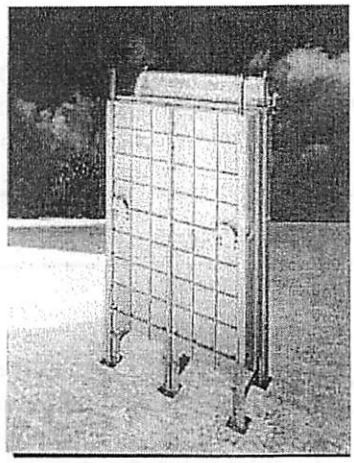
APPENDIX G

Kubota Wastewater Treatment Plant
Plans and Literature

Enviroquip's Membrane Bioreactor (MBR) incorporates Kubota's patented flat-plate microfiltration membrane technology to obtain high flux rates at low transmembrane pressure and dramatically reduce fouling. Designed specifically for wastewater applications, our MBR can provide superior effluent quality while reducing operating costs and plant footprint requirements.



Main Applications

- Municipal Wastewater Treatment
- Wastewater Reuse

Other Applications

- Sludge Thickening
- Industrial Wastewater Treatment

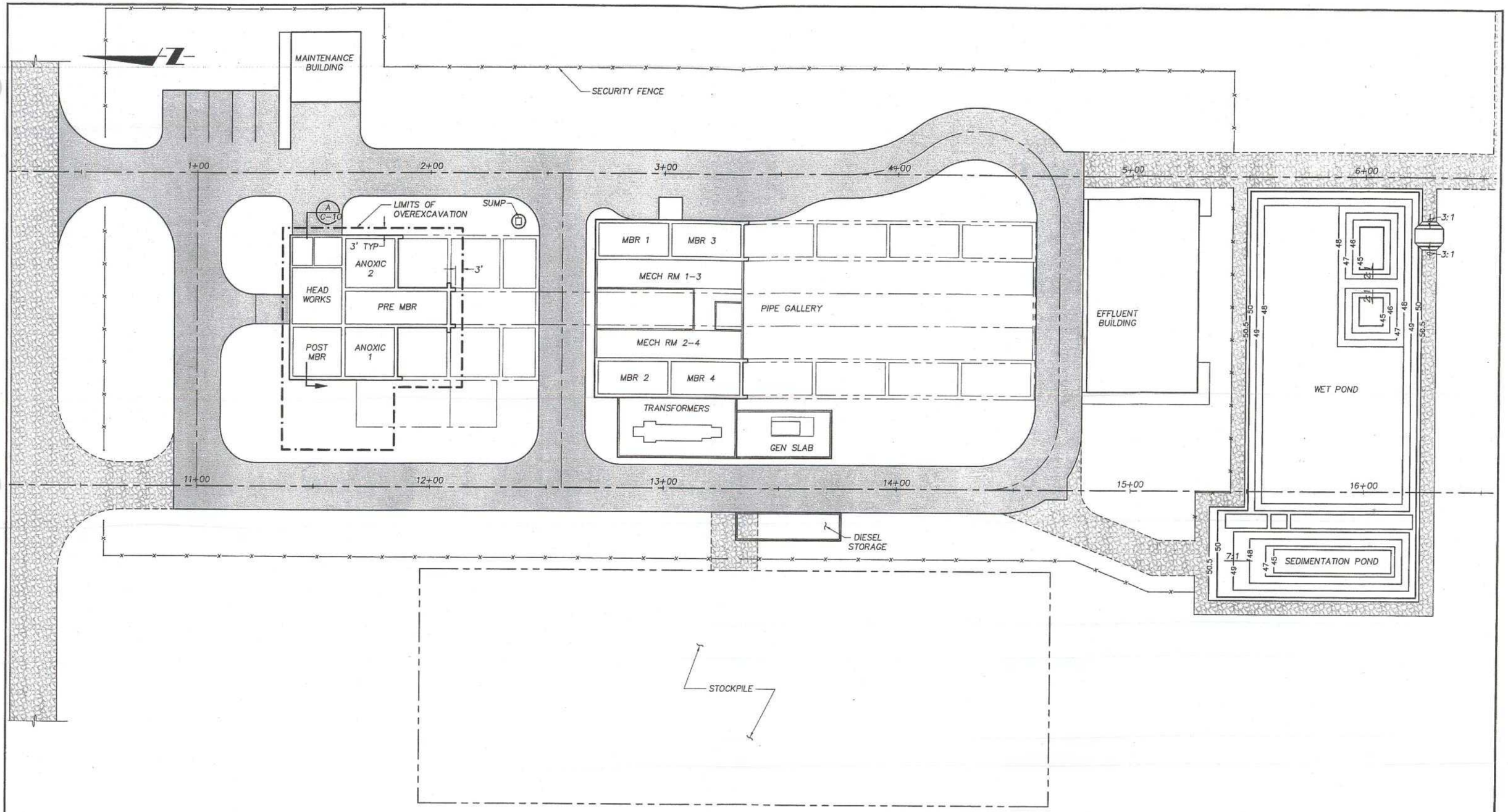
1	**Compact Plant** The use of membranes allows an MBR to operate independent of sludge settling qualities and eliminates the need for secondary clarification or filtration. As a result, a typical MBR can operate as MLSS concentrations between 15,000 and 30,000 mg/L. By operating at higher MLSS concentrations, the footprint of a conventional plant is often reduced by 50 percent or more.

2	**Reduced Sludge Production** Most MBR Plants operate at sludge ages in excess of 40 days. Long sludge ages can decrease plant sludge production by 40 percent thereby significantly reducing solids handling capital and operating costs.

3	**Lower Pressure Operation** The design of the membrane plates significantly improves hydraulic permeability as compared to other membrane technologies. As a result, our MBR can be gravity operated or utilize low suction head permeate pumps to drive the filtration process. Gravity operation can simplify system controls and reduce operation costs.

4	**Low Maintenance** Generally our membranes must be cleaned two to three times per year. The MBR membranes are cleaned in place using a dilute chemical solution that is simply poured or injected into the membrane case. The process is conducted while the plant is online and takes between one and two hours to complete.

5	**Exceptional Final Effluent** Classified as microfiltration, the average pore size of a Kubota membrane is 0.4 microns. However, within minutes of operation, a thin biofilm forms over the membrane reducing the effective pore size to 0.1 microns. Studies have shown virus and bacteria removal efficiencies of 99.9 percent and greater.



PLAN

SCALE: 1"=20'

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DESIGNED D. ROBERTS
DRAWN K. TAYLOR
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0 1" 2"
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PROJECT NAME
TULALIP TRIBES
WASTEWATER TREATMENT AND REUSE FACILITY
TULALIP, WASHINGTON

JOB NO. 216-1598-012 FILE NAME: S1598012C02

SITE PLAN

SHEET NO. C-1

XX

DATE: 05/09/02 IMAGES: XREF'S: S1, 1598120302de

J-1 IDENTIFICATION LETTERS

	FIRST LETTER		SUCCEEDING LETTERS		
	MEASURED OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A	ANALYSIS		ALARM		
B	BURNER, COMBUSTION		USER'S CHOICE	USER'S CHOICE	USER'S CHOICE
C	USER'S CHOICE			CONTROL	
D	DENSITY	DIFFERENTIAL			
E	VOLTAGE		SENSOR (PRIMARY ELEMENT)		
F	FLOW RATE	RATIO (FRACTION)			
G	USER'S CHOICE		GLASS, VIEWING DEVICE		
H	HAND				HIGH
I	CURRENT (ELECTRICAL)		INDICATE		
J	POWER	SCAN			
K	TIME, TIME SCHEDULE	TIME RATE OF CHANGE		CONTROL STATION	
L	LEVEL		LIGHT		LOW
M	MOISTURE	MOMENTARY			MIDDLE, INTERMEDIATE
N	USER'S CHOICE		USER'S CHOICE	USER'S CHOICE	USER'S CHOICE
O	USER'S CHOICE		ORIFICE,RESTRICTION		
P	PRESSURE, VACUUM		POINT (TEST) CONNECTION		
Q	QUANTITY	INTEGRATE, TOTALIZE			
R	RADIATION		RECORD		
S	SPEED, FREQUENCY	SAFETY		SWITCH	
T	TEMPERATURE			TRANSMIT	
U	MULTIVARIABLE		MULTIFUNCTION	MULTIFUNCTION	MULTIFUNCTION
V	VIBRATION, MECHANICAL ANALYSIS			VALVE, DAMPER, OR LOUVER	
W	WEIGHT, FORCE		WELL		
X	UNCLASSIFIED	X AXIS	UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED
Y	EVENT, STATE, PRESENCE	Y AXIS		RELAY, COMPUTE, CONVERT	
Z	POSITION, DIMENSION	Z AXIS		DRIVER, ACTUATOR, UNCLASSIFIED FINAL CONTROL ELEMENT	

GENERAL INSTRUMENT OR FUNCTION SYMBOLS	FIELD MOUNTED	PRIMARY LOCATION, ACCESSIBLE TO OPERATOR	AUXILIARY LOCATION, ACCESSIBLE TO OPERATOR	NORMALLY INACCESSIBLE OR BEHIND THE PANEL
DISCRETE INSTRUMENTS				
SHARED DISPLAY, SHARED CONTROL				
COMPUTER FUNCTION				
PROGRAMMABLE LOGIC CONTROL				

TYPICAL CONNECTION

- DIRECT CONNECTION TO PROCESS (BLOCK VALVE SYMBOL OPTIONAL)
- RADIATION OR SONIC SENSING
- TEMPERATURE ELEMENT WITH WELL (RTD IF APPLICABLE) — RTD
- FILLED SYSTEM, DIAPHRAGM SEAL CONNECTION
- IN-LINE DEVICE

INSTRUMENT SYMBOL IDENTIFIERS

J-4 / J-1 J-2 / J-3

- J-1: IDENTIFICATION LETTERS (SEE TABLE ABOVE)
- J-2: LOOP NUMBER
- J-3: PANEL NUMBER
- J-4: HANDSWITCH DESIGNATOR OR ADDITIONAL INFORMATION

J-4 HANDSWITCH DESIGNATORS

HOA	HAND-OFF-AUTO
HOR	HAND-OFF-REMOTE
LRS	LOWER-RAISE-STOP
LOR	LOCAL-OFF-REMOTE
COS	CLOSE-OPEN-STOP

LINES

LINE	DESCRIPTION
	MAIN PROCESS FLOW (WITH TYPICAL DIRECTION OF FLOW SHOWN)
	MAIN (EXISTING)
	SECONDARY PROCESS FLOW
	SECONDARY (EXISTING)
	INSTRUMENT SUPPLY, PROCESS TAPS, NON PROCESS FLOW
	PNEUMATIC SIGNAL (ANALOG)
	ELECTRIC SIGNAL (ANALOG)
	PNEUMATIC SIGNAL (DISCRETE)
	ELECTRIC SIGNAL (DISCRETE)
	CAPILLARY TUBE OR FILLED SYSTEM
	ELECTROMAGNETIC OR SONIC SIGNAL (GUIDED)
	ELECTROMAGNETIC OR SONIC SIGNAL (UNGUIDED)
	SOFTWARE OR DATA LINK
	MECHANICAL LINK
	HYDRAULIC
ES	ELECTRIC POWER SUPPLY 120VAC, 60HZ U.N.O.
SA	SERVICE AIR SUPPLY

MECHANICAL — ELECTRICAL

- OR — CONNECTED
- NOT CONNECTED
- OR — OR
- SPECIFICALLY NOTED)

FLOW PRIMARY ELEMENTS

- ORIFICE PLATE
- SINGLE PORT PITOT TUBE OR PITOT-VENTURI TUBE
- AVERAGING PITOT TUBE
- FLUME
- WEIR
- TURBINE OR PROPELLER-TYPE PRIMARY ELEMENT
- ROTAMETER
- POSITIVE DISPLACEMENT TYPE FLOW TOTALIZING INDICATOR
- VORTEX SENSOR
- TARGET TYPE SENSOR
- FLOW NOZZLE
- MAGNETIC FLOWMETER
- SONIC FLOWMETER
- DENSITY METER

VALVES

- GATE VALVE (N.O. / N.C.)
- GLOBE VALVE (N.O. / N.C.)
- PLUG VALVE (N.O. / N.C.)
- CHECK VALVE
- DIAPHRAGM VALVE (PINCH VALVE)
- BUTTERFLY VALVE (N.O. / N.C.)
- BALL VALVE (N.O. / N.C.)
- NEEDLE VALVE
- PRESSURE REDUCING REGULATING VALVE, SELF-CONTAINED
- BACK PRESSURE REGULATING VALVE, SELF-CONTAINED
- PRESSURE REDUCING REGULATOR WITH EXTERNAL PRESSURE TAP
- PRESSURE SURGE DISCHARGE
- 3-WAY VALVE (N.O. / N.C.)
- 4-WAY VALVE
- ANGLE VALVE
- AIR RELIEF VALVE
- VACUUM RELIEF VALVE
- V-PORT BALL VALVE
- PUMP CONTROL VALVE AND CHECK VALVE ANGLE PATTERN
- BALL CHECK
- PUMP CONTROL VALVE AND CHECK VALVE STRAIGHT PATTERN
- AIR VACUUM VALVE
- CORPORATION STOP (N.O. / N.C.)

VALVE OPERATORS

- DIAPHRAGM
- DIAPHRAGM, PRESSURE BALANCED
- HAND
- M — MOTOR
- CYLINDER OPERATOR
- S — SOLENOID

INSTRUMENT & MECHANICAL EQUIPMENT SYMBOLS & MISCELLANEOUS

- CENTRIFUGAL PUMP
- SUBMERSIBLE PUMP
- VERTICAL PUMP
- METERING PUMP
- PROGRESSING CAVITY PUMP
- BLOWER
- CALIBRATION CHAMBER
- SILENCER
- M — MOTOR
- INTAKE SCREEN/FILTER
- 3 — INTERLOCK. NUMBER IS THE CROSSREFERENCE TO A SPECIFIC ELEMENTARY DIAGRAM ON THE DRAWINGS OR, AS APPLICABLE, TO A SPECIFIC CONTROL STRATEGY DESCRIBED IN THE SPECIFICATIONS.
- XX — INTERFACE TO EXITING CONNECTIONS
- INTERFACE LINE CONTINUATION
- FLEXIBLE METAL HOSE
- EXPANSION JOINT, FLEXIBLE RUBBER SPOOL
- HOSE
- IXXX (E) (N) — INTERFACE CONTROL (E) = EXISTING (N) = NEW
- M — MIXER
- SLUICE GATE (NORMALLY OPEN)
- SLUICE GATE (NORMALLY CLOSED)
- INJECTOR
- FILTER OR SEPARATOR
- T — DRIP TRAP
- CAP OR PLUG
- HOSE BIBB CONNECTION
- DIAPHRAGM SEAL
- RUPTURE DISK, PRESSURE
- RUPTURE DISK, VACUUM
- LEVEL SWITCH
- IN-LINE PRESSURE SENSOR
- W — PUMP SEAL OR VALVE WATER SUPPLY, PLANT WATER
- FLANGE
- UNION
- Y STRAINER
- FLOW STRAIGHTENING VANE
- HOSE CONNECTION
- WELDED CAP
- BLIND FLANGE
- P — PURGE
- DRAIN
- THERMOMETER WELL
- QUICK DISCONNECT
- AIR COMPRESSOR
- PULSATION DAMPENER
- REDUCER OR INCREASER
- D — PIPED TO DRAIN
- STATIC MIXER
- FLEX COUPLING W/RODS
- HEAT TRACE
- CALIBRATION CHAMBER

ABBREVIATIONS

AC	ACID
AFD	ADJUSTABLE FREQUENCY DRIVE
AL	ALUM
AP	ANIONIC POLYMER
AS	AIR SUPPLY
CP	CATIONIC POLYMER/CONTROL PANEL
DF	D.A.F. FLOAT
DI	D.A.F. INFLUENT/DUCTILE IRON
DR	D.A.F. RECYCLE
DWV	DRAIN, WASTE, & VENT
EF	EFFLUENT FEED
EFB	EFFLUENT BYPASS
EFD	EFFLUENT DISCHARGE
EFR	EFFLUENT RECYCLE
ES	ELECTRICAL SUPPLY
F	FIRE SPRINKLER
F.C.	FAIL CLOSED
FD	FLOOR DRAIN
F.O.	FAIL OPEN
HOA	HAND-OFF-AUTO
HOR	HAND-OFF-REMOTE
I/O	ON/OFF
L/A	LOCAL/AUTO
MUX	TELEMETRY MULTIPLEXING
NaOH	SODIUM HYDROXIDE
N.C.	NORMALLY CLOSED
N.O.	NORMALLY OPEN
OAC	OPEN-AUTO-CLOSE
OF	OVERFLOW
OIL	OIL
OOR	ON-OFF-REMOTE
PLC	PROGRAMMABLE LOGIC CONTROLLER
PSE	PRIMARY SEPARATION EFFLUENT
PT	PRESSURE TAP
PVC	POLYVINYL CHLORIDE
PW	PLANT WATER
S	SEWER
SA	SAMPLE
SD	SLUDGE DISCHARGE
SP	SUMP PUMP
STL	STEEL
TURB	TURBIDITY
UNO	UNLESS NOTED OTHERWISE
V	VENT ABOVE ELEVATION
VSD	VARIABLE SPEED DRIVE (VFD)
WTS	WASTE TO SEWER
WWB	WASTEWATER BYPASS
WWF	WASTEWATER FEED
WWI	WASTEWATER INFLUENT
WWR	WASTEWATER RECYCLE
WWS	WASTEWATER STORAGE

NOTES:

1. THIS IS A GENERALIZED LEGEND SHEET. THIS CONTRACT MAY NOT USE ALL INFORMATION SHOWN.
2. INFORMATION SHOWN MAY NOT BE ALL INCLUSIVE. SEE ALSO ISA S5.1, S5.3 AND S7.3.
3. ═══ INDICATES INTERFACE TO PLC.

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TULALIP, WASHINGTON
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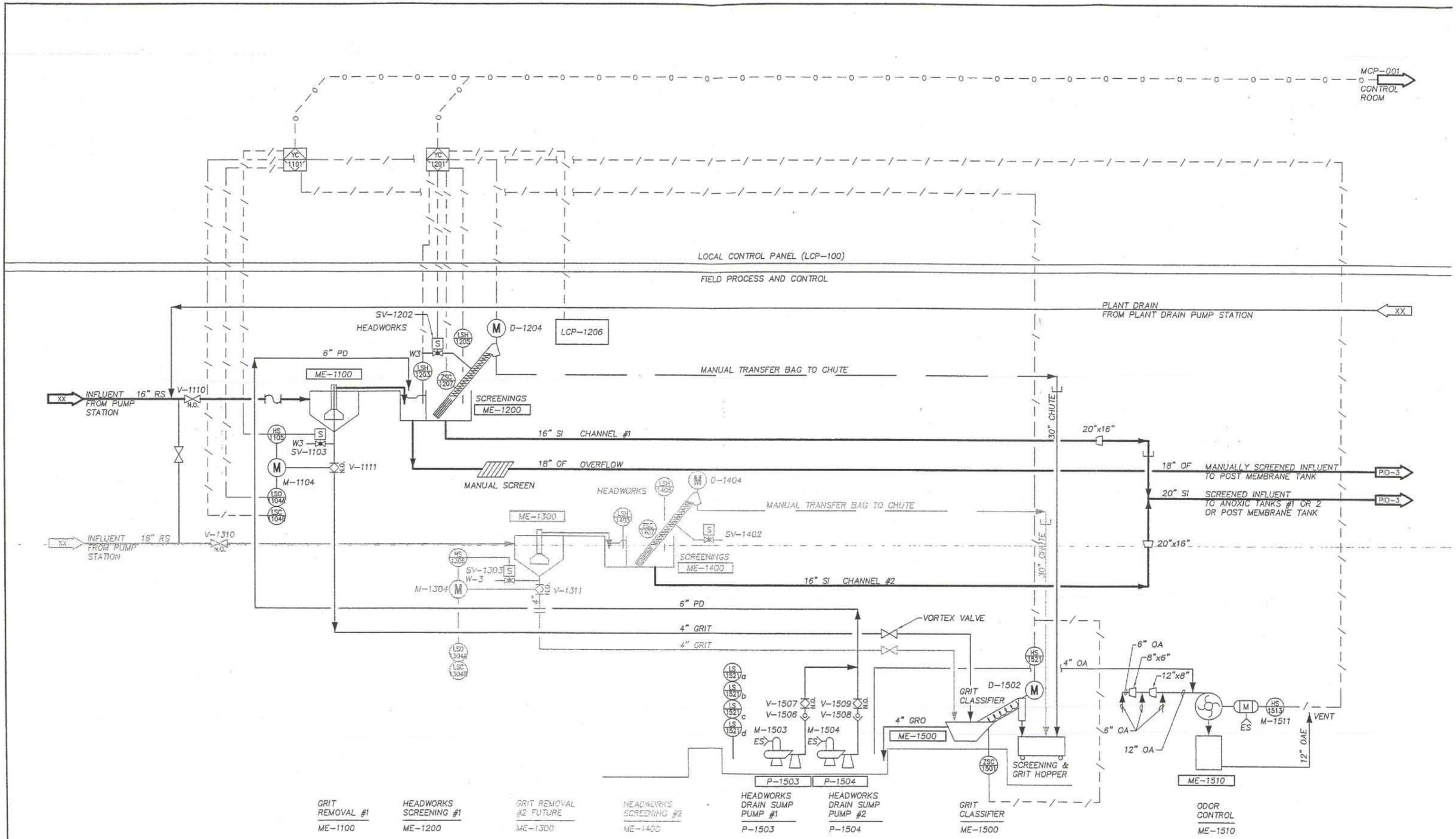
INSTRUMENTATION AND CONTROLS LEGEND AND ABBREVIATIONS

SHEET NO. PID-1 / XX

DATE: 05/07/02 IMAGES: XREF'S: S1598012PI



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PROCESS & INSTRUMENT DIAGRAM GRIT REMOVAL SCREENING AND GRIT CLASSIFIER

SHEET NO. PID-2
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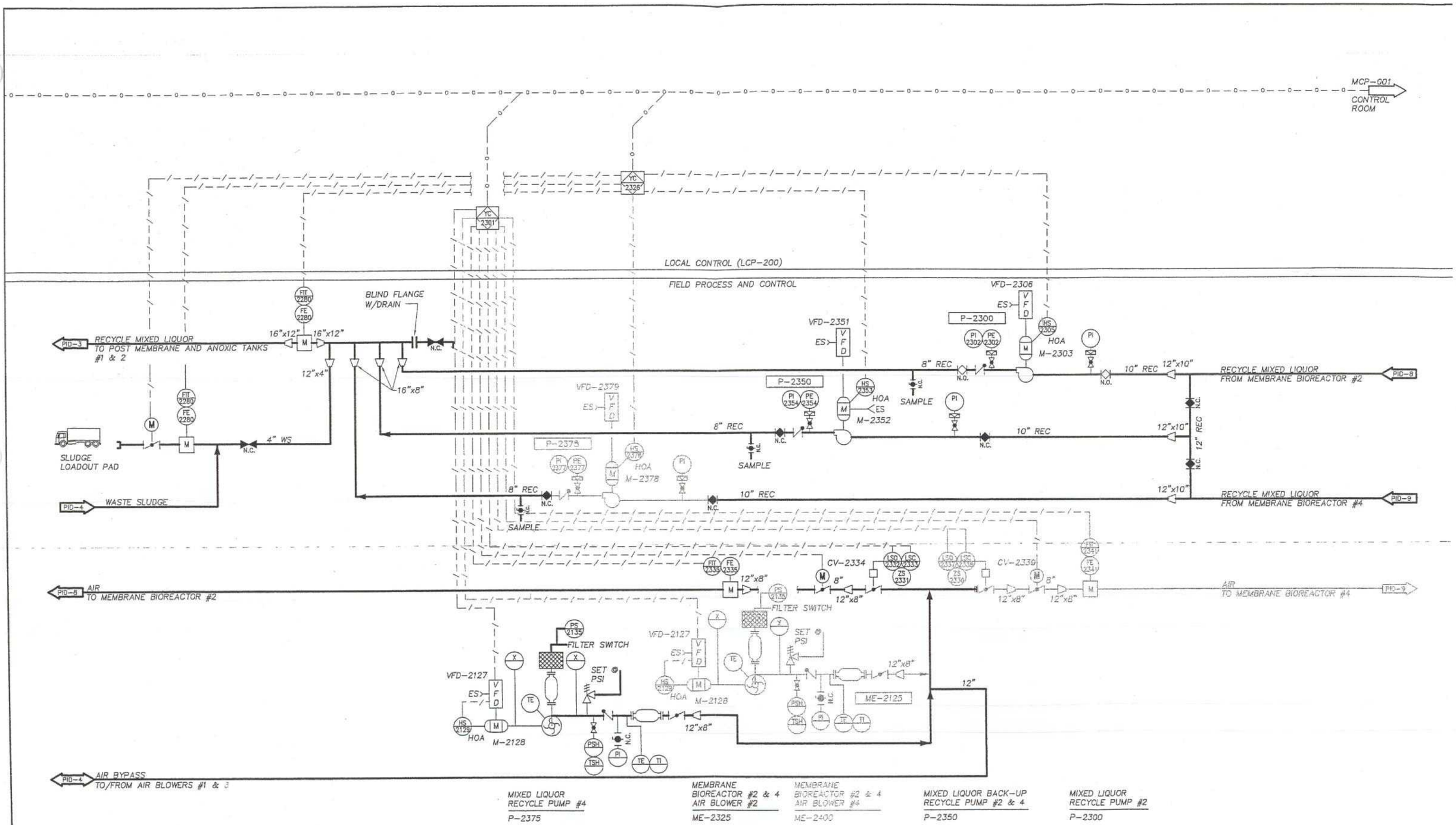
MAGES: WIDTS: S1598012PI
DATE: 05/06/02



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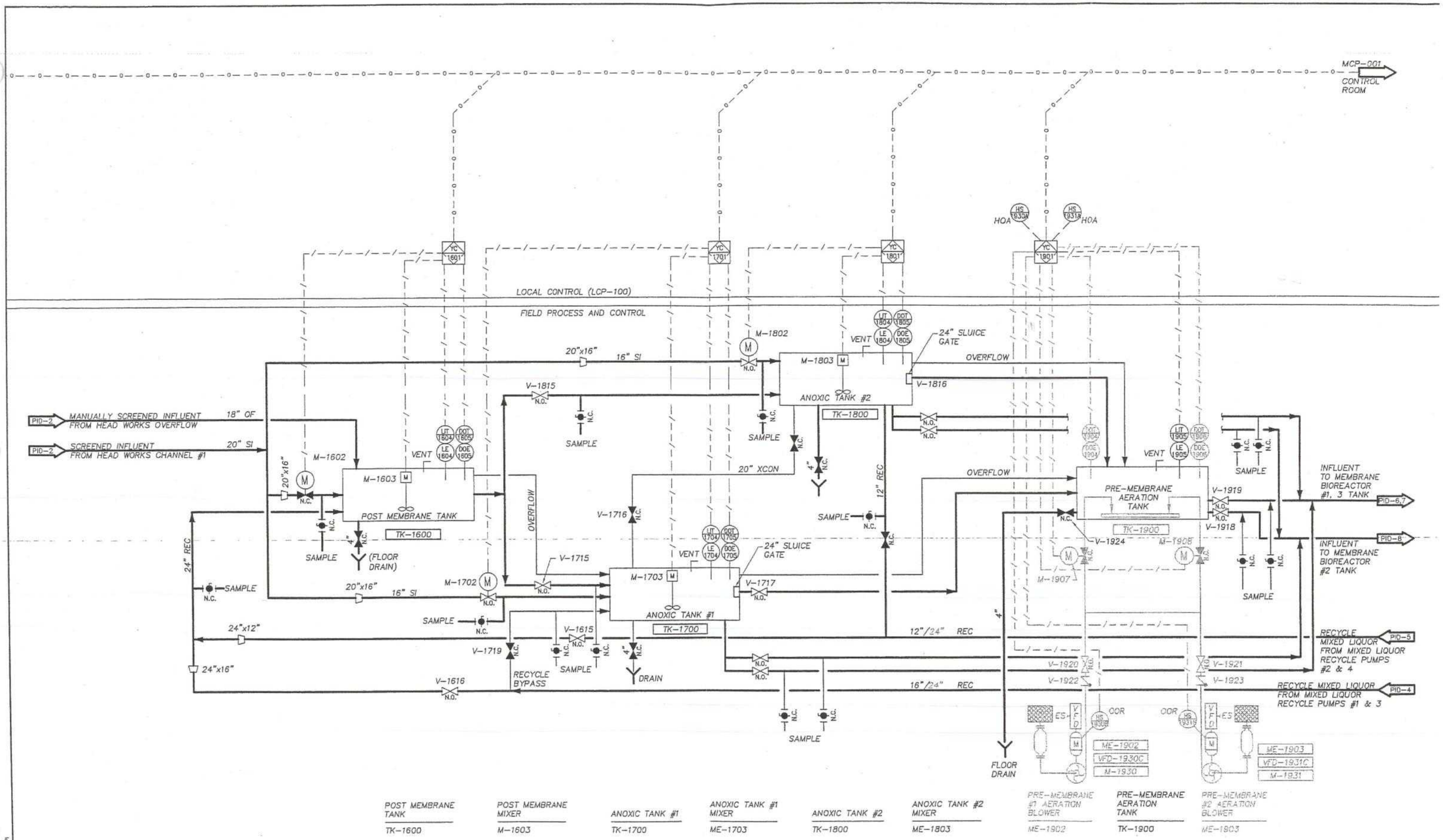
PROCESS & INSTRUMENT DIAGRAM RECYCLE EFFLUENT AND AIR BLOWERS #2 AND #4

SHEET NO. PID-5 / XX

DATE: 05/06/02 DWG'S: S1598012PI



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JOB NO. 216-1598-012 FILE NAME: S1598012PID02

PROCESS & INSTRUMENT DIAGRAM POST MEMBRANE, ANOXIC TANKS & PRE-MEMBRANE AERATION TANK

SHEET NO. PID-3
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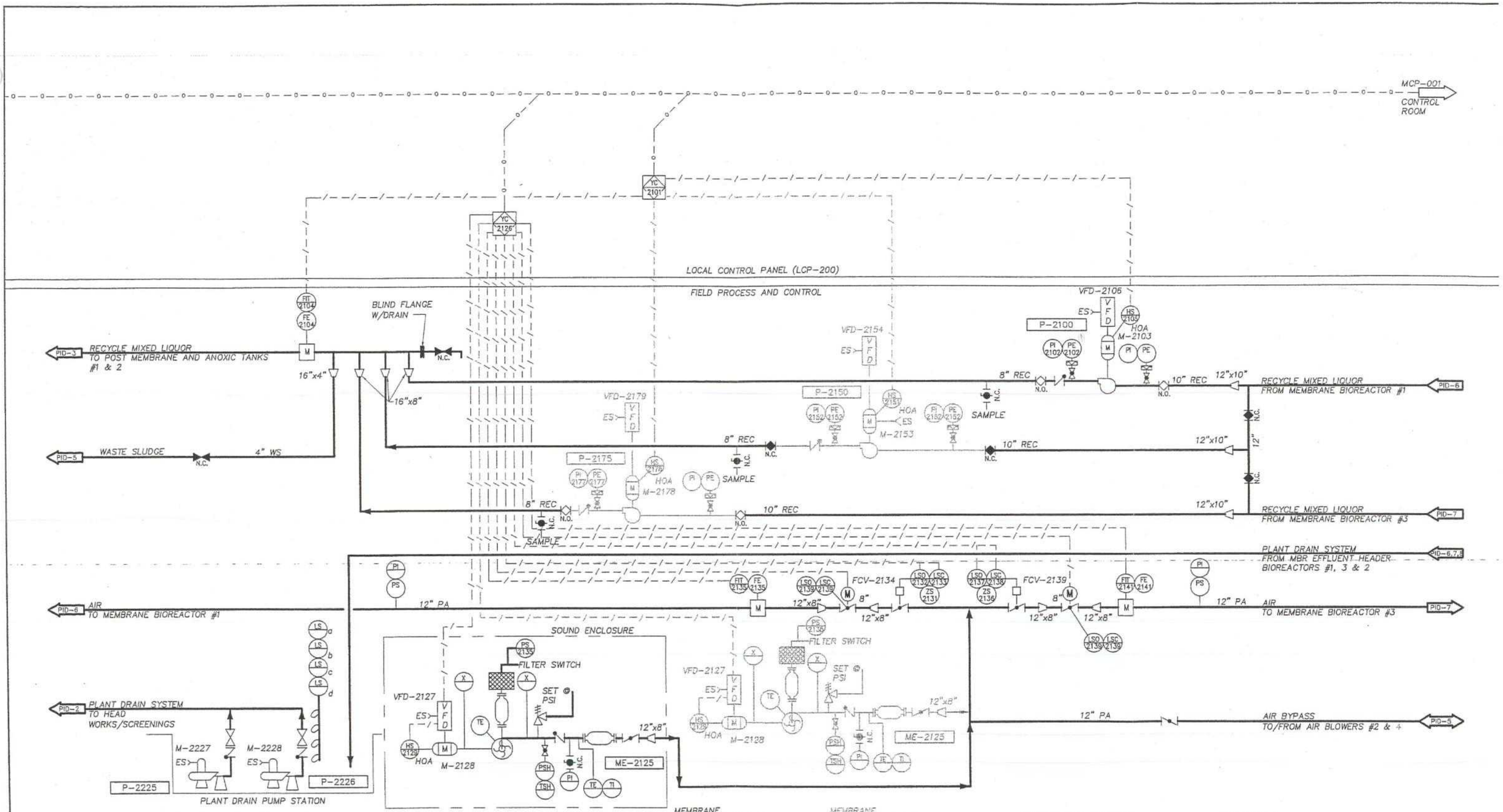
IMAGES: XREF'S: S1598012PI
DATE: 05/03/02



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PROCESS & INSTRUMENT DIAGRAM RECYCLE EFFLUENT AND AIR BLOWERS #1 AND #3

SHEET NO. PID-4
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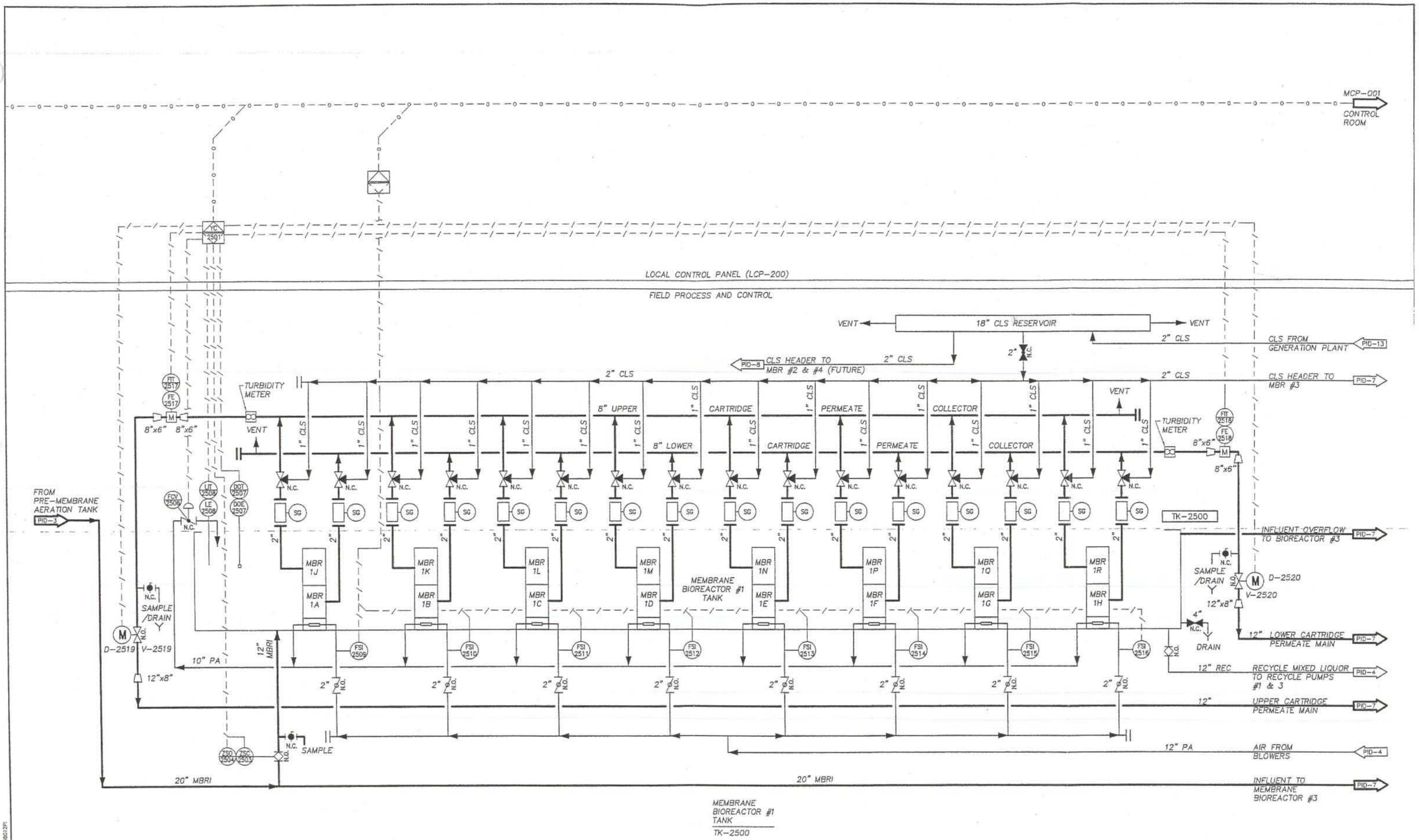

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PROCESS & INSTRUMENT DIAGRAM BIO-REACTOR #1

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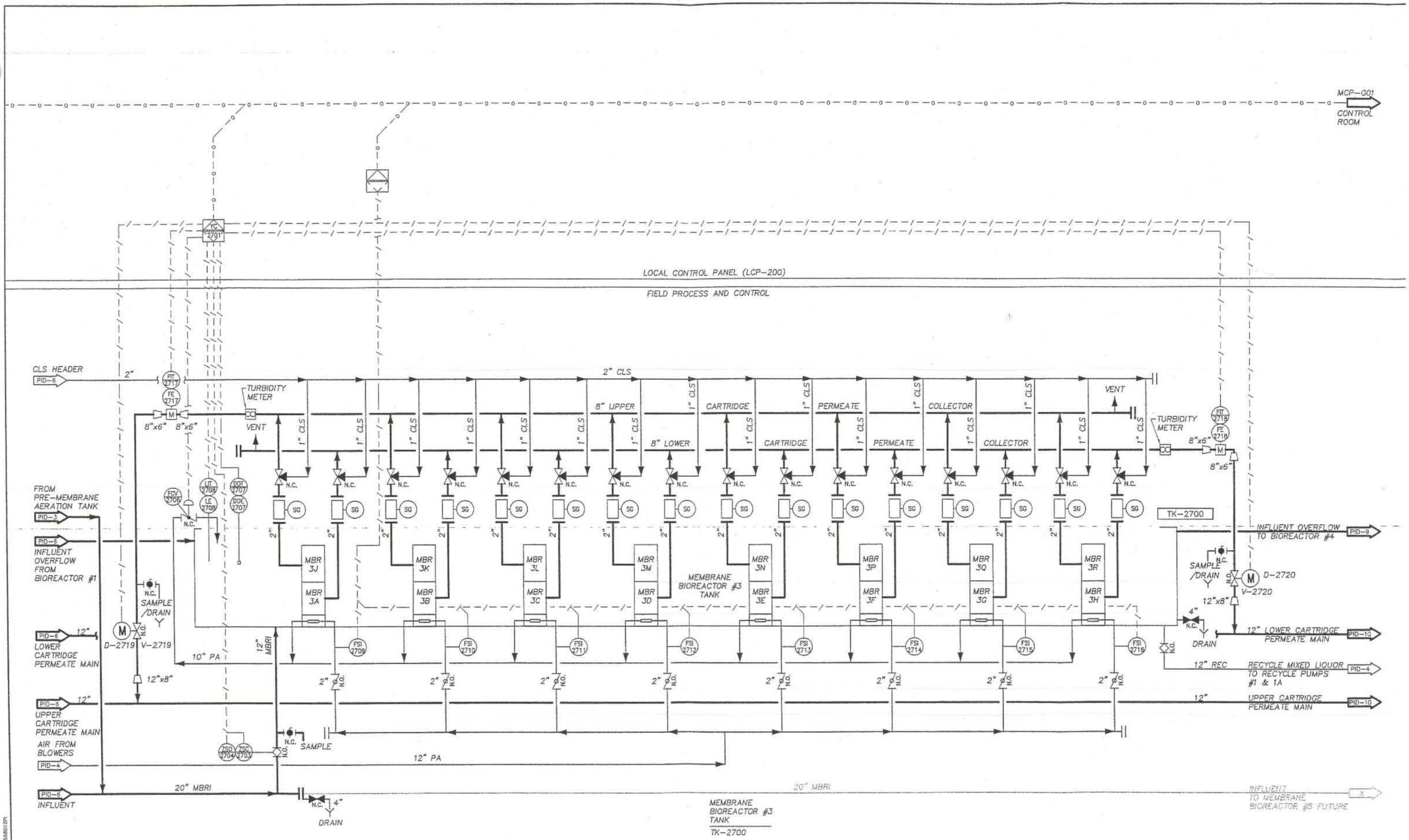

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PROCESS & INSTRUMENT DIAGRAM BIO-REACTOR #3

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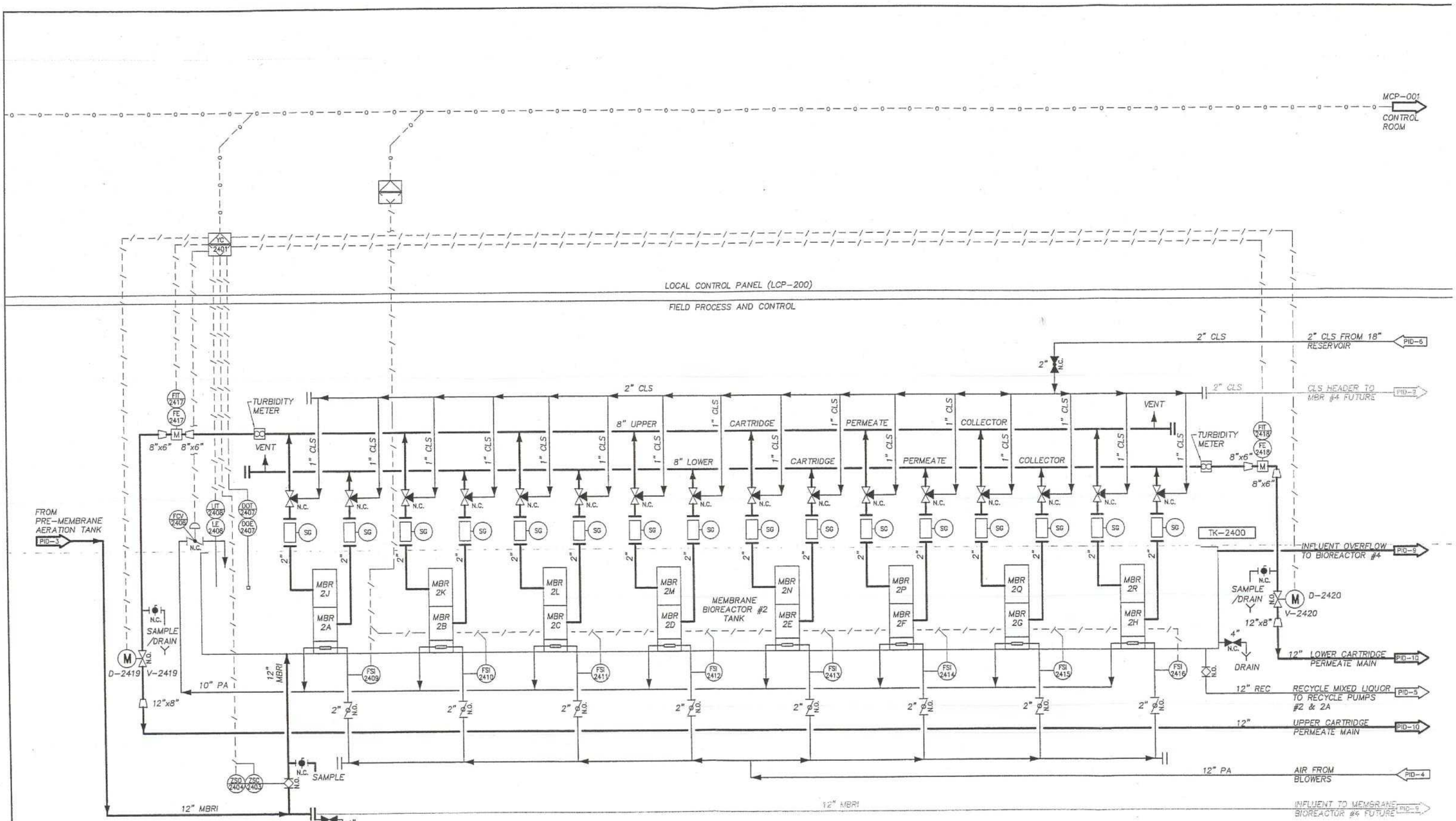

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PROCESS & INSTRUMENT DIAGRAM BIO-REACTOR #2

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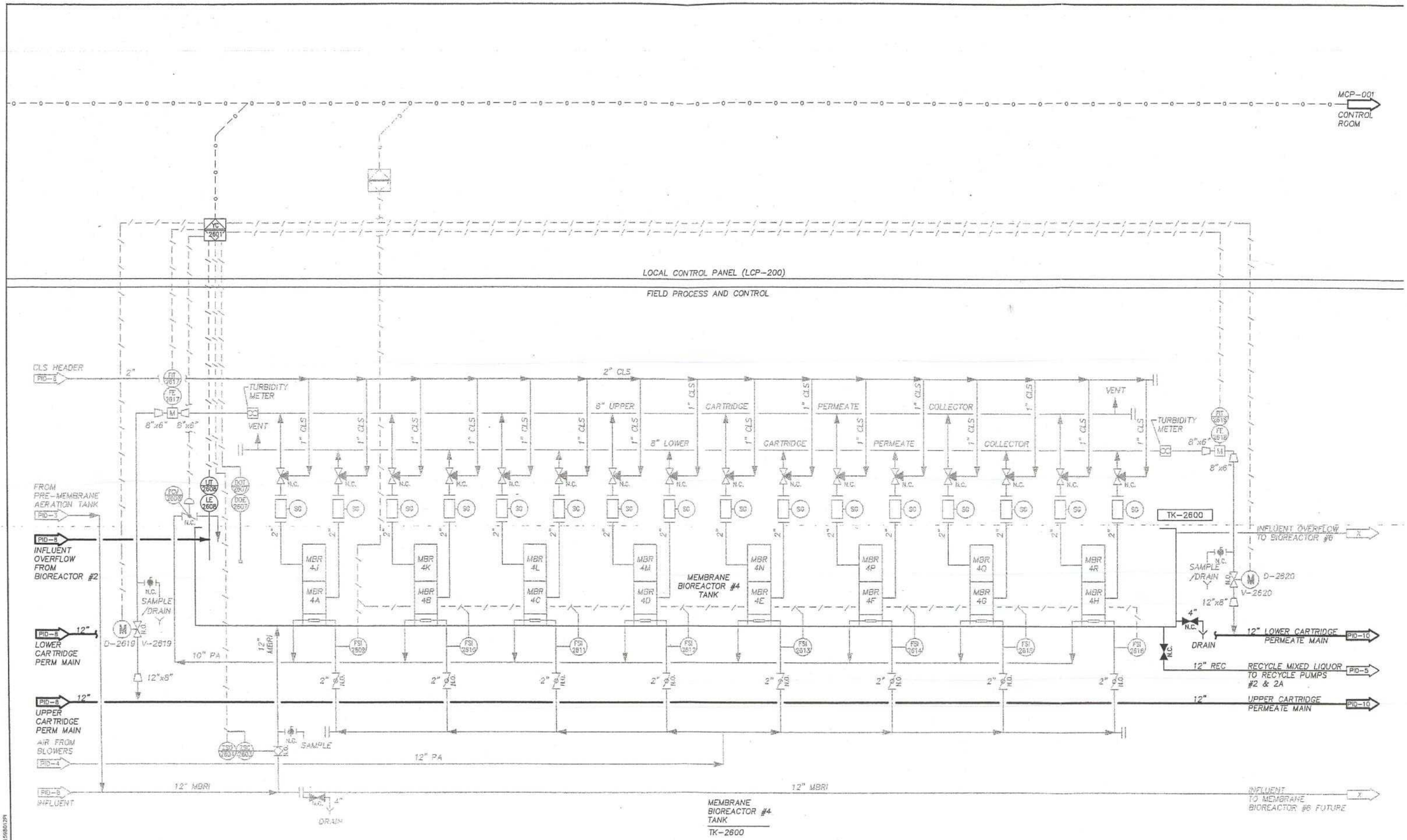

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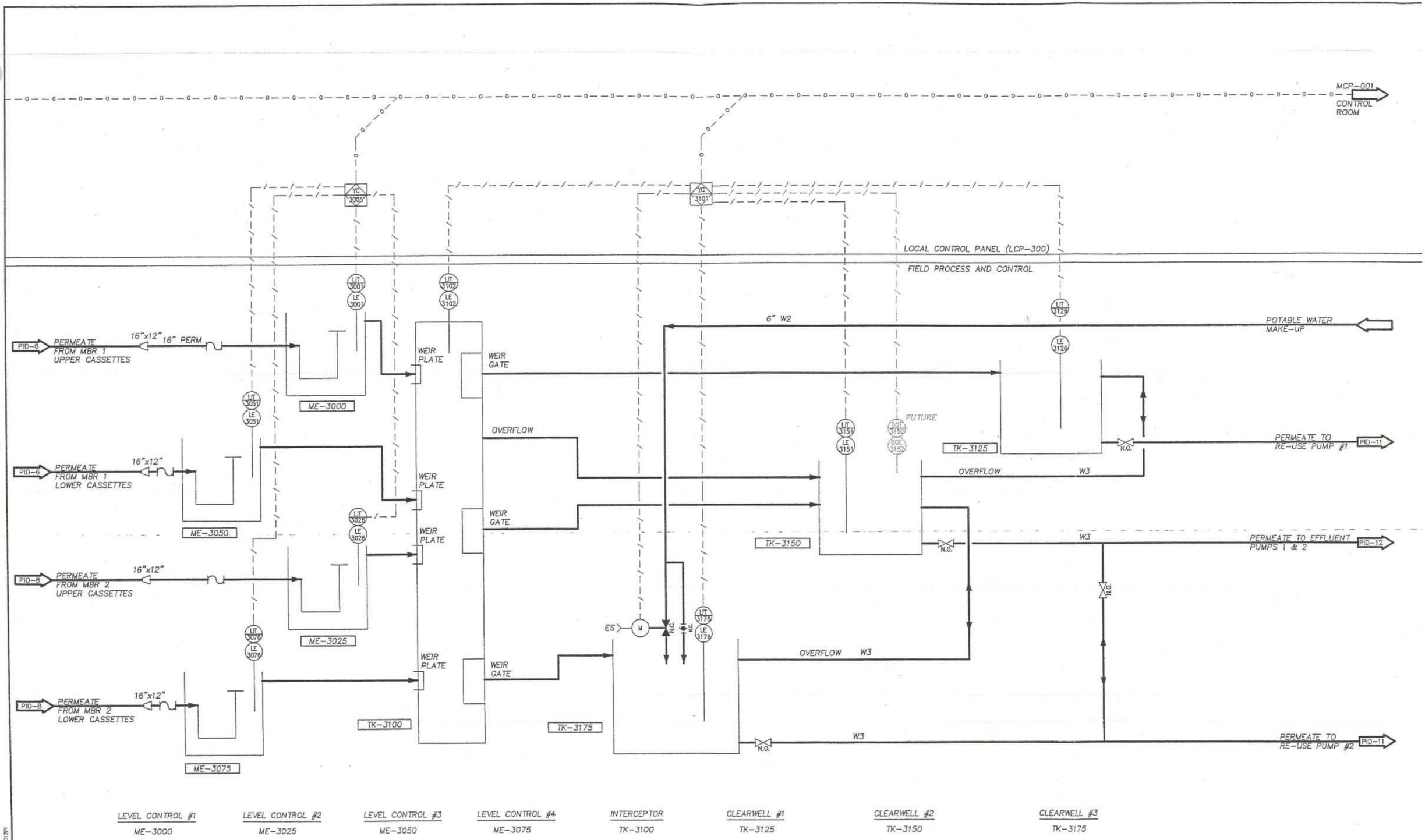

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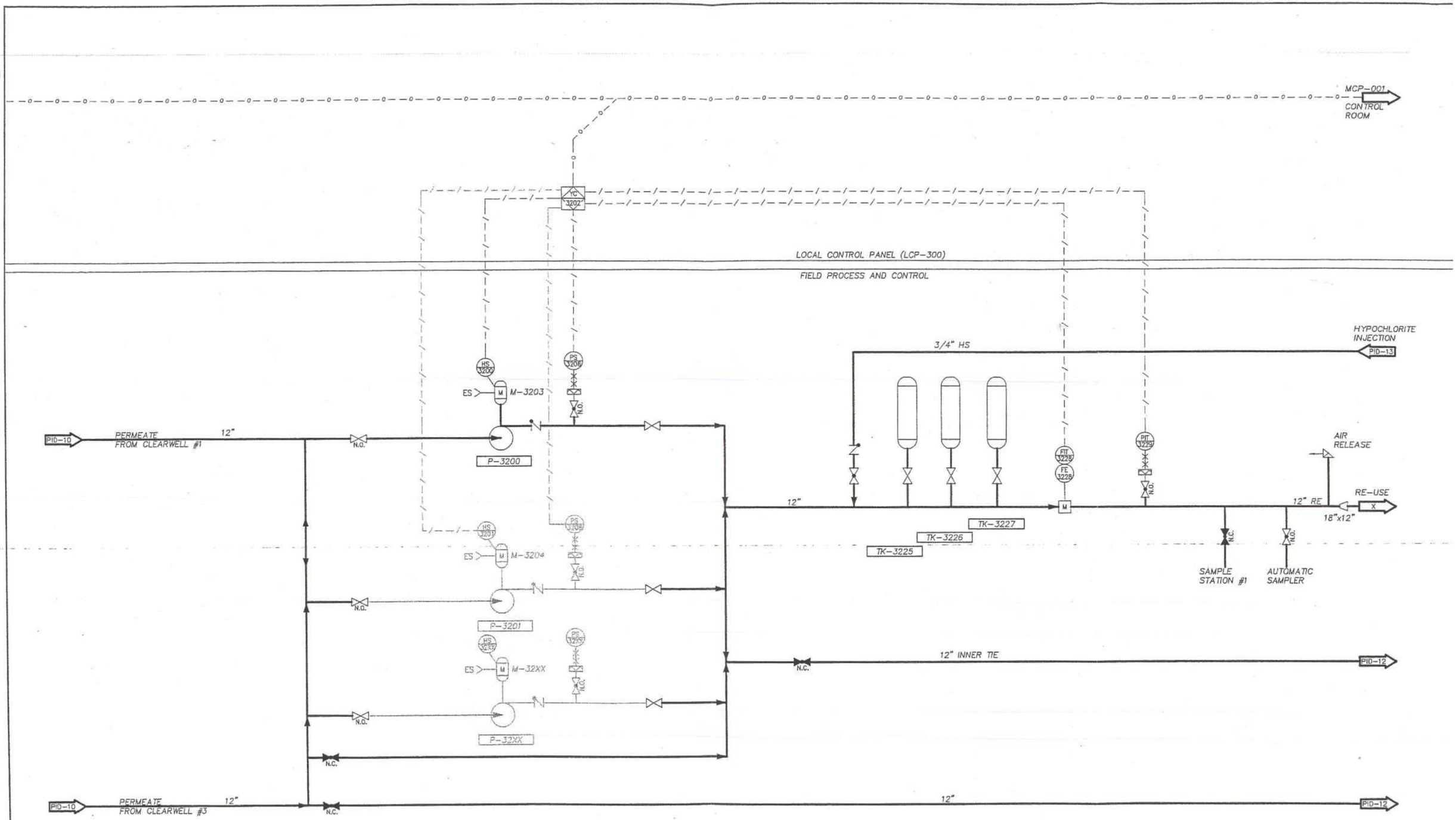
PROCESS & INSTRUMENT DIAGRAM EFFLUENT LEVEL CONTROL INTERCEPTOR AND CLEARWELLS

SHEET NO. PID-10
XX

IMAGES:
XREFS: S1598012PI
DATE: 05/06/02



NO.	REVISIONS	DATE	BY

DESIGNED T. CAMPBELL
DRAWN C. BLACKWELL
CHECKED
APPROVED

0 1" 2"
TWO INCHES AT FULL SCALE IF NOT SCALE ACCORDINGLY
SCALE NO SCALE
DATE MAY 2002

DRAFT

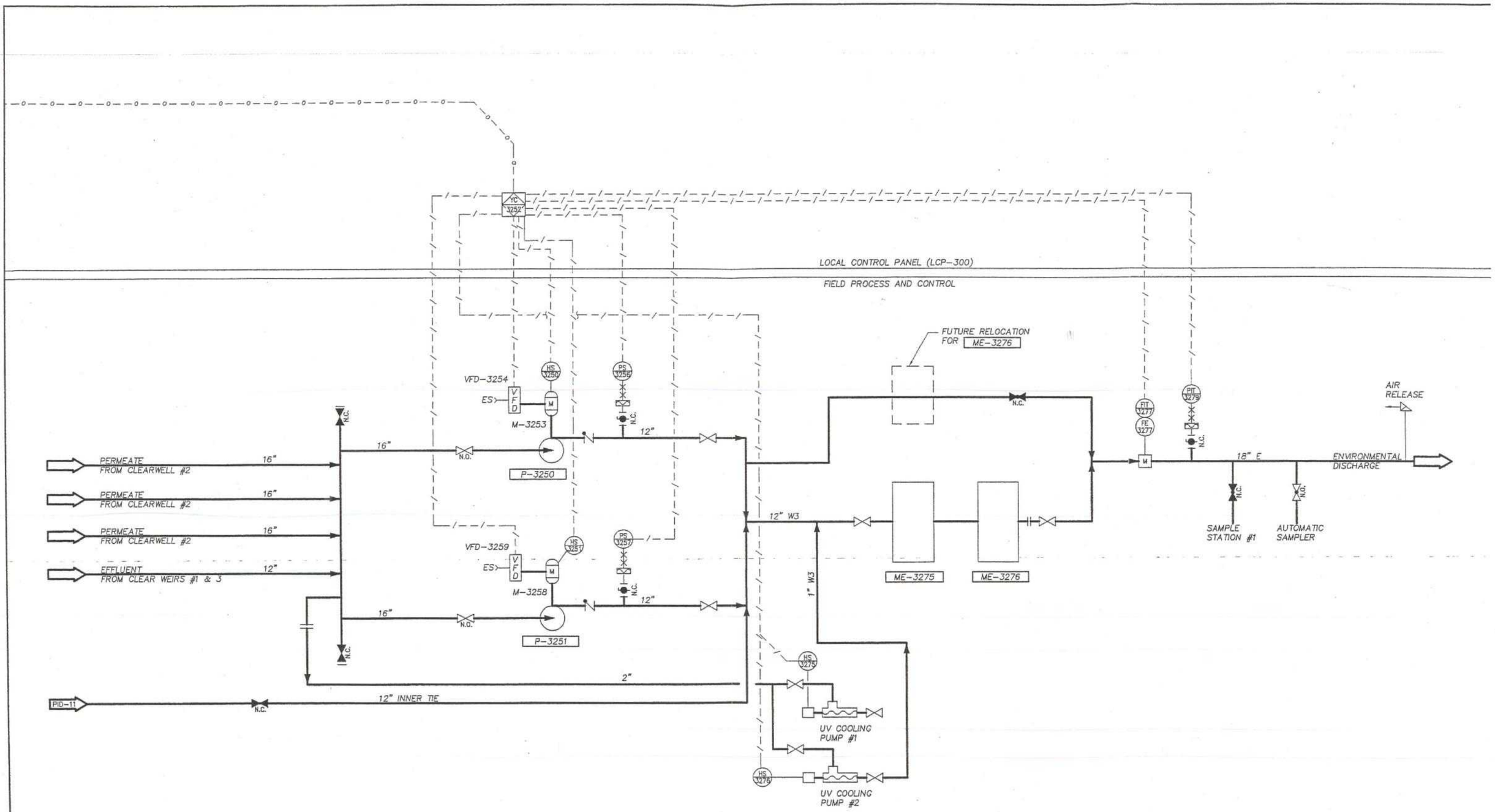
Parametrix, Inc. "Quality Service Through Employee Ownership"
1231 Fryar Avenue
Sumner, WA 98390
Ph: (253) 863-5128
Fax: (253) 863-0946
http://www.parametrix.com
WASHINGTON Sumner Bremerton Kirkland
OREGON Portland

PROJECT NAME
TULALIP TRIBES
WASTEWATER TREATMENT AND REUSE FACILITY
TULALIP, WASHINGTON
JOB NO. 216-1598-012
FILE NAME: S1598012PID13

PROCESS & INSTRUMENT DIAGRAM
EFFLUENT RE-USE

SHEET NO. PID-11
XX

DATE: 05/06/02 IMAGES: XREF'S: S1598012PI



EFFLUENT PUMP #1	EFFLUENT PUMP #2	EFFLUENT PUMP #3 FUTURE	EFFLUENT PUMP #4 FUTURE	UV SYSTEM #1	UV SYSTEM #2
P-3250	P-3251	P-3252	P-3253	ME-3275	ME-3276

NO.	REVISIONS	DATE	BY

DESIGNED T. CAMPBELL
DRAWN C. BLACKWELL
CHECKED
APPROVED

0 1" 2"
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SCALE NO SCALE
DATE MAY 2002

DRAFT

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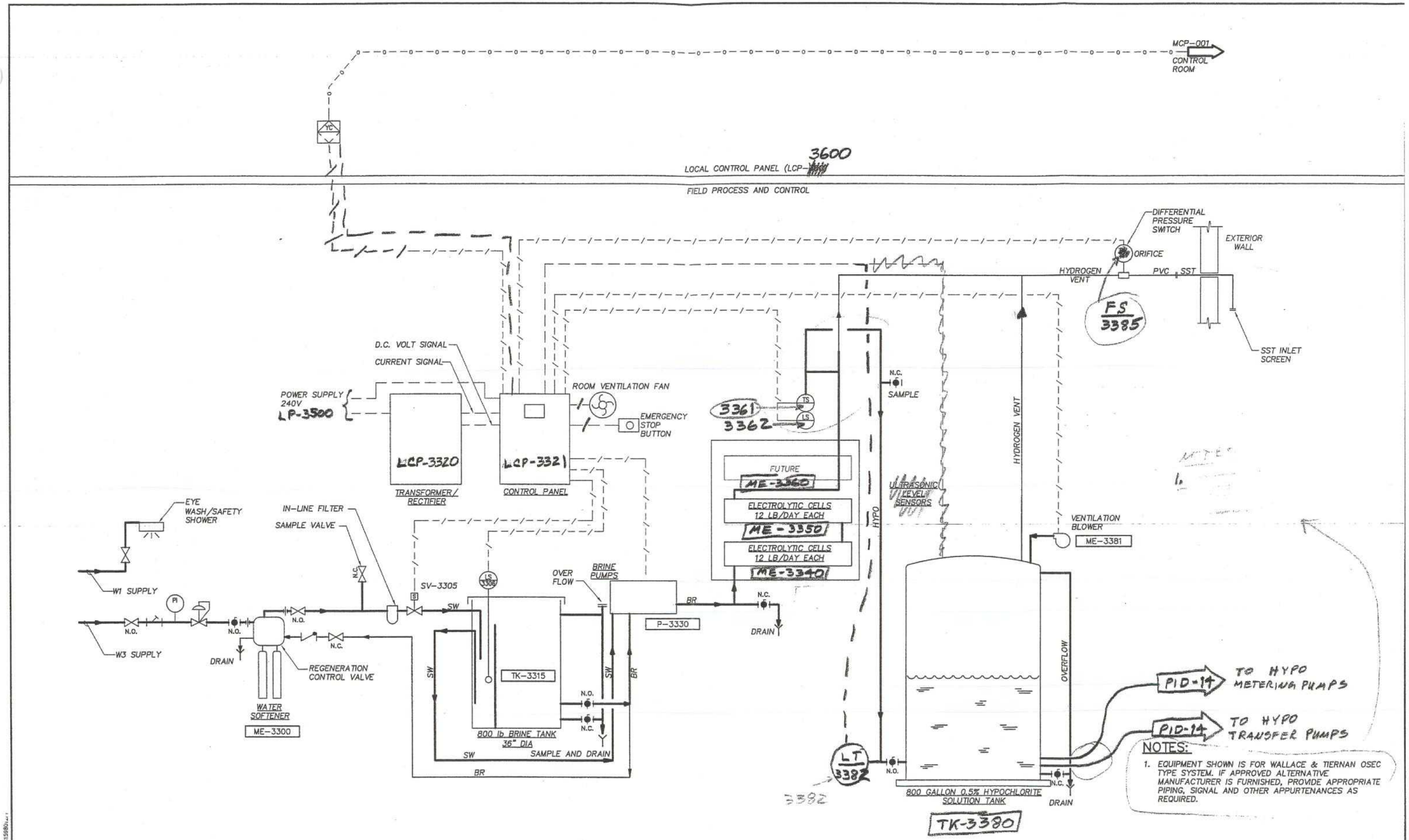
OREGON Portland

PROJECT NAME
TULALIP TRIBES
WASTEWATER TREATMENT AND REUSE FACILITY
TULALIP, WASHINGTON
JOB NO. 216-1598-012 FILE NAME: S1598012PID14

PROCESS & INSTRUMENT DIAGRAM EFFLUENT ULTRA VIOLET SYSTEM

SHEET NO. PID-12
XX

DATE: 05/06/02 INACES: MET'S S1598012PI



NO.	REVISIONS	DATE	BY

DESIGNED: T. NIELSEN
DRAWN: P. MORGAN
CHECKED
APPROVED

0 1" 2"
TWO INCHES AT FULL SCALE IF NOT SCALE ACCORDINGLY
SCALE: NONE
DATE: MAY 2002

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Sumner, WA 98390
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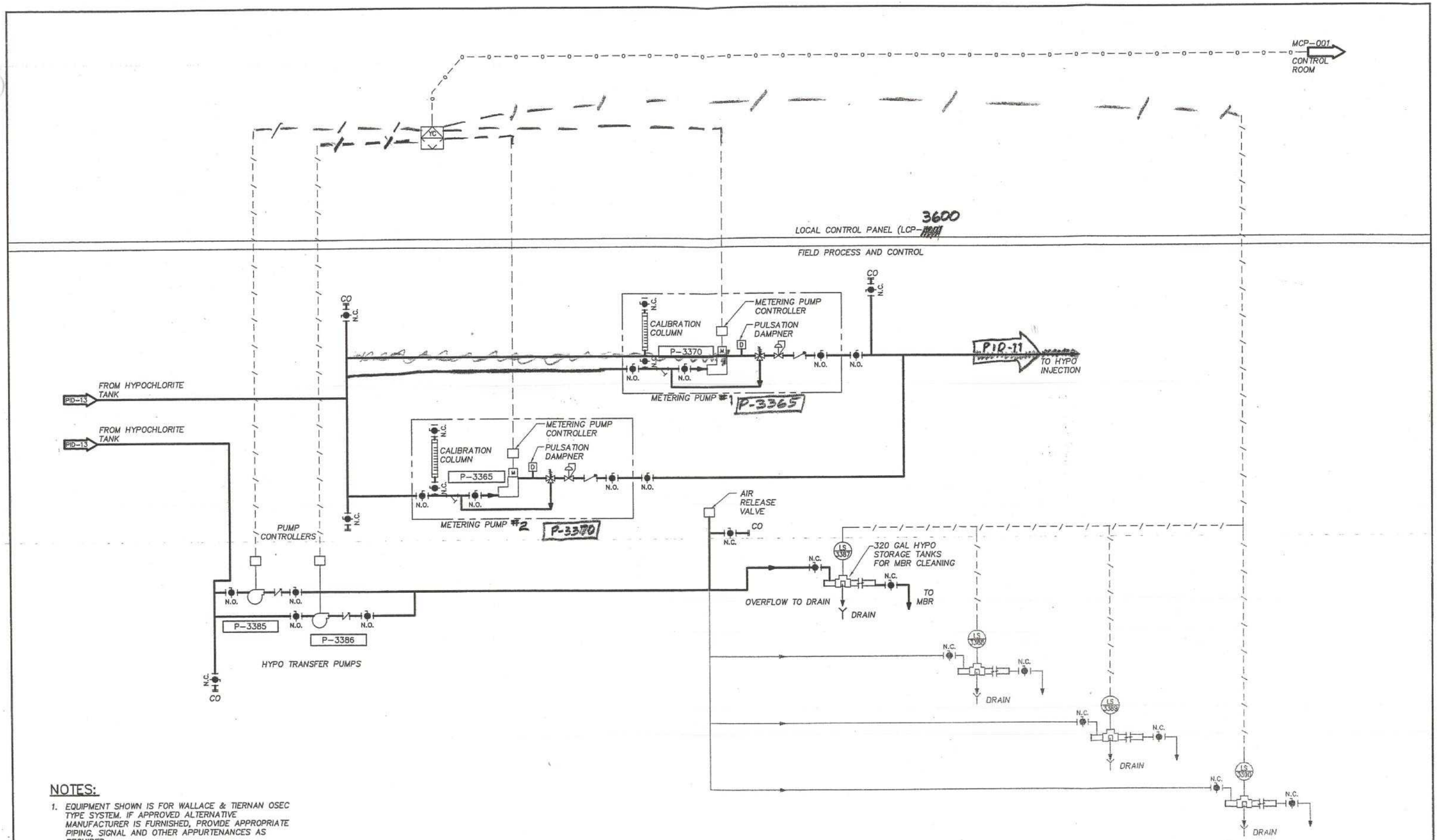
http://www.parametrix.com
WASHINGTON: Sumner, Bremerton, Kirkland
OREGON: Portland

PROJECT NAME: TULALIP TRIBES WASTEWATER TREATMENT AND REUSE FACILITY
TULALIP, WASHINGTON
JOB NO. 216-1598-012
FILE: S1598012PID15

PROCESS & INSTRUMENT DIAGRAM HYPOCHLORITE DELIVERY SYSTEM

SHEET NO. PID-13
XX

IMAGES:
XREFS: S1598012
DATE: 05/06/02



NOTES:

1. EQUIPMENT SHOWN IS FOR WALLACE & TIERNAN OSEC TYPE SYSTEM. IF APPROVED ALTERNATIVE MANUFACTURER IS FURNISHED, PROVIDE APPROPRIATE PIPING, SIGNAL AND OTHER APPURTENANCES AS REQUIRED.

NO.	REVISIONS	DATE	BY

DESIGNED T. NIELSEN
DRAWN P. MORGAN
CHECKED
APPROVED

0 1" 2"
TWO INCHES AT FULL SCALE IF NOT SCALE ACCORDINGLY
SCALE NONE
DATE MAY 2002

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PROJECT NAME
TULALIP TRIBES
WASTEWATER TREATMENT AND REUSE FACILITY
TULALIP, WASHINGTON
JOB NO. 216-1598-012 FILE: S1598012PID15

PROCESS & INSTRUMENT DIAGRAM HYPOCHLORITE DELIVERY SYSTEM

SHEET NO. PID-14
XX

IMAGES: JOBS S1598...
DATE: 05/01/02