
MCC-BL ELEVATION

0 1" 2"

FILENAME	E-179.dwg
SCALE	NONE

DRAWING NUMBER **E-179**

SHEET OF -



N

SHEET NOTES:

1. MCC–MBBR AND PLC13 ARE LOCATED IN THE MBBR INFLUENT PUMP STATION. SEE SHEET E–75.
2. ELECTRICAL CONNECTIONS SHOWN FOR UNOX TANK 1 ARE TYPICAL FOR UNOX TANKS 2, 3, AND 4.

D 3. SURFACE AERATOR IS TO BE REPLACED IN KIND. REUSE EXISTING STARTER AND RUN NEW POWER AND CONTROL WIRING TO MATCH EXISTING. FIELD VERIFY EXISTING CONDITIONS.

HDR Engineering, Inc.
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ISSUE	DATE	DESCRIPTION
E	04/18/2014	VE E–1A
D	03/12/2014	MIXER REVISIONS
C	09/20/2013	REVISED FOR PLC13
B	09/06/2013	REVISED FOR EXISTING PLC3
A	08/26/2013	CONCEPTUAL DESIGN SUBMITTAL

PROJECT MANAGER:	WILLIAM S. M'COY
DESIGNED BY:	J. VAN TASSEL
DRAWN BY:	J. VAN TASSEL
CHECKED BY:	L. ANDERSON
PROJECT NUMBER	

CONCEPTUAL DESIGN

CITY OF HOPEWELL
HOPEWELL REGIONAL WASTEWATER TREATMENT FACILITY

ALTERNATIVE 4A-1 LIGHT
PHASE 2

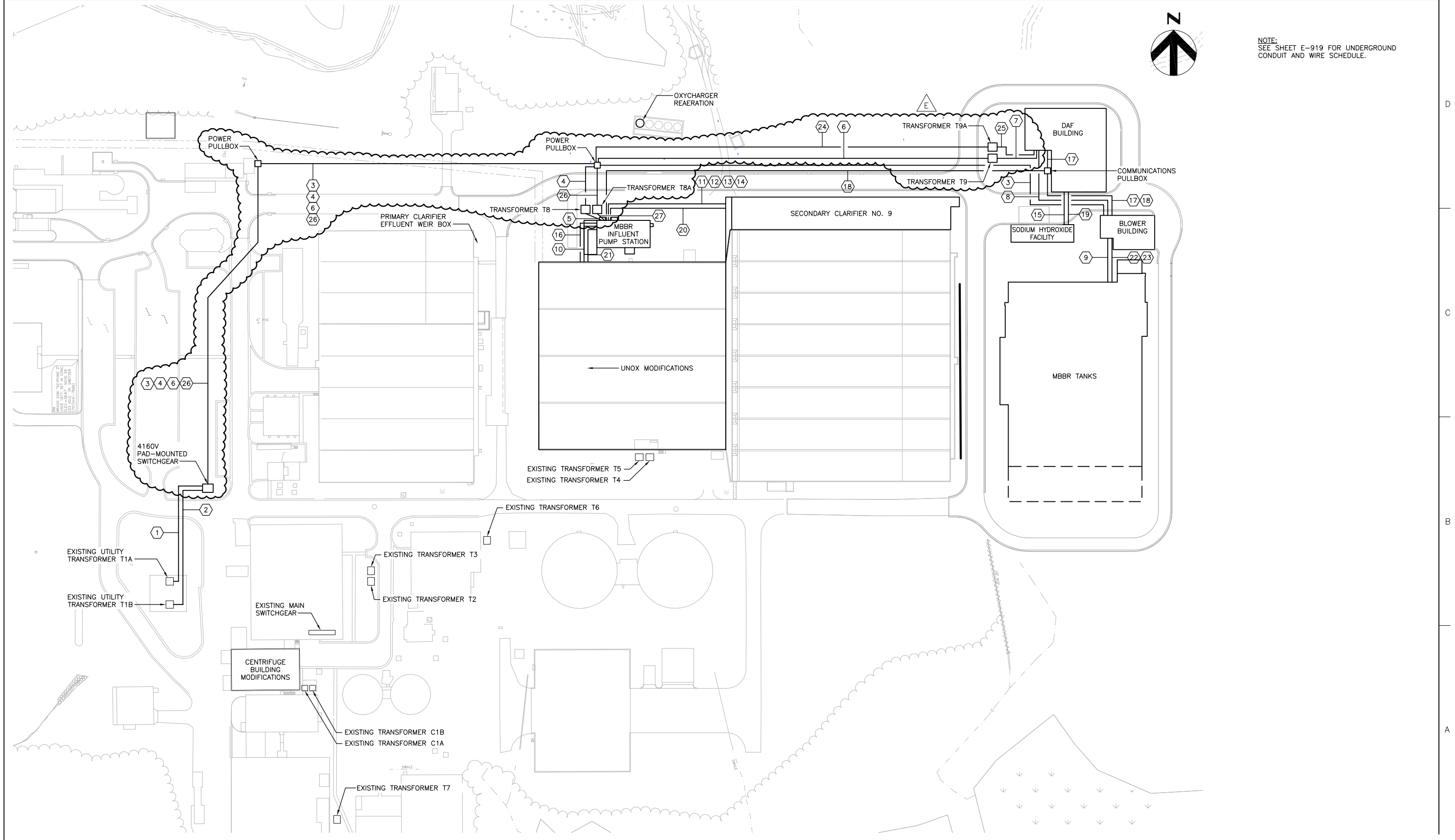
UNOX POWER PLAN

0 1" 2"

FILENAME	E–225.dwg
SCALE	1/16"=1'–0"

DRAWING NUMBER **E-225**

SHEET OF -



ISSUE	DATE	DESCRIPTION
E	04/18/2014	E-1A
D	10/08/2013	ADDED MBBR SCREENS/COMPACTORS
C	09/20/2013	REVISED FOR PLC13/ADDED MBBR TANKS
B	09/06/2013	CONCEPTUAL DESIGN SUBMITTAL

PROJECT MANAGER:	WILLIAM S. M'COY
DESIGNED BY:	J. VAN TASSEL
DRAWN BY:	J. VAN TASSEL
CHECKED BY:	L. ANDERSON
PROJECT NUMBER	

HDR Engineering, Inc.
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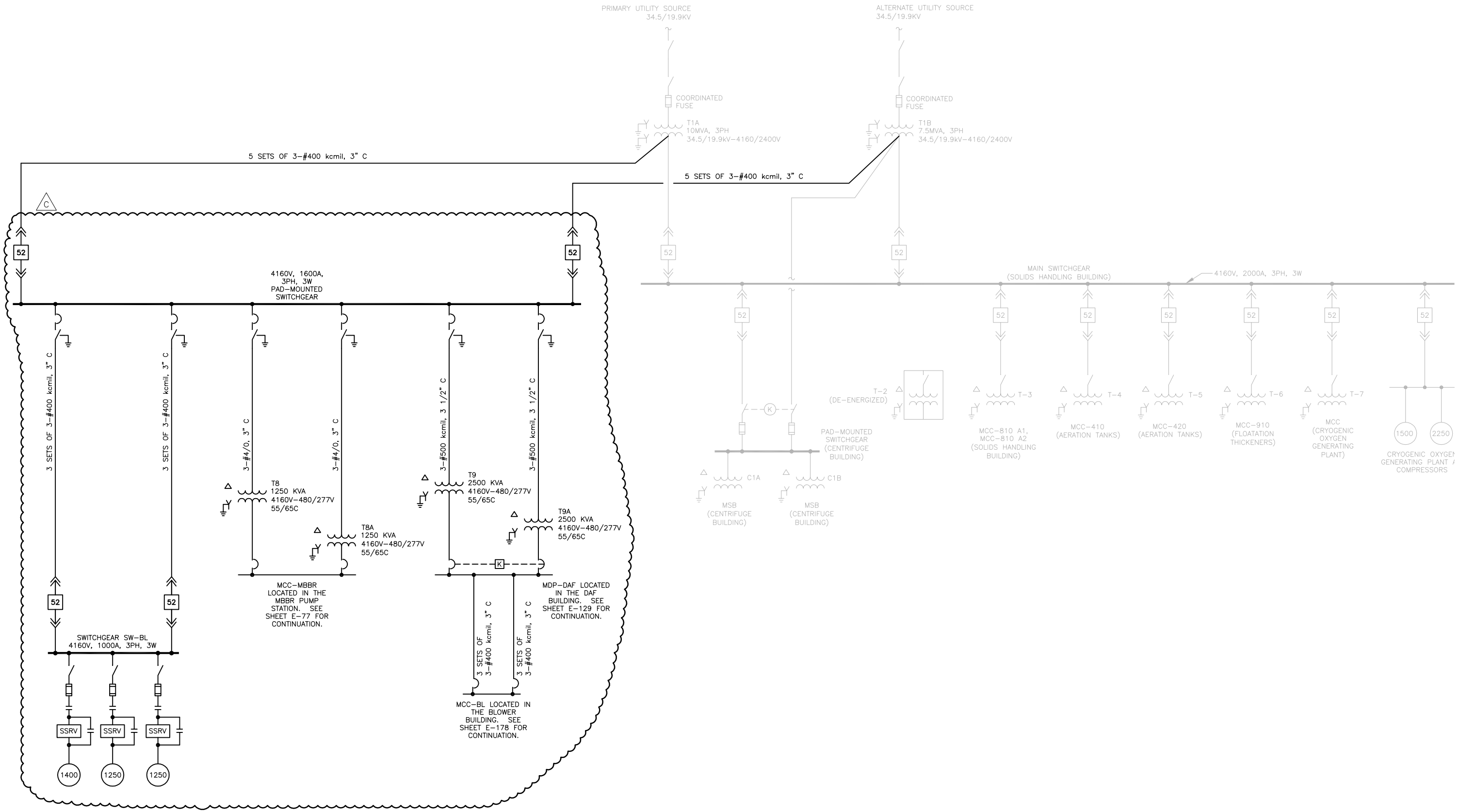
CONCEPTUAL DESIGN

CITY OF HOPEWELL
HOPEWELL REGIONAL WASTEWATER TREATMENT FACILITY

ALTERNATIVE 4A-1 LIGHT PHASE 2

ELECTRICAL SITE PLAN

FILENAME	E-905.dwg
SCALE	1"=60'
DRAWING NUMBER	E-905
SHEET	OF -



HDR Engineering, Inc. 5700 Lake Wright Dr. Suite 300 Norfolk, VA 23502			
	C	04/18/2014	VE E–1A
	B	09/20/2013	REVISED FOR BLOWER BUILDING
	A	08/26/2013	CONCEPTUAL DESIGN SUBMITTAL
	ISSUE	DATE	DESCRIPTION

PROJECT MANAGER:	WILLIAM S. M'COY
DESIGNED BY:	J. VAN TASSEL
DRAWN BY:	J. VAN TASSEL
CHECKED BY:	L. ANDERSON
PROJECT NUMBER	

CONCEPTUAL DESIGN

CITY OF HOPEWELL
HOPEWELL REGIONAL WASTEWATER TREATMENT FACILITY

ALTERNATIVE 4A-1 LIGHT
PHASE 2

PROPOSED OVERALL ELECTRICAL ONE-LINE DIAGRAM

0 1" 2"

FILENAME	E–915.dwg
SCALE	NONE
DRAWING NUMBER	E-915
SHEET	OF -

Light Fixture Schedule

Fixture Type	Description	Lamps	Manufacturer	Catalog Number	Remarks
LF1	4'-2-LAMP FLUORESCENT FIXTURE, ALUMINUM HOUSING, CORROSION RESISTANT FINISH, ENCLOSED AND GASKETED WITH INJECTION MOLDED ACRYLIC PRISNATIC LENS	2-F32T8	HOLOPHANE	7300-4-AL-O42-EP-U-T8LP841	
LF1A	SAME AS TYPE LF-2 EXCEPT WITH EMERGENCY BATTERY PACK FOR 90 MINUTE OPERATION UPON LOSS OF POWER	3-F32T8	HOLOPHANE	7300-4-AL-O42-EP-U-B600-T8LP841	
LF2	4'-2-LAMP FLUORESCENT FIXTURE, FIBERGLASS HOUSNG, MIRO 4 SPECULAR ALUMINUM REFLECTOR, ENCLOSED AND GASKETED WITH HIGH IMPACT ACRYLIC LENS SUITABLE FOR WET LOCATIONS	2-F32T8	HOLOPHANE	HES4-232-S1-X20-120	
LF2A	SAME AS TYPE LF-1 EXCEPT WITH EMERGENCY BATTERY PACK FOR 90 MINUTE OPERATION UPON LOSS OF POWER	2-F32T8	HOLOPHANE	HES4-232-S1-X20-120-EL14DW	
LF8	PENDANT MOUNTED FLUORESCENT HIGH BAY FIXTURE WITH WIDE DISTRIBUTION AND 5% UPLIGHT	3-54WATT T5HO	LITHONIA	IBC 354L IBPMP	
LF8A	SAME AS TYPE LF8 EXCEPT WITH EMERGENCY BATTER PACK FOR 90 MINUTE OPERATION UPON LOSS OF POWER	3-54WATT T5HO	LITHONIA	IBC 354L IBPMP EL14	
LF9	PENDANT MOUNTED HID FIXTURE, ENCLOSED AND GASKETED, 3/4" HUB, TYPE V GLASS REFRACTOR	175W CLEAR MH	HOLOPHANE PETROLUX II	PETL-175MH-545-P-PS	
LF17	EXTERIOR WALL MOUNTED COMPACT FLUORESCENT FIXTURE WITH DIE-CAST ALUMINUM HOUSING AND DOOR FRAME, FULLY GASKETED WITH TEMPERED GLASS LENS, INTERNAL PHOTOCELL CONTROLLED	2-32TRT	LITHONIA	WST-232TRT-MD-120-PE-LP1	
LF19	WALL MOUNTED LED FIXTURE, 30 CHIPS, 4000K, PRISNATIC GLASS REFRACTOR, DIE-CAST ALUMINUM HOUSING, BLACK FINISH, WET LOCATION LISTED WITH INTERNAL PHOTOCELL CONTROL	LED	HOLOPHANE	W4G-LED-30C-1000-40K-T3M-120-PE-SF-BK	
LF20	LED INDUSTRIAL LIGHT FIXTURE, 5000 LUMENS, WITH PRISNATIC GLASS REFRACTOR FOR LONG AND NARROW DISTRIBUTION WITH INTERNAL PHOTOCELL CONTROL, STANCHION MOUNTED	LED	HOLOPHANE	PLED2-05L-5K-12-UN-NA-W-L1-F1-BP-P3USWH	
X1	UNIVERSAL MOUNT POLYCARBONATE EXIT SIGN WITH REMOTE CAPACITY	LED	LITHONIA	LHQM-S-W-3-R-120/277-RO	
ER	REMCTE TWIN-HEAD EMERGENCY FIXTURE POWERED FROM FIXTURE X1	1-8W	LITHONIA	ELA-W-T-NX-NO806	

UNDERGROUND CONDUIT AND WIRE SCHEDULE

TAG NO.	FROM	TO	CONDUIT	WIRES	REMARKS
1	EXISTING TRANSFORMER T-1A	4160V PAD MOUNTED SWITCHGEAR	6-4"	5 SETS OF 3-#400 kcmil, 5KV PULL WIRE	PRIMARY POWER SOURCE
2	EXISTING TRANSFORMER T-1B	4160V PAD MOUNTED SWITCHGEAR	6-4"	5 SETS OF 3-#400 kcmil, 5KV PULL WIRE	ALTERNATE POWER SOURCE
3	4160V PAD MOUNTED SWITCHGEAR	BLOWER BUILDING	3-3" 3-3"	3 SETS OF 3-#400 kcmil, 5KV 3 SETS OF 3-#400 kcmil, 5KV	E BLOWER POWER
4	4160V PAD MOUNTED SWITCHGEAR	TRANSFORMER T8	3"	3-#4/0, 5KV	MBBR INFLUENT PUMP STATION POWER
5	TRANSFORMER T8	MBBR INFLUENT PUMP STATION MCC-MBBR	5-3"	5 SETS OF 3-#400 kcmil	MBBR INFLUENT PUMP STATION POWER
6	4160V PAD MOUNTED SWITCHGEAR	TRANSFORMER T9	2-4"	3-#500 kcmil, 5KV PULL WIRE	DAF BUILDING POWER
7	TRANSFORMER T9	DAF BUILDING MDP-DAF	8-3 1/2"	8 SETS OF 3-#500 kcmil	DAF BUILDING POWER
8	DAF BUILDING MDP-DAF	BLOWER BUILDING MCC-BL E	3-3" 3-3"	3 SETS OF 3-#400 kcmil 3 SETS OF 3-#400 kcmil	BLOWER BUILDING POWER
9	BLOWER BUILDING MCC-BL, PANEL PP-BL, PANEL LP-BL	MBBR TANKS	3-2" 7-1" 36-1" 2-1"	3 SETS OF 3-#1, #6G 7 SETS OF 3-#10, #10G 36 SETS OF 3-#10, #10G 2 SETS OF 2-#10, #10G	MBBR TANKS PUMP POWER VALVE/SCRN CTRL PNL PWR MBBR TANK MIXER POWER MBBR TANK LTG/RECPTS
10	MBBR INFLUENT PUMP STATION MCC-MBBR	UNOX TANK MIXERS	24-1"	24 SETS OF 3-#10, #10G	UNOX TANK MIXER POWER
11	MBBR INFLUENT PUMP STATION MCC-MBBR	SECONDARY CLARIFIER NO. 9 SCUM PUMP SP-200-01	1"	3-#10, #10G	SECONDARY CLARIFIER NO. 9 SP-200-01 POWER
12	MBBR INFLUENT PUMP STATION MCC-MBBR	SECONDARY CLARIFIER NO. 9 SCRAPPER DRIVE 1	1"	3-#10, #10G	SECONDARY CLARIFIER NO. 9 SCRAPPER DRIVE 1 POWER
13	MBBR INFLUENT PUMP STATION MCC-MBBR	SECONDARY CLARIFIER NO. 9 SCRAPPER DRIVE 2	1"	3-#10, #10G	SECONDARY CLARIFIER NO. 9 SCRAPPER DRIVE 2 POWER
14	MBBR INFLUENT PUMP STATION MCC-MBBR	SECONDARY CLARIFIER NO. 9 RAS PUMP RP-200-01	1 1/4"	3-#4, #8G	SECONDARY CLARIFIER NO. 9 RP-200-01 POWER
15	DAF BUILDING MDP-DAF	SODIUM HYDROXIDE FACILITY MDP-SH	3"	4-#4/0, #2G	SODIUM HYDROXIDE FACILITY POWER
16	UNOX TANKS EXISTING PLC-3	MBBR INFLUENT PUMP STATION PLC-13	2"	12-FIBER	STATUS AND CONTROLS
17	BLOWER BUILDING PLC-14	DAF BUILDING PLC-15	2"	12-FIBER	STATUS AND CONTROLS
18	MBBR INFLUENT PUMP STATION PLC-13	BLOWER BUILDING PLC-14	2"	12-FIBER	STATUS AND CONTROLS
19	DAF BUILDING PLC-15	SODIUM HYDROXIDE FACILITY	2" 1 1/2"	8-2/C SHIELDED CABLE 32-#14	STATUS AND CONTROLS
20	MBBR INFLUENT PUMP STATION PLC-13	SECONDARY CLARIFIER NO. 9	2" 2"	7-2/C SHIELDED CABLE 42-#14	STATUS AND CONTROLS
21	MBBR INFLUENT PUMP STATION PLC-13	UNOX TANK MIXERS	2"	60-#14	STATUS AND CONTROLS
22	BLOWER BUILDING PLC-14	MBBR TANKS	2-1 1/2" 2-2" (PER TRAIN)	14-2/C SHIELDED CABLE 90-#14 (PER MBBR TRAIN)	STATUS AND CONTROLS
23 E	BLOWER BUILDING PLC-14	MBBR SCREENS/COMPACTORS	2-1"	16-#14	STATUS AND ALARMS
24	4160V PAD MOUNTED SWITCHGEAR	TRANSFORMER T9A	2-4"	3-#500 kcmil, 5KV PULL WIRE	DAF BUILDING POWER
25	TRANSFORMER T9A	DAF BUILDING MDP-DAF	8-3 1/2"	8 SETS OF 3-#500 kcmil	DAF BUILDING POWER
26	4160V PAD MOUNTED SWITCHGEAR	TRANSFORMER T8A	3"	3-#4/0, 5KV	MBBR INFLUENT PUMP STATION POWER
27	TRANSFORMER T8A	MBBR INFLUENT PUMP STATION MCC-MBBR	5-3"	5 SETS OF 3-#400 kcmil	MBBR INFLUENT PUMP STATION POWER

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ISSUE	DATE	DESCRIPTION
E	04/18/2013	ADDED E-1A
D	10/08/2013	ADDED MBBR SCREENS/COMPACTORS
C	09/20/2013	REVISED LFS/WIRE & CONDUIT SIZES
B	09/06/2013	ADDED CONDUIT AND WIRE SCHEDULE
A	08/26/2013	CONCEPTUAL DESIGN SUBMITTAL

PROJECT MANAGER:	WILLIAM S. M'COY
DESIGNED BY:	J. VAN TASSEL
DRAWN BY:	J. VAN TASSEL
CHECKED BY:	L. ANDERSON
PROJECT NUMBER	

CONCEPTUAL DESIGN

CITY OF HOPEWELL
HOPEWELL REGIONAL WASTEWATER TREATMENT FACILITY

ALTERNATIVE 4A-1 LIGHT
PHASE 2

LIGHTING FIXTURE SCHEDULE AND DETAILS

0 1" 2"

FILENAME	E-919.dwg
SCALE	NONE
DRAWING NUMBER	E-919
SHEET	OF -

HRWTF Alternative 4A-1 Light Phase 2
Value Engineering Study Responses

Alternative No. E1-B
Description: Power Monitoring Improvements

Hopewell Nutrient Partners

Discussion of Design Base Changes:

The current proposed design does not clearly show where power monitoring equipment will be installed and how these devices will be networked into the plant SCADA. HNP will evaluate the power monitoring requirements for the project and make a recommendation.

Scope Reductions:

1) None.

Scope Additions:

1) Add Power monitoring equipment to the three blowers and the two main power feeds. A total of 5 power monitors are included.

2) Associated SCADA integration.

Other Notes:

Cost Summary:

Item	Capital Cost	Annual O&M Cost	Net Present Worth Cost
Added power monitors and SCADA integration	$42,037.00		
TOTAL	$42,037.00		

Recommendations:

This alternative has been selected by the City.

HRWTF Alternative 4A-1 Light Phase 2
Value Engineering Study Responses

Alternative No. MB-1
Description: Changes to Recycle Pumps for MBBR

Hopewell Nutrient Partners

Discussion of Design Base Changes:

The current design proposes using axial flow pumps to pump the MBBR Recycle flows. There are 3 pumps to convey 2Q or 39.4 MGD of flow. The pumps indicate a TDH of 20 feet and very low static head. HNP will review recycle pump piping arrangement and determine what modifications should be considered to reduce pumping energy.

Scope Reductions:

1) Delete proposed 16-inch, 75HP pumps x qty 3
2) Revised piping arrangement allows the TDH to be reduced from 20 FT to 12 FT; exposed pipe routing along north and west sides of the MBBR using knee-brace supports, move stairs to SW corner.
3) Delete flow meter bypass; this line can be temporarily taken out of service to replace the flow meter if necessary.
4) Delete check valves

Scope Additions:

1) Add 18-inch, 50HP pumps x qty 3
2) Add motorized actuator to the isolation plug-valve at each pump discharge.

Other Notes:

If MB-1 is selected, the three associated pumps will be 50-HP and power monitoring would not be included.

The modifications to the MBBR Recycle piping will reduce the pump discharge head by about 8 feet at average flow conditions. HNP has calculated the annual O&M cost savings and net present value based on an average MBBR recycle flow of 23 MGD and a power cost of $0.07 per kWh over a 20 year period at 5% interest rate.

Cost Summary:

Item	Capital Cost	Annual O&M Cost	Net Present Worth Cost
Downsize pump, include motor-actuator, revise meter	($119,355.00)		($119,355.00)
Pump Power Cost		($22,000.00)	($274,000.00)
TOTAL	($119,355.00)	($22,000.00)	($393,355.00)

Recommendations:

This alternative has been selected by the City.

Wrap MBBRR line around side of building at EL 38.5 (aprx) and support from side of tank.

Install Meter with no bypass.

See revised layout on Section A/ M-107

Relocate stair to south side.

145'-6"

34'-8"

36"-MBBRR

36"-AS

WG-100-01 WEIR GATE

WG-100-02 WEIR GATE

36"x14" REDUCER TYP

TYP 14"-AS (VERT RUN)

4"x12" REDUCER TYP

TYP 12"-AS

FIT-100-01 THERMAL MASS FLOW METER

36"x12" REDUCER TYP

12"-AS TYP

MV-100-03 6" BFV

FIT-100-04

TYP 6"-AS

MV-100-02 10" BFV

FIT-100-03

FIT-100-02

MV-100-01 12" BFV

SG-100-05 SLIDE GATE

SG-100-06 SLIDE GATE

WG-100-13 WEIR GATE

WG-100-14 WEIR GATE

WG-100-15 WEIR GATE

SG-100-07 SLIDE GATE

30"-MBBRE TYP

SIM A M-104

INFLUENT SCREENING CHAMBER

24"-GRFM

C M-106

WG-100-03 WEIR GATE

SG-100-02 SLIDE GATE

SG-100-01 SLIDE GATE

WG-100-04 WEIR GATE

S-100-01 SCREEN

MV-100-04 12" BFV

FIT-100-05

36"x30" REDUCER

10"-AS TYP

FIT-100-06

MV-100-06 6" BFV

MV-100-05 10" BFV

FIT-100-07

30"-AS

DO PROBE

DO PROBE

DO PROBE

WG-100-16 WEIR GATE

SG-100-08 SLIDE GATE

G M-107

D M-106

S-100-02 SCREEN

A M-106

30"-MBBRI

WG-100-05 WEIR GATE

SG-100-03 SLIDE GATE

SG-100-04 SLIDE GATE

WG-100-06 WEIR GATE

30"x14" REDUCER TYP

30"x12" REDUCER TYP

MV-100-09 6" BFV

FIT-100-10

MV-100-08 10" BFV

FIT-100-09

FIT-100-08

MV-100-07 12" BFV

SG-100-09 SLIDE GATE

SG-100-10 SLIDE GATE

MATCHLINE SEE M-103

J M-107

F M-107

H M-107

B M-104

A M-104

D

GENERAL NOTES:

1. –

KEY NOTES:

1

KEY PLAN

M-102

M-103

ISSUE	DATE	DESCRIPTION
D	03/12/2014	AIR SUPPLY PIPING & EFF CHAN. REVISION
C	09/18/2013	MBBR TANK REVISION
B	09/13/2013	MBBR TANK

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CHECKED BY:	
PROJECT NUMBER	

CONCEPTUAL DESIGN

CITY OF HOPEWELL
HOPEWELL REGIONAL WASTEWATER TREATMENT FACILITY

ALTERNATIVE 4A-1 LIGHT
PHASE 2

SEGREGATED MBBR SYSTEM
UPPER PLAN 1 OF 2

0 1" 2"

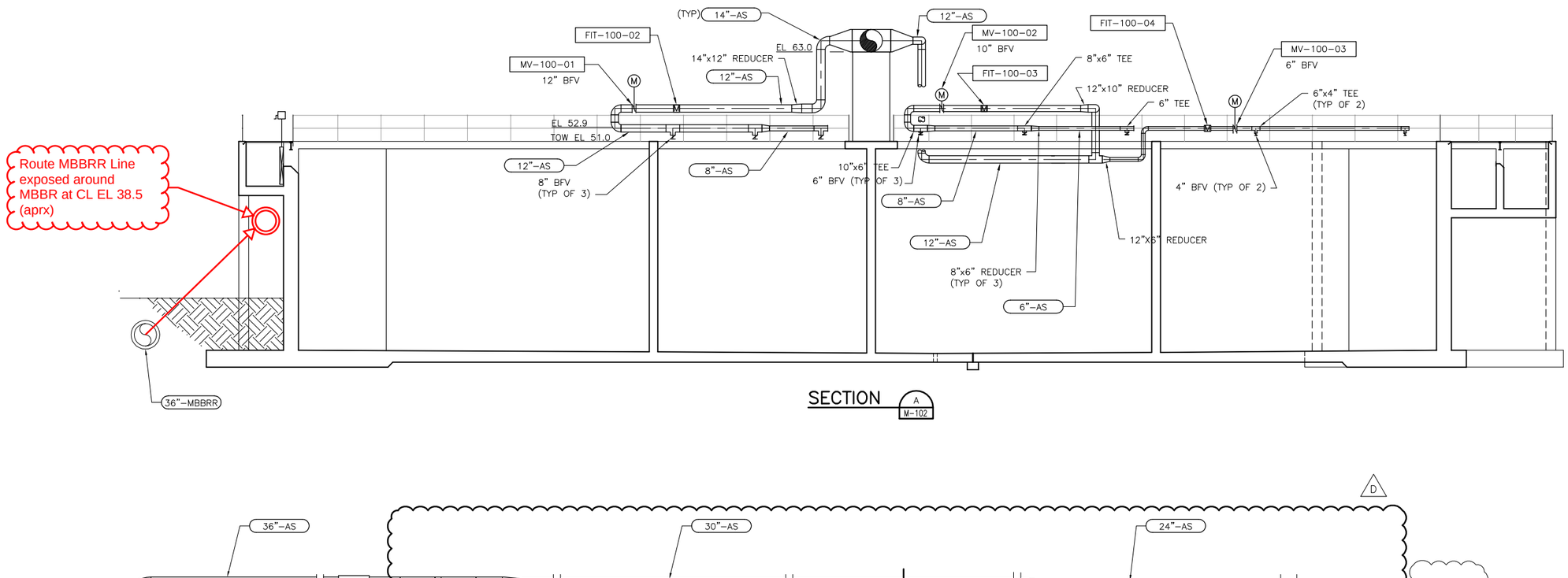
FILENAME	M-102.dwg
SCALE	3/32"=1'-0"

DRAWING NUMBER **M-102**

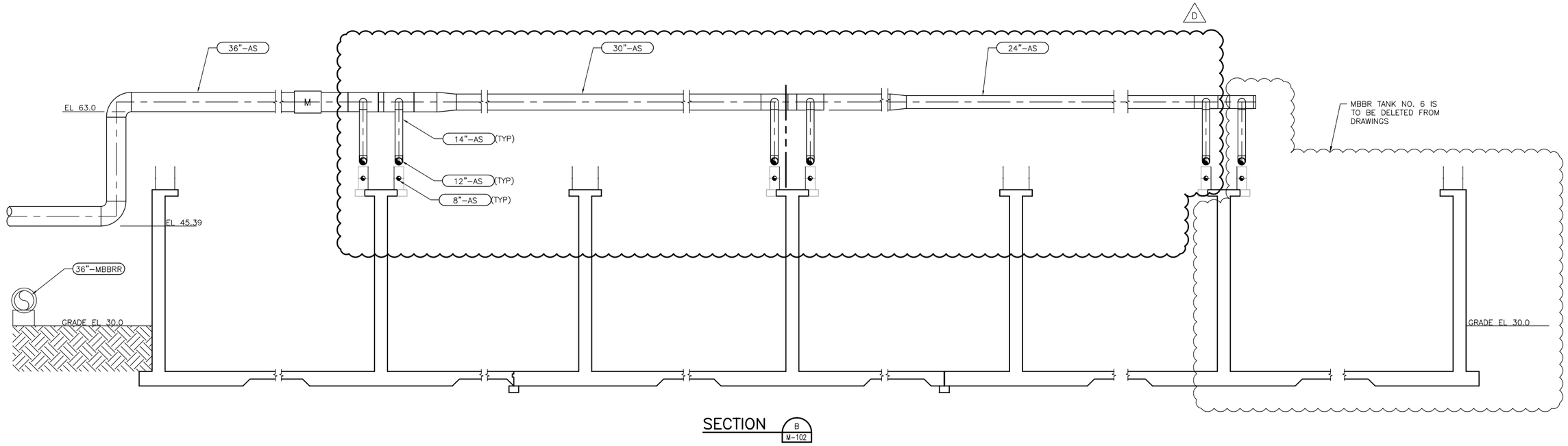
SHEET OF -

KEY NOTES:

1



SECTION A M-102



SECTION B M-102

ISSUE	DATE	DESCRIPTION
D	03/12/2014	AIR SUPPLY PIPING REVISION
C	09/18/2013	MBBR TANKS REVISION
B	09/13/2013	MBBR TANKS

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PROJECT MANAGER:	WILLIAM S. M'COY
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PROJECT NUMBER	

CONCEPTUAL DESIGN

CITY OF HOPEWELL
HOPEWELL REGIONAL WASTEWATER TREATMENT FACILITY

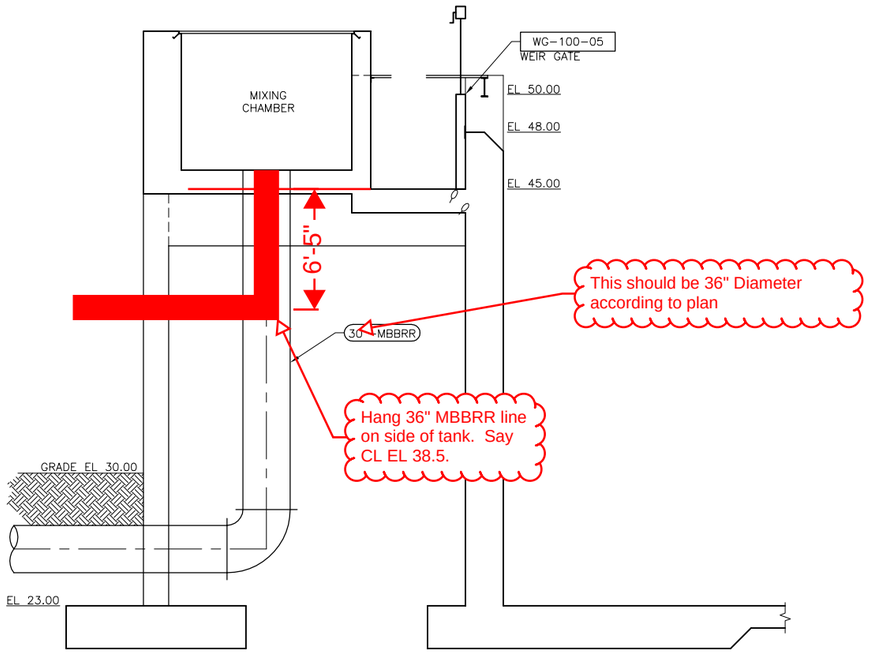
ALTERNATIVE 4A-1 LIGHT PHASE 2

SEGREGATED MBBR SYSTEM SECTIONS

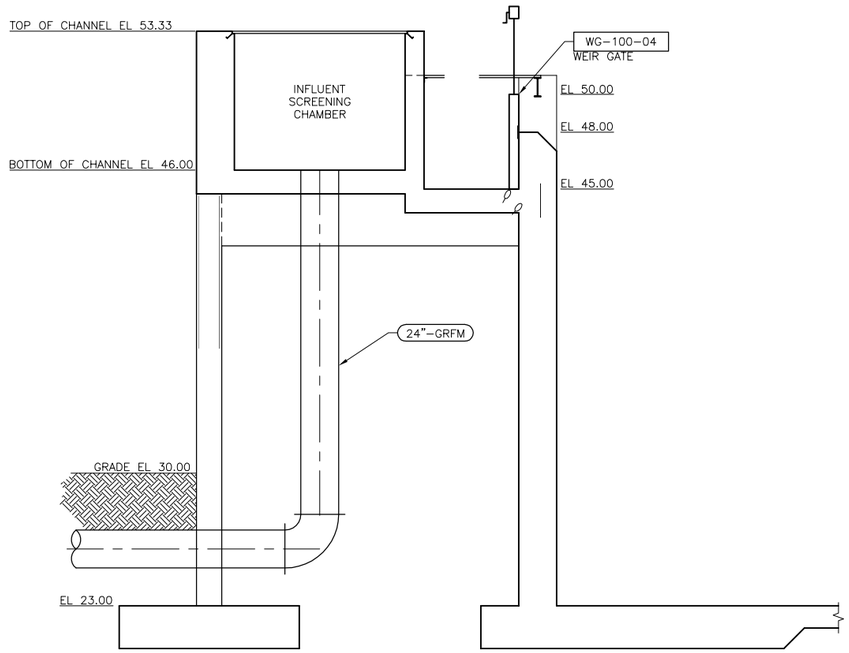
0 1" 2"

FILENAME	M–104.dwg
SCALE	1/8" = 1'–0"
DRAWING NUMBER	M-104
SHEET	OF -

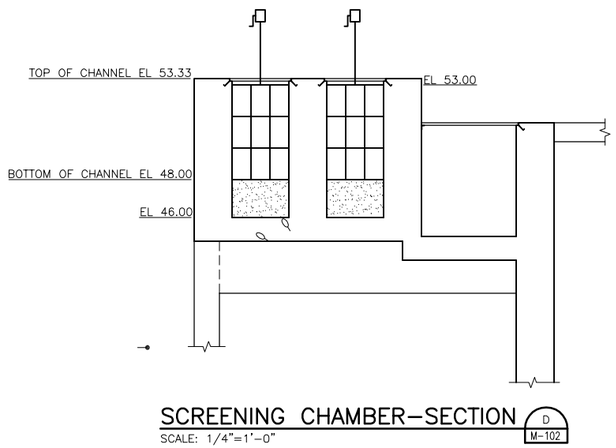
GENERAL NOTES:
1. –



MIXING CHAMBER–SECTION (A / M-102)
SCALE: 1/4"=1'-0"



INFLUENT SCREENING CHAMBER–SECTION (C / M-102)
SCALE: 1/4"=1'-0"



SCREENING CHAMBER–SECTION (D / M-102)
SCALE: 1/4"=1'-0"

HDR Engineering, Inc.
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ISSUE	DATE	DESCRIPTION
C	09/18/2013	MBBR TANKS

PROJECT MANAGER:	WILLIAM S. M'COY
DESIGNED BY:	D. ZIRKLE
DRAWN BY:	T. LOKEY
CHECKED BY:	
PROJECT NUMBER	

CONCEPTUAL DESIGN

CITY OF HOPEWELL
HOPEWELL REGIONAL WASTEWATER TREATMENT FACILITY

ALTERNATIVE 4A-1 LIGHT
PHASE 2

SEGREGATED MBBR SYSTEM
SECTIONS AND DETAILS

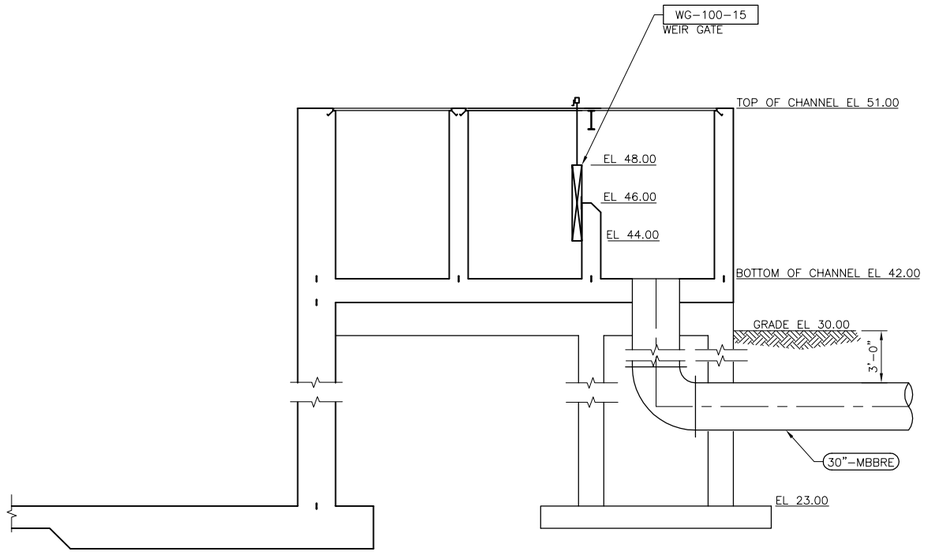
0 1" 2"

FILENAME	M-106.dwg
SCALE	AS NOTED

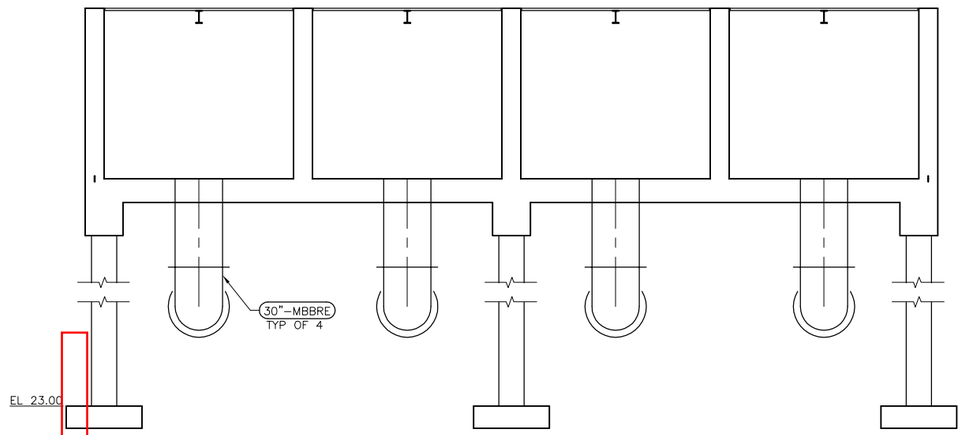
DRAWING NUMBER: **M-106**

SHEET OF -

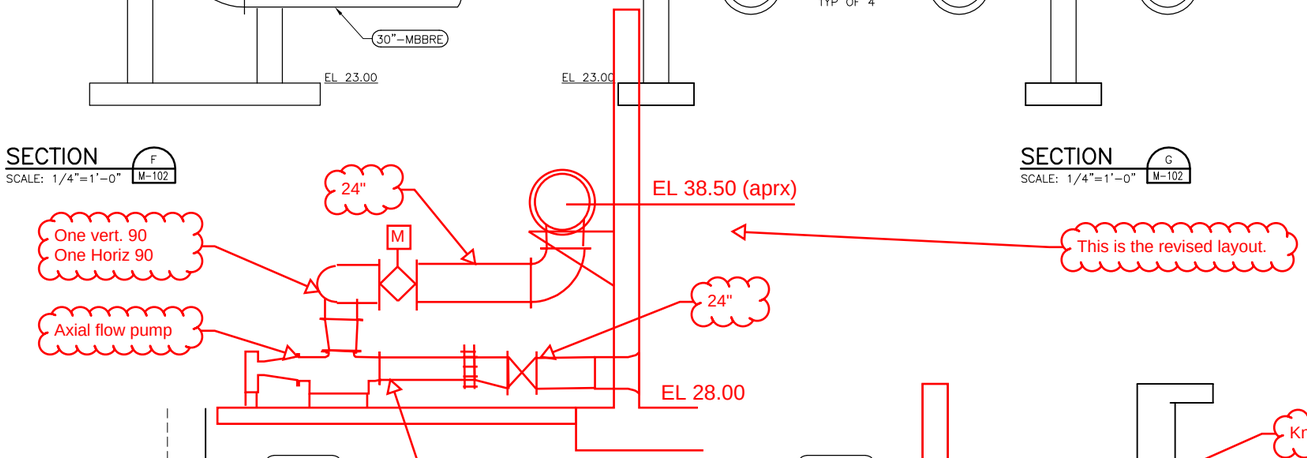
GENERAL NOTES:
1. –

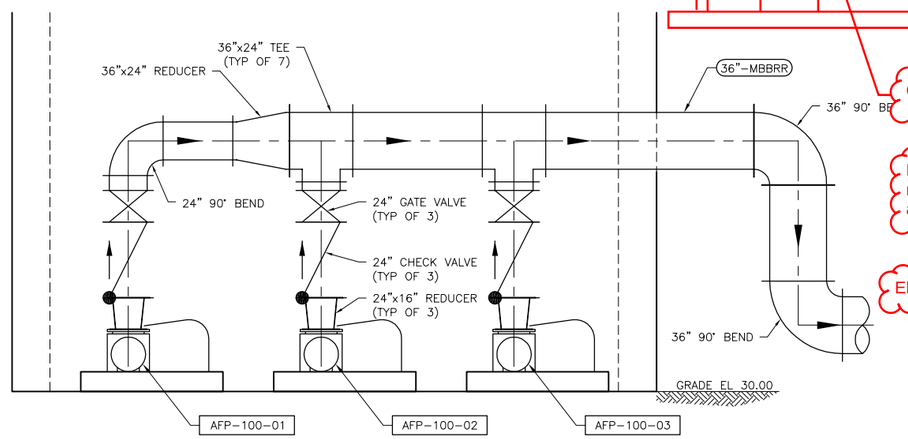


SECTION F
SCALE: 1/4"=1'–0" M–102

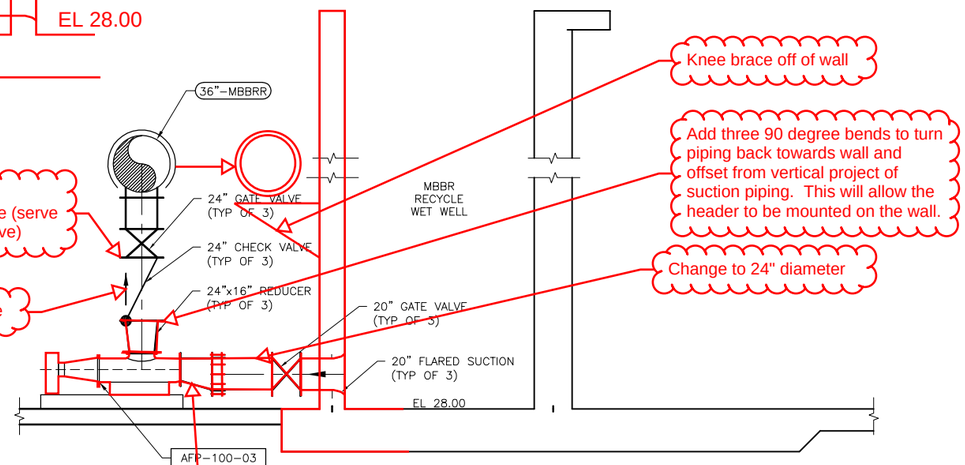


SECTION G
SCALE: 1/4"=1'–0" M–102





SECTION H
SCALE: 1/4"=1'–0" M–102



SECTION J
SCALE: 1/4"=1'–0" M–102

HDR Engineering, Inc.
5700 Lake Wright Dr.
Suite 300
Norfolk, VA 23502

ISSUE	DATE	DESCRIPTION
C	09/18/2013	MBBR TANK REVISION

PROJECT MANAGER:	WILLIAM S. M'COY
DESIGNED BY:	D. ZIRKLE
DRAWN BY:	T. LOKEY
CHECKED BY:	
PROJECT NUMBER	

CONCEPTUAL DESIGN

CITY OF
HOPEWELL REGIONAL WASTEWATER TREATMENT FACILITY

ALTERNATIVE 4A-1 LIGHT PHASE 2

SEGREGATED MBBR SYSTEM SECTIONS

0 1" 2"

FILENAME	M–107.dwg
SCALE	AS NOTED

DRAWING NUMBER **M-107**

SHEET OF -

HRWTF Alternative 4A-1 Light Phase 2
Value Engineering Study Responses

Alternative No. MB-10
Description: Review Blower Design/Turndown

Hopewell Nutrient Partners

Discussion of Design Base Changes:

The current design proposes utilizing three blowers, two multistage and one single-stage sized at 15,000 and 20,000 cfm respectively. The minimum airflow for the design conditions is approximately 8,400 cfm. There is a concern over the turndown ability of the proposed blowers to meet minimum airflow requirements. HNP has contacted the blower manufacturer to obtain a selection for a single stage blower with maximum capacity of 16,800 scfm with a 50% turndown to 8,400 scfm. The same blower model would be used for this revised capacity, but the air end impeller would be modified for the revised performance conditions. With these modifications, the motor size can be reduced to 1,250 HP.

The revised design basis will provide 30,000 cfm capacity with the largest unit out of service and 46,800 cfm capacity with all units in service. This will provide adequate capacity to meet the design basis air demands under 40% HW 2040 conditions listed in the Design Basis TM. It also provides adequate capacity to meet the maximum month air demand under 100% HW 2040 conditions, which is 32,700 cfm.

Scope Reductions:

1) Revised single stage blower selection

Scope Additions:

1) None.

Other Notes:

Siemens Turblex has confirmed that the design capacity of the proposed Model KA-44-SV-GL225 single-stage centrifugal compressor can be modified to 16,800 SCFM @ 13.5 PSIG discharge pressure (14.7 PSIA, 68 F, 36% RH) allowing comfortably for a 50% turndown capacity to 8,400 SCFM (or lower) by modifying the air-end impeller configuration. The blower size and model will remain the same, but the lower maximum air flow will reduce the required HP, and therefore reduce the drive motor size from 1,400 HP to 1,250 HP. Sizes of electrical equipment, conduit and wire would not change significantly in this reduction in motor size, therefore , no price impacton the power supply in terms of MCC starter/breaker size, power supply cables and conduit sizes . The equipment price deduct for reducing the motor size is noted below. The Siemens Turblex proposed scope of supply would otherwise remain the same except for the revised motor size of 1,250 HP.

Cost Summary:

Item	Capital Cost	Annual O&M Cost	Net Present Worth Cost
Revised single stage blower selection	($19,000.00)		
TOTAL	($19,000.00)		

Recommendations:

This alternative has been selected by the City.

HRWTF Alternative 4A-1 Light Phase 2
Value Engineering Study Responses

Alternative No. MI-3
Description: Delete Building Structure over Pump Room

Hopewell Nutrient Partners

Discussion of Design Base Changes:

The current design of the MBBR Influent Pump Station includes a masonry superstructure over the Pump Room, Mechanical and Electrical Room and the Sodium Bisulfite Metering Pump Room. The VE alternative proposes deleting the building structure over the Pump Room and leave the building structure over the other portions of the facility. The new design will leave the pumps exposed to outdoor conditions on a slab.

Scope Reductions:

1) Deleting the building over the VTSH pump room.

Scope Additions:

1) Adding heat trace and insulation as necessary for freeze protection in this room.

2) Upgrade electrical equipment for outdoor installation.

Other Notes:

The Electrical Room and Sodium Bisulfite Metering Pump Room were not changed to pre-engineered metal building construction. The construction of these rooms require fire-rated walls and corrosion-resistant materials due to the adjacent chemical storage facilities.

Cost Summary:

Item	Capital Cost	Annual O&M Cost	Net Present Worth Cost
Building Credit	($190,952.00)		
Heat Trace Adder	$1,442.00		
Electrical Upgrade to Outdoor Rated	$40,000.00		
TOTAL	($149,510.00)		

Recommendations:

This alternative has been selected by the City.

Alternative No. XX

Description: Change Blower CS Air Pipe to 304SS Air Piping

Hopewell Nutrient Partners

Discussion of Design Base Changes:

Change all air supply piping from carbon steel to 304 SS material. Pipe material shall have the following wall thickness:

Nominal Pipe Size (IN.)	Schedule/ Gauge/Plate	Nominal Wall Thickness (IN.)
6	Schedule 5	0.109
8	Schedule 5	0.109
10	12 Gauge Sheet	0.109
12	12 Gauge Sheet	0.109
14	11 Gauge Sheet	0.125
16	11 Gauge Sheet	0.125
18	11 Gauge Sheet	0.125
20	10 Gauge Sheet	0.140
24	Plate	0.188
30	Plate	0.188
36	Plate	0.188
42	Plate	0.250
48	Plate	0.250
54	Plate	0.312
60	Plate	0.312
72	Plate	0.375

Scope Reductions:

1) Coating credit

2) Credit Carbon Steel Pipe

Scope Additions:

1) L304 SST Pipe

Other Notes:

Selection of pipe material is Owner preference.

Cost Summary:

Item	Capital Cost	Annual O&M Cost	Net Present Worth Cost
Coating Credit	($42,635.00)		
Stainless Steel Pipe Adder	$634,257.00		
Credit Carbon Steel Pipe	($257,590.00)		
TOTAL	$334,032.00		

Recommendations:

This alternative has been selected by the City.

HRWTF Alternative 4A-1 Light Phase 2
Value Engineering Study Responses

Alternative No. YY
Description: Change Sodium Hydroxide Storage Tanks to Carbon Steel Material

Discussion of Design Base Changes:

The current design of the Sodium Hydroxide Facility includes Sodium Hydroxide Storage Tanks fabricated of FRP material. This VE alternate involves changing the storage tanks to carbon steel material. The tanks will be insulated and heat-traced for freeze protection.

Scope Reductions:

1) Change from FRP to carbon steel storage tank construction.

Scope Additions:

1) None.

Other Notes:

Cost Summary:

Item	Capital Cost	Annual O&M Cost	Net Present Worth Cost
Change insulated FRP Tanks to insulated CS tanks	($5,612.00)		
TOTAL	($5,612.00)		

Recommendations:

This alternative has been selected by the City.