AD-A273 436

Implementation Document
GROUNDWATER INTERCEPT and TREA
BASIN A NECK IR

VOLUME 3/ENGINEERING DRAWINGS

Rocky Mountain Arsenal
Information Center
Commerce City, Colorado

Prepared by

MK-ENVIRONMENTAL SERVICES
Denver, Colorado

Prepared for

Shell Oil Company

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ıtion Document for
:EPT and TREATMENT SYSTEM
A NECK IRA

ENGINEERING DRAWINGS

Mountain Arsenal
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Prepared by

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Prepared for

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93-29683

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REPORT DOCUMENTATION PAGE

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1

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IMPLEMENTATION DOCUMENT FOR GROUNDWATER INTERCEPT AND TREATMENT SYSTEM FOR BASIN A NECK, IRA

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7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
MORRISON-KNUDSEN ENGINEERS, INC.

8. PERFORMING ORGANIZATION REPORT NUMBER
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9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
SHELL OIL COMPANY

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT
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12b. DISTRIBUTION CODE

13. ABSTRACT (Maximum 200 words)

THE BASIN A NECK INTERIM RESPONSE ACTION WILL CONSIST OF:

1. SEVEN DEWATERING WELLS
2. SOIL BENTONITE SLURRY WALL
3. GROUND WATER TREATMENT BY ACTIVATED CARBON
4. GRAVEL-FILLED RECHARGE TRENCHES.

VOLUME I OF THIS IMPLEMENTATION DOCUMENT CONTAINS:

1. MOU BETWEEN THE ARMY AND SHELL CONCERNING SHELL'S PARTICIPATION IN THE IRA'S
2. CONSTRUCTION WORK PLANS
3. COST ESTIMATES
4. TASK SPECIFIC HEALTH AND SAFETY PLAN.

VOLUME II CONTAINS ENGINEERING SPECIFICATIONS. ENGINEERING DRAWINGS ARE FOUND IN VOLUME III.

14. SUBJECT TERMS
IRA E, COST, SCHEDULE, HEALTH, SAFETY, SPECIFICATION

15. NUMBER OF PAGES

16. PRICE CODE

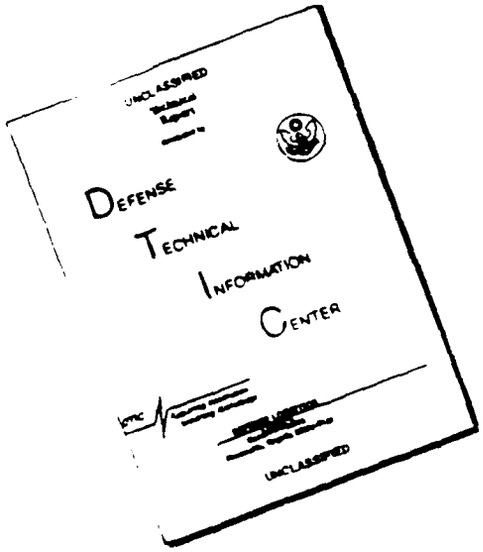
17. SECURITY CLASSIFICATION OF REPORT
UNCLASSIFIED

18. SECURITY CLASSIFICATION OF THIS PAGE

19. SECURITY CLASSIFICATION OF ABSTRACT

20. LIMITATION OF ABSTRACT

DISCLAIMER NOTICE



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373-34-001

BASIN A

ROCKY MOUNTAIN ARSENAL

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35-001	Miscellaneous Piping Sections and Details
37-001	Electrical Symbols
37-002	Electrical One-Line Diagram
37-003	Area Electrical Distribution
38-001	Groundwater Treatment System Process and Instrumentation Diagram Symbols and Legend
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34-012	Well and Trench Area Plan, Sections and Details
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37-010	Wells Power and Control Layout and Details
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37-027	Groundwater Treatment Building Electrical Plan and Details Sheet #1
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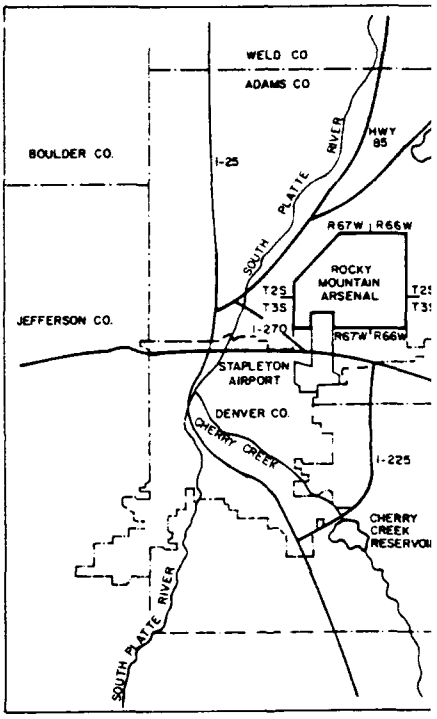

LOCATION MAP

Rocky Mountain Arsenal
Information Center
Commerce City, Colorado

1

NO.	BY	DATE	CKD	DESCRIPTION
O	MFF	8-22-89	GB	ISSUE FOR CONSTRUCTION TL#047
C	JMA	5-26-89	GB	ISSUE FOR IMPLEMENTATION PLAN TL# 045
B	GR	3-21-89	GB	ISSUE FOR OWNERS APPROVAL TL# 08
A	HK	3-17-89	GB	FOR REVIEW & COMMENT TL#12

REFERENCE DWGS — DRAWING NO. | TITLE

REVISIONS — NO. | BY | DATE | CKD | DESCRIPTION

APPROVALS — ARCH, CIV/STRL, MECH, ELECT, INSTR, PIPING, SAFETY, DEPT MGR, PROJECT

BASIN A NECK IRA

OCKY MOUNTAIN ARSENAL - ADAMS COUNTY, COLORADO

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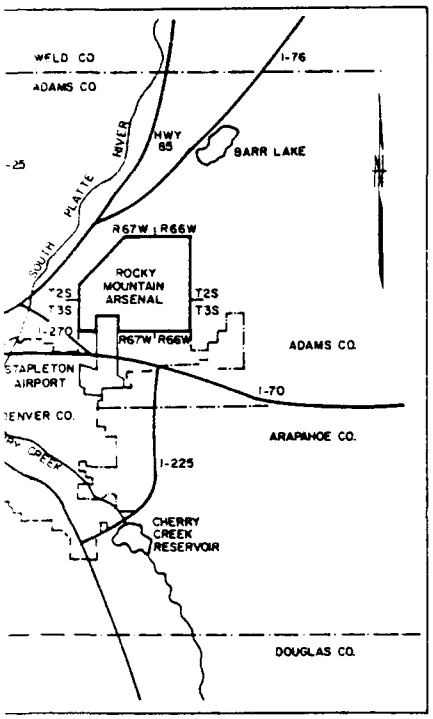

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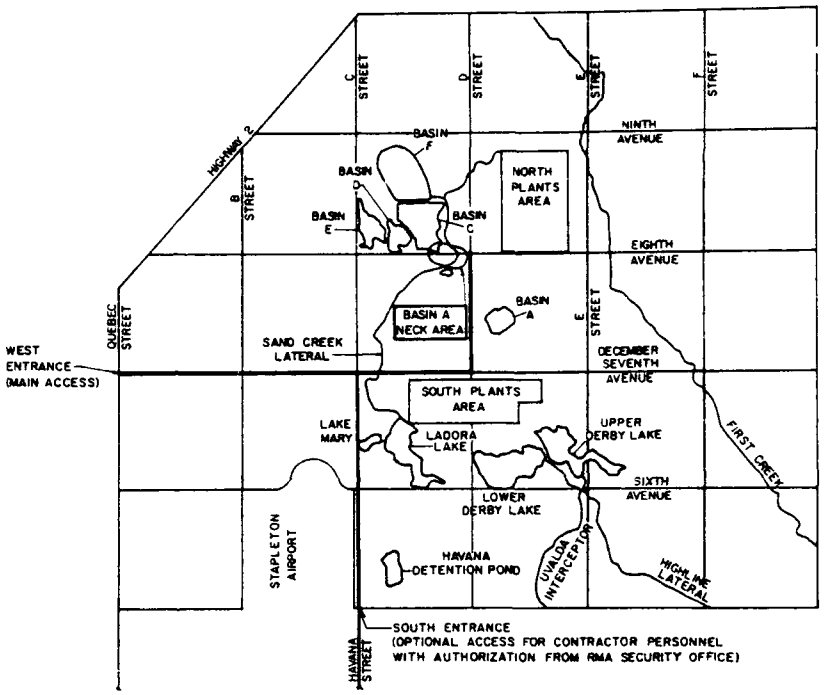


CONTRACTOR ACCESS

| | | |

373-34-002

1. **DESIGN CRITERIA NOTES:**

A. ROOF LIVE LOADS:
MINIMUM LIVE LOAD: UNIFORM 30 psf
SNOW LOAD: UNIFORM 30 psf
RAIN-ON-SNOW SURCHARGE LOAD = N/A
MECHANICAL/ELECTRICAL UNIFORM COLLATERAL LOAD - 10 psf

B. FLOOR LIVE LOADS:
FLOOR SLAB - STATIONARY UNIFORM LIVE LOAD = 250 psf
(OR EQUIPMENT WEIGHT, WHICHEVER IS GREATER)
ELEVATED PLATFORMS AND WALKWAYS = 125 psf (OR 2,000 LB. CONCENTRATED LOAD OVER 2.5 FT. SQ. AREA, WHICHEVER IS GREATER)
STAIRWAYS AND LANDINGS = 100 psf (OR 1,000 LB. CONCENTRATED MOVING LOAD)
OPERATING AND EQUIPMENT LAYDOWN AREA FLOORS = 250 psf
(OR EQUIPMENT WEIGHT, WHICHEVER IS GREATER)

C. WIND LOAD - PER UBC SECTION 2311
BASIC WIND SPEED: 85 mph
EXPOSURE: "C"
IMPORTANCE FACTOR I SHALL BE TAKEN AS 1.5 FOR "ESSENTIAL FACILITIES".

D. SEISMIC LOAD - PER UBC SECTION 2312
ZONE No. 1
THE IMPORTANCE FACTOR I SHALL BE TAKEN AS 1.5 FOR "ESSENTIAL FACILITIES".

2. **STEEL NOTES:**

A. ALL STEEL WORK SHALL CONFORM WITH THE AISC "SPECIFICATION FOR THE DESIGN, FABRICATION AND ERECTION OF STRUCTURAL STEEL FOR BUILDINGS", LATEST EDITION.

B. ALL WELDING SHALL BE IN ACCORDANCE WITH THE AWS "STRUCTURAL WELDING CODE", D1.1, LATEST EDITION.

C. STRUCTURAL STEEL SHAPES, PLATES, AND BARS SHALL BE ASTM A36, UNLESS NOTED. BUILDING STEEL MAY VARY. SEE SPEC. 33-1301.

D. STRUCTURAL CONNECTIONS SHALL BE:
A. WELDED, 3/16" MINIMUM SIZE, WITH E70xx ELECTRODES, OR
B. BOLTED WITH ASTM A325 HIGH STRENGTH BOLTS (3/4" UNLESS NOTED).

E. ALL STEEL SHALL BE SHOP PAINTED (EXCEPT WHERE EMBEDDED IN CONCRETE, OR NEAR AREAS OF FIELD WELDING) WITH ONE 2 mil COAT PER SSPC SPEC. PA1. SURFACE PREPARATION PRIOR TO PAINTING SHALL BE IN ACCORDANCE WITH SSPC-SP2 OR SSPC-SP3.

F. TEMPORARY BRACING USED DURING CONSTRUCTION AND SUBSEQUENT REMOVAL OF SAME, SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.

G. GROUT FOR BEARING AND BASE PLATES SHALL BE PRE-MIXED NON-SHRINK GROUT.

3. **CONCRETE NOTES:**

A. ALL CONCRETE CONSTRUCTION SHALL BE IN CONFORMANCE WITH ACI 301 "BUILDING CODE, REQUIREMENTS FOR REINFORCED CONCRETE", LATEST EDITION, AND SPECIFICATION 34-0301, CAST-IN-PLACE CONCRETE.

B. REINFORCING BARS SHALL BE DEFORMED BARS CONFORMING TO ASTM A615 AND SPECIFICATION 34-0321, CONCRETE REINFORCEMENT.

C. REINFORCING STEEL SHALL NOT BE WELDED WITHOUT PRIOR APPROVAL OF THE ENGINEER.

D. WELDED WIRE FABRIC SHALL CONFROM TO ASTM A185, AND SPECIFICATION 34-0321, CONCRETE REINFORCEMENT.

E. PORTLAND CEMENT SHALL BE TYPE II IN ACCORDANCE WITH ASTM C150.

F. CONCRETE COMPRESSIVE STRENGTH SHALL BE AS SPECIFIED IN SECTION 34-0301, CAST-IN-PLACE CONCRETE.

G. COPIES OF THE SOILS AND FOUNDATION INVESTIGATION REPORT ARE AVAILABLE FOR INSPECTION IN THE OFFICE OF THE ENGINEER.

H. CHAMFER ALL EXPOSED CONCRETE EDGES 1" x 45°, UNLESS NOTED.

I. SEE MECHANICAL, PIPING AND ELECTRICAL DRAWINGS FOR LOCATIONS OF PENETRATIONS AND EMBEDDED ITEMS IN FLOOR SLABS AND WALLS.

J. BUILDING ANCHOR BOLTS SHALL BE LOCATED USING A TEMPLATE PROVIDED BY THE BUILDING MANUFACTURER.

4. **GENERAL NOTES:**

A. FOOTING DESIGN IS BASED ON A SOIL BEARING CAPACITY OF
ALL EXCAVATION, BACKFILL AND COMPACTION SHALL BE PERF
ACCORDANCE WITH SPECIFICATION 34-0212 SITE PREPARATIO
EXCAVATION AND BACKFILLING.

B. EXCAVATIONS FOR FOOTINGS SHALL BE INSPECTED BY THE SO
ENGINEER PRIOR TO PLACING CONCRETE.

C. DESIGN, PERFORMANCE AND REMOVAL OF CONSTRUCION FORMWO
RESPONSIBILITY OF THE CONTRACTOR.

D. TOPOGRAPHICAL DATA IS MEAN SEA LEVEL AND BASED ON AREIAL PHOTOGRAMMETRY DATED 11-13-88 BY DELTA AREIAL - GEONEX, DENVER, COLORADO. COORDINATES ARE BASED ON COLORADO STATE PLANE, NORTH ZONE.

E. ALL EQUIPMENT FOUNDATIONS, ANCHOR BOLTS AND DIMENSION
MUST BE CONFIRMED WITH CERTIFIED VENDOR DATA.

F. THE TREATMENT SYSTEMS, DEWATERING WELLS, ALLUVIAL MON
WELLS #11 - #18, DENVER FORMATION MONITORING WELLS, R
SYSTEM, AND NECESSARY CONNECTING PIPING MUST BE OPERA
THE BEGINNING OF THE SOIL-BENTONITE SLURRY WALL CONST
CONSTRUCTION OF THE SOIL-BENTONITE SLURRY WALL WILL
DAMMING OF THE GROUNDWATER FLOW THROUGH THE BASIN A
AQUIFER, NECESSITATING SYSTEM START-UP.

G. ON SITE BORROW SHALL BE OBTAINED ONLY FROM SITES APPROVED BY THE ENGINEER.

H. CONSTRUCTION UTILITIES OBTAINED FROM ON SITE SHALL BE APPROVED BY THE ENGINEER.

REFERENCE DWGS

DRAWING NO.	TITLE

MODIFIERS

NO.	BY	DATE	CKD	DESCRIPTION

REVISIONS

NO.	BY	DATE	CKD	DESCRIPTION
0	KF	8/22/89	GB	ISSUE FOR CONSTRUCTION TL#047
C	KF	5/26/89	GB	ISSUE FOR IMPLEMENTATION PLAN TL#045
B	KO	4/30/89	GB	ISSUE FOR OWNER APPROVAL TL# 036
A	DOL	4/21/89	GB	ISSUE FOR REVIEW & COMMENT TL#028

APPROVALS

DEPT \ REV	A	B	C	0
ARCH		DL	DL	
CIV/STRL	GB	GB	GB	
MECH		JTF	JTF	
ELECT		JC	JRC	
INSTR		CD	JEH	
PIPING		DS	DLS	DLS
SAFETY		JC	JC	
DEPT MGR		CGV	CGV	CGV
PROJECT		JRH	JRH	JRH

GENERAL NOTES:

1. FOOTING DESIGN IS BASED ON A SOIL BEARING CAPACITY OF [illegible] PSF. ALL EXCAVATION, BACKFILL AND COMPACTION SHALL BE PERFORMED IN ACCORDANCE WITH SPECIFICATION [illegible] 2 SITE PREPARATION, GRADING, EXCAVATION AND BACKFILLING.

2. EXCAVATIONS FOR FOOTINGS SHALL BE INSPECTED BY THE SOILS ENGINEER PRIOR TO PLACING CONCRETE.

3. DESIGN, PERFORMANCE AND REMOVAL OF CONSTRUCTION FORMWORK IS THE RESPONSIBILITY OF THE CONTRACTOR.

4. TOPOGRAPHICAL DATA IS MEAN SEA LEVEL AND BASED ON AERIAL PHOTOGRAMMETRY DATED [illegible] BY DELTA AERIAL, ENGINEER, DENVER, COLORADO. COORDINATES ARE BASED ON COLORADO STATE PLANE, NORTH ZONE.

5. ALL EQUIPMENT FOUNDATIONS, ANCHOR BOLTS AND [illegible] MUST BE CONFIRMED WITH VERIFIED VENDOR DATA.

6. THE TREATMENT SYSTEMS DEWATERING WELLS, ALL MONITORING WELLS & [illegible] DENVER FORMATION MONITORING WELLS, PRESSURE SYSTEM, AND NECESSARY CONNECTING PIPING MUST BE OPERABLE BY THE BEGINNING OF THE DECONTAMINATION TO DURING WELL CONSTRUCTION. CONSTRUCTION OF THE DECONTAMINATION TO DURING WELL [illegible] DRAINAGE OF THE GROUNDWATER FLOW THROUGH THE BASIN [illegible] WELLS [illegible] NEEDED TO MAINTAIN SYSTEM STARTUP.

7. ON SITE BORROW SHALL BE OBTAINED ONLY FROM AREAS APPROVED BY THE ENGINEER.

8. CONSTRUCTION WASTES OBTAINED FROM ON SITE SHALL BE APPROVED BY THE ENGINEER.

NO				
BY				
NED BY				
ED BY				
CLIEN				

DRAFT	REV			
DESIGN				
ELECTRICAL				
MECH				
ELEC				
MECH				
CIVIL				
CHECK				
DRAFT MGR				
PROJECT				

SCALE	NAME	DATE
DRAWN BY		
DESIGNED BY		
CHECKED BY		
CLIENT APPROVALS		
APPR BY		DATE

[illegible] INC.

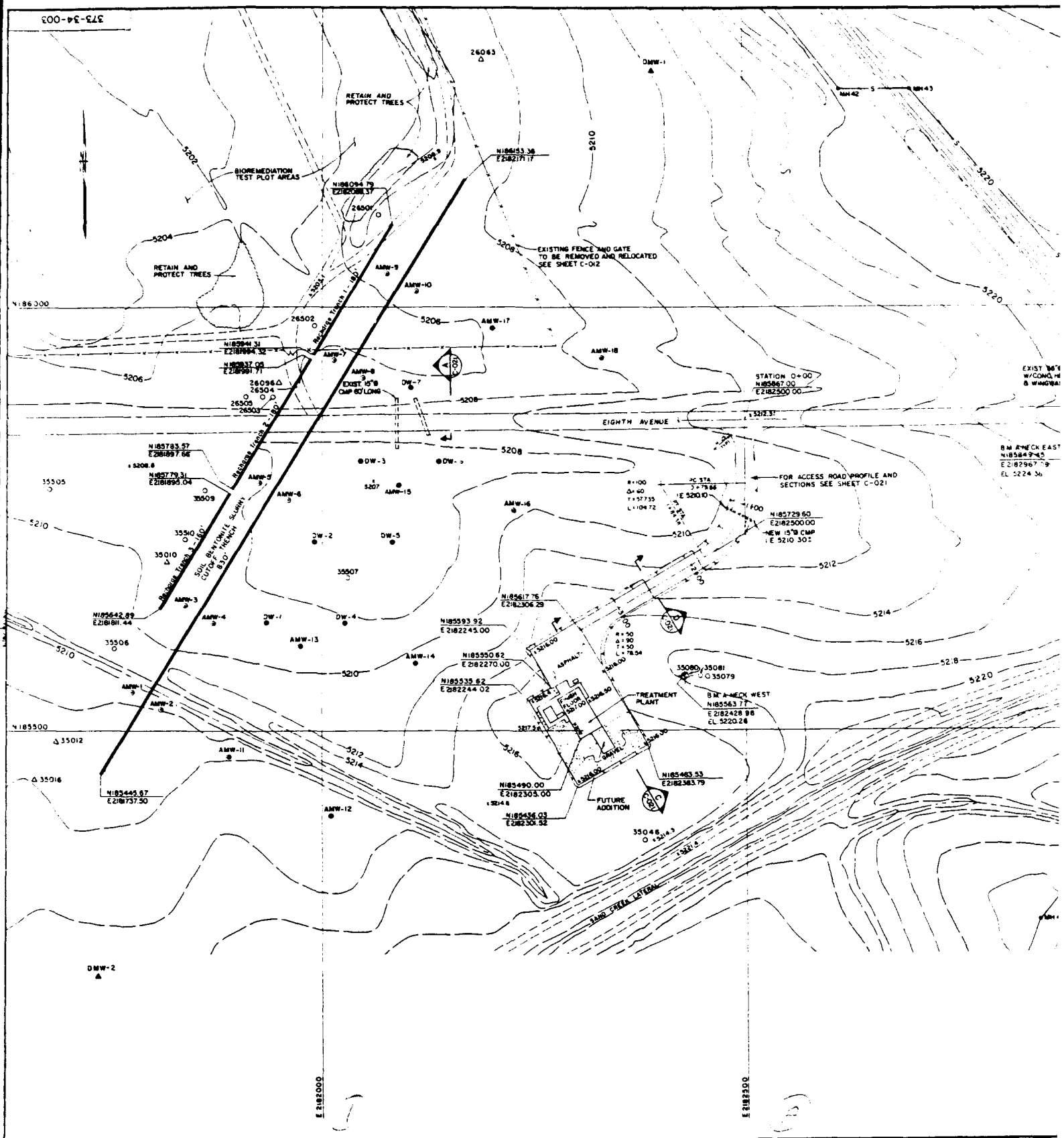
[illegible]

[illegible]

GENERAL NOTES

[illegible]	39
[illegible]	48
[illegible]	
[illegible]	

373-34-003



REFERENCE DRAWINGS	
C-010	WELL CONSTRUCTION DATA
C-011	RECHARGE & SLURRY TRENCH SECTIONS
C-012	WELL & TRENCH AREA PLAN, SECTIONS & DET'S
C-023	FOUNDATION PLAN, SECTION & DET'S
C-021	TREATMENT PLANT AREA SECTION & DET'S
C-022	SEWAGE SYSTEM PLAN & DET'S
DRAWING NO.	TITLE

REVISIONS

NO.	BY	DATE	CKD	DESCRIPTION

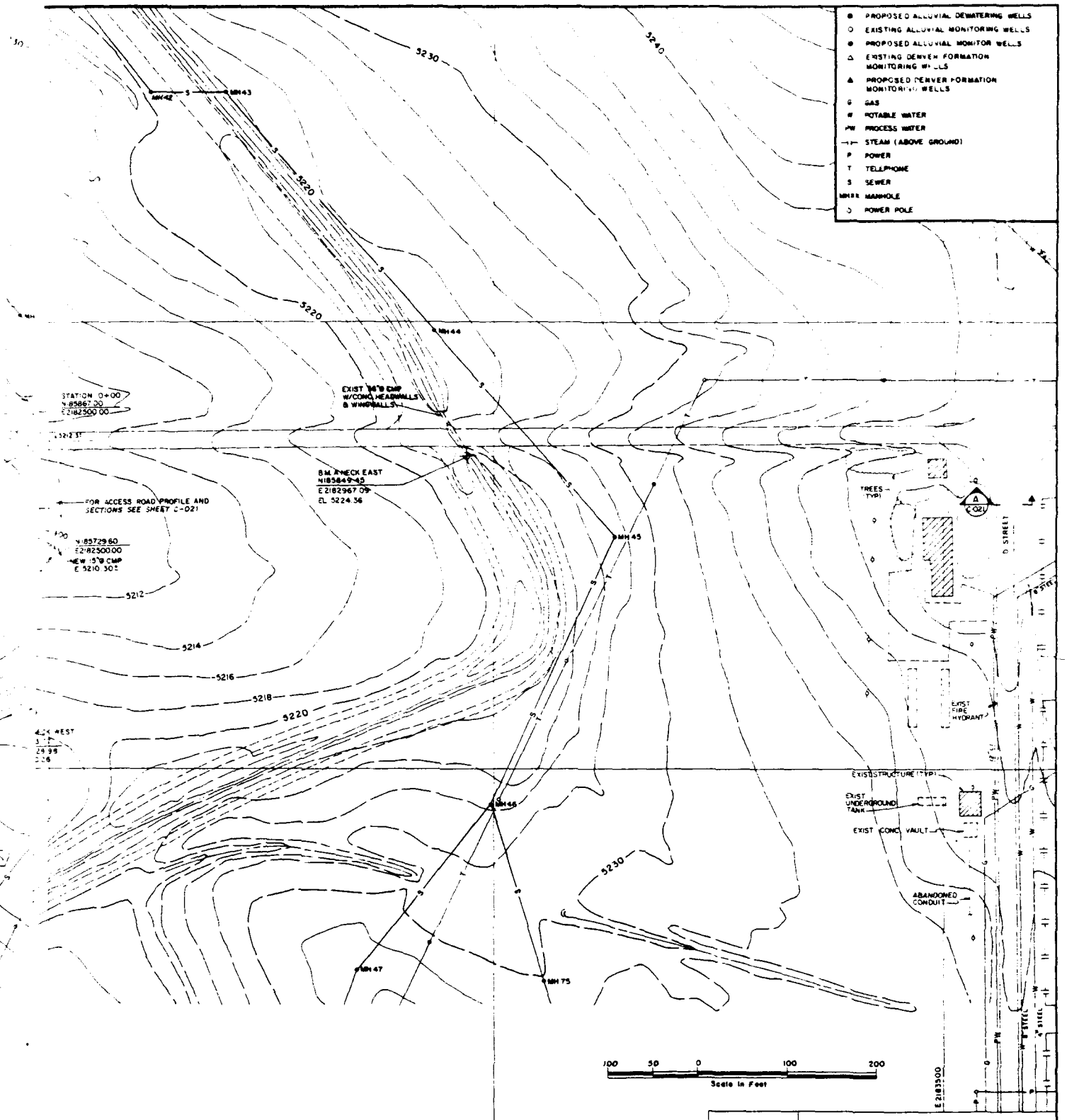
REVISIONS

NO.	BY	DATE	CKD	DESCRIPTION
D	KF	8-22-89	GB	ISSUE FOR CONSTRUCTION TL#047
C	JMA	5-26-89	GB	ISSUE FOR IMPLEMENTATION PLAN TL#045
B	GR	3-21-89	GB	ISSUE FOR OWNER'S APPROVAL TL#028
A	NK	3-17-89	GB	FOR REVIEW & COMMENT TL#012

APPROVALS

DEPT	REV: A	B	C	D
ARCH				
CIV/STRL				
MECH				
ELECT				
INSTR				
PIPING		DLS	DLS	DLS
SAFETY		TC	TC	TC
DEPT MGR				
PROJECT				

SCALE 1" = 30'
DRAWN BY
DESIGNED BY
CHECKED BY
REV:



DEPT REV	A	B	C	D	
ARCH					
CIV/STRL					
MECH					
ELECT					
INSTR					
PIPING					
SAFETY					
DEPT MGR					
PROJECT					

APPROVALS

SCALE 1" = 50'	DATE
DRAWN BY M.K.	3-9-89
DESIGNED BY G.B.	3-2-89
CHECKED BY R.M.	3-15-89
CLIENT APPROVALS	
REV BY	DATE

MORRISON-KNUDSEN ENGINEERS, INC.

SHELL OIL COMPANY
ROCKY MOUNTAIN ARSENAL REMEDIATION PROJECT
INTERIM RESPONSE ACTION FINAL DETAILED DESIGN

DRAWING TITLE
BASIN A NECK IRA
SITE PLAN

WORK ORDER 2127

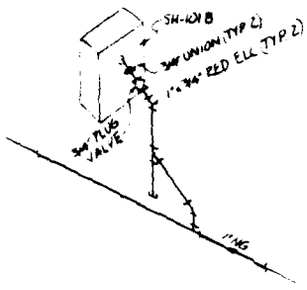
30 of 42

DRAWING NO. 373-34-003

REFERENCE NO. C-003

REV 0

373-35-001



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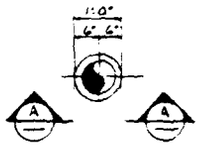

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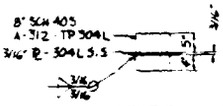

SECTION A
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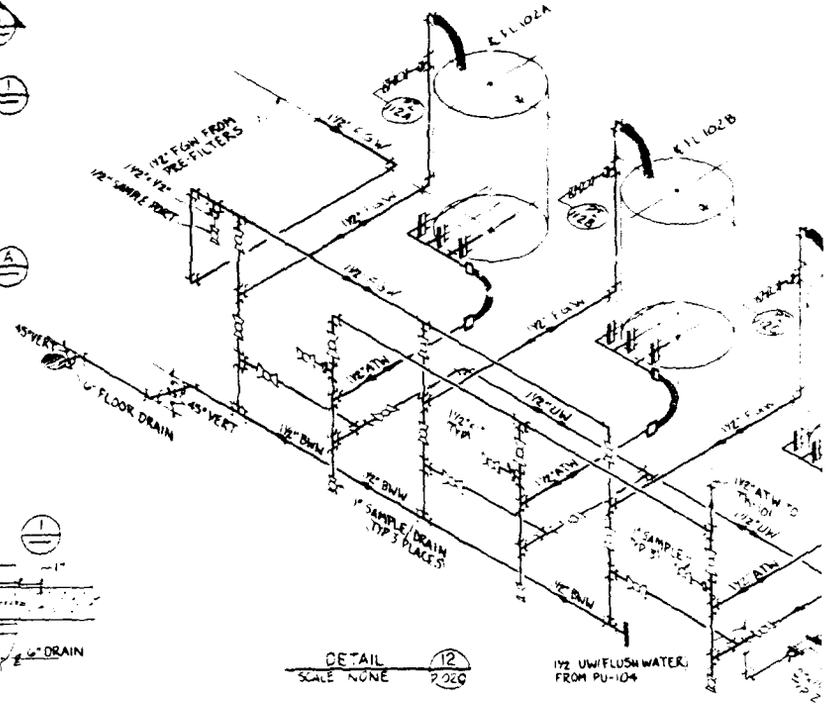

DETAIL 12
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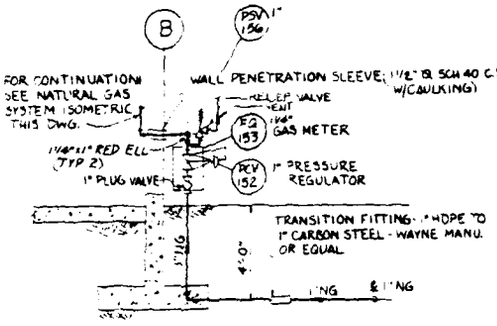

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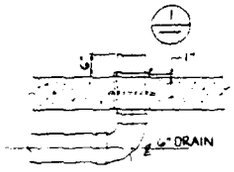
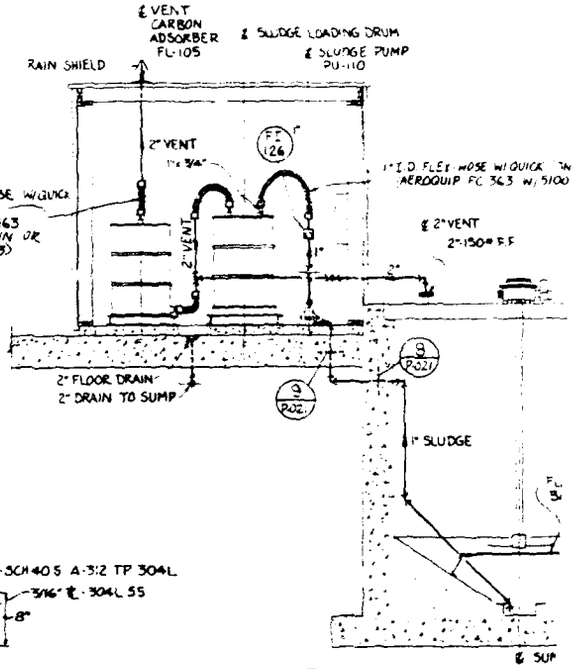
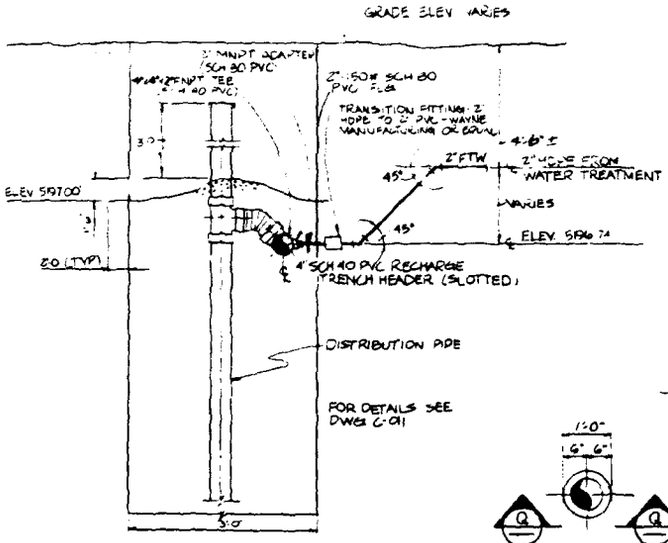
P-020



DRAIN HUB SLEEVE

DETAIL 11
SCALE: 3/4"=1'-0"
P-020





(TYPICAL 3 PLACES)
DETAIL 3
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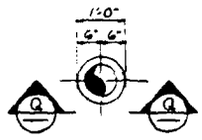
P-010



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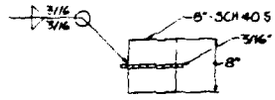
(TYPICAL 3 PLACES)
P-020



SECTION Q
SCALE: NONE

SECTION E
SCALE: 1/2"=1'-0"
P-020

DRAWING NO.	TITLE
C-011	RECHARGE SLURRY TRENCH SECTIONS
P-021	PIPING & PLUMBING SECT & DETAILS
P-020	PIPING & PLUMBING PLANS
P-010	WELL TRENCH (UTILITY PIPING
C-003	SITE PLAN
T-020	PFID

REFERENCE DWGS

NO.	BY	DATE	CKD	DESCRIPTION

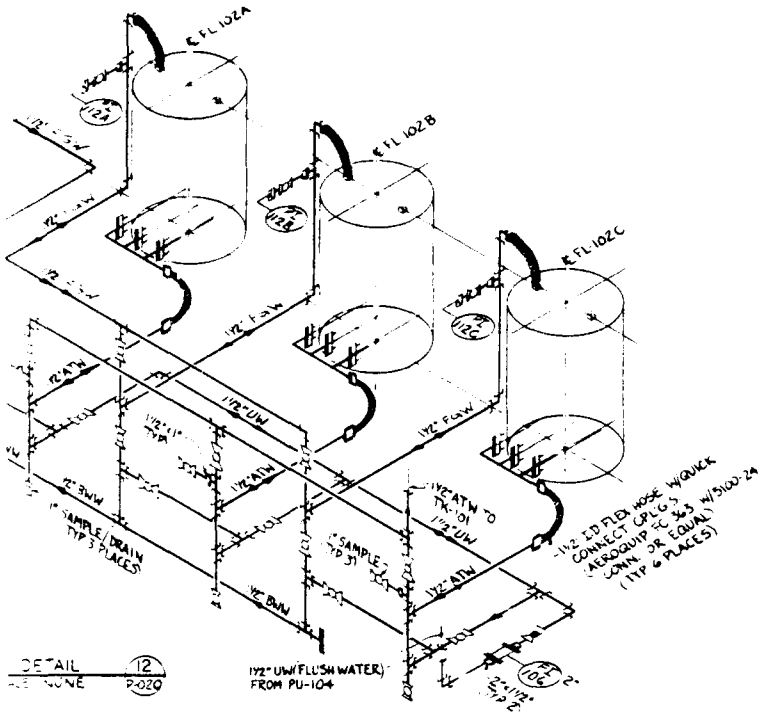
REVISIONS

NO.	BY	DATE	CKD	DESCRIPTION
0	DLS	9/22/89	JL	ISSUE FOR CONSTRUCTION & EL NO. 044
A	DLS	5/24/89	SP	ISSUE FOR REVIEW, COMMENT & IMPLEMENTATION PLAN T.S.# 045

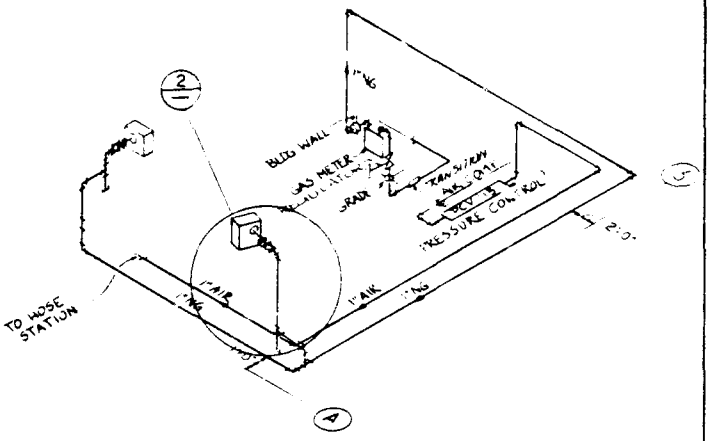
REVISIONS

	REV.	A	Q
DEPT			
ARCH			
CIV/STR			
MECH			
ELEC			
INSTR			
PIPING		JCS	DLS
SAFETY		JC	JC
DEPT MGR			
PROJECT			

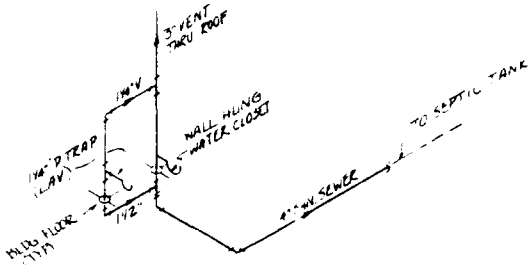
APPROVALS



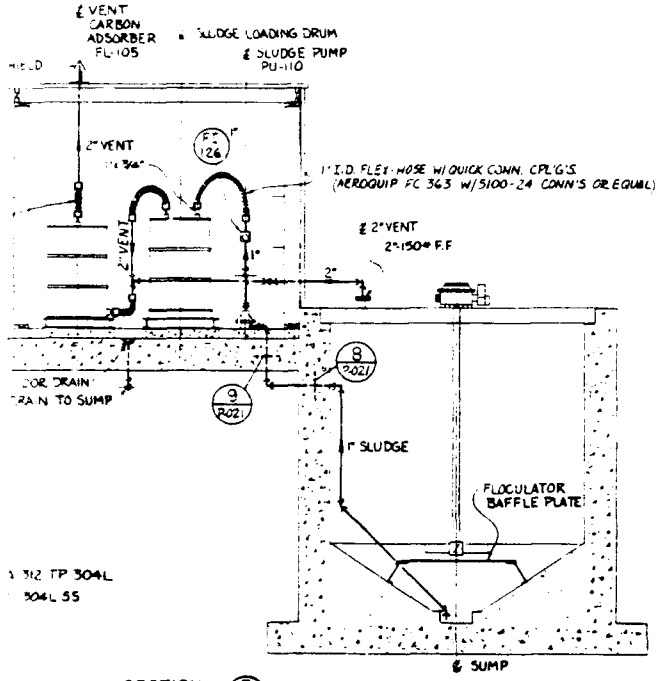
DETAIL 12 / P-020



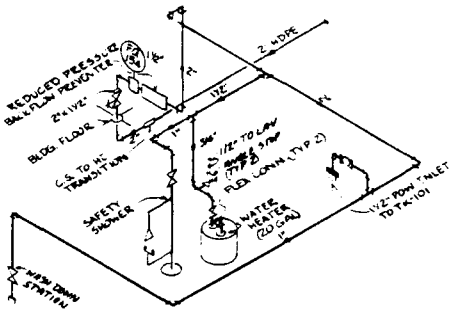
NATURAL GAS & AIR SYSTEM ISOMETRIC



SANITARY SEWER ISOMETRIC



SECTION E / P-020
SCALE: 1/2"=1'-0"



POTABLE WATER ISOMETRIC

NOTES:

1. MECHANICAL CONTRACTOR TO LOCATE, DESIGN, & INSTALL PIPE HANGERS & SUPPORTS.
2. DIMENSIONS SHOWN ARE PRELIMINARY AND SUBJECT TO CHANGE BASED ON FINAL EQUIPMENT SELECTED
3. MECHANICAL CONTRACTOR TO LOCATE & INSTALL HIGH POINT VENTS & LOW POINT DRAINS.
4. AIR SUPPLY HOSE REEL - HR-01 LINCOLN HEAVY DUTY TUBE REEL - MODEL 82838 W/CONNECTING HOSE #73024 BALL STOP #83517 OR APPROVED EQUAL PLUS 35'-½" HOSE W/ QUICK CONN. AIR COUPLING.
5. PENETRATION SLEEVES TO BE CAULKED WITH ATLAS INSULATING MASTIC OR APPROVED EQUAL.
6. SEE DRAWING I-001 FOR PIPING SYSTEM DESIGNATIONS.

APPROVALS		
DEPT REV:	A	
ARCH		
CIV/STRL		
MECH		
ELECT		
INSTR		
PIPING	DLS	DLS
SAFETY		
DEPT MGR		
PROJECT		

SCALE AS NOTED	DATE
DRAWN BY DLS	5/19/89
DESIGNED BY DLS	5/19/89
CHECKED BY	5/25/89
CLIENT APPROVALS	
REV. BY	DATE

MORRISON-KNUDSEN ENGINEERS, INC.

SHELL OIL COMPANY
ROCKY MOUNTAIN ARSENAL REMEDIATION PROJECT
INTERIM RESPONSE ACTION FINAL DETAILED DESIGN

DRAWING TITLE
BASIN A NECK IRA
MISC. PIPING
SECTIONS & DETAILS

WORK ORDER 2127 — 30 of 42
DRAWING NO. 373-35-001
REFERENCE NO. P-001 — REV 0

300-E-00

ELECTRICAL SYMBOL SHEET

- BUS RUN
- CABLE RUN
- CONTROL OR METERING RUN
- LINE INDICATING CONTROL CIRCUIT ACTION INITIATED BY PROTECTIVE RELAY OR DEVICE
- 1-PHASE, TWO-WINDING XFMR
- 3-PHASE, TWO-WINDING XFMR WITH DELTA-WYE CONNECTIONS
- 3-PHASE, 3-WIRE, DELTA
- 3-PHASE, 3-WIRE, DELTA, GROUNDED
- 3-PHASE, 4-WIRE, DELTA, GROUNDED
- 3-PHASE, 3-WIRE, WYE
- 3-PHASE, 4-WIRE, WYE, GROUNDED
- 3-PHASE, ZIG-ZAG, GROUNDED
- 3-PHASE, 3-WIRE, WYE, RESISTANCE GROUNDED
- CURRENT TRANSFORMER (# INDICATES QUANTITY)
- CURRENT TRANSFORMER, ZERO SEQUENCE TYPE
- POTENTIAL TRANSFORMER WITH PRIMARY FUSE (# INDICATES QUANTITY)
- POTENTIAL TRANSFORMER, DRAWOUT TYPE, WITH PRIMARY FUSE (# INDICATES QUANTITY)
- BUSHING-TYPE CURRENT TRANSFORMER (# INDICATES QUANTITY)
- WATTHOUR METERING UNIT
- FUSE, THERMAL CURRENT OVERLOAD DEVICE
- ISOLATING PRIMARY FUSE CUTOUT, DRY
- PRIMARY FUSE CUTOUT, OIL
- ISOLATING FUSE SWITCH FOR ON-LOAD SWITCHING
- SURGE ARRESTER
- CAPACITOR
- CIRCUIT BREAKER, LOW VOLTAGE, MOLDED CASE
- CIRCUIT BREAKER, LOW VOLTAGE, DRAWOUT TYPE
- CIRCUIT BREAKER, LOW VOLTAGE, DRAWOUT TYPE
  - # SS SOLID-STATE TRIP UNIT
  - # SS GF SOLID-STATE TRIP UNIT WITH GROUND FAULT MONITOR
- CIRCUIT BREAKER, MEDIUM OR HIGH VOLTAGE, FIXED TYPE
- CIRCUIT BREAKER, MEDIUM OR HIGH VOLTAGE, DRAWOUT TYPE
- CIRCUIT BREAKER COMBINATION STARTER, DRAWOUT TYPE WITH OVERLOAD PROTECTION (# INDICATES CIRCUIT BREAKER AND STARTER SIZE)
- FUSED COMBINATION STARTER, DRAWOUT TYPE WITH OVERLOAD PROTECTION (# INDICATES FUSE AND STARTER SIZE)

- FUSED SAFETY SWITCH (# INDICATES SWITCH AND FUSE RATING)
- DISCONNECT SWITCH, GROUP OPERATED
- DISCONNECT SWITCH, STICK OPERATED
- DISCONNECT SWITCH, SELECTOR OR DOUBLE-THROW
- SWITCH WITH HORN GAP, MANUALLY OPERATED
- POTHEAD
- CONNECTION
- CROSSING OF PATHS OR CONDUCTORS NOT CONNECTED
- SHIELDED ELECTRICAL CONDUCTOR
- SPACE HEATER
- RESISTOR
- RESISTANCE TEMPERATURE DETECTOR
- METAL-ENCLOSED BUS
- GROUNDING CONNECTION
- TYPICAL PUSHBUTTON STATION
- GENERATOR
- MOTOR
- SWITCHES (# INDICATES TYPE)
  - SS - SELECTOR, AS - AMMETER
  - VS - VOLTMETER
  - SYS - SYNCHRONIZING
- TRANSDUCER (# INDICATES TYPE)
- INSTRUMENT OR METER (# INDICATES TYPE)

A	- AMMETER	PF	- POWER FACTOR
F	- FREQ METER	PI	- POSITION INDICATOR
SYS	- SYNCHROSCOPE	REC	- RECORDING METER
V	- VOLTMETER	T	- TEMP RECORDER
VAR	- VARMETER	VA	- VOLT-AMPERE METER
W	- WATTMETER	VARH	- VARHOUR METER
TT	- TOTAL TIME METER	VHD	- VATTHOUR-DEMAND METER
GD	- GROUND DETECTOR	WH	- WATTHOUR METER

- CIRCUIT-CLOSING PUSHBUTTON MOMENTARY OR SPRING RETURN
- CIRCUIT-OPENING PUSHBUTTON MOMENTARY OR SPRING RETURN
- TWO-CIRCUIT PUSHBUTTON MOMENTARY OR SPRING RETURN
- TWO-CIRCUIT PUSHBUTTON MAINTAINED OR NOT SPRING RETURN
- MUSHROOM HEAD CIRCUIT OPENING PUSHBUTTON (FOR EMERGENCY APPLICATIONS)
- CIRCUIT-CLOSING SWITCH
- CIRCUIT-OPENING SWITCH
- TWO-POSITION TRANSFER SWITCH
- OFF - THREE-POSITION TRANSFER SWITCH
- MULTIPOSITION SWITCH, BREAK-BEFORE-MAKE, NONSHORTING DURING CONTACT TRANSFER. REFER TO G.E. TYPE SB SWITCH LITERATURE FOR CONTACT DIAGRAM ARRANGEMENTS
- MULTIPOSITION SWITCH, MAKE-BEFORE-BREAK, SHORTING DURING CONTACT TRANSFER
- NORMALLY OPEN LIMIT SWITCH
- NORMALLY OPEN LIMIT SWITCH HELD CLOSED
- NORMALLY CLOSED LIMIT SWITCH
- NORMALLY CLOSED LIMIT SWITCH HELD OPEN
- FLOW-ACTUATED SWITCH, CLOSES ON INCREASE IN FLOW
- FLOW-ACTUATED SWITCH, OPENS ON INCREASE IN FLOW
- LEVEL-ACTUATED SWITCH, CLOSES ON RISE IN LEVEL
- LEVEL-ACTUATED SWITCH, OPENS ON RISE IN LEVEL
- PRESSURE OR VACUUM-ACTUATED SWITCH, CLOSES ON RISING PRESSURE OR VACUUM
- PRESSURE OR VACUUM-ACTUATED SWITCH, OPENS ON RISING PRESSURE OR VACUUM
- DIFFERENTIAL PRESSURE SWITCH, CLOSES ON DIFFERENTIAL PRESSURE CHANGE
- TEMPERATURE-ACTUATED SWITCH, CLOSES ON RISING TEMPERATURE
- TEMPERATURE-ACTUATED SWITCH, OPENS ON RISING TEMPERATURE
- FOOT-OPERATED SWITCH, CLOSES BY FOOT PRESSURE
- FOOT-OPERATED SWITCH, OPENS BY FOOT PRESSURE
- SPEED-ACTUATED SWITCH, OPERATES ON SHAFT ROTATION (# INDICATES FUNCTION, ZS=ZERO SPEED, OS=OVERSPEED, US=UNDERSPEED)
- RELAY OR OPERATING COIL
  - # M - MOTOR STARTER
  - CR - CONTROL RELAY
  - TDR - TIME-DELAY RELAY
  - C - CONTACTOR
- NORMALLY OPEN CONTACT (MAKE)
- NORMALLY CLOSED CONTACT (BREAK)
- NORMALLY OPEN CONTACT WITH TIME DELAY CLOSING (TDC) AFTER COIL IS ENERGIZED
- NORMALLY CLOSED CONTACT WITH TIME DELAY OPENING (TDO) AFTER COIL IS ENERGIZED
- NORMALLY OPEN CONTACT WITH TIME DELAY OPENING (TDO) AFTER COIL IS DE-ENERGIZED
- NORMALLY CLOSED CONTACT WITH TIME DELAY CLOSING (TDC) AFTER COIL IS DE-ENERGIZED

- FUSE
- CIRCUIT BREAKER, SINGLE POLE
- CIRCUIT BREAKER, DOUBLE POLE
- SOLENOID
- PILOT LIGHT (# INDICATES COLOR)
  - A - AMBER, BL - BLUE, C - CLEAR, G - GREEN, O - ORANGE, OP - OPALESCENT, P - PURPLE, R - RED, W - WHITE, Y - YELLOW
- PILOT LIGHT (TRANSFORMER TYPE) (# INDICATES COLOR - SEE ABOVE)
- PILOT LIGHT (RESISTOR TYPE) (# INDICATES COLOR - SEE ABOVE)
- PILOT LIGHT (PUSH-TO-TEST) (# INDICATES COLOR - SEE ABOVE)
- CONTROL TRANSFORMER
- RESISTOR
- RESISTOR, WITH ADJUSTABLE CONTACT
- VARIABLE RESISTOR OR RHEOSTAT
- POTENTIOMETER
- INSTRUMENT OR RELAY SHUNT
- REACTOR OR INDUCTOR
- CAPACITOR
- OVERLOAD CONTACTS
- RECTIFIER DIODE
- BRIDGE-TYPE RECTIFIER
- SPACE HEATER
- CROSSING OF PATH OR CONDUCTORS NOT CONNECTED
- CONNECTION
- TERMINAL CONNECTION
- PLUG AND RECEPTACLE
- TWO CONDUCTORS WITH OVERALL SHIELD FOR GROUNDING CONNECTION
- GROUNDING CONNECTION
- SIGNAL OR ALARM HORN
- SIGNAL OR ALARM BELL
- THERMAL ELEMENT
- XXXX YYYY - PROGRAMMABLE CONTROLLER (PC) INPUT OR OUTPUT (XXXX INDICATES ADDRESS, YYYY INDICATES TERMINAL NO)

LIGHTING OUTLET SYMBOL (NOTE FIXTURE SCHEDULE NO. SMALL SWITCH)

CEILING MTD

REFERENCE DWGS	
E-028	ELECTRICAL PLAN & DETAILS SHT 02
E-023	ELECTRICAL PLAN & DETAILS SHT 01
E-021	ELECTRICAL CONTROL SCHEMATICS
E-010	WELLS POWER & CONTROL LAYOUT & DETAILS
E-003	AREA ELECTRICAL DISTRIBUTION
E-002	ELECTRICAL ONE-LINE DIAGRAM
DRAWING NO.	TITLE

REVISIONS				
NO.	BY	DATE	CHD	DESCRIPTION

REVISIONS				
D	JRC	8/22/89	JPC	ISSUED FOR CONSTRUCTION TL #047
C	JRC	3/26/89	GRB	ISSUED FOR IMPLEMENTATION PLAN, TL#045
B	JRC	06/12/89	GRB	ISSUED FOR APPROVAL TL#039
A	JRC	06/21/89		ISSUED FOR REVIEW & COMMENT-TL#028
NO.	BY	DATE	CHD	DESCRIPTION

APPROVALS				
DEPT / REV	A	B	C	D
ARCH		GL		
CIV/STRL		GJB		
MECH		JTP		
ELECT	JRC	JRC	JRC	JRC
INSTM		CED	JEM	
PIPING		DS		
SAFETY				
DEPT MGR		JEM		
PROJECT				

SCALE
DRAWN
DESIGNED
CHECKED
REV

1

2

ELECTRICAL SYMBOL SHEET

- FUSE
- CIRCUIT BREAKER, SINGLE POLE
- CIRCUIT BREAKER, DOUBLE POLE
- SOLENOID
- PILOT LIGHT
  * INDICATES COLOR
  - A - AMBER
  - B - BLUE
  - C - CLEAR
  - G - GREEN
  - O - ORANGE
  - OP - OPALESCENT
  - P - PURPLE
  - R - RED
  - W - WHITE
  - Y - YELLOW
- PILOT LIGHT (TRANSFORMER TYPE) * INDICATES COLOR (SEE ABOVE)
- PILOT LIGHT (RESISTOR TYPE) * INDICATES COLOR (SEE ABOVE)
- PILOT LIGHT (PUSH-TO-TEST) * INDICATES COLOR (SEE ABOVE)
- CONTROL TRANSFORMER (M1, M2, X1, X2)
- RESISTOR
- RESISTOR, WITH ADJUSTABLE CONTACT
- VARIABLE RESISTOR OR RHEOSTAT
- POTENTIOMETER
- INSTRUMENT OR RELAY SHUNT
- REACTOR OR INDUCTOR
- CAPACITOR
- OVERLOAD CONTACTS
- RECTIFIER DIODE
- BRIDGE-TYPE RECTIFIER
- SPACE HEATER
- CROSSING OF PATH OR CONDUCTORS NOT CONNECTED
- CONNECTION
- TERMINAL CONNECTION
- PLUG AND RECEPTACLE
- TWO CONDUCTORS WITH OVERALL SHIELD FOR GROUNDING CONNECTION
- GROUNDING CONNECTION
- SIGNAL OR ALARM HORN
- SIGNAL OR ALARM BELL
- THERMAL ELEMENT
- PROGRAMMABLE CONTROLLER (PC) INPUT OR OUTPUT XXXX INDICATES ADDRESS YYYY INDICATES TERMINAL NO

POWER & LIGHTING PLAN SYMBOLS

- EXPOSED CONDUIT OR CABLE
- UNDERGROUND CONDUIT OR DIRECT BURIAL CABLE
- EXPOSED CONDUIT OR CABLE (HIDDEN FROM VIEW)
- EQUIPMENT HIDDEN FROM VIEW
- POLE LINE
- UNDERGROUND DUCT BANK
- FLEXIBLE CONDUIT
- BRANCH CIRCUIT HOMERUN TO PANELBOARD, NO OF ARROWS INDICATE NO OF CIRCUITS
- 3-PHASE WIRES AND A NEUTRAL
- 4-PHASE WIRES, 2 NEUTRALS, AND 1 GROUND WIRE
- GROUND WIRE, NO 4/0 AWG
- GROUND WIRE CONNECTION, NO 2 AWG TAP
- GROUND ROD
- PIGTAIL FOR EQUIPMENT GROUND
- CONDUIT TURN UP
- CONDUIT TURN DOWN
- CONDUIT RUN WITH SEAL
- CONDUIT FITTINGS
- JB - JUNCTION BOX
- PB - PULL BOX

LIGHTING OUTLETS: CAPITAL LETTER OUTSIDE SYMBOL INDICATES FIXTURE TYPE AS SHOWN ON FIXTURE SCHEDULE. NUMERAL INDICATES CIRCUIT NO. SMALL LETTER DESIGNATES THE CONTROLLING SWITCH

CEILING MTD	WALL MTD	DESCRIPTION
A Sa	A Sa	SURFACE OR PENDANT INCANDESCENT, MERCURY-VAPOR, OR SIMILAR LAMP FIXTURE
R A Sa	R A Sa	RECESSED INCANDESCENT, MERCURY-VAPOR, OR SIMILAR LAMP FIXTURE
A Sa	A Sa	SURFACE OR PENDANT INDIVIDUAL FLUORESCENT FIXTURE
A Sa R	A Sa R	RECESSSED INDIVIDUAL FLUORESCENT FIXTURE
X	X	SURFACE OR PENDANT EXIT LIGHT. ARROWS INDICATE ROUTE OF EGRESS
RX	RX	RECESSED EXIT LIGHT. ARROWS INDICATE ROUTE OF EGRESS
B	B	BLANKED OUTLET
J	J	JUNCTION BOX
L	L	OUTLET CONTROLLED BY LOW-VOLTAGE SWITCHING OR WHEN RELAY IS INSTALLED IN OUTLET BOX
A Sa		SURFACE OR PENDANT CONTINUOUS-ROW FLUORESCENT FIXTURE
A Sa R		RECESSED CONTINUOUS ROW FLUORESCENT FIXTURE
A Sa		BARE LAMP FLUORESCENT STRIP
B Sa		BRACKET-MOUNTED FLOODLIGHT, ARROW INDICATES AIMING DIRECTION
B Sa		POLE-MOUNTED FLOODLIGHT, ARROW INDICATES AIMING DIRECTION
D S		EMERGENCY LIGHTING FIXTURE, BATTERY OPERATED. ARROWS INDICATE AIMING DIRECTION
		STANDARD ELECTRICAL INSTALLATION DETAIL. REFER TO SPECIFICATION 37-1601, APPENDIX A

RECEPTACLE OUTLETS: NUMERAL BY THE SIDE OF SYMBOL INDICATES CIRCUIT NUMBER

- 3 - SINGLE RCPT
- DUPLEX RCPT
- TRIPLEX RCPT
- QUADRUPLEX RCPT
- DUPLEX RCPT, SPLIT WIRED
- TRIPLEX RCPT, SPLIT WIRED
- SINGLE SPECIAL-PURPOSE RCPT
- DUPLEX SPECIAL-PURPOSE RCPT
- J - SPECIAL PURPOSE RCPT OR PROVISION FOR CONNECTION (SUPERSCRIPT INDICATES FUNCTION, W = WELDING)
- FLOOR SPECIAL PURPOSE RECEPTACLE
- FLOOR SINGLE RECEPTACLE
- FLOOR DUPLEX RECEPTACLE
- JUNCTION BOX
- THERMOSTAT
- TELEPHONE RCPT, PRIVATE
- FLOOR TELEPHONE RCPT, PRIVATE
- TELEPHONE RCPT, PUBLIC
- FLOOR TELEPHONE RCPT, PUBLIC
- SOUND SYSTEM DEVICE

SPECIAL IDENTIFICATION OF OUTLETS

- WP - WEATHERPROOF
- VT - VAPORTIGHT
- WT - WEATHERTIGHT
- DT - DUSTTIGHT
- RT - RAINTIGHT
- XP - EXPLOSIONPROOF

FIRE ALARM INITIATING AND SIGNALING DEVICES

- F - MANUAL STATION
- FC - CONTROL UNIT
- F - HEAT DETECTOR, FIXED TEMPERATURE
- R - HEAT DETECTOR, COMBINATION RATE OF RISE & FIXED TEMPERATURE OR RATE COMPENSATED
- S - AREA SMOKE DETECTOR
- D - DUCT SMOKE DETECTOR
- F - FLAME DETECTOR
- FA - ANNUNCIATOR
- F - BELL
- F - HORN
- F - BUZZER
- EOL - END OF LINE TERMINATING DEVICE
- PS - POWER SUPPLY
- RS - REMOTE STATION
- DH - DOOR HOLDER

SWITCH OUTLETS: SMALL LETTER BY THE SIDE OF SYMBOL INDICATES THE CONTROLLED FIXTURE

- S_a - SINGLE POLE SWITCH
- S_2 - DOUBLE POLE SWITCH
- S_3 - THREE-WAY SWITCH
- S_4 - FOUR-WAY SWITCH
- S_K - KEY-OPERATED SWITCH
- S_P - SWITCH WITH PILOT LIGHT
- S_L - SWITCH FOR LOW-VOLTAGE SWITCHING SYSTEM
- S_{LM} - MASTER SWITCH FOR LOW-VOLTAGE SWITCHING SYSTEM
- S - SWITCH AND SINGLE RCPT
- S - SWITCH AND DOUBLE RCPT
- S_D - DOOR SWITCH
- S_T - TIME SWITCH
- S_{CB} - CIRCUIT BREAKER SWITCH
- S_{TM} - MANUAL STARTER SWITCH WITH THERMAL OVERLOADS
- S_{MC} - MOMENTARY CONTACT SWITCH OR PUSHBUTTON
- - CEILING-MOUNTED PULL SWITCH
- - HORIZONTAL MOTOR OR GENERATOR
- - VERTICAL MOTOR OR GENERATOR
- - DRY-TYPE 1-PHASE TRANSFORMER
- - DRY-TYPE 3-PHASE TRANSFORMER
- - EXTERNALLY-OPERATED DISCONNECT SWITCH
- - COMBINATION CONTROLLER AND DISCONNECTING MEANS
- - SWITCHES OR DEVICES * INDICATES TYPE
  - FS - FLOW SWITCH
  - LMS - LIMIT SWITCH
  - PS - PRESSURE SWITCH
  - SV - SOLENOID VALVE

ABBREVIATIONS:

- RGS - RIGID GALVANIZED STEEL
- TSP - TWISTED SHIELDED PAIR
- ECP - ELECTRICAL CONTROL PANEL
- ICP - INSTRUMENT CONTROL PANEL
- BCW - BARE COPPER WIRE

DEPT REV	A	B	C	D	
ARCH		DL			
CIV/STRL		GJB			
MECH		JTF			
ELECT	JPC	JPC	JPC	JPC	
INSTR		CED	JEM		
PIPING		DS	DLS	DLS	
SAFETY					
DEPT MGR		JEM	JEM		
PROJECT		JEM	GJB		

APPROVALS

SCALE NONE		DATE
DRAWN BY	ejo	04/21/89
DESIGNED BY	JPC	04/20/89
CHECKED BY	GMB	5/1/89
CL. MT APPROVALS		
REV	BY	DATE

MORRISON-KNUDSEN ENGINEERS, INC.

SHELL OIL COMPANY
ROCKY MOUNTAIN ARSENAL REMEDIATION PROJECT
INTERIM RESPONSE ACTION FINAL DETAILED DESIGN

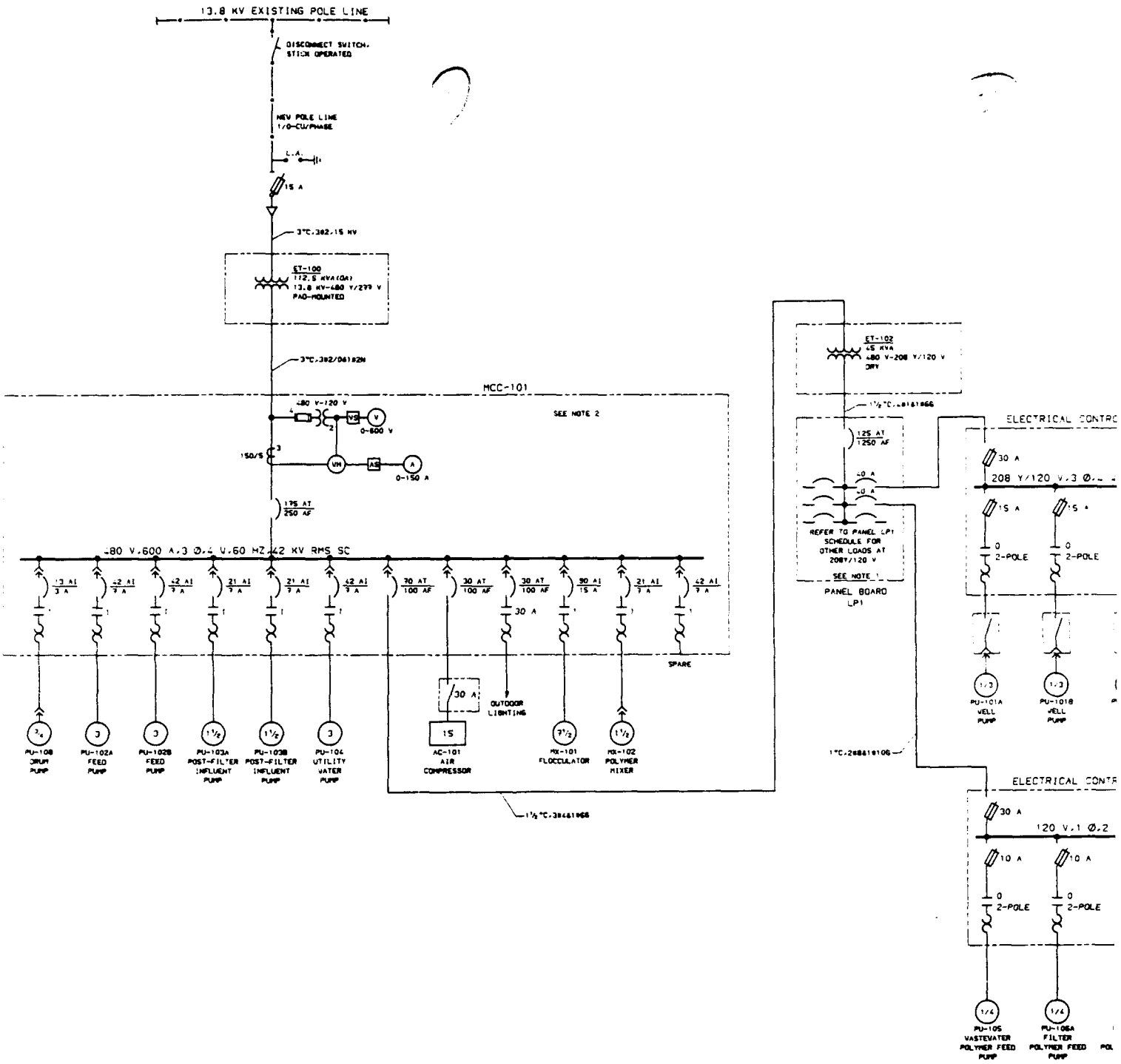
DRAWING TITLE
BASIN A NECK IRA
ELECTRICAL SYMBOLS

WORK ORDER NO. 2127
30 x 42
DRAWING NO. 373-37-001
REFERENCE NO. E-001
REV 0

2

3

373-37-002



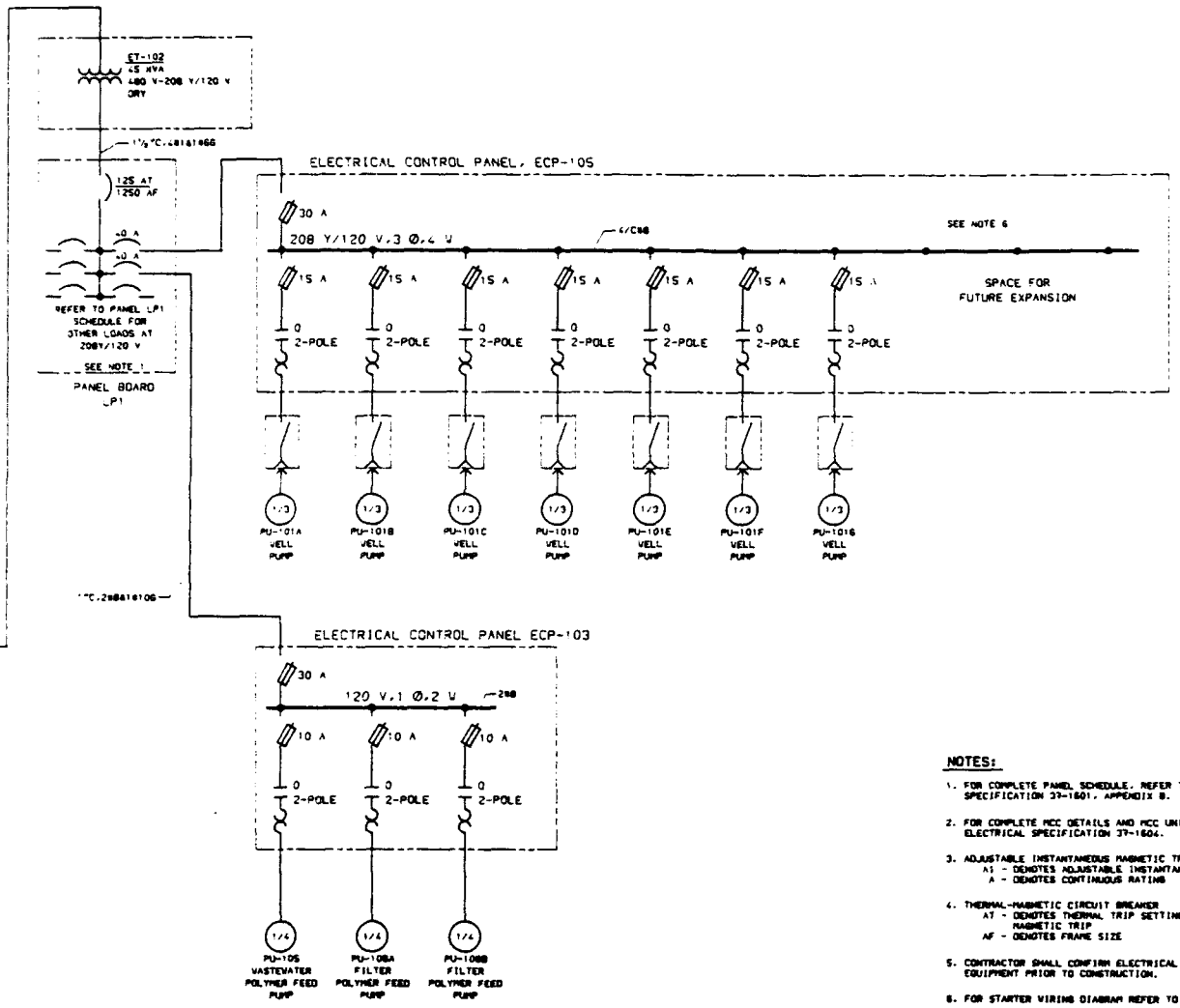
REFERENCE DWGS	
E-028	ELECTRICAL PLAN & DETAILS SHEET 02
E-027	ELECTRICAL PLAN & DETAILS SHEET 01
E-024	ELECTRICAL CONTROL WIRING DIAGRAMS
E-021	ELECTRICAL CONTROL SCHEMATICS
E-010	WELLS POWER & CONTROL LAYOUT & DETAILS
E-003	AREA ELECTRICAL DISTRIBUTION
DRAWING NO.	TITLE

REVISIONS				
NO.	BY	DATE	CKD	DESCRIPTION

REVISIONS				
O	JRC	8/22/89	JRC	ISSUED FOR CONSTRUCTION TL# 0403
C	JRC	5/26/89	JRC	ISSUED FOR IMPLEMENTATION PLAN. TL#046
B	JRC	05/12/89	GB	ISSUED FOR APPROVAL. TL#028
A	JRC	04/21/89	GB	ISSUED FOR REVIEW & COMMENT. TL#028
NO.	BY	DATE	CKD	DESCRIPTION

APPROVALS				
DEPT REV	A	B	C	O/C
ARCH		DL		
CIV/STRL		GJB		
MECH		JTF		
ELECT	JRC	JRC	JRC	JRC
INSTR		CED		
PIPING		DS	DLS	DLS
SAFETY				
DEPT MGR		MFT	JEM	JEM
PROJECT		JRH	GJB	

SCALE
DRAWN B
DESIGNE
CHECKED
REV



NOTES:

1. FOR COMPLETE PANEL SCHEDULE, REFER TO ELECTRICAL SPECIFICATION 37-1601, APPENDIX B.

2. FOR COMPLETE MCC DETAILS AND MCC UNIT WIRING DIAGRAM, REFER TO ELECTRICAL SPECIFICATION 37-1604.

3. ADJUSTABLE INSTANTANEOUS MAGNETIC TRIP ONLY CIRCUIT BREAKER(MCP)
   AI - DENOTES ADJUSTABLE INSTANTANEOUS TRIP SETTING
   A - DENOTES CONTINUOUS RATING

4. THERMAL-MAGNETIC CIRCUIT BREAKER
   AT - DENOTES THERMAL TRIP SETTING W/FIXED(OR ADJUSTABLE) MAGNETIC TRIP
   AF - DENOTES FRAME SIZE

5. CONTRACTOR SHALL CONFIRM ELECTRICAL DESIGN BASED ON ACTUAL PURCHASED EQUIPMENT PRIOR TO CONSTRUCTION.

6. FOR STARTER WIRING DIAGRAM REFER TO DRAWING E-021.

DEPT	REV	A	B	C	D/E
ARCH			DL		
CIV/STRL					
MECH			JTF		
ELECT		JRC	JRC		
INSTR			CED		
PIPING			DS		
SAFETY					
DEPT MGR			MFT	JEM	
PROJECT			JRM		

APPROVALS

SCALE	NONE	DATE
DRAWN BY		04/03/88
DESIGNED BY	JRC	04/15/88
CHECKED BY		04/21/88

CLIENT APPROVALS

REV	BY	DATE

MORRISON-KNUDSEN ENGINEERS, INC.

SHELL OIL COMPANY
ROCKY MOUNTAIN ARSENAL REMEDIATION PROJECT
INTERIM RESPONSE ACTION FINAL DETAILED DESIGN

DRAWING TITLE
BASIN A NECK IRA
ELECTRICAL ONE-LINE
DIAGRAM

WORK ORDER NO. 2127

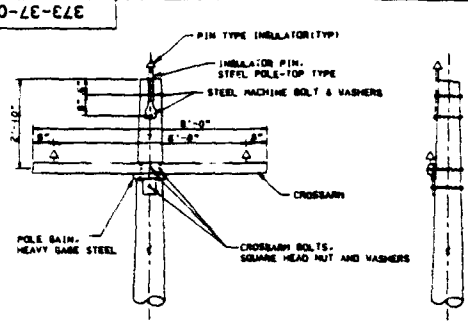
30 x 42

DRAWING NO. 373-37-002

REFERENCE NO. E-002

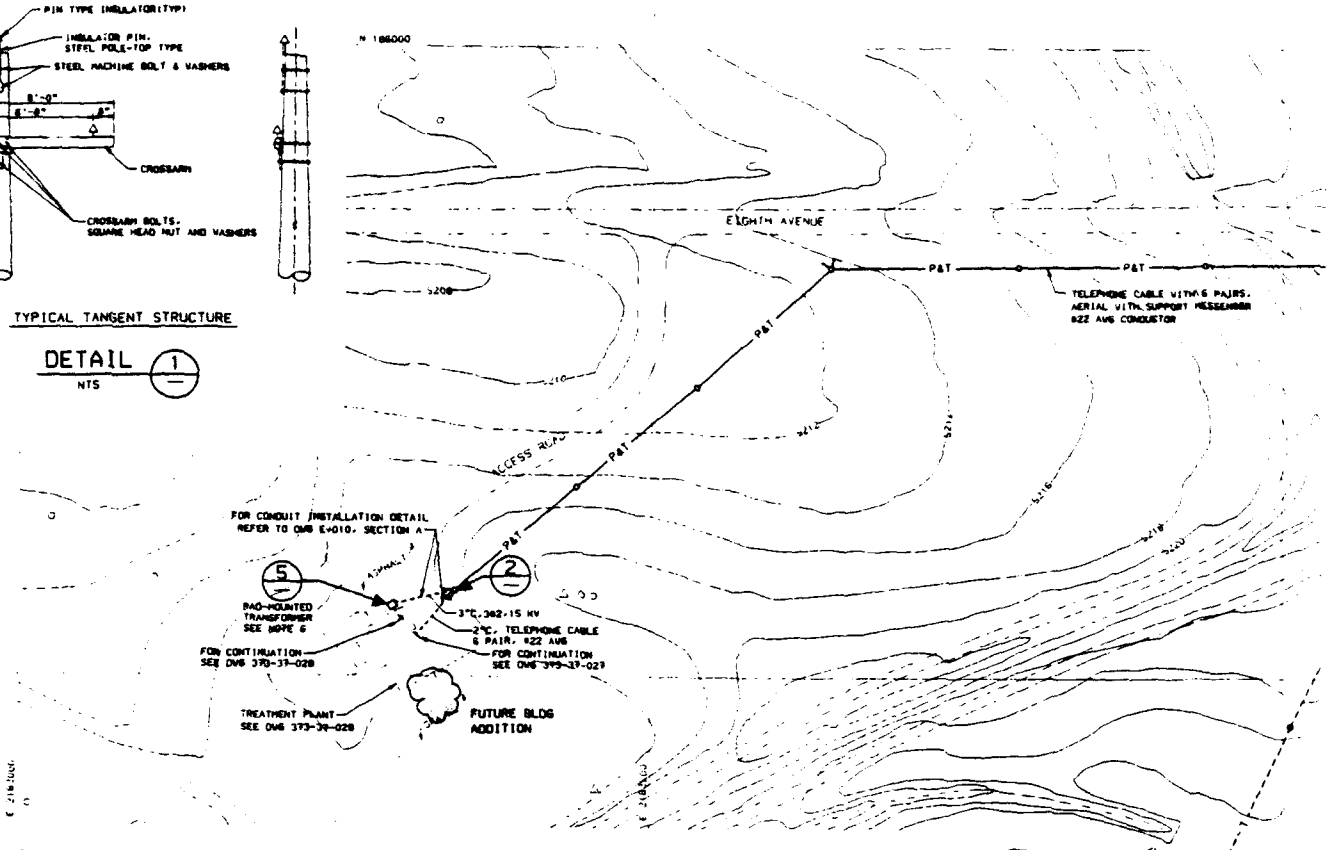
REV 0

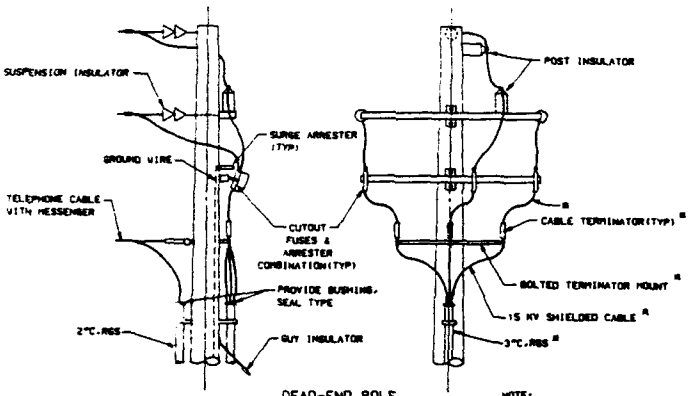
373-37-003



TYPICAL TANGENT STRUCTURE

DETAIL 1
NTS

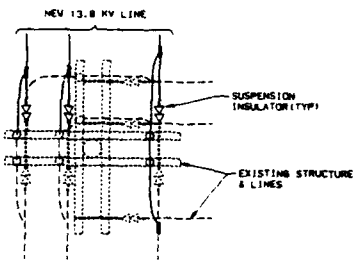




DEAD-END POLE

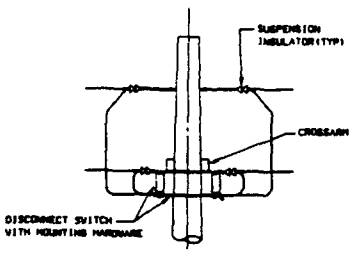
DETAIL 2
NTS

NOTE:
ITEMS MARKED WITH AN ASTERICK (*) ARE BY THE PLANT ELECTRICAL CONTRACTOR AND ARE NOT INCLUDED IN THE SECTION 37-1877 POLE LINE CONTRACT



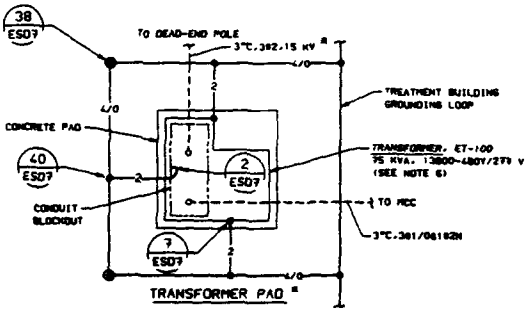
TAP FROM EXISTING LINE

DETAIL 4
NTS



POLE WITH DISCONNECT SWITCH, STICK OPERATED

DETAIL 3
NTS



TRANSFORMER PAD *

DETAIL 5
NTS

REFERENCE DWGS	
E-029	ELECTRICAL PLAN & DETAILS SHEET 02
E-027	ELECTRICAL PLAN & DETAILS SHEET 01
E-008	ELECTRICAL ONE-LINE DIAGRAM
C-022	SEWAGE SYSTEM PLAN AND DETAILS
C-002	SITE PLAN
P-010	WELL, TRENCH & UTILITY PIPING DISTRIBUTION
DRAWING NO.	TITLE

REVISIONS				
NO.	BY	DATE	CKD	DESCRIPTION

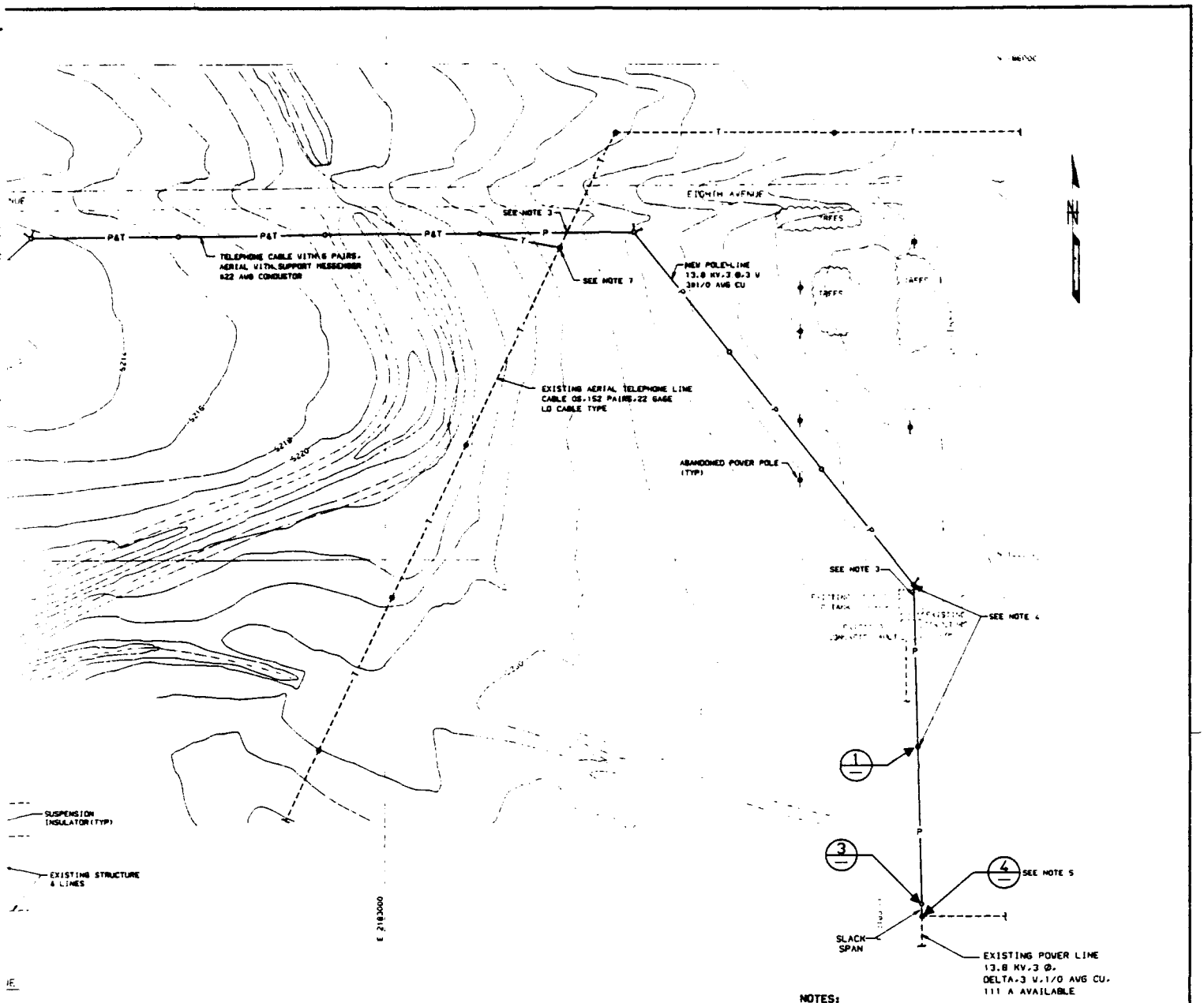
REVISIONS				
0	MJM	05/27/90	JMC	ISSUED FOR CONSTRUCTION TL #047
C	JMC	05/28/90	BMB	ISSUED FOR IMPLEMENTATION PLAN, TL8045
B	JMC	05/1	BMB	ISSUED FOR APPROVAL, TL8028
A	JMC	04/28/89	BMB	ISSUED FOR REVIEW & COMMENT, TL822
NO.	BY	DATE	CKD	DESCRIPTION

APPROVALS					
DEPT	REV	A	B	C	D
ARCH			CL	DOL	
CIV/STRL			GJB	CSV	
MECH			JTF	JFT	
ELECT		JMC	JMC	JMC	
INSTM			CED	JEM	
PIPING			DS	DLS	
SAFETY				JC	
DEPT MGR		MFT	JEM	JEM	
PROJECT		JRM	GJB	JRM	

SCALE
DRAWN
DESIGN
CHECK
REV

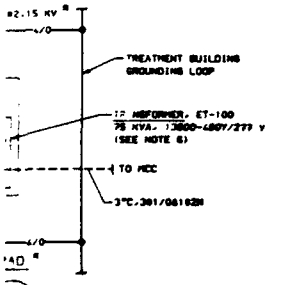
1

2



NOTES:

1. CONTRACTOR TO PROVIDE THE FINAL LOCATION AND NUMBERS OF POLES AND GUYS.
2. CONTRACTOR TO PROVIDE LINE DESIGN AS REQUIRED BY SPECIFICATION 39-1677.
3. CONTRACTOR TO PROVIDE ADEQUATE CLEARANCES BETWEEN CONDUCTOR AND EXISTING STRUCTURE AND BETWEEN CONDUCTOR AND EXISTING TELEPHONE LINE IN ACCORDANCE WITH NATIONAL ELECTRICAL SAFETY CODE (NESC) REQUIREMENTS.
4. CONTRACTOR TO REPLACE EXISTING POLES UNLESS THE POLE CONDITION AND CHARACTERISTICS MEET THE DESIGN REQUIREMENTS.
5. CONTRACTOR SHALL MAKE NECESSARY MODIFICATION TO EXISTING CORNER POLE FOR CONNECTION OF THE NEW 13.8 KV LINE AND IS RESPONSIBLE FOR SPLICING OF THE NEW POWER LINE CONNECTION.
6. CONTRACTOR TO OBTAIN TRANSFORMER PAD REQUIREMENTS AND STUB-UP DETAILS FROM TRANSFORMER MANUFACTURER AND INSTALL IN ACCORDANCE WITH MANUFACTURER INSTRUCTIONS. REFER TO DRAWING #373-34-022 FOR PAD DETAILS.
7. CONTRACTOR SHALL CONSULT WITH THE OWNER AND/OR THE TELEPHONE UTILITY COMPANY. BEFORE PURCHASING EQUIPMENT AND MATERIALS TO DO THE SPLICING FOR TAPPING THE EXISTING TELEPHONE CABLE. THE FINAL INSTALLATION HAS TO BE INSPECTED AND APPROVED BY THE OWNER OR TELEPHONE UTILITY COMPANY.



LEGEND:

- EXISTING 13.8 KV POLE LINE
- NEW 13.8 KV POLE LINE
- EXISTING TELEPHONE LINE
- NEW TELEPHONE LINE
- EXISTING WOOD POLES
- NEW WOOD POLES

DEPT	REV	A	B	C	D
ARCH			CL	DDL	
CIV/STRL			GJB	CBV	
MECH			JTF	JFT	
ELECT		JRC	JRC	JRC	
INSTR			CED	JEH	
PIPING			DS	DLS	
SAFETY				JC	
DEPT MGR		MFT	JEH	JEH	
PROJECT		JRH	GJB	JRH	

APPROVALS

SCALE	1"= 50'	DATE
DRAWN BY	ejo	03/29/89
DESIGNED BY	JRC	04/20/89
CHECKED BY	GHB	04/24/89
CLIENT APPROVALS		
REV	BY	DATE

MORRISON-KNUDSEN ENGINEERS, INC.

SHELL OIL COMPANY
ROCKY MOUNTAIN ARSENAL REMEDIATION PROJECT
INTERIM RESPONSE ACTION FINAL DETAILED DESIGN

DRAWING TITLE
BASIN A NECK IRA
AREA ELECTRICAL DISTRIBUTION

WORK ORDER 2127 — 30 of 42
DRAWING NO. 373-37-003
REFERENCE NO. E-003 — REV 0

RR2127.08-37-003

(2) (3)

373-38-001

INSTRUMENT IDENTIFICATION

	PROCESS VARIABLES	ALARM POINT HIGH (HH--HIGH HIGH)	ALARM POINT LOW (LL--LOW LOW)	CONTROLLER	SELF-ACTUATING CONTROL VALVE	PRIMARY ELEMENT	GLASS DEVICE	INDICATOR	INDICATING CONTROLLER	INTEGRATOR	RECORDER	RECORDER CONTROLLER	SWITCH	SAFETY VALVE	TRANSMITTER	VALVE, DAMPER, OR LOUVER	RELAY, MODIFIER OR CONDITIONER
		AH	AL	C	CV	E	G	I	IC	Q	R	RC	S	SV	T	V	Y
A	ANALYSIS	AAH	AAL	AC		AE		AI	AIC	AQ	AR	ARC	AS		AT	AV	AY
B	BURNER FLAME		BAL		BCV								BS	BSV		BV	
C	CONDUCTIVITY	CAH	CAL	CC		CE		CI	CIC		CR	CRC	CS		CT	CV	CY
D	DENSITY	DAH	DAL	DC		DE		DI	DIC		DR	DRC	DS		DT	DV	DY
E	VOLTAGE	EAH	EAL	EC		EE		EI	EIC		ER	ERC	ES		ET		EY
F	FLOW RATE	FAH	FAL	FC	FCV	FE	FG	FI	FIC	FQ	FR	FRC	FS		FT	FV	FY
H	HAND			HC					HIC				HS			HV	
I	CURRENT	IAH	IAL	IC		IE		II	IIC		IR	IRC	IS		IT		IY
J	POWER	JAH	JAL	JC		JE		JI	JIC	JQ	JR	JRC	JS		JT		JY
L	LEVEL	LAH	LAL	LC	LCV	LE	LG	LI	LIC		LR	LRC	LS		LT	LV	LY
M	MOISTURE	MAH	MAL	MC		ME		MI	MIC		MR	MRC	MS		MT		MY
P	PRESSURE	PAH	PAL	PC	PCV	PE		PI	PIC		PR	PRC	PS	PSV	PT	PV	PY
S	SPEED	SAH	SAL	SC	SCV	SE		SI	SIC	SQ	SR	SRC	SS		ST	SV	SY
T	TEMPERATURE	TAH	TAL	TC	TCV	TE		TI	TIC		TR	TRC	TS		TT	TV	TY
V	VISCOSITY	VAH	VAL	VC		VE		VI	VIC		VR	VRC	VS		VT	VV	VY
W	WEIGHT	WAH	WAL	WC		WE		WI	WIC	WQ	WR	WRC	WS		WT	WV	WY
Z	POSITION	ZAH	ZAL	ZC		ZE		ZI	ZIC		ZR	ZRC	ZS		ZT		ZY
X	AIR RELEASE															XV	

INSTRUMENT IDENTIFICATION NOTES:

1. REFER TO ISA STANDARD S5.1 FOR LETTERS OR LETTER MEANINGS THAT DO NOT APPEAR IN TABLE ABOVE.
2. SHADED AREAS REPRESENT IMPROBABLE OR IMPOSSIBLE COMBINATIONS.
3. INSTRUMENT IDENTIFICATON IS MADE UP OF TWO TO FOUR LETTERS FROM THIS TABLE, FOLLOWED BY A LOOP NUMBER.
4. READILY RECOGNIZED SELF-DEFINING CHEMICAL SYMBOLS SUCH AS CO2, O2, ETC., USED IN CONJUNCTION WITH ANALYSIS INSTRUMENTS. THE SYMBOL WILL BE PLACED OUTSIDE THE INSTRUMENT BALLOON.
5. THE GRAMMATICAL FORM OF THE SUCCEEDING LETTER MEANING MAY BE MODIFIED AS REQUIRED. FOR EXAMPLE, I MAY BE USED FOR INDICATOR OR INDICATING.
6. THE LETTERS F (RATIO) & D (DIFFERENTIAL) MAY BE USED AS MODIFIERS WITH AN APPROPRIATE FIRST LETTER, TO BETTER DEFINE THE FUNCTIONAL ASPECTS OF THE SYSTEM. FOR EXAMPLE: FFIC = FLOW RATIO INDICATING CONTROLLER AND PDSH = PRESSURE DIFFERENTIAL SWITCH HIGH.

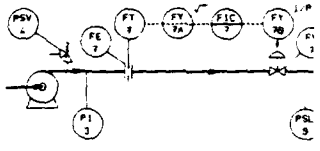
TAGGING AND LOOP IDENTIFICATION:

A UNIQUE NUMBER SHALL BE ASSIGNED TO EACH CONTROL
EACH INSTRUMENT IN THAT LOOP SHALL BE IDENTIFIED

ITEMS SUCH AS PRESSURE GAGES, THERMOMETERS, PRESSU
ETC., OR ANY INSTRUMENT USED INDIVIDUALLY SHALL BE
INDIVIDUAL CONTROL OR MONITOR LOOP.

EACH LOOP SHALL HAVE A UNIQUE NUMBER.

TYPICAL LOOP DIAGRAM



LINE IDENTIFICATION:

6"-POV
SIZE
SERVICE

PIPELINE SERVICE ABBREVIATIONS:

PA	PLANT AIR
IA	INSTRUMENT AIR
POW	POTABLE WATER
SS	SANITARY SEWER
NG	NATURAL GAS
RGW	RAW GROUND WATER
FGW	FILTERED GROUND WATER
ATW	ADSORBER TREATED WATER
UW	UTILITY WATER
FTW	FILTERED TREATED WATER
SPD	SUMP PUMP DISCHARGE
BWW	BACKWASH WASTEWATER
PS	POLYMER SUPPLY
V	VENT
DR	DRAIN

SYMBOLS USED IN CONJUNCTION WITH SIGNAL CONDITIONERS AND COMPUTING DEVICES TO DESCRIBE THE FUNC

CURRENT TO PNEUMATIC	PNEUMATIC TO CURRENT		CURRENT TO HYDRAULIC	VOLTAGE TO PNEUMATIC		PNEUMATIC TO
I/P	P/I		I/H	E/P		P/E
ADD & SUBTRACT	SUBTRACT	MULTIPLY	DIVIDE	SQUARE ROOT	HIGH SELECT	LOW SELE
Σ	Δ	⊠	÷	√	>	<

REFERENCE DWGS

DRAWING NO.	TITLE

REVISIONS

NO.	BY	DATE	CKD	DESCRIPTION

REVISIONS

NO.	BY	DATE	CKD	DESCRIPTION
D	EB	8/22/89	DLS	ISSUED FOR CONSTRUCTION TL#847
C	EB	5/13/89		ISSUED FOR IMPLEMENTATION
B	EB	4/18/89	DLS	ISSUED FOR APPROVAL TL#24
A	CEO	3/17/89	CEO	ISSUED FOR REVIEW & COMMENT TL#012

APPROVALS

DEPT	REV	A	B	C	D
ARCH					
CIV/STRL					
MECH		JF	JC		
ELECT			JC		
INSTR		CEO	CEO		
PIPING		JVM	DLS		
SAFETY			JC	JC	JC
DEPT MGR		MFT	MFT		
PROJECT		JRH	JRH		

SCA
DRA
DES
CHE
REV

1

2

UMENT IDENTIFICATION

	INDICATOR / INDICATING CONTROLLER	INTEGRATOR	RECORDER / RECORDER CONTROLLER	SWITCH	SAFETY VALVE	TRANSMITTER	VALVE, DAMPER, OR LOUVER	RELAY, MODIFIER OR CONDITIONER			
IC	Q	R	RC	S	SV	T	V	Y			
IIC	AQ	AR	ARC	AS		AT	AV	AY			
				BS	BSV		BV				
CIC		CR	CRC	CS		CT	CV	CY			
DIC		DR	DRC	DS		DT	DV	DY			
EIC		ER	ERC	ES		ET		EY			
FIC	FQ	FR	FRC	FS		FT	FV	FY			
HIC				HS			HV				
IIC		IR	IRC	IS		IT		IY			
JIC	JQ	JR	JRC	JS		JT		JY			
LIC		LR	LRC	LS		LT	LV	LY			
MIC		MR	MRC	MS		MT		MY			
PIC		PR	PRC	PS	PSV	PT	PV	PY			
SIC	SQ	SR	SRC	SS		ST	SV	SY			
TIC		TR	TRC	TS		TT	TV	TY			
VIC		VR	VRC	VS		VT	VV	VY			
WIC	WQ	WR	WRC	WS		WT	WV	WY			
ZIC		ZR	ZRC	ZS		ZT		ZY			
							XV				

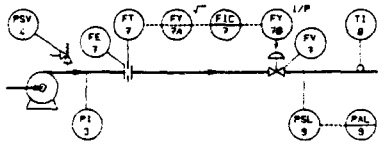
TAGGING AND LOOP IDENTIFICATION:

A UNIQUE NUMBER SHALL BE ASSIGNED TO EACH CONTROL OR MONITOR LOOP AND EACH INSTRUMENT IN THAT LOOP SHALL BE IDENTIFIED BY THE SAME NUMBER.

ITEMS SUCH AS PRESSURE GAGES, THERMOMETERS, PRESSURE SAFETY VALVES, ETC., OR ANY INSTRUMENT USED INDIVIDUALLY SHALL BE TREATED AS AN INDIVIDUAL CONTROL OR MONITOR LOOP.

EACH LOOP SHALL HAVE A UNIQUE NUMBER.

TYPICAL LOOP DIAGRAM



NINGS THAT
INATIONS.
ETTERS FROM
CH AS CO2,
NTS.
LOON.
G MAY BE
INDICATOR
AS MODIFIERS
HE FUNCTIONAL
D INDICATING
SH.

L CONDITIONERS AND COMPUTING DEVICES TO DESCRIBE THE FUNCTION

CURRENT TO HYDRAULIC	VOLTAGE TO PNEUMATIC	PNEUMATIC TO VOLTAGE
I/H	E/P	P/E
DIVIDE	SQUARE ROOT	HIGH SELECT	LOW SELECT

SYMBOL DESCRIPTION

VALVE BODY

	GATE
	GLOBE
	BUTTERFLY
	CHECK
	ROTARY BALL
	ROTARY PLUG
	PINCH
	DIAPHRAGM
	LOUVER OR DAMPER
	ANGLE - THREE WAY - FOUR WAY

ACTUATOR

	FLOAT
	DIAPHRAGM / DIAPHRAGM PRESSURE-BALANCED
	ROTARY MOTOR
	DOUBLE ACTING CYLINDER
	HAND ACTUATOR
	PRESSURE RELIEF OR SAFETY VALVE / VACUUM RELIEF
	SOLENOID / ELECTRO-HYDRAULIC
	PRESSURE CONTROL VALVE SELF CONTAINED (SELF CONNECTED)/(DIRECT CONNECTED)
	BACK PRESSURE CONTROL VALVE SELF CONTAINED (SELF CONNECTED)/(DIRECT CONNECTED)

MISCELLANEOUS

	GENERALIZED - FOR UNDEFINED OR COMPLEX INTERLOCK LOGIC
	INTERLOCK IS EFFECTIVE ONLY IF ALL INPUTS EXIST
	INTERLOCK IS EFFECTIVE IF ANY ONE OR MORE INPUTS EXIST
	TIME DELAY
	CHEMICAL SEAL
	PILOT LIGHT
	INPUT-OUTPUT POINTS TO COMPUTERS, PCs, ETC.

SYMBOL DESCRIPTION

INSTRUMENT LINE

	CONNECTION TO PROCESS, MECHANICAL LINK OR INSTRUMENT SUPPLY
	ELECTRICAL SIGNAL
	PNEUMATIC SIGNAL OR UNDEFINED SIGNAL.
	CAPILLARY TUBING (FILLED SYSTEM)
	HYDRAULIC SIGNAL
	ELECTROMAGNETIC, SONIC OR RADIATION SIGNAL (WITHOUT WIRING OR TUBING)
	COMMON OR INTERCONNECTED SIGNAL
	INTERLOCKED SIGNALS

INSTRUMENT BALLOON

	LOCALLY MOUNTED
	MOUNTED ON CONTROL PANEL
	MICROPROCESSOR OR COMPUTER BASED SYSTEM - SHARED DISPLAY
	MOUNTED BEHIND CONTROL PANEL
	MOUNTED BEHIND LOCAL PANEL
	LOCALLY MOUNTED TWO VARIABLES OR FUNCTIONS
	MOUNTED ON CONTROL PANEL, TWO VARIABLES OR FUNCTIONS
	MOUNTED ON LOCAL PANEL, TWO VARIABLES OR FUNCTIONS
	MOUNTED BEHIND CONTROL PANEL, TWO VARIABLES OR FUNCTIONS
	MOUNTED BEHIND LOCAL PANEL, TWO VARIABLES OR FUNCTIONS

PROCESS QUANTITY

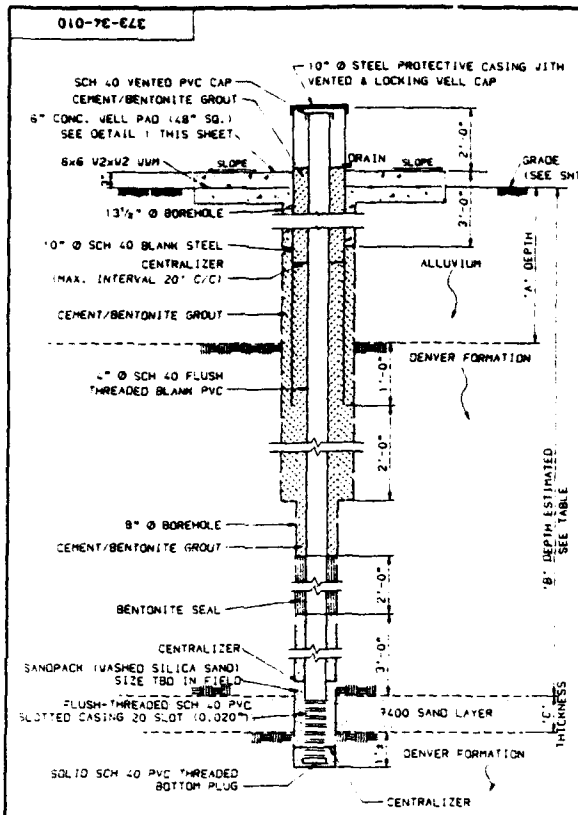
	LIQUID FLOW
	WEIGHT FLOW
	GAS FLOW
	PRESSURE
	TEMPERATURE

PRIMARY ELEMENT

	VENTURI TUBE OR FLOW NOZZLE / ORIFICE PLATE
	WEIR / FLUME
	MAGNETIC FLOW METER / TURBINE METER
TE XXXX	TEMPERATURE ELEMENT WITH WELL
TI XXXX	FILLED SYSTEM TEMPERATURE INDICATOR WITH WELL
TI XXXX	BI-METALLIC, GLASS THERMOMETER OR OTHER LOCAL TEMPERATURE INDICATOR
FI XXXX	INLINE TYPE FLOW INDICATOR

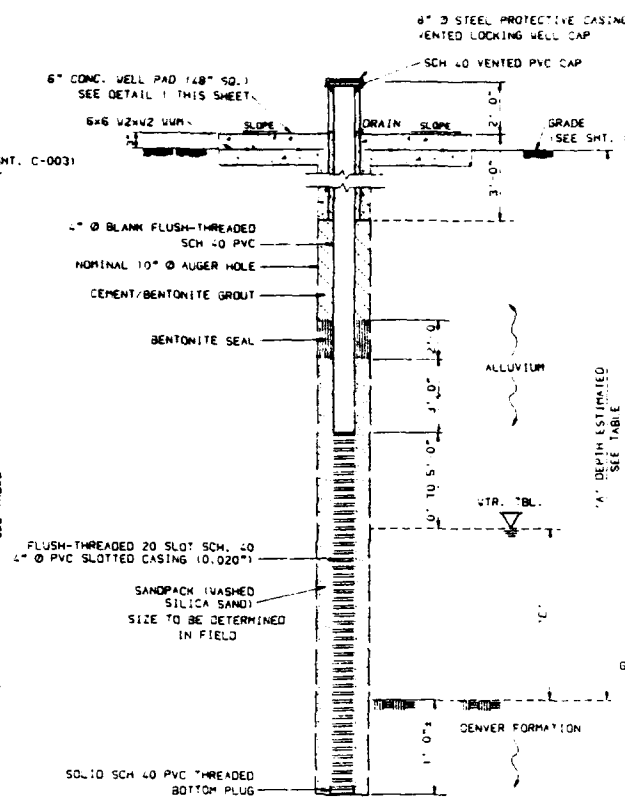
DRAWING NUMBERING SYSTEM:
03-38-0-001
- DRAWING SEQUENTIAL NUMBER
- RESPONSIBLE DISCIPLINE
- PROJECT AREA

DISCIPLINE NUMBERS:
33 ARCHITECTURAL
34 CIVIL/STRUCTURAL
35 PIPING
36 MECHANICAL
37 ELECTRICAL
38 INSTRUMENTATION



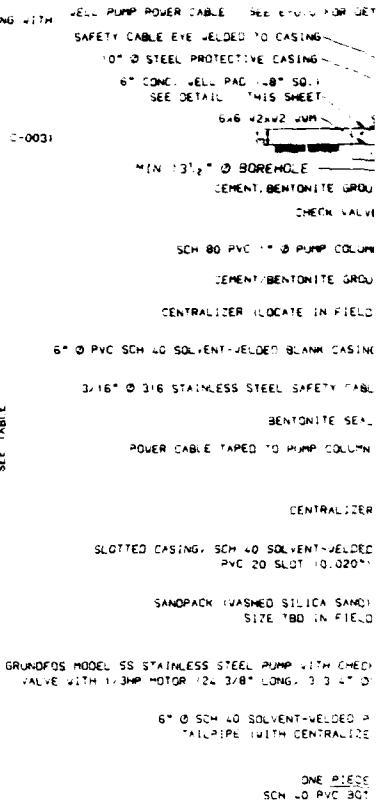
DENVER FORMATION MONITORING WELL (DMW-X)

N.T.S.



ALLUVIAL MONITORING WELLS (AMW-X)

NTS



RMA BASIN 'A'

DENVER FORMATION MONITORING WELLS ▲

WELL	COORDINATES	APPROX. DEPTHS (FT.) 'A'	'B'	'C'
DMW-1	N 186,280 E2,182,390	20	47	24
DMW-2	N 185,210 E2,181,735	19	38	24

ALLUVIAL MONITORING WELLS ⊙ PROPOSED

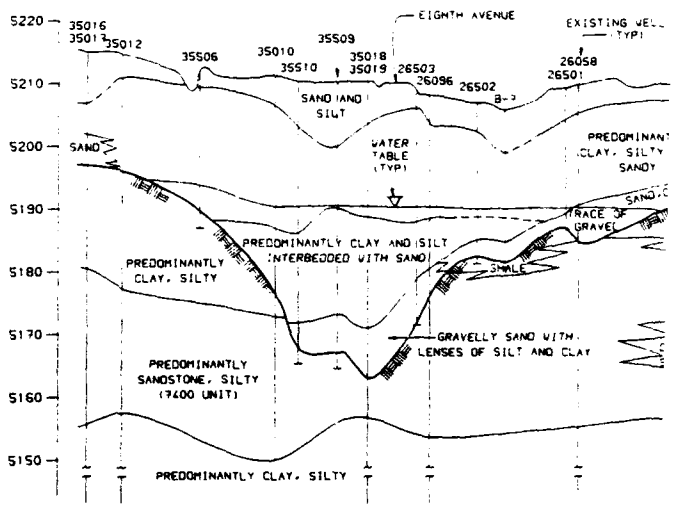
WELL	COORDINATES	APPROX. DEPTHS (FT.) 'A'	'C'
AMW-1	N 185,546 E2,181,775	21	5
AMW-2	N 185,525 E2,181,809	21	5
AMW-3	N 185,648 E2,181,838	30	14
AMW-4	N 185,627 E2,181,872	31	15
AMW-5	N 185,793 E2,181,927	47	26
AMW-6	N 185,772 E2,181,961	47	26
AMW-7	N 185,938 E2,182,016	30	10
AMW-8	N 185,917 E2,182,050	30	10
AMW-9	N 186,040 E2,182,078	24	4
AMW-10	N 186,019 E2,182,112	23	4
AMW-11	N 185,470 E2,181,890	25	7
AMW-12	N 185,400 E2,182,010	33	12
AMW-13	N 185,600 E2,181,975	37	20
AMW-14	N 185,580 E2,182,110	44	25
AMW-15	N 185,790 E2,182,090	34	14
AMW-16	N 185,760 E2,182,225	28	9
AMW-17	N 185,975 E2,182,200	24	6
AMW-18	N 185,940 E2,182,330	26	8

AMW-1 THRU AMW-10 TO BE CONSTRUCTED AFTER TRENCH CONSTRUCTION IS COMPLETED.

DEWATERING WELLS ●

WELL	COORDINATES	APPROX. DEPTHS (FT.) 'A'	'C'
DW-1	N 185,628 E2,181,935	37	19
DW-2	N 185,723 E2,181,990	47	27
DW-3	N 185,819 E2,182,045	36	16
DW-4	N 185,628 E2,182,027	44	25
DW-5	N 185,723 E2,182,082	40	20
DW-6	N 185,819 E2,182,137	30	10
DW-7	N 185,905 E2,182,108	28'	9

NOTE: ACTUAL DEPTHS WILL BE DETERMINED IN THE FIELD DURING INSTALLATION DEPTHS COULD VARY BY 5'±OR MORE



GEOLOGIC SECTION
APPROXIMATELY 150' N.W. OF PROPOSED WELLS DW-1, -2, -3 AND -7

100 50 0 100 200
HORIZONTAL SCALE IN FEET
10X VERTICAL EXAGGERATION

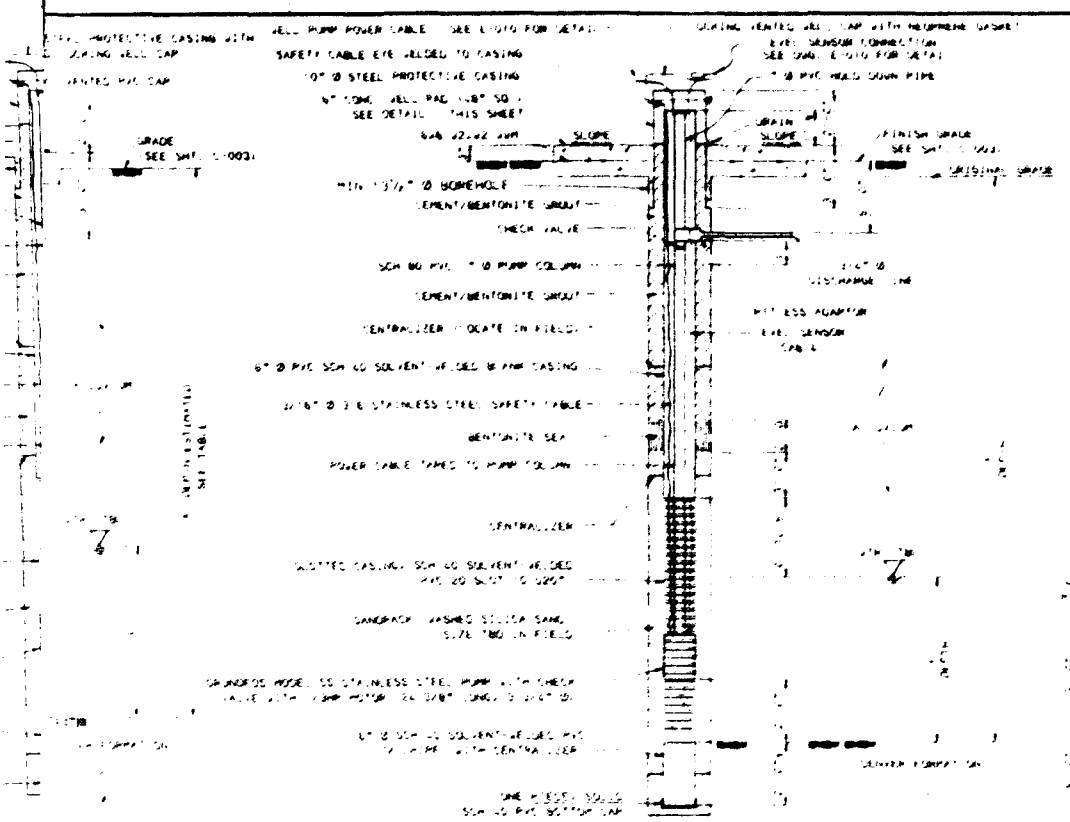
DRAWING NO.	TITLE
C-003	SITE PLAN

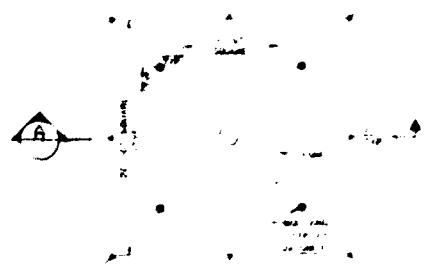
NO.	BY	DATE	CHK	DESCRIPTION
D	KF	8/22/89	JB	ISSUE FOR CONSTRUCTION TL0047
C	KF	5/26/89	JB	ISSUE FOR IMPLEMENTATION TL0045
B	DDL	4/21/89	BB	ISSUE FOR OWNER APPROVAL TL0028
A	KF	3/17/89	BB	ISSUE FOR REVIEW & COMMENT TL0012

APPROVALS	REV A	B	C	D
DEPT				
ARCH		DL	DL	
CIV/STRL		BB	BB	
MECH		JTF	JTF	
ELECT		JRC	JRC	
INSTR		CDD	JRH	
PIPING		DLS	DLS	
SAFETY		JC	JC	
DEPT MGR		BB	CBV	CBV
PROJECT		JRH	JRH	

SCALE
DRAWN
DESIGN
CHECK
REV

(1) (2)

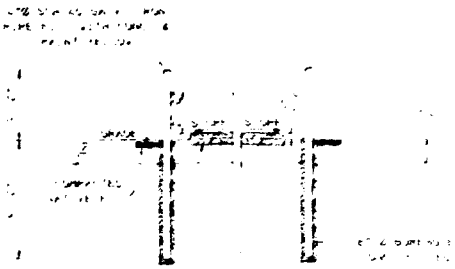




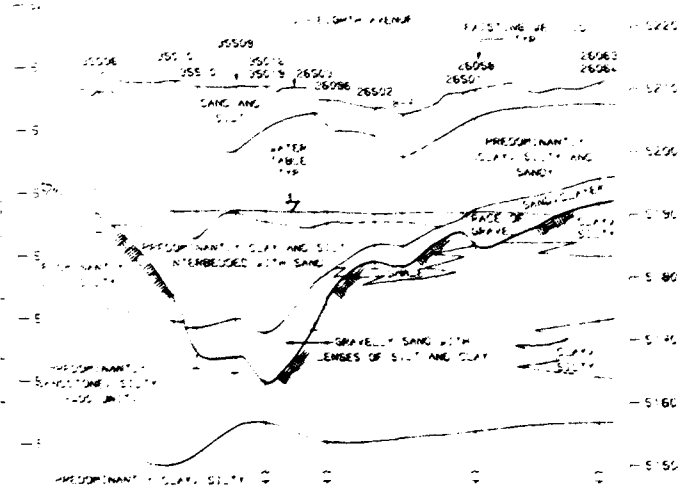
PLAN

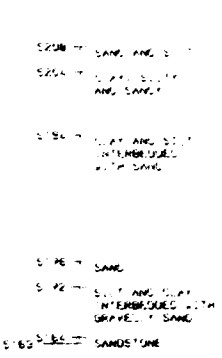
DETAIL

TYPICAL SURFACE COMPLETION
AT WELLS (AMW, OMW, DW)



SECTION A





GEOLOGICAL
COLUMN
WELL 35507
VICINITY
PROPOSED
RECLAIM WELLS

BASIN 'A' NECK HYDROSTRATIGRAPHIC UNITS

GEOLOGIC SECTION
APPROXIMATELY 150' N.W. OF PROPOSED
WELLS DW-1, -2, -3 AND -7

HORIZONTAL SCALE IN FEET
NO VERTICAL EXAGGERATION

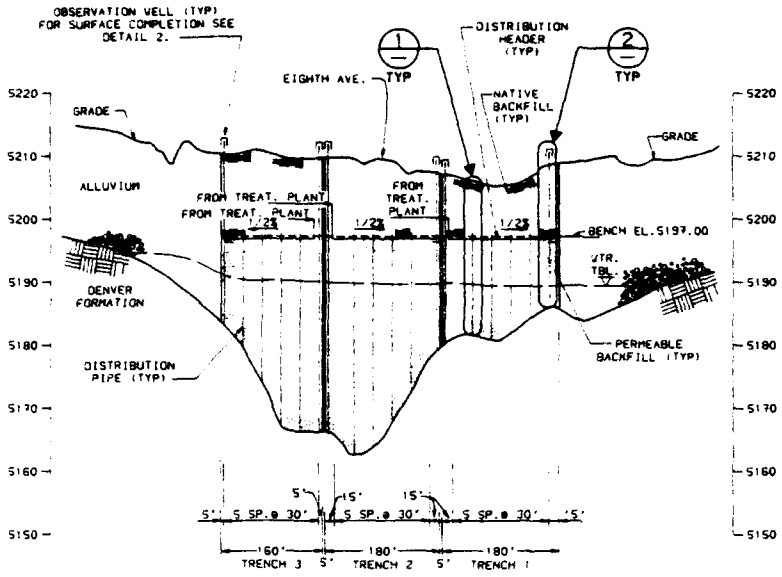
SCALE	N.T.S.	DATE	
DRAWN BY	K.FAHEY	3/88	
DESIGNED BY	N.HIEM	3/88	
CHECKED BY	BESSAW	3/16/88	
CLIENT APPROVALS			
REV	BY	DATE	

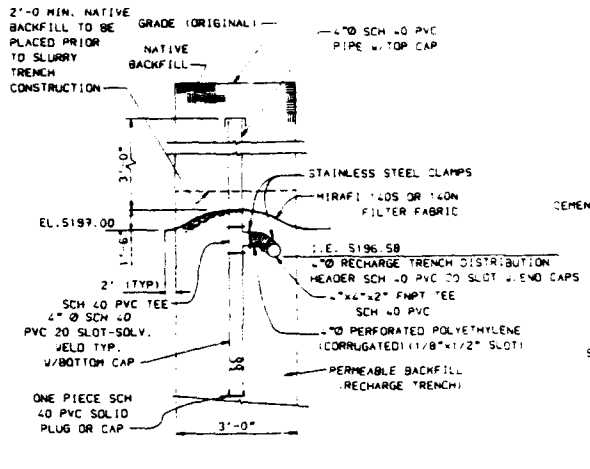
MORRISON-KNUDSEN ENGINEERS, INC.

SHELL OIL COMPANY
ROCKY MOUNTAIN ARSENAL REMEDIATION PROJECT
INTERIM RESPONSE ACTION FINAL DETAILED DESIGN

DRAWING TITLE
BASIN A NECK IRA
WELL CONSTRUCTION DATA

WORK GROUP 2127
DRAWING NO. 373-34-010
REFERENCE NO. C-010
REV 0





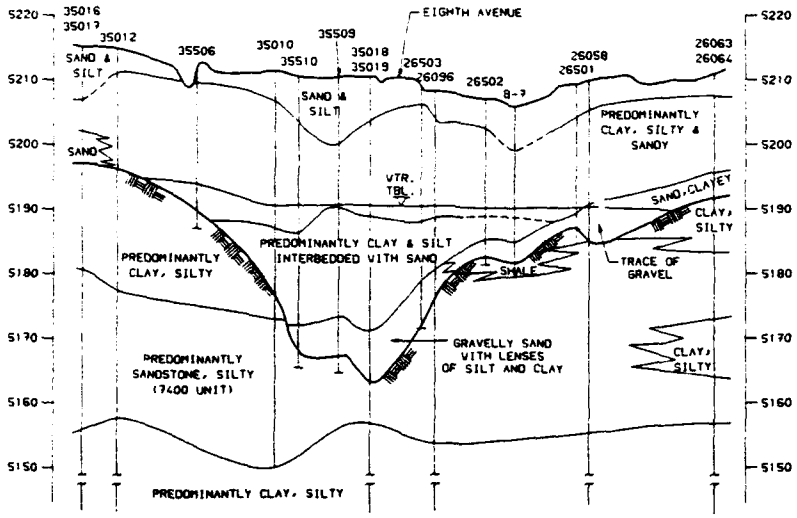
DISTRIBUTION PIPE

DETAIL 1

N.T.S.

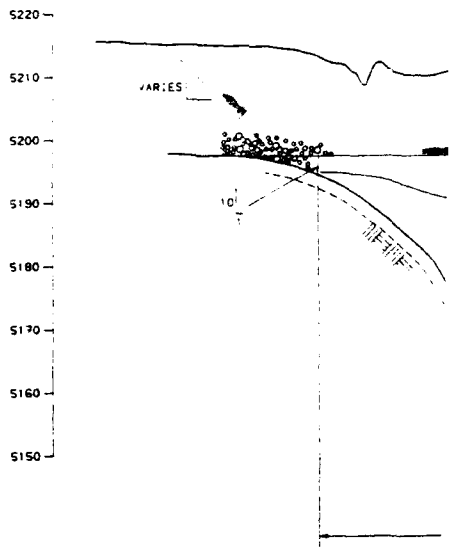
RMA - BASIN 'A' NECK RECHARGE TRENCHES

SCALE: HORIZ. 1" = 100'
VERT. 1" = 10'



BASIN 'A' NECK GEOLOGIC CROSS SECTION

SCALE: HORIZONTAL 1" = 100'
VERTICAL 1" = 10'



RMA - BASIN 'A' NEC

REFERENCE DWGS	
C-012	WELL & TRENCH AREA PLAN, SECT.& DET.
C-010	WELL CONSTRUCTION DATA
C-003	SITE PLAN
DRAWING NO.	TITLE

REVISIONS				
NO.	BY	DATE	CKD	DESCRIPTION

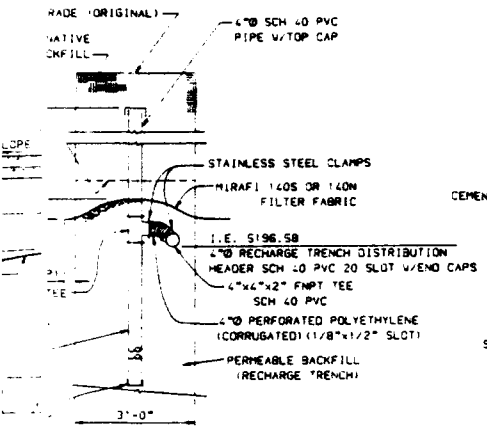
REVISIONS				
D	KF	8/22/89		ISSUE FOR CONSTRUCTION TL#047
C	KF	5/26/89	GB	ISSUE FOR IMPLEMENTATION PLAN TL#045
B	ODL	4/21/89	GB	ISSUE FOR OWNER APPROVAL TL#026
A	KF	3/17/89	GB	ISSUE FOR COMMENT TL#012
NO.	BY	DATE	CKD	DESCRIPTION

APPROVALS	REV	A	B	C	D
DEPT					
ARCH			DL	DL	
CIV/STRL		GB	GB	GB	GB
MECH			JTF	JTF	
ELECT			JMC	JMC	
INSTR			CED	CED	
PIPING			DLS	DLS	
SAFETY			JC	JC	
DEPT MGR		JB	CGV	CGV	
PROJECT		JRH	JRH	JRH	

SCALE
DRAWN BY
DESIGNED
CHECKED
CL
REV

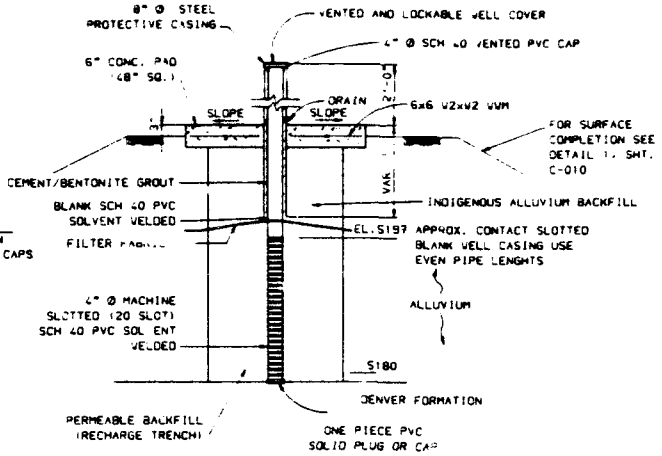
1

2



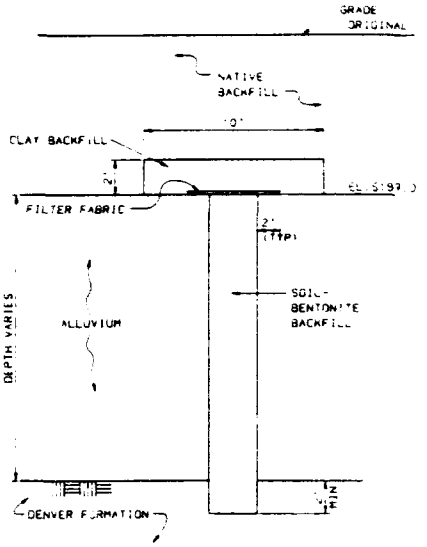
DISTRIBUTION PIPE

DETAIL 1
N.T.S.



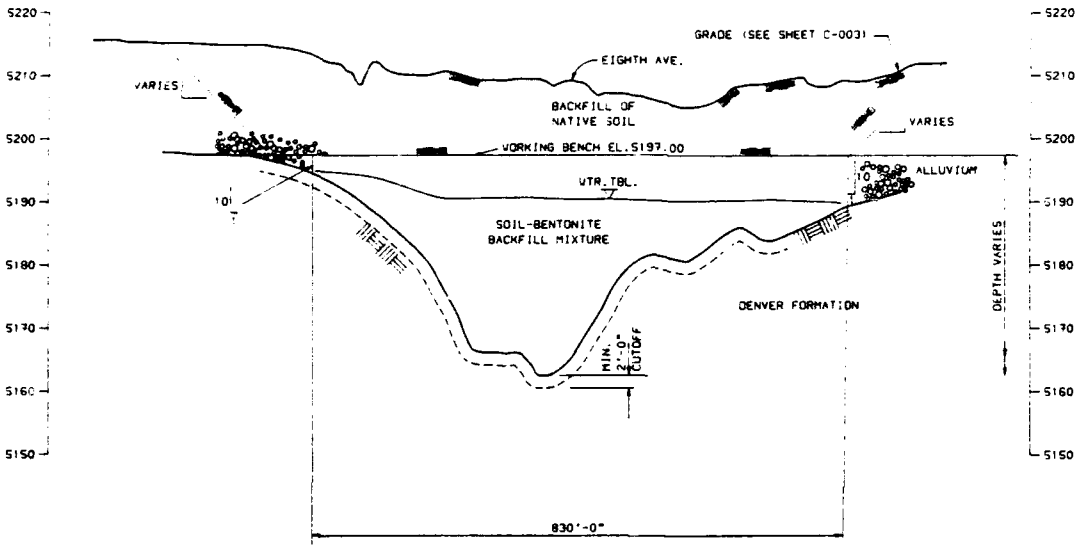
OBSERVATION WELL

DETAIL 2
N.T.S.



SOIL - BENTONITE SLURRY CUTOFF TRENCH

DETAIL 3
N.T.S.



NOTES:

1. DISTRIBUTION PIPES AND OBSERVATION WELLS TO BE INSTALLED NEAR VERTICAL PER SPECIFICATION 34-0261

RMA - BASIN 'A' NECK SOIL - BENTONITE SLURRY CUTOFF TRENCH

SCALE: HORIZONTAL 1" = 100'
VERTICAL 1" = 10'-0"

DEPT	REV	A	B	C	D
ARCH			DL	DL	
CIV/STRL		GB	GB	GB	GB
MECH			JTF	JTF	
ELECT			JHC	JHC	
INSTR			CED	CED	
PIPING			DLS	DLS	
SAFETY			JC	JC	
DEPT MGR		JB	CGV	CGV	
PROJECT		JRH	JRH	JRH	

APPROVALS

SCALE	AS NOTED	DATE
DRAWN BY	FAHEY	3/89
DESIGNED BY	NIEMI	3/89
CHECKED BY	BESSAV	3/16/89
CLIENT APPROVALS		
REV	BY	DATE

MORRISON-KNUDSEN ENGINEERS, INC.
A DEPARTMENT OF MORRISON-KNUDSEN COMPANY

SHELL OIL COMPANY
ROCKY MOUNTAIN ARSENAL REMEDIATION PROJECT
INTERIM RESPONSE ACTION FINAL DETAILED DESIGN

DRAWING TITLE
BASIN A NECK IRA
RECHARGE & CUTOFF TRENCH
SECTIONS

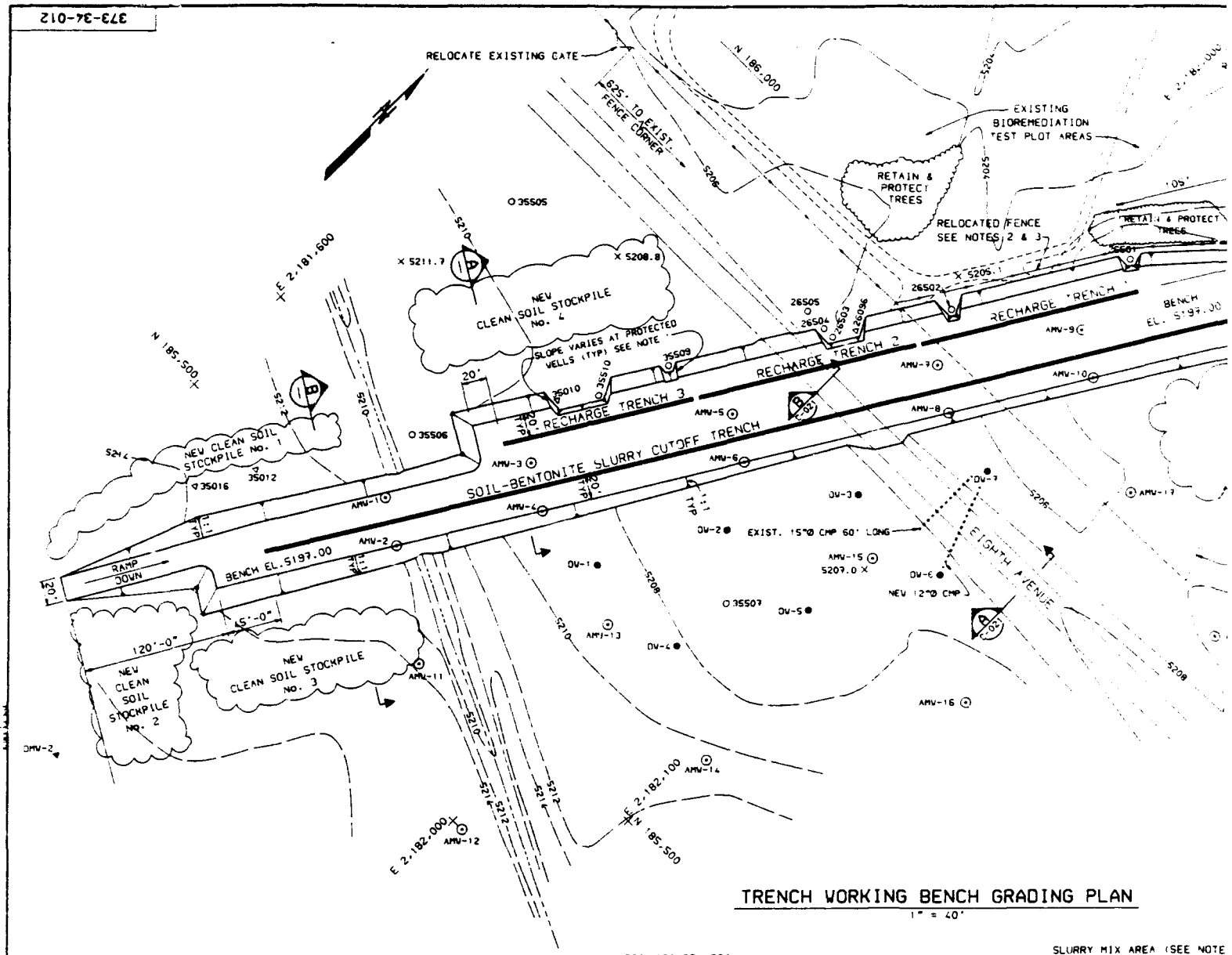
WORK ORDER 2127
30 of 42
DRAWING NO. 373-34-011
REFERENCE NO. C-011
REV 0

8/8/89 00-34-011

2

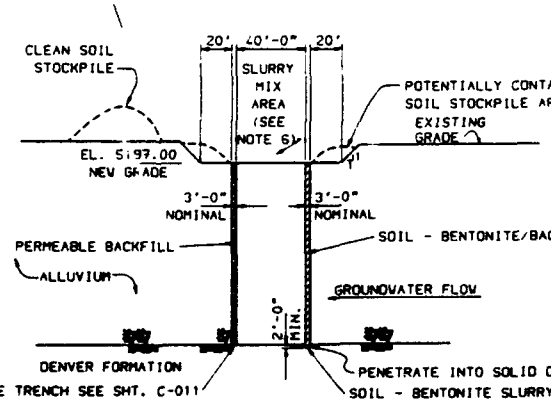
3

373-34-012



TRENCH WORKING BENCH GRADING PLAN

1" = 40'



SECTION A

1" = 40'

SLURRY MIX AREA (SEE NOTE
CLEAN SOIL STOCKPILE
EXISTING GRADE
EL. 5
NEW
ALLUVIUM
DENVER FORMA

DRAWING NO.	TITLE
E-010	WELLS POWER & CONTROL, LAYOUT & DET'S
C-011	RECHARGE & SLURRY TRENCH SECTIONS
C-010	WELL CONSTRUCTION DATA

REFERENCE DWGS

NO.	BY	DATE	CKD	DESCRIPTION

REVISIONS

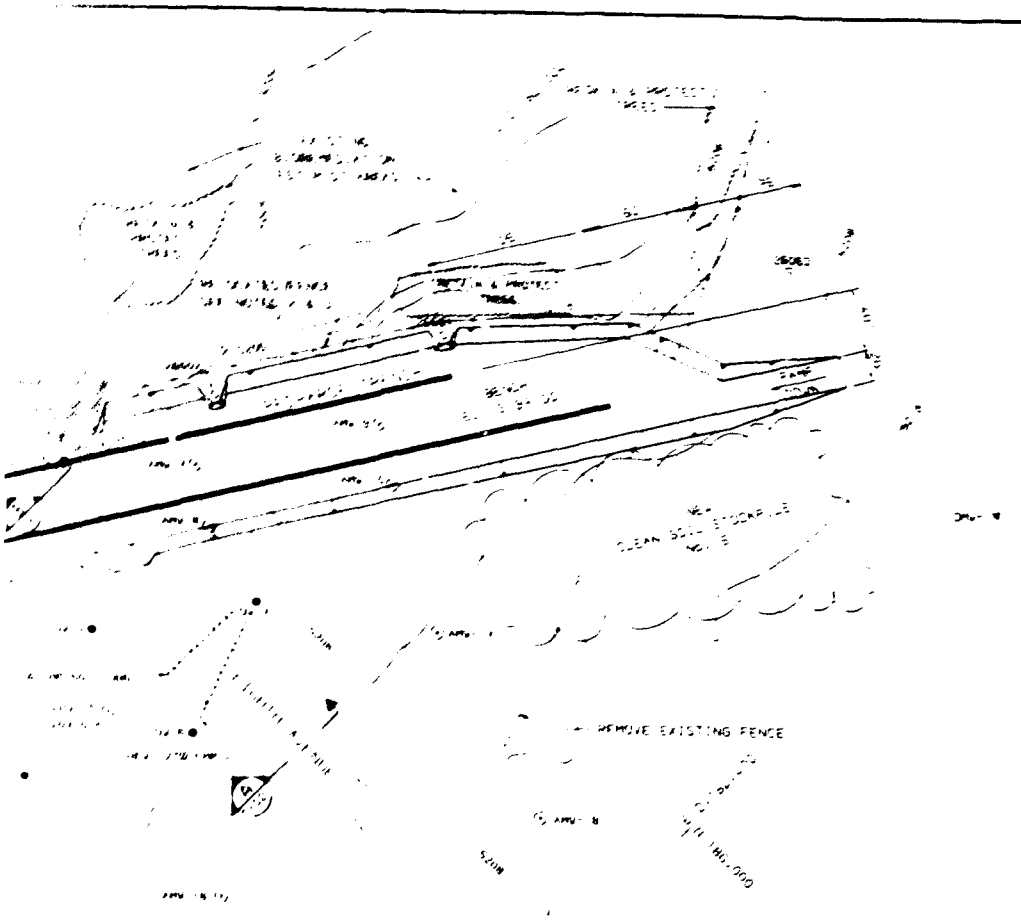
NO.	BY	DATE	CKD	DESCRIPTION
0	KF	8/22/89	GB	ISSUE FOR CONSTRUCTION TL#047
C	KF	5/26/89	GB	ISSUE FOR IMPLEMENTATION PLAN TL#045
B	KF	4/21/89	GB	ISSUE FOR OWNER APPROVAL TL#026
A	KF	4/12/89	GB	ISSUE FOR REVIEW & COMMENT TL#012

REVISIONS

APPROVALS	REV	A	B	C	D
ARCH			DL	DL	
CIV/STRL		GB	GJB	GJB	
MECH			JF	JF	
ELECT			JRC	JRC	
INSTR			CED	JEM	
PIPING			DLS	DLS	
SAFETY			JC	JC	
DEPT MGR			CGV	CGV	
PROJECT			JRM	JRM	

SCALE
DRAWN BY
DESIGNED BY
CHECKED BY
CLIE
REV

(1) (2)



LEGEND

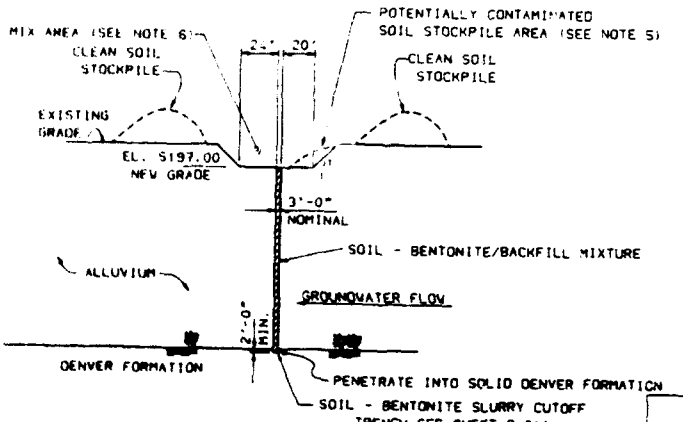
- [illegible]
- [illegible]
- DEWATER NO WELLS PROPOSED
- [illegible]
- DENVER MON TOR NO WELLS PROPOSED

NOTES:

1. FIELD VERIFY AND ENSURE SLOPE STABILITY AT PROTECTED WELLS
2. FIELD ENGINEER TO DETERMINE ALIGNMENT OF RELOCATED FENCE
3. MATCH EXISTING CONSTRUCTION FOR RELOCATED FENCE CONSTRUCTION - METAL POST WOVEN WIRE AND 3 STRAND BARBED WIRE
4. TOPSOIL TO BE STOCKPILED SEPARATELY FROM OTHER EXCAVATED CLEAN SOIL PER SPECIFICATION 34-0010.
5. SOIL EXCAVATED FROM TRENCHES SHALL BE CONSIDERED POTENTIALLY CONTAMINATED AND STOCKPILED. MAX MUM HEIGHT SHALL BE LOWER THAN ADJACENT NATURAL GRADE
6. ALL SLURRY MIXING TO BE CONDUCTED WITHIN WORKING BENCH AREA AND BELOW ADJACENT NATURAL GRADE.
7. WORKING BENCH TO BE BACKFILLED: EIGHTH AVENUE RECONSTRUCTION, SOIL STOCKPILES REMOVED AND THE AREA REGRADED FOLLOWING COMPLETION OF RECHARGE TRENCHES AND CUTOFF WALL IN ACCORDANCE WITH SPECIFICATIONS 34-0010, 0041 AND 0018.
8. SEE SHEET C-010 FOR SURFACE COMPLETION AT WELLS.

WORKING BENCH GRADING PLAN

1" = 40'



SECTION B
1" = 40'

20 0 20 60 100
SCALE IN FEET

SCALE	AS NOTED
DRAWN BY	FAHEY 3/89
DESIGNED BY	NIEMI 3/89
CHECKED BY	BROWN 4/7/89
CLIENT APPROVALS	

MORRISON-KNUDSEN ENGINEERS, INC.

SHELL OIL COMPANY
ROCKY MOUNTAIN ARSENAL REMEDIATION PROJECT
INTERIM RESPONSE ACTION FINAL DETAILED DESIGN

WORK ORDER 2127 — 30 of 42

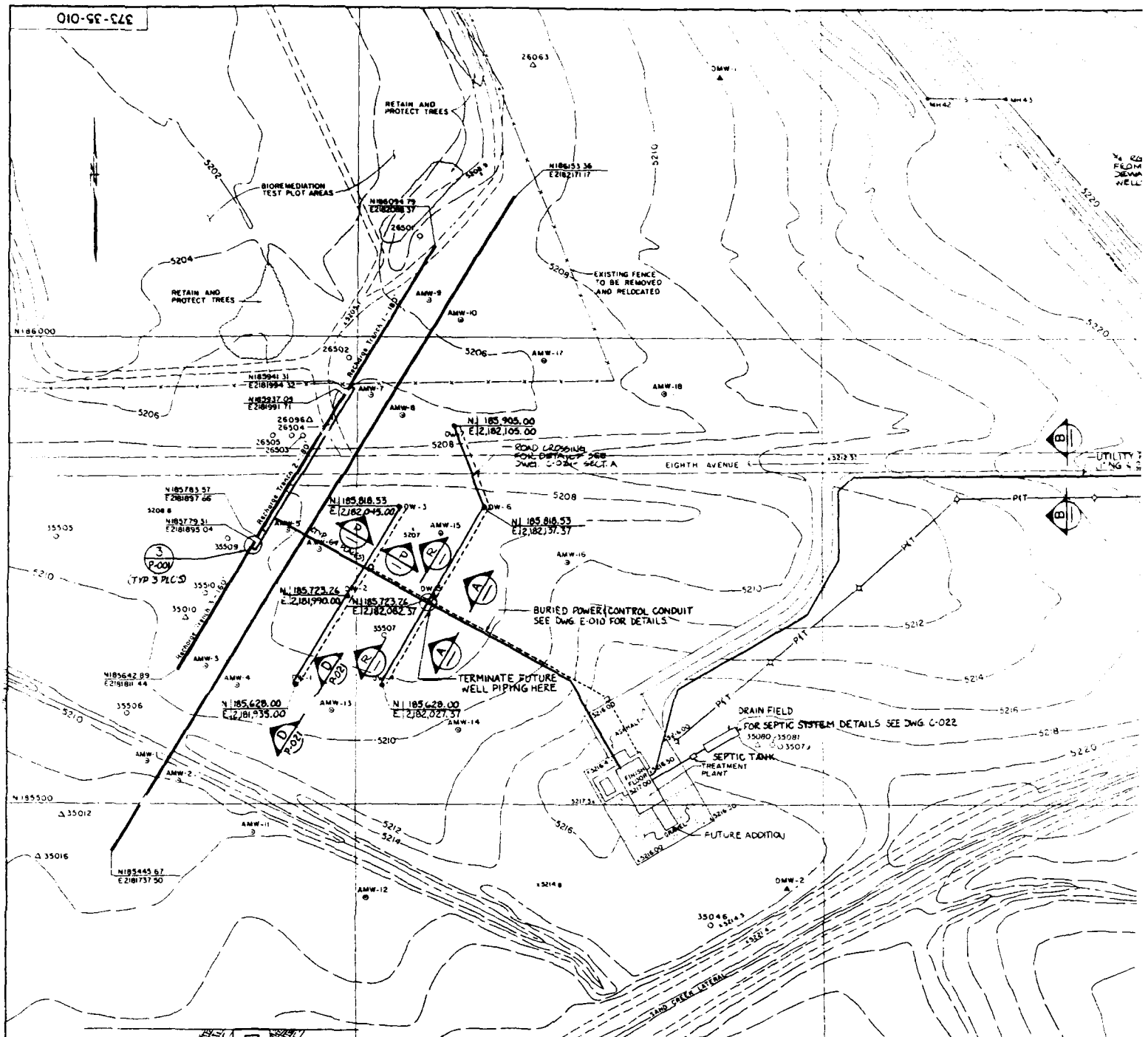
DRAWING TITLE: BASIN A NECK IRA WELL AND TRENCH AREA PLAN, SECTIONS AND DETAILS

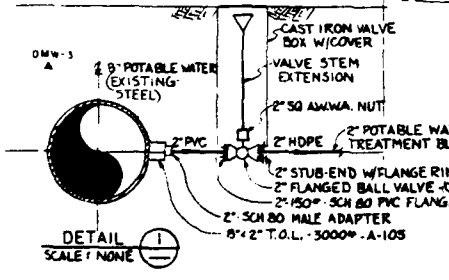
DRAWING NO. 373-34-012

REFERENCE NO. C-012 — REV 0

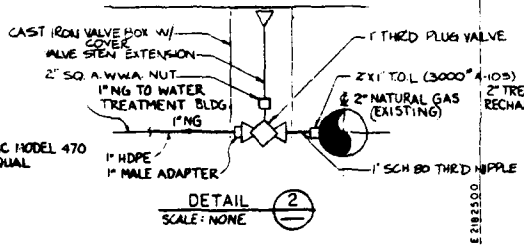
8/9/89

373-35-010

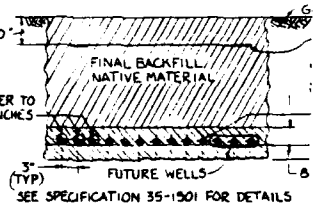




DETAIL 1
SCALE: NONE



DETAIL 2
SCALE: NONE



SEE SPECIFICATION 35-1501 FOR DETAILS

SECTION A
SCALE: NONE
(TYPICAL TRENCH SECTION)

REFERENCE DWGS	
P-001	MISC. PIPING SECTIONS & DETAILS
C-022	SEWAGE SYSTEM PLAN & DETAILS
P-021	PIPING & PLUMBING SECT. & DETAILS
P-020	PIPING & PLUMBING PLANS
I-020	P&ID
C-003	SITE PLAN

DRAWING NO. | TITLE

REVISIONS

NO.	BY	DATE	CHD	DESCRIPTION

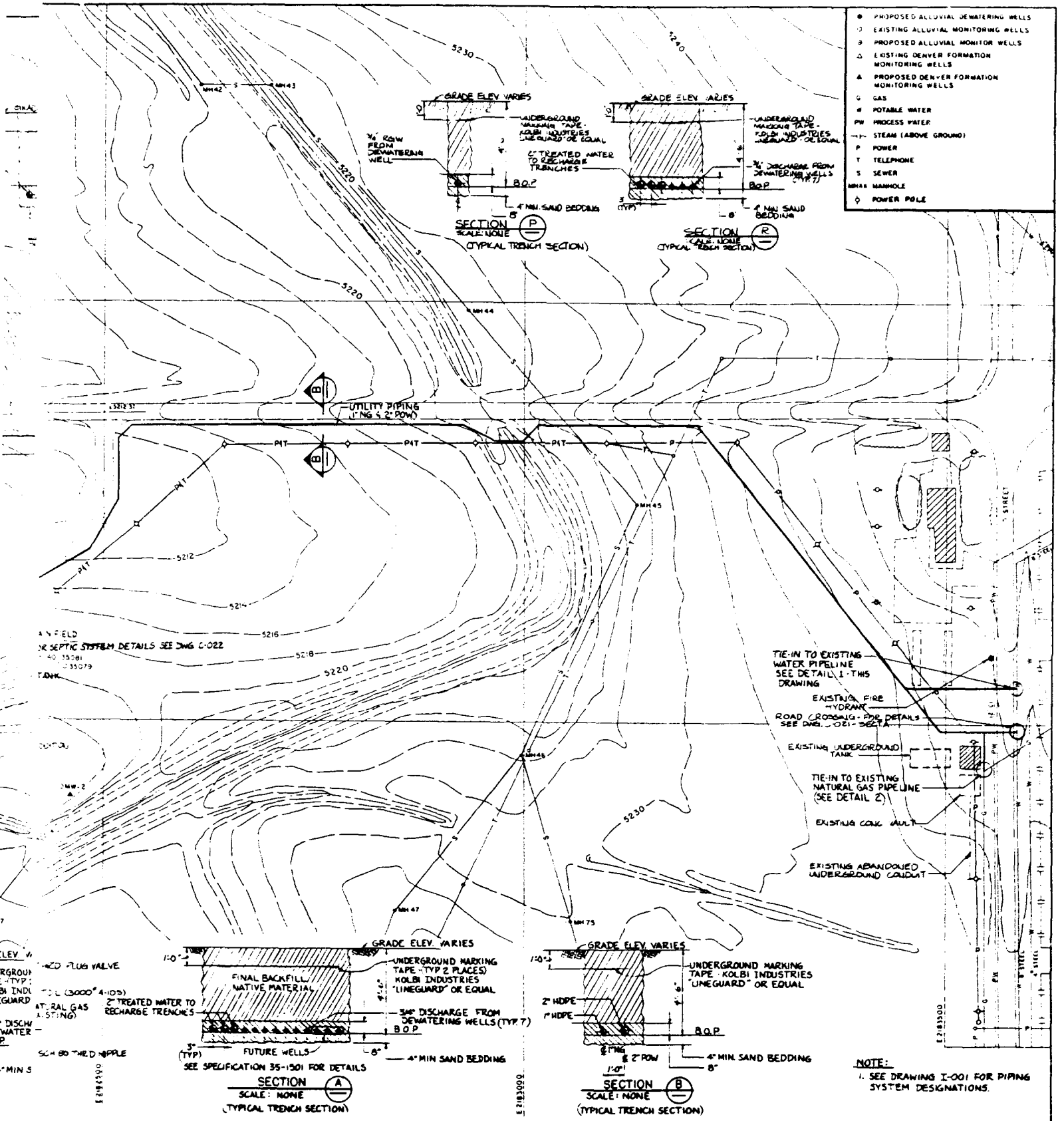
REVISIONS

NO.	BY	DATE	CHD	DESCRIPTION
0	DLS	6/22/89	JC	ISSUE FOR CONSTRUCTION TL # 047
B	DLS	5/24/89	SP	ISSUE FOR OWNER APPROVAL & IMPLEMENTATION PLAN TL # 045
A	DLS	4/21/89		FOR REVIEW & COMMENT TL # 028

APPROVALS

DEPT	REV	A	B	C
ARCH				
CIV/STRL				
MECH				
ELECT				
INSTM				
PIPING		DLS	DLS	DLS
SAFETY				
DEPT MGR				
PROJECT				

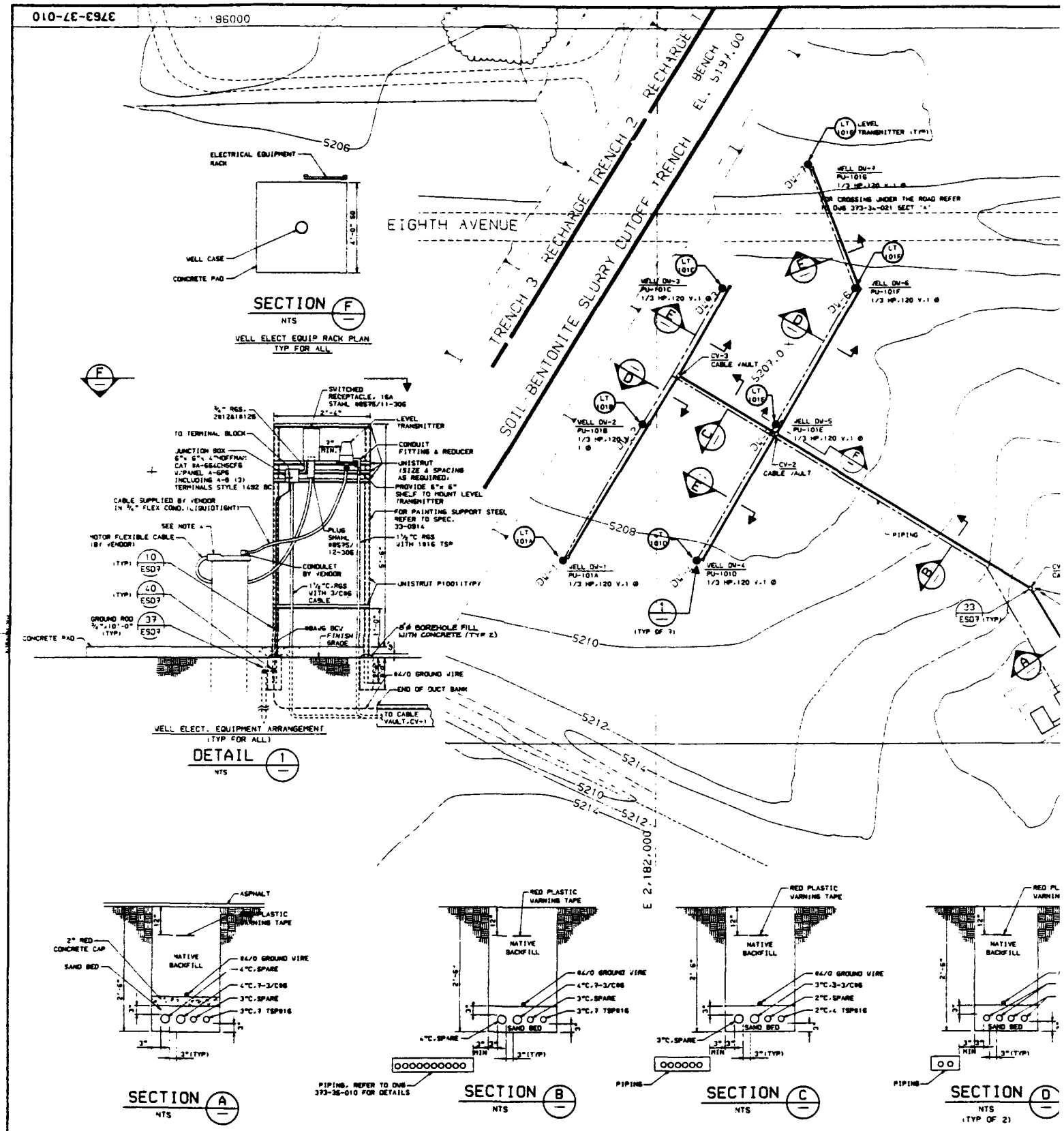
SCA
DRA
DES
CHE
REV



MORRISON-KNUDSEN ENGINEERS, INC.	SHELL OIL COMPANY ROCKY MOUNTAIN ARSENAL REMEDIATION PROJECT INTERIM RESPONSE ACTION FINAL DETAILED DESIGN	WORK ORDER 2127	30 x 42
	DRAWING TITLE BASIN A NECK IRA WELL, TRENCH & UTILITY PIPING YARD DISTRIBUTION	DRAWING NO. 373-35-010	
		REFERENCE NO. P-010	REV C

SCALE 1" = 50'
DRAWN BY DLS 4/13/89
DESIGNED BY DLS 4/13/89
CHECKED BY 5/24/89
CLIENT APPROVALS

APPROVALS: DEPT REV A B C; ARCH; CIV/STRL; MECH; ELECT; INSTR; PIPING DLS DLS DLS; SAFETY; DEPT MGR; PROJ. ENG.



REFERENCE DWGS	
C-010	WELL CONSTRUCTION DATA
C-021	TREATMENT PLAN AREA SECTIONS & DETAILS
E-020	ELECTRICAL PLAN & DETAILS SHEET 2
E-002	ELECTRICAL ONE-LINE DIAGRAM
M-010	WELL, TRENCH & UTILITY PIPING
C-003	SITE PLAN
DRAWING NO.	TITLE

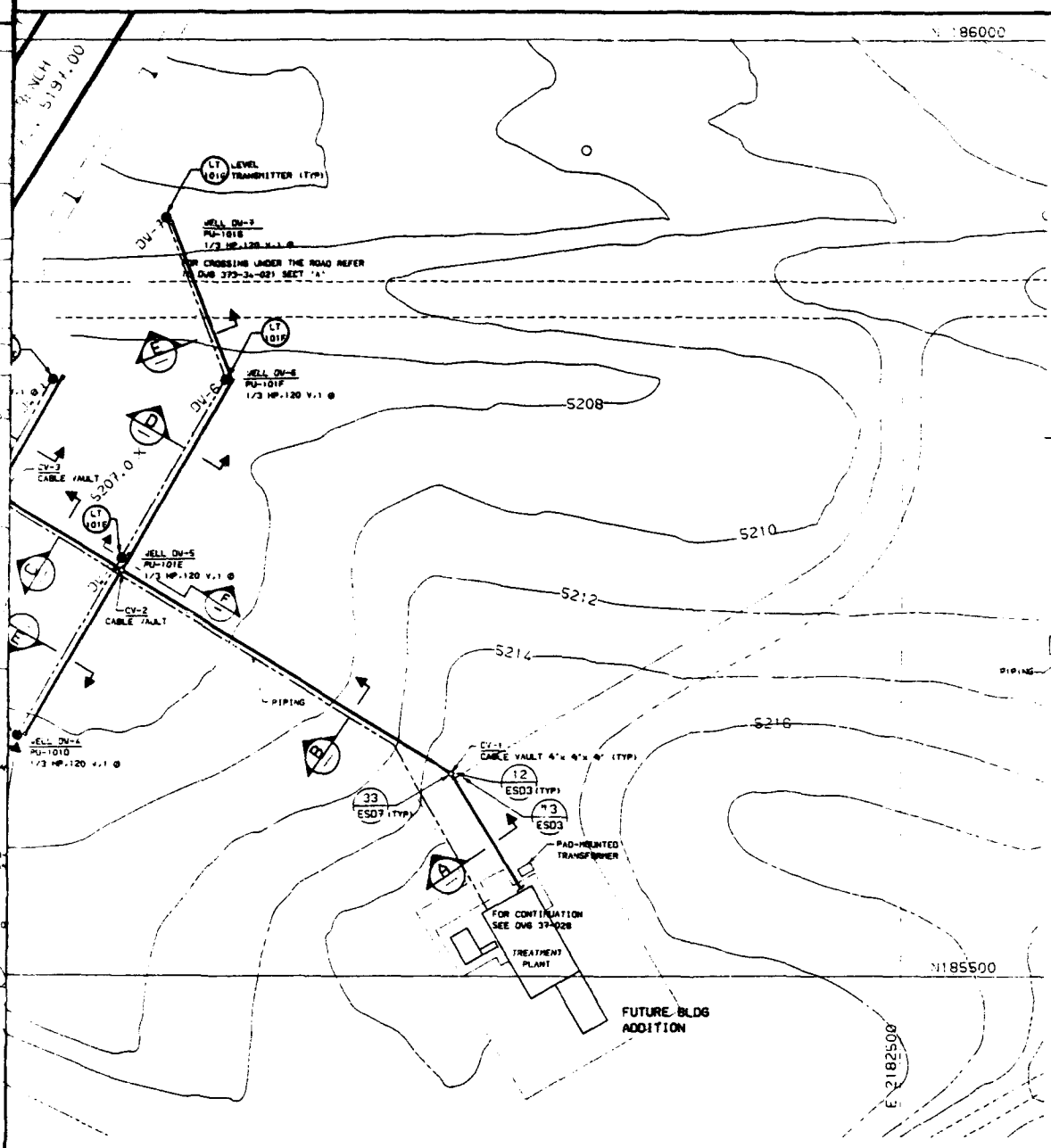
REVISIONS				
NO.	BY	DATE	CKD	DESCRIPTION

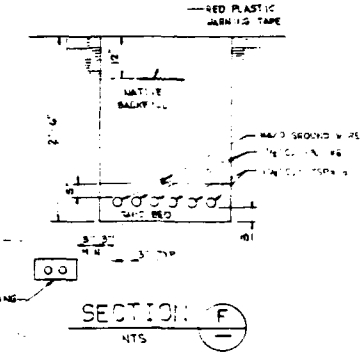
REVISIONS				
0	PUD	08/22/89	JPC	ISSUED FOR CONSTRUCTION TL#042
B	JPC	05/26/89	GMB	ISSUED FOR APPROVAL & IP. TL#045
A	EB	04/28/89	MFT	ISSUED FOR REVIEW & COMMENTS. TL#32
NO.	BY	DATE	CKD	DESCRIPTION

APPROVALS	REV	A	B	0
DEPT				
ARCH			DDL	
CIV/STRL			CGV	
MECH			JTF	
ELECT		JPC	JPC	
INSTR			JEM	
PIPING			DLS	
SAFETY			JC	
DEPT MGR			MFT	JEM
PROJECT			JRH	JRH

SCALE
DRAWN
DESIGNED
CHECKED
REV

(1) (2)



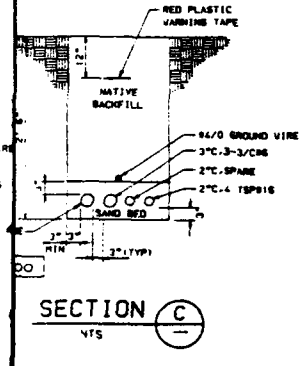


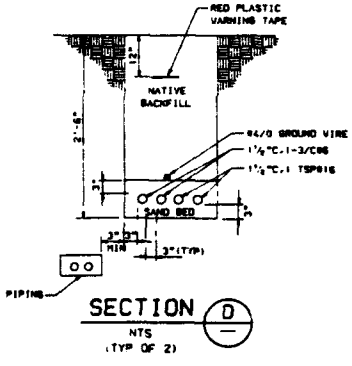
NOTES:

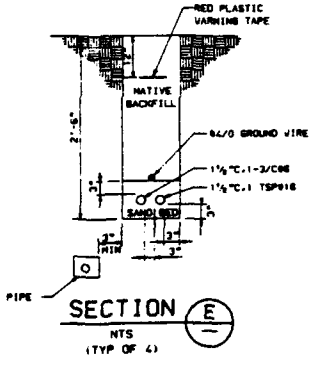
1. DUCT BANK SHALL BE INSTALLED WITH SLOPE TO DRAIN TO CABLE VAULT, AS SPECIFIED IN SPEC. 37-1601
2. REFER TO SPECIFICATION 37-1601 FOR DETAILED REQUIREMENTS FOR ALL ELECTRICAL WORK PERFORMED ON THIS PROJECT
3. CONTRACTOR TO RUN ELECTRICAL CONDUITS ALONG WITH PIPING. REFER TO PIPING DRAWING TO COORDINATE THE WORK AND AVOID INTERFERENCES
4. WELL CAP SHALL HAVE A SLOT ON THE SIDE OF THE WIRING CELL TO BRING THE CABLE OUT HORIZONTALLY. CONTRACTOR TO PROVIDE RUBBER SLEEVE OR GROMMET TO PROTECT WIRING FROM FRAYING AND CUTTING ON EDGE OF THE WELL CASING

LEGEND

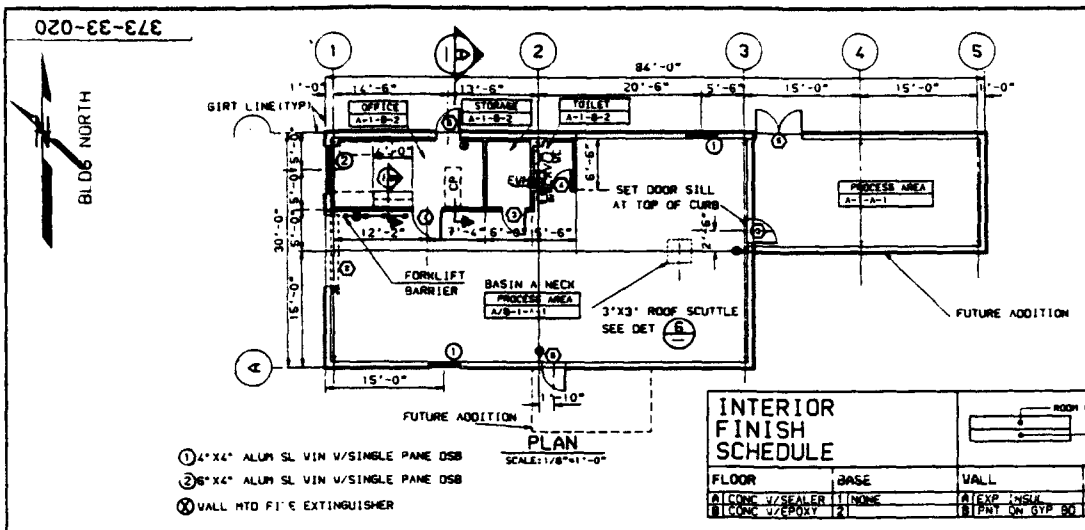
DUCT BANK







373-33-020



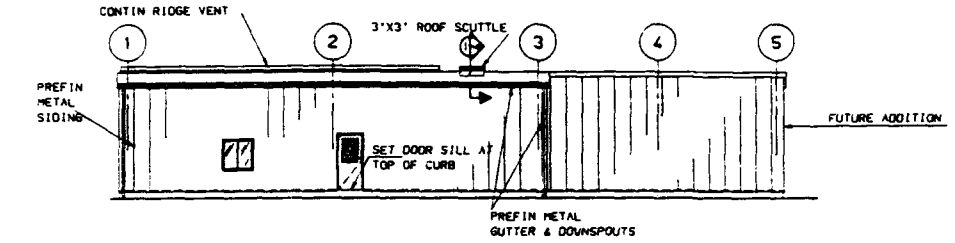
PLAN
SCALE: 1/8"=1'-0"

① 4"X4" ALUM SL VIN W/SINGLE PANE DSB
② 6"X4" ALUM SL VIN W/SINGLE PANE DSB
Ⓧ WALL MTD FIRE EXTINGUISHER

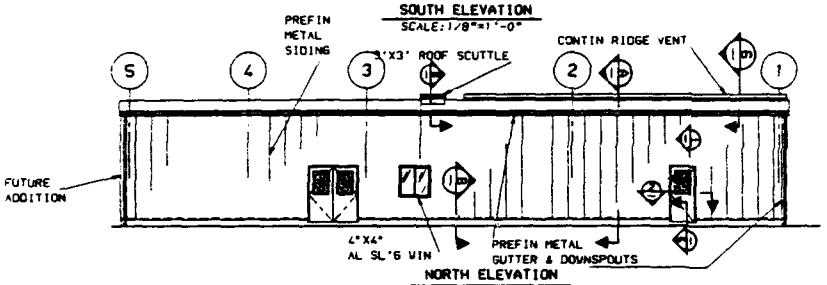
INTERIOR FINISH SCHEDULE

ROOM NAME
ROOM FINISH INDEX SEE SCHEDULE

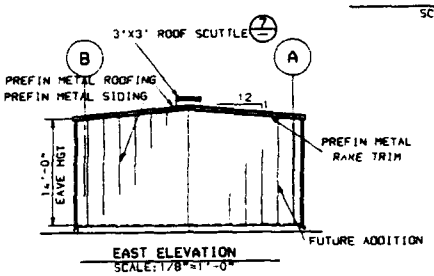
FLOOR	BASE	WALL	CEILING
A CONC W/SEALER	1 NONE	A EXP INSUL	1 EXP STR/INSUL
B CONC W/EPOXY	2	B PNT ON GYP BD	2 PNT ON GYP BD



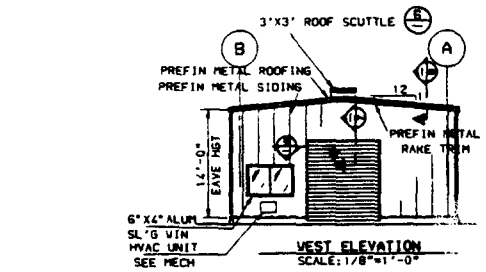
SOUTH ELEVATION
SCALE: 1/8"=1'-0"



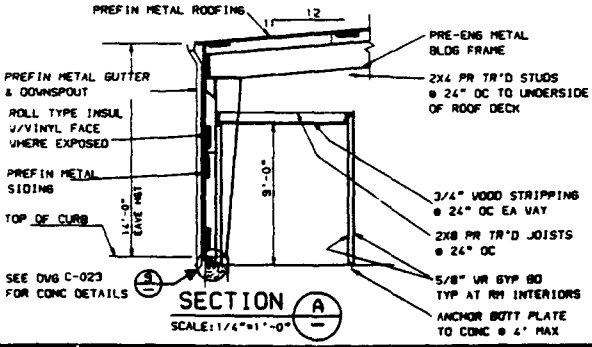
NORTH ELEVATION
SCALE: 1/8"=1'-0"



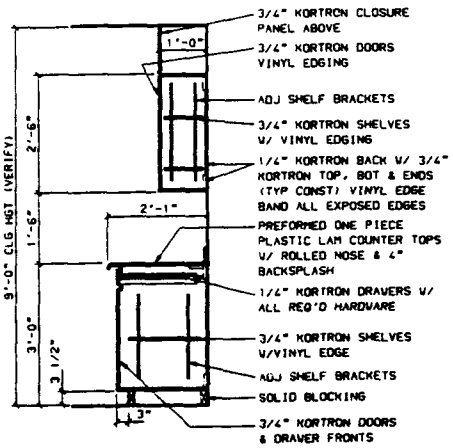
EAST ELEVATION
SCALE: 1/8"=1'-0"



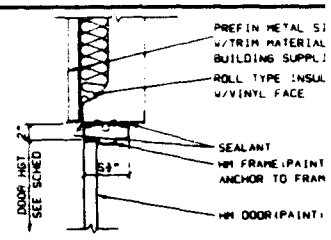
WEST ELEVATION
SCALE: 1/8"=1'-0"



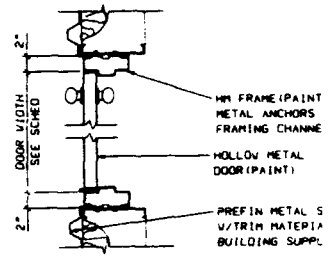
SECTION A
SCALE: 1/4"=1'-0"



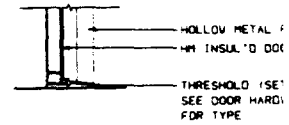
CABINET SECTION B
SCALE: 3/8"=1'-0"



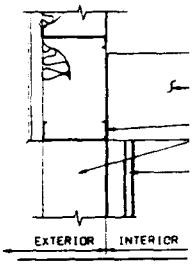
HEAD DETA
SCALE: 1 1/2"=1'-0"

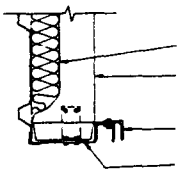


JAMB DETAI
SCALE: 1 1/2"=1'-0"

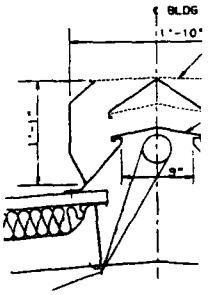


THRESHOLD DETAI
SCALE: 1 1/2"=1'-0"





JA
SCALE



CONTINUOUS VEN

REFERENCE DWGS	
C-024	FOUNDATION PLAN, SECTION & DETAILS
DRAWING NO.	TITLE

REVISIONS				
NO.	BY	DATE	CKD	DESCRIPTION

REVISIONS				
0	DOL	8/22/89	TDA	ISSUED FOR CONSTRUCTION TL#047
C	DOL	5/19/89	TDA	ISSUE FOR IMPLEMENTATION PLAN TL#046
B	DOL		TDA	ISSUE FOR OWNER APPROVAL
A	DOL	3/13/89	TDA	ISSUE FOR REVIEW & COMMENT
NO.	BY	DATE	CKD	DESCRIPTION

APPROVALS				
DEPT \ REV	A	B	C	D
ARCH	DOL	DOL	DOL	DOL
CIV/STRL		GJB	GJB	GJB
MECH		JC	JF	JF
ELECT		JPC	JPC	JPC
INSTR		CED	CED	CED
PIPING		DLS	DLS	DLS
SAFETY		JC	JC	JC
DEPT MGR	TDA	TDA	TDA	TDA
PROJECT	JRH	JRH	JRH	JRH

SCALE
DRAWN
DESIG
CHECK
REV

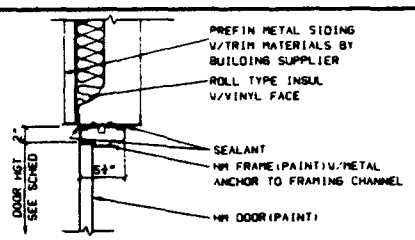
1

2

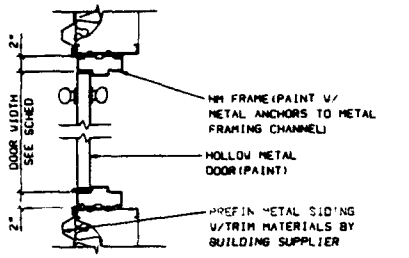
DOOR SCHEDULE

DOOR NO	SIZE WIDTH	SIZE HGT	SIZE THK	DOOR TYPE	DOOR MAT'L	DOOR FIN	FRAME TYPE	FRAME MAT'L	FRAME FIN	DETAILS HEAD	DETAILS JAMB	DETAILS SILL	FIRE RTG	HDW GRP	REMARKS
1	3'-8"	8'-0"	1¾"	A	HM	PNT	1	HM	PNT	1	2	3	--	*	
2	9'-0"	10'-0"	1½"	B	HET	PNT	INTEG	HET	PNT	1 --	--	--	--	*	INSULATED MOTORIZED
3	3'-0"	7'-0"	1¾"	C	HM	PNT	1	HM	PNT	1	2	3	--	1	LOWER HALF LOUVE
4	2'-8"	7'-0"	1¾"	C	HM	PNT	1	HM	PNT	1	2	3	--	3	
5	3'-0"	7'-0"	1¾"	D	HM	PNT	1	HM	PNT	1	2	3	--	*	PAIR-INSULATED
6	3'-0"	7'-0"	1¾"	A	HM	PNT	1	HM	PNT	1	2	3	--	*	INSULATED

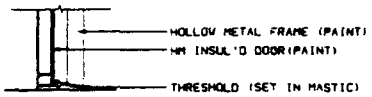
*SEE SPEC 1301 SEC 7-A(3)



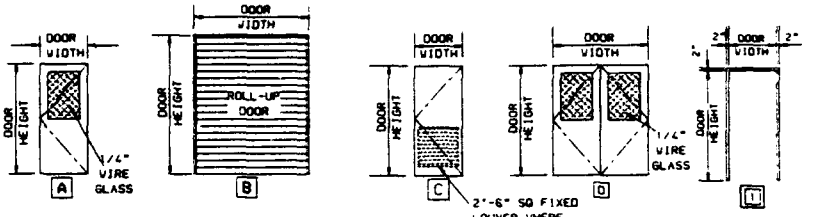
HEAD DETAIL (1)
SCALE: 1 1/2"=1'-0"



JAMB DETAILS (2)
SCALE: 1 1/2"=1'-0"

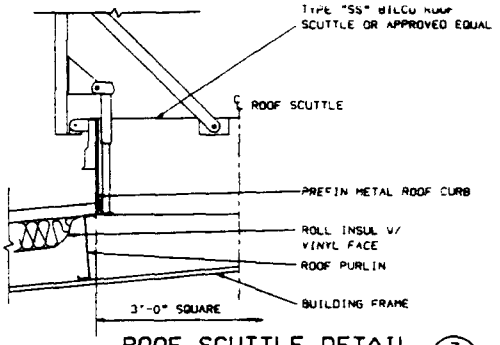


THRESHOLD DETAIL (3)
SCALE: 1 1/2"=1'-0"

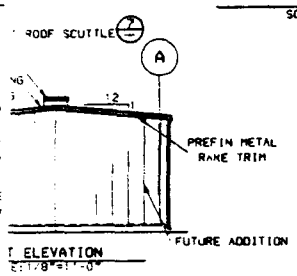


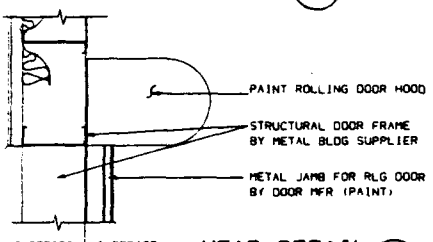
DOOR TYPES

FRAME TYPE

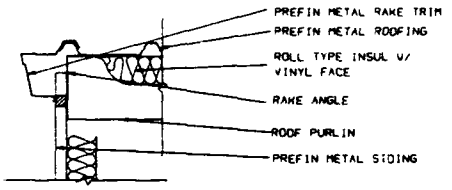


ROOF SCUTTLE DETAIL (7)
SCALE: 1 1/2"=1'-0"

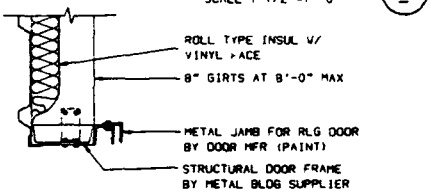




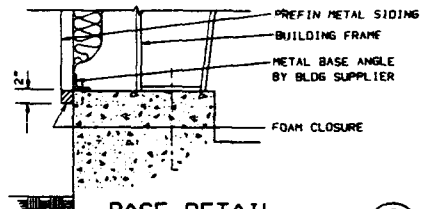
HEAD DETAIL (4)
SCALE: 1 1/2"=1'-0"



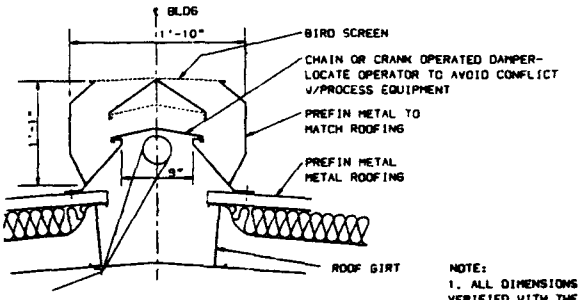
TYPICAL RAKE DETAIL (8)
SCALE: 1 1/2"=1'-0"



JAMB DETAIL (5)
SCALE: 1 1/2"=1'-0"



BASE DETAIL (9)
SCALE: 1 1/2"=1'-0"



CONTINUOUS VENT DETAIL (6)
SCALE: 1 1/2"=1'-0"

NOTE:
1. ALL DIMENSIONS SHOWN ARE TO BE VERIFIED WITH THE PRE-ENGINEERED BUILDING MANUFACTURER PRIOR TO CONSTRUCTION.

DEPT \ REV	A	B	C	D
ARCH	DDL	DDL	DDL	DDL
CIV/STRL		GJB	GJB	GJB
MECH		JC	JF	JF
ELECT		JPC	JPC	JPC
INSTR		CED	CED	CED
PIPING		DLS	DLS	DLS
SAFETY		JC	JC	JC
DEPT MGR	TOA	TOA	TOA	TOA
PROJECT	JRH	JRH	JRH	JRH

APPROVALS

SCALE AS SHOWN		DATE
DRAWN BY	DDL	3/13/89
DESIGNED BY	DDL	3/13/89
CHECKED BY	TOA	4/18/89

CLIENT APPROVALS

REV	BY	DATE

MORRISON-KNUDSEN ENGINEERS, INC.

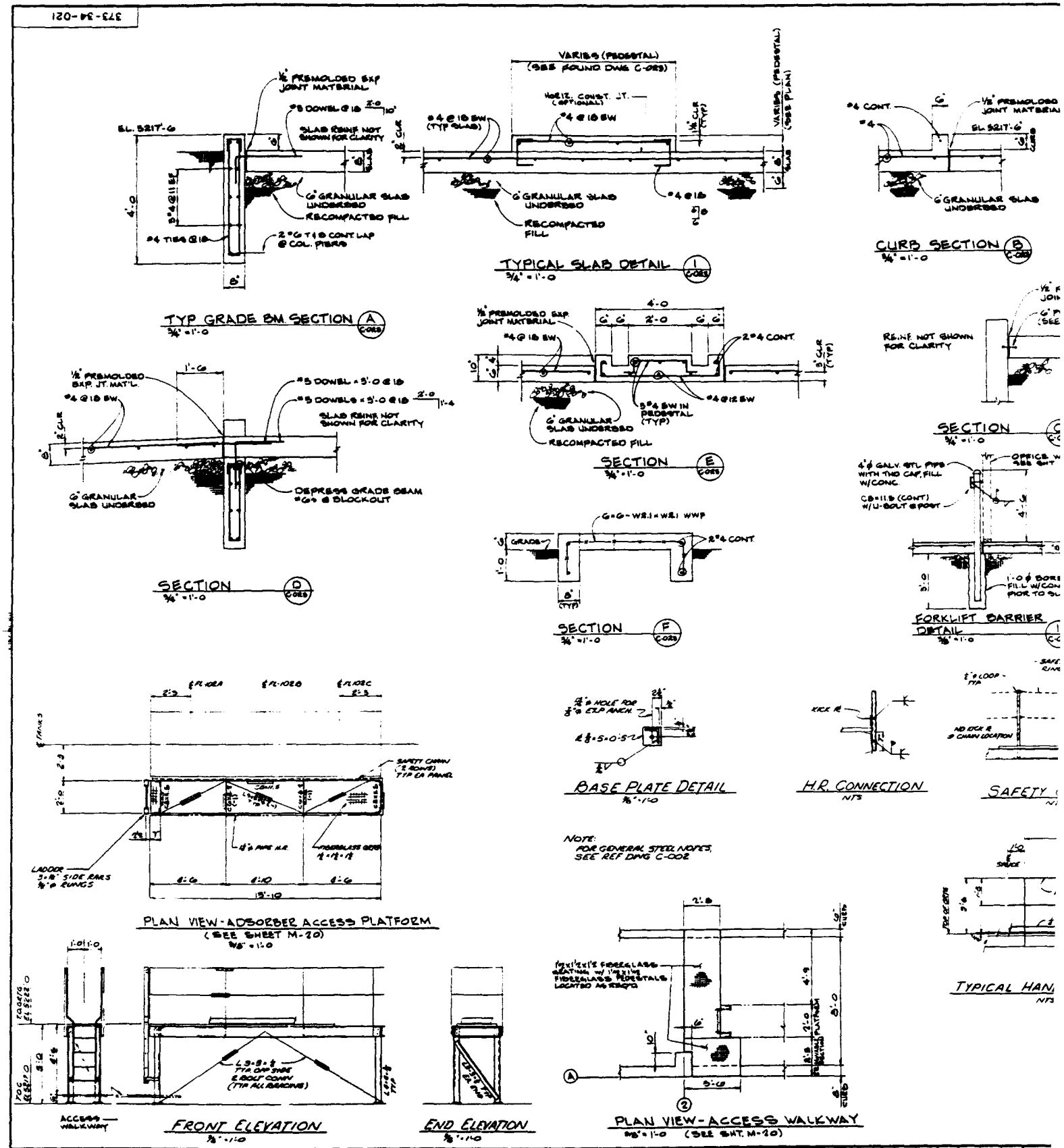
SHELL OIL COMPANY
ROCKY MOUNTAIN ARSENAL REMEDIATION PROJECT
INTERIM RESPONSE ACTION FINAL DETAILED DESIGN

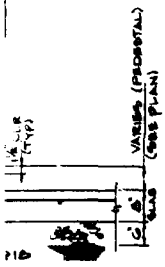
DRAWING TITLE
BASIN A NECK IRA
GROUND WATER TREATMENT BUILDING
PLAN & DETAILS

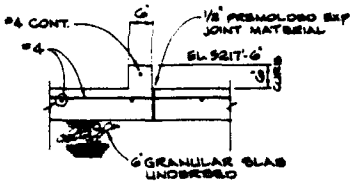
WORK ORDER 2127 — 30 of 42
DRAWING NO. 373-33-020
REFERENCE NO. A-20 — REV 0

2127-373 00-33-020

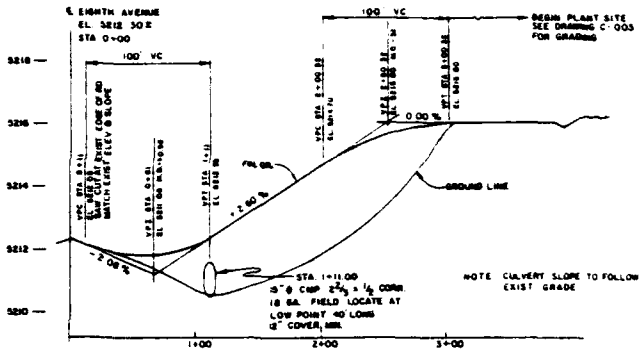
373-34-021


TYP GRADE BM SECTION A C-023
TYPICAL SLAB DETAIL 1 C-023
CURB SECTION B C-023
SECTION D C-023
SECTION E C-023
SECTION F C-023
SECTION
FORKLIFT BARRIER DETAIL
BASE PLATE DETAIL
H.R. CONNECTION
SAFETY
PLAN VIEW-ADSORBER ACCESS PLATFORM
(SEE SHEET M-20)
FRONT ELEVATION
END ELEVATION
PLAN VIEW-ACCESS WALKWAY
(SEE SHT. M-20)
TYPICAL HAN
NOTE:
FOR GENERAL STEEL NOTES, SEE REF DWG C-002
VARIES (PEDESTAL)
(SEE FOUND DWG C-023)
SLAB REINF NOT SHOWN FOR CLARITY
6" GRANULAR SLAB UNDERSEED
RECOMPACTED FILL
DEPRESS GRADE BEAM
REINF NOT SHOWN FOR CLARITY
SAFETY CHAIN
LADDER
EL. 521'-6
REFERENCE DWGS
C-020 GROUNDWATER TREATMENT SYSTEM GENERAL ARRANGEMENT PLAN
E-010 WELLS, POWER & CONTROL LAYOUT & DETAILS
C-023 FOUNDATION PLAN SECTIONS AND DETAILS
C-003 SITE PLAN
DRAWING NO. TITLE
REVISIONS
NO. BY DATE CKD DESCRIPTION
REV. A B C D
ARCH
CIV/STRL
MECH
ELECT
INSTR
PIPING
SAFETY
DEPT MGR
PROJECT
SCALE
DRAWN
DESIGN
CHECKED
REV.
0 KF 8-22-89 GB ISSUE FOR CONSTRUCTION TL#047
C JMA 3-28-89 GB ISSUE FOR IMPLEMENTATION PLAN TL#039
B CDF 9-8-89 GB ISSUE FOR OWNER APPV'L TL#036
A 4/21-89 GB ISSUE FOR REVIEW and COMMENT TL#028

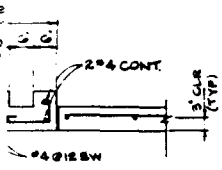


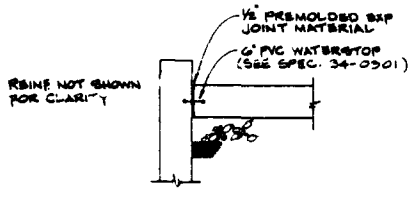


CURB SECTION (B) C-022
3/4" = 1'-0

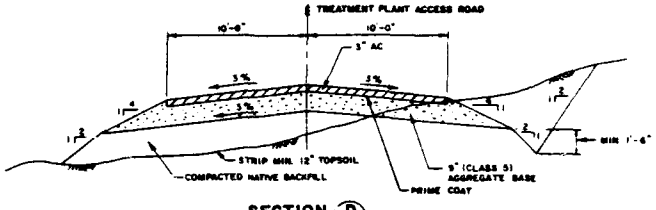


TREATMENT PLANT ACCESS ROAD PROFILE
SCALE: AS NOTED

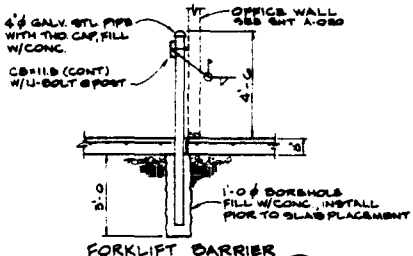




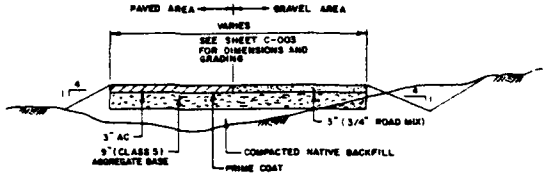
SECTION (C) C-022
3/4" = 1'-0



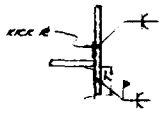
SECTION (D) C-003
NTS
ACCESS ROAD



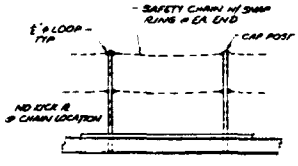
FORKLIFT BARRIER DETAIL (1) C-022
3/4" = 1'-0



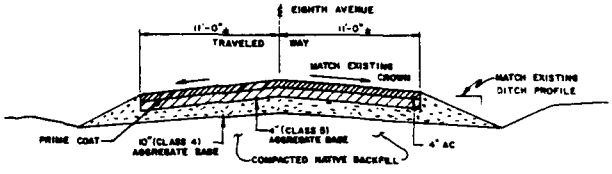
SECTION (C) C-003
NTS
PLANT SITE



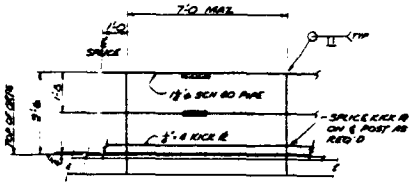
H.R. CONNECTION
NTS



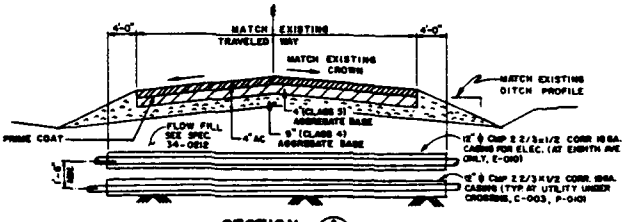
SAFETY CHAIN DETAIL
NTS



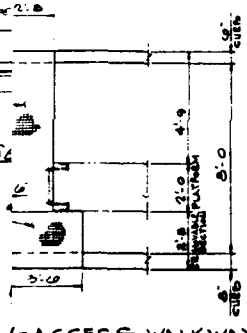
SECTION (B) C-012
NTS
EIGHTH AVENUE CROSSING AT WORKING BENCH



TYPICAL HANDRAIL SECTION
NTS



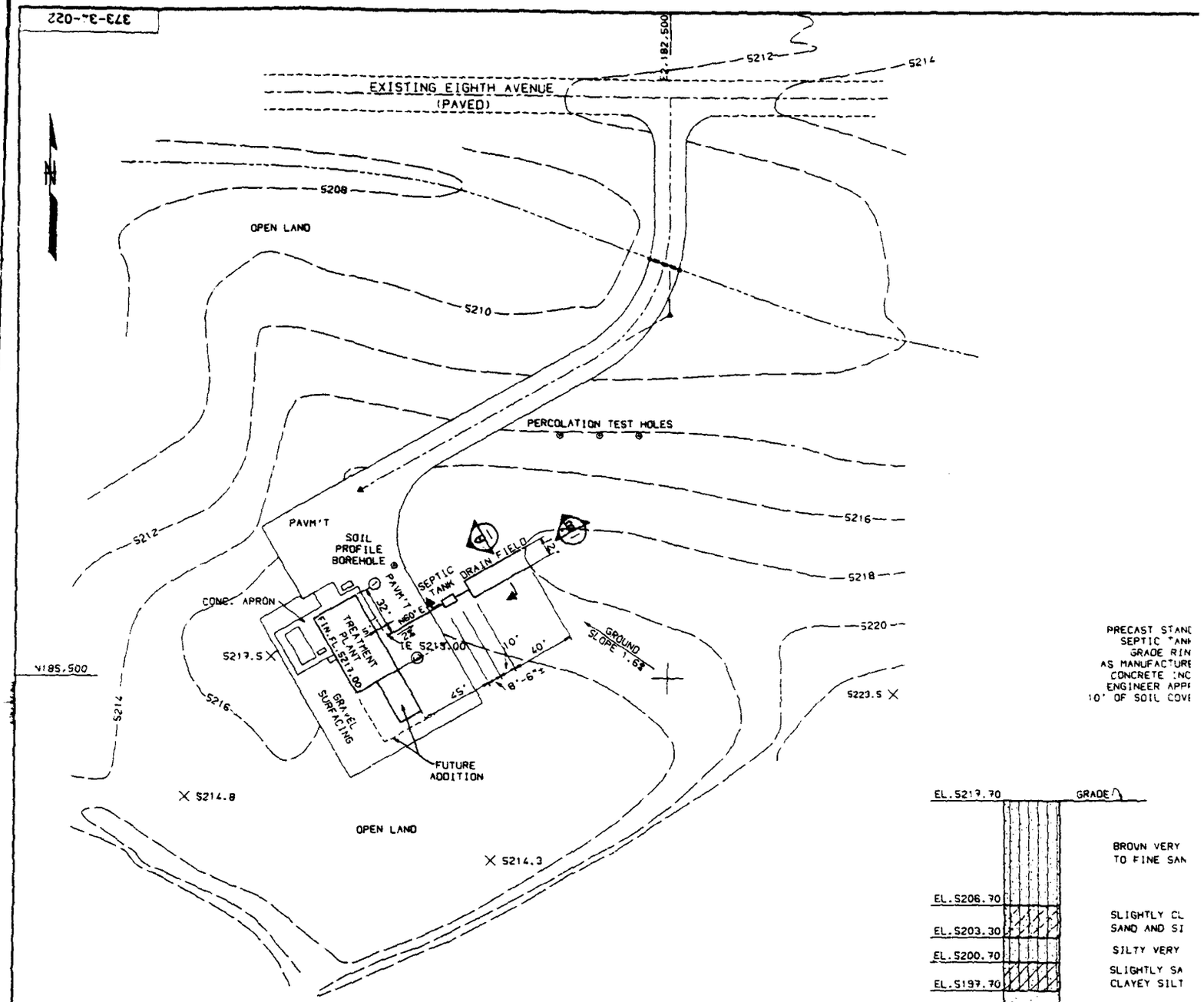
SECTION (A) C-003, E-010
NTS
TYPICAL UTILITY UNDERCROSSING



-ACCESS WALKWAY
(SEE SHT. M-20)

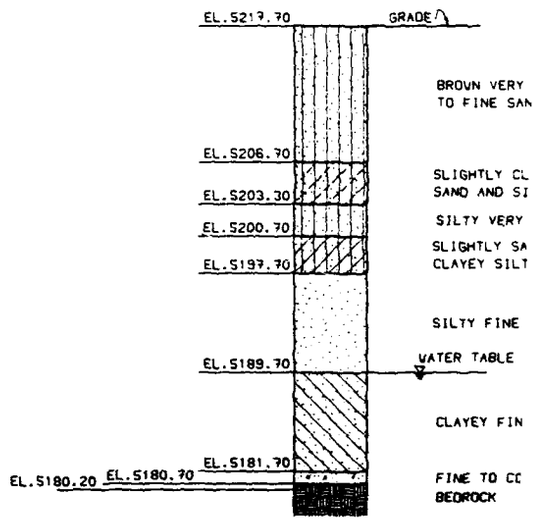
| | | |

373-3-022



PLAN
1" = 30'

PRECAST STAND
SEPTIC TANK
GRADE RIN
AS MANUFACTURE
CONCRETE INC
ENGINEER APP
10' OF SOIL COVE



SOIL PROFILE BOREHOLE LOG

DRAWING NO.	TITLE
E-003	AREA ELECTRICAL DISTRIBUTION
P-020	PIPING AND PLUMBING PLANS, ARRANGEMENTS AND DETAILS
C-003	SITE PLAN

REFERENCE DWGS

NO.	BY	DATE	CKD	DESCRIPTION

REVISIONS

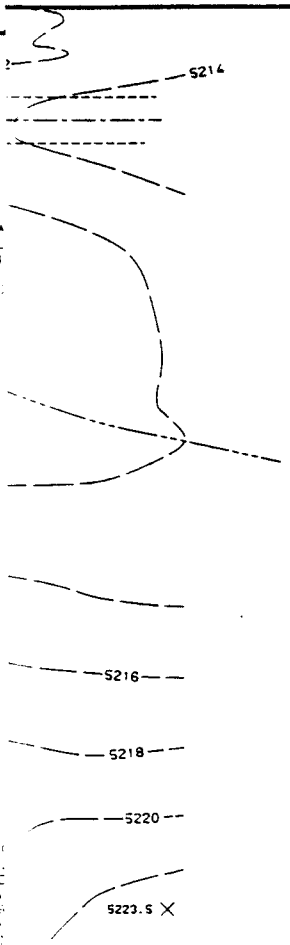
NO.	BY	DATE	CKD	DESCRIPTION
D	KF	8/22/89	GB	ISSUE FOR CONSTRUCTION TL0047
C	KF	5/26/89	GB	ISSUE FOR IMPLEMENTATION PLAN TL0045
B	KF	4/30/89	GB	ISSUE FOR OWNER APPROVAL TL0 038
A	KF	4/21/89	GB	ISSUE FOR REVIEW & COMMENT TL0028

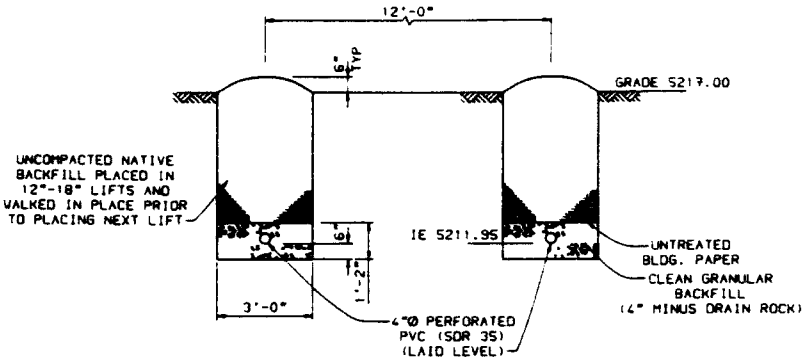
REVISIONS

DEPT	REV	A	B	C	D
ARCH			DL	DL	
CIV/STRL		GB	GB	GB	
MECH			JTF	JTF	
ELECT			JC	JPC	
INSTR			CED	CED	
PIPING			DS	DLS	
SAFETY			JC	JC	
DEPT MGR		CBV	CBV	CBV	
PROJECT		JRH	JRH	JRH	

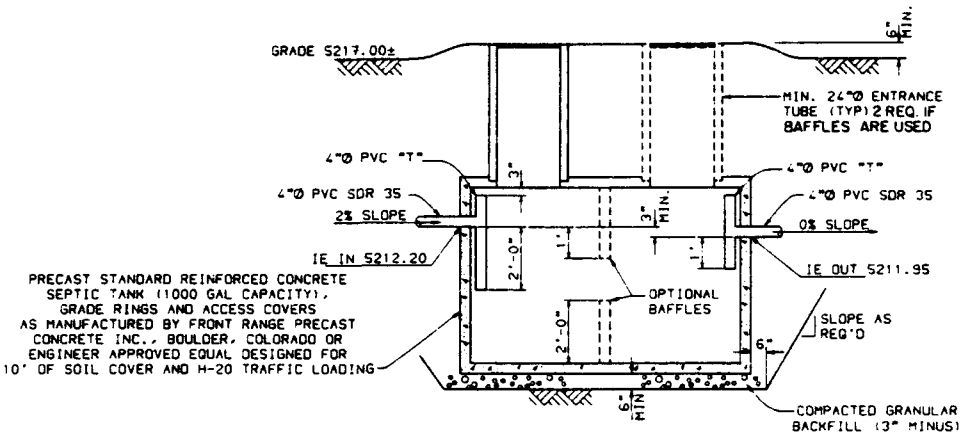
APPROVALS

SCALE
DRAWN
DESIGN
CHECKED
REV

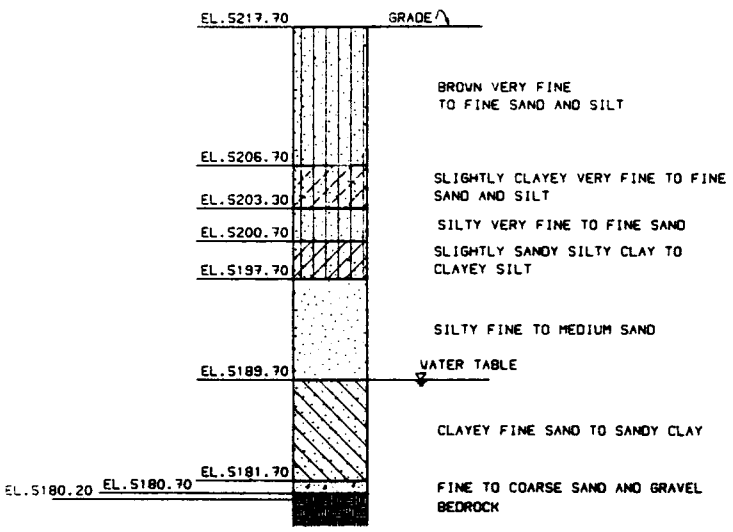




SECTION A
1/2" = 1'-0"



SECTION B
1/2" = 1'-0"



SOIL PROFILE BOREHOLE LOG

DESIGN BASIS:

1. DESIGN CRITERIA FOR DAILY FLOW CALCULATIONS

PERSONNEL	No. SHIFTS	ESTIMATED INFLOW
2	2	35 GPD/PERSON

INFLOW CONSISTS OF ONLY SANITARY WASTES FROM THE PERSONNEL RESTROOM

2. DESIGN DAILY FLOW

2 PERSONS x 2 SHIFTS x 35 GPD/PERSON x150% = 210 GPD

3. REQUIRED RETENTION 30 HOURS

4. VOLUME REQUIRED = $\frac{30 \text{ HRS}}{24 \text{ HRS}}$ x 210 GPD = 263 GALLONS

5. USE 1000 GALLON SEPTIC TANK (FOR POTENTIAL FUTURE REQUIREMENTS.

6. SEE DRAWING C-003 FOR DETAILS ON PLANT LAYOUT AND GRADING.

DSPT	REV	A	B	C	D
ARCH			DL	DL	
CIV/STRL		GB	GB	GB	
MECH			JTF	JTF	
ELECT			JC	JRC	
INSTR			CED	CED	
PIPING			DS	DLS	
SAFETY			JC	JC	
DSPT MGR		CBV	CBV	CBV	
PROJECT		JRH	JRH	JRH	

APPROVALS

SCALE	AS NOTED	DATE
DRAWN BY	FAHEY	4/89
DESIGNED BY	BROWN	3/89
CHECKED BY	THORNE	4/89

CLIENT APPROVALS

REV	BY	DATE

MORRISON-KNUDSEN ENGINEERS, INC.

SHELL OIL COMPANY
ROCKY MOUNTAIN ARSENAL REMEDIATION PROJECT
INTERIM RESPONSE ACTION FINAL DETAILED DESIGN

DRAWING TITLE
BASIN A NECK IRA
SEWAGE SYSTEM PLAN
AND DETAILS

WORK ORDER 2127

30 of 42

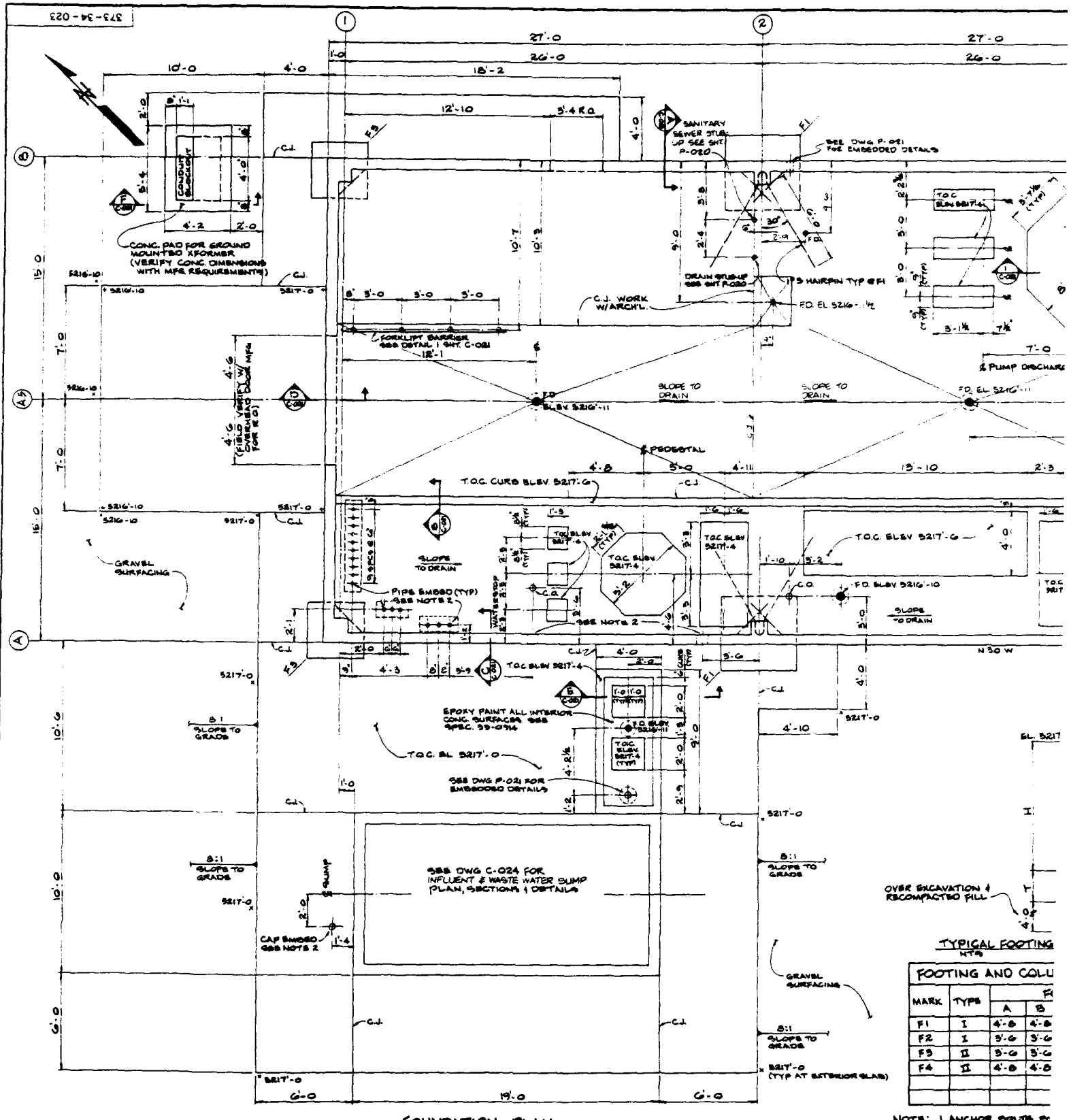
DRAWING NO. 373-34-022

REFERENCE NO. C-022

REV 0

8/10/89 00-34-022 PLOT

373-34-023



FOUNDATION PLAN
3/8" = 1'-0"

TYPICAL FOOTING
NTS

FOOTING AND COLU			
MARK	TYPE	A	B
F1	I	4'-8	4'-8
F2	I	3'-6	3'-6
F3	II	3'-6	3'-6
F4	II	4'-8	4'-8

NOTE: 1. ANCHOR BOLTS
2. SEE PIPING DRAW

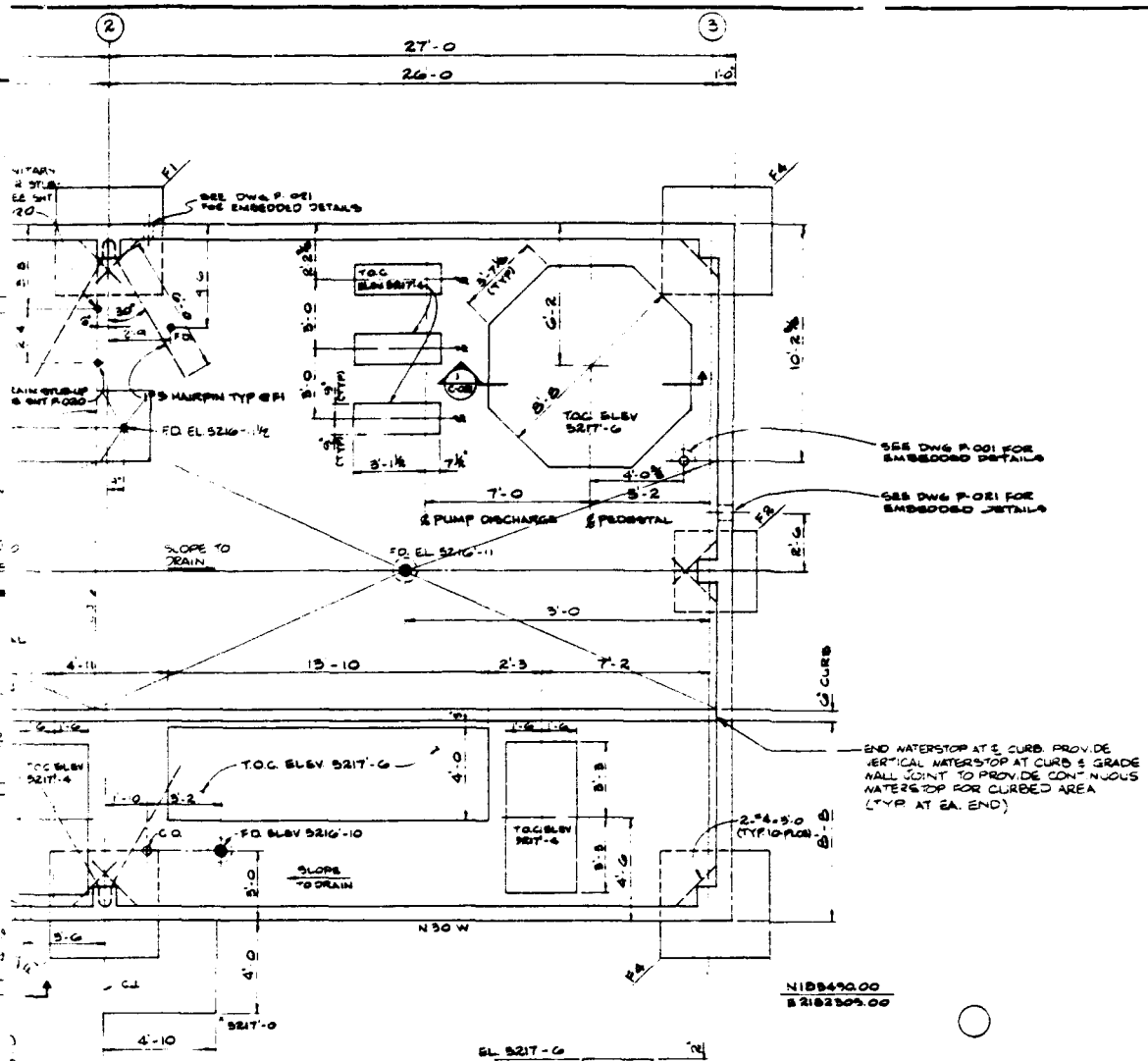
REFERENCE DWGS	
M-020	[illegible]
E-020	ELECTRICAL PLAN & DETAILS SHEET 2
E-003	AREA ELECTRICAL DISTRIBUTION
P-021	PIPING & PLUMBING SECTIONS & DETAILS
P-020	PIPING & PLUMBING PLANS/[illegible] & DETAILS
C-024	FLOOR, SUMP & MISC. PLAN SECT & DET.
C-021	TREATMENT PLANT AREA SECTIONS & DETAILS
C-003	SITE PLAN
DRAWING NO.	TITLE

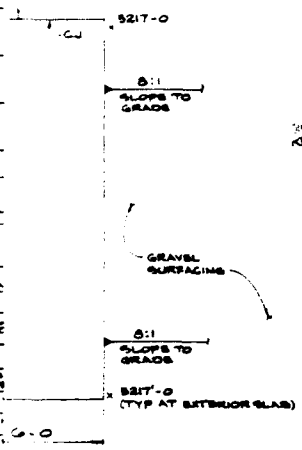
REVISIONS				
NO.	BY	DATE	CKD	DESCRIPTION

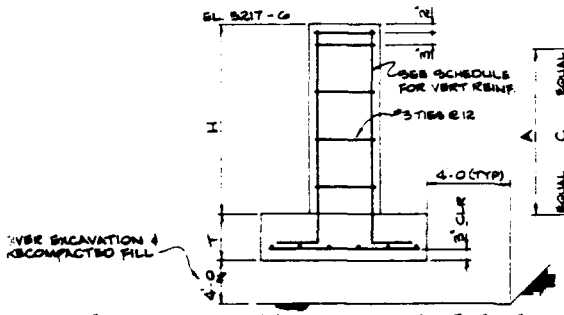
REVISIONS				
D	KP	8-22-89	GB	ISSUE FOR CONSTRUCTION TL#047
C	CDP	8-26-89	GB	ISSUE FOR IMPLEMENTATION PLAN TL#048
B	CDP	5-8-89	GB	ISSUE FOR OWNERS APPV'L TL#030
A	CDP	4-21-89	GB	ISSUE FOR REVIEW & COMMENT TL#028
NO.	BY	DATE	CKD	DESCRIPTION

APPROVALS	REV	A	B	C	D
DEPT					
ARCH					
CIV/STRL					
MECH					
ELECT					
INSTR					
PIPING			DLS	DLS	DLS
SAFETY			TC	TC	TC
DEPT MGR					
PROJECT					

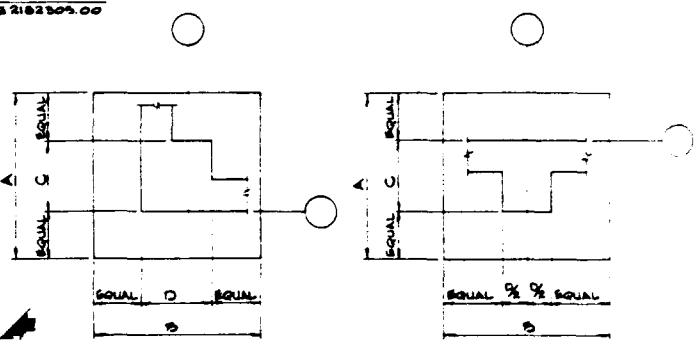
SCALE
DRAWN BY
DESIGNED
CHECKED
REV







TYPICAL FOOTING & COLUMN PEDESTAL ELEVATION
NTS



TYPE II TYPE I

TYPICAL FOOTING & COLUMN PEDESTAL PLANS
NTS

FOOTING AND COLUMN PEDESTAL SCHEDULE

MARK	TYPE	FOOTING A	FOOTING B	FOOTING T	FOOTING REINF E.W.		COLUMN PEDESTAL C	COLUMN PEDESTAL D	COLUMN PEDESTAL H	COLUMN PEDESTAL VERT REINF
F1	I	4'-8	4'-8	12"	6#5		1'-6	1'-0	4'-0	4#6
F2	I	5'-6	5'-6	10"	4#5		1'-6	1'-0	4'-0	4#6
F3	II	3'-6	3'-6	10"	4#5		1'-6	1'-6	4'-0	4#6
F4	II	4'-8	4'-8	12"	6#5		1'-6	1'-6	4'-0	4#6

NOTES: 1. ANCHOR BOLTS BY BUILDING & EQUIPMENT VENDORS
2. SEE PIPING DRAWING FOR EMBED DETAILS AND ℄ ELEVATIONS.

DEPT	REV A	B	C	D
ARCH				
CIV/STR				
MECH				
ELECT				
INSTR				
PIPING				
SAFETY				
DEPT MGR				
PROJECT				

APPROVALS

SCALE AS NOTED	DATE
DRAWN BY CDF	4-10-89
DESIGNED BY CGV	4-10-89
CHECKED BY	4-20-89
CLIENT APPROVALS	
REV BY	DATE

MORRISON-KNUDSEN ENGINEERS, INC.

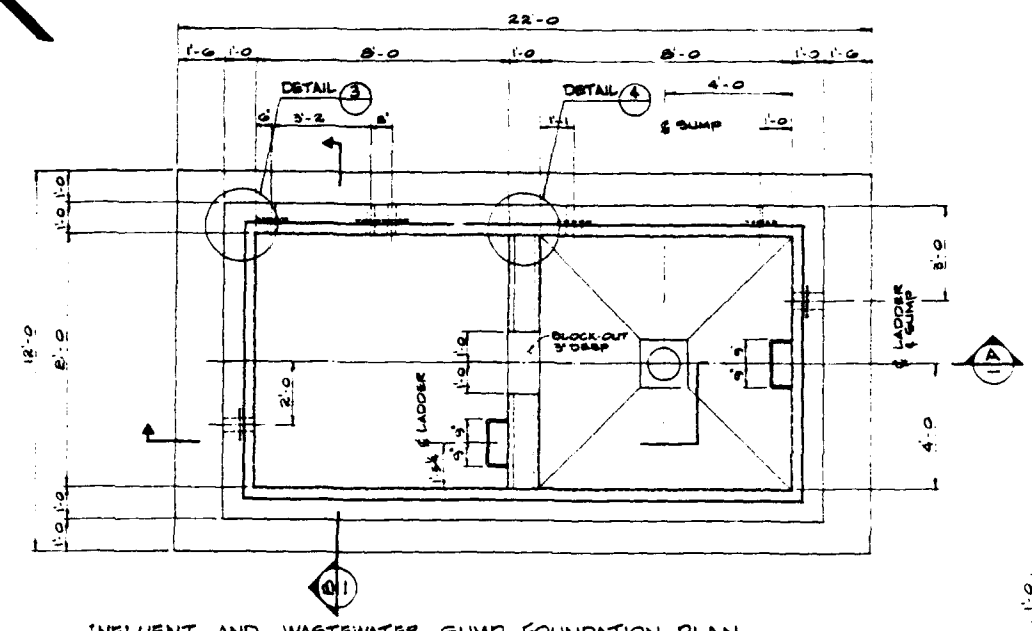
SHELL OIL COMPANY
ROCKY MOUNTAIN ARSENAL REMEDIATION PROJECT
INTERIM RESPONSE ACTION FINAL DETAILED DESIGN

DRAWING TITLE
BASIN A NECK IRA
GROUNDWATER TREATMENT BLD'G
FOUNDATION PLAN
SECTIONS & DETAILS

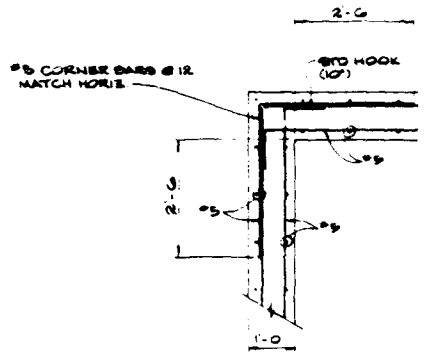
WORK ORDER NO 2127 — 30 of 42
DRAWING NO. 373-34-023
REFERENCE NO. C-023 — REV 0

3

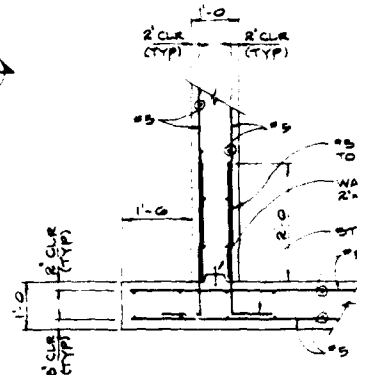
373-34-024



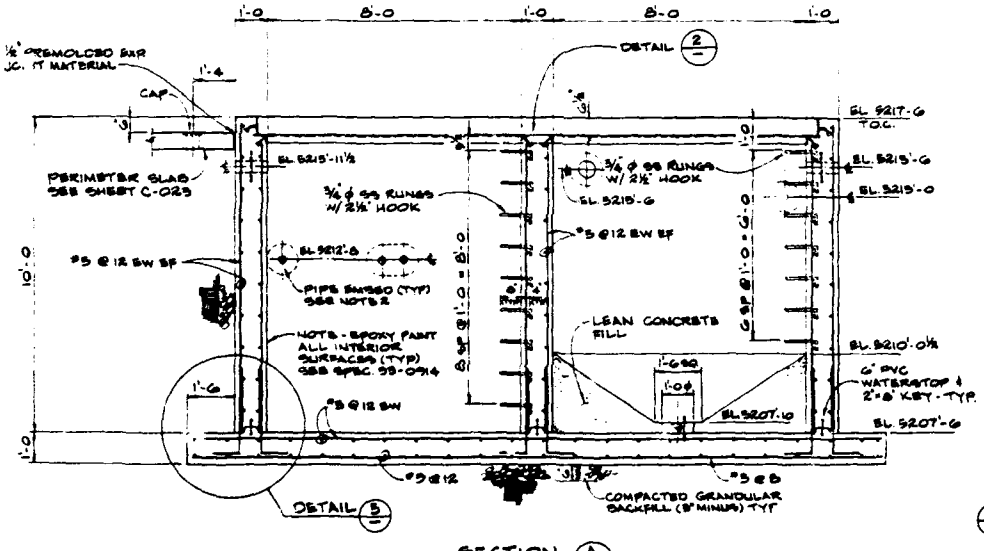
INFLUENT AND WASTEWATER SUMP FOUNDATION PLAN
½" = 1'-0"



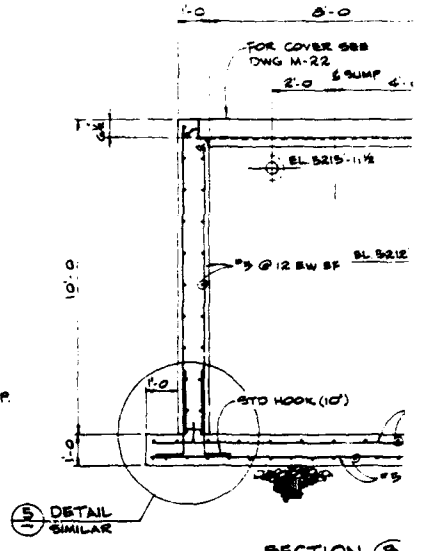
TYPICAL CORNER
3/4" = 1'-0"



DETAIL 5
3/4" = 1'-0"



SECTION A
½" = 1'-0"



SECTION B
½" = 1'-0"

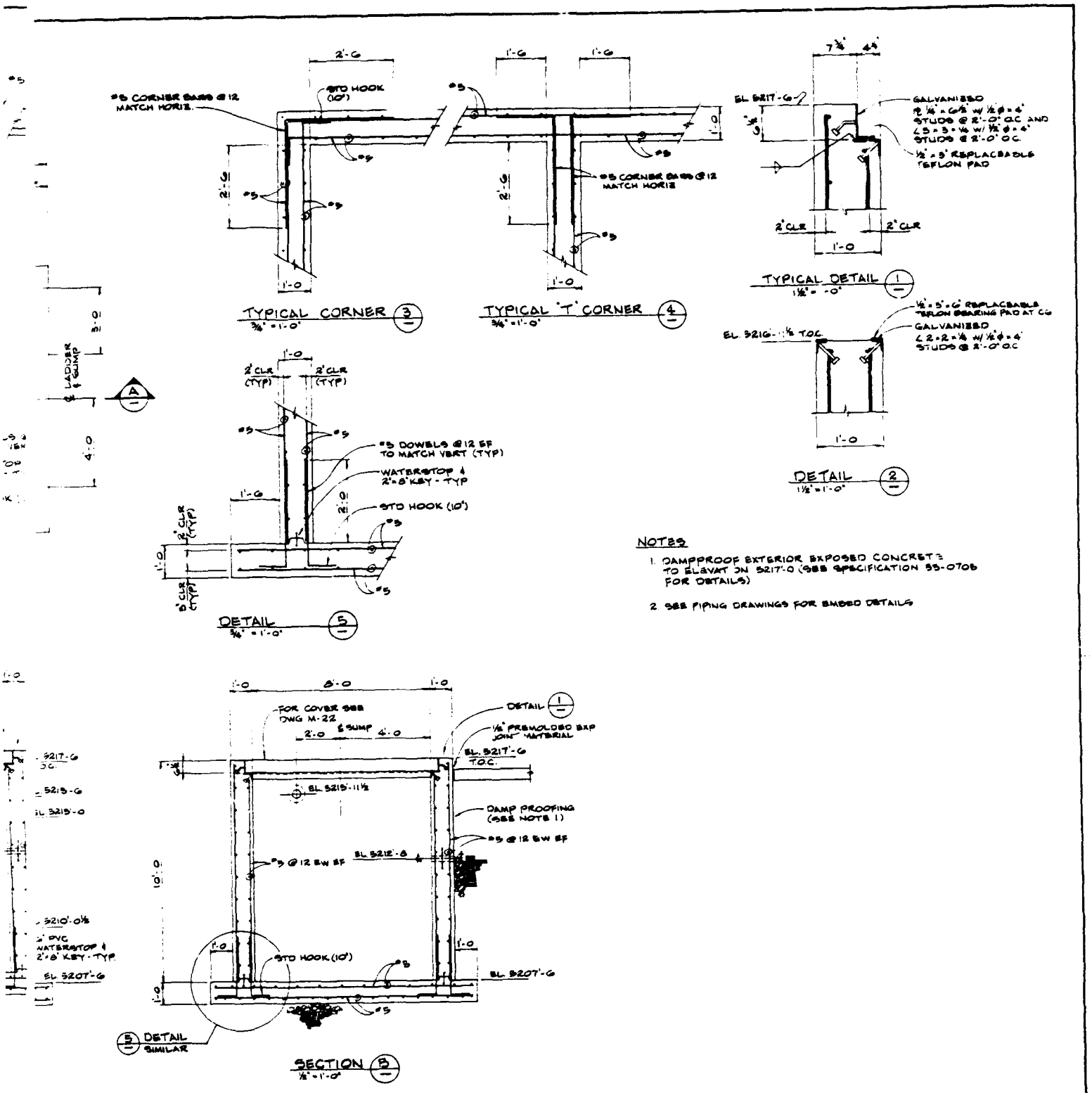
REFERENCE DWGS	
M-021	[illegible]
M-020	[illegible]
P-021	PIPING & PLUMBING SECTIONS & DETAILS
P-020	PIPING & PLUMBING PLAN ARRANGEMENT & DETAILS
C-029	FOUNDATION PLAN, SECTIONS & DETAILS
C-005	SITE PLAN
DRAWING NO.	TITLE

REVISIONS				
NO.	BY	DATE	CHD	DESCRIPTION

REVISIONS				
0	KF	8-22-89	GB	ISSUE FOR CONSTRUCTION TL-047
C	CDF	8-26-88	GB	ISSUE FOR IMPLEMENTATION PLAN TL-045
B	CDF	8-8-88	GB	ISSUE FOR OWNERS APV'L TL-036
A	CDF	4-21-87	GB	ISSUE FOR REVIEW & COMMENT TL-0724
NO.	BY	DATE	CHD	DESCRIPTION

APPROVALS				
DEPT	REV	A	B	C
ARCH				
CIV/STRL		GB	GB	GB
MECH				
ELECT		JWC	JWC	JWC
INSTR				
PIPING		DLS	DLS	DLS
SAFETY		TC	TC	TC
DEPT HDR				
PROJECT				

SCALE
DRAWN
DESIGN
CHECKED
REV.

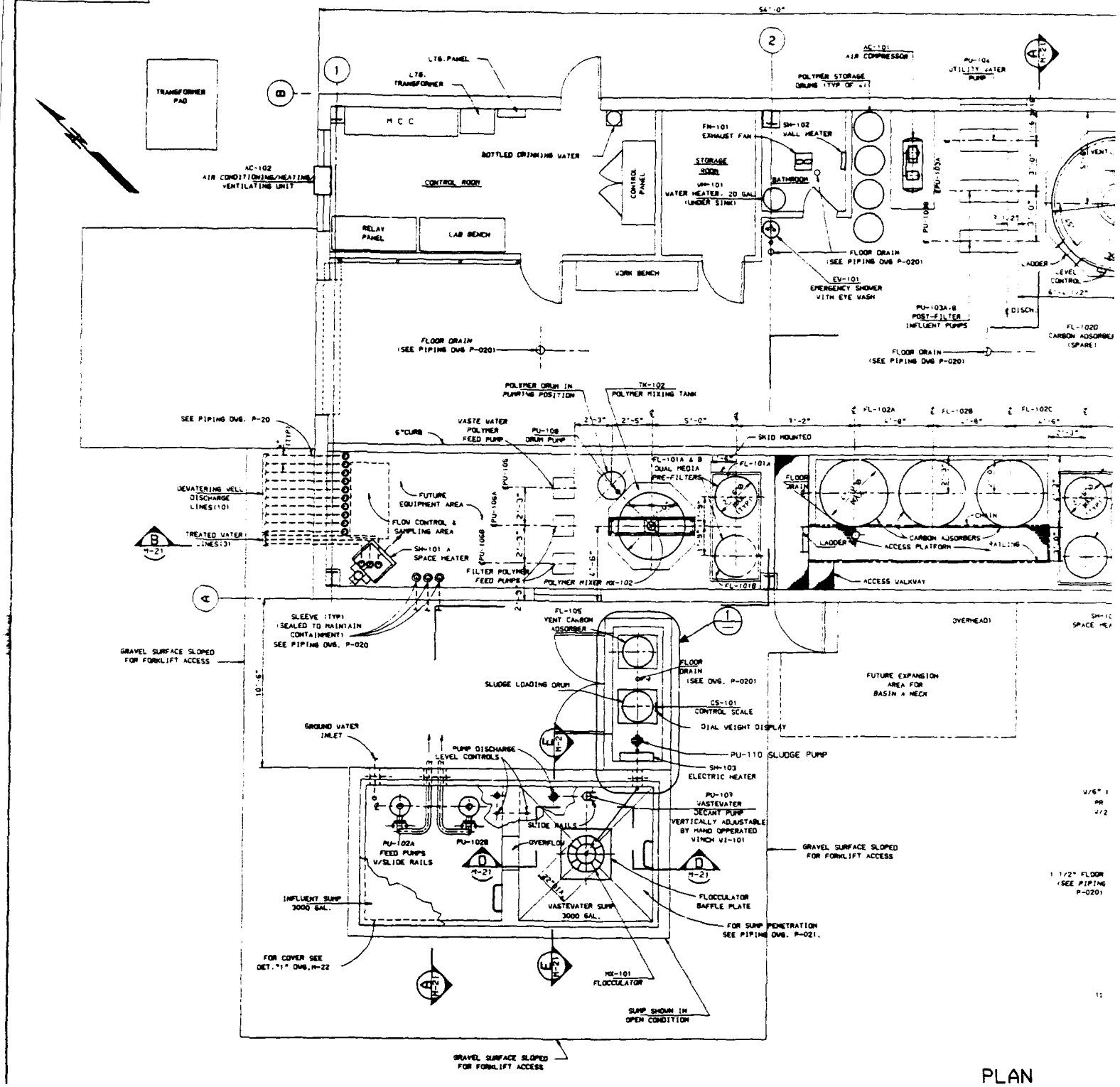


MORRISON-KNUDSEN ENGINEERS, INC.	SHELL OIL COMPANY ROCKY MOUNTAIN ARSENAL REMEDIATION PROJECT INTERIM RESPONSE ACTION FINAL DETAILED DESIGN	WORK ORDER NO. 2127	30 of 42
	DRAWING TITLE BASIN A NECK IRA INFLUENT & WASTEWATER SUMP PLAN, SECTIONS & DETAILS	DRAWING NO. 373-34-024	
		REFERENCE NO. C-024	REV 0

DEPT	REV A	B	C	D
ARCH				
CIV/STR	GAB			
MECH				
ELECT	JMC	JMC	JMC	
INSTR				
PIPING	DLS	DLS	DLS	
SAFETY				
DEPT MGR				
PROJECT				

SCALE AS NOTED	DATE
DRAWN BY COF	4-14-89
DESIGNED BY GJB	4-11-89
CHECKED BY CGV	4-10-89
CLIENT APPROVALS	
REV: BY	DATE

373-36-020



PLAN

SCALE: 3/8"=1'-0"

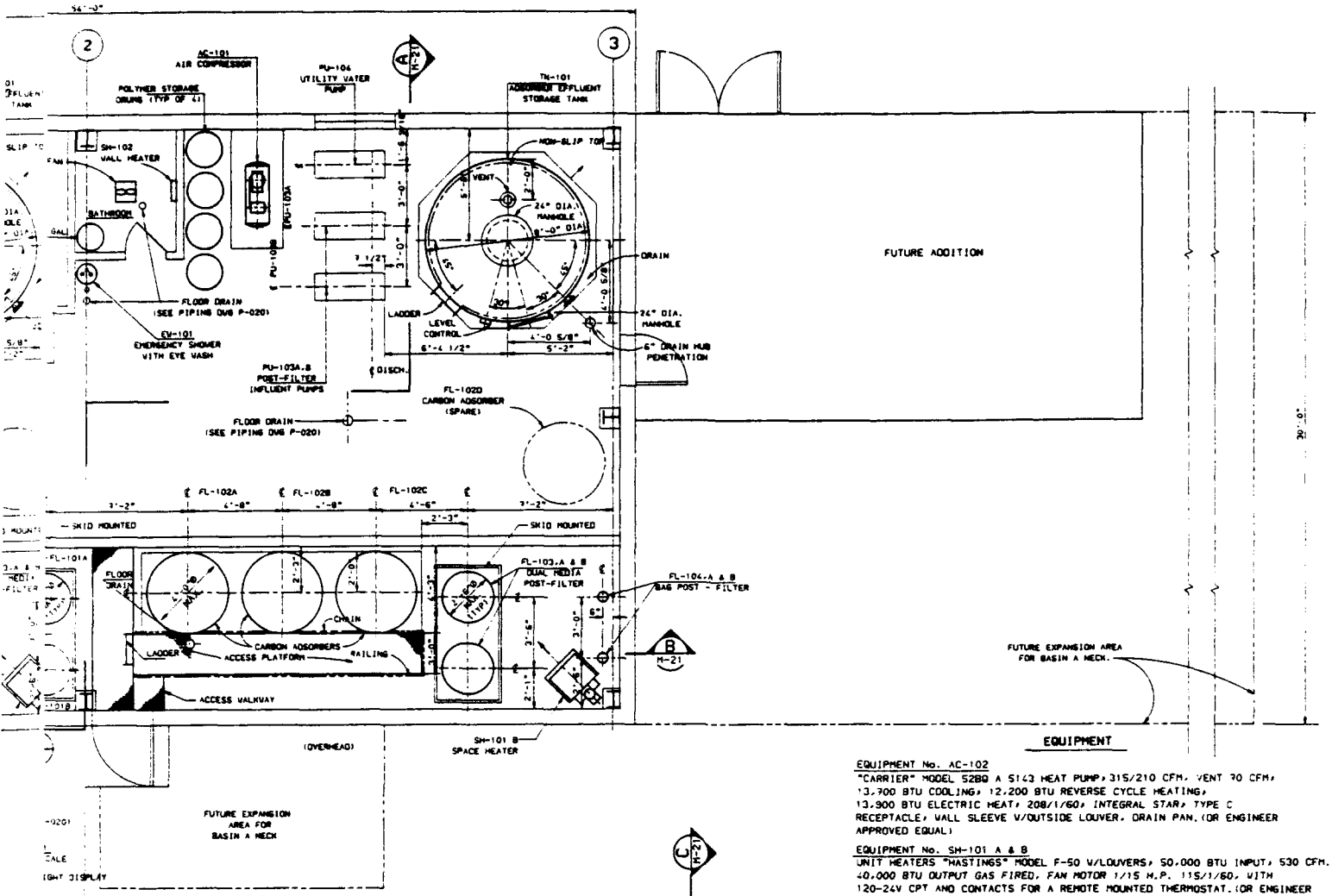
REFERENCE DWGS	
M-21	PIPING DWG.
P-20	PIPING DWG.
1-20	P & I.D.
M-22	GENERAL ARRANGEMENT - DETAILS
M-21	GENERAL ARRANGEMENT NO.2 SECTIONS
DRAWING NO.	TITLE

REVISIONS				
NO.	BY	DATE	CKD	DESCRIPTION

REVISIONS				
0	JTF	8/22/89		ISSUE FOR CONSTRUCTION TL # 047
C	DDL	5/26/89		FOR IMPLEMENTATION PLAN TL# 045
B	JTF	4/20/89		ISSUED FOR APPROVAL TL# 026
A	JTF	3/19/89		ISSUED FOR REVIEW & COMMENT TL NO.012
NO.	BY	DATE	CKD	DESCRIPTION

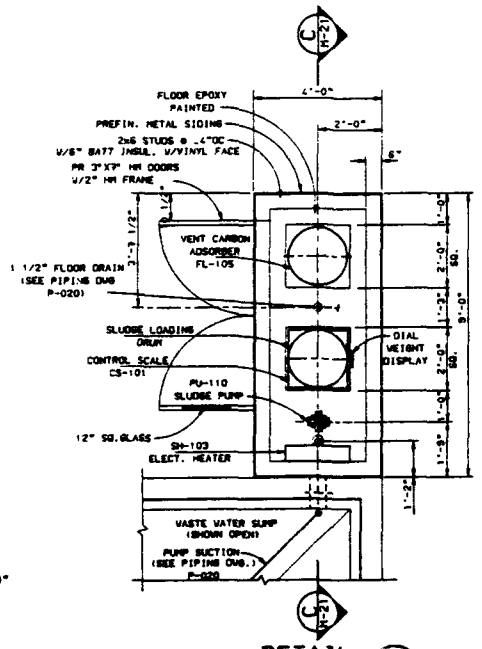
APPROVALS				
DEPT	REV.	A	B	C
ARCH		DDL	DDL	
CIV/STRL		GB	GB	
MECH		JTF	JTF	
ELECT		JMC	JMC	
INSTM		CED	EM	
PIPING		JVM	DLS	
SAFETY				
DEPT MGR		JG	DCV	
PROJECT		JRH	JRH	

SCALE
DRAWN
DESIGN
CHECK
REVI



PLAN

SCALE: 3/8"=1'-0"



DETAIL 1

SCALE: 1/4"=1'-0"

EQUIPMENT

EQUIPMENT No. AC-102
"CARRIER" MODEL 52BQ A 5143 HEAT PUMP, 315/210 CFM, VENT 70 CFM, 13,700 BTU COOLING, 12,200 BTU REVERSE CYCLE HEATING, 13,900 BTU ELECTRIC HEAT, 208/1/60, INTEGRAL STAR, TYPE C RECEPTACLE, WALL SLEEVE W/OUTSIDE LOUVER, DRAIN PAN. (OR ENGINEER APPROVED EQUAL)

EQUIPMENT No. SH-101 A & B
UNIT HEATERS "HASTINGS" MODEL F-50 W/LOUVERS, 50,000 BTU INPUT, 530 CFM. 40,000 BTU OUTPUT GAS FIRED, FAN MOTOR 1/15 H.P. 115/1/60, WITH 120-24V CPT AND CONTACTS FOR A REMOTE MOUNTED THERMOSTAT. (OR ENGINEER APPROVED EQUAL)

EQUIPMENT No. SH-102
WALL HEATER: CHROMOLOX MODEL AUH-3204-1, 5120 BTUH, 1500 WATT, 208/1/60, RECESSED WALL HEATER, FAN DRIVEN W/INTEGRAL THERMOSTAT. (OR ENGINEER APPROVED EQUAL)

EQUIPMENT No. FN-101
EXHAUST FAN: PENN ZEPHYR, MODEL Z-6, 100 CFM, 115/1/60, 1/25 H.P., 1/4" S.P. VENTED TO WALL ABOVE CEILING WITH WALL CAP. (OR ENGINEER APPROVED EQUAL) STATIC PRESSURE 1/4" W.C.

EQUIPMENT No. MX-102
ELECTRIC TANK MIXER: IONCO, MODEL No. VS-315T, WITH EXTERNAL BRIDGE MIXER SUPPORT, TEFC 1 1/2 H.P. 230-460 VOLTS. (OR ENGINEER APPROVED EQUAL)

EQUIPMENT No. SH-103
ELECTRIC HEATER, CHROMALOX, TYPE HVT, MODEL No. HVT-2411 W/THERMOSTAT, 120V, 1.0 KW. (OR ENGINEER APPROVED EQUAL)

EQUIPMENT No. WH-101
ELECTRIC WATER HEATER, 20 GAL. CAPACITY, RHEEM MANUFACTURING CO. MODEL EGS-20S, RECOVERY RATE 9 GPM, ELEMENT 3000 W, 25 AMPS DRAW, 120V/60Hz, FLOOR LOCATED (OR ENGINEER APPROVED EQUAL).

EQUIPMENT No. PU-108
ELECTRIC DRUM PUMP: SERFILCO LTD., MODEL SS6000-1 1/4, 3/4 H.P. 460 VOLT 3 PHASE. (OR ENGINEER APPROVED EQUAL)

NOTES:
DIMENSIONS MAY VARY UPON VENDOR EQUIPMENT SELECTION.

DEPT	REV	A	B	C	D
ARCH		DOL	DOL		
CIV/STRL			GB	GB	
MECH			JTF	JTF	
ELECT			JMC	JMC	
INSTR			CED	JEM	
PIPING			JVM	JLS	
SAFETY				JC	JC
DEPT MGR			JG	DCV	
PROJECT			JMH	JMH	

APPROVALS

SCALE	AS NOTED	DATE
DRAWN BY	CWF	3/89
DESIGNED BY	SJA	3/89
CHECKED BY	JTF	3/89

CLIENT APPROVALS

REV	BY	DATE

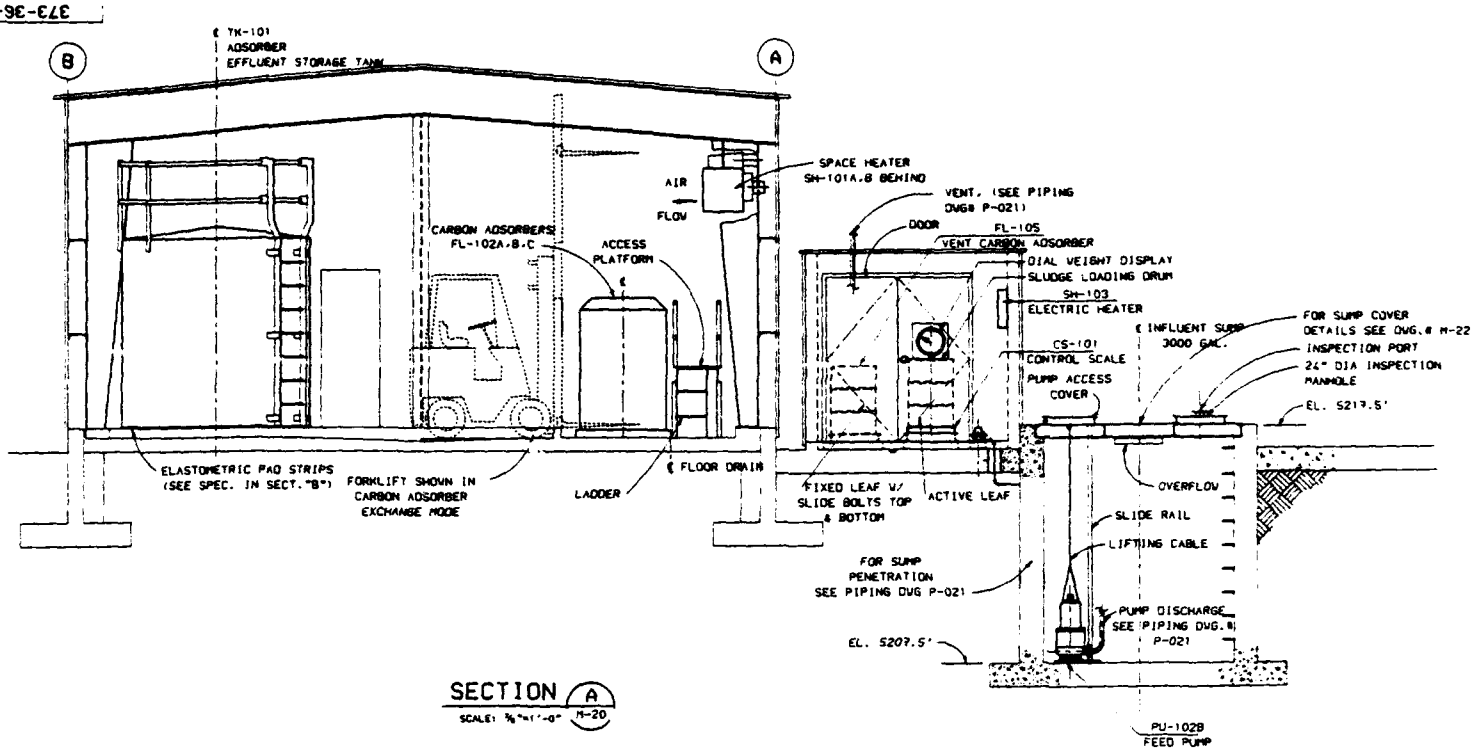
MORRISON-KNUDSEN ENGINEERS, INC.

SHELL OIL COMPANY
ROCKY MOUNTAIN ARSENAL REMEDIATION PROJECT
INTERIM RESPONSE ACTION FINAL DETAILED DESIGN

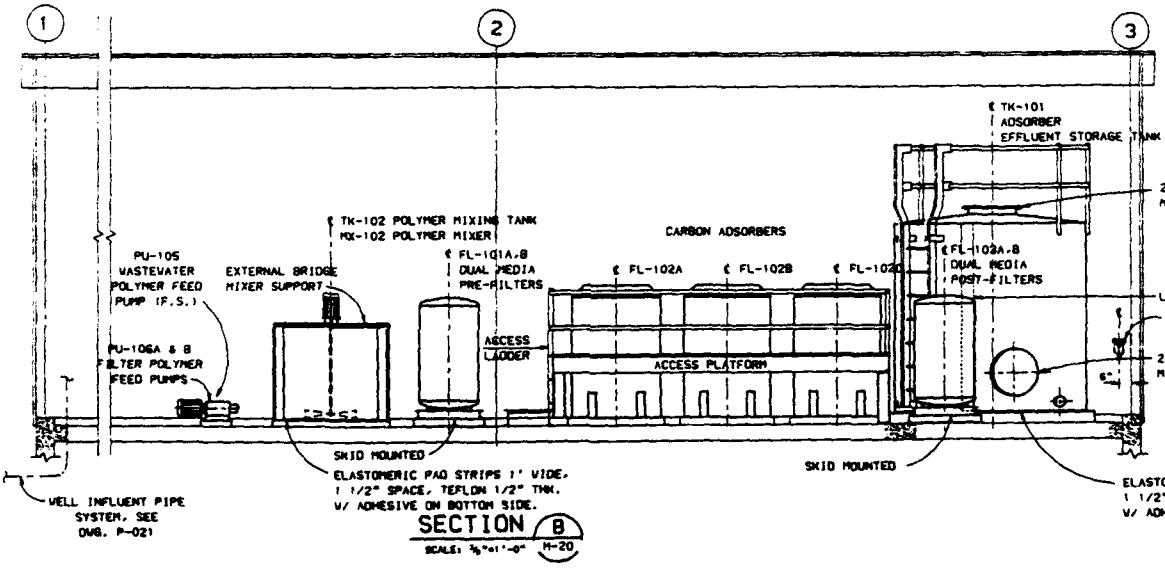
DRAWING TITLE
BASIN A NECK IRA
GROUND WATER TREATMENT SYSTEM
GENERAL ARRANGEMENT PLAN

WORK ORDER 2127
30 x 42
DRAWING NO. 373-36-020
REFERENCE NO. M-20
REV 0

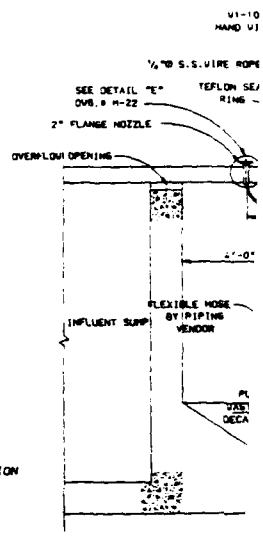
373-36-021



SECTION A
SCALE: 3/8"=1'-0" M-20



SECTION B
SCALE: 3/8"=1'-0" M-20



REFERENCE DWGS	
P-21	PIPING DWG.
P-20	PIPING DWG.
I-20	P & I D
M-22	GENERAL ARRANGEMENT - DETAILS
M-20	GENERAL ARRANGEMENT NO. 1
DRAWING NO.	TITLE

REVISIONS			
NO.	BY	DATE	CHKD	DESCRIPTION

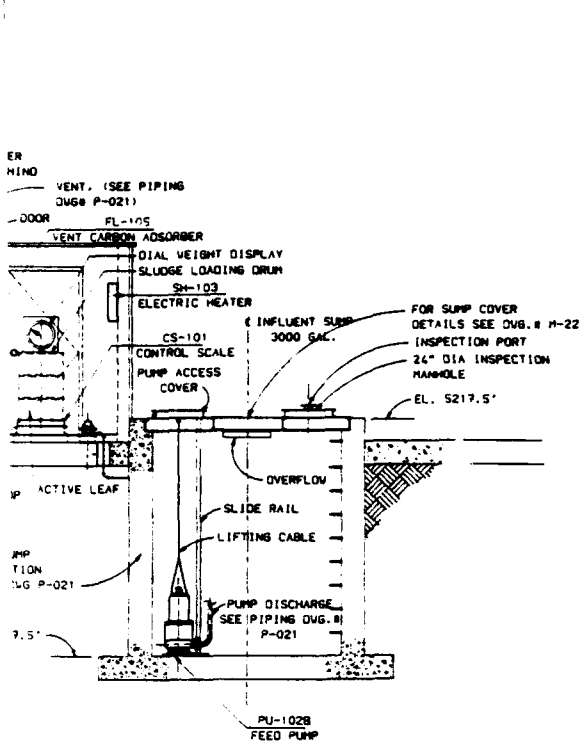
REVISIONS				
D	JTF	8/22/89		ISSUE FOR CONSTRUCTION TL# 047
C	JTF	5/26/89		FOR IMPLEMENTATION PLAN TL# 045
B	JTF	4/20/89		ISSUED FOR APPROVAL TL# 028
A	JTF	3/17/89		FOR REVIEW & COMMENT TL 9012
NO.	BY	DATE	CHKD	DESCRIPTION

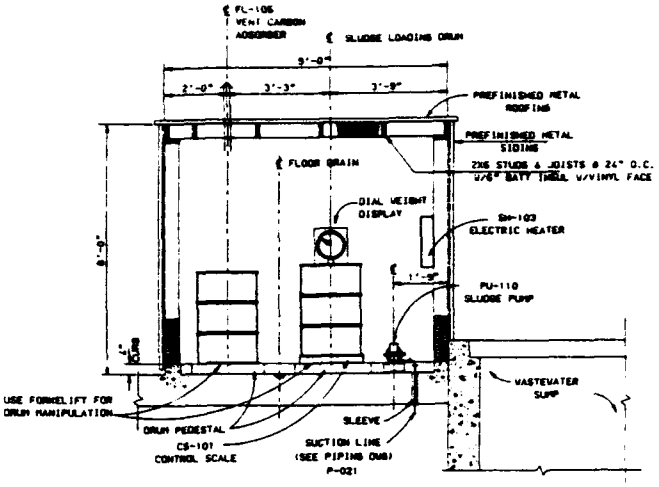
APPROVALS				
DEPT REV	A	B	C	D
ARCH		DDL	DDL	
CIV/STRL		GB	GB	
MECH		JTF	JTF	
ELECT		JRC	JRC	
INSTM		CSD	JGN	
PIPING		JWH	DLB	
SAFETY			JC	
DEPT MGR		JB	DCV	JC
PROJECT		JRH	JRH	

SCALE
DRAWN
DESIGN
CHECK
REV

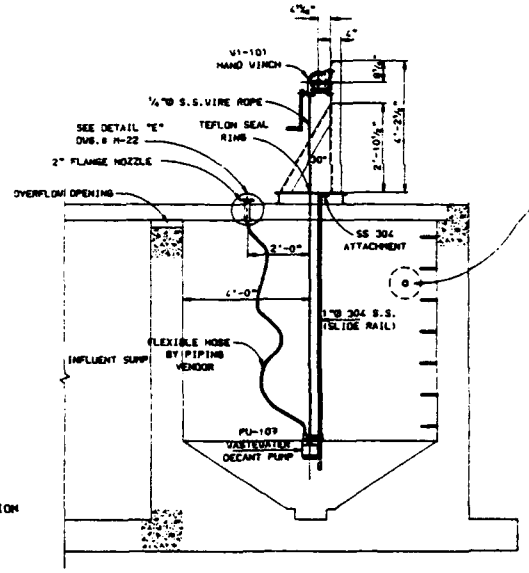
1

2

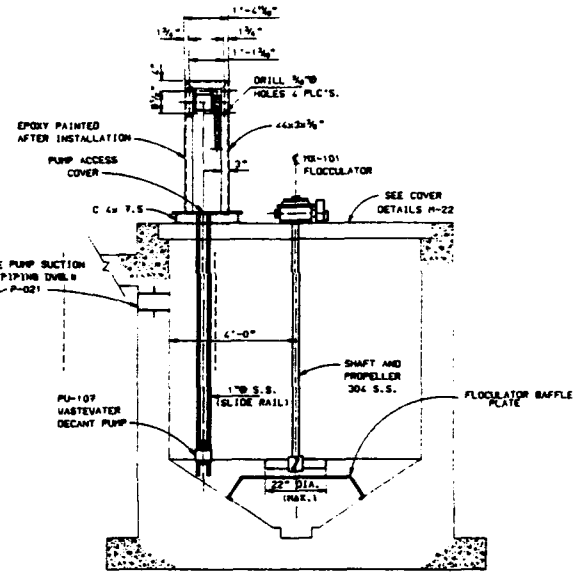




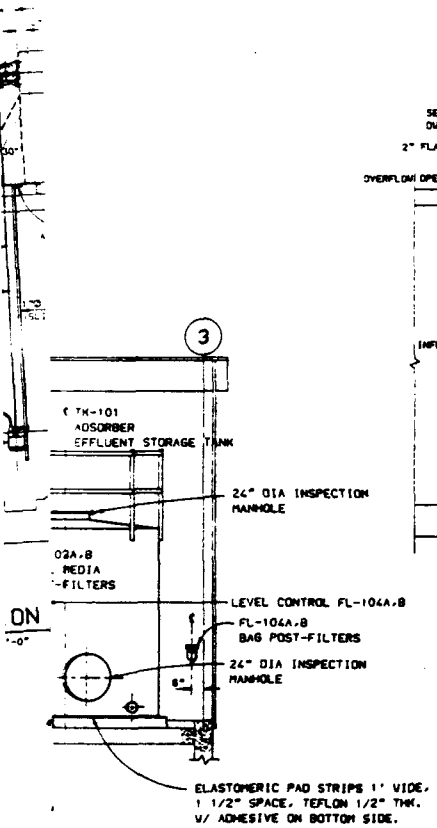
SECTION C
SCALE: 1/2"=1'-0" M-20



SECTION D
SCALE: 1/2"=1'-0" M-20



SECTION E
SCALE: 1/2"=1'-0" M-20



EQUIPMENT

EQUIPMENT No. CS-101
CONTROL SCALE: HOME RICHARDSON SCALE CO. XL DIAL MODEL # 6401 BENCH TYPE. 28"X28" STAINLESS STEEL PAN. 1000 LB CAPACITY. (OR ENGINEER APPROVED EQUAL)

EQUIPMENT No. FL-105
VENT CARBON ADSORBER, TIBB CORP. "CANSORB" MODEL C1530P (150 LB.CARBON CAPACITY) OR ENGINEER APPROVED EQUAL.

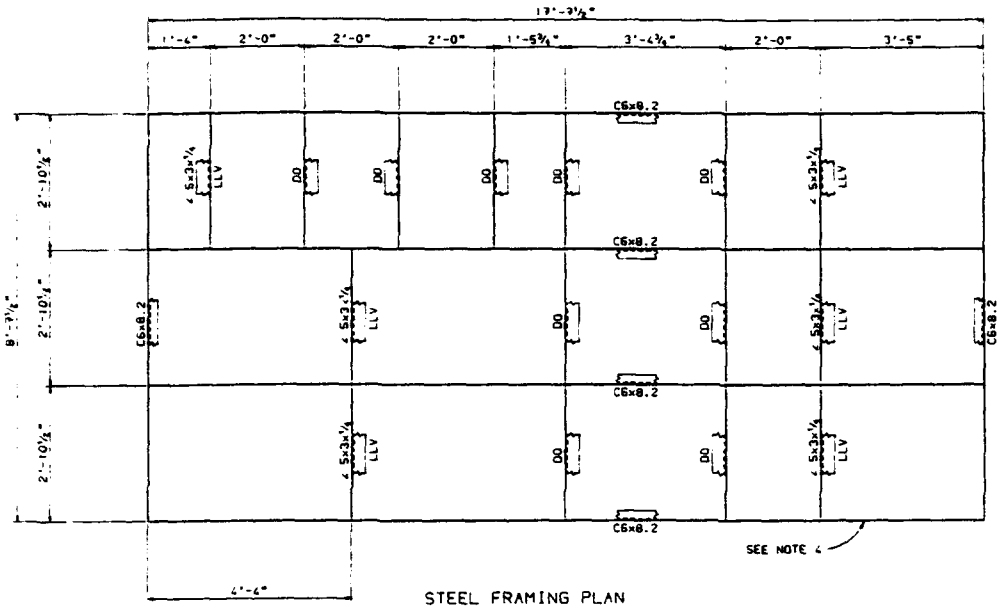
EQUIPMENT No. VI-101
HAND WINCH. PULLING CAPACITY 750 LB., DRUM SIZE 6"X8", GEAR RATIO 25:1. STEPHENS ADAMSON #30 OR ENGINEER APPROVED EQUAL.

NOTES:

1. DIMENSIONS MAY VARY UPON VENDOR EQUIPMENT SELECTION.

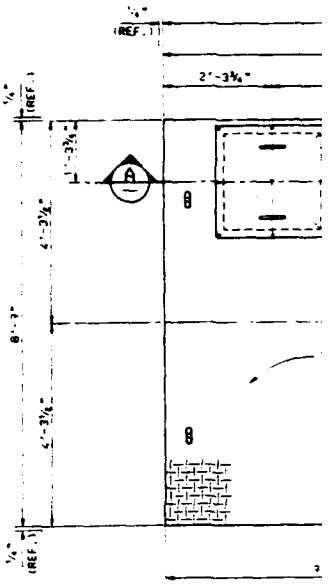
| | | |

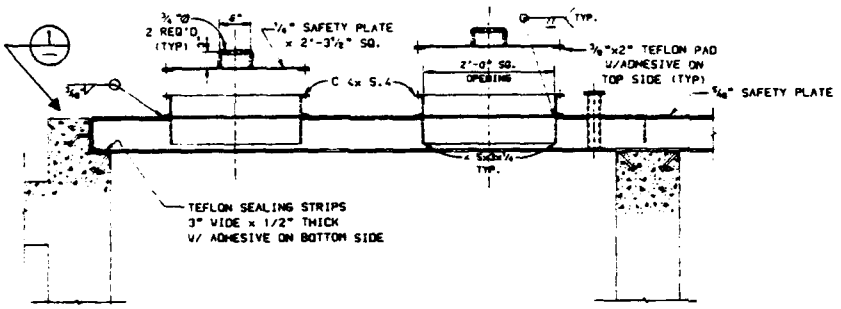
373-36-022



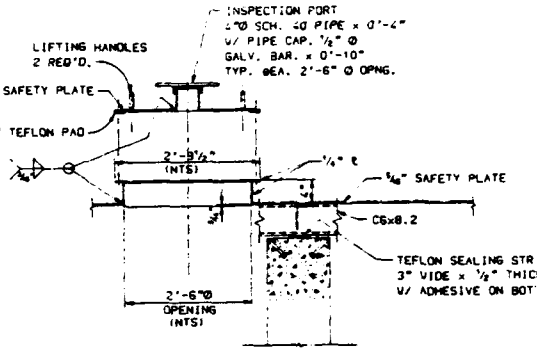
STEEL FRAMING PLAN
WASTEWATER SUMP COVER

DETAIL 1 (M-21)
SCALE: ¼"=1'-0"

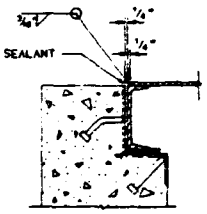




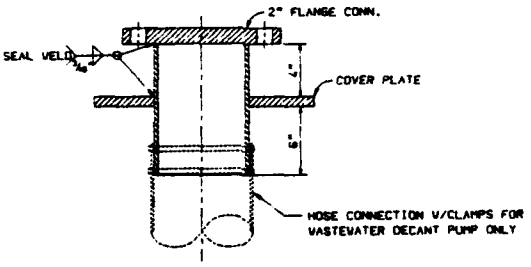
SECTION A
SCALE: 1"=1'-0"



SECTION B
SCALE: 1"=1'-0"



DETAIL 1
NTS



DETAIL 2
NTS

REFERENCE DWGS	
P-21	PIPING DWG.
P-20	PIPING DWG.
1-20	P & I D
M-21	GENERAL ARRANGEMENT - NO.2.SECTIONS
M-20	GENERAL ARRANGEMENT NO.1
DRAWING NO.	TITLE

REVISIONS

NO.	BY	DATE	CHD	DESCRIPTION

REVISIONS

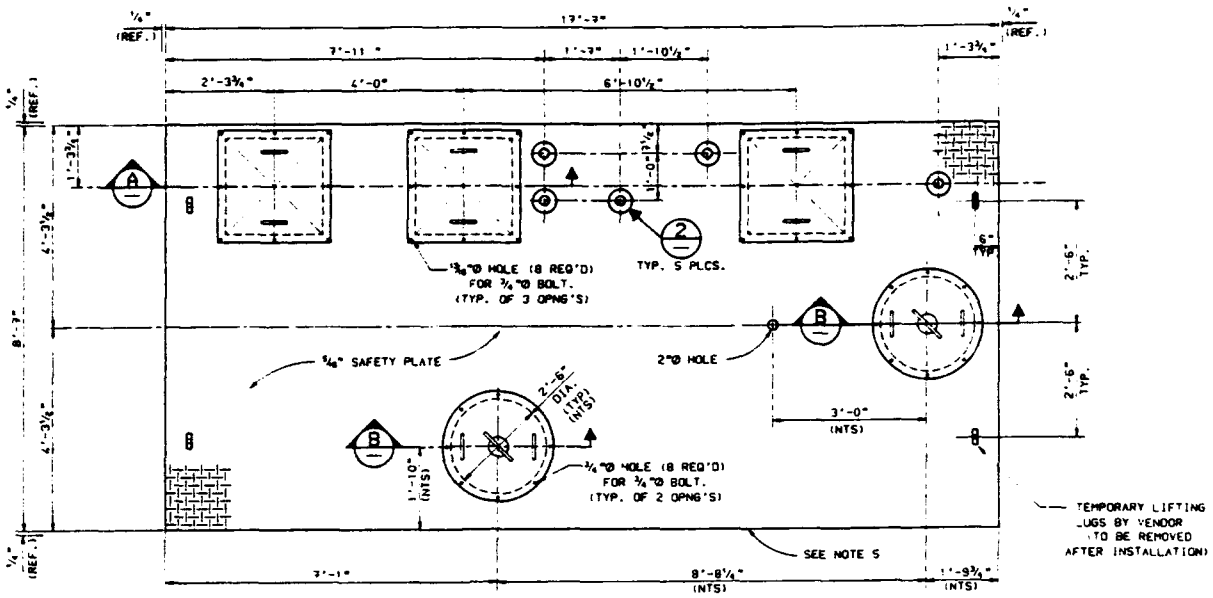
NO.	BY	DATE	CHD	DESCRIPTION
D	JTF	8/22/88		ISSUE FOR CONSTRUCTION TL0 047
C	JTF	5/26/88		FOR IMPLEMENTATION PLAN TL0 045
B	JTF	4/21/88	JC	FOR OWNER APPROVAL TL0026
A	JTF	3/19/88		FOR REVIEW & COMMENTS TL NO.012

APPROVALS

DEPT	REV	A	B	C	D
ARCH		DDL	DDL	DDL	
CIV/STRL			GB	GB	
MECH		JTF	JTF	JTF	
ELECT			JPC	JPC	JPC
INSTR			CED	JSK	
PIPING			JWH	DLB	
SAFETY				JC	
DEPT MGR			JB	DCV	JB
PROJECT		JRH	JRH	JRH	

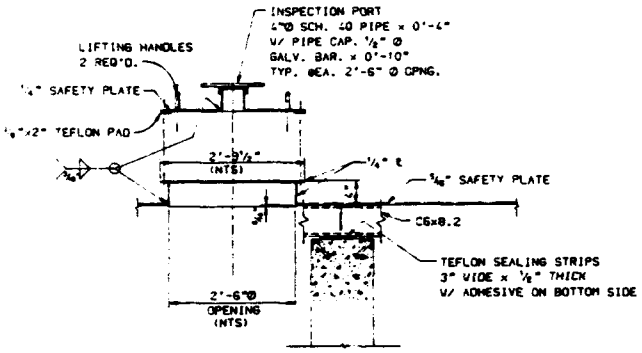
SCALE AS
DRAWN BY
DESIGNED BY
CHECKED BY
CLIEN
REV

(1) (2)



COVER PLATE DETAIL

SCALE: 3/4"=1'-0"



SECTION B

SCALE: 1"=1'-0"

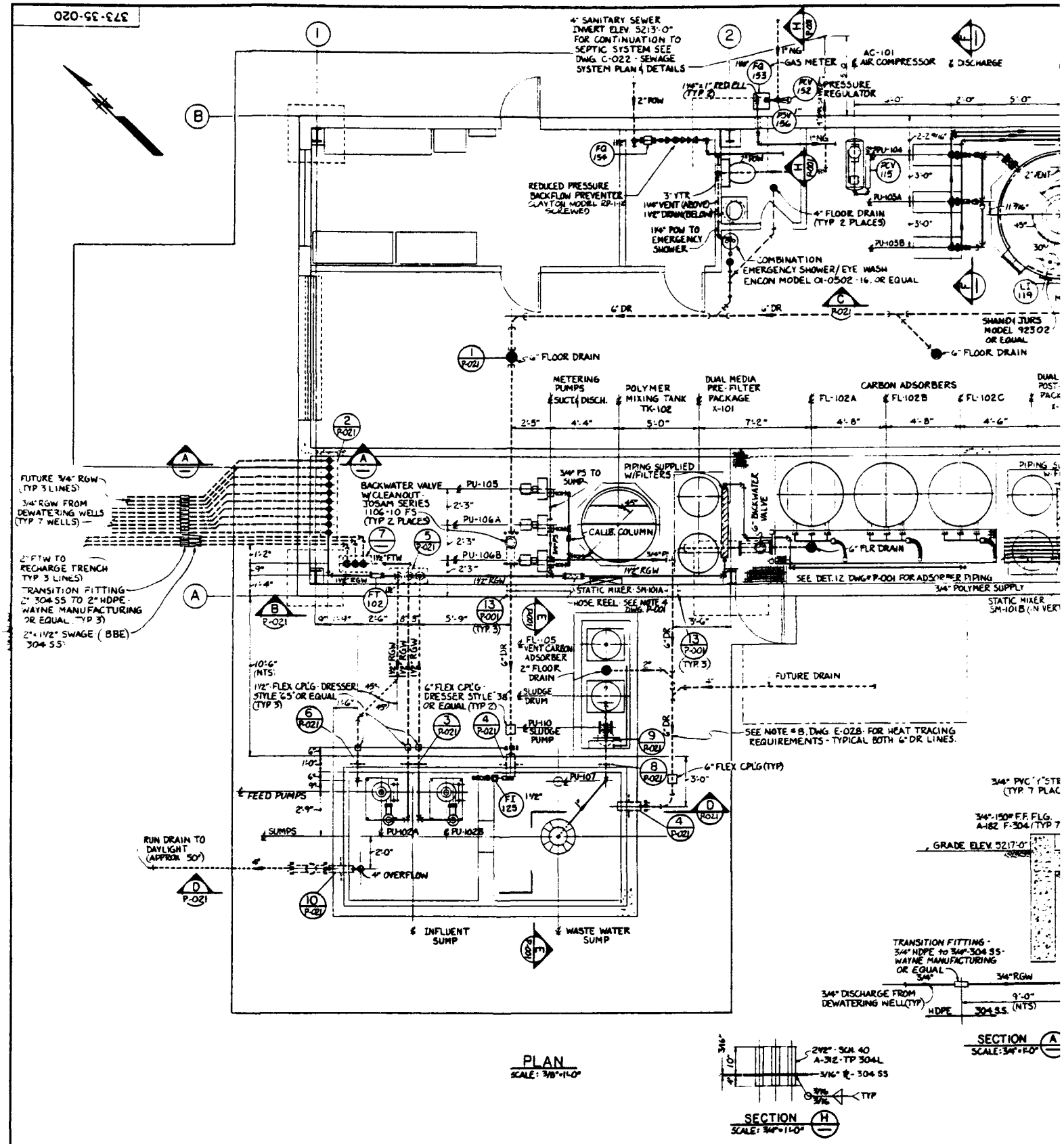
NOTES:

1. SHOP COAT ENTIRE STRUCTURE WITH EPOXY. SEE SPEC 33-0914 (EXCLUDING THREADS & FLANGE SURFACES.)
2. DIMENSIONS MAY VARY UPON EQUIPMENT VENDOR SELECTION.
3. MATERIAL OF CONSTRUCTION: A-36 STEEL - SEE SPEC 34-0503.
4. FRAME TO BE ALL WELDED CONST. CORNERS TO BE MITERED, BLOCKED, OR CUT TO FIT AS REQUIRED. NO WELDING OF TOP FLANGES.
5. PROVIDE 1" Ø HOLES AT 3'-0"± FOR PLUG WELDING COVER PLATE TO STEEL FRAME. (SEE STL. FRAMING PLAN.)
6. SLIDE RAILS TO BE ATTACHED TO SUMP COVER BY FIELD.

CLAMPS FOR PUMP ONLY

DATE
4/8
4/89
5/89

DATE



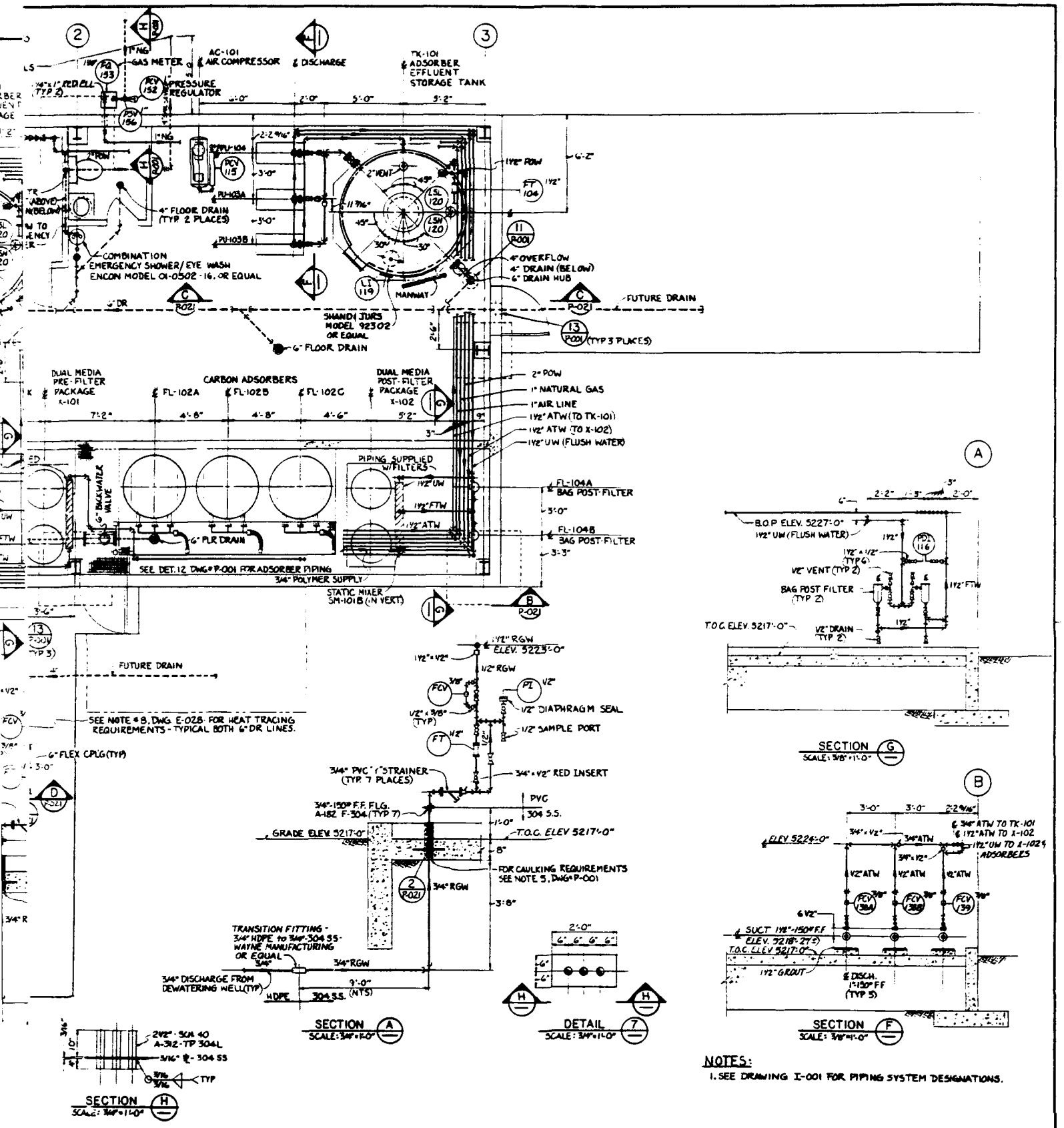
REFERENCE DWGS	
M-20	TREATMENT PLANT GENERAL ARRANGEMENT
S-023	FOUNDATION PLAN SECT & DETAILS
P-021	PIPING & PLUMBING, SECT. & DETAILS
I-020	PID
C-003	SITE PLAN
DRAWING NO.	TITLE

REVISIONS				
NO.	BY	DATE	CKD	DESCRIPTION

REVISIONS				
NO.	BY	DATE	CKD	DESCRIPTION
O	DLS	8/22/89	JA	ISSUE FOR CONSTRUCTION TL NO. 039
B	DLS	5/26/89	JT	ISSUE FOR OWNER APPROVAL & IMPLEMENTATION PLAN TL# 045
A	DLS	4/21/89		FOR REVIEW COMMENT TL# 028

APPROVALS			
DEPT	REV	A	B	O
ARCH			JK	JK
CIV/STRL			GB	GB
MECH				
ELECT			VPC	VPC
INSTR			RGM	RGM
PIPING		DLS	DLS	DLS
SAFETY			JC	JC
DEPT MGR		JK	JK	D
PROJECT		RAM	RAM	RAM

SCALE
DRAWN BY
DESIGNED
CHECKED
REV

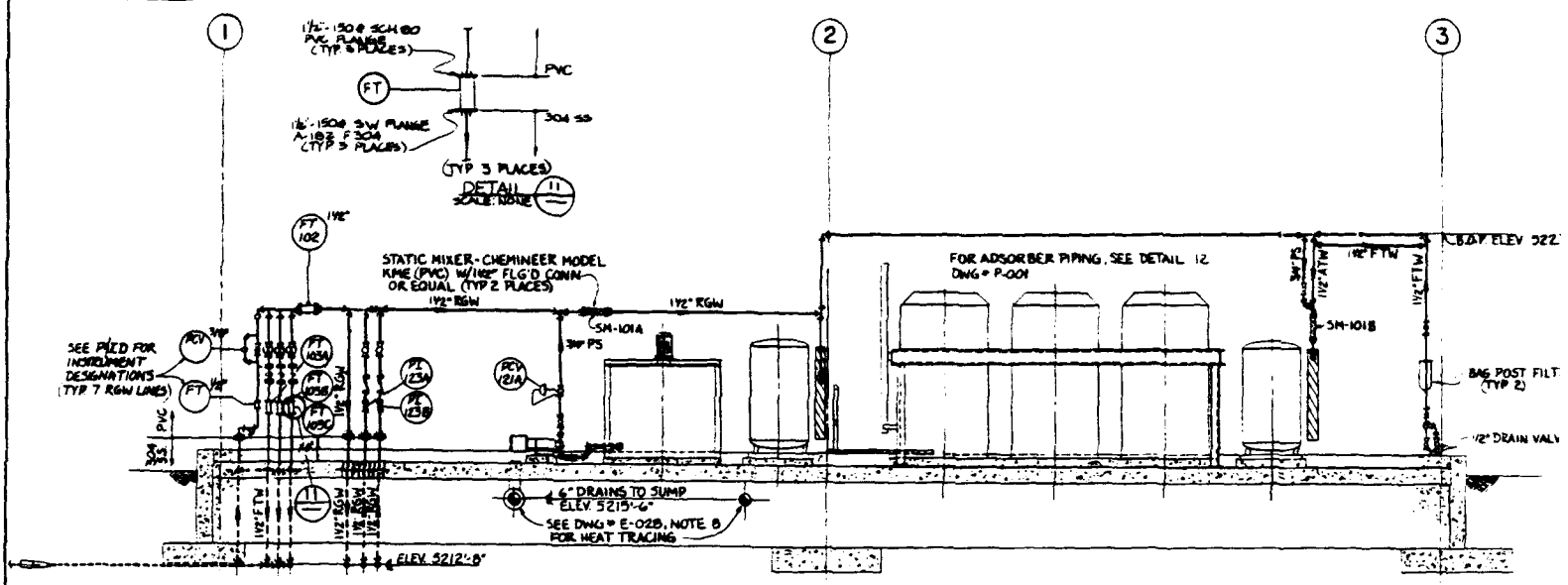


NOTES:

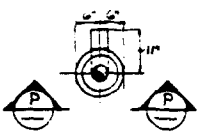
1. SEE DRAWING I-001 FOR PIPING SYSTEM DESIGNATIONS.

| | | |

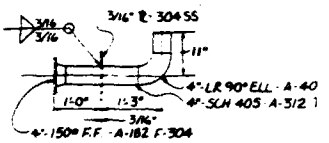
373-35-021



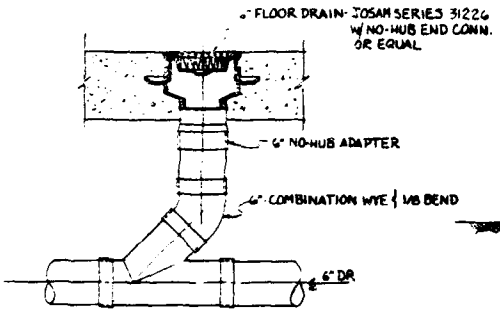
SECTION B
SCALE: 3/8" = 1'-0"
P-020



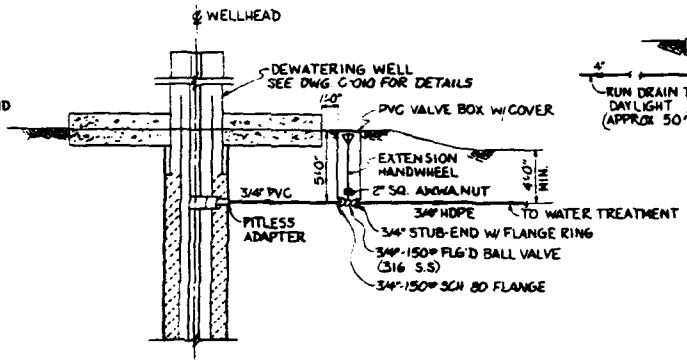
DETAIL 10
SCALE: 3/4" = 1'-0"
P-020



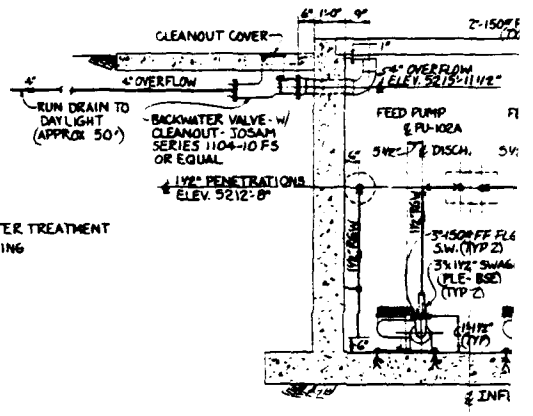
SECTION P
SCALE: 3/4" = 1'-0"

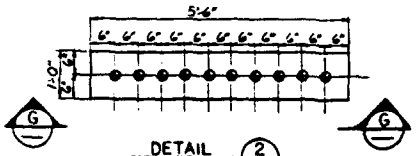


DETAIL 1
SCALE: NONE
P-020



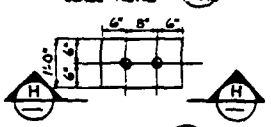
TYPICAL 7 DEWATERING WELLS



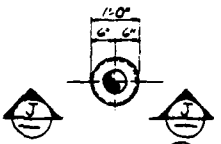


DETAIL 2
SCALE: 3/4" = 1'-0"
P-020

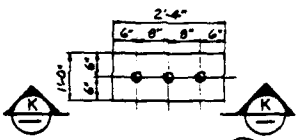
SECTION D
SCALE: NONE
P-020



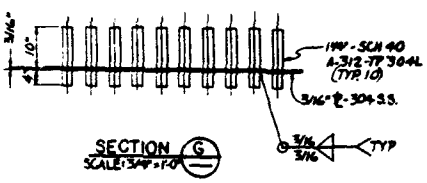
DETAIL 3
SCALE: 3/4" = 1'-0"
P-020



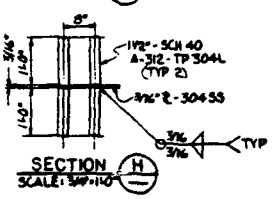
DETAIL 4
SCALE: 3/4" = 1'-0"
P-020



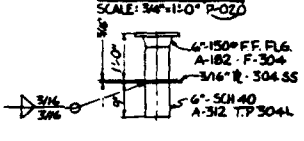
DETAIL 5
SCALE: 3/4" = 1'-0"
P-020



SECTION G
SCALE: 3/4" = 1'-0"

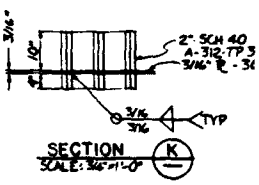


SECTION H
SCALE: 3/4" = 1'-0"



TYPICAL 2 PLACES

SECTION J
SCALE: 3/4" = 1'-0"



SECTION K
SCALE: 3/4" = 1'-0"

DRAWING NO.	TITLE
P-001	MISC. PIPING SECTIONS & DETAILS
P-020	PIPING & PLUMBING PLANS
I-020	P&ID
C-009	SITE PLAN

REFERENCE DWG

NO.	BY	DATE	CKD	DESCRIPTION

REVISIONS

NO.	BY	DATE	CKD	DESCRIPTION
C	JB	8/22/89	JC	ISSUE FOR CONSTRUCTION T.L. NO. 047
B	DLS	9/26/89	SF	ISSUE FOR OWNER APPROVAL & IMPLEMENTATION PLAN T.L. # 045
A	DLS	4/21/89		ISSUE FOR REVIEW & COMMENT T.L. # 028

REVISIONS

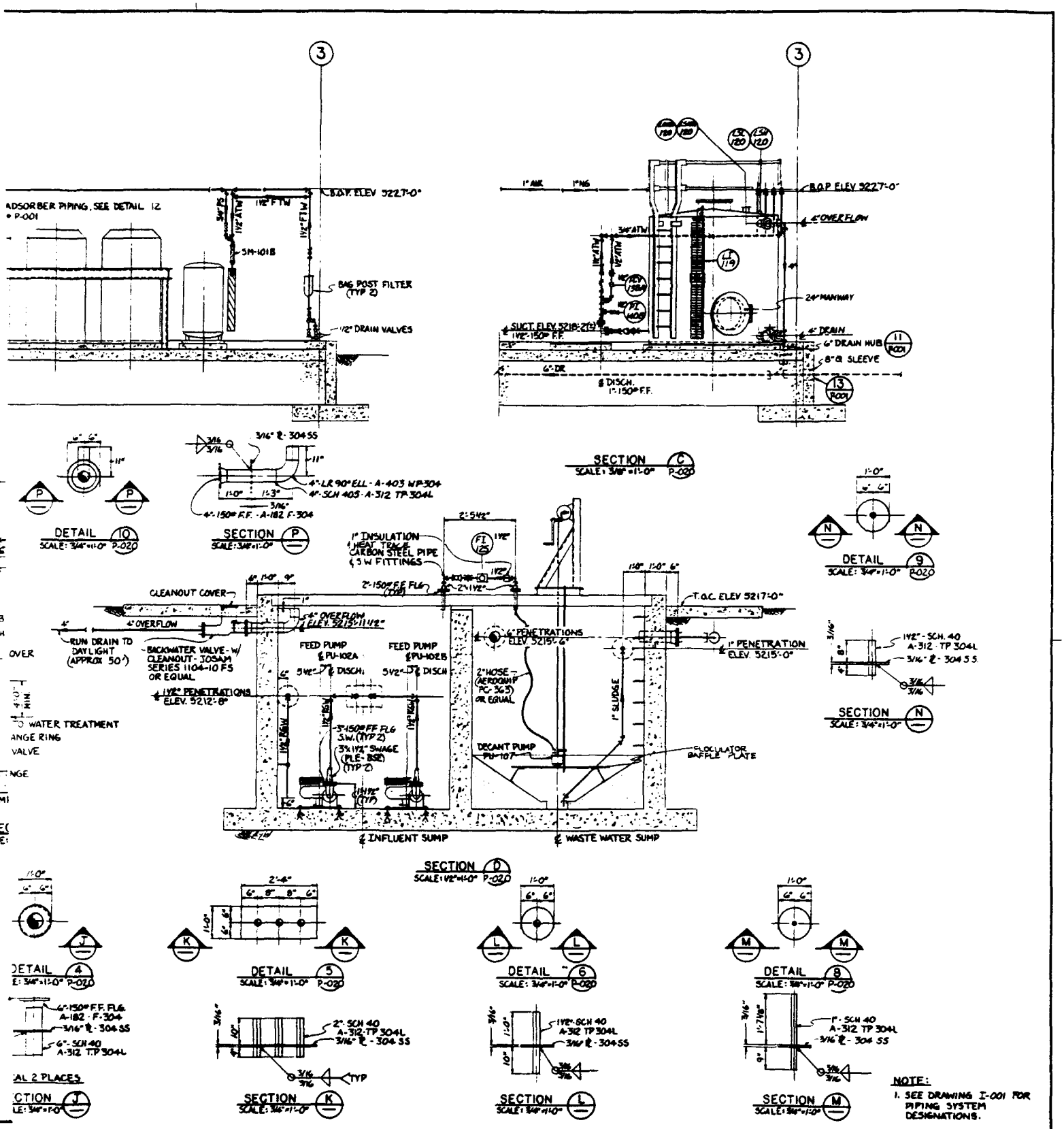
DEPT	REV	A	B	C
MECH			JC	JC
CIV/STRL			SF	SF
ELECT			VAC	VAC
INSTR			JC	JC
PIPING		DLS	DLS	DLS
SAFETY			JC	JC
DEPT MGR			JC	JC
PROJECT			JC	JC

APPROVALS

SCALE A
DRAWN BY
DESIGNED
CHECKED
REV.

1

2

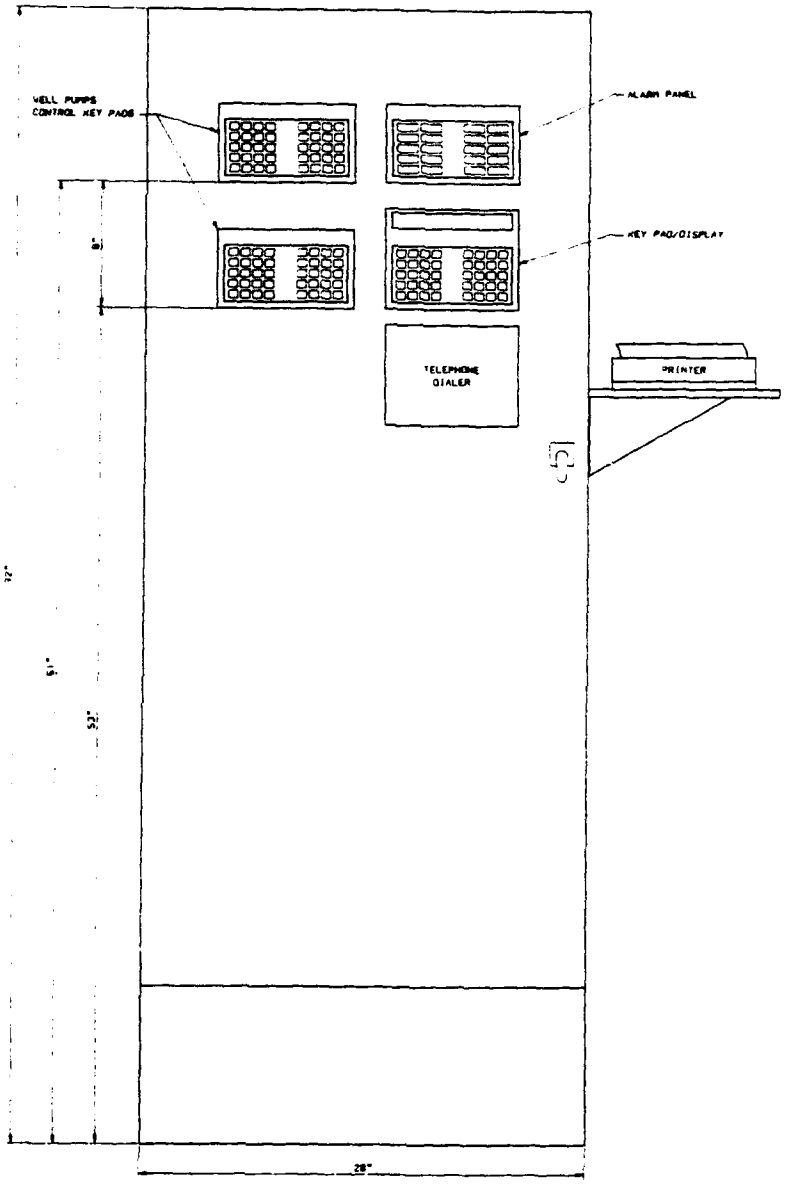


NOTE:
1. SEE DRAWING I-001 FOR PIPING SYSTEM DESIGNATIONS.

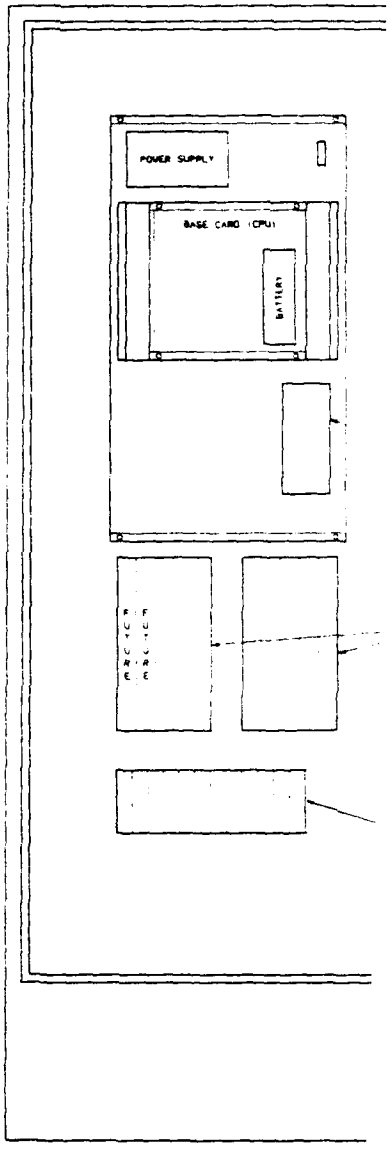
SCALE AS NOTED	DATE	MORRISON-KNUDSEN ENGINEERS, INC.	SHELL OIL COMPANY ROCKY MOUNTAIN ARSENAL REMEDIATION PROJECT INTERIM RESPONSE ACTION FINAL DETAILED DESIGN	WORK ORDER 2127	30 of 42
DRAWN BY DLS	4/10/89			DRAWING NO. 373-35-021	
DESIGNED BY DLS	4/10/89		DRAWING TITLE BASIN A NECK IRA PIPING & PLUMBING SECTIONS & DETAILS	REFERENCE NO. P-021	REV 0
CHECKED BY					
CLIENT APPROVALS					
REV	BY	DATE			

3

373-37-020



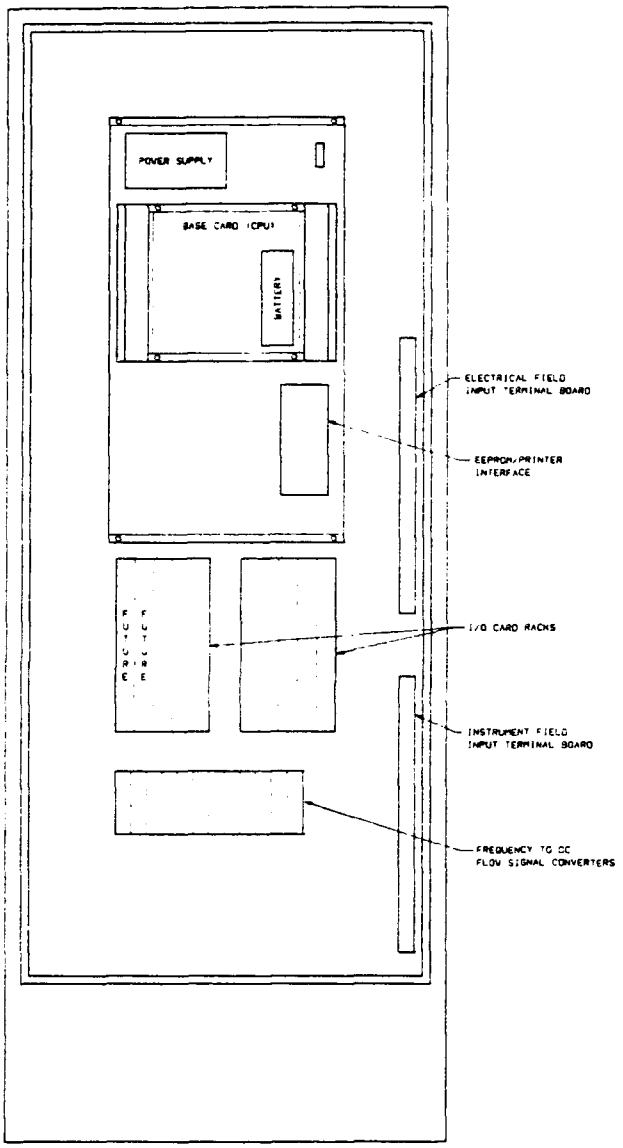
FRONT VIEW



VIEW W/O DOOR

REFERENCE DWGS	REVISIONS	REVISIONS	APPROVALS
DRAWING NO. TITLE	NO. BY DATE CKD DESCRIPTION	NO. BY DATE CKD DESCRIPTION	DEPT REV A 0
		0 JMC 8/22/86 JMC ISSUED FOR CONSTRUCTION TL#0497	ARCH
		A JMC 5/26/87 JMC ISSUED FOR APPROVAL & I.P. TL#0498	CIV/STRL
			MECH
			ELECT JMC JMC
			INSTM
			PIPING
			SAFETY
			DEPT MGR JEMP
			PROJECT

SCALE
DRAWN
DESIGN
CHECKED
REV



VIEW W/O DOOR

NOTES:

1. THIS PANEL CONFIGURATION IS BASED ON A PROPOSAL BY AUTOCON FOR A MICROCFT CLASS 9500 PUMP CONTROLLER AND MONITOR.
2. FOR EXTERNAL CONNECTION REFER TO DRAWING #E-024, "ELECTRICAL & CONTROL WIRING DIAGRAM."
3. TERMINAL BLOCKS SHALL BE ALLEN-BRADLEY #1492-CA1 OR APPROVED EQUAL.

DEPT REV A	SCALE 1/4"=1"	DATE	MORRISON-KNUDSEN ENGINEERS, INC.
ARCH	DRAWN BY	08/23/89	
CIV/STRL	DESIGNED BY		
MECH	CHECKED BY		
ELECT	CLIENT APPROVALS		
INSTM	REV	BY	DATE
PIPING			
SAFETY			
DEPT MGR			
PROJECT			

APPROVALS

SHELL OIL COMPANY
ROCKY MOUNTAIN ARSENAL REMEDIATION PROJECT
INTERIM RESPONSE ACTION FINAL DETAILED DESIGN

DRAWING TITLE
BASIN A NECK IRA
INSTRUMENT CONTROL PANEL
LAYOUT

WORK ORDER NO. 2127

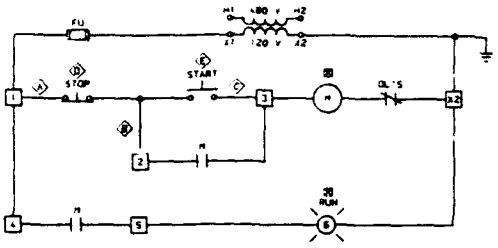
30 of 42

DRAWING NO. 373-37-020

REFERENCE NO. E-020

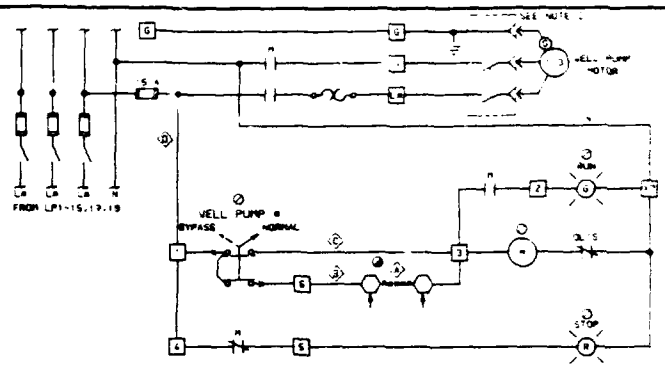
REV C

373-37-021



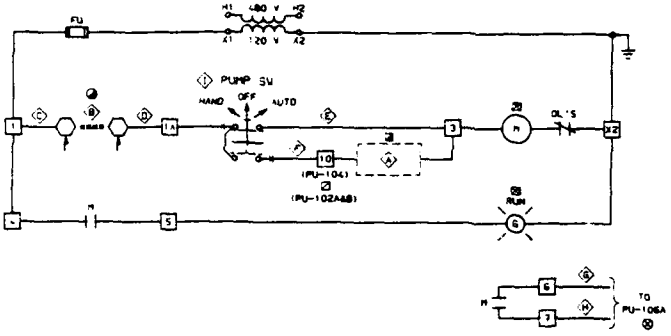
EQPT NO.	EQUIPMENT DISCRIPTION	WIRE NO.S			DEVICE LOCATION	
		(A)	(B)	(C)	(D)	(E)
MX-101	FLOCCULATOR	101-1	101-2	101-3	☑	☑
MX-102	POLYMER MIXER	102-1	102-2	102-3	☑	☑
PU-108	DRUM PUMP	108-1	108-2	108-3	☑	☑

480 V FVNR STARTER
(START/STOP PUSHBUTTON STATION)



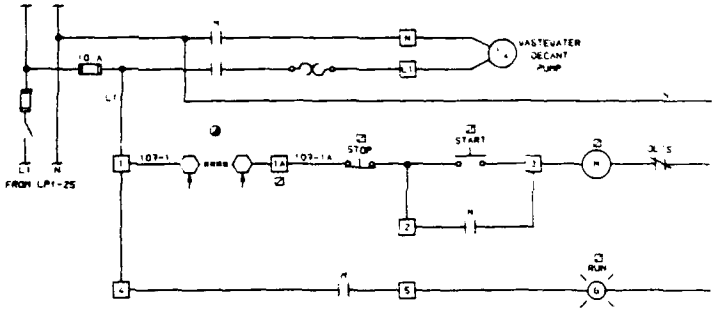
EQPT NO.	EQUIPMENT DESCRIPTION	DEVICE	WIRE NO.S		
		(A)	(B)	(C)	(D)
PU-101A	WELL PUMP A	ICP-100 OUTPUT	101A-6	101A-3	-1
PU-101B	WELL PUMP B		101B-6	101B-3	-2
PU-101C	WELL PUMP C		101C-6	101C-3	-3
PU-101D	WELL PUMP D		101D-6	101D-3	-1
PU-101E	WELL PUMP E		101E-6	101E-3	-2
PU-101F	WELL PUMP F		101F-6	101F-3	-3
PU-101G	WELL PUMP G		101G-6	101G-3	-1

120 V SINGLE-PHASE STARTER
(BYPASS-NORMAL CONTROL DEVICE)

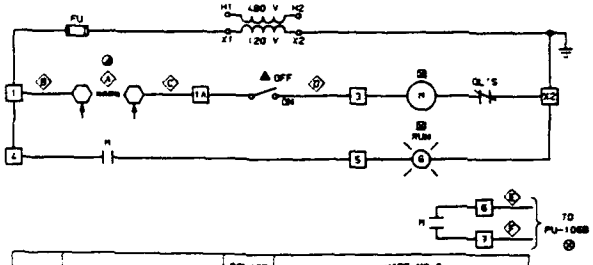


EQPT NO.	EQUIPMENT DISCRIPTION	DEVICE		WIRE NO.						FIELD LOCATION
		(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)
PU-102A	FEED PUMP	SL-124	ICP-100 OUTPUT	102A-1	102A-1A	102A-3	102A-10	106A-4	106A-3	☑
PU-102B	FEED PUMP	SL-124		102B-1	102B-1A	102B-3	102B-10	106A-4	106A-3	☑
PU-104	UTILITY WATER PUMP	E-101 E-102		104-1	104-1A	104-3	104-10	—	—	▲

480 V FVNR STARTER
(HAND-OFF-AUTO CONTROL STATION)

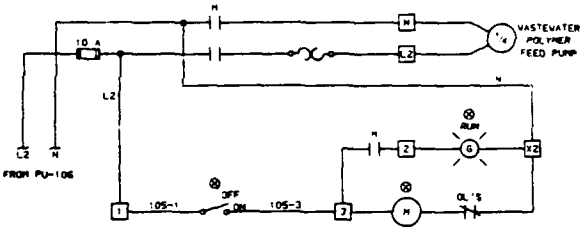


WASTEWATER DECANT PUMP PU-107
(120 V SINGLE-PHASE STARTER)



EQPT NO.	EQUIPMENT DISCRIPTION	DEVICE	WIRE NO.S				
		(A)	(B)	(C)	(D)	(E)	(F)
PU-103A	POST-FILTER FEED PUMP	ICP-100 OUTPUT	103A-1	103A-1A	103A-3	106B-4	106B-3
PU-103B	POST-FILTER FEED PUMP		103B-1	103B-1A	103B-3	106B-4	106B-3

480 V FNVR STARTER
(OFF-ON CONTROL DEVICE)



WASTEWATER POLYMER FEED PUMP PU-105
(120 V SINGLE-PHASE STARTER)

REFERENCE DWGS

DRAWING NO.	TITLE
I-020	PROCESS & INSTRUMENTATION DIAGRAM (P&ID)
E-024	ELECTRICAL AND CONTROL WIRING DIAGRAM
E-010	WELLS POWER & CONTROL LAYOUT
E-002	ELECTRICAL ONE-LINE DIAGRAM

REVISIONS

NO.	BY	DATE	CKD	DESCRIPTION

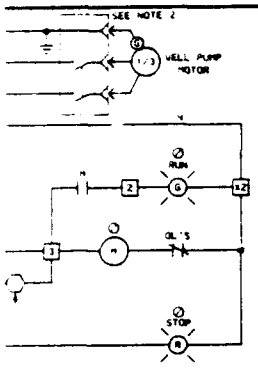
REVISIONS

NO.	BY	DATE	CKD	DESCRIPTION
0	JMC	08/22/89	JMC	ISSUED FOR CONSTRUCTION TL8047
B	JMC	05/26/89	JMC	ISSUED FOR IMPLEMENTATION PLAN TL8045
A	JMC	05/12/89	JMC	ISSUED FOR REVIEW & COMMENTS TL8040

APPROVALS

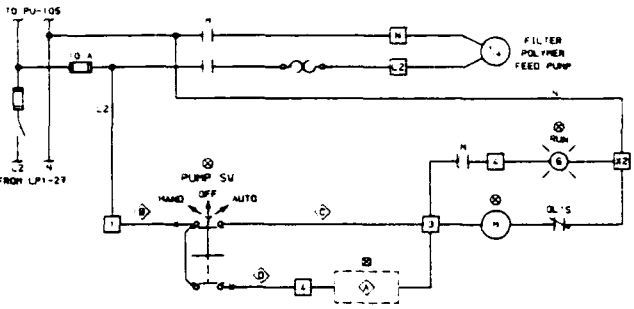
DEPT	REV	A	B	0
ARCH			DOL	
CIV/STRL			CGV	
MECH			JFT	
ELECT		JMC	JMC	
INSTR			JEM	
PIPING			DLS	DLS
SAFETY			JL	
DEPT MGR		JEM	JEM	
PROJECT		GMB	JRM	

SCALE
DRAWN BY
DESIGNED
CHECKED
REV



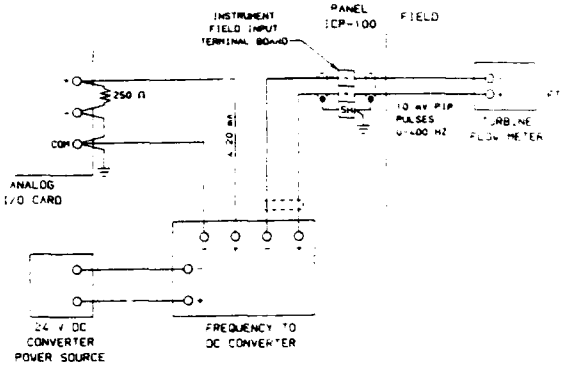
WIRE NO.S		
B)	C)	D)
101A-6	101A-3	L1
101B-6	101B-3	L2
101C-6	101C-3	L3
101D-6	101D-3	1
101E-6	101E-3	L4
101F-6	101F-3	L3
101G-6	101G-3	L1

STARTER
(OL DEVICE)

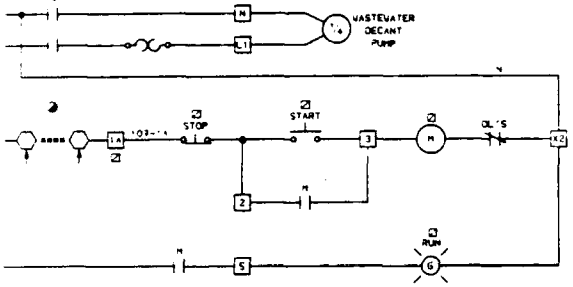


EQPT NO.	EQUIPMENT DESCRIPTION	DEVICE A	WIRE NO.S B	C	D
PU-106A	FILTER POLYMER FEED PUMP	HIPU-102A1 / HIPU-102B1	106A-1	106A-3	106A-4
PU-106B	FILTER POLYMER FEED PUMP	HIPU-103A1 / HIPU-103B1	106B-1	106B-3	106B-4

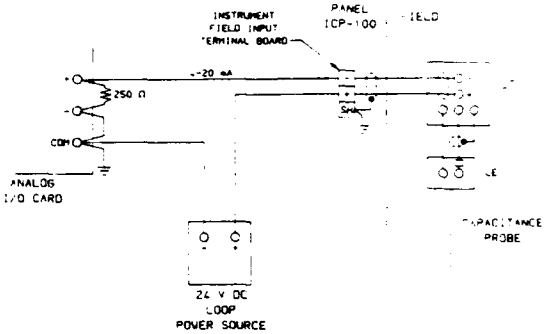
120 V SINGLE-PHASE STARTER
(H-O-A CONTROL DEVICE)



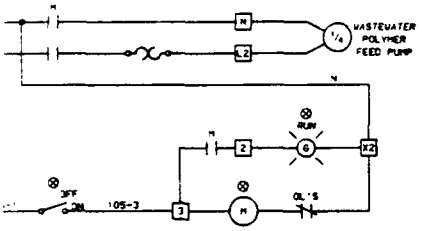
TYPICAL TURBINE FLOW TRANSMITTER LOOP DIAGRAM



WASTEWATER DECANT PUMP PU-107
(120 V SINGLE-PHASE STARTER)



TYPICAL DREXELBROOK WELL LEVEL TRANSMITTER LOOP DIAGRAM



WASTEWATER POLYMER FEED PUMP PU-105
(120 V SINGLE-PHASE STARTER)

LEGEND:

- ☑ - ECP-102 MOUNTED DEVICE
- ◪ - FIELD MOUNTED DEVICE
- ◐ - MICROPROCESSOR OR COMPUTER BASED SYTEM, OUTPUT IN ICP-100
- ▲ - ECP-104 MOUNTED DEVICE
- ⊗ - ECP-103 MOUNTED DEVICE
- ⊠ - MCC MOUNTED DEVICE
- ⊘ - ECP-105 MOUNTED DEVICE
- ⊞ - RING TERMINAL IN MOTOR STARTER

NOTES:

1. CONTRACTOR SHALL CONFIRM ELECTRICAL DESIGN BASED ON ACTUAL PURCHASED EQUIPMENT PRIOR TO CONSTRUCTION.
2. SWITCHED RECEPTACLE WITH PLUG IS STAHL #8675/11-308. REFER TO DRAWING E-010 FOR MORE DETAILS.

DEPT	REV	A	B	C
ARCH			DOL	
CIV/STRL			CGV	
MECH			JFT	
ELECT		JMC	JMC	JMC
INSTM			JEM	
PIPING			DLS	DLS
SAFETY			JC	
DEPT MGR			JEM	JEM
PROJECT			GMB	JRH

APPROVALS

SCALE	NONE	DATE
DRAWN BY	ajo	06/06/89
DESIGNED BY	JEM	06/06/89
CHECKED BY	JMC/GMB	06/11/89
CLIENT APPROVALS		
REV	BY	DATE

MORRISON-KNUDSEN ENGINEERS, INC.

SHELL OIL COMPANY
ROCKY MOUNTAIN ARSENAL REMEDIATION PROJECT
INTERIM RESPONSE ACTION FINAL DETAILED DESIGN

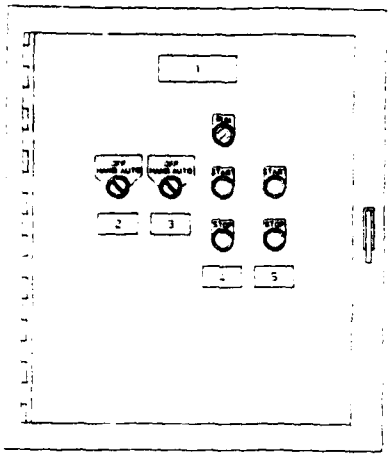
DRAWING TITLE
BASIN A NECK IRA
ELECTRICAL CONTROL SCHEMATICS

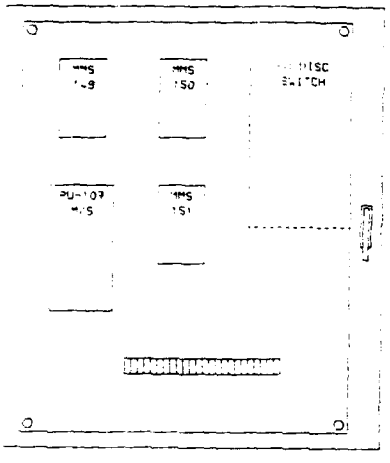
WORK ORDER 2127 — 30 of 42
DRAWING NO. 373-37-021
REFERENCE NO. E-021 — REV 0

MK2127.00-33-021

373-37-022

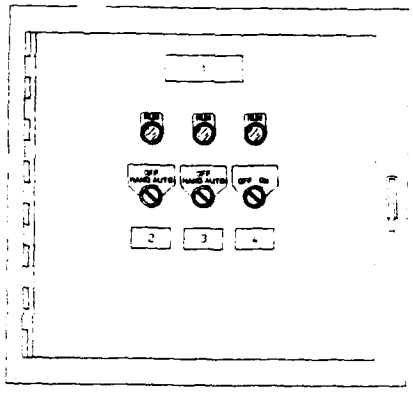
ECP-102

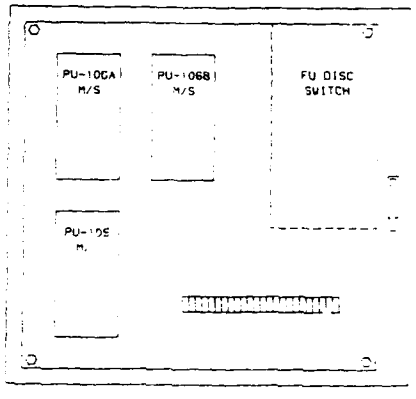




QTY	DESCRIPTION
1	HOFFMAN A-30HS250BLP W/A30P24 & A-8 DS30 FUSED DISC SW
3	MOTOR MOISTURE SENSOR(MMS) SUPPLIED BY MOTOR MANUFACTURER & INSTALLED BY CONTRACTOR
2	ALLEN-BRADLEY 3-POSITION SEL SW. 800H-JR4A & 'H-O-A' PLATE (SPRING RETURN FROM HAND)
1	ALLEN-BRADLEY SINGLE-PHASE STARTER, 509-AOXD & FUSE
2	ALLEN-BRADLEY PUSHBUTTONS, 800H-R1A & 'START' PLATE
2	ALLEN-BRADLEY PUSHBUTTONS, 800H-R6A & 'STOP' PLATE
1	ALLEN-BRADLEY INDICATING LT. 800H-PR16G & 'RUN' PLATE
AR	ALLEN-BRADLEY TERMINAL BLOCKS, CAT #1492-CA1
AR	NAMEPLATES: 1 - ECP-102 2 - FEED PUMP PU-102A 3 - FEED PUMP PU-102B 4 - WASTEWATER DECANT PUMP PU-107 5 - FLOCCULATOR MX-101

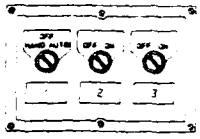
ECP-103





QTY	DESCRIPTION
1	HOFFMAN A-24HS250BLP W/A-24P24 & A-8 DS30 FUSED DISC SW
3	ALLEN-BRADLEY SINGLE-PHASE STARTERS 509-AOXD & FUSE
2	ALLEN-BRADLEY 3-POSITION SEL SW. 800H-JR2A & 'H-O-A' PLATE
1	ALLEN-BRADLEY 2-POSITION SEL SW. 800H-HR2B & 'OFF-ON' PLATE
3	ALLEN-BRADLEY INDICATING LTS. 800H-PR16G & 'RUN' PLATE
AR	ALLEN-BRADLEY TERMINALS, CAT #1492-CA1
AR	NAMEPLATES: 1 - ECP-103 2 - FILTER POLYMER FEED PUMP PU-106A 3 - FILTER POLYMER FEED PUMP PU-106B 4 - WASTEWATER POLYMER FEED PUMP PU-105

ECP-104



QTY	DESCRIPTION
1	HOFFMAN A-1068JFG W/A-8P6
1	ALLEN-BRADLEY 3-POSITION SEL SW. 800H-JR2A & 'H-O-A' PLATE
2	ALLEN-BRADLEY 2-POSITION SEL SW. 800H-HR2B & 'OFF-ON' PLATE
AR	NAMEPLATES: 1 - UTILITY WATER PUMP PU-104 2 - POST FILTER INFLUENT PUMP PU-103A 3 - POST FILTER INFLUENT PUMP PU-103B

REFERENCE DWGS	
E-020	PROCESS & INSTRUMENTATION DIAGRAM(P&ID)
E-028	ELECTRICAL PLAN & DETAILS SHEET #2
E-024	ELECTRICAL & CONTROL WIRING DIAGRAMS
E-021	ELECTRICAL CONTROL SCHEMATICS
E-002	ELECTRICAL ONE-LINE DIAGRAM
DRAWING NO.	TITLE

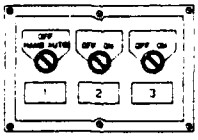
REVISIONS				
NO.	BY	DATE	CKD	DESCRIPTION

REVISIONS				
D	JMC	8/22/89	JMC	ISSUED FOR CONSTRUCTION TL# 047
B	JMC	5/26/89	JMC	ISSUED FOR APPROVAL & IP-TL#045
A	JMC	05/12/89	JMC	ISSUED FOR REVIEW & COMMENTS.TL#040
NO.	BY	DATE	CKD	DESCRIPTION

APPROVALS			
DEPT	REV	A	B	D
ARCH			
CIV/STRL			
MECH			
ELECT	JMC	JMC	JMC
INSTM			
PIPING		DLS	DLS
SAFETY		JC	JC
DEPT MGR		JEM	JEM
PROJECT		GJB	JEM

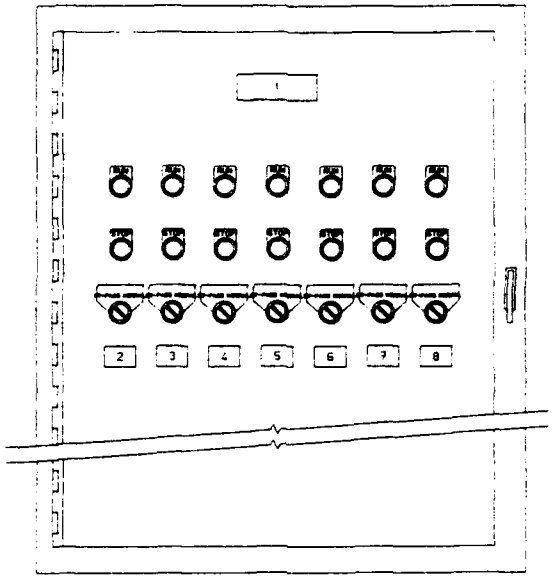
SCALE
DRAWN B
DESIGNE
CHECKED
REV

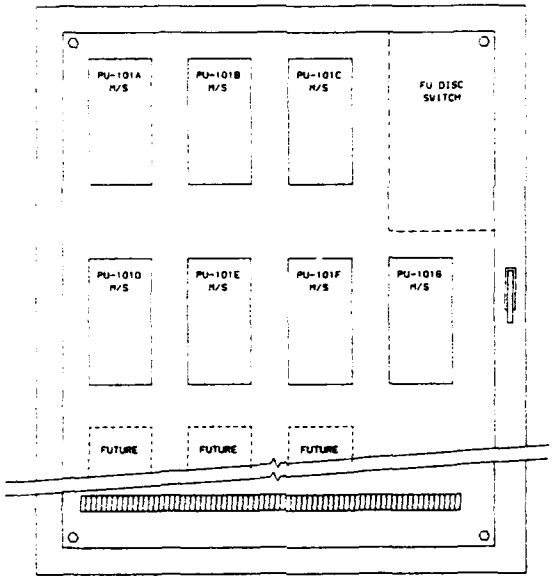
ECP-104 ▲



QTY	DESCRIPTION
1	HOFFMAN A-1068JFS W/A-BPS
1	ALLEN-BRADLEY 3-POSITION SEL SW. 800H-JR2A & 'H-O-A' PLATE
2	ALLEN-BRADLEY 2-POSITION SEL SW. 800H-HR2B & 'OFF-ON' PLATE
AR	NAMEPLATES: 1 - UTILITY WATER PUMP PU-104 2 - POST FILTER INFLUENT PUMP PU-103A 3 - POST FILTER INFLUENT PUMP PU-103B

ECP-105 ⊘





QTY	DESCRIPTION
1	HOFFMAN A-42HS3112LP W/A42P30 & A-8 DS30 FU DISC SW
7	ALLEN-BRADLEY SINGLE-PHASE STARTERS 509-AOXD & FUSE
7	ALLEN-BRADLEY INDICATING LTS. 800H-PR16G & 'RUN' PLATE
7	ALLEN-BRADLEY INDICATING LTS. 800H-PR16R & 'STOP' PLATE
7	ALLEN-BRADLEY 2-POSITION SEL SW. 800H-HR4B. 'BYPASS'-'NORMAL' PLATE & SPRING RETURN FROM 'BYPASS' TO 'NORMAL'
AR	ALLEN-BRADLEY TERMINAL BLOCKS. CAT 01432-CA1
AR	NAMEPLATES: 1 - ECP-105 2 - WELL PUMP PU-101A 3 - WELL PUMP PU-101B 4 - WELL PUMP PU-101C 5 - WELL PUMP PU-101D 6 - WELL PUMP PU-101E 7 - WELL PUMP PU-101F 8 - WELL PUMP PU-101G

NOTES:

1. CONTRACTOR SHALL CONFIRM ELECTRICAL DESIGN BASED ON ACTUAL PURCHASED EQUIPMENT PRIOR TO CONSTRUCTION AND FABRICATION.

APPROVALS		
DEPT REV	A	
ARCH		
CIV/STRL		
MECH		
ELECT	JRC	
INSTR		
PIPING		
SAFETY		
DEPT MGR	JEM	
PROJECT	SJB	

SCALE	NONE	DATE
DRAWN BY	mjm	05/11/89
DESIGNED BY	JRC	05/08/89
CHECKED BY	JRC	05/11/89
CLIENT APPROVALS		
REV	BY	DATE

MORRISON-KNUDSEN ENGINEERS, INC.

SHELL OIL COMPANY
ROCKY MOUNTAIN ARSENAL REMEDIATION PROJECT
INTERIM RESPONSE ACTION FINAL DETAILED DESIGN

DRAWING TITLE
BASIN A NECK IRA
ELECTRICAL CONTROL PANEL
LAYOUT

WORK ORDER NO. 2127

30 x 42

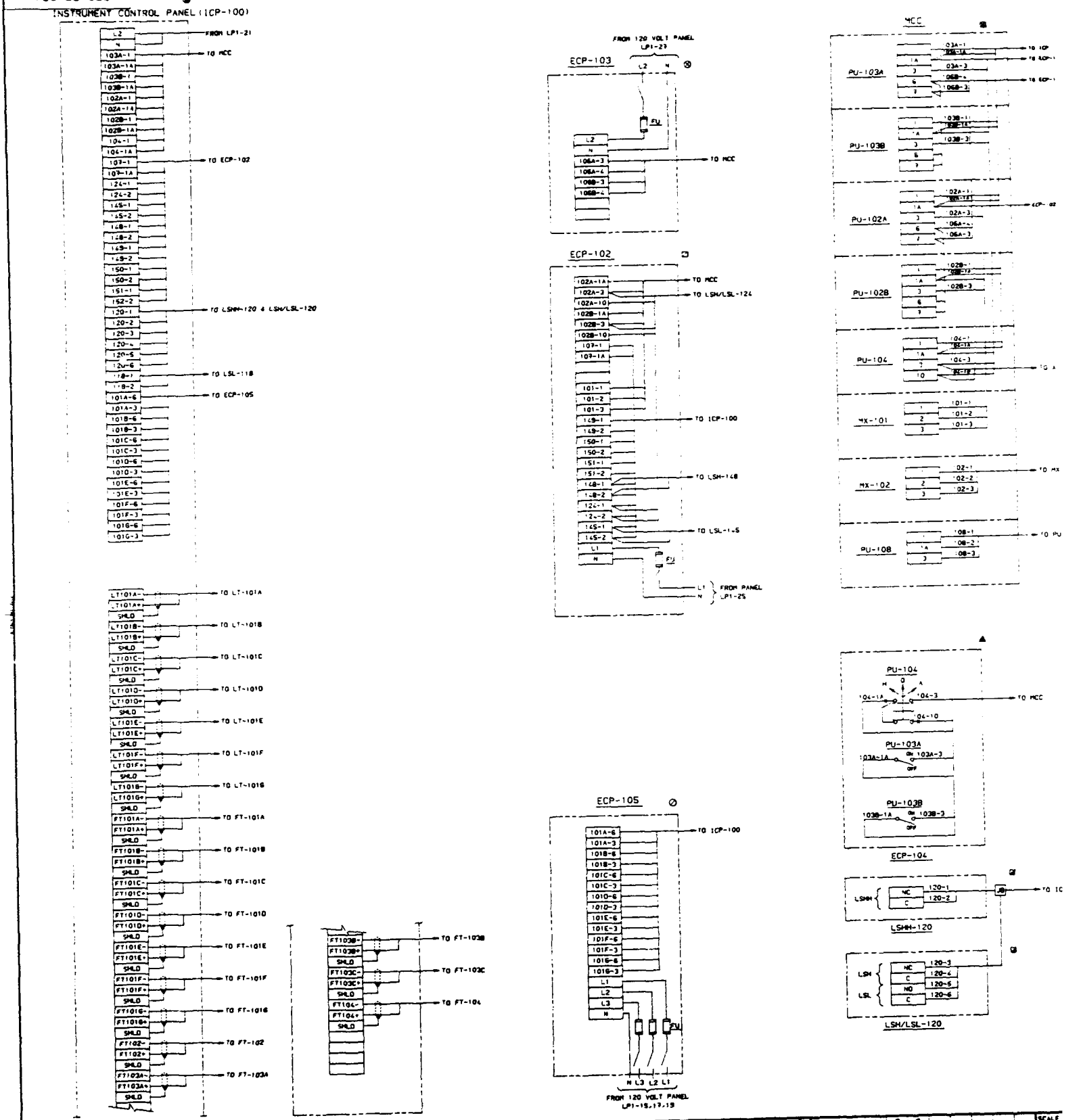
DRAWING NO. 373-37-022

REFERENCE NO. E-022

REV 0

HR2127.73-37-022

373-37-024



REFERENCE DWGS	
E-020	ELECTRICAL PLAN & DETAILS SHEET 2
I-020	PROCESS & INSTR DIAGRAM (P&ID)
E-002	ELECTRICAL ONE-LINE DIAGRAM
E-021	ELECTRICAL CONTROL SCHEMATICS
DRAWING NO.	TITLE

REVISIONS				
NO.	BY	DATE	CKD	DESCRIPTION

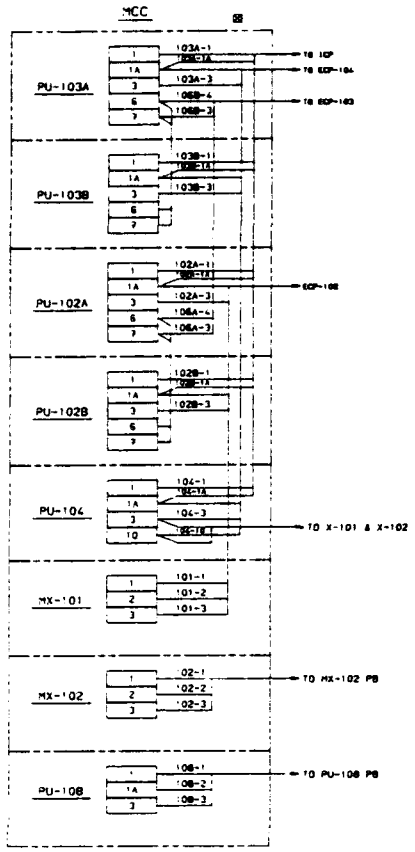
REVISIONS				
0	JMC	9/22/88	JMC	ISSUED FOR CONSTRUCTION TL-8045
B	JMC	5/26/88		ISSUED FOR APPROVAL & IP-TL8045
A	EB	5/12/88	JMC	ISSUED FOR REVIEW & COMMENTS TL8040
NO.	BY	DATE	CKD	DESCRIPTION

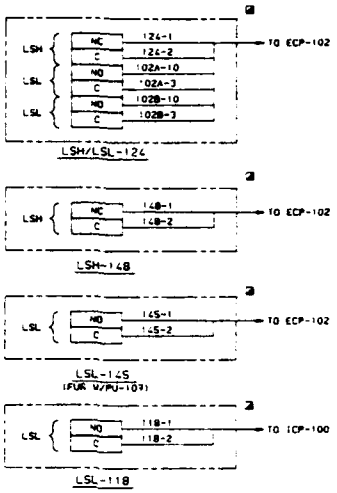
APPROVALS	REV	A	B	0
DEPT				
ARCH				
CIV/STRL				
MECH				
ELECT	JMC	JMC	JMC	
INSTR		JEM	JEM	
PIPING		DLS	DLS	
SAFETY		JC	JC	
DEPT MGR	JEM	JEM		
PROJECT	GJB	JRH		

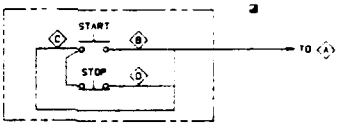
SCALE
DRAWN
DESIGN
CHECKED
REV

1

2

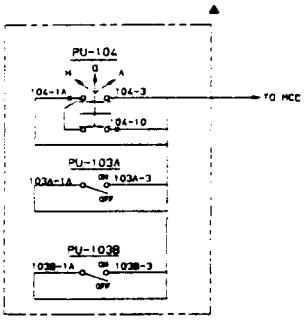




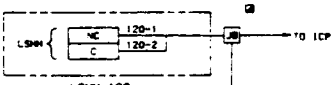


EQUIPMENT NO.	EQUIPMENT	TO (A)	WIRE NUMBERS (B)	(C)	(D)
MX-102	POLYMER MIXER	MCC	102-1	102-2	102-3
PU-108	DRUM PUMP	MCC	108-1	108-2	108-3

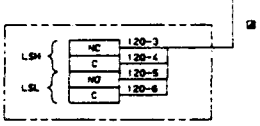
TYPICAL START/STOP PUSHBUTTON STATION



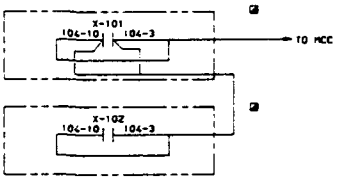
ECP-104



LSHH-120



LSH/LSL-120



BACKWASH CONTROL PANELS

LEGEND:

- ☑ - ECP-102 MOUNTED DEVICE
- ◪ - FIELD MOUNTED DEVICE
- ◐ - MICROPROCESSOR OR COMPUTER BASED SYSTEM, OUTPUT IN ICP-100
- ▲ - ECP-104 MOUNTED DEVICE
- ⊗ - ECP-103 MOUNTED DEVICE
- ⊠ - MCC MOUNTED DEVICE
- ⊘ - ECP-105 MOUNTED DEVICE

NOTES:

1. CONTRACTOR SHALL CONFIRM ELECTRICAL DESIGN BASED ON ACTUAL PURCHASED EQUIPMENT PRIOR TO CONSTRUCTION.

DEPT	REV	A	B	C
ARCH				
CIV/STRL				
MECH				
ELECT		JRC	JRC	JRC
INSTR				
PIPING				
SAFETY				
DEPT MGR		JEN	JEM	
PROJECT		DJB		

APPROVALS

SCALE	NONE	DATE
DRAWN BY	E BENSON	5/5/89
DESIGNED BY	JEN	5/5/89
CHECKED BY	JRC/GHB	5/11/89
CLIENT APPROVALS		
REV	BY	DATE

MORRISON-KNUDSEN ENGINEERS, INC.

SHELL OIL COMPANY
ROCKY MOUNTAIN ARSENAL REMEDIATION PROJECT
INTERIM RESPONSE ACTION FINAL DETAILED DESIGN

DRAWING TITLE
BASIN A NECK IRA
ELECTRICAL & CONTROL
WIRING DIAGRAM

WORK ORDER NO. 2127

30 X 42

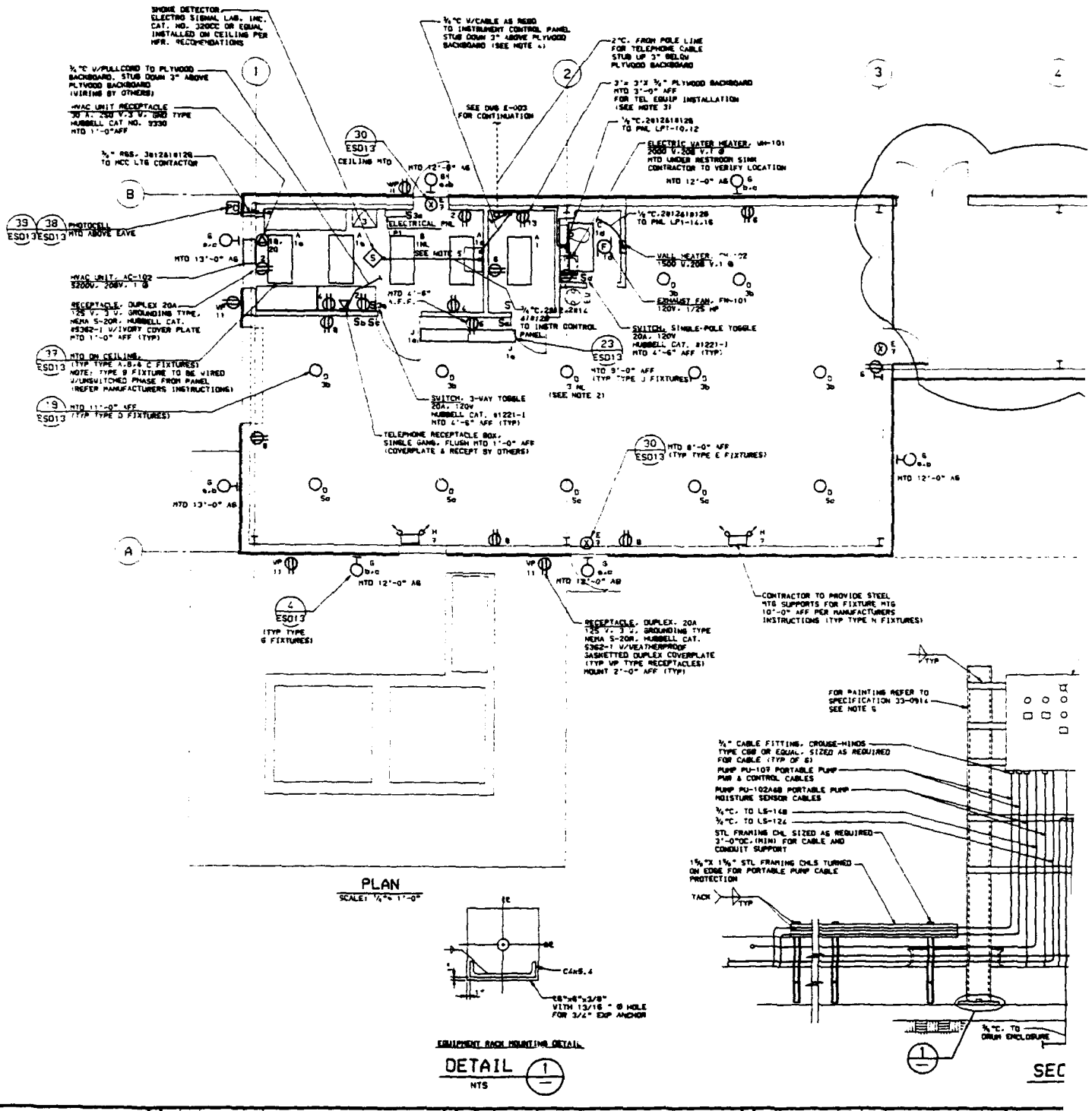
DRAWING NO. 373-37-024

REFERENCE NO. E-024

REV 0

MK2127.00-37-024

373-37-027



REFERENCE DWGS	
M-021	WATER TREATMENT SYSTEM S.A. SECTIONS
M-020	WATER TREATMENT SYSTEM GENERAL ARRNT
A-020	TREATMENT PLAN BLDG PLAN & DETAILS
E-028	ELECTRICAL PLAN & DETAILS, SHEET 2
E-001	ELECTRICAL SYMBOLS
DRAWING NO.	TITLE

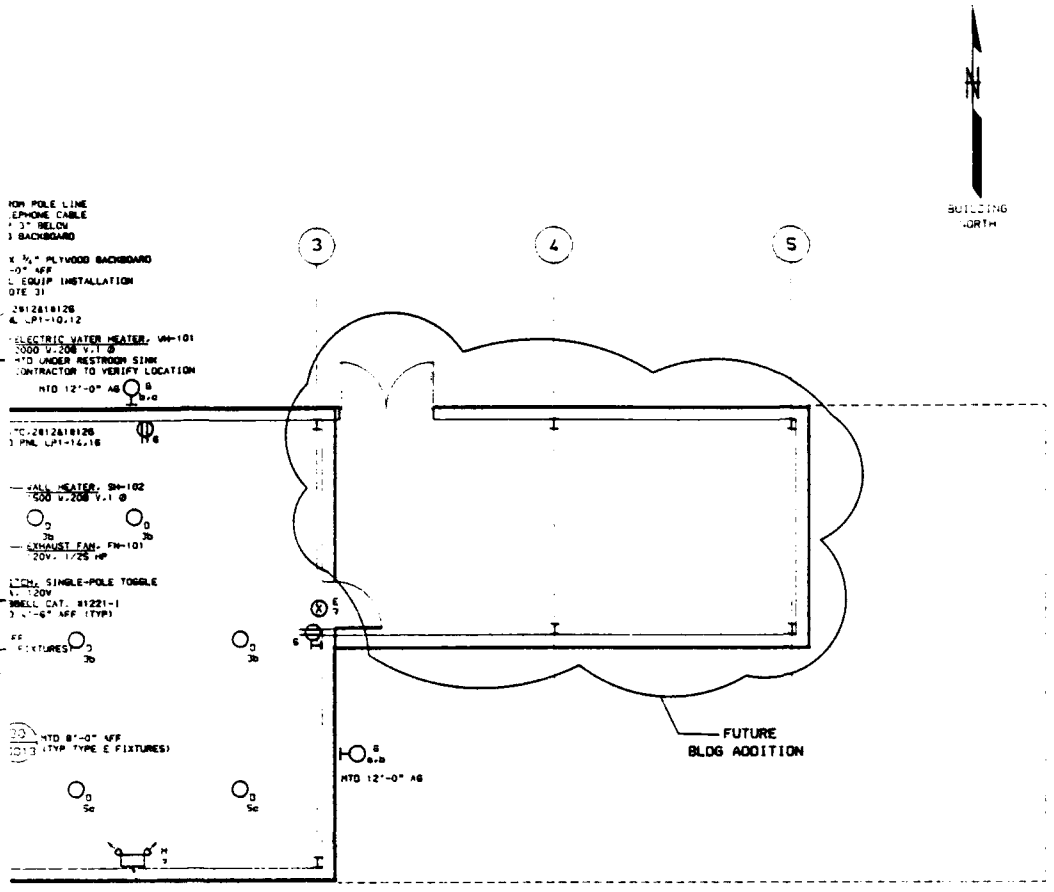
REVISIONS				
NO.	BY	DATE	CKD	DESCRIPTION

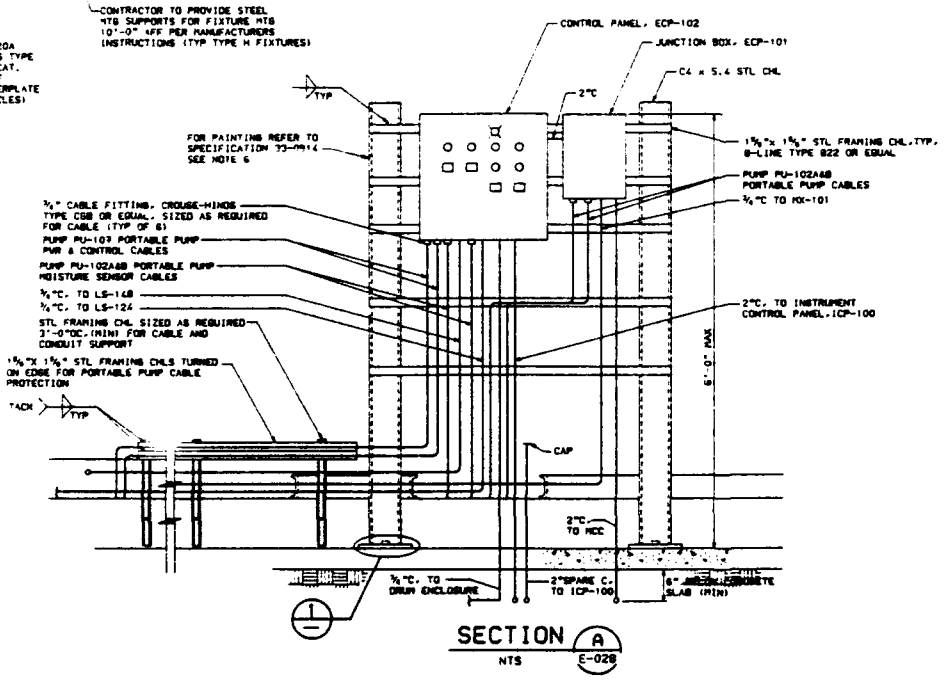
REVISIONS				
D	JMC	8/22/89	JMC	ISSUED FOR CONSTRUCTION TL #047
C	JMC	5/26/89	GMB	ISSUED FOR IMPLEMENTATION PLAN, TL#046
B	JMC	06/12/88	GMB	ISSUED FOR APPROVAL, TL#028
A	JMC	04/21/88	GMB	ISSUE FOR REVIEW & COMMENTS, TL#028
NO.	BY	DATE	CKD	DESCRIPTION

APPROVALS					
DEPT	REV	A	B	C	D
ARCH			DDL		
CIV/STRL			GJB		
MECH			JTF		
ELECT		JMC	JMC	JMC	
INSTR			CED		
PIPING			DS	DLS	DLS
SAFETY				JC	JC
DEPT MGR		MFT	JEM	JEM	
PROJECT		JRH	GJB	JRH	JRH

SCALE	A
DRAWN BY	
DESIGNED BY	
CHECKED BY	
CLIEN	
REV	

1





SECTION A
NTS E-028

NOTES:

1. REFER TO SPECIFICATION 33-1601 FOR LIGHTING FIXTURE SCHEDULE, PANEL SCHEDULE, ELECTRICAL DETAILS AND GENERAL WORKMANSHIP AND MATERIALS.
2. NL - DESIGNATES FIXTURE TO BE WIRED AS A NIGHT LIGHT, BYPASSING THE SWITCH, DIRECTLY TO CIRCUIT BREAKER PANEL.
3. CONTRACTOR TO VERIFY ALL TELEPHONE EQUIPMENT REQUIREMENTS W/LOCAL TELEPHONE UTILITY PRIOR TO CONSTRUCTION. CABLE AND TELEPHONE EQUIPMENT TO BE FURNISHED AND INSTALLED BY OTHERS.
4. CONTRACTOR TO INSTALL CABLE AS REQUIRED BY LOCAL TELEPHONE UTILITY, FROM AUTO DIALER INSTRUMENTATION CONTROL CABINET TO TELEPHONE BACKBOARD. CONTRACTOR TO COORDINATE CONNECTION OF DIALER AND TELEPHONE SYSTEM WITH TELEPHONE UTILITY.
5. TYPE B FIXTURE INCLUDES SELF-CONTAINED BATTERY POWERED EMERGENCY LIGHTS.
6. CONTRACTOR TO PROVIDE PAINTING FOR ALL STRUCTURAL SUPPORT MEMBERS.

APPROVALS					
DEPT	REV	A	B	C	D
ARCH			DDL		
CIV/STRL			GJB		
MECH			JTF		
ELECT		JMC	JMC	JMC	
INSTR			CED		
PIPING			DS	DLS	DLS
SAFETY				JC	
DEPT MGR		MFT	JEM	JEM	
PROJECT		JRH	GJB	JRH	

SCALE	AS NOTED	DATE
DRAWN BY	E. BENSON	6/13/88
DESIGNED BY	JJS	04/19/89
CHECKED BY	JRB	04/21/89
CLIENT APPROVALS		
REV	BY	DATE

MORRISON-KNUDSEN ENGINEERS, INC.

SHELL OIL COMPANY
ROCKY MOUNTAIN ARSENAL REMEDIATION PROJECT
INTERIM RESPONSE ACTION FINAL DETAILED DESIGN

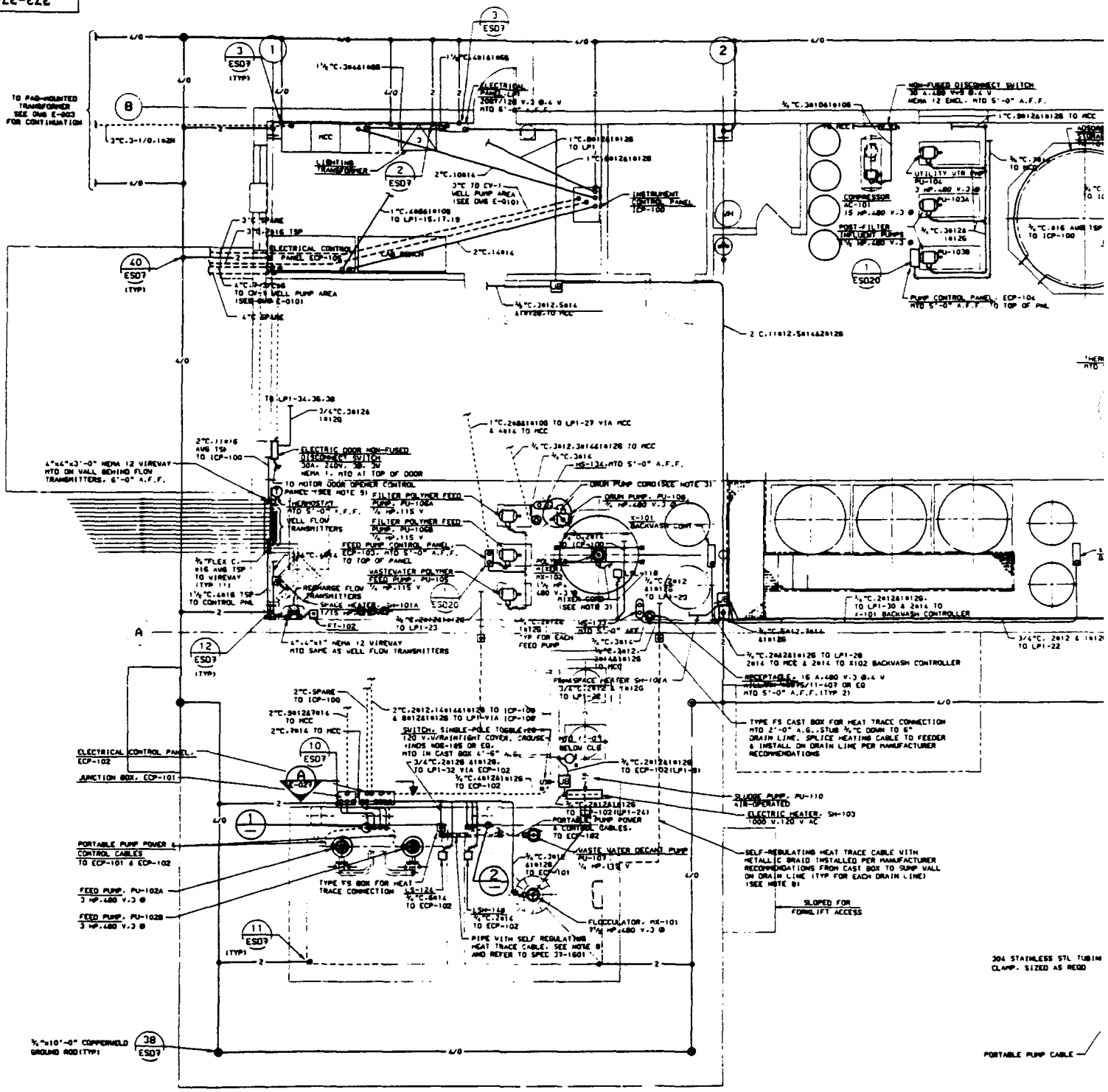
DRAWING TITLE
BASIN A NECK IRA
GROUNDWATER TREATMENT BLDG
ELEC PLAN & DETAILS, SHT #1

WORK ORDER NO. 2127 — 30 of 42
DRAWING NO. 373-37-027
REFERENCE NO. E-027 — REV 0

MK2127.00-37-027

(2)

373-37-028



DRAWING NO.	TITLE
P-020	PIPING & PLUMBING PLAN & DETAILS
M-021	WATER TREATMENT SYSTEM G.A. SECTIONS
M-022	WATER TREATMENT SYSTEM G.A. PLAN
E-002	ELECTRICAL PLAN & DETAILS SHEET 1
E-003	ELECTRICAL CONTROL PANEL LAYOUTS
E-005	ELECTRICAL ONE-LINE DIAGRAM
E-001	ELECTRICAL SYMBOLS

REFERENCE DWGS

NO.	BY	DATE	CKD	DESCRIPTION
0	JMC	08/22/89	JTS	ISSUED FOR CONSTRUCTION TL#047
C	JMC	05/26/89	GHB	ISSUED FOR IMPLEMENTATION PLAN.TL#045
B	EB	05/12/89	GHB	ISSUED FOR APPROVAL.TL#039
A	JMC	04/28/89	GHB	ISSUED FOR CLIENT'S APPROVAL.TL#32

REVISIONS

DEPT	REV	A	B	C	D
ARCH			DOL	DOL	
CIV/STRL			GJB	GJB	
MECH			JTF	JTF	
ELECT		JMC	JMC	JMC	
INSTR			CEO	CEO	
PIPING			DS	DLS	
SAFETY				JC	
DEPT MGR			MFT	JEM	JEM
PROJECT			JRH	GJB	JRH

APPROVALS

SCALE ¼"=
DRAWN BY
DESIGNED BY
CHECKED BY
CLIENT
REV

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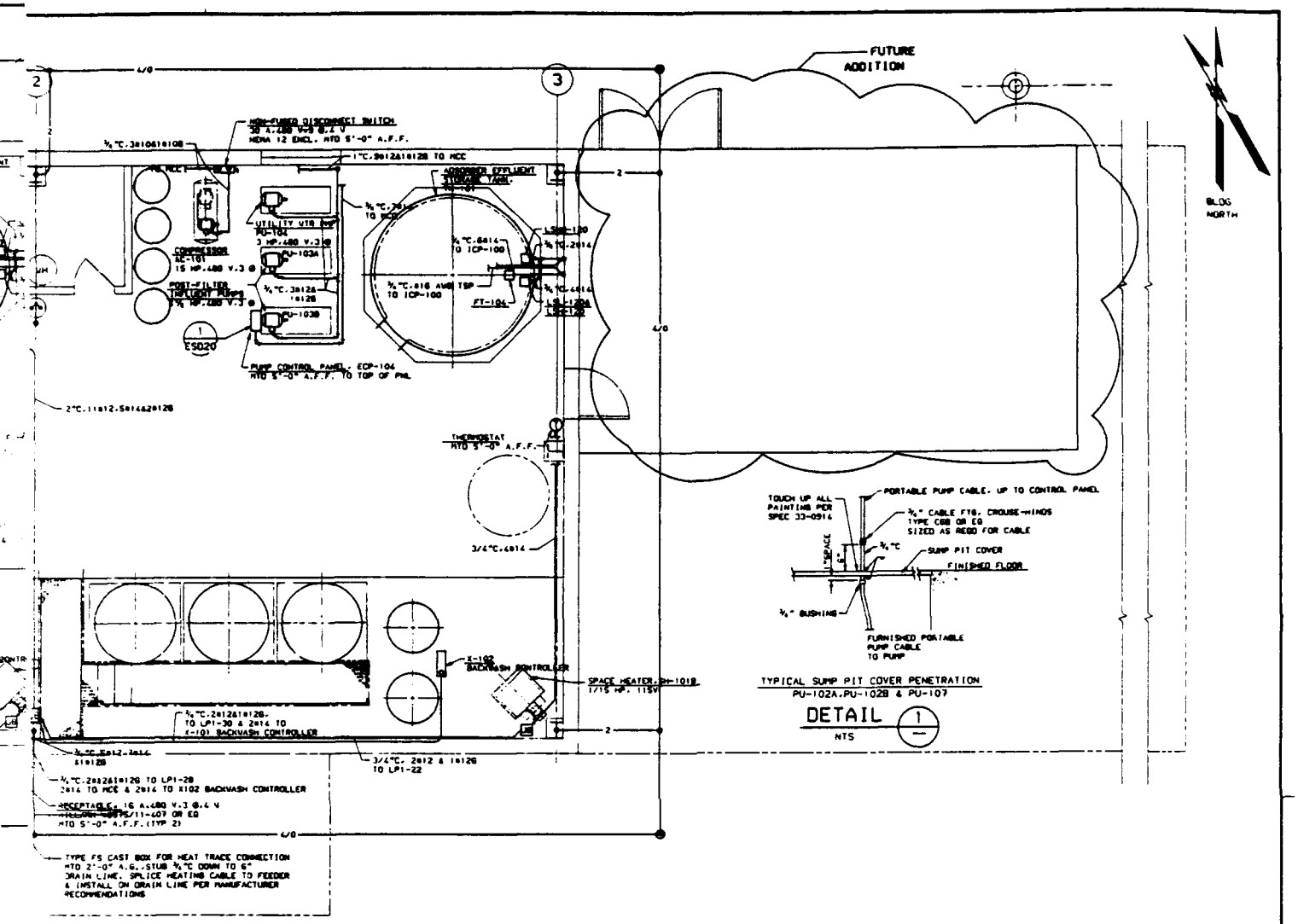
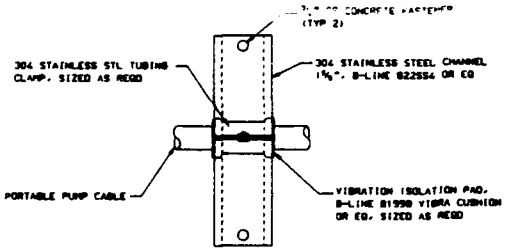




PORTABLE PUMP CABLE WALL CLAMP
FOR SUMP PUMPS
PU-102A, PU-102B & PU-107
(SEE NOTE 7)

DETAIL 2
NTS

NOTES:

1. REFER TO SPECIFICATION 37-1601 FOR LIGHTING FIXTURE SCHEDULE, PANEL SCHEDULE, ELECTRICAL DETAILS AND GENERAL WORKMANSHIP AND MATERIALS.
2. CONTRACTOR TO DETERMINE AND VERIFY ALL CONDUIT STUB-UP LOCATIONS, BASED ON ACTUAL EQUIPMENT PURCHASED PRIOR TO CONDUIT INSTALLATION.
3. SUPPLY 25 FT J/C & GND SO CABLE, #12 AWG, WITH PLUG TO MATCH RESPECTIVE EQPT. CONNECT TO MOTOR WITH APPROVED WATER-TIGHT CABLE CLAMP.
4. ALL TWISTED SHIELDED PAIR SIGNAL WIRES ARE TO BE ROUTED IN SEPARATE CONDUITS FROM POWER AND CONTROL.
5. CONTRACTOR SHALL VERIFY ELECTRICAL DESIGN WITH REQUIREMENTS OF ACTUAL EQUIPMENT PURCHASED AND WITH FIELD CONDITIONS- PRIOR TO CONSTRUCTION.
6. CONTRACTOR TO CONSTRUCT EQUIPMENT RACK, EQUIPMENT SUPPORTS, AND CONDUIT AND CABLE SUPPORTS AS REQUIRED TO SUIT EQUIPMENT PURCHASED AND FIELD CONDITIONS.
7. PORTABLE PUMP CABLE CLAMPS TO BE INSTALLED ON EACH SUMP PUMP CABLE, 2'-0" MAX. BELOW SUMP COVER PENETRATION.
8. CONTRACTOR SHALL DESIGN HEAT TRACING SYSTEM TO PROVIDE FREEZE PROTECTION FOR EACH DRAIN LINE FROM BUILDING TO SUMP WELL AND PIPE OVER SUMP WELL AS INDICATED ON THE DRAWING. CONTRACTOR SHALL SUBMIT HEAT TRACE CALCULATIONS AND MATERIAL LIST TO ENGINEER FOR APPROVAL PRIOR TO PURCHASE. REFER TO DWG P-020 & P-021 FOR PIPING INSULATION AND DETAILS.
9. CONTRACTOR TO PROVIDE AND CONNECT ELECTRIC DOOR DISCONNECT SWITCH TO DOOR CONTROL PANEL PER MANUFACTURER RECOMMENDATIONS.

APPROVALS	REV	A	B	C	D
DEPT					
ARCH			DOL	DOL	
CIV/STRL			GJB	GJB	
MECH			JTF	JTF	
ELECT		JRC	JRC	JRC	
INSTR			CED	CED	
PIPING			DS	DLS	
SAFETY				JC	
DEPT MGR		RFT	JEM	JEM	
PROJECT		JRH	GJB	JRH	

SCALE	1/8"=1'-0"	DATE
DRAWN BY	ajo	04/24/98
DESIGNED BY	JJS	04/25/98
CHECKED BY	GMB	04/27/98
CLIENT APPROVALS		
REV	BY	DATE

MORRISON-KNUDSEN ENGINEERS, INC.

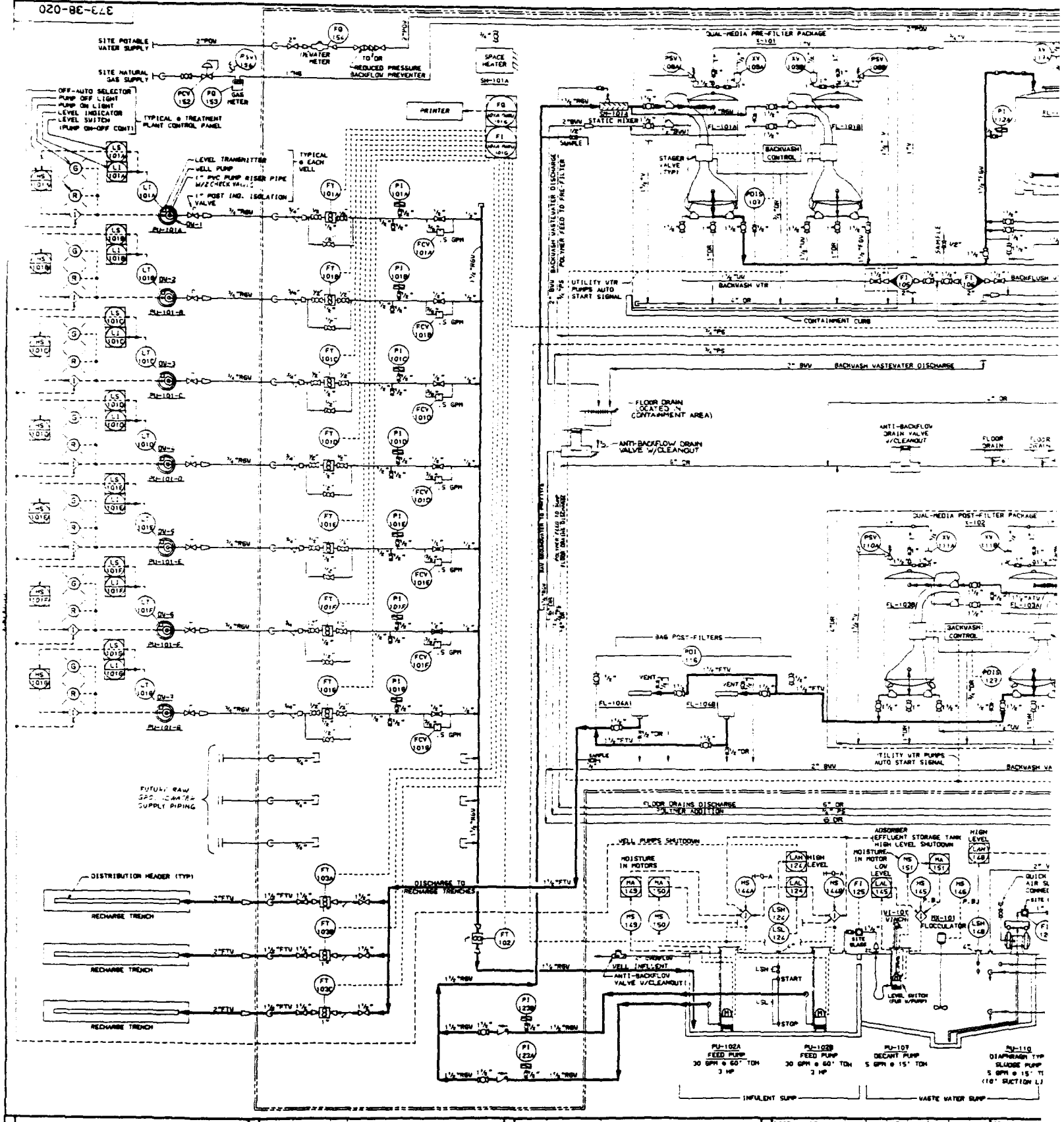
SHELL OIL COMPANY
ROCKY MOUNTAIN ARSENAL REMEDIATION PROJECT
INTERIM RESPONSE ACTION FINAL DETAILED DESIGN

DRAWING TITLE
BASIN A NECK IRA
GROUNDWATER TREATMENT BLDG
ELEC PLAN & DETAILS, SHT #2

WORK ORDER 2127 — 30 x 42
DRAWING NO. 373-37-028
REFERENCE NO. E-028 — REV 0

M42127.00-37-028

373-38-020



DRAWING NO.	TITLE

NO.	BY	DATE	CKD	DESCRIPTION

NO.	BY	DATE	CKD	DESCRIPTION
0	EB	8/22/89	JLS	ISSUED FOR CONSTRUCTION TL #047
C	EB	5/19/89		ISSUED FOR IMPLEMENTATION PLAN TL#046
B	EB	4/18/89	JLS	ISSUED FOR APPROVAL TL#24
A	EB	3/17/89	CED	ISSUED FOR REVIEW & COMMENT TL#102

APPROVALS				
DEPT	REV	A	B	C
ARCH				
CIV/STRL			GJB	
MECH		JF	JC	
ELECT			JC	
INSTR		CED	CED	
PIPING		JVR	DLS	
SAFETY			JC	JC
DEPT MGR		MFT	MFT	
PROJECT		JRH	JRH	

SCALE	
DRAWN BY	E
DESIGNED BY	
CHECKED BY	
	CLIEN
REV.	

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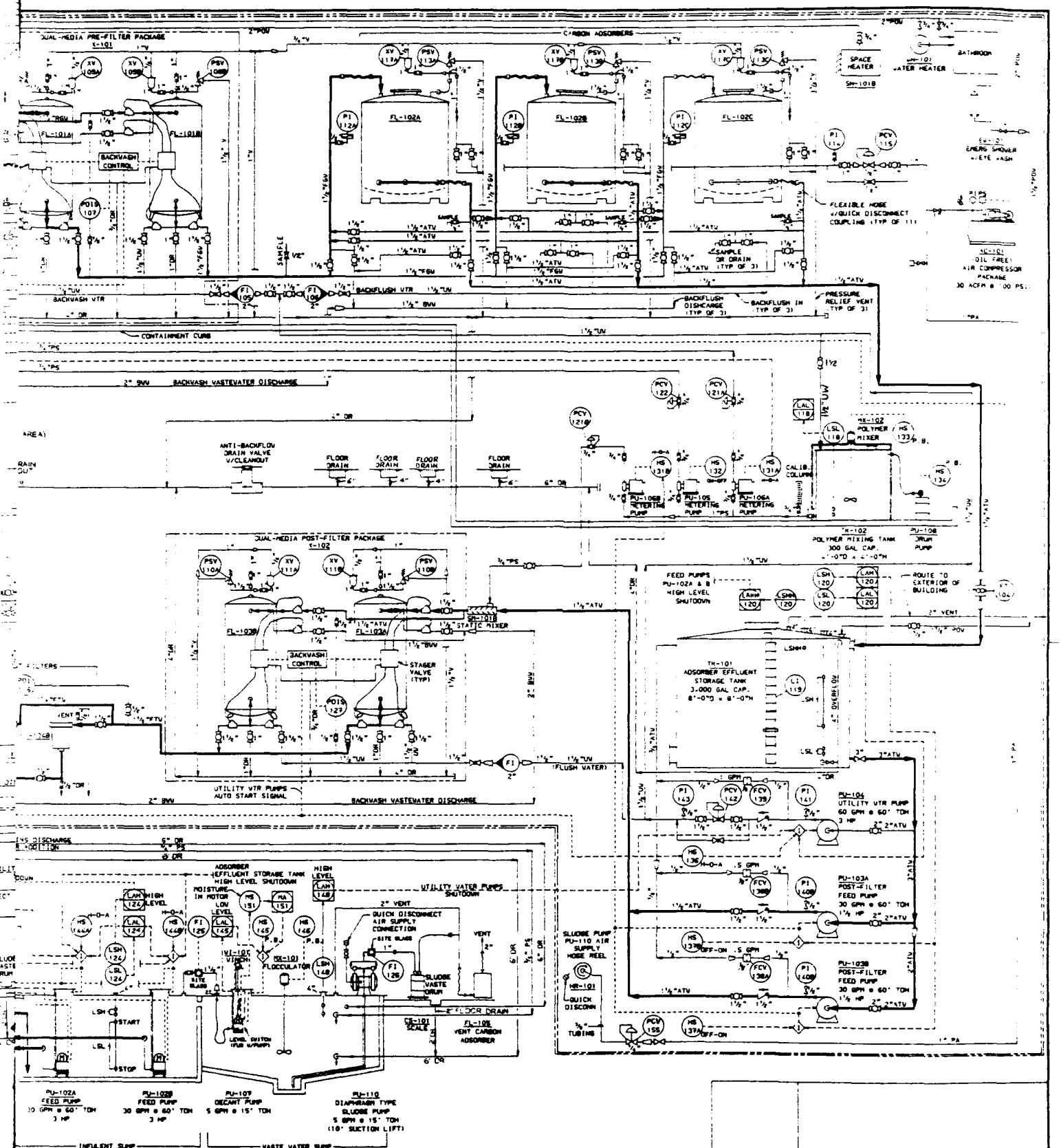

DEPT	REV	A	B	C	D
ARCH					
CIV/STRL			SJB		
MECH			JC		
ELECT			JC		
INSTR			CED		
PIPING			JVR	DLS	
SAFETY				JC	JC
DEPT HGR			MFT	MFT	
PROJECT			JRH	JRH	

APPROVALS

SCALE	NONE	DATE
DRAWN BY	E BENSON	1/13/89
DESIGNED BY	CED	3/13/89
CHECKED BY	DLS	4/18/89

CLIENT APPROVALS

REV	BY	DATE

MORRISON-KNUDSEN ENGINEERS, INC.

SHELL OIL COMPANY
ROCKY MOUNTAIN ARSENAL REMEDIATION PROJECT
INTERIM RESPONSE ACTION FINAL DETAILED DESIGN

DRAWING TITLE
BASIN A NECK IRA
GROUNDWATER TREATMENT SYSTEM
PROCESS & INSTR DIAGRAM

WORK ORDER NO. 2127

30 of 42

DRAWING NO. 373-38-020

REFERENCE NO. I-020

REV C

M2127.10-38-020