

City of Marshfield

Water and Wastewater SCADA systems Improvements Scope

Work shall be performed under four separate contracts on four separate timelines which may or may not happen to coincide under three general contractors. Improvements below are being separated based on contracts, location, systems, and timing. All bids shall be considered on total amounts and not on individual contracts.

Please provide costs for the following improvements described below.

Costs for three of the contracts will be included as an allowance under current projects awaiting bids. The fourth contract will be directly with the city.

Prior to submitting a price for work, integrator shall visit site locations and verify existing conditions.

In general, the work to be performed will be replacing existing Survalent controllers with Allen Bradley PLC's. See photos in appendix for sample panel layouts.

Water System Improvements - Contract 1

Water Improvements in Contract 1 will require 3 new control panels. Panels will be located indoors in a clean heated space. Panels will be located at Warren Well House, Route 38 Well House, and McVay Well House.

Each new control panel will require:

1. Suitably Sized painted steel Nema 12 Enclosure
2. 1 x 1766-L32AWAA - MicroLogix 1400 PLC
3. 3 x 1762-IA8 discrete input cards
4. 3 x 1762-IF4 analog input cards
5. 1 x 1762-OF4 analog output card
6. Space for SHO-ME POWER Fiber Switch (approximately 8" x 10" max)
7. Main Circuit breaker – 20A @120VAC
8. 120V Surge Protection
9. UPS – Sola or equal
10. Analog, and Ethernet Surge Protection
11. Enclosure Light
12. 120VAC Receptacle
13. Din Rail
14. Terminal Blocks
15. 10A rated Ice Cube Relays
16. 24VDC Power Supply
17. Wireway and other related accessories

In addition to physical components the system shall be programmed for the following general configuration. Modifications shall be made for a complete and operational system.

Monitor Automatic Transfer Switch (Normal, Emergency, Normal Available, Emergency Available, Fault Status), 1 well pump (Running, Fault, Auto, Call to Run), monitoring flow (4-20mA with resettable totalizer, Low alarm, High alarm) and pressure (4-20mA) on discharge. Control three chemical feed pumps with well pump (Hypochlorite, Caustic, and Phosphate – [Running, Fault, Standby, Speed

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Command (4-20mA), Speed Feedback (4-20mA)). Monitor chemical weights for all three chemicals (Level (4-20mA), Alarm), Chlorine and Ph Level (4-20mA) as well as the associated tank level (Pressure converted to level (4-20mA) with Low Level alarm, On Level, Off Level, High Level alarm, Overflow Level) [At Warren Only].

Well pumps will be called to run based on tank levels at Warren, Blue Jay, and Elm Street (New in Contract 2) tanks. All three pumps will be called to run based on a "On Level" elevation at any tank. The operator shall be able to select well as out of service to prevent operation and run on 1, 2 or 3 wells at once. Well will run until any of the three tanks reaches the "Off Level" at which point each well pump will stop running. Each well pump may become disabled during operation based on a fault from the soft starter or the hypo chlorite system. If an individual pump becomes inoperable the remaining pumps will continue to operate as described above.

Chemical feed systems will operate based on well pump operation. The PLC shall monitor the level of all three chemical scales. A low-level alarm discrete input will be monitored for each scale. Chemical pump speed shall be programmed based on operator setpoints for Chemical Concentration and feed rate in PPM. Equation shall be $\text{Process GPM from well flow meter} \times \text{Feed Rate in ppm} \times 1440$ divided by $\text{Chemical Concentration \%} \times 10,000 \times \text{the Chemical Specific Gravity}$. SG is 1.2 for sodium hypochlorite, 1.384 for phosphate and 1.53 for caustic. This equation shall drive the pump output required in GPD. Pump speed shall be calculated by $\text{Pump Output in GPD} \times 100$ divided by $\text{Max Pump Flow in GPD}$. Speed shall be sent to chemical feed pump via proposed 4-20mA outputs. The PLC shall monitor the Chlorine level and pH levels via 4-20mA inputs.

Alarms for low level and high levels shall be set up for all analog signals and alarms shall be conveyed for alarm dialer to operator during off duty hours. A high chlorine level shall shut down the well pump. A high ph level shall shut down the caustic chemical feed pump. All alarms shall be operator adjustable from SCADA system.

Water System Improvements - Contract 2

Water Improvements in Contract 2 will require 1 new control panel as well as 2 rehab panels. Panels will be located indoors in a clean heated space. New panel will be located at North Elm Water Tower, rehab panels will be located at Blue Jay Water Tower, and Elm Street Booster Pumping Station.

Each control panel will require:

1. Suitably Sized painted steel Nema 12 Enclosure (Rehabs shall re-use existing panel)
 2. 1 x 1766-L32AWAA - MicroLogix 1400 PLC
 3. 1 x 1762-IA8 discrete input cards
 4. 1 x 1762-IF4 analog input cards
 5. 1 x 1762-OF4 analog output card
 6. Space for SHO-ME POWER Fiber Switch (approximately 8" x 10" max)
 7. Main Circuit breaker – 20A @120VAC
 8. 120V Surge Protection
 9. UPS – Sola or equal
 10. Analog, and Ethernet Surge Protection
 11. Enclosure Light
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12. 120VAC Receptacle
13. Din Rail
14. Terminal Blocks
15. 10A rated Ice Cube Relays
16. 24VDC Power Supply
17. Wireway and other related accessories

In addition to physical components the system shall be programmed for the following general operation. Each tower will monitor at minimum pressure (Pressure converted to level (4-20mA) with Low Level alarm, On Level, Off Level, High Level alarm, Overflow Level). Additionally, system shall include monitoring of mixing system (Running), temperature (4-20mA) and door alarm.

North Elm water tower will require Chemical Feed Pump (Hypochlorite only) control based on analyzer feedback as well as monitor chemical weight and tank level. The PLC shall monitor the level of all the chemical scale. A low-level alarm discrete input will be monitored. Chemical pump speed shall be programmed based on operator setpoints for Chemical Concentration and feed rate in PPM. Equation shall be $\text{Process GPM from well flow meter} \times \text{Feed Rate in ppm} \times 1440$ divided by $\text{Chemical Concentration \%} \times 10,000 \times \text{the Chemical Specific Gravity}$. SG is 1.2 for sodium hypochlorite. This equation shall drive the pump output required in GPD. Pump speed shall be calculated by $\text{Pump Output in GPD} \times 100$ divided by $\text{Max Pump Flow in GPD}$. Speed shall be sent to chemical feed pump via proposed 4-20mA outputs. The PLC shall monitor the Chlorine level via 4-20mA input.

Elm Street booster station is a standard dual pump booster station on VFD control. IO and programming shall match existing. No new improvements to operations are being implemented.

City Contract

Lift Stations

Wastewater Improvements will include 13 rehab panels for 13 remote lift station sites. Panels will be located outdoors.

1. Re-Use existing Enclosure
 2. 1 x 1766-L32AWAA - MicroLogix 1400 PLC
 3. 2 x 1762-IA8 discrete input cards
 4. 1 x 1762-IF4 analog input cards
 5. 1 x 1762-OF4 analog output card
 6. Main Circuit breaker – 20A @120VAC
 7. 120V Surge Protection
 8. UPS – Sola or equal
 9. Analog, and Ethernet Surge Protection
 10. Enclosure Light
 11. 120VAC Receptacle
 12. Din Rail
 13. Terminal Blocks
 14. 10A rated Ice Cube Relays
 15. 24VDC Power Supply
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16. Wireway and other related accessories
17. Re-use Fiber Switch

In addition to physical components system shall be programmed for operation. All sites are assumed to be standard duplex pumping station with across the line starters and flow, pressure and level monitoring. No mechanical or operational improvements are proposed at these sites.

Wastewater Contract

Main Plant

Wastewater Improvements will include 2 rehab panels for Headworks and Control Building. Panels will be located indoors in a clean and heated space.

Headworks:

1. Re-use existing panel
2. Reuse existing MicroLogix 1400 PLC
3. 4 x 1762-IA8 discrete input cards.
4. 1 x 1762-OA8 discrete output card
5. 2 x 1762-IF4 analog input cards
6. Re-use Fiber Switch
7. Main Circuit breaker – 20A @120VAC
8. 120V Surge Protection
9. UPS – Sola or equal
10. Analog, and Ethernet Surge Protection
11. Enclosure Light
12. 120VAC Receptacle
13. Din Rail
14. Terminal Blocks
15. 10A rated Ice Cube Relays
16. 24VDC Power Supply
17. Wireway and other related accessories
18. Ethernet Switch

Programming shall include monitoring of influent pump station consisting of three influent pumps and associated level control, monitoring and control of influent gate for building flood protection, monitoring of local systems for existing grit, NEW excess flow pump station, and NEW influent screening. Additionally, a new flow meter off the influent pump station shall be added. Contractor shall coordinate with new systems to message data over ethernet communications. Existing systems shall be hard wired monitoring.

Contractor shall take influent channel level before screen to control influent gate. At operator adjustable high-level influent gate shall go to operator adjustable level setpoint. At operator adjustable alarm level influent gate shall close. Gate shall return to high level setpoint when water level drops below high level for 10 minutes. Gate shall return to full open when level drops below operator adjustable open level for 10 minutes.

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Control Building:

1. Re-use existing panel
2. 1 x 1769-L33ER- CompactLogix 5370 L3 controller
3. 5 x 1769-IA8I discrete input cards.
4. 2 x 1769-OA8I discrete output card
5. 4 x 1769-IF4 analog input cards
6. 3 x 1769-OF4 analog output card
7. Re-use Fiber Switch
8. Main Circuit breaker – 20A @120VAC
9. 120V Surge Protection
10. UPS – Sola or equal
11. Analog, and Ethernet Surge Protection
12. Enclosure Light
13. 120VAC Receptacle
14. Din Rail
15. Terminal Blocks
16. 10A rated Ice Cube Relays
17. 24VDC Power Supply
18. Wireway and other related accessories
19. Ethernet Switch

Programming shall include variable speed and staging control of three blowers for reactor aeration. PLC shall monitor DO and Temperature of two reactors and control blower operation to an operator adjustable setpoint for DO. The lowest value from the two tanks will be utilized for control and blowers will be staged and cycled based on demand. Blower shall be designated Lead, Lag 1 and Lag 2. Designations shall swap automatically on a weekly basis. PLC shall also monitor two clarifier drives, Three RAS pumps and associated flow meter, three WAS pumps and associated flow meter and pressure sensor, and the non-potable water pump including associated flow switch.

The PLC shall also monitor alarms from the Filter Building PLC. Existing description denotes 12 alarms.

SCADA Server and Software

Provide costs for two new servers and Wonderware software with Historian, Trending, Alarming, and Reporting. One server will be housed at the Marshfield City Hall and shall be a rack mount device. Coordinate space requirements and constraints at City Hall location. Second server will be tower style located at the wastewater treatment plant. All locations referenced above are connected to an existing fiber optic network through Sho-me Technologies. Servers shall be configured as redundant systems such that a failure at one location does not bring down the system. A new desktop computer with dual monitors and printer/scanner shall also be provided for the operator's workstation at the exiting administration building.

Graphics shall be isolated for Water and Wastewater systems. Both systems shall start with city wide view and allow user to drill down to individual locations (Wells, Towers, Lift Stations, Plant etc.).

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In general graphics shall follow “Green” = Running or Open, “Red” = Stopped or Closed, “Amber” = Alarmed or fault, “Gray” = Out of Service

All analog items shall be trended every 15 minutes.

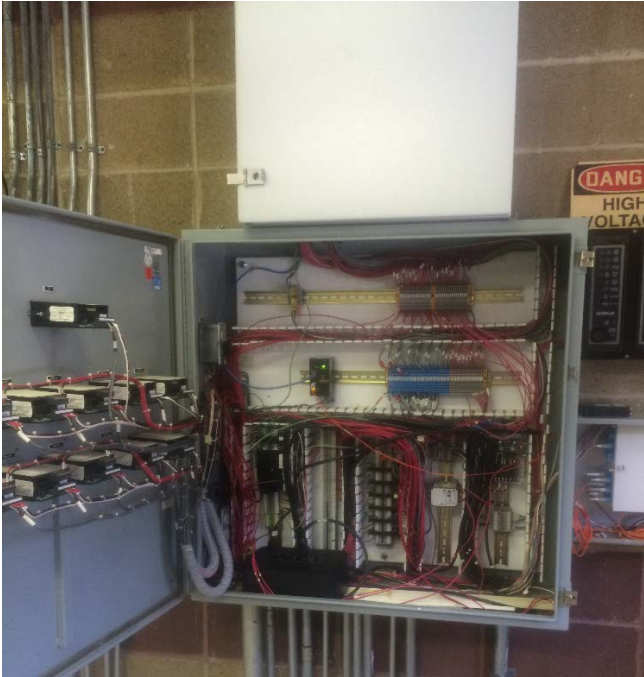
Include Software for RSLogix500 and RSLogix5000.

All screen layouts shall be pre-approved by the city for look and functionality prior to implementation.

Spare Items

Overall provide the following spare items

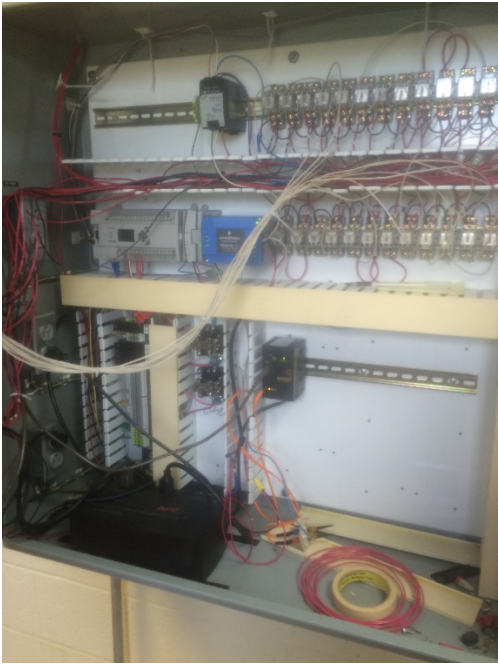
1. 1 x 1766-I32AWAA – MicroLogix 1400 PLC
2. 2 x 1762-IA8 discrete input card
3. 2 x 1762-IF4 analog input card
4. 2 x 1762-OF4 analog output card
5. 2 x 24VDC Power Supply
6. 2 x UPS



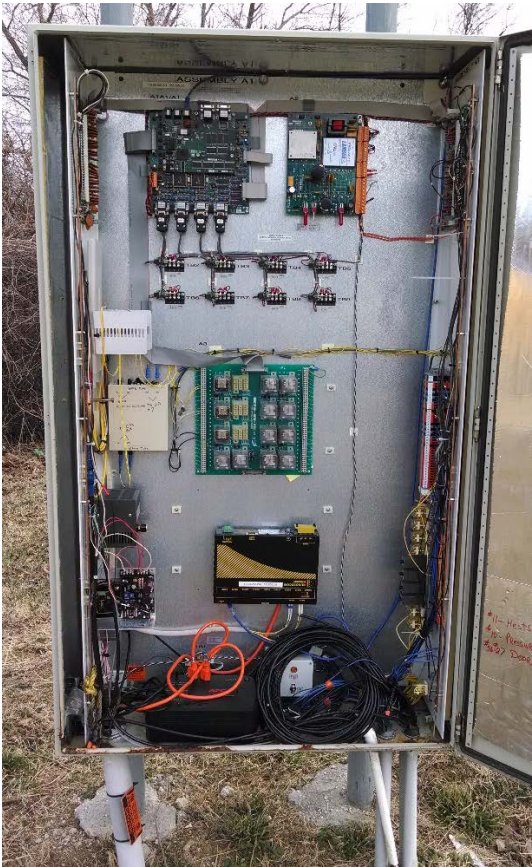
Existing Control Building Cabinet with Survalent equipment above



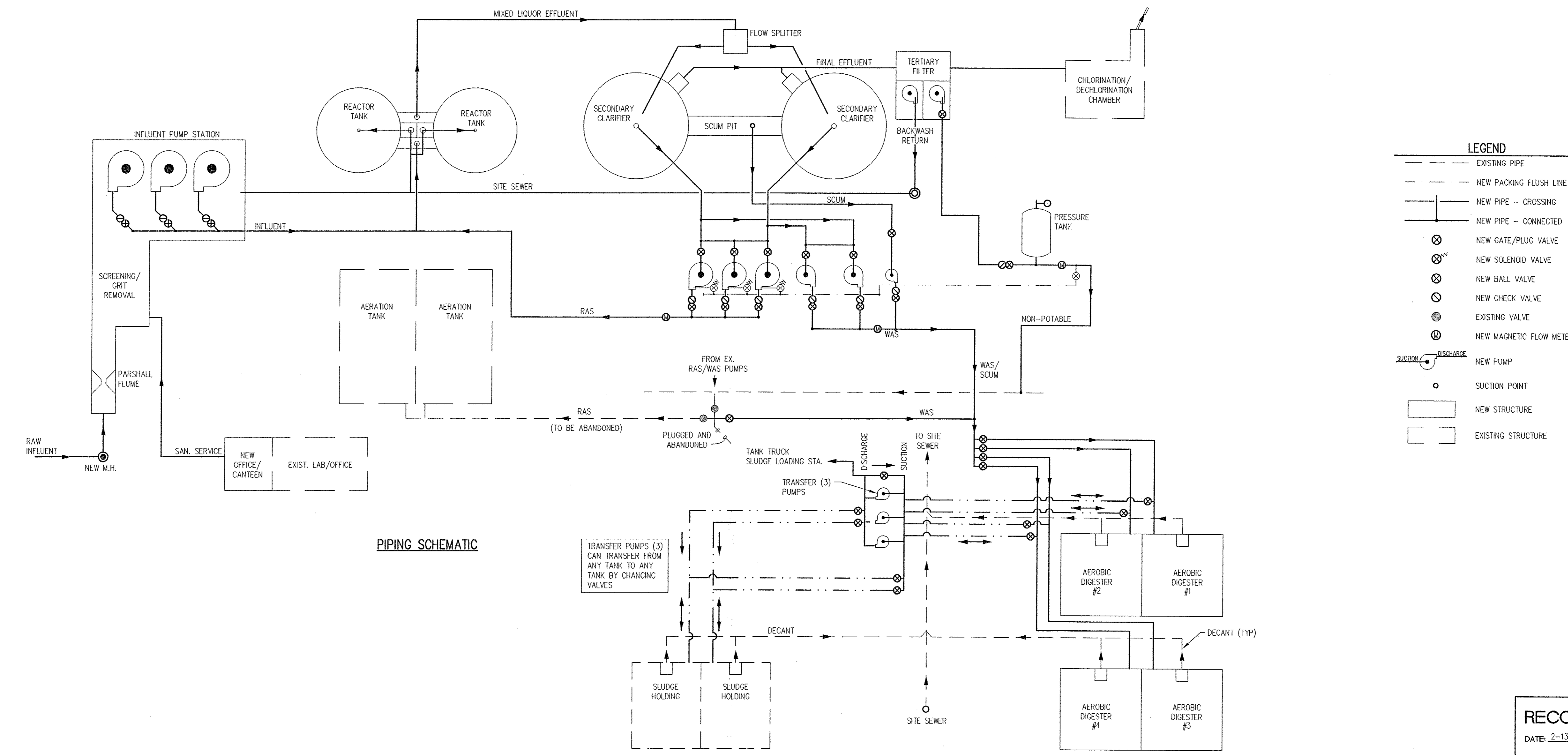
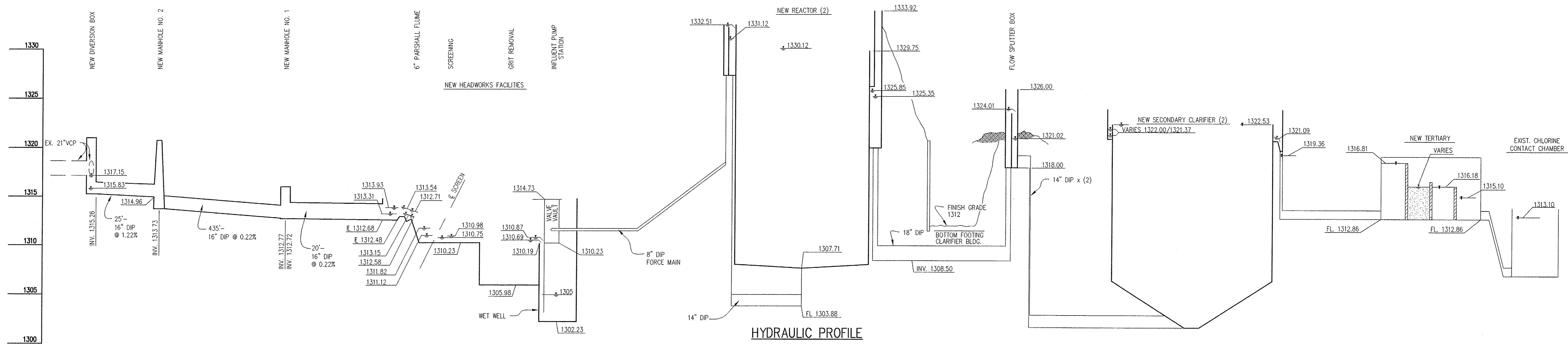
Control Building Survalent Equipment



Existing Headworks Panel with Allen Bradley PLC and Survalent Equipment



Typical Existing Lift Station Control Panel



RECORD DRAWING
DATE: 2-13-01 BY: R. HAYES

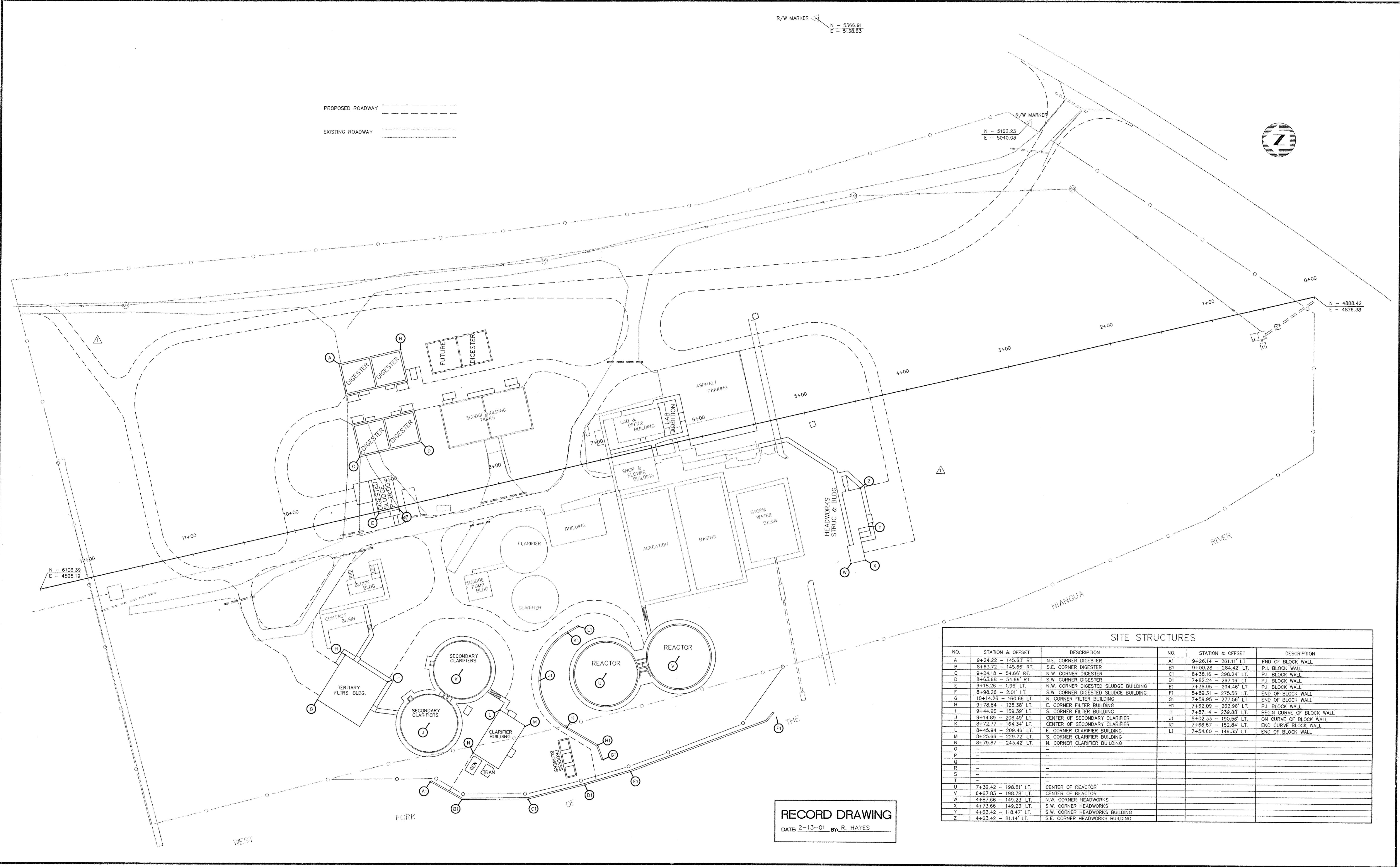
NO.	DATE	REVISION DESCRIPTION	BY	NO.	DATE	REVISION DESCRIPTION
1	11/4/97	REVISED FOR APPROVAL	R.H.			

MECO ENGINEERING COMPANY, INC.
ENGINEERS • SURVEYORS
3120 HIGHWAY W P.O. BOX 917
HANNIBAL, MISSOURI 63401 (573) 221-4048

WASTEWATER TREATMENT FACILITY
CITY OF MARSHFIELD

SCHEMATIC DIAGRAM

SURVEYED	DESIGNED	DRAWN	CHECKED	APPROVED	RELEASED	SCALE	DRAWING NO.	PROJECT NO.	SHEET NO.
	J.S. DOSS	R. HAYES C.T.				NO SCALE	423010HP	423-010	C1



SITE STRUCTURES					
NO.	STATION & OFFSET	DESCRIPTION	NO.	STATION & OFFSET	DESCRIPTION
A	9+24.22 - 145.63' RT.	N.E. CORNER DIGESTER	A1	9+26.14 - 261.11' LT.	END OF BLOCK WALL
B	8+63.72 - 145.66' RT.	S.E. CORNER DIGESTER	B1	9+00.28 - 284.42' LT.	P.I. BLOCK WALL
C	9+24.18 - 54.66' RT.	N.W. CORNER DIGESTER	C1	8+38.16 - 236.24' LT.	P.I. BLOCK WALL
D	8+63.68 - 54.66' RT.	S.W. CORNER DIGESTER	D1	7+82.24 - 297.16' LT.	P.I. BLOCK WALL
E	9+18.26 - 1.96' LT.	N.W. CORNER DIGESTED SLUDGE BUILDING	E1	7+36.95 - 294.46' LT.	P.I. BLOCK WALL
F	8+98.26 - 2.01' LT.	S.W. CORNER DIGESTED SLUDGE BUILDING	F1	5+89.31 - 275.56' LT.	END OF BLOCK WALL
G	10+14.26 - 160.66' LT.	N. CORNER FILTER BUILDING	G1	7+59.95 - 277.56' LT.	END OF BLOCK WALL
H	9+78.84 - 123.38' LT.	E. CORNER FILTER BUILDING	H1	7+42.09 - 262.96' LT.	P.I. BLOCK WALL
I	9+44.96 - 159.39' LT.	S. CORNER FILTER BUILDING	I1	7+57.14 - 239.88' LT.	BEGY CURVE OF BLOCK WALL
J	9+14.89 - 208.49' LT.	CENTER OF SECONDARY CLARIFIER	J1	8+02.33 - 190.56' LT.	ON CURVE OF BLOCK WALL
K	8+72.77 - 164.34' LT.	CENTER OF SECONDARY CLARIFIER	K1	7+66.67 - 152.64' LT.	END CURVE BLOCK WALL
L	8+45.94 - 209.46' LT.	E. CORNER CLARIFIER BUILDING	L1	7+54.80 - 149.35' LT.	END OF BLOCK WALL
M	8+25.66 - 239.72' LT.	S. CORNER CLARIFIER BUILDING			
N	8+79.87 - 243.42' LT.	N. CORNER CLARIFIER BUILDING			
O	--	--			
P	--	--			
Q	--	--			
R	--	--			
S	--	--			
T	--	--			
U	7+39.42 - 198.81' LT.	CENTER OF REACTOR			
V	6+67.83 - 198.78' LT.	CENTER OF REACTOR			
W	4+87.66 - 149.23' LT.	N.W. CORNER HEADWORKS			
X	4+73.66 - 149.23' LT.	S.W. CORNER HEADWORKS			
Y	4+63.42 - 118.47' LT.	S. CORNER HEADWORKS BUILDING			
Z	4+63.42 - 81.14' LT.	S.E. CORNER HEADWORKS BUILDING			

RECORD DRAWING
DATE: 2-13-01 BY: R. HAYES

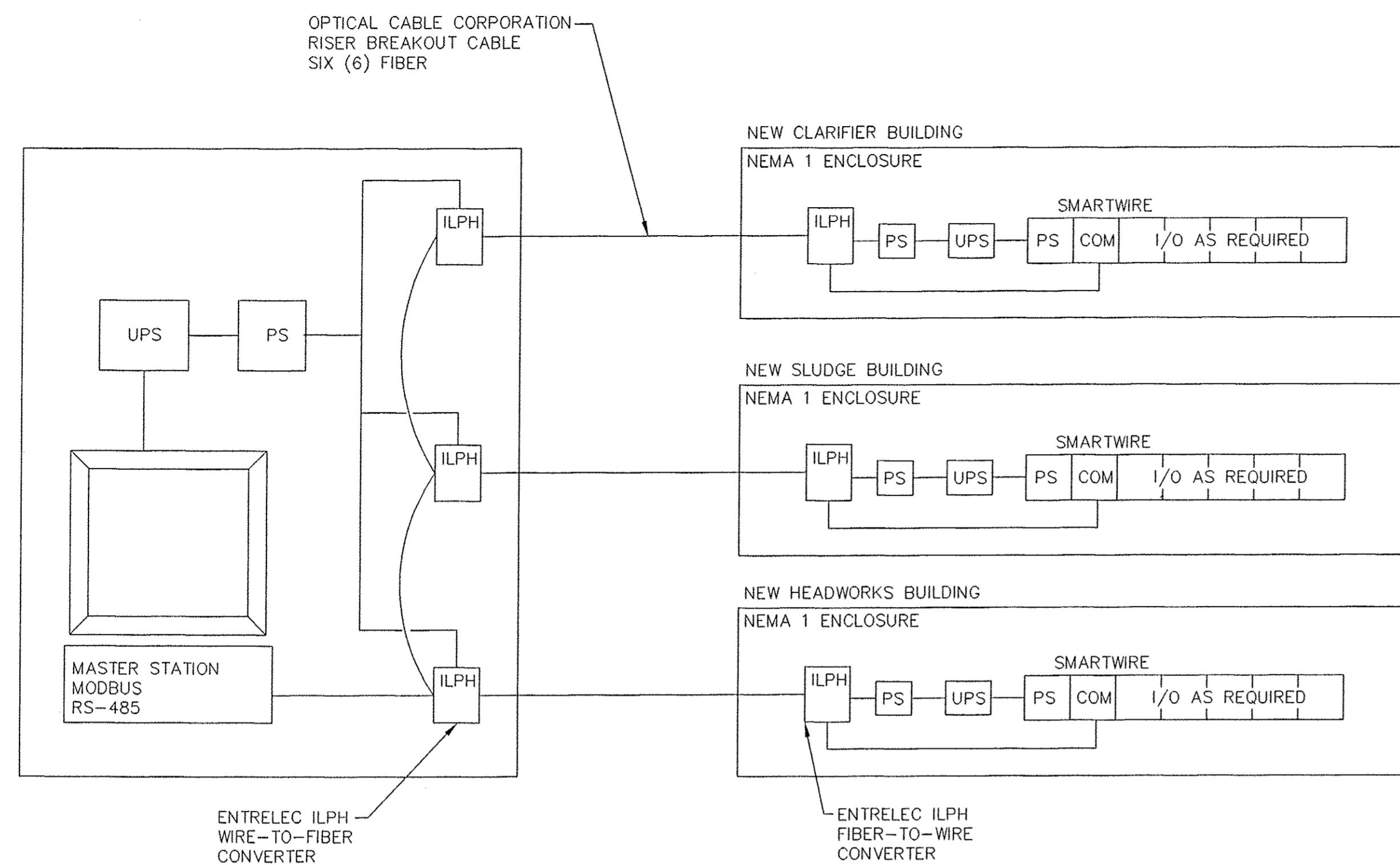
NO.	DATE	REVISION DESCRIPTION	BY	NO.	DATE	REVISION DESCRIPTION
1	2/11/99	REVISED AS PER ADDENDUM - REMOVED SECTION OF PROPOSED ROADWAY AND ADDED NEW SECTION OF ROADWAY	R.H.			

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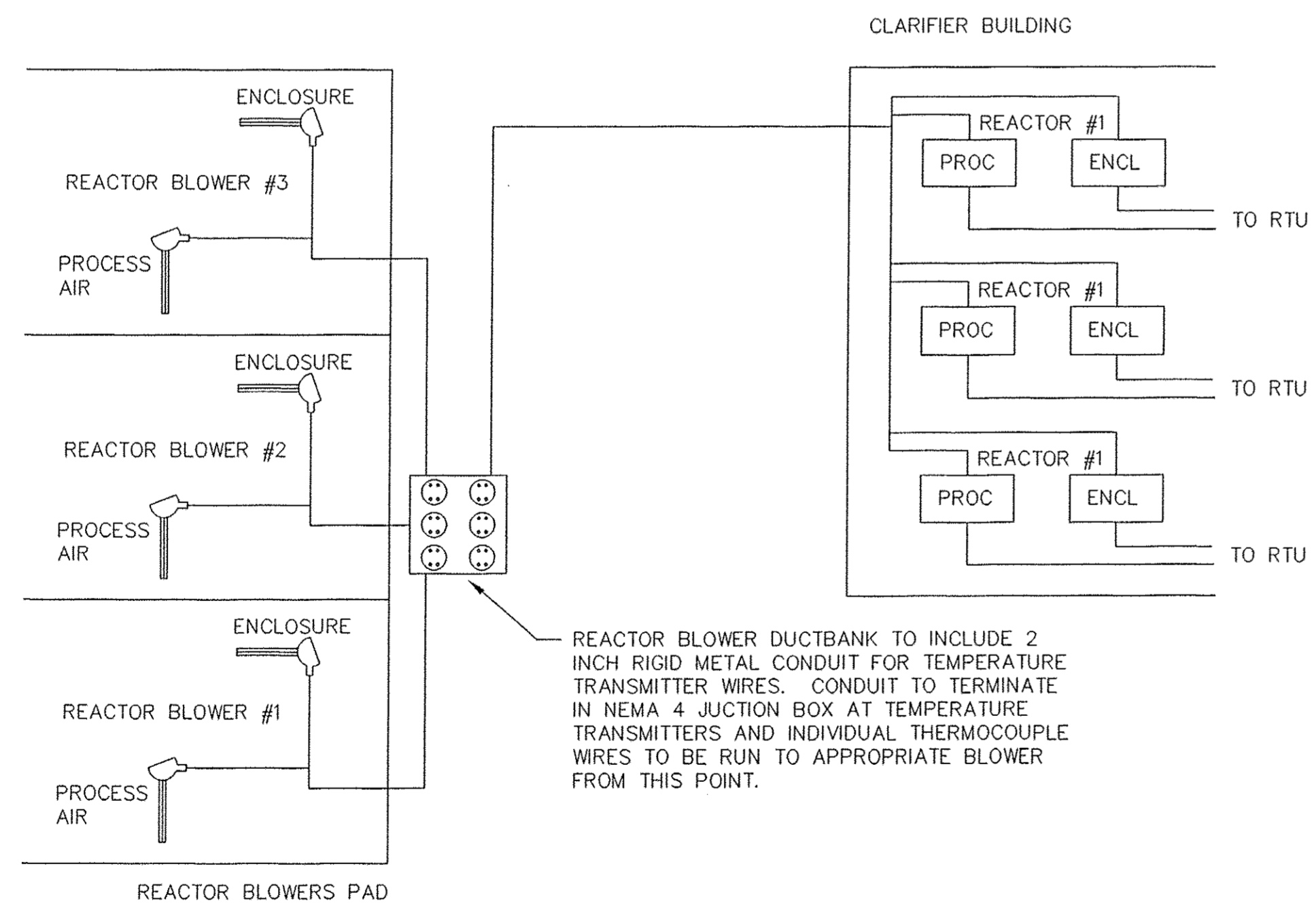
WASTEWATER TREATMENT FACILITY
CITY OF MARSHFIELD

BUILDING SITE LAYOUT

SURVEYED R.K. & B.H.	DESIGNED J. DOSS	DRAWN G. MOORE & R. HAYES	CHECKED	APPROVED	RELEASED	SCALE 1" = 40'-0"	DRAWING NO. 423010ST-B	PROJECT NO. 423-010	SHEET NO. C2
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1 CONTROL SYSTEM ONE-LINE DIAGRAM
E14



2 TYPICAL BLOWER TEMPERATURE PROBES ONE-LINE
E14

NEW HEADWORKS BUILDING I/O REQUIREMENTS

- INFLUENT PUMPS CALL (3)
- INFLUENT PUMPS ON (3)
- INFLUENT PUMPS FAULT (3)
- PARSHALL FLUME FLOWMETER (1)
- HIGH LEVEL FLOAT (1)
- GRIT BLOWER ON (1)
- GRIT POWER ON (1)
- GRIT FAULT (1)
- SCREEN POWER ON (1)
- SCREEN FAULT (1)

NEW CLARIFIER BUILDING I/O REQUIREMENTS

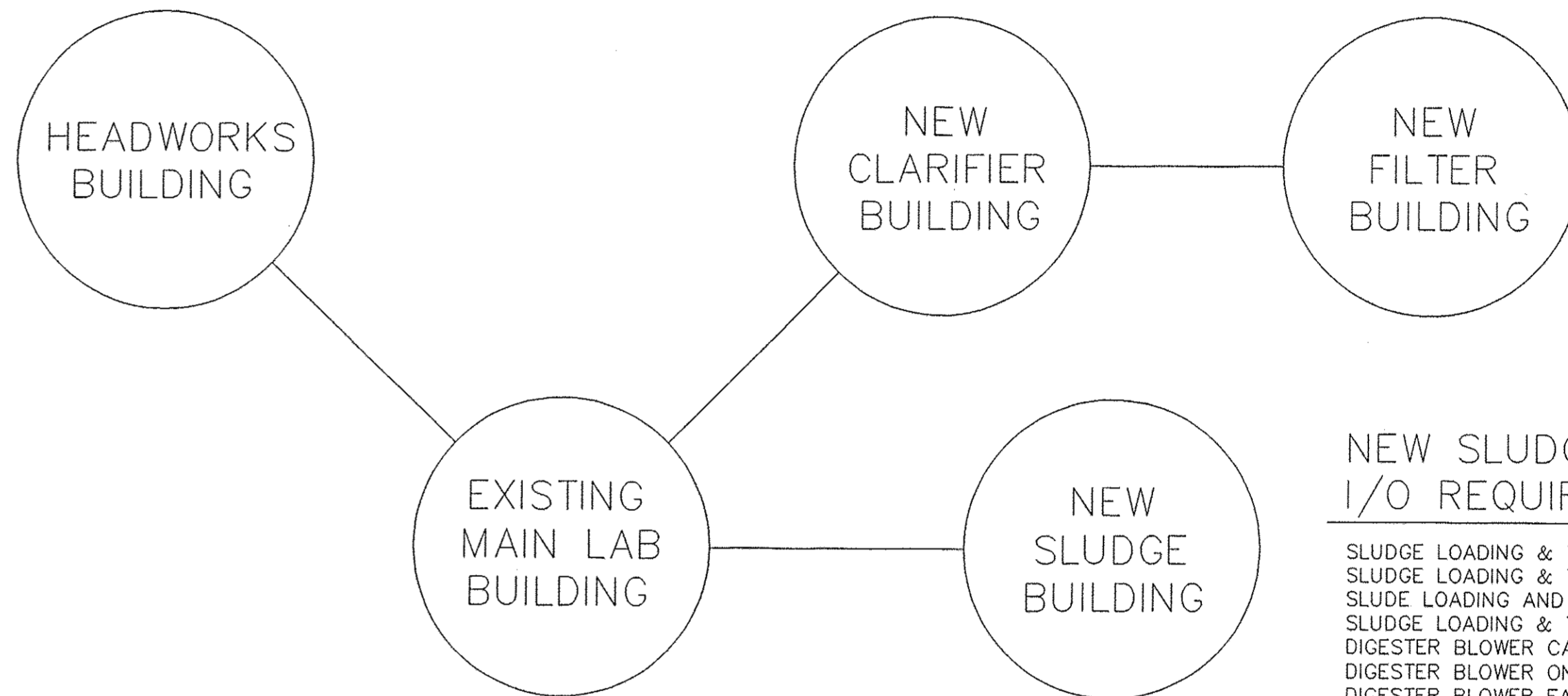
- REACTOR BLOWERS CALL (3)
- REACTOR BLOWERS ON (3)
- REACTOR BLOWERS FAULT (3)
- PROCESS AIR TEMPERATURE (3)
- BLOWER ENCLOSURE TEMPERATURE (3)
- PROCESS AIR TEMPERATURE ALARMS (3)
- BLOWER ENCLOSURE TEMPERATURE ALARMS (3)
- CLARIFIER DRIVE ON (2)
- CLARIFIER DRIVE OVERTORQUE AND/OR OVERLOAD (2)
- RETURN ACTIVATED SLUDGE FLOWMETER (1)
- RETURN ACTIVATED SLUDGE PUMPS CALL (3)
- RETURN ACTIVATED SLUDGE PUMPS ON (3)
- RETURN ACTIVATED SLUDGE PUMPS FAULT (3)
- WASTE ACTIVATED SLUDGE FLOWMETER (1)
- WASTE ACTIVATED SLUDGE PUMPS CALL (3)
- WASTE ACTIVATED SLUDGE PUMPS ON (3)
- WASTE ACTIVATED SLUDGE PUMPS FAULT (3)
- WASTE ACTIVATED SLUDGE LINE PRESSURE (1)
- NON-POTABLE WATER PUMP CALL (1)
- NON-POTABLE WATER PUMP ON (1)
- NON-POTABLE WATER PUMP FAULT (1)
- NON-POTABLE WATER PUMP FLOW SWITCH (1)

NEW FILTER BUILDING I/O REQUIREMENTS

- FILTER SYSTEM ALARMS (12)

NEW SLUDGE BUILDING I/O REQUIREMENTS

- SLUDGE LOADING & TRANSFER PUMPS ON (3)
- SLUDGE LOADING & TRANSFER PUMPS FAULT (3)
- SLUDGE LOADING & TRANSFER LINE PRESSURE (1)
- SLUDGE LOADING & TRANSFER OVERPRESSURE (1)
- DIGESTER BLOWER CALL (7) (SEE NOTE 2)
- DIGESTER BLOWER ON (7) (SEE NOTE 2)
- DIGESTER BLOWER FAULT (7) (SEE NOTE 2)
- SLUDGE HOLDING BLOWER ON (2)
- SLUDGE HOLDING BLOWER FAULT (2)
- SLUDGE LOADING MAG-METER (FLOW) (1)



3 SITE I/O DISTRIBUTION
E14

- NOTE 1: ALL WORK SHALL BE DONE IN ACCORDANCE WITH THE LATEST EDITION OF THE NATIONAL ELECTRICAL CODE AND ANY APPLICABLE STATE AND LOCAL CODES. ANY WORK NOT CONFORMING SHALL BE REDONE AT THE CONTRACTORS EXPENSE.
- NOTE 2: THIS CONTRACT WILL ONLY INSTALL FIVE (5) DIGESTER BLOWERS. HOWEVER, THE CONTRACTOR WILL PROVIDE THE INPUTS FOR THE SIXTH AND SEVENTH BLOWERS.
- NOTE 3: THE MASTER COMPUTER SHALL HAVE FACTORYLINK LITE (OR EQUAL) INSTALLED AND BE CONFIGURED AS THE BUS MASTER.
- NOTE 4: ALL COMMUNICATIONS AND I/O EQUIPMENT SHALL BE PROTECTED BY A UPS.

RECORD DRAWING
DATE: 2/26/01 BY: R. HAYES

NO.	DATE	REVISION DESCRIPTION	BY	NO.	DATE	REVISION DESCRIPTION

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WASTEWATER TREATMENT FACILITY
CITY OF MARSHFIELD

SURVEYED	DESIGNED	DRAWN	CHECKED	APPROVED	RELEASED
	T. BOMAN	T. BOMAN			

PLANT I/O AND CONTROL SYSTEM
NEW FACILITY

SCALE	DRAWING NO.	PROJECT NO.	SHEET NO.
NONE	423010EE	423-010	E14