CITY OF ALBUQUERQUE, NEW MEXICO

PUMP STATION NO. 47 MONTAÑO OPERATIONS MANUAL

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The technical material and data contained in the Operations Manual were prepared under the supervision and direction of the undersigned, whose seal as a Professional Engineer, licensed to practice in the State of New Mexico, is affixed below.

DISCLAIMER

All information pertaining to the stormwater pump station equipment and mode of operation is based on information relevant at the time this manual was prepared. Information will be subject to change as equipment is up graded and replaced in the future. We recommend the Owner update the information contained in this manual as improvements occur so this manual can continue to serve as a useful tool to the operations staff.

(SEAL)

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Kenneth R. Muller
7-6-15

N.M.P.E. No. 12548

All questions about the meaning or intent of these documents shall be submitted only to the Engineer of Record, stated above, in writing.

OPERATIONS MANUAL
FOR THE
CITY OF ALBUQUERQUE STORMWATER PUMP STATION NO. 47 MONTAÑO

LIST OF TABLES

LIST OF FIGURES

APPENDICES

LIST OF ACRONYMS AND ABBREVIATIONS

3P	Three Phase
A	Ampere
ABCWUA	Albuquerque Bernalillo County Water Utility Authority
AC	Alternating Current
AC/hr	Air Changes per hour
ASHRAE	American Society of Heating, Refrigeration, and Air Conditioning Engineers
AWG	American Wire Gauge
BSCP	Bar Screen Control Panel
CAS	Control and Status (pump relay)
CFM	Cubic feet per minute
CP	Control Panel
CT	Control Transformer
CV	Check Valve
DB	dry bulb
DC	Direct Current
FVNR	Full Voltage Non-Reversing (Motor Starter)
FVR	Full Voltage Reversing (Motor Starter)
GF	Ground Fault
GND	Ground
gpm	gallons per minute
HMI	Human-machine interface (screen and keyboard)
H-O-A	hand-off- automatic
HP	horsepower
HVAC	Heating, Ventilation, and Air Conditioning
Hz	Hertz (cycles per second)
ICP	Integrated control panel
IM	isolation means
IMP	Impedance
JB	junction box
kcmil	thousand circular mils (area of conductor)
kV	Kilovolt
kVA	Kilo volt-ampere
kW	kilowatt
kWH	Kilowatt Hour (meter)
LE	Level Element
LIT	Level Indicator Transmitter
LOA	Local-Off-Auto
LOR	Local-Off-Remote
LOTO	lock-out-tag-out
LPCP	Lift Pump Control Panel
LSCP	Lift Station Control Panel
LS	Level Switch

LIST OF ACRONYMS AND ABBREVIATIONS (continued)

mA	Milliampere
MCB	Main Circuit Breaker
MCC	Motor Control Center
mg/L	milligrams per liter
MGD	million gallons per day
MLO	Main Lug Only
MV	Medium Voltage
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NPSH	Net Positive Suction Head
O&M	Operation and Maintenance
OC	open-close
OCA	open-close-automatic
OIP	operator interface panel
OIS	operator interface station (screen and keyboard)
OL	Overload
OSE	Office of the State Engineer
P	Pump
P&ID	process and instrumentation diagram
PFCC	Power Factor Correction Capacitor
PLC	programmable logic controller
PMH-9	Model of Primary Voltage Switchgear Manufactured by S&C Electric
PNM	Public Service Company of New Mexico
PPE	personal protection equipment
PRV	pressure relief valve
psi	pounds per square inch
PT/CT	Potential (voltage) transformer/current transformer
PT	power transformer
RCP	reinforced concrete pipe
RMC	Rigid Metal Conduit
ROF	Reverse-Off-Forward
RPM	revolutions per minute
RTU	radio telemetry unit
RVPW	reduced voltage part winding
RVSS	reduced voltage solid state starter
SCADA	supervisory control and data acquisition
SLCP	Station Level Control Panel
SMP	Standard Maintenance Procedure
SOJP	Standard Operation Job Procedure
SPCP	Sump Pump Control Panel
sq.ft.	square feet
SS	stainless steel
SSCP	Stepped Speed Contactor Panel

LIST OF ACRONYMS AND ABBREVIATIONS (continued)

SWRP	Southside Water Reclamation Plant
TDH	total dynamic head
UPS	Uninterruptible Power Supply
V	Volts
V	Valve
VDC	Volts Direct Current
VFD	variable frequency drive
WB	Wet Bulb
WC	Water column
WUA	Water Utility Authority
WUA-AMP	Water Utility Authority Asset Management Program
WWTP	Wastewater Treatment Plant
XFMR	Transformer

1.0 INTRODUCTION

This Operations Manual refers exclusively to the existing stormwater pump station facilities for Pump Station No. 47 Montaño. Refer to Section 1.3 for a description of existing facilities. The intent of this manual is to inform the operator of how each component operates and to serve as a reference for performing particular tasks. The intent of this manual is achieved by addressing three areas of operation: Operations & Maintenance (O&M); Overview, Standard Operating Job Procedure (SOJPs); and Standard Maintenance Procedures (SMPs). This manual is written with the assumption that the operator reading it has more than just a basic understanding of storm drainage systems and stormwater pump stations in general and is not intended to be used as an education publication.

1.1 Guide to the Manual

1.1.1 Section Organization

The information presented in this manual for the three (3) areas of operation is organized into nine (9) major sections. Each section includes specific information that pertains to the section title. Although each section contains valuable information necessary for efficient, orderly, and safe operations of the facilities, certain sections cover the technical operations of the facility and contain detailed instructions on how the pump station should be operated.

There is some variation, but most of the sections listed above are broken down into subsections under the following headings:

- Overview
- Equipment Description
- Design Criteria
- Instrumentation and Alarms
- Normal Operation
- Safety: Information Unique to the System or Process

1.1.2 Section Headings

The text of this manual is prepared using a sequence numbering system for all of the headings and components (figure numbers, table numbers, and page numbers). The first number denotes the start of a section. The second number denotes the start of a subsection. The third number denotes the headings or the component of each subsection. Some sections that appear in this manual may have a fourth division. For example, 4.1.4 refers to the normal operations for the mechanical barscreen in Section 4 – Pump Station System.

This section would be located under Section 4 – Pump Station System, Subsection 4.1 – Mechanical Bar Screen, Heading 4.1.4 – Normal Operation.

Tables, page numbers, and figures are presented using a similar numbering system. The first number indicates the section where the figure, table, or page can be found. The second number is separated from the first number by a dash and indicates the order of the figures, table, or page in the appropriate section.

To minimize repetition, many systems are cross-referenced throughout the text to show the interrelationship between the various units. Where possible, discussions concerning identical or similar equipment installed at different locations are kept as similar as possible to provide the personnel with a routine, which can be used at all of the involved locations.

1.2 City-Wide Stormwater Pumping System Description

The City of Albuquerque stormwater pump stations are located mostly in low areas of the Valley, with three (3) stations, Nos. 31, 35, and 36, designed to discharge into the North Diversion Channel, and are used to collect and pump stormwater runoff and prevent or mitigate the impact of flooding; three (3) stations, Nos. 30, 44, and 47, are located outside of the City limits in unincorporated Bernalillo County. A map of all fourteen (14) pump stations is presented in Figure 1-1. Please note Station No. 42 Paseo Del Norte has been decommissioned, but is shown in Figure 1-1.

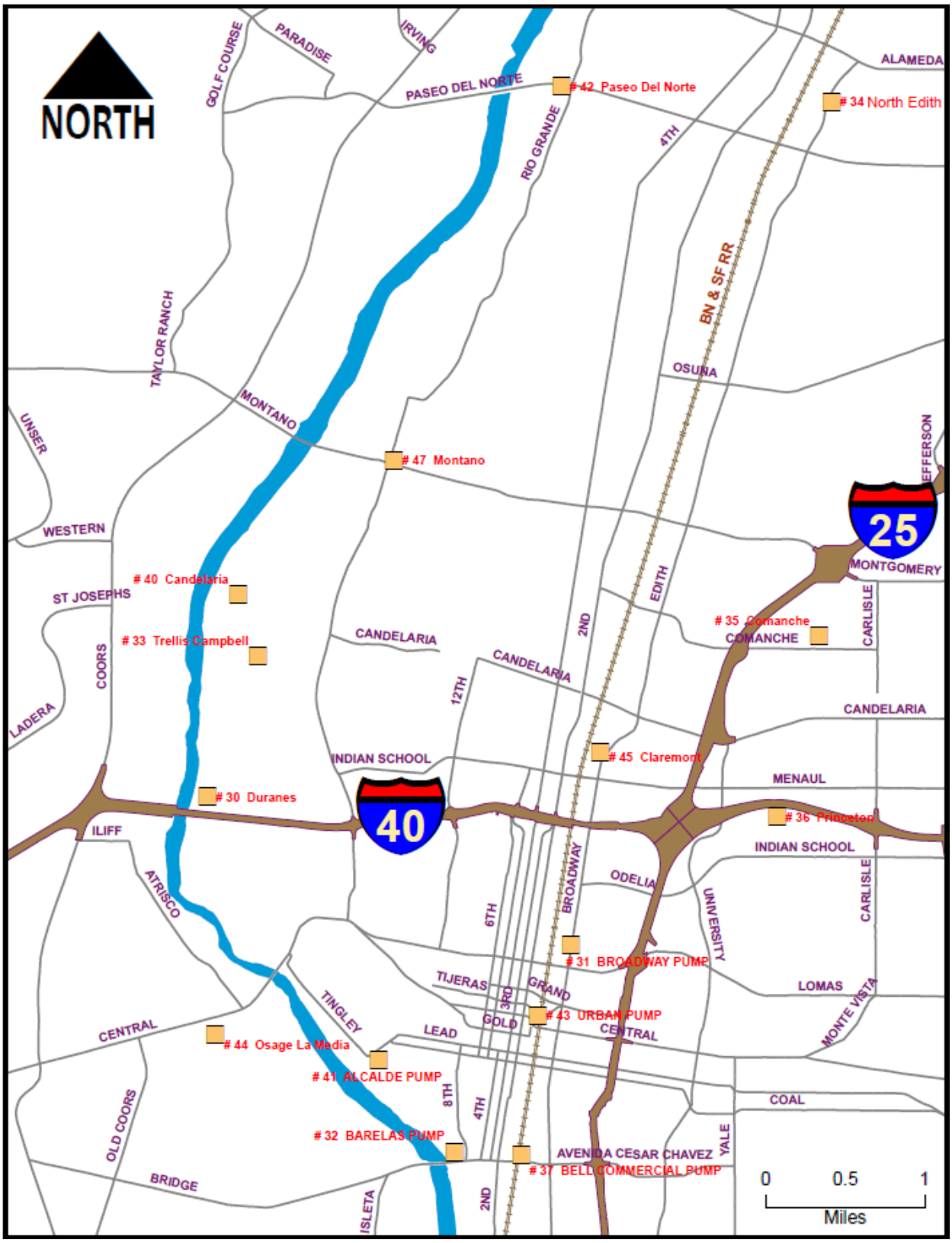


FIGURE 1-1
STORMWATER PUMP STATIONS MAP
Source: City of Albuquerque, DMD, SDD

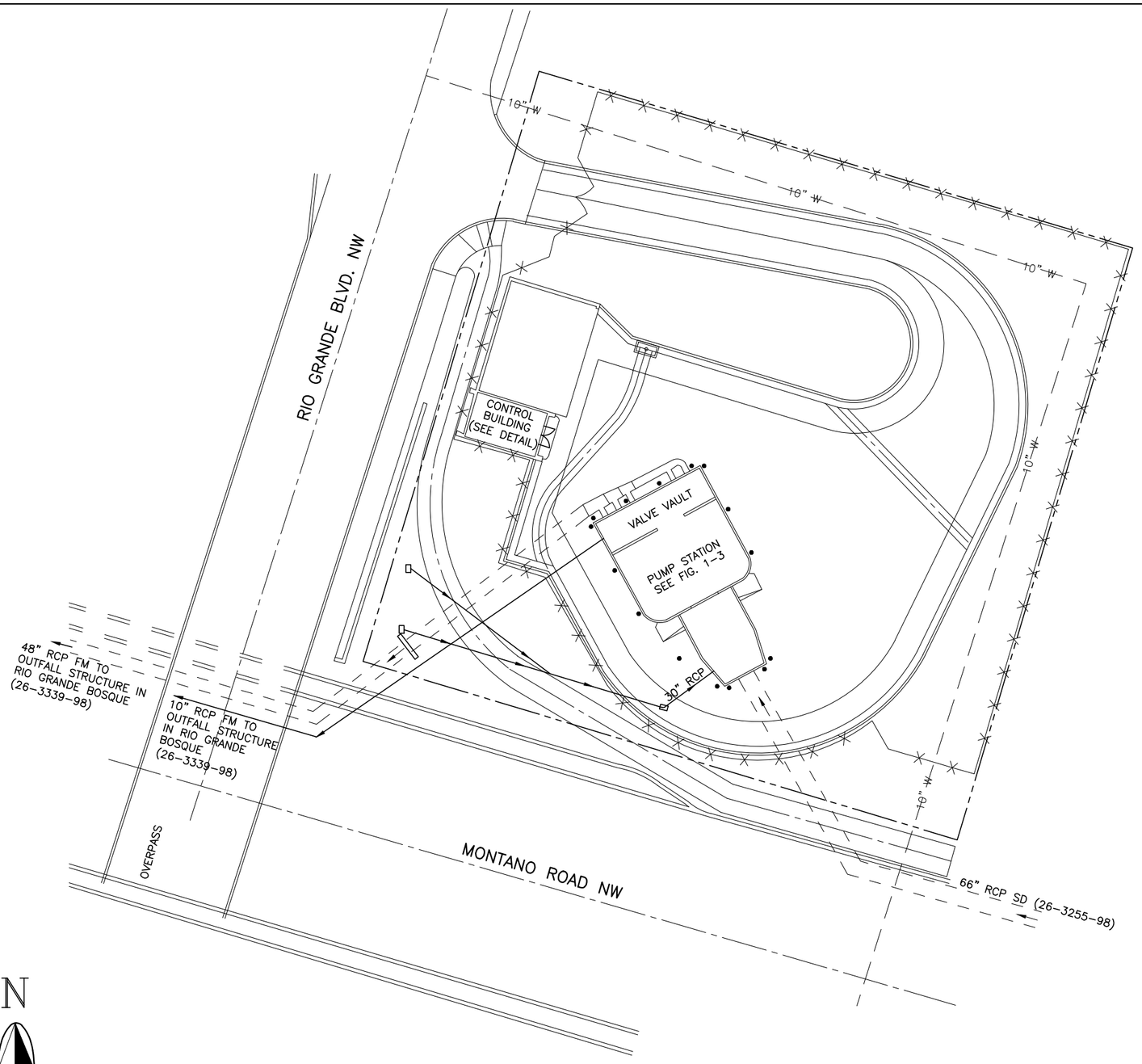
The stormwater pump stations are owned by the City of Albuquerque (COA) and are administered by the Albuquerque Department of Municipal Development (DMD), Engineering Division, Storm Drain Design (SDD). Through an agreement between the City and the Albuquerque Bernalillo County Water Utility Authority (ABCWUA), the ABCWUA Field Operations Department, Line Maintenance/ Lift Station Section operate and maintain the stormwater pump stations, along with their other duties to operate and maintain the wastewater vacuum and lift stations.

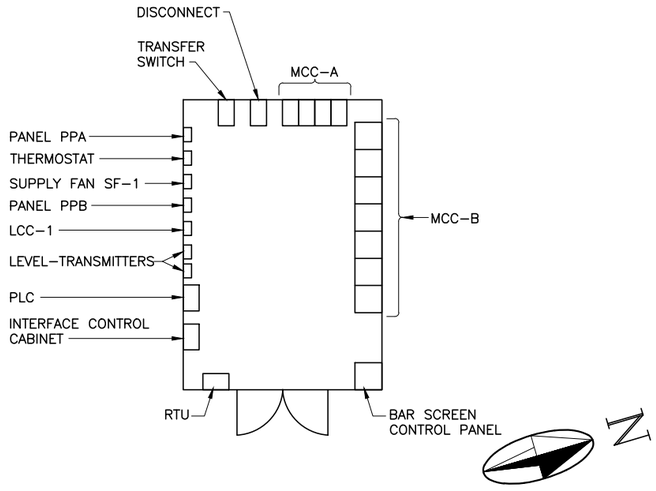
1.3 General Description of Stormwater Pump Station No. 47 Montaño

Pump Station No. 47 Montaño is located on the northeast corner of the intersection at Rio Grande Boulevard NW and Montaño Road NW, shown in Figure 1-1. The address is 4500 Rio Grande Boulevard NW, which is located in zoning map grid F-13. It was constructed in 1998 and receives runoff from a storm drain network that extends to the east.

The drainage area extends east to the detention ponds located just west of the intersection of Montaño Road NE and South Renaissance Boulevard NE. The drainage also includes an area north of Montaño Road NE along 4th Street NE that extends to Calle Diez NW in the west and Alameda Drain to the east. The network of storm drains feeding the station are capable of delivering between 48,000 and 97,000 gallons per minute (gpm), as discussed in Section 3.1.1. The station's lift pumps have a combined pumping capacity of approximately 53,000 gpm. Excess stormwater collects locally, ponding in the surrounding neighborhood until the over-burdened storm drain system can convey water to the pump station. The station discharges westward through approximately 2,500 feet of 48-inch reinforced concrete pipe to the Rio Grande Bosque.

Site and base plans of the pump station are provided in Figure 1-2 and Figure 1-3, respectively.





DETAIL – CONTROL BLDG.
NOT TO SCALE

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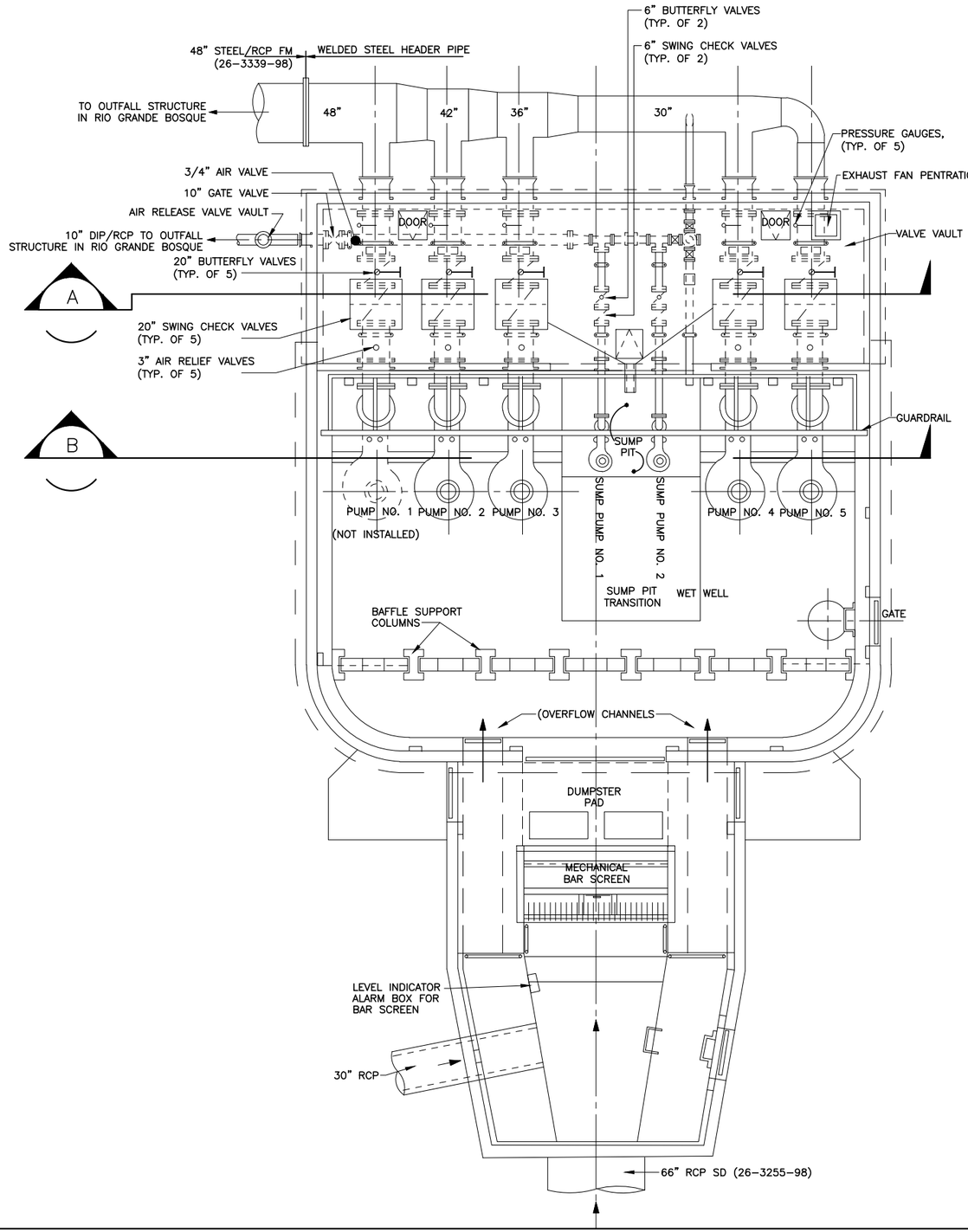
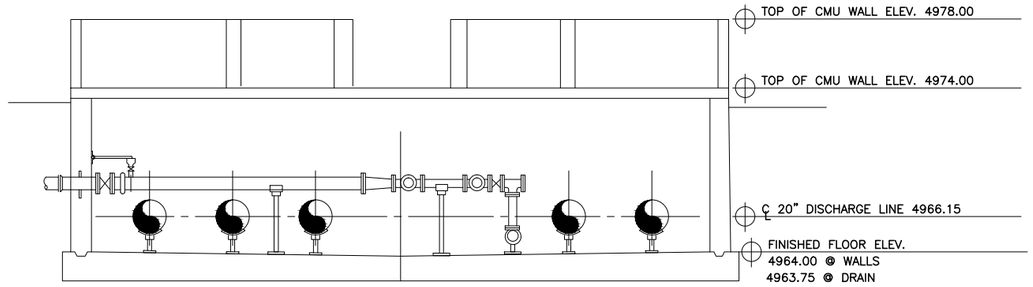
City Of Albuquerque Stormwater Pump Stations

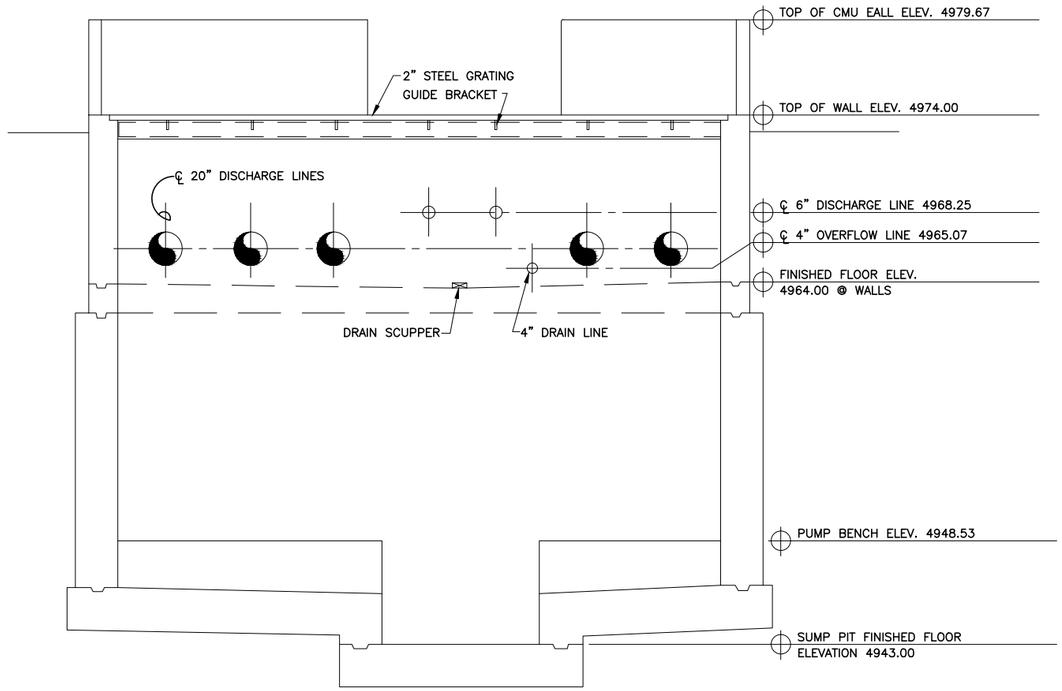
Pump Station No. 47 Montaño Site Plan

Figure 1-2





SECTION A–A



SECTION B–B

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City Of Albuquerque Stormwater Pump Stations

Pump Station No. 47 Montaño Base Plan and Sections

Figure 1-3

2.0 STANDARDS

This section provides a brief description of the standards applicable to this pump station and identifies the governing regulations which dictate the level of standards recommended for design and installation.

2.1 Water Resource Standards

The stormwater pumps are recommended to be designed and installed to meet the following standards by the American National Standard Institute/ Hydraulic Institute (ANSI-HI):

- ANSI/HI 1.3 Rotodynamic (Centrifugal) Pumps for Design and Application
- ANSI/HI 2.3 Rotodynamic (Vertical) Pumps for Design and Application
- ANSI/HI 9.6.4 Rotodynamic Pumps for Vibration Measurement and Allowable Values
- ANSI/HI 9.8 Intake Design for Rotodynamic Pumps**.**
- ANSI/HI 14.6 Rotodynamic Pumps for Hydraulic Performance Acceptance Tests

2.2 Electrical Standards

The Electrical systems are recommended to be designed and installed to meet the following standards:

- 2012 National Fire Protection Association (NFPA) – National Fire Code, NFPA 70 – National Electrical Code
- NFPA 70B – Recommended Practices for Electrical Equipment Maintenance
- NFPA 70E – Standard for Electrical Safety in the Workplace
- NFPA 110 – Standard for Emergency and Standby Power Systems
- New Mexico Electrical Code (14.10.4.) Title 14 – Housing and Construction, Chapter 10.

Also, the Electrical design is to comply with the recommended practices of the following organizations:

- NEMA – National Electrical Manufacturer's Association
- UL – Underwriters Laboratories
- IEEE – Institute of Electrical and Electronics Engineers

2.3 HVAC Standards

The HVAC systems are recommended to be designed and installed to meet the following standards: 2009 International Building Code, 2009 Uniform Mechanical Code, 2009 International Energy Conservation Code, and the National Fire Code. Special attention is focused on 2012 National Fire Protection Association (NFPA) 820, Standard for Fire Protection in Wastewater Treatment and Collection Facilities.

Also, the HVAC design and installation is to comply with the recommended practices of the following organizations:

- ASHRAE Standard 62.1-2010 Ventilation for Acceptable Indoor Air Quality
- American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE)
- Sheet Metal and Air Conditioning Contractors National Association (SMACNA)
- Air Moving and Conditioning Association (AMCA)
- Associated Air Balance Council (AABC)

2.3.1 HVAC Standard Description

2009 Uniform Mechanical Code – The Uniform Mechanical Code provides requirements for the installation and maintenance of heating, ventilating, cooling, and refrigeration systems.

2009 International Energy Conservation Code – The International Energy Conservation Code is a model code that regulates the minimum energy conservation requirements for all aspects of energy use in facilities heating and ventilating systems.

2012 National Fire Protection Association (NFPA) 820, Standard for Fire Protection in Wastewater Treatment and Collection Facilities.– This standard establishes the minimum requirements for protection against fire and explosion hazards in waste water treatment plants or collections systems such as storm sewers.

American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) – ASHRAE is the world's foremost technical society in the fields of heating, ventilation, air conditioning, and refrigeration.

Sheet Metal and Air Conditioning Contractors National Association (SMACNA) – SMACNA standards address all facets of the sheet metal industry, from duct construction and installation to air pollution control, and from energy recovery to roofing.

Air Moving and Conditioning Association (AMCA) – The Air Moving and Control Association is a non-profit association of air system equipment manufacturers – primarily fans, louvers, dampers, and air curtains used in commercial or industrial buildings.

Associated Air Balance Council (AABC) – The Associated Air Balance Council establishes industry standards for the field measurement and documentation of HVAC systems.

ASHRAE Standard 62.1-2010 Ventilation for Acceptable Indoor Air Quality – ASHRAE 62.1 standard specifies the minimum ventilation rates and measures intended to provide indoor air quality that is acceptable to human occupants.

3.0 DESIGN CRITERIA

This section provides a brief description of the criteria applicable to this pump station.

3.1 Water Resources Design Criteria

3.1.1 Inlet Pipe Capacity and Local Storage Volume

The station wet well is fed by a 66-inch reinforced concrete pipe (RCP) trunk storm drain extending approximately 4,400 feet east under Montaño Road to Guadalupe Trail at an average slope of 0.001 feet per foot. The full flow capacity of this pipe is approximately 47,700 gallons per minute (gpm). Assuming the street is flooded at Guadalupe Trail, and the water level in the wet well is at the crown of the inlet pipe, the surcharged flow rate would be approximately 96,600 gpm.

The station wet well and inlet pipe combine to provide a local equalization volume for larger flood events. If it is assumed that the wet well is flooded to the ground elevation at the station and the inlet pipe is flowing at full depth to the manhole at Guadalupe Trail, the local storage volume can be estimated at 2.7 acre-feet (890,000 gallons).

3.1.2 Lift Pumps

The four (4) station lift pumps are Flygt submersibles, Model CP3400 with 505-millimeter, 830-type impellers. The pumps are driven by integral 230 horsepower (HP), 885 RPM full speed motors that run on 460V, 3-phase power. Each pump discharges through 20-inch piping and several expansions and junctions that result in a 48-inch RCP force main. The force main runs approximately 2,500 feet underneath Montaño Road before emptying into the Rio Grande Bosque to the west. Each pump's individual design capacity is approximately 11,200 gpm at 62 feet of total dynamic head (TDH). Because of their combined discharge configuration, the peak capacity of the pumps is an estimated 53,400 gpm at 55 feet of TDH. Refer to Appendix C for manufacturer's pump curve and data and estimated system hydraulics.

The lift pumps are installed in a wet well that is approximately 28 feet deep. The pumps are installed in Flygt's "P" configuration, which indicates that the pump has a vertical discharge riser, no suction piping, and is submerged under normal operating conditions. The pumps are controlled by the wet well level sensors and are equipped with butterfly isolation, swing-check, and air pressure relief valves.

The station design called for the number of lift pumps as additive alternates. As such, Lift Pump No. 1 was not installed, but the discharge piping is in place should the station ever need additional capacity. As shown on the system hydraulic in Appendix C, adding an additional of the same model and size would increase the station's capacity to as much as 62,500 gpm at 58 feet of TDH.

The manufacturer's pump curve indicates that the pumps require 25 feet of net positive suction head when running at the design flow. If cavitation occurs, the pump will run noisily and sound like it is pumping marbles. Prolonged cavitation will result in pitting of the impeller and volute. Stormwater pumping periods tend to be brief, and some cavitation is tolerable over the life of the pump. At the station's site elevation, the pumps would require at least 4 inches of water over the impeller (positive suction head) to prevent cavitation. However, the manufacturer also specifies that water should not fall below the top of the volute during normal operation.

3.1.3 Sump Pumps

The two (2) wet well sump pumps are designed to handle small, non-storm infiltration and excess water that remains after normal lift pump operation. The pumps are 20 HP, 1,750 RPM constant speed Flygt submersibles, Model HP5540 with 432-type impellers, that run on 460V, 3-phase power and deliver 870 gpm at 62 feet TDH. The pumps are installed in Flygt's "P" configuration, which indicates that the pump has a vertical discharge riser, no suction piping, and is submerged under normal operating conditions. Refer to Appendix D for manufacturer's pump curve and data.

3.1.4 Mechanical Bar Screen

Influent stormwater is cleaned by a 10-foot wide climber-type mechanical bar screen, Model GA25COG, manufactured by USFilter/Link-Belt. The raking mechanism is driven by a 5 HP drive motor in a submersible enclosure. Two (2) steel dumpsters collect the screenings. The raking mechanism is activated by a Flygt ENM-10 float level switch located in the inlet channel. Refer to Appendix B for the manufacturer's maintenance schedule.

The inlet channel was constructed with bypass channels on each side of the bar screen to allow unscreened stormwater to enter the wet well under high-flow or blinded screen conditions. After passing through the bar screen, stormwater enters the pump station's wet well.

3.2 Electrical Design Criteria

3.2.1 Electrical Service

The station power is fed from a single 12,470V source and stepped down to low voltage (480V) by two (2) different transformers located on site.

3.2.2 Electrical Low Voltage

Low voltage power is distributed to two (2) different motor control centers (MCC). MCC-A distributes power to two (2) of the lift pumps and one (1) of the sump pumps. MCC-B distributes power to three (3) lift pumps, one (1) sump pump, and the bar screen.

3.2.3 Controls

The bar screen is controlled by the Bar Screen Control Panel, which is a relay logic-type controller. The lift and sump pumps are controlled by the Lift Station Control Panel (LSCP), which is a programmable logic-type controller. The LSCP contains control and status relays for the lift and sump pumps and receives 4-20mA signals from the wet well level transmitters. The LSCP has an operator input panel for controlling station operations.

3.3 HVAC Design Criteria

3.3.1 Outdoor Design

Outdoor Design conditions as follows:

Outside Summer: 96 °F DB / 60 °F WB

Outside Winter: 16 °F DB

3.3.2 Indoor Design

Indoor design conditions vary, depending on the occupancies of the areas served. Table 3-1 lists the indoor design conditions, as well as the code required ventilation rates. The ventilation rates for spaces are as required by NFPA 820 or ASHRAE 62.1. These rates are expressed in air changes per hour (AC/hr). This corresponds to the flow of fresh, outdoor air that is required to be supplied to the spaces.

TABLE 3-1
INDOOR HVAC DESIGN CRITERIA

Facility	Area	Min Indoor Design Temperature (°F)	Max Indoor Design Temperature (°F)	Ventilation Rate (Outdoor Air) (AC/hr)	Source/Reason for Ventilation Rate
Montaño – Pump Station No.47	Wet Well	Ambient	Ambient	Not Required	NFPA 820
	Control Room	55	90	Not Required	ASHRAE 62.1
	Valve Pit Enclosed – Below Grade – dry side of pumping station	55	90	Continuously at 6 AC/hr.	NFPA 820

4.0 PUMP STATION SYSTEM

This section provides a brief description of the different components of the stormwater pump station shown in Figure 1-2, including an overview, description of equipment, instrumentation and alarms, normal operating characteristics, and safety information unique to the system or process. This section is supplemented with photos and diagrams of the processes at this pump station. The process and instrumentation diagram is shown in Section 7.

4.1 Mechanical Bar Screen

4.1.1 Overview

Stormwater enters the pump station through 30-inch and 66-inch reinforced concrete pipe (RCP) storm drains into a 10-foot wide channel. The stormwater is conveyed through the mechanical bar screen (Figure 4-1), where debris is pulled out of the channel and up the face of the screen by a raking mechanism, and deposited into a dumpster.

4.1.2 Equipment Description

The debris collected on the 10-foot wide bar screen is removed by a motorized, climber-type raking mechanism manufactured by USFilter/Link-Belt. The 5 horsepower (HP) rake motor is inside a submersible enclosure. The bar screen, oriented 80° from horizontal, has 1.5-inch clear openings. The screen channel has overflow channels to divert unscreened flow during high flow or blinded-screen conditions.

The bar screen at this station is not tagged with a Water Utility Authority Asset Management Program Equipment Tag. A tag number was prescribed to the bar screen to aid in identification. The bar screen tag number is listed below in Table 4-1 and shown on Figure 47-1 in Section 7 to provide clarity.

TABLE 4-1
EQUIPMENT INFORMATION

Equipment No.	Asset Info	Classification Type	Classification
U54741	Station	Bar Screen	Unit

FIGURE 4-1
MECHANICAL BAR SCREEN

4.1.3 Instrumentation and Alarms

Instrumentation includes:

- Bar screen inlet level float switch
- Bar screen inlet high level float switch

Alarms connected to telemetry include:

- High channel level
- Bar screen rake run
- Bar screen torque overload

4.1.4 Normal Operation

The bar screen rake run cycle timer is initiated by a Flygt ENM-10 float level switch located inside the inlet channel. The rake runs on a prescribed interval and if there are no obstructions, it will continue to run until the duration timer expires. If debris caught in the screen causes the channel to rise, a high channel level relay contact closes and restarts the rake and run cycle timer. If the debris is large enough to overload the motor, the torque overload and reverse motion alternator switches are activated. The rake will run in reverse until it reaches the idle position. Large debris will need to be removed manually in this instance, or cleared by operating the rake in hand mode. For more information on operating the rake in hand mode, refer to SOJP No. 4700-SU-Montaño Pump Station in Section 7.

4.1.5 Safety: Information Unique to the System or Process

Refer to Section 9 for general safety guidelines.

4.2 Lift Pumps

4.2.1 Overview

After passing through the inlet screen or bypass channel, stormwater enters the station wet well. The water level is monitored by redundant Drexelbrook Universal III level transmitters with fixed probe-type sensing elements. The four (4) lift pumps (Pumps No. 2 through 5) (Figure 4-2) cycle on and off in a lead/lag/alternate sequence according to the level in the wet well. The station also contains provisions for a fifth lift pump (Pump No. 1), but the pump itself has never been installed because there has been no demand to increase the station's capacity.

4.2.2 Equipment Description

Stormwater is pumped by any combination of the four (4) submersible Flygt pumps, Model CP3400 with 505-millimeter, 830-type impellers. Each pump is driven by an integral 230 HP motor that runs at 880 full speed RPM on 460V, 3-phase power. The design capacity of each individual pump is approximately 11,200 gpm at 62 feet of total dynamic head.

The station design called for the number of lift pumps as additive alternates. As such, Lift Pump No. 1 was not installed, but the discharge piping is in place should the station ever need additional capacity.

The lift pumps at this station are not tagged with a Water Utility Authority Asset Management Program Equipment Tags. Tag numbers were prescribed to the lift pumps to aid in identification. The lift pump tag numbers are listed below in Table 4-2 and shown on Figure 47-1 in Section 7 to provide clarity.

FIGURE 4-2
LIFT PUMPS

TABLE 4-2
EQUIPMENT INFORMATION

Equipment No.	Asset Info	Classification Type	Classification
P54701	Station	Lift Pump No. 1 (West)	Not Installed
P54702	Station	Lift Pump No. 2	Pump
P54703	Station	Lift Pump No. 3	Pump
P54704	Station	Lift Pump No. 4	Pump
P54705	Station	Lift Pump No. 5 (East)	Pump

4.2.3 Instrumentation and Alarms

The wet well level signal is connected to the lift station control panel. Alarms connected to telemetry include:

- Lift Pump No. 2 Run
- Lift Pump No. 3 Run
- Lift Pump No. 4 Run
- Lift Pump No. 5 Run
- Lift Pump No. 2 Fail
- Lift Pump No. 3 Fail
- Lift Pump No. 4 Run
- Lift Pump No. 5 Fail
- High wet well level

4.2.4 Normal Operation

The lift pump start is initiated at a prescribed well depth by one (1) of the two (2) redundant level sensors located in the wet well. The pumps lift water from the wet well, through a valve vault, and into a common header that discharges into a 48-inch RCP force main. The force main runs approximately 2,500 feet underneath Montaño Road before emptying into the Rio Grande Bosque to the west.

4.2.5 Safety: Information Unique to the System or Process

Refer to Section 9 for general safety guidelines.

4.3 Sump Pumps

4.3.1 Overview

Stormwater below the lift pumps and small, non-storm infiltration flow is handled by the two (2) sump pumps located in the wet well (Figure 4-3). One (1) of the sump pumps was out for repair when the picture was taken, but the discharge piping can be seen in the top left of Figure 4-3.

The two (2) Flygt sump pumps have 6-inch discharge pipes that combine into a 10-inch discharge pipe after the valve vault. The sump pump discharge pipe runs parallel to the lift pump piping and ultimately empties in the Rio Grande Bosque at the same location as the lift pumps.

4.3.2 Equipment Description

The two (2) wet well sump pumps are Flygt Model HP5540 submersibles with a 432-type impeller. Each pump is driven by an integral 20 HP, 1,750 RPM full speed motor using 460V, 3-phase power and has an estimated capacity of 900 gpm at 58 feet of TDH. The pumps are installed in Flygt's "P" configuration, which indicates that the pumps have a vertical discharge riser, no suction piping, and are submerged under normal operating conditions.

The sump pumps and motors at this station are not tagged with Water Utility Authority Asset Management Program Equipment Tags. Tag numbers were prescribed to the pumps and motors to aid in identification. The Equipment Tag numbers are listed below in Table 4-3 and shown on Figure 47-1 in Section 7 to provide clarity.

FIGURE 4-3
SUMP PUMPS

TABLE 4-3
EQUIPMENT INFORMATION

Equipment No.	Asset Info	Classification Type	Classification
P54706	Station	Sump Pump No.1 (West)	Pump
P54707	Station	Sump Pump No. 2 (East)	Pump

4.3.3 Instrumentation and Alarms

The station wet well level signal is connected to the sump pump control panel. Alarms connected to telemetry include:

- Sump Pump No. 1 Run
- Sump Pump No. 2 Run
- Sump Pump No. 1 Fail
- Sump Pump No. 2 Fail
- High wet well level

4.3.4 Normal Operation

The two (2) sump pumps are controlled by level transmitters located in the wet well and are equipped with butterfly isolation and swing-check. The sump pumps will run when there is insufficient wet well volume to initiate the lift pumps.

4.3.5 Safety: Information Unique to the System or Process

Refer to Section 9 for general safety guidelines.

4.4 Valve Vault

4.4.1 Overview

Stormwater conveyed through the discharge piping passes through a series of control valves (Figure 4-4) before leaving the station. Each lift pump is equipped with butterfly isolation and swing-disk check valves, as well as an air pressure relief valve.

FIGURE 4-4
VALVE VAULT

4.4.2 Equipment Description

Each lift pump discharge pipe is equipped with a swing-disk check valve, butterfly isolation valve, and air pressure relief valve. The 250 pounds per square inch (psi) rated swing-disk check valves are 20-inch counter-weighted and spring-loaded units manufactured by CCNE (now Milliken/Mueller). The swing-disk check valves include an Allen-Bradley position switch, Model 802T-WS1. The butterfly isolation valves are 20-inch, 150 psi, Model 2F2 units manufactured by Pratt. The isolation valves are manually operated by a hand wheel in the valve vault and have a top-mounted position indicator needle. The air pressure relief valves are 3-inch, 300 psi Val-Matic units. The pressure relief valves are also equipped with small, hand-operated isolation valves.

Each sump pump discharge pipe is equipped with a swing-disk check valve and butterfly isolation valve. The 250 psi swing-disk check valves are 6-inch counter-weighted and spring-loaded units manufactured by CCNE (now Milliken/Mueller). The swing-disk check valves include an Allen-Bradley position switch, Model 802T-WS1. The butterfly isolation valves are 6-inch, 150 psi rated, Model 2F2 units manufactured by Pratt. The isolation valves are manually operated by a hand wheel in the valve vault and have a top-mounted position indicator needle.

The sump pumps feed a common 10-inch discharge pipe that is also equipped with a gate valve and an air pressure relief valve. The gate valve on the common header is a 10-inch, hand wheel operated unit. The air pressure relief valve is a 0.75-inch, 175 psi rated Val-Matic unit.

The valves at this station are not tagged with Water Utility Authority Asset Management Program Equipment Tags. Tag numbers were prescribed to the valves to aid in identification. The Equipment Tag numbers are listed below in Table 4-4 and shown on Figure 47-1 in Section 7 to provide clarity.

4.4.3 Instrumentation and Alarms

The swing check valve position sensors are connected to the lift pump and sump pump control panels.

TABLE 4-4
EQUIPMENT INFORMATION

Equipment No.	Asset Info	Classification Type	Classification
CV54702	Station	Lift Pump No. 2 Check Valve	Check Valve
CV54703	Station	Lift Pump No. 3 Check Valve	Check Valve
CV54704	Station	Lift Pump No. 4 Check Valve	Check Valve
CV54705	Station	Lift Pump No. 5 Check Valve	Check Valve
CV54706	Station	Sump Pump No. 1 Check Valve	Check Valve
CV54707	Station	Sump Pump No. 2 Check Valve	Check Valve
PRV54702	Station	Lift Pump No. 2 Air Relief Valve	Air Relief Valve
PRV54703	Station	Lift Pump No. 3 Air Relief Valve	Air Relief Valve
PRV54704	Station	Lift Pump No. 4 Air Relief Valve	Air Relief Valve
PRV54705	Station	Lift Pump No. 5 Air Relief Valve	Air Relief Valve
PRV54706	Station	Sump Pump Air Relief Valve	Air Relief Valve
V54702	Station	Lift Pump No. 2 Isolation Valve	Isolation Valve
V54703	Station	Lift Pump No. 3 Isolation Valve	Isolation Valve
V54704	Station	Lift Pump No. 4 Isolation Valve	Isolation Valve
V54705	Station	Lift Pump No. 5 Isolation Valve	Isolation Valve
V54706	Station	Sump Pump No. 1 Isolation Valve	Isolation Valve
V54707	Station	Sump Pump No. 2 Isolation Valve	Isolation Valve

4.4.4 Normal Operation

Valve positions during normal operation are as follows:

IN SERVICE – Lift Pump No. 2 swing-disk check valve **CV54702**

IN SERVICE – Lift Pump No. 3 swing-disk check valve **CV54703**

IN SERVICE – Lift Pump No. 4 swing-disk check valve **CV54704**

IN SERVICE – Lift Pump No. 5 swing-disk check valve **CV54705**

IN SERVICE – Sump Pump No. 1 swing-disk check valve **CV54706**

IN SERVICE – Sump Pump No. 2 swing-disk check valve **CV54707**

IN SERVICE – Lift Pump No. 2 air pressure relief valve **PRV54702**

IN SERVICE – Lift Pump No. 3 air pressure relief valve **PRV54703**

IN SERVICE – Lift Pump No. 4 air pressure relief valve **PRV54704**

IN SERVICE – Lift Pump No. 5 air pressure relief valve **PRV54705**

IN SERVICE – Sump Pump air pressure relief valve **PRV54706**

OPEN – Lift Pump No. 2 butterfly isolation valve **V54702**

OPEN – Lift Pump No. 3 butterfly isolation valve **V54703**

OPEN – Lift Pump No. 4 butterfly isolation valve **V54704**

OPEN – Lift Pump No. 5 butterfly isolation valve **V54705**

OPEN – Sump Pump No. 1 butterfly isolation valve **V54706**

OPEN – Sump Pump No. 2 butterfly isolation valve **V54707**

OPEN – Lift Pump No. 2 air relief isolation valve

OPEN – Lift Pump No. 3 air relief isolation valve

OPEN – Lift Pump No. 4 air relief isolation valve

OPEN – Lift Pump No. 5 air relief isolation valve

OPEN – Sump Pump air relief isolation valve

Note: The air pressure relief isolation valves are considered part of their respective air pressure relief valve assemblies and are not itemized as individual units in the Water Authority's Asset Management Program.

4.4.5 Safety: Information Unique to the System or Process

Refer to Section 9 for general safety guidelines.

5.0 ELECTRICAL SYSTEM

This section provides a brief description of the electrical system at this pump station. Refer to Figure 5-1 for Electrical One-Line Diagram and Figure 5-2 for Electrical Site Plan.

5.1 Electrical Service

5.1.1 Overview

The pump station service is by two (2) 12,470V feeders from PNM. The service conductors are connected to an S & C Electric Company Model PMH-9 medium voltage (MV) switch that has no interconnecting bus, resulting in two (2) fused switches. The switches feed 12,470V to 480V transformers. The secondary of each transformer is connected to feed a 480V Motor Control Center (MCC). The secondary of each transformer is metered. The PMH-9 switch and the 12,470V to 480V transformers are owned and maintained by PNM.

5.1.2 Equipment Description

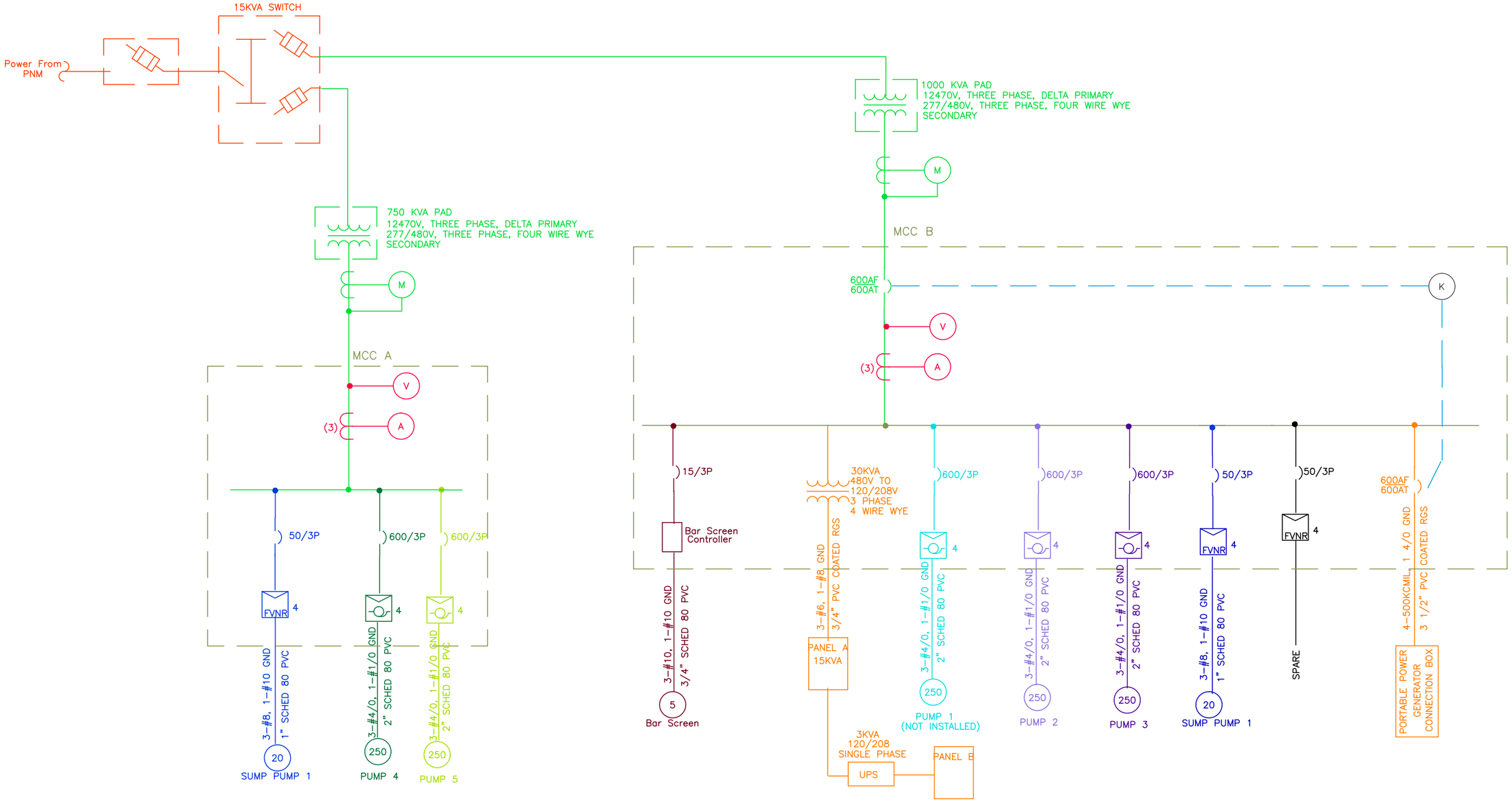
The service disconnects are the main circuit breakers (MCB) in the 480V MCCs.

5.1.3 Controls

The Lift Station Control Panel (LSCP) is a programmable logic-type controller (PLC) manufactured by Yukon and Associates. Wet well level transmitters in the wet well are connected to the LSCP.

5.1.4 Normal Operation

The LSCP detects the wet well level from the level transmitters. The LSCP provides the following control: lift pump control, sump pump control, intrusion detection and alarm.



PUMP STATION #47 ONE-LINE DIAGRAM

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City Of Albuquerque Stormwater Pump Stations

Pump Station No. 47 Montaño Electrical One-Line Diagram

Figure 5-1

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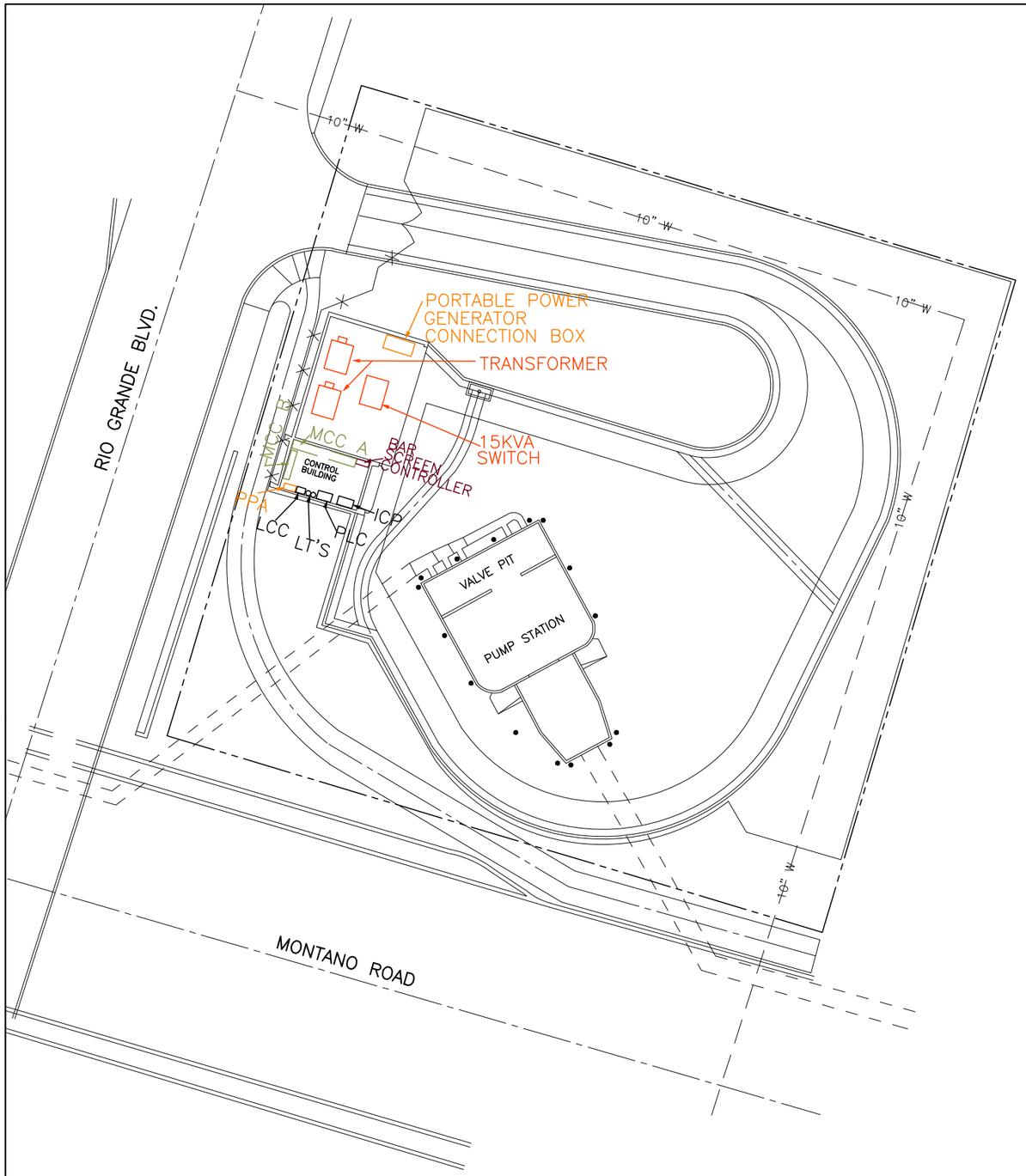
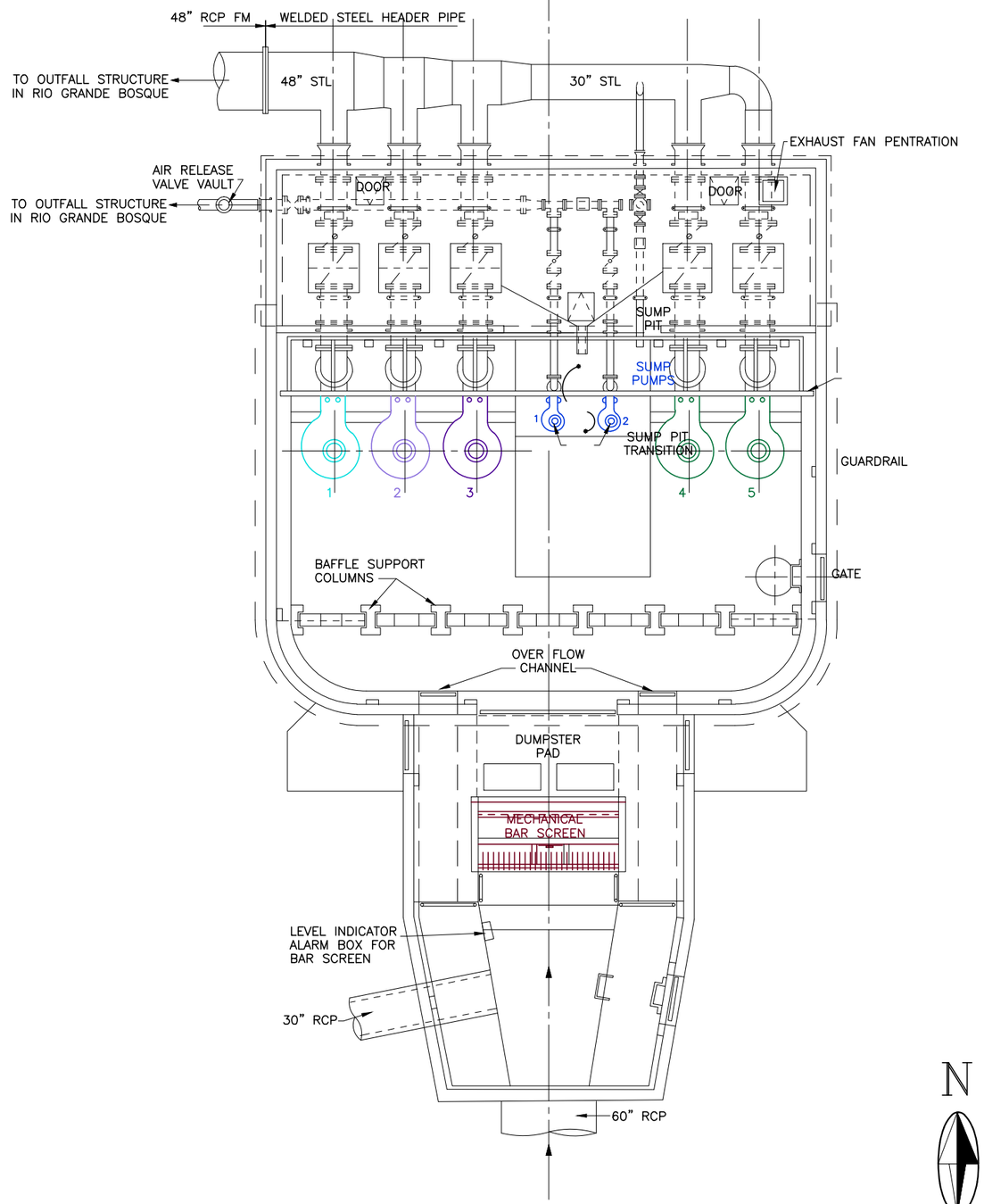
DWG. NAME: PS47_ELECSITEPlanU.dwg



ELECTRICAL SITE PLAN – UPPER LEVEL



ELECTRICAL SITE PLAN – LOWER LEVEL

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City Of Albuquerque Stormwater Pump Stations

Pump Station No. 47 Montaño Electrical Site Plan

Figure 5-2

5.1.5 Safety: Information Unique to the System or Process

Electrical service is energized at 480V. Coordinate with PNM to disconnect respective source before servicing. Contact PNM for maintenance and service of the MV switches and 12,470V transformers.

5.2 480V Motor Control Centers

5.2.1 Overview

The MCCs, designated MCC A and MCC B, were manufactured by Allen Bradley and field prepped by Yukon and Associates.

5.2.2 Equipment Description

MCC-A, installed on the west wall of the control building, contains a main circuit breaker (MCB) full voltage non-reversing (FVNR) starters for one (1) sump pump and one (1) spare starter, and reduced voltage solid state (RVSS) starters for two (2) lift pumps.

MCC-B, installed on the north wall of the control building, contains a MCB, FVNR starters for one (1) sump pump and one (1) spare FVNR, feeder circuit breakers (CB) for the station bar screen, the station transformer and one (1) spare CB, the station 480V to 120/208V transformer, and RVSS starters for three (3) lift pumps. MCC-B also contains a sub-feed CB for connection to a standby generator. The sub-feed CB is key-interlocked with the MCC-B MCB.

5.2.3 Controls

Controls on the RVSS starters include the RVSS operator interface, the starter disconnect switch, the Hand–Off–Automatic (HOA) switch, a RVSS – bypass selector switch, start and stop pushbuttons for RVSS and bypass. There are also pilot indicators for run, bypass run, and ready (after back spin timer has expired.)

Controls of the FVNR starters include the starter disconnect switch, the HOA switch, start pushbutton, stop pushbutton, and pilot indicator for run.

The generator CB contains a key interlock with the MCB to allow closing only one (1) of these CBs at a time.

Control of the CBs includes manual operation handle.

5.2.4 Normal Operation

When the LSCP calls for a pump to run, it signals to the associated starter in the 480V MCC. The starter connects the pump motor to the 480V source to start the pump.

5.2.5 Safety: Information Unique to the System or Process

The 480V MCCs operate at 480V. The disconnect switches shall be operated by trained personnel; the MCC shall be serviced and maintained by trained electricians. MCC-B may be served from more than one (1) source. Disconnect; then lockout and tagout all sources before servicing. Contact PNM to disconnect the utility source, then lockout and tagout the source before servicing either MCC.

5.3 Lift Pumps

5.3.1 Overview

The lift pumps are submersible style installed inside the wet well.

5.3.2 Equipment Description

The lift pumps are 230 HP submersible type pumps that operate at 480V. The pumps are controlled by the LSCP based on level sensors installed in the wet well.

5.3.3 Controls

Each pump has an internal temperature switch and a moisture detection switch. The internal switches are connected to control and status relay (CAS) mounted in the station integrated control panel (ICP). Additional protection for the lift pump motors include Flygt Submeg relays and high resistance relays, also mounted in the ICP. The Submeg monitors the resistance of the motor windings and the high resistance relay monitor resistance of the motor ground connection.

5.3.4 Normal Operation

The LSCP receives the wet well level from the level sensors installed in the wet well. When the level rises to the start lead pump level, the LSCP starts the lead pump. If the level continues to rise, and reaches the start lag pump level, the LSCP starts the lag pump. The LSCP stops the lag pump when pumping has lowered the wet well level to the stop lag pump level. The LSCP stops the lead pump when the wet well level falls to the stop lead level.

5.3.5 Safety: Information Unique to the System or Process

The lift pumps operate at 480V. Disconnect all sources before servicing a lift pump.

5.4 Sump Pumps

5.4.1 Overview

The sump pumps are submersible pumps installed in a sump area in the wet well. These pumps operate to maintain the wet well level below the start level of the storm pumps. The pumps are also used to empty the wet well for inspection and maintenance.

5.4.2 Equipment Description

The sump pumps are 20 HP Flygt brand submersible pumps that operate at 480V. The pumps are controlled by the LSCP based on 4 to 20 mA signals received from level transmitters installed in the wet well.

5.4.3 Controls

The pumps have an internal temperature switches and moisture detection switches. The internal switches are connected in the pump control circuit to stop the pump in event of an alarm.

5.4.4 Normal Operation

The LSCP receives the wet well level from the level transmitters installed in the wet well. When the level rises to the start sump pump level, the LSCP starts the lead sump pump. When pumping has lowered the wet well level to the stop level, the LSCP stops the sump pump. While the sump pump is running, if the level continues to increase, the LSCP stops the sump pump and starts the lead storm water pump at the predetermined level.

5.4.5 Safety: Information Unique to the System or Process

The sump pumps are remotely controlled and they operate at 480V. Disconnect and lock out source before servicing.

5.5 Bar Screen Control Panel (BSCP)

5.5.1 Overview

The BSCP operates the bar screen to remove debris from the influent to minimize channel blockage and protect the lift pumps.

5.5.2 Equipment Description

The BSCP is a relay logic-type controller that receives a control output from the LSCP, a high level switch input from the station influent channel, and signals from the bar screen mechanism. Relays and timers operate the reversing contactor to run the bar screen to clear the channel. The BSCP operates relays that initiate alarms to the station LSCP.

5.5.3 Controls

Controls mounted on the front of the BSCP include:

- Control power switch
- HOA switch
- Alarm silence pushbutton
- Reset pushbutton
- E-Stop pushbutton
- Panel front mounted indicators for:
    - Control power on indicator
    - Screen over torque
    - Motor overload
    - High brake temperature
    - High channel level
    - Channel flood level
    - Run forward
    - Run reverse

Controls inside the BSCP:

- Repeat cycle timer. Selectable interval.
- Run duration timer. Selectable duration; set for five (5) seconds for a single pass up to eight (8) minutes.

Controls at the bar screen mechanism:

- Reverse-Off-Forward (ROF) switch
- Start level switch
- Alarm level switch
- Torque overload limit switch

5.5.4 Normal Operation

A contact of the LSCP closes to start the bar screen on the preset interval. If there are no obstructions, the bar screen runs until the run duration timer expires. After the run duration timer expires, the screen continues to run until the rake reaches the park position to open an end of run switch; then the screen stops. Should debris caught in the bars cause the channel level to rise, a high channel level relay contact closes which initiates a bar screen run timer. The bar screen run timer initiates a run sequence. The bar screen runs continuously until the bar screen run timer expires. If the debris is large enough to overload the bar screen, the torque overload switch and the reverse motion alternator limit switch are activated. This causes the bar screen to stop. The bar screen may be switched to Hand and run in reverse to clear the obstruction. For more information on running the bar screen, refer to SOJP No. 4700-SU-Montaño Pump Station in Section 7.

5.5.5 Safety: Information Unique to the System or Process

The BSCP is energized at 480V. It shall be serviced only by electricians who are trained in the operation and are equipped with proper protective gear. All guards are to remain in place before starting and during operation of the equipment.

5.6 Lift Station Control Panel (LSCP)

5.6.1 Overview

The LSCP receives the wet well level signals. The LSCP energizes relays to start the lift pumps in accordance to the wet well level and the lead selections made by the operator. The LSCP relay contacts are connected to the radio transmitter to broadcast alarms to the Southside Water Reclamation Plant.

5.6.2 Equipment Description

The LSCP is a PLC controller. The LSCP has front panel mounted indicators to indicate the station operations.

5.6.3 Controls

The LSCP has a door mounted PLC operator interface panel. It also has pushbuttons for alarm acknowledge and reset.

5.6.4 Normal Operation

In automatic operation, level signals are applied to the LSCP. When the level signal reaches a preprogrammed level, relays are operated to start the lead sump pump. As the wet well level rises, the lead storm water pump is started and the sump pump is stopped. When the level falls into the sump pump range, the lead pump is stopped and the sump pump starts to empty the wet well.

5.6.5 Safety: Information Unique to the System or Process

The control panel has voltage from more than one (1) source. Disconnect all sources before servicing.

6.0 SECTION 6 – HVAC SYSTEMS OPERATION

This section provides a brief description of the HVAC system at this pump station.

6.1 Supply Fan System

6.1.1 Overview

The supply fan provides minimal ventilative cooling in the control room.

6.1.2 Equipment Description

The supply fan is a Greenheck. Its capacity is estimated at 715 cubic feet per minute (CFM).

6.1.3 Controls

The supply fan is operated by an automatic thermostat.

6.1.4 Normal Operation

The thermostat in the control room should be set to a maximum temperature of 90°F. A thermostat in the control room activates a supply fan whenever temperatures in the control room are equal to or above 90°F. When temperatures in the control room are below 90°F, the supply fan will be off.

6.1.5 Safety: Information Unique to the System or Process

Ventilation is required to maintain safe working temperatures of the electrical equipment. Overheating of the electrical equipment would likely result in costly replacement or possible down time on the pumping station.

6.2 Exhaust Fan System

6.2.1 Overview

The exhaust fan system provides minimal ventilation in the valve pit.

6.2.2 Equipment Description

The exhaust fan is an up-blast Greenheck ROU-18-3A5. The capacity of the exhaust fan is approximately 1,500 CFM.

6.2.3 Controls

The exhaust fan is activated by an on/off switch.

6.2.4 Normal Operation

HVAC Standard NFPA 820 requires continuous 6 AC/hr of ventilation for the enclosed valve room.

6.2.5 Safety: Information Unique to the System or Process

Ventilation is required in enclosed valve pit areas to reduce the chance of accumulating combustible gas.

7.0 STANDARD JOB OPERATING PROCEDURES

This section includes Standard Operating Job Procedures (SOJP) for the system and equipment for Pump Station No. 47 Montaño. The SOJPs provide the detailed instructions for testing each component necessary to ensure that during the summer storm season of July 1st through September 30th, the facilities will be prepared to operate. SOJPs are utility by the Albuquerque Bernalillo County Water Utility Authority (WUA) and are used as the primary means for testing the equipment within their system. If a facility appears to have an issue, the SOJP testing shall bring the issue to light and a means to promptly correctly address the issue.

7.1 List of SOJPs

Below is a list of the SOJPs developed for Pump Station No. 47 Montaño and are included in this section.

SOJP_4700_SU_Montaño Pump Station
SOJP_4700_N_Montaño Pump Station
SOJP_4700_SD_Montaño Pump Station

SOJP_4700_SU_ Montaño Supply Fan
SOJP_4700_N_ Montaño Supply Fan
SOJP_4700_SD_ Montaño Supply Fan

SOJP_4700_SU_ Montaño Exhaust Fan
SOJP_4700_N_ Montaño Exhaust Fan
SOJP_4700_SD_ Montaño Exhaust Fan

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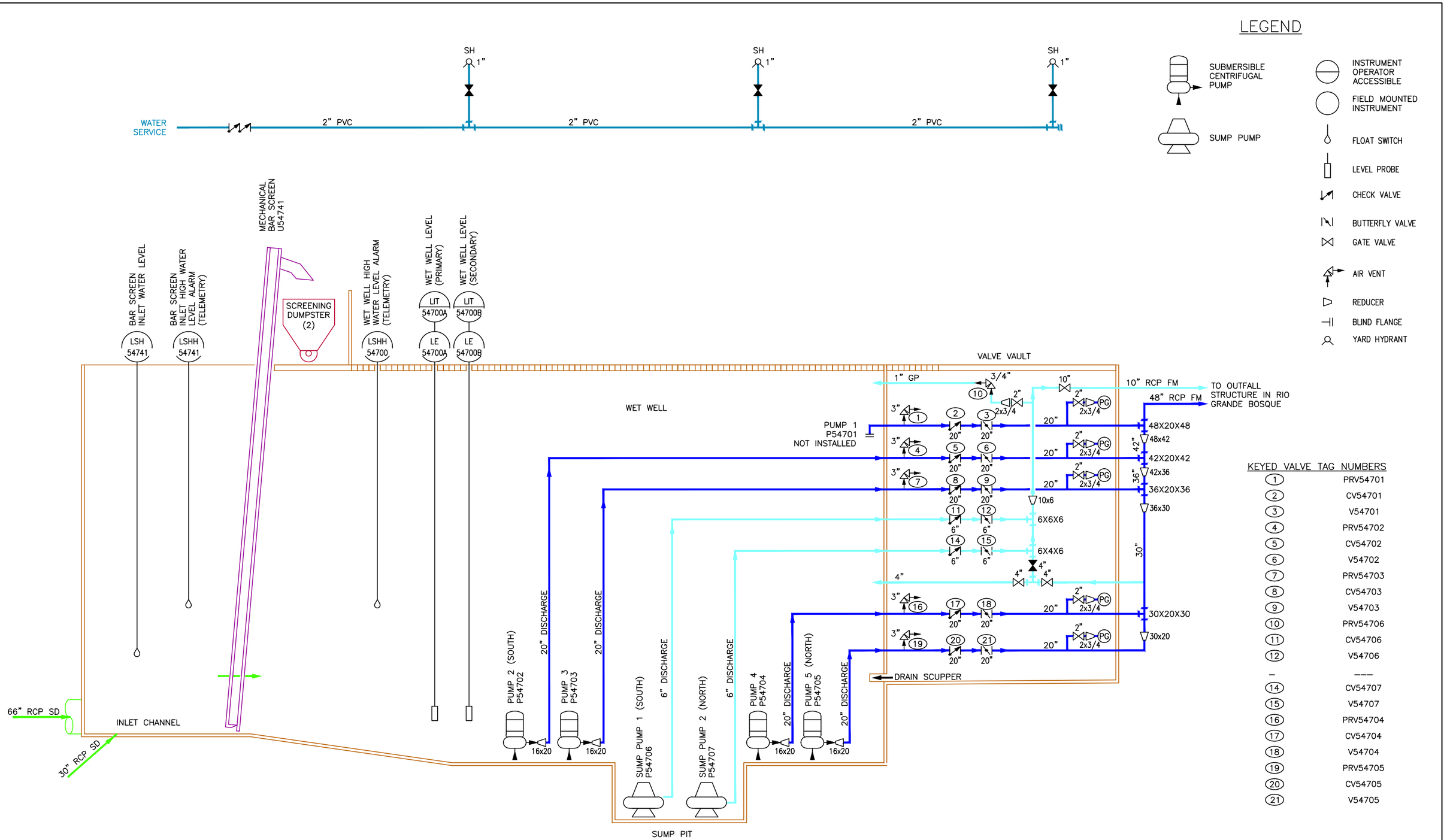
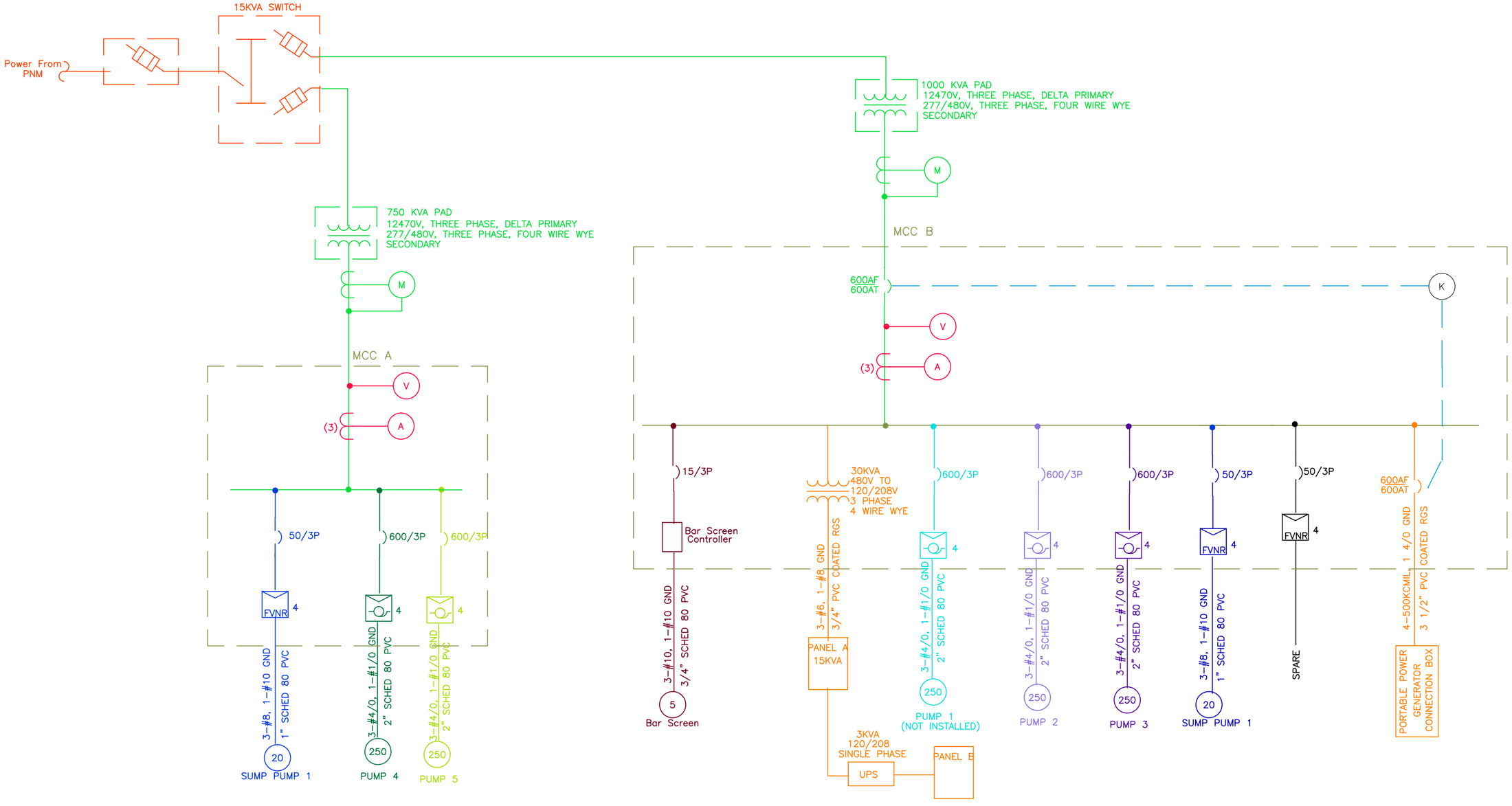


MOLZENCORBIN

City Of Albuquerque Stormwater Pump Stations

Pump Station No. 47 Montaño P&ID

Figure 47-1



PUMP STATION #47 ONE-LINE DIAGRAM

MOLZENCORBIN

City Of Albuquerque Stormwater Pump Stations

Pump Station No. 47 Montaño Electrical One-Line Diagram

Figure 47-2

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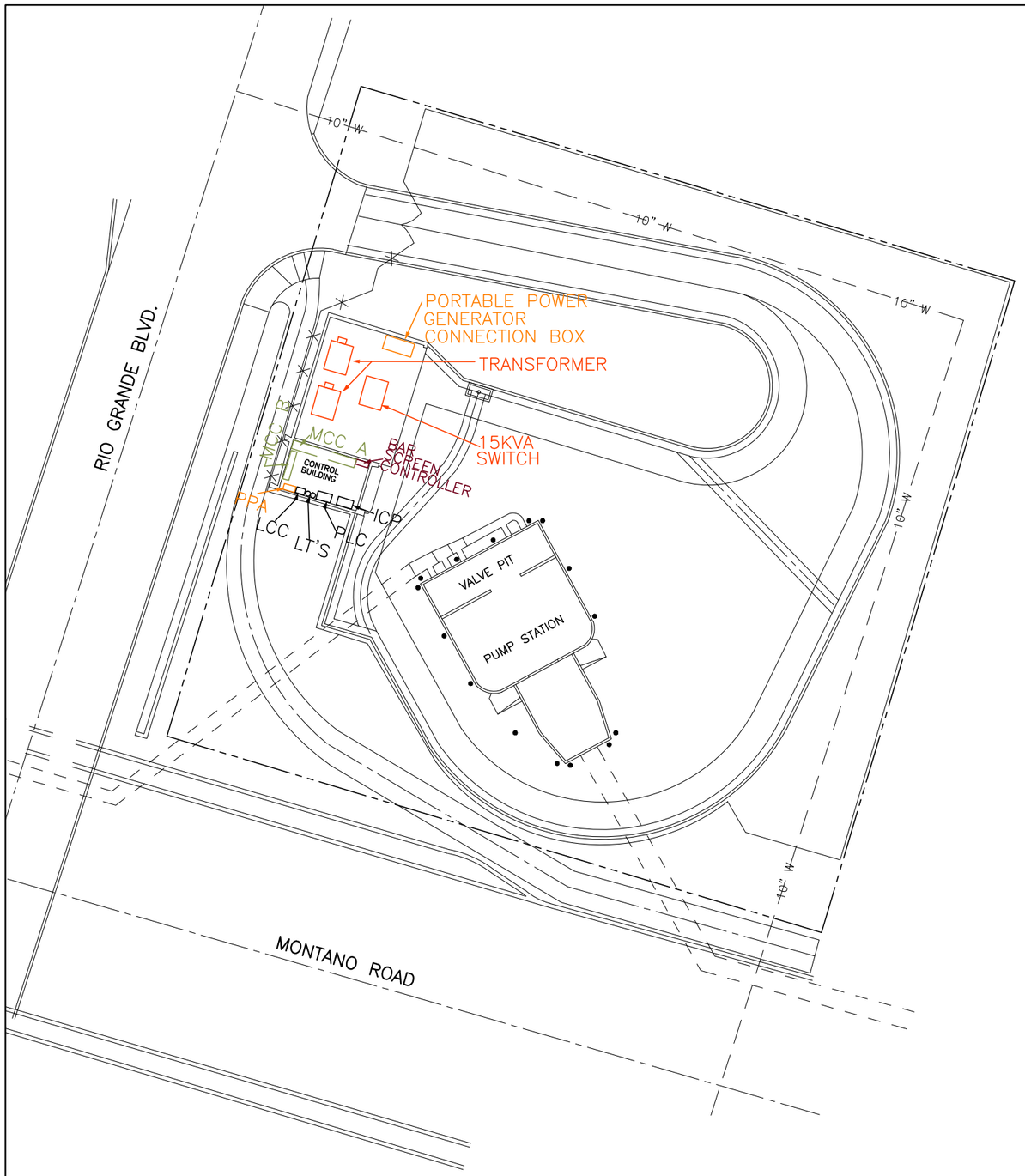
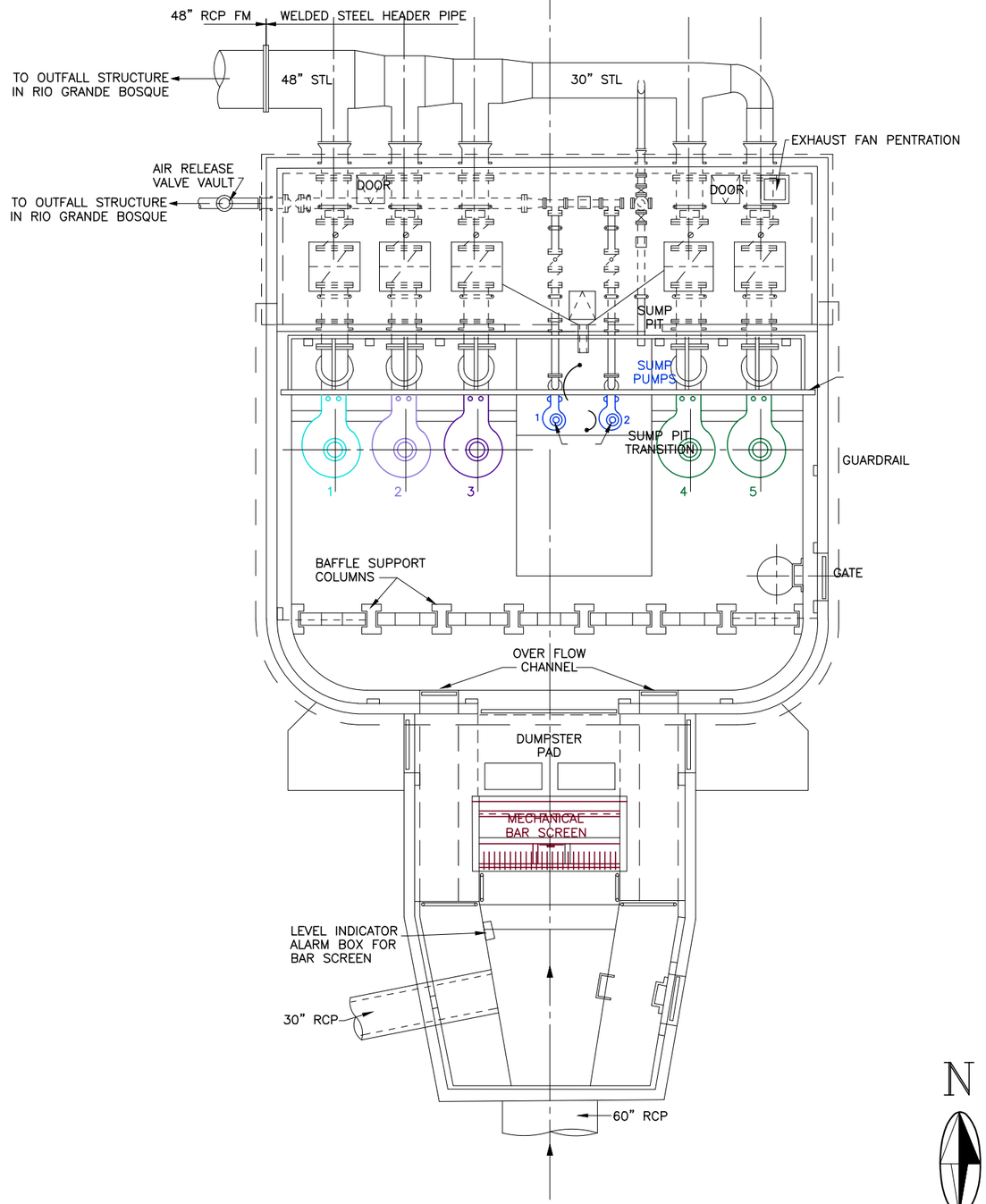


ELECTRICAL SITE PLAN – UPPER LEVEL



ELECTRICAL SITE PLAN – LOWER LEVEL

MOLZENCORBIN

City Of Albuquerque Stormwater Pump Stations

Pump Station No. 47 Montaño Electrical Site Plan

Figure 47-3

REF (Filename): SOJP_4700_SU_MONTAÑO PUMP STATION.doc
Revision Date: 7/7/2015
Revised By: Molzen Corbin
Approved by:

SOJP NO.: 4700-SU-MONTAÑO PUMP STATION

TITLE: MONTAÑO PUMP STATION – START-UP

Tools: Personal Protection Equipment: Hard hat, safety boots and safety glasses.

Hazards: Slip and fall and electrical shock.

Caution: See Section 9 Safety of the Stormwater Pump Station No. 47 Montaño Operations Manual

SYSTEM SCHEMATICS

Figure 47-1 Pump Station No. 47 Montaño P&ID
Figure 47-2 Pump Station No. 47 Montaño Electrical One-Line Diagram
Figure 47-3 Pump Station No. 47 Montaño Electrical Site Plan

MONTAÑO PUMP STATION

SYSTEM START-UP

PROCEDURE

Station Entry/Exit and Alarm Deactivation Procedure

Entry

1. Call Plant Control: Identify yourself with a Call Number: Example #202 and advise of your entry.
2. Entry: At the PLC Screen, Push the "F1" key and enter the code 5241. This code will disable the intrusion alarm and the screen will light all the indicators lights to verify entry.

Exit

1. To exit the station: The operators will need to push the reset button to clear and acknowledge all alarms. Once the reset button has been pushed and cleared, the operator will exit the station after securing the doors. The alarm system will reset in 120 seconds.
2. Call Plant control to verify all the alarms have been cleared and advise of your departure.

Before Normal Operation, the following is required:

1. Position or verify that the pump station valves are as follows:
   IN SERVICE – Lift Pump No. 2 swing-disk check valve **CV54702**
   IN SERVICE – Lift Pump No. 3 swing-disk check valve **CV54703**
   IN SERVICE – Lift Pump No. 4 swing-disk check valve **CV54704**
   IN SERVICE – Lift Pump No. 5 swing-disk check valve **CV54705**

IN SERVICE – Sump Pump No. 1 swing-disk check valve **CV54706**
IN SERVICE – Sump Pump No. 2 swing-disk check valve **CV54707**
IN SERVICE – Lift Pump No. 2 air pressure relief valve **PRV54702**
IN SERVICE – Lift Pump No. 3 air pressure relief valve **PRV54703**
IN SERVICE – Lift Pump No. 4 air pressure relief valve **PRV54704**
IN SERVICE – Lift Pump No. 5 air pressure relief valve **PRV54705**
IN SERVICE – Sump Pump air pressure relief valve **PRV54706**
OPEN – Lift Pump No. 2 butterfly isolation valve **V54702**
OPEN – Lift Pump No. 3 butterfly isolation valve **V54703**
OPEN – Lift Pump No. 4 butterfly isolation valve **V54704**
OPEN – Lift Pump No. 5 butterfly isolation valve **V54705**
OPEN – Sump Pump No. 1 butterfly isolation valve **V54706**
OPEN – Sump Pump No. 2 butterfly isolation valve **V54707**
OPEN – Lift Pump No. 2 air relief isolation valve
OPEN – Lift Pump No. 3 air relief isolation valve
OPEN – Lift Pump No. 4 air relief isolation valve
OPEN – Lift Pump No. 5 air relief isolation valve
OPEN – Sump Pump air relief isolation valve
Note: The air pressure relief isolation valves are considered part of their respective air pressure relief valves and are not itemized as individual units in the Water Authority's Asset Management Program.

2. Test the pumps starting with water in the wet well at a level at least 2 feet above the bottom of the impeller bell. Water may be diverted into the storm drains from a nearby ditch or from a fire hydrant. A pipe cap may be fitted to the inlet pipe to reduce the volume needed to test the pumps.
3. Check that the station medium voltage disconnect switch is closed (**ON**).

Test the Lift Pumps.

4. Check that the pump breaker switch(es) on the MCC are closed (**ON**).
   Note: If a breaker or disconnect switch (other than a 120V) for the equipment to be started is not in the **ON** position, notify the shift supervisor, enter the event in the operator log, and generate a work order for a maintenance repair dispatch to have the switch(es) placed in the **ON** position.

Test the Lift Pumps in HAND.

5. Place the lift pump HAND-OFF-AUTO (HOA) switch(es) on the Lift Station Control Panel (LSCP) in **AUTO**.
6. Select a lead lift pump with the selector switch at the LSCP.
   Note: Verify there is at least 2 feet of water above the impeller bell before starting a lift pump.
7. Place the HOA selector in **HAND** position to start the lead pump. Record amperage and secondary voltage.

Test the Lift Pumps in AUTO.

8. Place the HOA switches on the LSCP in the **AUTO** position.

9. Check and record the level at which the lead lift pump starts.
10. Check and record the level at which the lead lift pump stops.
11. Verify the HOA switches are in the **AUTO** position after start-up is complete.

Test the Sump Pump in HAND.

12. Verify the station 480V disconnect circuit breaker, on the 480V MCC is closed (**ON**).
    Note: Verify there is sufficient wet well level before starting the sump pump.
13. Select the **HAND** position with the HOA switch on the door of the Sump Pump Control Panel (SPCP) and then press the start pushbutton.
14. Verify the run indicator on the door of the SPCP illuminates.
    Note: Observe the wet well level. Stop the pump when the wet well level goes below the top of the pump housing.

Test the Sump Pump in AUTO.

15. Place the HOA switch on the SPCP in the **AUTO** position.
16. Check and record the level at which the sump pump starts.
17. Check and record the level at which the sump pump stops.
18. Verify the HOA switch is in the **AUTO** position after start-up is complete.

Test the Bar Screen Rake in HAND (FORWARD).

19. Verify the station 480V disconnect circuit breaker, on the 480V MCC is closed (**ON**).
20. Verify that the power disconnect on the door of the Bar Screen Control Panel (BSCP) is closed (**ON**).
21. Verify the control power on indicator is illuminated.
22. Select the **HAND** position with the HOA switch on the door of the BSCP.
23. Using the REVERSE-OFF-FORWARD (ROF) selector switch on the BSCP, select the **FORWARD** position.
    Note: Use caution. The bar screen will start in the forward direction.
24. **Test the Bar Screen Rake in HAND (REVERSE).**
25. Start the bar screen rake in the forward direction.
26. While the bar screen rake is in motion, move the ROF switch to the **OFF** position. The bar screen rake should stop.
27. While the bar screen rake is stopped, switch to the **REVERSE** position. The bar screen rake should run in reverse.
28. Verify that the ROF switch returns to the **OFF** position when it is released.

Test the Bar Screen Rake in AUTO.

29. Select the **AUTO** position with the HOA on the door of the BSCP.
30. After the start-up checks are complete, verify the bar screen HOA switch is in the **AUTO** position.

Albuquerque Bernalillo County
Water Utility Authority

REF (Filename): SOJP_4700_N_ MONTAÑO PUMP STATION .docx
Revision Date: 7/7/2015
Revised By: Molzen Corbin
Approved by:

SOJP NO.: 4700-N-MONTAÑO PUMP STATION

TITLE: MONTAÑO PUMP STATION - NORMAL OPERATION

Tools: Personal Protection Equipment: Hard hat, safety boots, and safety glasses.

Hazards: Slip and fall and electrical shock

Caution: See Section 9 Safety of the Stormwater Pump Station No. 47 Montaño Operations Manual

SYSTEM SCHEMATICS

Figure 47-1 Pump Station No. 47 Montaño P&ID
Figure 47-2 Pump Station No. 47 Montaño Electrical One-Line Diagram
Figure 47-3 Pump Station No. 47 Montaño Electrical Site Plan

MONTAÑO PUMP STATION

NORMAL OPERATION

GENERAL

Stormwater is conveyed into the pump station inlet channel through 4,400 feet of 66-inch diameter reinforced concrete pipe (RCP). The stormwater passes through a mechanical bar screen, whose raking mechanism is activated by float level sensors. The screenings are raked up the face of the screen into two (2) outdoor dumpsters above grade. The inlet channel was constructed with bypass channels on each side of the bar screen to allow unscreened stormwater to enter the wet well under high-flow or blinded screen conditions. After passing through the bar screen, stormwater enters the pump station's wet well.

The pump station has a duty-standby configuration for the four (4) lift pumps and two (2) wet well sump pumps. Stormwater is pumped by any combination of the four (4) 230 HP submersible pumps. Capacity of the wet well sump pump is small, relative to the lift pumps. The intent of the sump pump is only to remove water in the wet well that remains once the water level has dropped below the inlet of the lift pumps, and to handle small, non-storm infiltration flows. Each pump is equipped with an air pressure relief valve, a check valve, and an isolation valve.

NORMAL OPERATION CONDITIONS

During normal operation, the HOA switches for the sump pump and lift pumps will be in **AUTO** and will start and stop automatically based on the level transmitters.

LEAD, LAG, STANDBY assignments:

The lead lift pump is selected manually with the selector at the LSCP.

The active level transmitter is selected automatically as the transmitter with the highest level indications or manually with a switch at the LSCP.

Valve Positions at Pump Station No. 47 Montaño during normal operation are as follows:

IN SERVICE – Lift Pump No. 2 swing-disk check valve **CV54702**
IN SERVICE – Lift Pump No. 3 swing-disk check valve **CV54703**
IN SERVICE – Lift Pump No. 4 swing-disk check valve **CV54704**
IN SERVICE – Lift Pump No. 5 swing-disk check valve **CV54705**
IN SERVICE – Sump Pump No. 1 swing-disk check valve **CV54706**
IN SERVICE – Sump Pump No. 2 swing-disk check valve **CV54707**
IN SERVICE – Lift Pump No. 2 air pressure relief valve **PRV54702**
IN SERVICE – Lift Pump No. 3 air pressure relief valve **PRV54703**
IN SERVICE – Lift Pump No. 4 air pressure relief valve **PRV54704**
IN SERVICE – Lift Pump No. 5 air pressure relief valve **PRV54705**
IN SERVICE – Sump Pump air pressure relief valve **PRV54706**
OPEN – Lift Pump No. 2 butterfly isolation valve **V54702**
OPEN – Lift Pump No. 3 butterfly isolation valve **V54703**
OPEN – Lift Pump No. 4 butterfly isolation valve **V54704**
OPEN – Lift Pump No. 5 butterfly isolation valve **V54705**
OPEN – Sump Pump No. 1 butterfly isolation valve **V54706**
OPEN – Sump Pump No. 2 butterfly isolation valve **V54707**
OPEN – Lift Pump No. 2 air pressure relief isolation valve
OPEN – Lift Pump No. 3 air pressure relief isolation valve
OPEN – Lift Pump No. 4 air pressure relief isolation valve
OPEN – Lift Pump No. 5 air pressure relief isolation valve
OPEN – Sump Pump air pressure relief isolation valve

Note: The air pressure relief isolation valves are considered part of their respective air pressure relief valve assemblies and are not itemized as individual units in the Water Authority Asset Management Program.

NORMAL OPERATING PROCEDURES

Station Entry/Exit and Alarm Deactivation Procedure

Entry

1. Call Plant Control: Identify yourself with a Call Number: Example #202 and advise of your entry.
2. Entry: At the PLC Screen, Push the "F1" key and enter the code 5241. This code will disable the intrusion alarm and the screen will light all the indicators lights to verify entry.

Exit

1. To exit the station: The operators will need to push the reset button to clear and acknowledge all alarms. Once the reset button has been pushed and cleared, the operator will exit the station after securing the doors. The alarm system will reset in 120 seconds.
2. Call Plant control to verify all the alarms have been cleared and advise of your departure.

After initial Start-up, Normal Operation is as follows:

1. Check for abnormal conditions when entering facility – flooding, broken equipment, electrical fires, etc.
2. Check the building thermostat for proper HVAC settings.
3. Check the pump station and equipment status at the control panel.
4. Check and record the AC voltage at the Motor Control Center.
5. During lift pump operation check and record the amperage and secondary voltage.
6. Check the bar screen control panel indicators for faults and indication that control power is available.
7. Check sump pump control panel indicators for faults.
8. Check and record wet well level at the level transmitters.
9. When the bar screen motor is subjected to high torque, the motor will shut-off after four (4) reverse-forward shuttle attempts to clear the obstruction and send an alarm. Upon receiving high torque alarm, visually assess how to clear the obstruction, which may involve running the bar screen in **HAND** mode in **REVERSE** and **FORWARD** cycles.
10. When the water level in the entrance channel is high, just above the channel wall, the bar screen will shut off. Manually operate the rake to park the motor in the **UP** position (using either forward or reverse operation as needed). This will prevent submerging the bar screen motor. Operate the lift pumps to bring the water level below the channel walls and resume bar screen operations.

Albuquerque Bernalillo County
Water Utility Authority

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Revision Date: 7/7/20151
Revised By: Molzen Corbin
Approved by:

SOJP NO.: 4700-SD-MONTAÑO PUMP STATION

TITLE: MONTAÑO PUMP STATION-SHUTDOWN

Tools: Personal Protection Equipment: Hard hat, safety boots and safety glasses.

Hazards: Slip and fall and electrical shock.

Caution: See Section 9 Safety of the Stormwater Pump Station No. 47 Montaño Operations Manual

SYSTEM SCHEMATICS

Figure 47-1 Pump Station No. 47 Montaño P&ID
Figure 47-2 Pump Station No. 47 Montaño Electrical One-Line Diagram
Figure 47-3 Pump Station No. 47 Montaño Electrical Site Plan

MONTAÑO PUMP STATION

SYSTEM SHUTDOWN

PROCEDURE

Mechanical Bar Screen Shutdown

Shutdown is required for maintenance or for replacement. Shutdown of the mechanical bar screen is as follows:

1. Disconnect, lock and tag the power source of the mechanical bar screen before servicing. Failure to disconnect the power source can result in fire, shock, or serious injury. Follow ABCWUA lock out, tag out (LOTO) procedures located in Appendix E.
2. Select the **OFF** position with the HAND-OFF-AUTO (HOA) switch on the door of the BSCP.
3. The 480V disconnect switch in the BSCP should be opened for complete shutdown.

   Note: if a breaker or disconnect switch (other than a 120V) for the equipment to be shutdown is not in the **OFF** position, notify the shift supervisor, enter the event in the operator log, and generate a work order for a maintenance repair dispatch to have the switch(es) placed in the **OFF** position.

Lift Pump Shutdown

Shutdown is required for maintenance or for replacement. Shutdown of the selected lift pump is as follows:

1. Disconnect, lock and tag the power source of the selected lift pump before servicing. Failure to disconnect the power source can result in fire, shock, or serious injury. Follow ABCWUA LOTO procedures located in Appendix E.

2. Select the **OFF** position for the selected pump with the HOA switch on the door of the Lift Station Control Panel.
3. Verify the HOA for the remaining lift pumps are in the **AUTO** position.
4. Close the discharge isolation valve of the selected lift pump.

Sump Pump Shutdown

Shutdown is required for maintenance or for replacement. Shutdown of the selected sump pump is as follows:

1. Disconnect, lock and tag the power source of the selected sump pump before servicing. Failure to disconnect the power source can result in fire, shock, or serious injury. Follow ABCWUA LOTO procedures located in Appendix E.
2. Select the **OFF** position for the sump pump with the HOA switch on the door of the Sump Pump Control Panel (SPCP).
3. Open the 480V circuit breaker inside the SPCP.
4. Close the discharge isolation valve of the selected sump pump.

Albuquerque Bernalillo County
Water Utility Authority

REF (Filename): SOJP_4700_SU_ MONTAÑO SUPPLY FAN.doc
Revision Date: 7/7/2015
Revised By: Molzen Corbin
Approved by:

SOJP NO.: 4700-SU-MONTAÑO SUPPLY FAN

TITLE: MONTAÑO SUPPLY FAN SYSTEM – START-UP

Tools: Personal Protection Equipment: Hard hat, safety boots and safety glasses, tachometer, and screw driver for set crews.

Hazards: Improper installation can result in electric shock.

Caution: When servicing fan, motor may be hot enough to cause pain or injury.

SYSTEM SCHEMATICS

NA

MONTAÑO SUPPLY FAN SYSTEM

SYSTEM START-UP

GENERAL

The supply fan system provides ventilative cooling in the control room.

PROCEDURE

Before Normal Operation, the following is required:

1. Check all fasteners for tightness. In particular, check the setscrews in the wheel hub.
2. While in the **OFF** position or before connecting the fan to power, turn the fan wheel by hand to be sure it is not striking any obstacle.
3. Start the fan and shut if off immediately to check rotation of the wheel with directional arrow in the motor compartment.
4. When the fan is started, observe the operation and check for unusual noises.
5. With the system in full operation, measure the current input to the motor and compare with the nameplate rating to determine if the motor is operating under safe load conditions.
6. Inspection of the fan should be conducted at the first 30-minute and 24-hour intervals of satisfactory operation.
7. At the 30-minute interval, inspect bolts, setscrews and motor mounting bolts. Adjust and tighten as necessary.
8. At the 24-hour interval, check all internal components. On belt drives only, inspect belt alignment and tension. Adjust and tighten as necessary.
9. Set line voltage thermostat to 90°F for system serving control room.

Albuquerque Bernalillo County
Water Utility Authority

REF (Filename): SOJP_4700_N_MONTAÑO SUPPLY FAN.doc
Revision Date: 7/7/2015
Revised By: Molzen Corbin
Approved by:

SOJP NO.: 4700-N-MONTAÑO SUPPLY FAN

TITLE: MONTAÑO SUPPLY FAN SYSTEM – NORMAL OPERATION

Tools: Personal Protection Equipment: Hard hat, safety boots and safety glasses, tachometer, and screw driver for set crews.

Hazards: Improper installation can result in electric shock.

Caution: When servicing fan, motor may be hot enough to cause pain or injury.

SYSTEM SCHEMATICS

NA

MONTAÑO SUPPLY FAN SYSTEM

NORMAL OPERATIONS

GENERAL

The supply fan system provides minimal ventilation cooling in the control room.

NORMAL OPERATION PROCEDURE

After initial Start-up, Normal Operation is as follows:

1. The thermostat in the control room should be set to a maximum temperature of 90°F. A line voltage thermostat mounted in the control room will activate an exhaust fan whenever temperature in the control room is equal to or above 90°F. When temperature in the control room is below 90°F, the exhaust fan will be off.

Albuquerque Bernalillo County
Water Utility Authority

REF (Filename): SOJP_4700_SD_MONTAÑO SUPPLY FAN.doc
Revision Date: 7/7/2015
Revised By: Molzen Corbin
Approved by:

SOJP NO.: 4700 – SD-MONTAÑO SUPPLY FAN

TITLE: MONTAÑO SUPPLY FAN-SHUTDOWN

Tools: Personal Protection Equipment: Hard hat, safety boots and safety glasses, tachometer, and screw driver for set crews.

Hazards: Improper installation can result in electric shock.

Caution: When servicing fan, motor may be hot enough to cause pain or injury.

SYSTEM SCHEMATICS

NA

MONTAÑO SUPPLY FAN SYSTEM

SHUTDOWN OPERATIONS

PROCEDURE

Shutdown is required for maintenance or for replacement. Shutdown of the supply fans is as follows:

1. Disconnect, lock, and tag power source before servicing. Failure to disconnect power source can result in fire, shock, or serious injury.

Albuquerque Bernalillo County
Water Utility Authority

REF (Filename): SOJP_4700_SU_MONTAÑO EXHAUST FAN.doc
Revision Date: 5/7/2015
Revised By: Molzen Corbin
Approved by:

SOJP NO.: 4700-SU-MONTAÑO EXHAUST FAN

TITLE: MONTAÑO EXHAUST FAN SYSTEM – START-UP

Tools: Personal Protection Equipment: Hard hat, safety boots and safety glasses, tachometer, and screw driver for set crews.

Hazards: Improper installation can result in electric shock.

Caution: When servicing fan, motor may be hot enough to cause pain or injury.

System Schematics:

NA

MONTAÑO EXHAUST FAN SYSTEM

SYSTEM START-UP

GENERAL

The exhaust fan system provides ventilation in the control valve room.

PROCEDURE

Before Normal Operation, the following is required:

1. Check all fasteners for tightness. In particular, check the setscrews in the wheel hub.
2. While in the **OFF** position or before connecting the fan to power, turn the fan wheel by hand to be sure it is not striking any obstacle.
3. Start the fan and shut if off immediately to check rotation of the wheel with directional arrow in the motor compartment.
4. When the fan is started, observe the operation and check for unusual noises.
5. With the system in full operation, measure the current input to the motor and compare with the nameplate rating to determine if the motor is operating under safe load conditions.
6. Inspection of the fan should be conducted at the first 30-minute and 24-hour intervals of satisfactory operation.
7. At the 30-minute interval, inspect bolts, setscrews and motor mounting bolts. Adjust and tighten as necessary.
8. At the 24-hour interval, check all internal components. On belt drives only, inspect belt alignment and tension. Adjust and tighten as necessary.
9. Set switch to on for system serving the control valve room.

Albuquerque Bernalillo County
Water Utility Authority

REF (Filename): SOJP_4700_N_ MONTAÑO EXHAUST FAN.doc
Revision Date: 7/7/2015
Revised By: Molzen Corbin
Approved by:

SOJP NO.: 4700-N-MONTAÑO EXHAUST FAN

TITLE: MONTAÑO EXHAUST FAN SYSTEM – NORMAL OPERATION

Tools: Personal Protection Equipment: Hard hat, safety boots and safety glasses, tachometer, and screw driver for set crews.

Hazards: Improper installation can result in electric shock.

Caution: When servicing fan, motor may be hot enough to cause pain or injury.

SYSTEM SCHEMATICS

NA

MONTAÑO EXHAUST FAN SYSTEM

NORMAL OPERATIONS

GENERAL

The exhaust fan system provides continuous ventilation in the control valve room.

NORMAL OPERATION PROCEDURE

After initial Start-up, Normal Operation is as follows:

1. The control valve room is required 6 AC/hr of continuous ventilation. An on/off switch mounted in the control valve room will activate an exhaust fan whenever continuous ventilation is required.

Albuquerque Bernalillo County
Water Utility Authority

REF (Filename): SOJP_4700_SD_ MONTAÑO EXHAUST FAN.doc
Revision Date: 7/7/2015
Revised By: Molzen Corbin
Approved by:

SOJP NO.: 4700–SD-MONTAÑO EXHAUST FAN

TITLE: MONTAÑO EXHAUST FAN-SHUTDOWN

Tools: Personal Protection Equipment: Hard hat, safety boots and safety glasses, tachometer, and screw driver for set crews.

Hazards: Improper installation can result in electric shock.

Caution: When servicing fan, motor may be hot enough to cause pain or injury.

SYSTEM SCHEMATICS

NA

MONTAÑO EXHAUST FAN SYSTEM

SHUTDOWN OPERATIONS

PROCEDURE

Shutdown is required for maintenance or for replacement. Shutdown of the exhaust fans is as follows:

1. Disconnect, lock, and tag power source before servicing. Failure to disconnect power source can result in fire, shock, or serious injury.

8.0 STANDARD MAINTENANCE PROCEDURES

Standard Maintenance Procedures are developed to provide a list of tasks to be performed at a specified frequency to increase the overall life and performance of the lift station equipment. These procedures provide the recommended maintenance to be performed at the pump station with input from facilities staff and/or manufacturer's instructions.

8.1 Water Resource Equipment

8.1.1 Mechanical Bar Screen

Maintenance is to be performed only by qualified personnel who are familiar with this type of equipment. The maintenance schedule includes items which should be completed based on run-time, as well as weekly, monthly, quarterly, and semi-annual intervals. The schedule is contained in Appendix B. For further instruction, reference the manufacturer's O&M manual.

8.1.2 Lift Pumps

Maintenance is to be performed only by qualified personnel who are familiar with this type of equipment. The local sales and service representative Flygt Pumps is James, Cooke, and Hobson, located in Albuquerque, NM. For further instruction, refer to the manufacturer's O&M manual. Appendix C may also be referenced for manufacturer's general information and pump maintenance specifications.

The lift pumps will need to be lifted with a hired, truck-mount crane. The pump locations in the wet well are equipped with guide rails that prevent swinging during removal and aid in alignment during reinstallation. The approximate weight of any equipment should be verified prior to lifting.

8.1.3 Sump Pumps

Maintenance is to be performed only by qualified personnel who are familiar with this type of equipment. The local sales and service representative Flygt Pumps is James, Cooke, and Hobson, located in Albuquerque, NM. For further instruction, refer to the manufacturer's O&M manual. Appendix D may also be referenced for manufacturer's general information and pump maintenance specifications.

The sump pumps will need to be lifted with either a portable crane or winch. The pump locations in the wet well are equipped with guide rails that prevent swinging during removal and aid in alignment during reinstallation. The approximate weight of any equipment should be verified prior to lifting.

8.1.4 Valves

Maintenance is to be performed only by qualified personnel who are familiar with this type of equipment. All manual valves should be cycled annually to ensure proper operation. Inspect for leakage around mating surfaces and replaces gaskets as needed. The swing check valve lever arms should be manually operated annually to ensure proper operation. Valves that appear to be faulty should be removed, inspected, and replaced if necessary. Refer to Appendix A for a listing of valves and local service technicians.

8.2 Electrical Equipment

8.2.1 480V Motor Control Center (MCC)

The 480V MCC contains the main circuit breaker (MCB) for the station 480V service. The MCC has reduced voltage solid state (RVSS) starters for the three (3) station storm water lift pumps, and two (2) sump pumps. The MCC has circuit breakers (CB) to feed the bar screen controller and a unit heater. Additionally, there is a sub-feed CB through which a standby generator may be

connected to serve the pump station. The generator sub-feed CB is key-interlocked with the MCC MCB. The MCC also houses the station 480V to 120/208V transformer and a panelboard.

Maintenance: Always disconnect, lock and tag power source before servicing.

Ongoing:

- Visual inspection
- Keep the surrounding area clean

Annual:

- Visual inspection
- Vacuum interior of the MCC
- Operate each circuit breaker
- Plug or cover all unused openings

5-Year:

- Perform annual inspection
- Check/tighten all connections

8.2.2 Bar Screen Control Panel (BSCP)

The BSCP operates the bar screen rake to remove debris from the influent to minimize channel blockage and protect the lift pumps.

Ongoing:

- Visual inspection
- Keep the surrounding area clean

Annual:

- Visual inspection
- Vacuum interior of the control panel
- Check/tighten all connections
- Operate all switches
- Test all pilot indicators

- Plug or cover all unused openings
- Manually operate floats and check control relative to rising signal

5-Year:

- Conduct annual maintenance
- Infrared scan

8.2.3 Lift Station Control Panel (LSCP)

The LSCP is a programmable logic-type controller that receives input regarding pump station status and produces outputs to affect pump station operation. The LSCP starts and stops the sump pumps and upon stop, alternates the lead pump. The LSCP starts and stops the storm water lift pumps and alternates the start sequence based on station operator inputs. The LSCP receives alarms from the BSCP. The LSCP monitors intrusion switches for station security. The LSCP also communicates status and alarms to the control system at the Southside Water Reclamation Plant.

Ongoing:

- Visual inspection
- Keep the surrounding area clean

Annual:

- Visual inspection
- Vacuum interior of the control panel
- Check/tighten all connections
- Operate input switches and observe the LSCP reaction
    - Intrusion switches
    - Float switches for bar screen and sump pump
- Connect variable 4 to 20 mA signal and check the LSCP reaction to wet well rising level.

5-Year:

- Conduct annual maintenance
- Test radio communication signal strength

8.3 HVAC Equipment

8.3.1 Supply Fan

Maintenance is to be performed only by qualified personnel who are familiar with this type of equipment. Maintenance is generally limited to cleaning, replacing belts, lubricating bearings and checking wheel alignment. Cleaning is limited to exterior surfaces only and removing dust build up on motor housing. Refer to the specific manufacturer's guidelines for further details. The following general guidelines should be followed every 12 months:

General:

1. Always disconnect, lock and tag power source before servicing.
2. Greasing of motors is only intended when fittings are provided. Many fractional horsepower motors are permanently lubricated and should not be lubricated.
3. Motors supplied with grease fittings should be greased in accordance with manufacturer's recommendations. Where motor temperatures do not exceed 104°F, the grease should be replaced after 2,000 run hours.
4. Wheels and motor housing should be dusted off.
5. Shaft bearings that are non-lubricating require no further lubrication.
6. Cast pillow block bearings are factory lubricated and are provided with external grease fittings. Use only one (1) or two (2) shots of lubricant with a hand gun while rotating bearings.
7. Grease fittings should be wiped clean.
8. Grease should be pumped slowly until slight bead forms around the seal. A high grade lithium base grease should be used. Some Grease manufactures include the following:
    a. US Electric Motors – Grease No. 83343
    b. Chevron USA Inc - Chevron SRI Grease #2
    c. Mobile oil Corporation – Mobilith or Mobil 532.
9. All fasteners should be checked for tightness each time maintenance checks are performed prior to restarting.

10. Wheel position is factory preset and realignment may be necessary if movement occurred. Reference vendor's maintenance manual for minimum overlap and gap dimensions.
11. Check wheel rotation by momentarily energizing the unit. Rotation should be clockwise when viewing from the shaft side. If wheel rotation is incorrect, reverse tow of the wiring leads or check motor wiring for single phase.

Direct Drives Only:

1. Centering height alignment can be accomplished by loosening the set screws in the wheel and moving the wheel to the desired position.
2. Fan RPM should be checked and verified with a tachometer.

Belt Drives Only:

1. Worn belts should be replaced with new belts of the same type as supplied with unit.
2. To ensure belt tightness, check pulley set screws. Proper keys must be in keyways. Belt tension can be adjusted by loosening four (4) fasteners on the drive frame. Reference vendor's maintenance manual for Belt tension requirements.
3. Fan RPM should not be readjusted. Only use pulleys of identical size and type when replacing pulleys. The adjustable motor pulley is factory set for the RPM specified. Speed is increased by closing or decreased by opening the adjustable pulley. Any increase in speed represents a substantial increase in horsepower and motor amperage should always be checked to avoid serious damage when speed is varied.
4. Centering can be accomplished by loosening the bolts holding the drive frame to the shock mounts and repositioning the drive frame.
5. Wheel and inlet cone overlap can be adjusted by loosening the set screws in the wheel and moving the wheel to the desired position.
6. For units with two (2) groove pulleys, adjust so the tension is equal in both belts.
7. If adjustments are made, it is very important to check the pulleys for straight alignment.

8.3.2 Exhaust Fan

Maintenance is to be performed only by qualified personnel who are familiar with this type of equipment. Maintenance is generally limited to cleaning, replacing belts, lubricating bearings and checking wheel alignment. Cleaning is limited to exterior surfaces only and removing dust build up on motor housing. Refer to the specific manufacturer's guidelines for further details. The following general guidelines should be followed every 12 months:

General:

1. Always disconnect, lock and tag power source before servicing.
2. Greasing of motors is only intended when fittings are provided. Many fractional horsepower motors are permanently lubricated and should not be lubricated.
3. Motors supplied with grease fittings should be greased in accordance with manufacturer's recommendations. Where motor temperatures do not exceed 104°F, the grease should be replaced after 2,000 run hours.
4. Wheels and motor housing should be dusted off.
5. Shaft bearings that are non-lubricating require no further lubrication.
6. Cast pillow block bearings are factory lubricated and are provided with external grease fittings. Use only one (1) or two (2) shots of lubricant with a hand gun while rotting bearings.
7. Grease fittings should be wiped clean.
8. Grease should be pumped slowly until slight bead forms around the seal. A high grade lithium base grease should be used. Some Grease manufactures include the following:
    a. US Electric Motors – Grease No. 83343
    b. Chevron USA Inc - Chevron SRI Grease #2
    c. Mobile oil Corporation – Mobilith or Mobil 532.
9. All fasteners should be checked for tightness each time maintenance checks are performed prior to restarting.
10. Wheel position is factory preset and realignment may be necessary if movement occurred. Reference vendor's maintenance manual for minimum overlap and gap dimensions.

11. Check wheel rotation by momentarily energizing the unit. Rotation should be clockwise when viewing from the shaft side. If wheel rotation is incorrect, reverse tow of the wiring leads or check motor wiring for single phase.

Direct Drives Only:

1. Centering height alignment can be accomplished by loosening the set screws in the wheel and moving the wheel to the desired position.
2. Fan RPM should be checked and verified with a tachometer.

Belt Drive Only:

1. Worn belts should be replaced with new belts of the same type as supplied with unit.
2. To ensure belt tightness, check pulley set screws. Proper keys must be in keyways. Belt tension can be adjusted by loosening four fasteners on the drive frame. Reference vendor's maintenance manual for Belt tension requirements.
3. Fan RPM should not be readjusted. Only use pulleys of identical size and type when replacing pulleys. The adjustable motor pulley is factory set for the RPM specified. Speed is increased by closing or decreased by opening the adjustable pulley. Any increase in speed represents a substantial increase in horsepower and motor amperage should always be checked to avoid serious damage when speed is varied.
4. Centering can be accomplished by loosening the bolts holding the drive frame to the shock mounts and repositioning the drive frame.
5. Wheel and inlet cone overlap can be adjusted by loosening the set screws in the wheel and moving the wheel to the desired position.
6. For units with two (2) groove pulleys, adjust so the tension is equal in both belts.
7. If adjustments are made, it is very important to check the pulleys for straight alignment.

9.0 SAFETY

This section presents general information on safety procedure to help prevent accidents. Consequently, to reduce the danger, anyone engaged in the operation of a storm water pump station must be familiar with safety practices that pertain specifically to the profession. Once recognized, the inherent hazards can be readily corrected or at least guarded against by proper warnings and safety procedures. The overall dangers of accidents are much the same whether in valve vaults, pumping stations, or other facilities. These hazards can usually be classified under one of the following categories:

- Physical injuries
- Body infections
- Dangers from explosive or noxious gases or vapors and oxygen deficiency

Safety regulations, such as those developed by the New Mexico Occupation Health & Safety Bureau (OHSB) and the Occupational Safety & Health Administration (OSHA), should be followed. More information can be found at:

- https://www.osha.gov/law-regs.html and
- https://www.osha.gov/dcsp/osp/stateprogs/new_mexico.html.

9.1 General Safety Guidelines

1. Observe all written and verbal safety rules and be aware of the particular hazards surrounding your job.
2. Do not start a task until you have received and fully understand the instructions.
3. Immediately correct or report to your supervisor any hazardous conditions, unsafe equipment, or unsafe working practice.
4. Report all injuries or accidents to your supervisor.
5. Do not run. Watch for and avoid slippery or congested areas.
6. Do not ride on or operate any moving equipment unless it is part of your job and you have been instructed in its use.

7. When operating moving equipment, observe all traffic signs, speed limits, and parking regulations.
8. Do not wear loose clothing or carry rags in your pockets. Cloth may become caught in equipment and cause personal injury.
9. Use protective equipment (PPE) such as goggles, hard hats, gloves, and respirators, whenever warranted or required by the tasks.
10. Do not operate any equipment unless all safety guards and safety devices designed for that equipment are in place, except as permitted in written maintenance or emergency operation procedures.
11. Lock out equipment before cleaning debris from moving parts. Follow ABCWUA LOTO Procedures before working on any equipment. Refer to Appendix E.
12. If it is necessary to remove safety devices, handrails, manhole covers, or related items, warn fellow employees.
13. Keep all tools in good repair and ensure that you use tools appropriate to the work being performed.
14. Do not pass under or work beneath fellow employees unless a task requires doing so. Never enter a wet well, tank, or basin until all precautions have been taken to ensure safety.
15. Practice good housekeeping. Immediately clean up any grease, oil, or hydraulic fluid that may have spilled or leaked from the equipment. Do not use gasoline to clean up oil and grease. Keep all passageways, aisles, stairs, and exits clear of tools, equipment, and other materials.
16. Do not consider a job finished until you have made conditions as safe as possible for the next person.
17. Work in pairs when feasible, especially if the work being done has high risk of injury or requires assistance.

9.2 Electrical Hazards

1. Do not ground yourself in water or on pipes or drains. Avoid them when working near any electricity.
2. Allow only authorized people to work on electrical equipment and repairs.

3. Keep all electrical controls accessible and well marked.
4. Keep rubber mats on the floor in front of electrical panels; keep edges trimmed so they do not become a tripping hazard.
5. Keep wires from becoming a tripping hazard.
6. Work in pairs around electrical equipment.
7. Place "MAN ON LINE" signs on electrical disconnects, and lock the disconnects when working on electrical equipment which another person can turn on.
8. Never use metal ladders around electrical equipment.
9. Handle breaker wires as though they were "live" wires.
10. When there is a question about any electrical hazard, ask before you expose yourself to it.
11. Do not use any part of your body to test a circuit.
12. Ground all electrical tools.
13. When working around electrical equipment, as with any other hazardous work, always remain aware of the potential hazard.

9.3 Mechanical Equipment Hazards

The exposed moving parts of some pieces of equipment pose a safety hazard to personnel working around the equipment. Installing stationary guards where necessary can prevent accidental injury related to these parts. These guards, which would shield the moving part without interfering with its operation, should be considered for belts, wheels, chains, shafts, and any couplings between a piece of equipment and its drive motor or two moving parts of a piece of equipment. Protective guards are sometimes furnished in the form of screens, plates, hollow shells, or tubes by the manufacturer and installed when the equipment is put into service. The designated personnel should inspect V-belts, drive chains, horizontal or vertical drive shafts, and all exposed moving parts.

Guards should be kept in good condition and replaced if necessary. Bent or improperly fitting guards could rub and interfere with the movement of a belt, shaft, wheel, etc. Before a guard is replaced, the related piece of equipment should be shut off and the power disconnected.

In addition, certain pieces of equipment may pose noise problems. High noise levels could cause serious injury to personnel coming into close contact with the equipment. Some form of ear protection, such as headsets, should be provided for personnel working near the unit. However, before any corrective measure is taken, the personnel should make certain the high noise level is not the result of a malfunction in the unit. At no time should unauthorized personnel be allowed to come near a piece of machinery that poses a safety threat. Whether guards are installed or not, this protective measure should always be observed.

9.4 Explosion and Fire Hazards

1. Install fire extinguishers where a fire hazard exists, and mark the location of the extinguishers with properly placed signs.
2. Post "NO SMOKING" signs where a potential fire hazard exists.
3. Instruct plant employees in fire prevention and what action to take in case of a fire.
4. Label all portable containers of flammable materials to indicate their contents.
5. Mark storage locations for flammable materials with signs reading "FLAMMABLE MATERIAL".
6. Store flammable combustible liquids in tanks or closed containers.
7. Clean up leaks or spills of flammable materials immediately and dispose of them promptly.
8. Inspect fire extinguishers monthly, keep them charged, and test them at least once every five years.

9.5 Biological Hazards

1. All cuts, skin abrasions, scratches, and similar injuries should be treated promptly. It is recommended that all cuts and scratches, no matter how small, be treated immediately with a povidone-iodine solution and watched closely for any signs of redness, tenderness, swelling, or infection. If any of these signs appear, the individual should see a physician.
2. A doctor should be called for all but minor injuries.
3. Treatment facility personnel should be familiar with first aid treatment.
4. Avoid putting fingers in nose, mouth, or eyes while working.

5. Thoroughly clean hands when convenient and always before eating, smoking, or leaving work. Fingernails should be kept short to aid cleanliness.
6. Wear proper shoes and clothing on site, especially when working in the pump station wet well, to protect from injury (ex., needles, razors, broken glass, etc.).
7. Wear leather gloves to protect hands from nicks, scratches, etc.
8. Wear rubber gloves when direct contact with wastewater is a possibility.

9.6 Oxygen Deficiency and Noxious Gas Hazards

1. Test atmosphere before entering any confined space, in conformance with ABCWUA confined space entry procedures. Refer to Appendix F.
2. In closed spaces, allow no smoking or open flames, and guard against sparks.
3. Use only safety explosion-proof lighting equipment or mirrors.
4. Always ventilate all manholes, tanks, etc. (enclosed areas), before entering.
5. Test the atmosphere for explosive and toxic gases and oxygen deficiency, as required by the New Mexico Occupational and Health Safety Bureau. If the atmosphere is normal, a worker may enter with a safety harness attached and two men available at the top. The atmosphere must be continually monitored.
6. If gas or oxygen deficiency is found, the atmosphere should be ventilated with pure air by natural or artificial means. Use of a portable blower is the most practical method of artificial ventilation. Gas tests should then be repeated and atmosphere cleared as normal before workers enter. Adequate ventilation must be maintained during work, and tests frequently repeated.
7. If gas or oxygen deficiency is present and it is not practical or possible to ventilate adequately before workers enter (such as in the saving of life), a hose mask or self-contained breathing apparatus should be worn and extreme care taken to avoid all sources of ignition if flammable gas is present. Use explosion-proof safety lights (not ordinary flashlights), wear rubber boots or non-sparking shoes, use non-sparking tools, etc.

Note: Work in a flammable gas atmosphere is extremely hazardous and should never be attempted except by those thoroughly familiar with the dangers and fully equipped with the proper protection safety equipment, and then only if it is impossible to provide a safe atmosphere within the time limitation of the emergency.

9.7 Safety Equipment

Safety helmets provide head protection from falling or flying objects and from limited electric shock.

Hearing protection (e.g. earplugs or earmuff) is required in areas of high noise levels.

Goggles prevent eye injury where there is a reasonable probability of injury.

Protective creams protect the skin from sunburn, oils, greases, paints, and dust.

Gloves of the appropriate material prevent injuries while handling pipe, tools, chemicals, solvents, and similar materials.

Safety boots protect toes from falling objects and when moving heavy items.

Oxygen, toxic gas, and explosive condition detectors are used to assure that the air in confined spaces or other work areas is not hazardous.

Portable air blowers are used for ventilating manholes and other confined spaces before entering.

Self-contained breathing apparatus or hose masks are used when atmospheres immediately hazardous to life or health must be entered.

Safety harness is required where individuals are exposed to hazardous atmospheres; the only type that should be used is that consisting of a body belt with a buckle and a shoulder harness.

1. Warning Signs or Tags: Required to be placed in strategic areas around dangerous or potentially dangerous areas; temporary tags should be attached to broken-down units to prevent start-up resulting in an injury.
2. Tools: Required by OSHA standards that the management makes sure that proper tools in good repair are available at all times (even those tools owned by employees); non-sparking tools should be available and used in required areas.
3. Fire Extinguishers: Required to place fire extinguishers approved by the Underwriter's Laboratories in areas of possible fire hazards.
4. Medical Aid: Required by OSHA standards that the employer must insure the availability of medical personnel; if there are no medical facilities in the nearby area, some employee trained in first aid should be available, as should a first aid kit.
5. Gas Detection Meter: Prevents injury by the detection of explosive and toxic gases before removal of manhole covers.

APPENDIX A

Pump Station List of Equipment

Pump Station No. 47 Montaño Equipment List

Equipment Number	Description	Manufacturer	Model Number	Serial Number	Size, Capacity	Local Source for Parts and Service
CP54700	Lift Station Control Panel	YUKON & ASSOCIATES	NEMA 12 ASSEMBLY	AC-131155		Yukon & Associates; Albuquerque, NM
CP54711	Valve Vault Control Panel	YUKON & ASSOCIATES	ASSEMBLY			Yukon & Associates; Albuquerque, NM
CP54714	Lighting Control Panel	YUKON & ASSOCIATES	ASSEMBLY DWG196F01SF NEMA12	UL#AC-131135		Yukon & Associates; Albuquerque, NM
CP54741	Barscreen Control Panel	US FILTER ENG.	CHALFONT	1886x89-3		Yukon & Associates; Albuquerque, NM
CP54770	Exhaust Fan Control Panel	YUKON & ASSOCIATES	ASSEMBLY DWG196F01SF NEMA12	UL#AC-131153		Yukon & Associates; Albuquerque, NM
CV54701	Lift Pump 1 Check Valve	CCNE/Milliken			20 IN., 250 PSI	Construction Product Marketing; Phoenix, AZ
CV54702	Lift Pump 2 Check Valve	CCNE/Milliken			20 IN., 250 PSI	Construction Product Marketing; Phoenix, AZ
CV54703	Lift Pump 3 Check Valve	CCNE/Milliken			20 IN., 250 PSI	Construction Product Marketing; Phoenix, AZ
CV54704	Lift Pump 4 Check Valve	CCNE/Milliken			20 IN., 250 PSI	Construction Product Marketing; Phoenix, AZ
CV54705	Lift Pump 5 Check Valve	CCNE/Milliken			20 IN., 250 PSI	Construction Product Marketing; Phoenix, AZ
CV54706	Sump Pump 1 Check Valve	CCNE/Milliken			6 IN., 250PSI	Construction Product Marketing; Phoenix, AZ
CV54707	Sump Pump 2 Check Valve	CCNE/Milliken			6 IN., 250PSI	Construction Product Marketing; Phoenix, AZ
E54700A	Level Transmitter Power Supply	DREXELBROOK	401-0013-024			Yukon & Associates; Albuquerque, NM
E54700A	Motor Control Center A (MCC-A)	ALLEN-BRADLEY	CENTERLINE			Yukon & Associates; Albuquerque, NM
E54700B	Level Transmitter Power Supply	DREXELBROOK	401-0013-024			Yukon & Associates; Albuquerque, NM
E54700B	Motor Control Center B (MCC-B)	ALLEN-BRADLEY	CENTERLINE			Yukon & Associates; Albuquerque, NM
E54701	Lift Pump 1 Reduced Voltage Starter	ALLEN-BRADLEY		ERZK082/2	300 AMPS.	Yukon & Associates; Albuquerque, NM
E54702	Lift Pump 2 Reduced Voltage Starter	ALLEN-BRADLEY		ERZK082/2	300 AMPS.	Yukon & Associates; Albuquerque, NM
E54703	Lift Pump 3 Reduced Voltage Starter	ALLEN-BRADLEY		ERZK082/2	300 AMPS.	Yukon & Associates; Albuquerque, NM

Pump Station No. 47 Montaño Equipment List

Equipment Number	Description	Manufacturer	Model Number	Serial Number	Size, Capacity	Local Source for Parts and Service
E54704	Lift Pump 4 Reduced Voltage Starter	ALLEN-BRADLEY		ERZK082/2	300 AMPS.	Yukon & Associates; Albuquerque, NM
E54705	Lift Pump 5 Reduced Voltage Starter	ALLEN-BRADLEY		ERZK082/2	300 AMPS.	Yukon & Associates; Albuquerque, NM
E54706	Sump Pump 1 Reduced Voltage Starter	ALLEN-BRADLEY	MCC-B	ERZK082/2	300 AMPS.	Yukon & Associates; Albuquerque, NM
E54707	Sump Pump 2 Reduced Voltage Starter	ALLEN-BRADLEY	MCC-B	ERZK082/2	300 AMPS.	Yukon & Associates; Albuquerque, NM
E54708	Lighting	WESTINGHOUSE				Yukon & Associates; Albuquerque, NM
E54709	Automatic Transfer Switch	ASCO	940			Yukon & Associates; Albuquerque, NM
E54710	Motor Control Center (MCC) Generator	ALLEN-BRADLEY	MCC-B	ERZK082/2	2000 AMPS.	Yukon & Associates; Albuquerque, NM
E54712	Power Distribution Panelboard	CUTLER-HAMMER	CAT#1C96646G01 ROW-R-LINE	UL#FZ697701		Yukon & Associates; Albuquerque, NM
E54713	Power Distribution Panelboard	CUTLER-HAMMER	CAT#1C96646G01 ROW-R-LINE	UL#FZ697700		Yukon & Associates; Albuquerque, NM
H54710	Exhaust Fan	GREENHECK				Yukon & Associates; Albuquerque, NM
H54711	Valve Vault Exhaust Fan	GREENHECK				Yukon & Associates; Albuquerque, NM
ICP54700	Station Interface Control Panel	YUKON & ASSOCIATES	ASSEMBLY DWG196F01IC	UL# AC-131158		Yukon & Associates; Albuquerque, NM
LE54700A	Wet Well Level (Primary) Element	700-0005-018	346787			Yukon & Associates; Albuquerque, NM
LE54700B	Wet Well Level (Secondary) Element	700-0005-054	AEF00994			Yukon & Associates; Albuquerque, NM
LSH54741	Barscreen Inlet Water Level Switch	FLYGT	ENM-10			James, Cooke, and Hobson; Albuquerque, NM
LSHH54741	Barscreen Inlet High Level Switch	FLYGT	ENM-10			James, Cooke, and Hobson; Albuquerque, NM
LSHH54700	Wet Well High Level Switch	FLYGT	ENM-10			James, Cooke, and Hobson; Albuquerque, NM
LT54700A	Wet Well Level (Primary) Transmitter	DREXELBROOK	409-1000-001	13243		Yukon & Associates; Albuquerque, NM
LT54700B	Wet Well Level (Secondary) Transmitter	DREXELBROOK	409-1030-001	5185		Yukon & Associates; Albuquerque, NM
P54701	Not Installed					

Pump Station No. 47 Montaño Equipment List

Equipment Number	Description	Manufacturer	Model Number	Serial Number	Size, Capacity	Local Source for Parts and Service
P54702	Lift Pump 2 (West)	FLYGT	CP3400/830-505	9841102	11,220 gpm at 62' TDH, 230HP, 885RPM, 460V/3PH	James, Cooke, and Hobson; Albuquerque, NM
P54703	Lift Pump 3	FLYGT	CP3400/830-505	9841103	11,220 gpm at 62' TDH, 230HP, 885RPM, 460V/3PH	James, Cooke, and Hobson; Albuquerque, NM
P54704	Lift Pump 4	FLYGT	CP3400/830-505	9841104	11,220 gpm at 62' TDH, 230HP, 885RPM, 460V/3PH	James, Cooke, and Hobson; Albuquerque, NM
P54705	Lift Pump 5 (East)	FLYGT	CP3400/830-505	9841105	11,220 gpm at 62' TDH, 230HP, 885RPM, 460V/3PH	James, Cooke, and Hobson; Albuquerque, NM
P54706	Sump Pump 1 (West)	FLYGT	HP5540/432		870 gpm at 62' TDH, 20HP, 1750RPM, 460V/3PH	James, Cooke, and Hobson; Albuquerque, NM
P54707	Sump Pump 2 (East)	FLYGT	HP5540/432		870 gpm at 62' TDH, 20HP, 1750RPM, 460V/3PH	James, Cooke, and Hobson; Albuquerque, NM
PRV54701	Lift Pump 1 Air Pressure Relief Valve	VAL-MATIC	203C.2		3 IN.	Pipestone Equipment; Golden, CO
PRV54702	Lift Pump 2 Air Pressure Relief Valve	VAL-MATIC	203C.2		3 IN.	Pipestone Equipment; Golden, CO
PRV54703	Lift Pump 3 Air Pressure Relief Valve	VAL-MATIC	203C.2		3 IN.	Pipestone Equipment; Golden, CO
PRV54704	Lift Pump 4 Air Pressure Relief Valve	VAL-MATIC	203C.2		3 IN.	Pipestone Equipment; Golden, CO
PRV54705	Lift Pump 5 Air Pressure Relief Valve	VAL-MATIC	203C.2		3 IN.	Pipestone Equipment; Golden, CO
PRV54706	Sump Pump Air Pressure Relief Valve	VAL-MATIC	102		3/4 IN.	Pipestone Equipment; Golden, CO
S54700						
T54700	Telemetry System	MOTOROLA	F7563A	085SNG042W		Yukon & Associates; Albuquerque, NM

Pump Station No. 47 Montaño Equipment List

Equipment Number	Description	Manufacturer	Model Number	Serial Number	Size, Capacity	Local Source for Parts and Service
U54741	Barscreen Unit	USFILTER/Link-Belt	GA25 COG SCREEN	ORD # 20035-01	10 FT WIDTH, 5HP	
UPS54700	Uninterruptable Power Supply	EATON (POWERWARE)	PW9125 P/N05146001-6501	TB152A0271	16 AMPS.	Yukon & Associates; Albuquerque, NM
UPS547001	Uninterruptable Power Supply	MGE UPS SYSTEMS	PULSAR EXL MODEL# 05146520-001	PP0023010709	16 AMPS.	Yukon & Associates; Albuquerque, NM
XA54700	Intrusion Alarm	SENTROL	2505A			
YS54710						
ZS54701	Lift Pump 1 Check Valve Position Switch	ALLEN-BRADLEY	802T-WS1			Yukon & Associates; Albuquerque, NM
ZS54702	Lift Pump 2 Check Valve Position Switch	ALLEN-BRADLEY	802T-WS1			Yukon & Associates; Albuquerque, NM
ZS54703	Lift Pump 3 Check Valve Position Switch	ALLEN-BRADLEY	802T-WS1			Yukon & Associates; Albuquerque, NM
ZS54704	Lift Pump 4 Check Valve Position Switch	ALLEN-BRADLEY	802T-WS1			Yukon & Associates; Albuquerque, NM
ZS54705	Lift Pump 5 Check Valve Position Switch	ALLEN-BRADLEY	802T-WS1			Yukon & Associates; Albuquerque, NM
ZS54706	Sump Pump 1 Check Valve Position Switch	ALLEN-BRADLEY	802T-WS1			Yukon & Associates; Albuquerque, NM
ZS54707	Sump Pump 2 Check Valve Position Switch	ALLEN-BRADLEY	802T-WS1			Yukon & Associates; Albuquerque, NM

APPENDIX B

Manufacturer's Mechanical Bar Screen Maintenance Schedule

MAINTENANCE

WARNING:

Disconnect and LOCKOUT all power sources before initiating any maintenance and repair.

The carriage assembly must be secured in position before any disassembly of the brake and or motor is attempted or before the manual brake release is operated.

Repairs of the motors for class I and II, and gear reducers must be done by the motor and gear reducer manufacturers.

Refer to individual maintenance instructions for each of the components of the machine.

The following general maintenance should be carried out once a month, except as indicated, to maintain proper operation of the machine:

1. To ensure adequate cooling of the reducer and motor, deposits of dirt and dust on the surfaces of the units must be removed at frequent intervals.
2. Check the location of the limit switches so that they are located as originally set.
3. Grease the motor every 4 months.
4. Change the oil in the reducer after 20,000 operating hours.

Replacement of Guide Rollers

1. Stop the drive carriage with the guide roller positioned at the removable access doors in the side frame.
2. Disconnect and LOCKOUT all power sources before initiating any maintenance and repair.
3. Remove the access door.
4. With an Allen wrench unscrew the guide roller.
5. Clean threads in the end of the shaft and apply "Loctite" general blue, to threads of new guide roller.
6. Replace new guide roller into end of shaft.
7. Tighten guide roller so that its shoulder is seated against the end of the shaft to a torque of 300 Ft. Lbs..
8. Replace access door.

Removal of Drive Carriage

1. Stop the drive carriage with the drive shaft positioned at the removable flange sections in the middle track section of the side frame.
2. Disconnect and LOCKOUT all power sources before initiating any maintenance and repair.
3. Disconnect the SO cables and power track from the drive carriage.
4. Remove the removable power track guards, flange plates and track angle section.
5. Move the carriage assembly out of the side frame through the flange openings allowing the guide shaft to roll in the guide track until it can pass through the flange opening.

Reassembly of the Drive Carriage

1. Move the guide shaft through the access opening into the guide track in the side frames. Move the guide shaft up until the drive shaft assembly passes through the access opening and engages the cog wheels into the pin rack. Make certain that the cog wheels are engaged at the same pin in both side frames.
2. Secure the drive shaft assembly in position to prevent it from descending the pin rack during assembly.
3. Replace the flange plates, removable track angle section and power track guard.
4. Make certain the guide shaft is centered between the side frames and is parallel to the drive shaft.
5. Adjust rake blade to provide clearance between the rake teeth and the bar rack as described on Sheet #11.
6. Mount the power track with the SO cable and make all electrical connections.

TROUBLE SHOOTING GUIDE

Problem	Possible Solution
Rake moves in opposite direction as indicated on the control panel.	Reverse leads on motor
Motor brake does not hold or is overheating.	Refer to "Troubleshooting" guide in brake service instruction.
Rake does not stop in parked position.	Check the gap between the limit switch and the read angle. Gap should be less than 1/2 inch.
Rake does not engage bar rack properly.	Realign rake teeth to bar rack.

MAINTENANCE AFTER ACCIDENTAL, TEMPORARY SUBMERSION

Special maintenance and inspection procedures must be followed after any and all submersion occurrences of the drive assembly. Failure to properly maintain the unit after submersion may void the equipment warranty.

1) Oil in the reducer shall be inspected for water contamination. Emulsified or "foamy" oil is an indication that the oil has been contaminated with water. Oil in the reducer shall be promptly changed with new oil in accordance with the manufacturer's instructions if there is any indication of water contamination.

2) Visually inspect the contact surfaces of the guide tracks to ensure proper grease lubrication is present on the tracks. Remove any debris which may have adhered to the tracks. Apply new grease to the guide tracks, as required, in accordance with the lubrication instructions in this manual.

3) Visually inspect the cog wheels and remove any debris which may have adhered to the wheels or pin rack.

4) Visually inspect the power track to insure that it is still in the track. Make sure that there are no cracks in the covering.

5) Inspect and clean the pin rack rollers & bushings and lubricate.

6) Inspect and clean the drive shaft bearings and lubricate.

7) Inspect and clean the guide rollers.

8) Inspect and clean the motor and brake assembly for any water damage.

NOTE: If any replacement parts are required, contact USF for price and availability.

LUBRICATION SCHEDULE

ITEM	FREQUENCY	LUBRICANT	REMARKS
Check oil level of reducer			See reducer section for lubricant specifications.
Lubricate reducer brgs.			See reducer section for lubricant specifications.
Lubricate motor	See the motor section of manual	Mobilux 2 Mobilgrease HP Shell Alvania Gulfcrown 2 Exxon Ronex MP	See the motor section of manual for lubricant specifictions.
Manually lubricate pin rack and guide angles	1 Month	Bison open gear guard*	Manually lubricate. (Not required with non-metallic pin rack)

*The American Lubricants Company, 1227 Deeds Avenue, P.O. Box 696, Dayton, Ohio 45401-0696 Phone: 513-222-2851 Fax: 513-461-7729

APPENDIX C

Manufacturer's Lift Pump Curve and General Information

PERFORMANCE CURVE

DATE 1998–05–14	PROJECT MONTANO BRIDGE P.S.	ISSUE 5	PROD C3400/765

NO. OF BLADES.....	3	TOT.MOM.OF INERTIA.....	8.71	KGM²	POLES: 8	FREQ: 60	HZ
IMPELLER THROUGHLET...	110*110 Circul.	RATED SPEED.....	885	RPM	VOLTAGE.....	460	V
					MOTOR SHAFT POWER.....	172 (230 hp)	KW
					STARTING TORQUE.....	2080	NM
					MAX TORQUE.....	3855	NM
					RATED CURRENT.....	285	A
					STARTING CURRENT.....	1360	A

	1/1–LOAD	3/4–LOAD	1/2–LOAD
MOTOR COS FI	0.82	0.79	0.71
MOTOR EFFICIENCY	92.0%	92.0%	91.5%
GEAR EFFICIENCY			

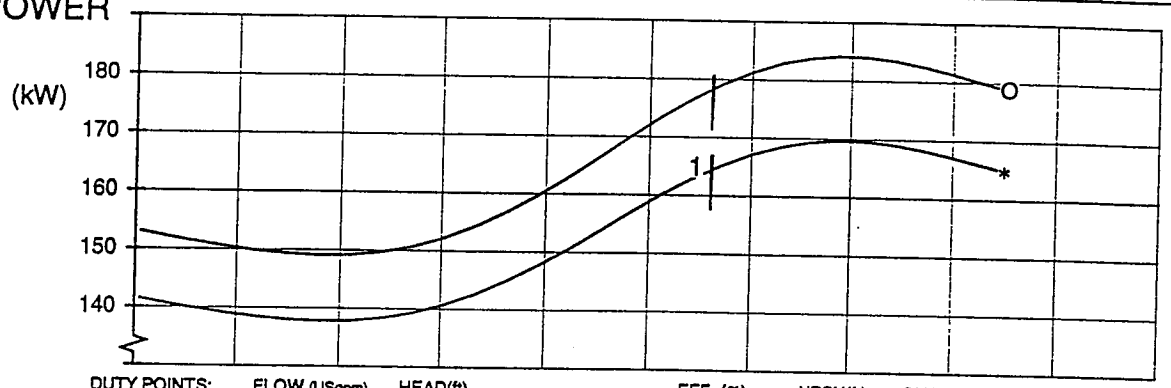
CURVE NO 63–830

IMPELLER DIAMETER 505 MM

MOTOR TYPE 43–56–8AA/ 1

GEAR TYPE RATIO

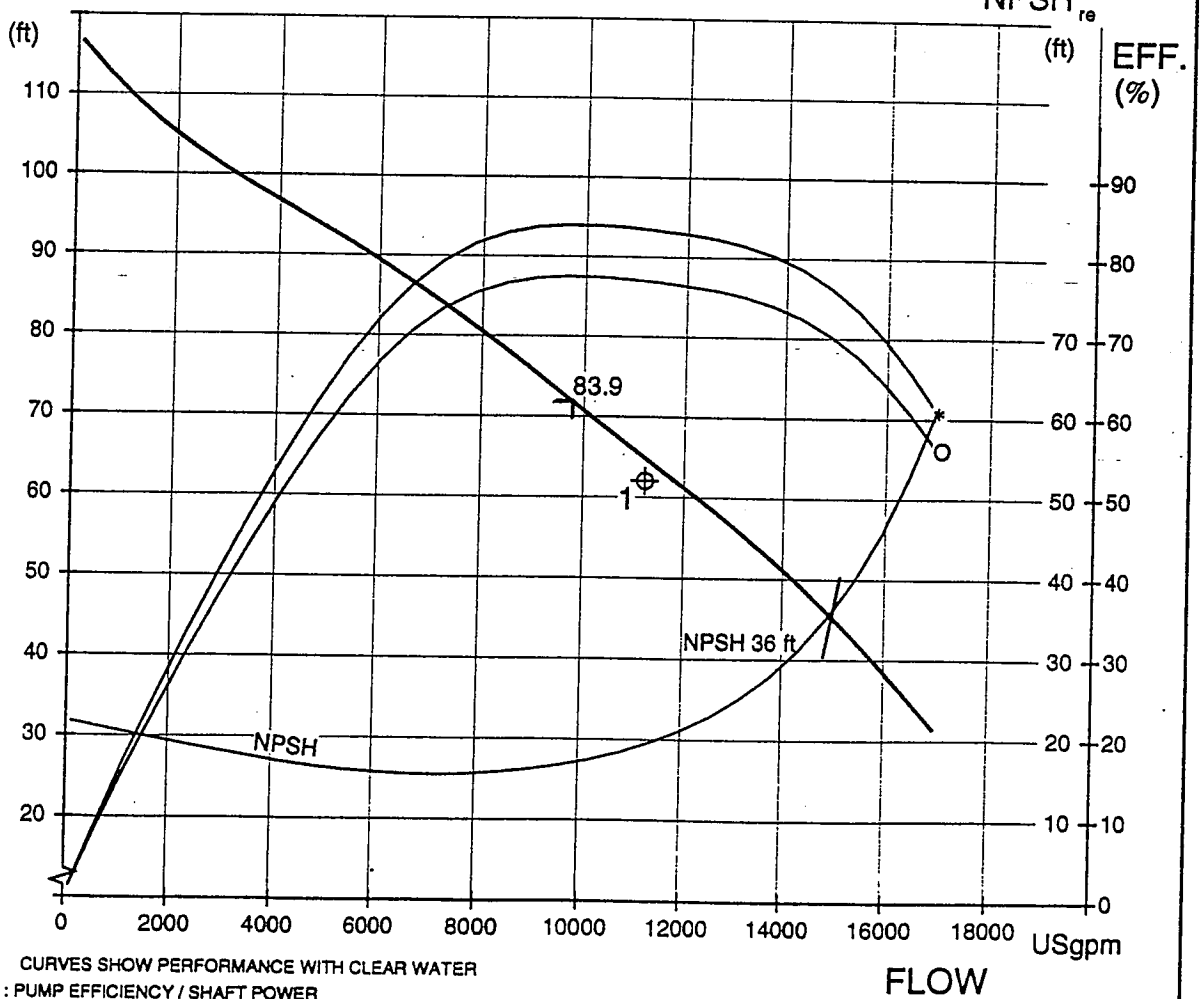
POWER



DUTY POINTS: FLOW (USgpm) HEAD(ft) EFF. (%) NPSH(ft) GUARANTEE

1 11220 62.0 74.6 (80.9) 21.4 HI lev–A

HEAD



CURVES SHOW PERFORMANCE WITH CLEAR WATER

*: PUMP EFFICIENCY / SHAFT POWER

O: OVERALL EFFICIENCY / INPUT POWER

unix AUTHOR: FUS116 CUPF rev.6.5

FLYGT	MOTOR CHART	MOTOR NO: 43–56–8AA	ISSUE: 12 Date: 95 11 17

CP 3400/765

Project: MONTANO BRIDGE P.S.

NOMINAL VALUES:

VOLTAGE: 3 *460 V FREQUENCY: 60 HZ POLES: 8 STATOR: 01 D

P–INPUT: 186 KW P–SHAFT: 172 KW 230 HP CURRENT: 285 A SPEED: 885 RPM

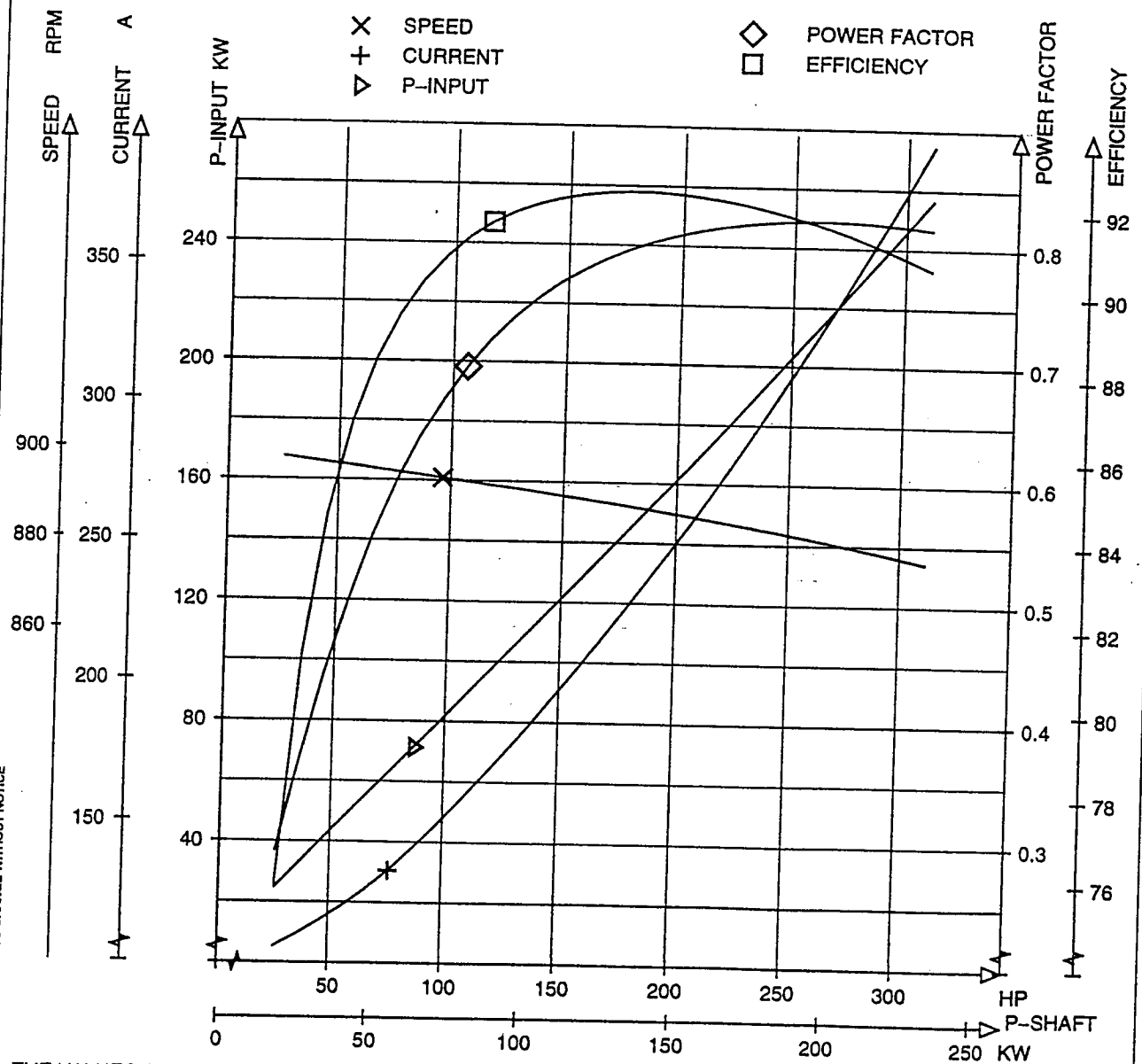
TORQUE (NM / QUOTIENT COMPARED TO TORQUE AT NOMINAL SPEED)

START: 2080 / 1.1 PULL–UP: 1540 / 0.8 BREAK–DOWN:3855 / 2.1

MOMENT OF INERTIA: 3.5 KGM^2

LOAD	1/1	3/4	1/2
POWER FACTOR	0.82	0.79	0.72
EFFICIENCY %	92.0	92.0	91.5
CURRENT A	285	220	164

BREAKAWAY STARTING CURRENT (LOCKED ROTOR CURRENT ACC. TO NEMA)	1360 A
BREAKAWAY STARTING POWER FACTOR	0.30
NO LOAD CURRENT	101 A
NO LOAD POWER FACTOR	0.07
INSULATION	CLASS F



THE VALUES ARE STATED WITH TOLERANCES ACC. TO IEC 34–1
AT 75 C°TOTAL TEMPERATURE AND 830 W FRICTION LOSSES

PP04.L

RUN BY: FUS116 DATE: 1998–05–14 / MGDATA rev(4.3)

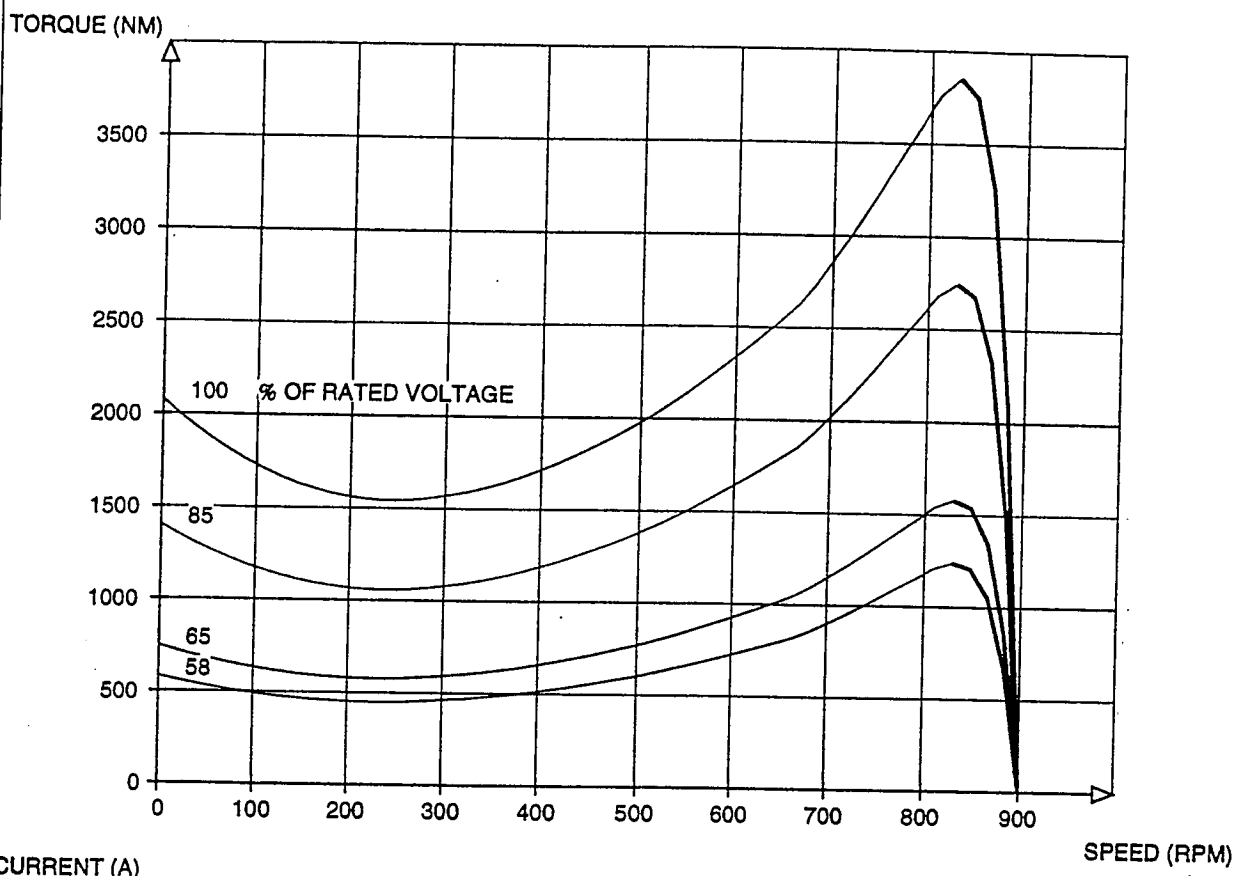
FLYGT

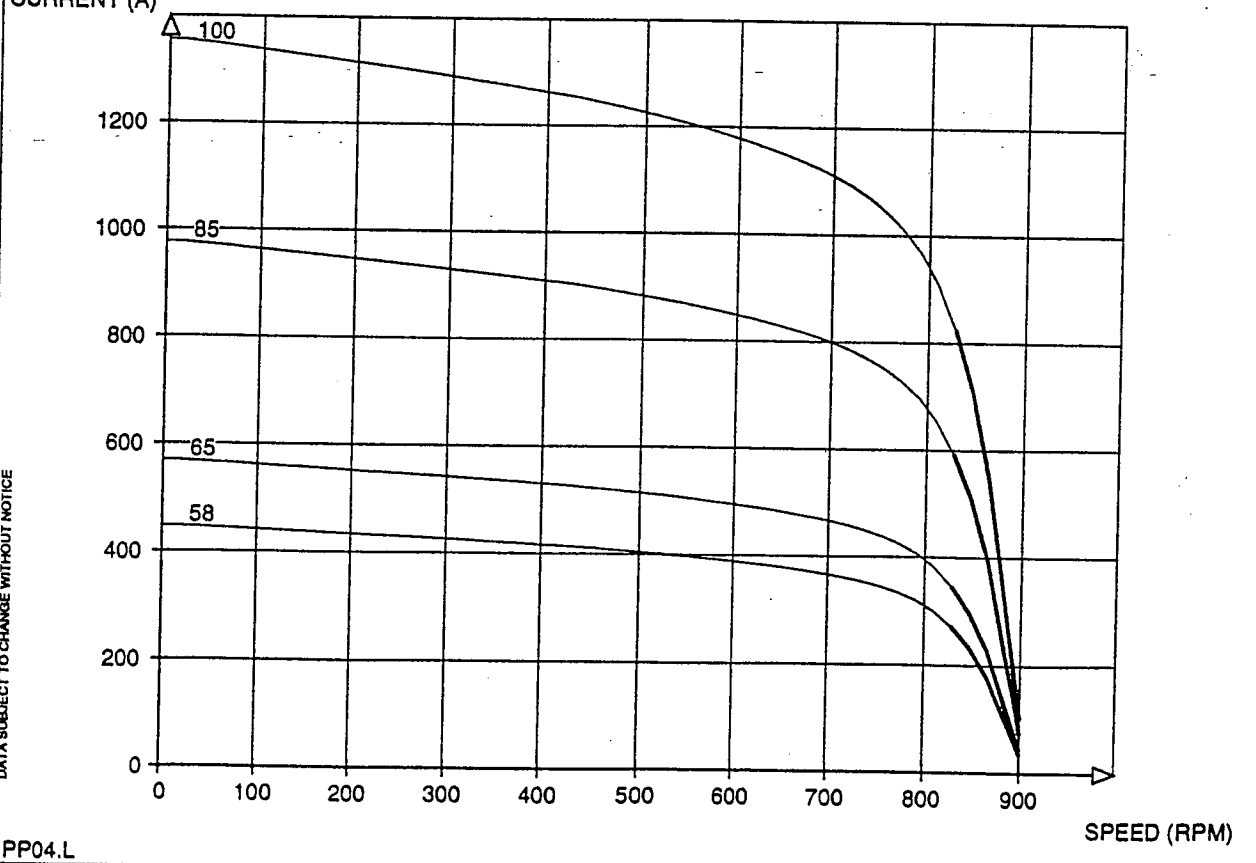
TORQUE–CURRENT–SPEED CHART

MOTOR NO: 43–56–8AA

RATED VALUES VOLTAGE: 3*460V FREQUENCY: 60 HZ STATOR: 01 D

ISSUE : 12
DATE : 19951117





RUN BY: FUS116 DATE: 1998–05–14 / MGDATA rev(4.3)

PP04.L

C-3351, 3400, 3800
Performance Specifications

SECTION	PAGE
7	1
SUPERSEDES	ISSUED
6/94	10/96

REQUIREMENTS

Furnish and install 4 submersible non-clog wastewater pump(s). Each pump shall be equipped with a close coupled 230 HP, submersible electric motor connected for operation on 460 volts, 3 phase, 60 hertz, 3 wire service with 50 linear feet of submersible cable (SUBCAB) suitable for submersible pump applications. The power cable shall be sized according to NEC and ICEA standards and also meet with P-MSHA Approval. Also, 50 linear feet of multiconductor submersible cable (SUBCAB) will be used to convey pump monitoring device signals.

The pump shall be supplied with a mating cast iron 16 inch discharge connection and be capable of delivering 11220 GPM at 62 FT. TDH. An additional point on the same curve shall be 16000 GPM at 39 FT. TDH. Pump shut off head shall be no less than 115 feet. Each pump shall be fitted with 40 feet of SS lifting chain or stainless steel cable. The working load of the lifting system shall be 50% greater than the pump unit weight.

PUMP DESIGN

The pump(s) shall be automatically and firmly connected to the discharge connection, guided by no less than two parallel guide bars extending from the top of the station to the wet well mounted discharge connection. There shall be no need for personnel to enter the wet-well. Sealing of the pumping unit to the discharge connection shall be accomplished by a machined metal to metal watertight contact. Sealing of the discharge interface with a diaphragm, O-ring or profile gasket will not be acceptable. The entire weight of the pump/motor unit shall be borne by the pump discharge elbow. No portion of the pump/motor unit shall bear on the sump floor directly or on a sump floor mounted stand.

Power and pilot cable supports shall be provided and consist of a wire braid sleeve with attachment loops or tails to connection to the under side of the access frame.

PUMP CONSTRUCTION

Major pump components shall be of gray cast iron, ASTM A-48, Class 35B, with smooth surfaces devoid of blow holes or other casting irregularities. All exposed nuts or bolts shall be AISI type 304 stainless steel. All metal surfaces coming into contact with the pumped media, other than stainless steel, shall be protected by a factory applied spray coating of acrylic dispersion zinc phosphate primer with a polyester resin paint finish on the exterior of the pump.

Sealing design shall incorporate **metal-to-metal contact** between machined surfaces. Pump/Motor unit mating surfaces where watertight sealing is required shall be machined and fitted with Nitrile or Viton rubber O-rings. Joint sealing will be the result of controlled compression of rubber O-rings in two planes and O-ring contact of four sides without the requirement of a specific bolt torque limit.

Rectangular cross sectioned rubber, paper or synthetic gaskets that require specific torque limits to achieve compression shall not be considered as adequate or equal. No secondary sealing compounds, elliptical O-rings, grease or other devices shall be used.

COOLING SYSTEM

Each pump/motor unit shall be provided with an integral, self-supplying cooling system. The motor water jacket shall encircle the stator housing and shall be of cast iron, ASTM A-48, Class 35B. The water jacket shall thus provide heat dissipation for the motor regardless of whether the motor unit is submerged in the pumped media or surrounded by air. After passing through a classifying labyrinth, the impeller back vanes shall provide the necessary circulation of the cooling liquid, a portion of the pumpage, through the cooling system. Two cooling liquid supply pipes, one discharging low and one discharging high within the jacket, shall supply the cooling liquid to the jacket. An air evacuation tube shall be provided to facilitate air removal from within the jacket. Any piping internal to the cooling system shall be shielded from the cooling media flow allowing for unobstructed circular flow within the jacket about the stator housing. Two cooling liquid return ports shall be provided. The internals to the cooling system shall be non-clogging by virtue of their dimensions. Drilled and threaded provisions for external cooling and, seal flushing or air relief are to be provided. The cooling jacket shall be equipped with two flanged, gasketed and bolted inspection ports of not less than 4"Ø located 180° apart. The cooling system shall provide for continuous submerged or completely non-submerged pump operation in liquid or in air having a temperature of up to 40°C (104°F), in accordance with NEMA standards. Restrictions limiting the ambient or liquid temperatures at levels less than 40°C are not acceptable.

CABLE ENTRY SEAL

The cable entry seal design shall preclude specific torque requirements to insure a watertight and submersible seal. The cable entry shall consist of dual cylindrical elastomer grommets, flanked by washers, all having a close tolerance fit against the cable outside diameter and the cable entry

inside diameter. The grommets shall be compressed by the cable entry unit, thus providing a strain relief function. The assembly shall provide ease of changing the cable when necessary using the same entry seal. **The cable entry junction chamber and motor shall be sealed from each other, which shall isolate the stator housing from foreign material gaining access through the pump top. Epoxies, silicones, or other secondary sealing systems shall not be considered acceptable.**

MOTOR

The pump motor shall be induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber, NEMA B type. The stator windings and stator leads shall be insulated with moisture resistant Class F insulation rated for 155°C (311°F). The stator shall be dipped and baked three times in Class F varnish and shall be heat-shrink fitted into the stator housing. The use of bolts, pins or other fastening devices requiring penetration of the stator housing is not acceptable. The motor shall be specifically designed for submersible pump usage and designed for continuous duty pumping media of up to 40°C (104°F) with an 80°C temperature rise and capable of at least 15 evenly spaced starts per hour. The rotor bars and short circuit rings shall be made of cast aluminum or copper. Thermal switches shall be embedded in the stator end coils to monitor the temperature of each phase winding. These thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to the control panel. The junction chamber shall contain two distinct and separate terminal boards. The first terminal board shall be used for the connection of the pilot sensor leads with the pilot sensor cable. The second terminal boards shall be utilized for the line power connection to the motor stator leads. This power terminal board shall use threaded compression type binding posts to connect the cable conductors and motor stator leads. The use of wire nuts or crimping type connectors is not acceptable. The motor and pump shall be produced by the same manufacturer.

The combined service factor (combined effect of voltage, frequency and specific gravity) shall be a minimum of 1.15. The motor shall have a voltage tolerance of plus or minus 10%. The motor shall be designed for operation up to 40°C (104°F) ambient and with a temperature rise not to exceed 80°C. A performance chart shall be provided upon request showing curves for torque, current, power factor, input/output kW and efficiency. This chart shall also include data on starting and no-load characteristics.

The power cable shall be sized according to the NEC and CEA standards and shall be of sufficient length to reach the junction box without the need of any splices. The outer jacket of the cable shall be oil resistant chloroprene rubber. The motor and cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of at least 65 feet.

The motor horsepower shall be adequate so that the pump is non-overloading throughout the entire pump performance curve from shut-off through run-out.

BEARINGS

The pump shaft shall rotate on at least three grease-lubricated bearings. The upper bearing, provided for radial forces, shall be a single roller bearing. The lower bearings shall consist of at least one roller bearing for radial forces and one or two angular contact ball bearings for axial thrust.

The minimum L_{10} bearing life shall be 100,000 hours at any point along the usable portion of the pump curve at maximum product speed.

The lower bearing housing shall include an independent thermal sensor to monitor the bearing temperature. If a high temperature occurs, the sensor shall activate an alarm and shut the pump down.

MECHANICAL SEAL

Each pump shall be provided with a tandem mechanical shaft seal system consisting of two totally independent seal assemblies. The lower seal shall be independent of the impeller hub. The seals shall operate in an lubricant reservoir that hydrodynamically lubricates the lapped seal faces at a constant rate. The lower, primary seal unit, located between the pump and the lubricant chamber, shall contain one stationary and one positively driven rotating **tungsten-carbide** seal ring. The upper, secondary seal unit, located between the lubricant chamber and the motor housing, shall contain one stationary **tungsten-carbide** seal ring and one positively driven rotating **tungsten-carbide** seal ring. Each seal interface shall be held in contact by its own spring system. The seals shall require neither maintenance or adjustment and shall be capable of operating in either clockwise or counter clockwise direction of rotation without damage or loss of seal. For special applications, other seal face materials shall be available.

Should both seals fail and allow fluid to enter the stator housing, a port shall be provided to direct that fluid immediately to the stator float switch to shut down the pump and activate an alarm. Any intrusion of fluid shall not come into contact with the lower bearings.

The following seal types shall not be considered acceptable nor equal to the dual independent seal specified: shaft seals without positively driven rotating members, or conventional double mechanical seals containing either a common single or double spring acting between the upper and lower seal faces. Cartridge type systems will not be acceptable. No system requiring a pressure differential to offset pressure and to effect sealing shall be used.

Each pump shall be provided with an lubricant chamber for the shaft sealing system. The lubricant chamber shall be designed to prevent overfilling and to provide lubricant expansion capacity. The drain and inspection plug, with positive anti-leak seal shall be easily accessible from the outside. The seal system shall not rely upon the pumped media for lubrication. **The motor shall be able to operate continuously while non-submerged without damage while pumping under load.**

Seal lubricant shall be FDA Approved, nontoxic.

PUMP SHAFT
Pump and motor shaft shall be a solid continuous shaft. The pump shaft is an extension of the motor shaft. Couplings shall not be acceptable. The pump shaft shall be of carbon steel C1035 and shall be completely isolated from the pumped liquid.

IMPELLER
The impeller(s) shall be of gray cast iron, Class 35B, dynamically balanced, multiple vaned, double shrouded non-clogging design having long throughlets without acute turns. The impeller(s) shall be capable of handling solids, fibrous materials, heavy sludge and other matter found in wastewater. Mass moment of inertia calculations shall be provided by the pump manufacturer upon request. Impeller(s) shall be keyed to the shaft, retained with an expansion ring and shall be capable of passing a minimum 3 inch diameter solid. All impellers shall be coated with an acrylic dispersion zinc phosphate primer.

WEAR RINGS
A wear ring system shall be used to provide efficient sealing between the volute and suction inlet of the impeller. Each pump shall be equipped with a Nitrile rubber coated steel or brass ring insert that is drive fitted to the volute inlet.

This pump shall also have a stainless steel impeller wear ring heat-shrink fitted onto the suction inlet of the impeller.

VOLUTE
Pump volute(s) shall be single-piece gray cast iron, class 35B. non-concentric design with smooth passages large enough to pass any solids that may enter the impeller. The volute shall be of a modified double-volute design for use in the pumping of liquids containing solids and stringy materials. The internal volute guide vane shall be split so as to prevent clogging but still allow for symmetrical internal volute pressure distribution.
Pumps utilizing a conventional full vane, double-volute design are not acceptable.

PROTECTION
All stators shall incorporate thermal switches in series to monitor the temperature of each phase winding. Should high temperature occur, the thermal switches shall open, stop the motor and activate an alarm.

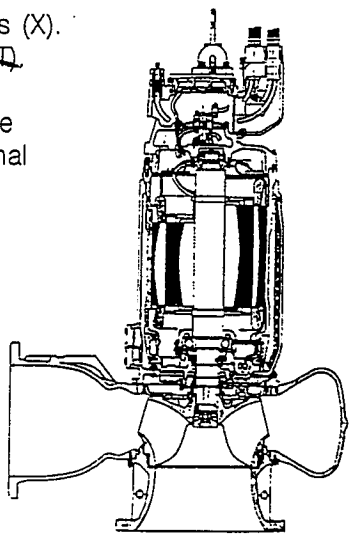
A lower bearing temperature sensor shall be provided. The sensor shall directly contact the outer race of the thrust bearing providing for accurate temperature monitoring.

A leakage sensor shall be provided to detect water in the stator chamber. The Float Leakage Sensor (FLS), a small float switch, shall be used to detect the presence of water in the stator chamber. When activated, the FLS will stop the motor and activate an alarm. **USE OF VOLTAGE SENSITIVE SOLID STATE SENSORS SHALL NOT BE ALLOWED.**

The thermal switches, FLS and the lower bearing temperature monitor shall be connected to a CAS (Control and Status) monitoring unit. The CAS shall be designed to be mounted in the control panel.

MODIFICATIONS
1. Explosion-proof Pumps (X).
2. Dry Pit Installations (~~CT~~).

Refer to the General Guide Specifications for additional information.



Motor Data

RATED OUTPUT POWER HP	(kW)	MOTOR DRIVE UNIT (FM)	Ø	VOLTS NOM.	FULL LOAD AMPS	LOCKED ROTOR AMPS	LOCKED ROTOR KVA	LOCKED ROTOR CODE LETTER KVA/HP	RATED INPUT POWER kW	POLES/RPM
170	(127)	765 (775)	3	460 575	231 185	890 712	709	D	~~138~~	10/705
185	(138)	735 (745)	3	460 575	~~231~~ ~~185~~	1085 868	865	E	150	8/885
~~185~~	~~(138)~~	805 (815)	3	460 575	253 202	1275 1020	1016	F	~~148~~	10/710
240	(179)	805 (815)	3	460 ~~575~~	295 ~~236~~	1385 ~~1108~~	1104	E	191	8/890

PUMP MOTOR HP	EFFICIENCY			POWER FACTOR		
	100% LOAD	75% LOAD	50% LOAD	100% LOAD	75% LOAD	50% LOAD
170	91.5	~~92.0~~	91.0	~~0.75~~	~~0.72~~	0.62
185 (8 - pole)	91.5	~~92.0~~	91.0	~~0.81~~	0.79	0.71
~~185 (10 - pole)~~	~~90.0~~	~~90.0~~	~~92.0~~	~~0.74~~	~~0.69~~	~~0.57~~
240	93.5	93.5	93.0	0.81	0.79	0.71

Cable Data

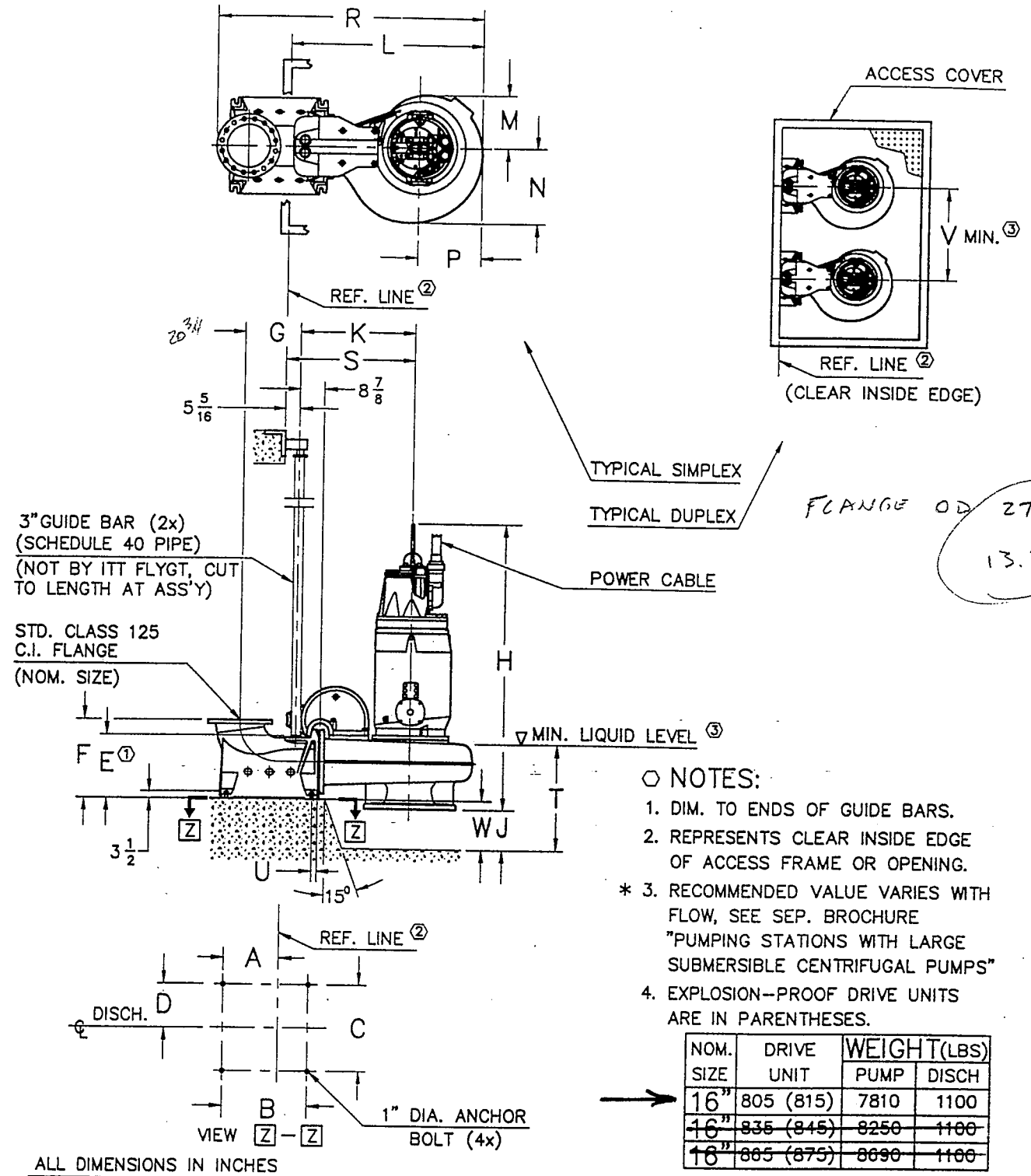
HP	VOLTS	MAX. LENGTH FT.	CABLE SIZE/ NOMINAL DIA.	CONDUCTORS (IN ONE CABLE)	PART NUMBER
170	460	480	4 G 120 58mm (2.3")	(3) 120 (PWR) (1) 120 (GND)	~~00094 20 52~~
	575	500	4 G 70 47mm (1.85")	(3) 70 (PWR) (1) 70 (GND)	00094 20 50
185 (8 - pole)	460	475	4 G 120 58mm (2.3")	(3) 120 (PWR) (1) 120 (GND)	00094 20 52
	575	490	4 G 70 47mm (1.85")	(3) 70 (PWR) (1) 70 (GND)	00094 20 50
185 (10 - pole)	460	440	4 G 120 58mm (2.3")	(3) 120 (PWR) (1) 120 (GND)	00094 20 52
	575	585	4 G 95 56mm (2.2")	(3) 95 (PWR) (1) 95 (GND)	00094 20 51
240	**460	370	4 G 50 43mm (1.69")	(3) 50 (PWR) (1) 50 (GND)	00094 20 49
	~~575~~	~~585~~	4 G 120 58mm (2.3")	(3) 120 (PWR) (1) 120 (GND)	~~00094 20 52~~
~~170, 185 &~~ 240	Pilot Cable		12 X 1.5 19.7mm (0.78")	(12) 1.5 (CTRL)	00094 19 20

** Requires 2 cables

THREE CABLES PER PUMP

PAGE	SECTION
2	4
ISSUED	SUPERSEDES
3/96	6/94

CP-3400 (800 Series Drives)
Outline Dimensions



FLANGE OD 27½"
13.75

NOTES:

1. DIM. TO ENDS OF GUIDE BARS.
2. REPRESENTS CLEAR INSIDE EDGE OF ACCESS FRAME OR OPENING.
* 3. RECOMMENDED VALUE VARIES WITH FLOW, SEE SEP. BROCHURE "PUMPING STATIONS WITH LARGE SUBMERSIBLE CENTRIFUGAL PUMPS"
4. EXPLOSION–PROOF DRIVE UNITS ARE IN PARENTHESES.

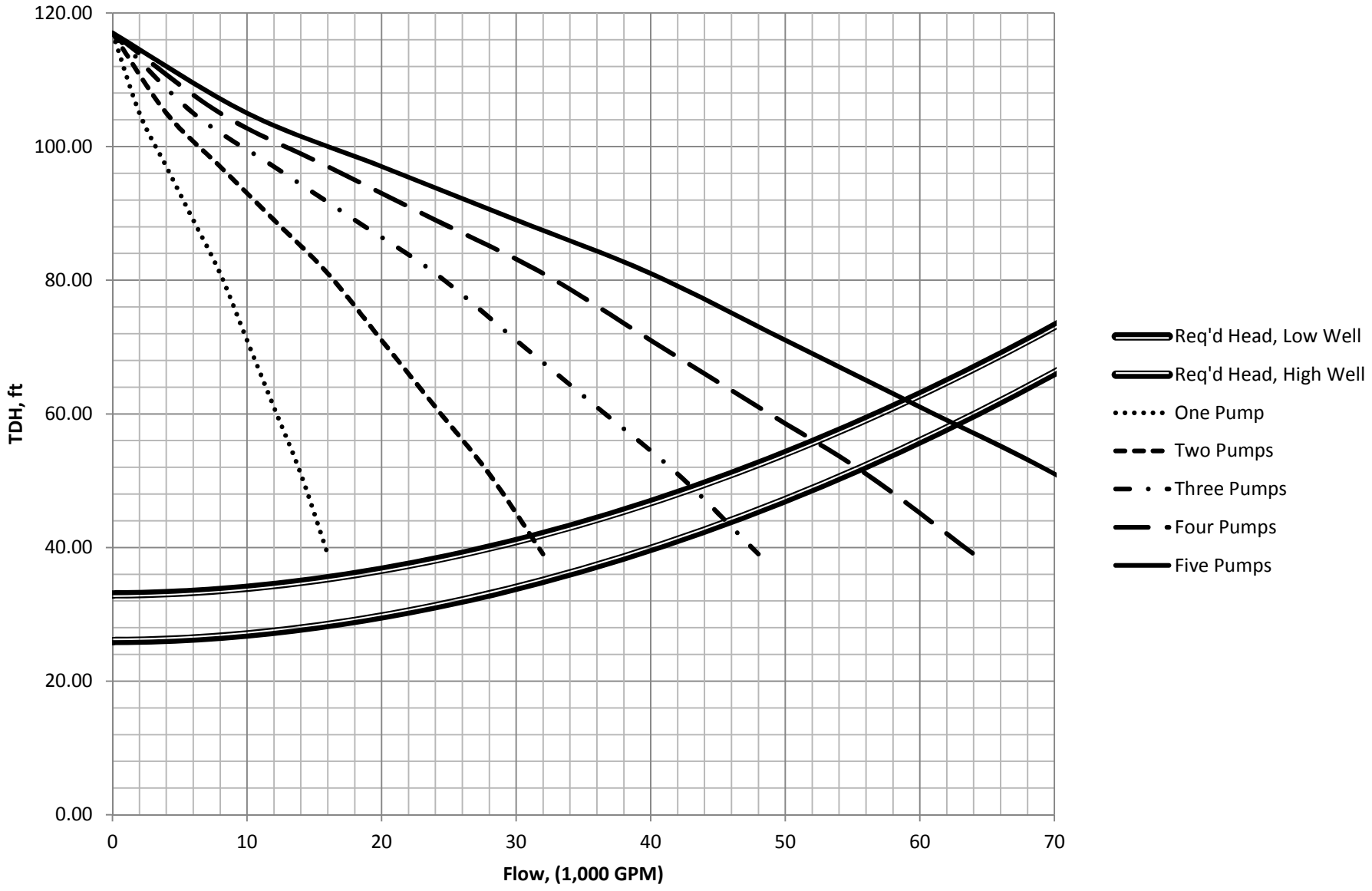
NOM. SIZE	DRIVE UNIT	WEIGHT (LBS) PUMP	DISCH
16"	805 (815)	7810	1100
~~16"~~	~~835 (845)~~	~~8250~~	~~1100~~
~~16"~~	~~865 (875)~~	~~8690~~	~~1100~~

ALL DIMENSIONS IN INCHES

NOM. SIZE	DRIVE UNIT	DIMENSIONAL CHART A	B	C	D	E	F	G	H	J	K	L	M	N	P	R	S	T	U	V	W
16"	805 (815)	20 1/8	31 1/2	31 1/2	15 3/4	22 3/4	29	20 3/4	104 1/2	14 3/4	42 1/2	71 1/4	19 3/4	27 3/4	23 1/2	98 1/2	47 3/4	*	1 3/4	*	18
~~16"~~	~~835 (845)~~	~~20 1/8~~	~~31 1/2~~	~~31 1/2~~	~~15 3/4~~	~~22 3/4~~	~~29~~	~~20 3/4~~	~~110~~	~~14 3/4~~	~~42 1/2~~	~~71 1/4~~	~~19 3/4~~	~~27 3/4~~	~~23 1/2~~	~~98 1/2~~	~~47 3/4~~	*	~~1 3/4~~	*	~~18~~
~~16"~~	~~865 (875)~~	~~20 1/8~~	~~31 1/2~~	~~31 1/2~~	~~15 3/4~~	~~22 3/4~~	~~29~~	~~20 3/4~~	~~115 1/2~~	~~14 3/4~~	~~42 1/2~~	~~71 1/4~~	~~19 3/4~~	~~27 3/4~~	~~23 1/2~~	~~98 1/2~~	~~47 3/4~~	*	~~1 3/4~~	*	~~18~~

LS No. 47 Montaño - System Head Curve

Five Flygt 3400 Pumps (Four Existing & One Theoretical)

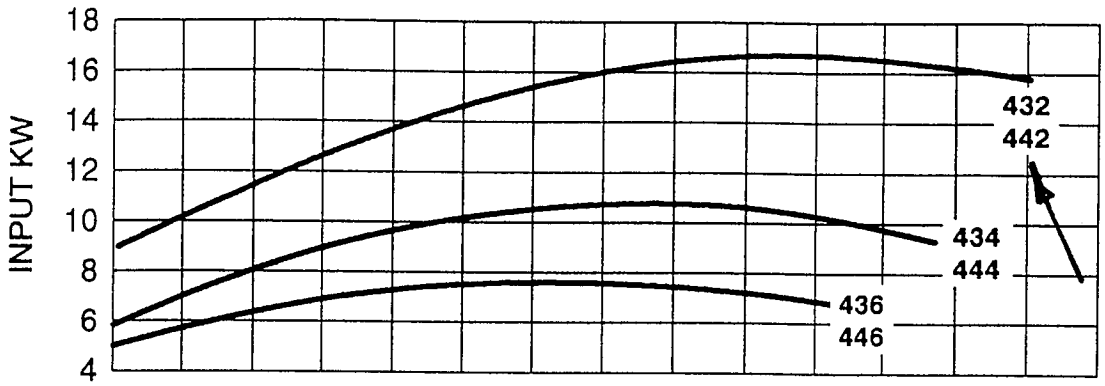


APPENDIX D

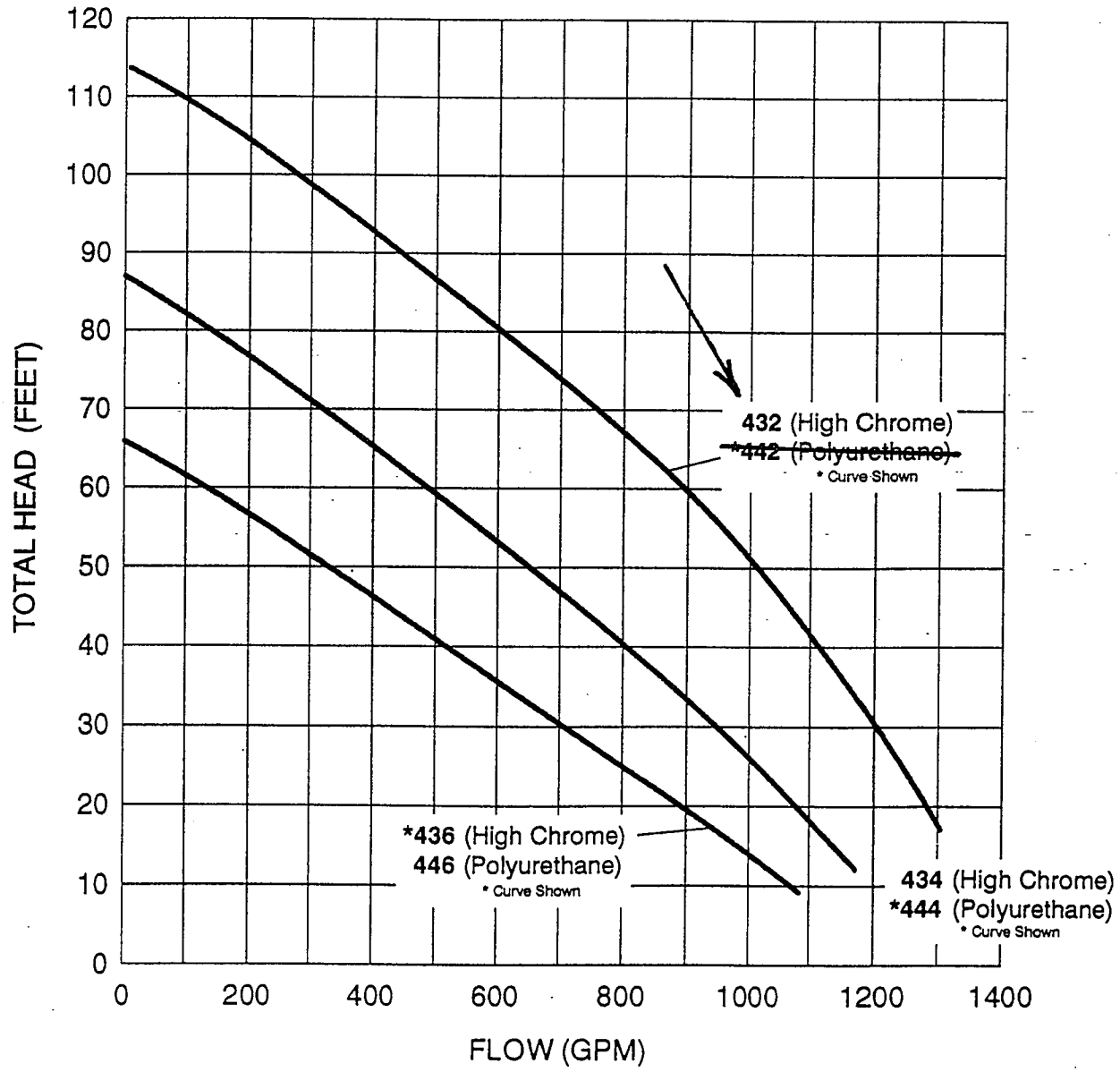
Manufacturer's Sump Pump Curve and General Information

Abrasion Resistant Pumps

5540 Family of Curves



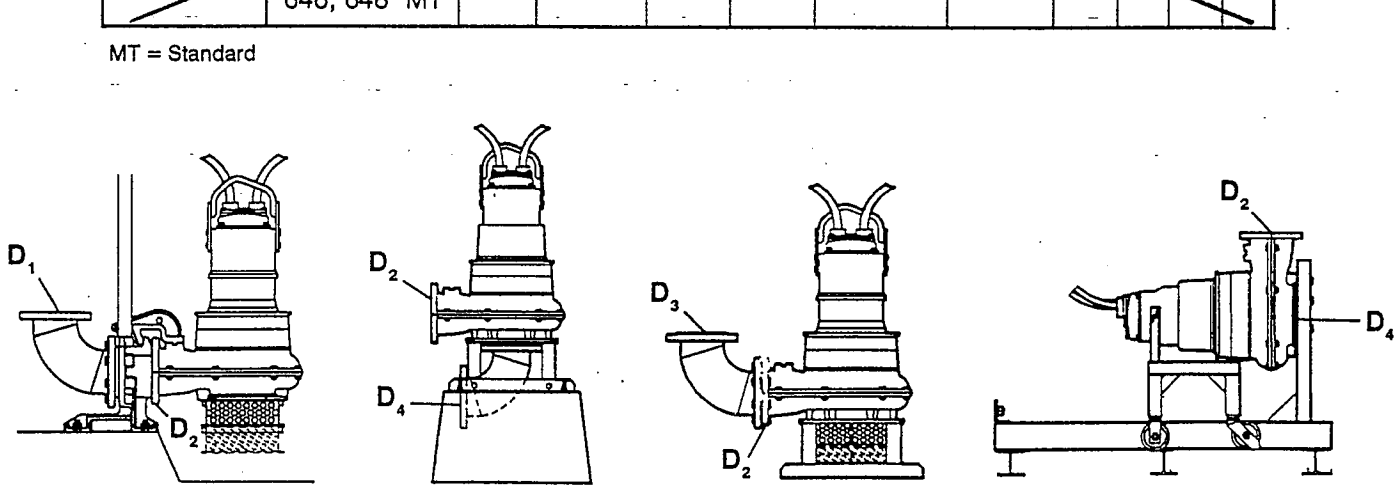
Note:
Refer to ITT Flygt Industrial Products catalog for more information regarding impeller performance and materials.



Abrasion Resistant Pumps
Impeller/Motor/Nominal Sizes

PUMP MODEL	IMPELLER CODE	HP RATING HP	HT HZ	HS	HZ	VAC	RPM	D1	D2	D3	D4
5510	434, 444 MT	3	--	3	--	200 230/460 575	1700	4"	4"	4"	--
5520	436, 438, 446, 448 MT	5	4	5	4		1735	4"	4"	4"	4"
5530	436, 446 MT	10	--	10	--		1740	6"	6"	8"	--
5540	432, 434, 436, 442, 444, 446 MT	20	20	20	20		1750	6"	6"	6"	6"
5550	454, 456, 458, 459 MT	45	45	45	45		1760	8"	8"	8"	8"
	636, 638, 646, 648 MT	35	35	35	35		1170				
5560	454, 456, 457, 458, 459 MT	85	85	85	85		1770	8"	8"	8"	8"
	632, 634, 636, 638, 642, 644, 646, 648 MT	75	75	75	75		1170				

MT = Standard



HP HT HS HZ

Note: Family curves are shown for all pumps on the following pages except for 5550 - 4xx and 5560 - 4xx which show individual pump performance curves.

For more information, request separate "**ITT Flygt Industrial Products**" catalog from the ITT Flygt regional office nearest you.

Components	Materials	
Major Castings Hydraulic Casing	Cast Iron	ASTM A48 Class 35B
Outer Casing, Cooling Jacket,	Galvanized Steel	ASTM A284 Grade D
Screws, Studs, and Nuts	Stainless Steel	ASTM A320 Type 304
Impeller and Hydraulic Wear parts:	Alloyed white Cast Iron High Chrome Polyurethane-lined Cast Iron	ASTM 532-80 Alloy 111A
Strainer	Painted Steel	A248 Grade D A573 Grade 65
Lifting Handle	Galvanized Steel	A248 Grade D A573 Grade 65 ASTM A572
Shaft	Stainless Steel	431
Rotating & Stationary Wear Ring	"SSAB Hardox 400"	
O-Ring	Nitrile Rubber 70°IRH	
Mechanical Face Seals:	Inner Stationary: tungsten carbide Inner Rotating: tungsten carbide Outer Stationary: tungsten carbide (Silicon carbide optional) Outer Rotating: tungsten carbde (Silicon carbide optional)	
Surface Treatment -- Impeller: Outer Casing:	Sprayed with water based acrylic primer. After priming, the outer casing is coated with polyester based paint.	

Abrasion Resistant Pumps
Design Features

Lifting Device
Large lifting handle with correct geometry. Pumps can be raised and lowered above center of gravity for secure and safe handling

Cable
A range of cables specially developed for submersible products, withstands temperatures of up to 70°C. Precise tolerance for tight cable entry. Tear-proof and extremely flexible.

Cable Entry
Separate sealing and strain-relief functions reduce risk of damage due to faulty handling. Stressed polymer (non-epoxy) bushings for easy servicing and high operational reliability.

Junction Chamber
The entire junction chamber is sealed off from motor. Generously dimensioned chamber for easy wiring, clearly marked terminal board and no cable clips. Terminal board connections can easily be changed to suit voltage requirements.

Motor
Squirrel cage induction motor, with 4 and 6 pole windings, for class S1(continuous) duty, designed and manufactured by ITT Flygt. Class F insulated stator windings, rated at 155°C (310°F), allow for up to 15 starts per hour. Heat shrink fitted, the stator is locked against rotation, for optimum alignment with rotor, without need for external locking bolts, a potential source of leakage.

Stator housing sensor
Float switch shuts pump down in presence of water.

Winding sensors
Thermal sensors are embedded in the stator windings to prevent overheating.

Rotor
Fan blades on the rotor produce even, homogeneous temperature under all operating conditions.

Shaft
The short shaft overhang virtually eliminates shaft deflection, resulting in dramatic increase in seal and bearing life, low vibration and silent operation.

Oil housing
In addition to lubricating the seals, the oil-filled compartment dissipates heat from the bearings. The housing also provides additional security against liquid penetration. Easy-to-perform oil checks indicate condition of seals.

Oil Housing sensor
Emulsion sensor checks content of water in oil, providing continuous monitoring of outer seal efficiency.

Abrasion Resistant Pumps
Design Features

SECTION	PAGE
8	5
SUPERSEDES	ISSUED
12/91	2/96

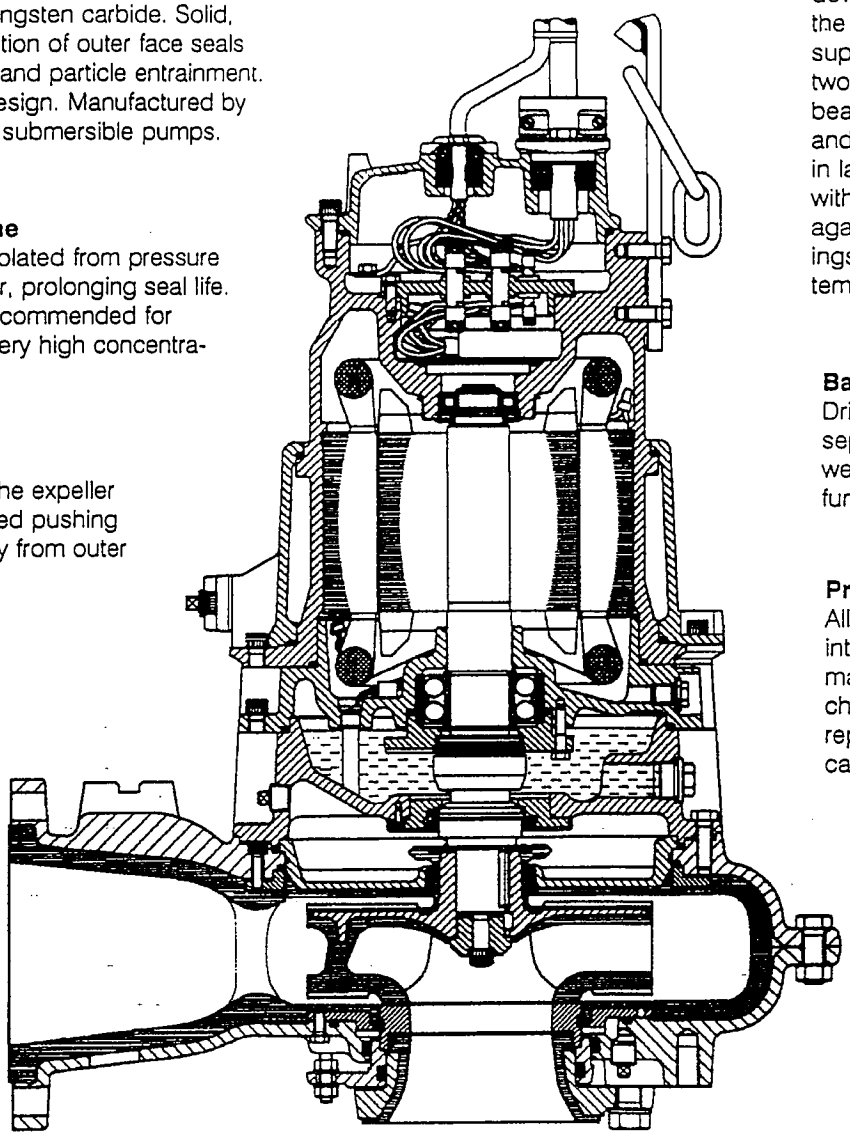
Seals
Two sets of mechanical face seals work independently of each other for double security. Both outer and inner seal mating rings made from tungsten carbide. Solid, one-piece construction of outer face seals prevents distortion and particle entrainment. Patent protected design. Manufactured by ITT Flygt for use in submersible pumps.

Seal isolation zone
The outer seal is isolated from pressure created by impeller, prolonging seal life. External flushing recommended for media containing very high concentration of solids.

Expeller
Attached to shaft, the expeller rotates at high speed pushing solids out and away from outer seal.

Impeller
High efficiency closed impeller, made of wear-resistant materials. The 3-vane design gives balanced pumping action for long seal and bearing life.

Back vanes
Back vanes decrease pressure between impeller and volute, limiting flow into isolation zone.



Bearings
Specially adapted bearing arrangements have been developed in cooperation with the bearing manufacturer. The support bearing consists of a two-row angular contact ball bearing, countering both radial and axial forces. Lower bearings in larger pumps are equipped with a warning sensor to protect against overheating. All bearings are packed with high temperature grease.

Back pull-out
Drive unit and wet end easily separated for fast access to wear parts with back pull-out function.

Protected wet end
All parts in the wet end coming into contact with medium are made of polyurethane or high chrome. Lining of volute can be replaced, thanks to a split casing.

Wet end liners
Wet end liners reduce cost of parts replacement.

Wear ring trimming
To maintain optimum pumping efficiency, the wear ring can be adjusted to reduce losses. To minimize wear in very abrasive media, gap between impeller and wear ring can be flushed with water from an external point.

APPENDIX E

Albuquerque Bernalillo County Water Utility Authority

Lockout/Tagout (LOTO)

Albuquerque Bernalillo County
Water Utility Authority

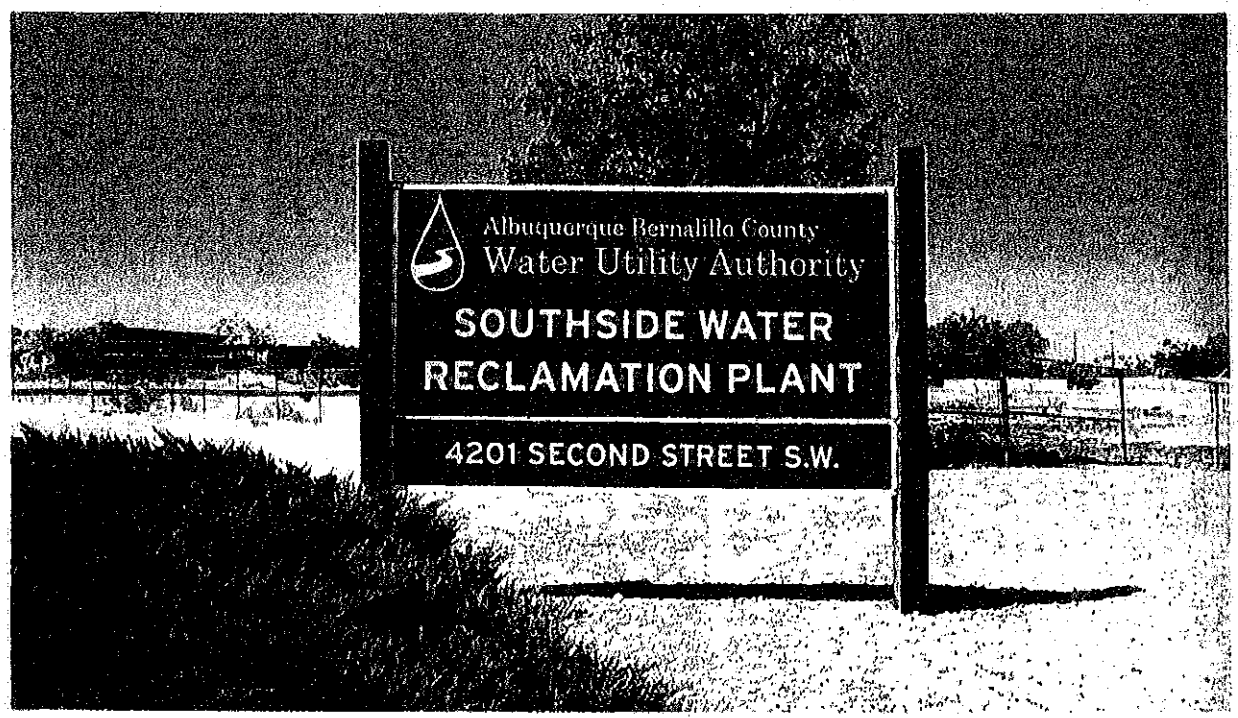
Southside Water Reclamation Plant

Program for the

Control of Hazardous Energy (Lockout/Tagout)

Based on

OSHA 29 CFR PART 1910.147



The Control of Hazardous Energy (Lockout/Tagout) Program

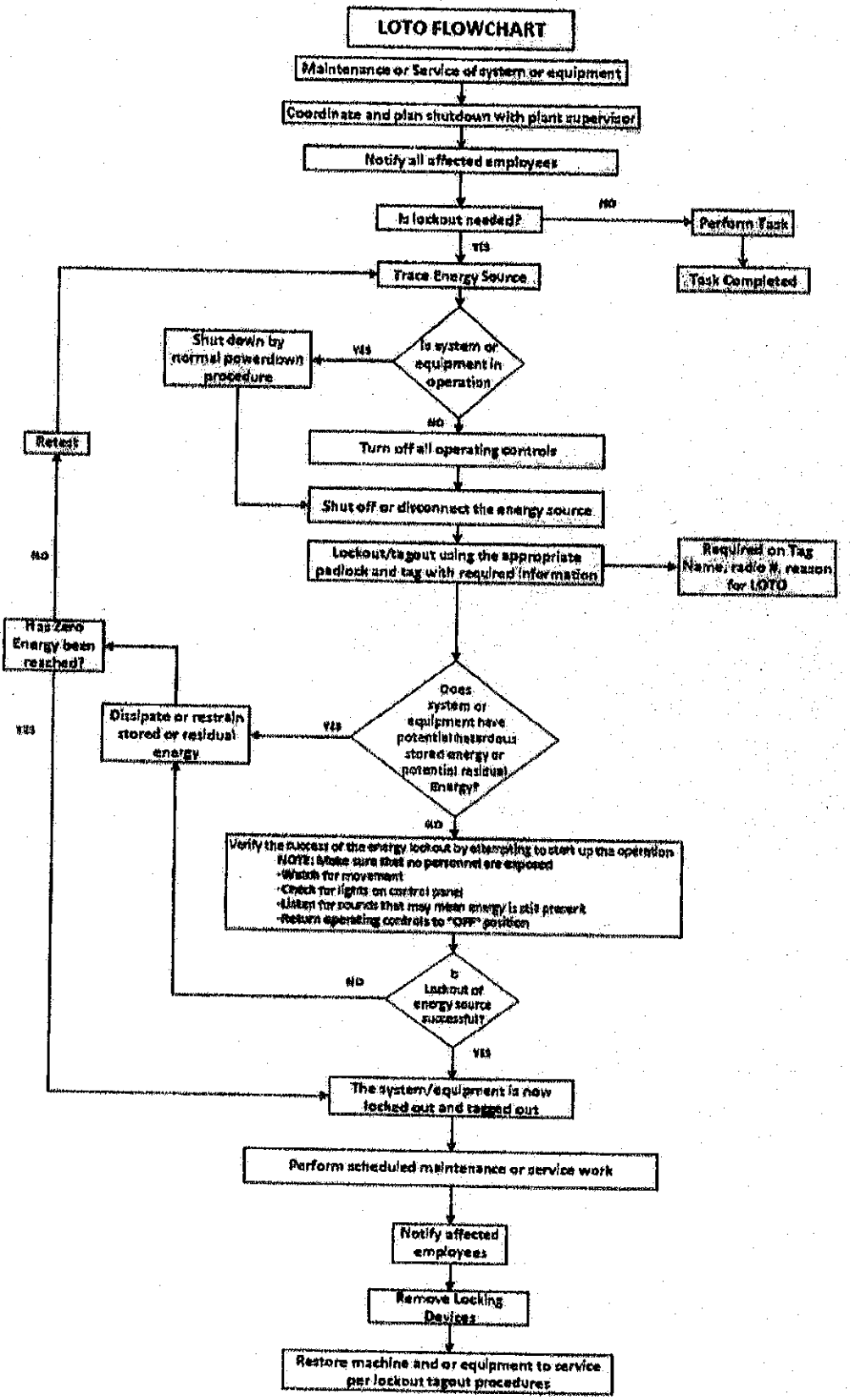
Table of Contents

Lockout/Tagout

Last Revised: March 2013

REVIEWED/APPROVED

Title/Name	Signature	DATE
Chief Engineer Jeff Romanowski		3-28-13
Operations Superintendent Joey Nogales		3-29-13
Maintenance Superintendent Jeff Romero		4-1-13
SAF J. Frank Bailey		4-1-13
Safety Manager Mike Cummings		4/4/13


LOTO FLOWCHART
Maintenance or Service of system or equipment
Coordinate and plan shutdown with plant supervisor
Notify all affected employees
Is lockout needed?
NO
Perform Task
Task Completed
YES
Trace Energy Source
Is system or equipment in operation
YES
Shut down by normal powerdown procedure
NO
Turn off all operating controls
Shut off or disconnect the energy source
Lockout/tagout using the appropriate padlock and tag with required information
Required on Tag Name, radio #, reason for LOTO
Does system or equipment have potential hazardous stored energy or potential residual energy?
YES
Dissipate or restrain stored or residual energy
Has Zero Energy been reached?
NO
YES
Retest
NO
Verify the success of the energy lockout by attempting to start up the operation
NOTE: Make sure that no personnel are exposed
-Watch for movement
-Check for lights on control panel
-Listen for sounds that may mean energy is still present
-Return operating controls to "OFF" position
Is Lockout of energy source successful?
NO
YES
The system/equipment is now locked out and tagged out
Perform scheduled maintenance or service work
Notify affected employees
Remove Locking Devices
Restore machine and or equipment to service per lockout tagout procedures

I. Introduction

The following "Lockout/Tagout" (LOTO) are the specific practices and procedures of the Albuquerque Bernalillo County Water Utility Authority (ABCWUA, hereafter referred to as Water Authority) Southside Water Reclamation Plant (SWRP) requirements to safeguard employees from the unexpected energization or startup of machinery and equipment, or the release of any stored hazardous energy during service or maintenance activities. This stored energy could be electrical, hydraulic, mechanical or any other source that may cause unexpected movement. This requires that a designated individual turns off, disconnects, disengages or blocks the machinery or equipment from its energy source(s) before performing service or maintenance.

All employees are required to follow the procedures outlined in this program.

II. Purpose

It is the policy of the SWRP for all employees working at this facility to follow all these established and effective lockout/tagout practices and procedures to ensure the safety of Water Authority employees.

III. Program Management Responsibilites

(A) Management (Chief Engineer):

(1) Responsible for providing the tools and resources necessary to implement this program and for ensuring that the provisions in this program are being followed by the Program Administrator.

(2) Developing specific lockout procedures for each individual piece of machinery/equipment at the facility. The Administrator will involve the maintenance staff, electricians, and employees operating the machinery/equipment in the development of the procedures to ensure all energy sources are identified.

(3) Identifying employee classifications – "Authorized" and Affected".

(B) Program Administrator (Safety Manager):

(1) Review program at least annually, or more frequently if changes are needed or new equipment is aquired.

(2) Identifying the proper personal protective equipment (PPE) needed, if any, during the LOTO procedures.

(3) Providing appropriate level of safety training to employees based on their classification.

(4) Providing outside contractors working at the SWRP with training and information on the SWRP Lockout/Tagout Program and procedures.

(C) Superintendents and Supervisors:

(1) Ensuring that only Authorized Employees who are qualified and trained apply and remove locks and tags.

(2) Ensuring that employees who are found to have insufficient skills or understanding of LOTO requirements do not perform LOTO and receive retraining before conducting any lockout/tagout procedures.

(3) Ensuring employees comply with all elements described in this program.

(4) Providing any information necessary for the continued functioning or updating of this program.
(5) Implement disciplinary procedures for employees deviating from the LOTO procedure.

(D) Employee Classification:

(1) "Authorized" Employees: Employees who are trained on the dangers of exposure to hazardous energy and are authorized (and trained) to perform de-energization of this hazardous energy. Employess are also trained to perform proper lock and tag out on a machine or piece of equipment in order to conduct servicing or maintenance on that machine, tool or piece of equipment under this program.

Duties of an "Authorized" employee include:

(a) Completing all training required to be authorized to perform lockout/tagout procedures on specific equipment, tool(s) or machinery under this program.
(b) Performing lockout/tagout activities which are in conformance with this program.
(c) Retaining control of the equipment, system or machinery while a lockout/tagout is in progress and works only under their own lock and tag.
(d) Maintaining lockout/tagout hardware and tags in good condition.
(e) Notifications of staff.

(2) "Affected" Employees. All employees whose job requires them to operate or use a machine or piece of equipment on which servicing or maintenance activities are being performed under LOTO, or whose job requires them to be in an area in which LOTO is being used, are considered "Affected" employees. They are not authorized to implement lockout/tagout procedures.

IV. Training and Communication

(A) Authorized Employees and their Supervisors

(1) The SWRP has developed and will provide LOTO training on the recognition of applicable hazardous energy sources, the type and magnitude of the energy available in the workplace, the methods and means available for energy isolation and control, and removal of energy-control devices. Equipment-specific training will be accomplished by presenting applicable written procedures to Authorized Employees, verifying that they understand the requirements of the procedure and observing correct performance of the lockout/tagout procedure(s). Reference SOJP's, SMJP's, and O&M manuals. Employees shall be trained on all individual lockout devices.

(B) Affected Employees

(1) Affected Employees working in areas where lockout/tagout may be used will be trained in the purpose of the lockout/tagout program, identification of locks and tags and restrictions these impose on equipment operation.
(2) Affected Employees must be retrained if a significant OSHA regulation or SWRP lockout/tagout guideline change has been made (i.e., new requirement, change in locks or tags).
(3) Affected Employee retraining can be delivered through awareness campaigns. Other Employees will be trained on the procedure and instructed never to attempt to restart or reenergize a machine that has been locked out or tagged out.

(C) Retraining of Authorized and Affected Employees

Retraining is required if:

(1) There is a change in task assignment that involves use of different LOTO procedures for which the Authorized Employee has not been previously trained.

(2) There is a change in the machine, equipment or processes that presents new hazards.

(3) There is a change in the energy-control procedures.

(4) The Supervisor has reason to believe, or determines through a periodic inspection or observation, that an Authorized or Affected Employee is performing the energy-control procedures inadequately or has deviated from or lacks sufficient knowledge of established procedures.

(D) Record retention

(1) All training records, including employee names and training dates, will be maintained in the employee's personnel files, or in plant administrative safety files.

(2) Training records will be maintained indefinitely.

(3) Training will be certified using Attachment A (Authorized Personnel) or Attachment B (Affected and Other personnel). The certifications will be retained in the employee personnel files.

V. Lockout/Tagout Control

LOTO devices are provided by the Water Authority. LOTO devices must be standardized as to color, size and shape. Each authorized person will have access to his/her individual lockout devices. Locks must be individually keyed. It shall be the responsibility of the employees performing the maintenance or repair to implement the lockout/tag out procedure before work begins. Supervisors are responsible for maintaining LOTO stations.

Note: LOTO procedures are the required method of isolating equipment. Tag out alone shall only be used when it is not possible to lock out the energy-isolating device and **shall not** be considered as an alternative method until all other options have been proven "Infeasible". When alternative methods are proven infeasible and only a tagout is used a safety watch, visual barriers, and danger or caution tape are required to be in place.

(A) Short-term locks are working-locks that are individually keyed in *red*, working locks are to be attached to energy isolation devices by each person in a work crew. Working locks are to be removed when maintenance is no longer being performed. Whenever a working lock is used, a "Danger - Do Not Operate" lock out tag shall be attached to the working lock. The lock out tag must also include the date that the lock is attached, a legible name and radio number of the person attaching the lock (see Appendix A).

(B) Long-term locks are color coded for operations and each maintenance group as shown in the table below:

DEPARTMENT	COLOR
Electrical	White
Instrumentation	Yellow
Mechanical	Blue
Operations	Green
Operations (* construction coordination)	Black

* Black padlocks are used by the Operations Superintendent or Assistant Operations Superintendent for new construction, contractor coordination and assistance requests.

VI. TAG OUT REQUIREMENTS

Tags used in the LOTO program (Appendix A) will be constructed of a laminated material (so that the following information can be recorded/written with a "grease pencil"); this information will contain but not be limited to:

(1) Full name
(2) Date, radio number, and phone number if applicable
(3) Reason for the LOTO / description

These Tags will be standardized as described below:
When a long-term lock is used, an identification tag shall be attached to a lock. The identification tag must also include the date that the lock was attached, a legible name and radio number of the person attaching the lock, and a brief description of work. Long-term locks are common keyed per work group and controlled by work group supervisors.

A tag may be used when it is infeasible to, or may create an unsafe condition to use a lockout/tagout device, and such no other means of isolation is possible. This tag will need approval from the Superintendent.

Tags shall be attached in such a manner as will clearly indicate that the operation or movement of energy isolating devices from the "neutral" or "off" position is prohibited. Tags shall be attached using all environment-tolerant nylon tie-wraps. Where a tag cannot be affixed directly to the energy isolating device, the tag shall be located as close as safely possible to the device, in a position that will be immediately obvious to anyone attempting to operate the device.

Note: Other (caution or work order) tags are not part of the LOTO program, but is used for informational purposes. They are not intended for employee protection. This process is referred to as an "administrative control" and is not a part of the LOTO procedure.

VII. ENERGY CONTROL PROCEDURE

(1) Coordinate and plan the shutdown of process equipment with the plant or field operations supervisor, as appropriate. Operations is primarily responsible for shut down, isolation, and lockout of plant process equipment. All personnel shall place their work group specific lock on the isolation device relevant to the equipment that they will be working on, along with a lock out tag.
Note: Planning and coordination must be done between the affected groups and all isolation points must be identified and addressed prior to the commencement of any work.
(2) Notify impacted employees that a lock out procedure is going to be utilized, and advise them of the machine or equipment that is involved.
(3) Isolate the equipment from all applicable energy sources using the isolation switches, breakers, valves or other energy isolating devices as appropriate.
Example: To change the drive belts on a HVAC system, isolate the voltage source. To perform maintenance on the heating cores, on a HVAC System, isolate the voltage source and the hot water supply and return lines. Bleed any stored thermal and hydraulic energy.

(4) Relieve stored energy associated with the equipment. Stored energy (such as that in springs, elevated machine members, hydraulic systems and air, gas, steam or water pressure, etc.) must be dissipated or restrained by methods such as repositioning, blocking, bleeding down pressure, etc. *Example:* To remove a hotsy after isolating all energy sources (voltage, gas and water supplies), allow the unit to cool, bleed off the water pressure, and after ensuring proper ventilation, vent off the gas pressure before proceeding to remove the equipment.
(5) LOTO the energy isolating device with an assigned padlock and attach a tag (Appendix A) to the lock.
(6) Verify that the equipment will not operate using normal operating controls.

VIII. REMOVING THE LOTO FOR START-UP

(1) After the servicing and/or maintenance are complete, and equipment is ready for normal operation, check the area around the machine or equipment that is locked out. Ensure that no one is exposed to danger if the machine or equipment is energized.
(2) Check the machine or equipment to ensure that all tools have been removed from the machine or equipment and that any guards that were removed have been reinstalled.

CAUTION: Insure controls are in "neutral" or "off" position prior to start-up and testing of equipment. Follow applicable SOJP's when starting or testing equipment.

(3) Notify operations supervisor that the equipment is ready for testing or start-up. Plant Operations is responsible for the start-up of plant equipment by removing operations locks from energy isolating devices. Operate the energy isolating devices to restore energy to the machine or equipment. Test the operation of the machine or equipment that was locked out for proper operation.
(4) Notify shift supervisor and the control room operator that the machine or equipment is no longer locked out and available for service or appropriate equipment status.

IX. DISCIPLINARY ACTION REQUIRED FOR VIOLATING LOTO PROCEDURES

The only person authorized to remove the LOTO devices is that person who installed the devices; therefore, unauthorized removal or by-passing the LOTO device procedure compromises the worker's safety. Any person who violates a LOTO procedure and energizes, starts or otherwise activates a machine or who removes a LOTO device without authorization shall be disciplined according to Water Authority policies and procedures. Disciplinary action shall be taken whether or not injury or damage occurs.

X. PROCEDURES INVOLVING MORE THAN ONE PERSON

If more than one person is involved in the service or repair of a machine or equipment, each individual will place his/her personal LOTO device on all energy isolating devices. When an energy isolating device cannot accept multiple locks or tags, a multiple lockout device (a hasp) may be used.

If LOTO is used, a single lock may be used to lockout the machine or equipment, but the key to that lock must be placed in a lockout box or cabinet which allows the use of multiple locks to secure it. Each employee will then use his/her own lock to secure the box or cabinet. As each person no longer needs to maintain his/her LOTO protection, that person will remove his/her own lock from the lockout device or from the lockout box.

XI. PROCEDURES INVOLVING MORE THAN ONE WORK GROUP

When a work group finishes its daily work, the work crew shall ensure that all tools are removed. Only that crews red lock out device and identification tag shall be removed from the energy isolating device associated with the machine or equipment. The technician/operator shall not remove his/her lock until all coworkers and affected personnel are notified and clear. If the equipment is ready for service, the last work crew to complete its work will assist operations in the complete procedure for removing the lock out devices and ensuring proper operation.

There may be occasions when a LOTO device must remain in place for more than one work shift or after other personnel changes. The procedure depends on whether or not employees on the incoming shift will be working on the locked out or tagged out equipment.

(A) Service or repair work will be continued by the new shift:
Employees leaving the work place will remove their locks and incoming employees will connect their locks under the direct observation of their supervisors. The supervisors for both shifts will be present for the transfer of the LOTO.

(B) Employees on other shifts will not be working on the machines:
The LOTO devices will remain in place and the incoming personnel will be notified that a LOTO is in affect. The supervisors of both shifts will be responsible for ensuring that the information is made available to the incoming personnel.

XII. NON-ROUTINE REMOVAL OF A LOTO DEVICE

When the employee who applied the LOTO device is not available to remove it, the LOTO may be removed under the direction of the supervisor of the employee who applied the lock out device, or under the direction of the responsible superintendent. The rules for LOTO removal still apply. Moreover, the supervisor must:

(1) Verify that any Authorized Employee who applied lock(s) and associated tag(s) is not on duty and that their work is no longer in progress. All reasonable efforts will be made to contact the Authorized Employee(s) to discuss the planned removal of their lock(s) and determine if the Authorized Employee(s) have any safety concerns with removal of their lock(s).
(2) An Authorized Employee/Supervisor returns the equipment to service and notifies the Affected Employees that service or maintenance is completed and the equipment is ready for use.
(3) When the Authorized Employee(s) whose lock(s) were removed return to work, their Supervisor(s) will again notify them that their lock(s) and tag(s) were removed.

XIII. HOT TAP OPERATIONS

Hot Tap Operations requires preapproval of the Chief Engineer. Work involving transmission and distribution systems for substances such as gas, steam, water or petroleum can be performed on pressurized pipeline systems if:
(A) The employer can demonstrate that the continuity of service is essential.
(B) Shutdown of the system is infeasible, and could lead to employees being exposed to other

hazards. In this case employees will need to follow established safe work procedures, developed for these operations.

(C) Special equipment is used that will provide effective protection for employees.

XIV. AUDIT/INSPECTION OF THE LOTO PROCEDURE

All LOTO procedures will be reviewed at least **annually**. The procedure will be reviewed for adequacy and completeness by an Authorized Employee who does not regularly use the machine/equipment-specific lockout procedure or by the Safety Manager or his/her designee. If any deviations or inadequacies are identified, the Program Administrator will take all necessary steps to update the procedure. The annual inspection will include a review, between the Reviewer and each Authorized Employee of that machine/equipment, to determine if they understand their responsibilities under that procedure. Annual inspections are documented with the information shown in **Attachment D**. This inspection record will be retained indefinitely.

XV. PROCEDURES FOR OUTSIDE PERSONNEL/ CONTRACTORS

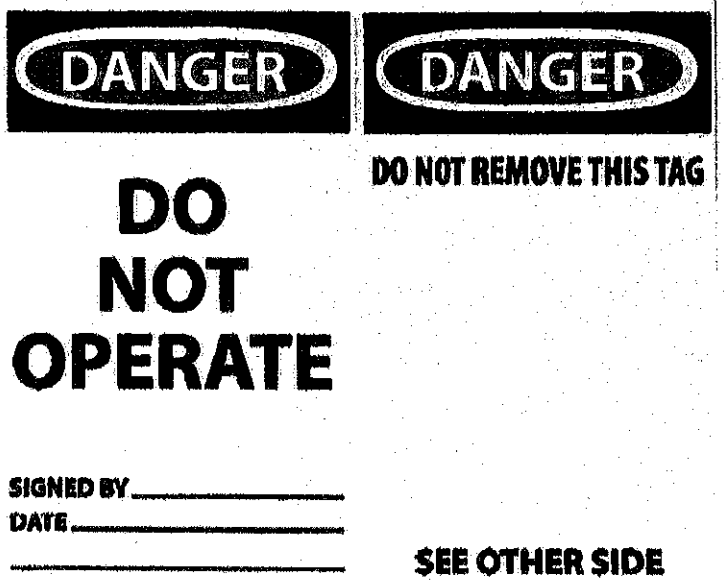
(A) Outside personnel/contractors shall be advised that the SWRP has and enforces the use of LOTO procedures. They will be informed of the use of locks and tags and notified about the prohibition of attempts to restart or re-energize machines or equipment that are locked out or tagged out.

(B) The company will obtain information from the outside personnel/contractor about their LOTO procedures and advise affected employees of this information.

(C) The outside personnel/contractor will be required to sign a certification form (see Attachment E). If outside personnel/contractor has previously signed a certification that is on file, additional signed certification is not necessary.

APPENDIX A

Lock Out Tag



ATTACHMENT A

Certification of Training
(Authorized Personnel)

I certify that I received training as an "Authorized Employee" under SWRP Lockout/Tagout program. I further certify that I understand the procedures and will abide by those procedures.

AUTHORIZED EMPLOYEE SIGNATURE

DATE

ATTACHMENT B

Certification of Training
(Affected Personnel)

I certify that I received training as an Affected Employee under SWRP Lockout/Tagout Program. I further certify and understand that I am prohibited from attempting to restart or re-energize machines or equipment that are locked out or tagged out.

AUTHORIZED EMPLOYEE SIGNATURE _____ DATE _____

ATTACHMENT C

Lockout/Tagout Equipment Inspection Certification

I certify that _____was inspected on this date utilizing lockout/tagout procedures. The inspection was performed while working on

_____.

_____ _____

AUTHORIZED EMPLOYEE SIGNATURE DATE

_____ _____

INSPECTOR SIGNATURE DATE

ATTACHMENT D

Annual Evaluation Report

Date(s) of Evaluation _____

Evaluation was made by _____.
(PRINT)

General policy has been reviewed: YES____NO____

Comments on general policy:

The following specific procedures have been reviewed (list below):

Does the procedure comply with the SWRP program?

If a specific lockout/tagout were inspected in the field placed by the employee evaluated:

Location: _____

Equipment No.: _____

Equipment Name: _____ Serial No.: _____

Department who apply the Lockout/Tagout in the machine/equipment: _____

Does the machine/equipment have properly the LOTO? Yes____ No____

If not explain what need to be addressed and fix it:_____

ATTACHMENT E

Outside Personnel/Contractor Certification

I certify that _____and _____ (outside personnel/contractor) have informed each other of our respective Lockout/Tagout procedures.

_____ _____

AUTHORIZED EMPLOYEE SIGNATURE DATE

_____ _____

INSPECTOR SIGNATURE DATE

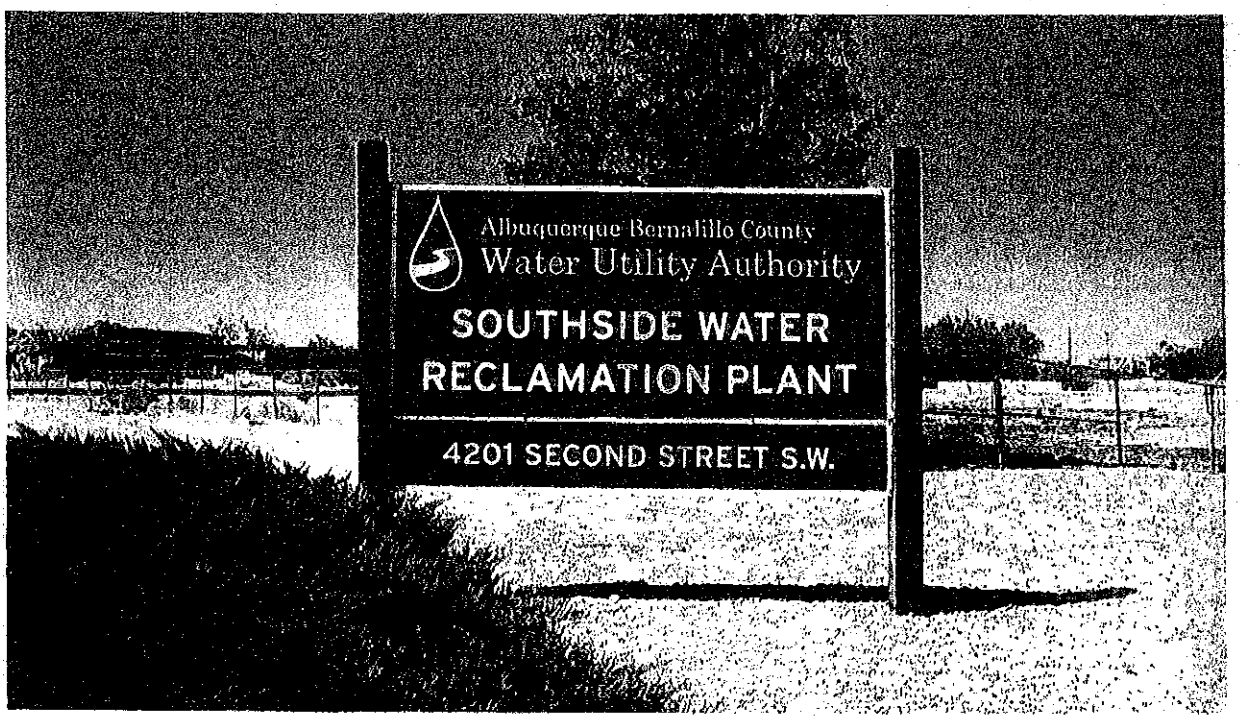
APPENDIX F

Albuquerque Bernalillo County Water Utility Authority

Confined Space Program

Albuquerque Bernalillo County
Water Utility Authority

Confined Space Program
For
Southside Water Reclamation Plant



Albuquerque Bernalillo County
Water Utility Authority

Southside Water Reclamation Plant

Confined Space Program

Last Revised: April 3, 2014

REVIEWED/APPROVED

SAFETY SUPERVISOR: _____

SWRP CHIEF ENGINEER: _____

SWRP OPERATIONS SUPERINTENDENT: _____

SWRP MAINTENANCE SUPERINTENDENT: _____

TABLE OF CONTENTS

CONFINED SPACE ENTRY PROCEDURES

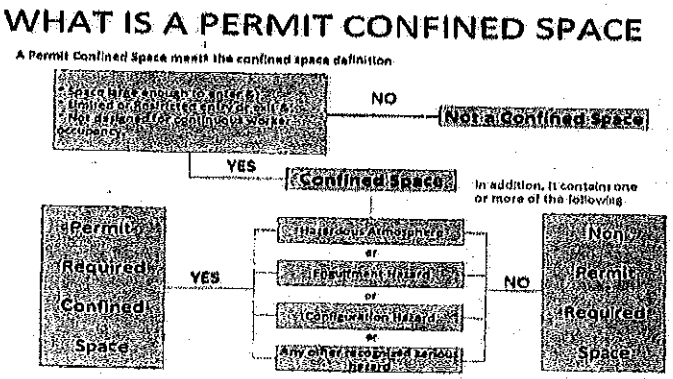
ALBUQUERQUE BERNALILLO COUNTY WATER UTILITY AUTHORITY
CONFINED SPACE ENTRY PROGRAM

I. Description of our Water Authority Program

The purpose of this program is to set forth the requirements for practices and procedures to protect Water Authority employees and contractors from exposure and injury from the hazards of entering and performing work in confined spaces. The policies and procedures in this document are elements that make up the Water Authority's Permit Space Program. This program is intended to meet and exceed the requirements of the U.S. Department of Labor, Occupational Safety and Health Administration's Confined Space Standard 29 CFR 1910.146.

II. Scope

This program applies to all confined spaces owned by the Water Authority. This program also applies to all confined spaces that may be entered by Water Authority employees. Included in this program are the Southside Water Reclamation Plant, Surface Water Treatment Plant, Sanitary Lift Stations, Storm Water Lift Stations, Well Stations, Water Pump Stations, and Chemical Feed Stations.



III. Requirements of the Water Authority

(1) In administering this Confined Space Entry Program the Chief Engineers and Safety Manager will:

(a) Monitor the effectiveness of the program;

(b) Provide training to affected employees and supervisors that is sufficient to impart necessary understanding, knowledge and skills;

(c) Certify that training has been accomplished. Certification must include employee's name, signature of trainer, dates of training;

(d) Provide atmospheric testing equipment as needed;

(e) Provide personal protective equipment as needed;

(f) Provide technical assistance as needed;

(g) Review and update the program on an annual basis or more often as needed.

(2) The Chief Engineers and Operation/Maintenance Superintendents are responsible for managing the Confined Space Entry Program in the Water Authority facilities and they will:

(a) Verify that all confined spaces at their facilities are properly labeled and maintained;
(b) Review all confined space entry permits for successful operation and perform "lessons learned" for any entry that experienced any problems or presented any condition that caused the permit to be canceled and the confined space to be evacuated;
(c) Maintain hard copies and electronic storage of all canceled/completed confined space entry permits. These canceled/completed permits will be kept for a minimum of 3 years;
(d) Require all employees who enter confined spaces to receive training which will make them both competent and qualified to perform confined space entry operations and establish employee proficiency in required duties;
(e) Verify that employees are provided all necessary confined space entry/rescue equipment, maintain that equipment properly, and ensure employees use that equipment properly;
(f) Perform monthly inspections of all related confined space entry equipment and verify all such equipment meets manufacturers' standards.

IV. Safety Policies and Regulations

It is the safety policy of the Water Authority that a confined space:
(1) Is large enough and so configured that an employee can bodily enter to perform assigned work; and
(2) Has limited or restricted means for entry or exit (for example, tanks, vessels, silos, storage bins, hoppers, vaults, and pits are spaces that may have limited means of entry); and
(3) Is not intended for continuous employee occupancy.

It is the safety policy of the Water Authority that a Permit-Required Confined Space means a confined space that has one or more of the following characteristics:
(1) Contains or has a potential to contain a hazardous atmosphere;
(2) Contains a material that has the potential for engulfing an entrant;
(3) Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section; or
(4) Contains any other recognized serious safety or health hazard.
Unauthorized entry into a permit-required confined space by Water Authority employees and contractors is forbidden and cause for disciplinary action.

Manpower and equipment shall be available during permit-required confined space entry to immediately and safely remove any disabled worker from the confined space. Assisted Self-Rescue is the approved procedure Water Authority employees will use to remove a disabled worker from a confined space.

Water Authority employees will perform Assisted Self-Rescue (ASR) vertical direct retrieval operations only. Horizontal confined space rescue is not allowed and will be contracted out to Rocco or some other confined space rescue service.

No Hot Work shall be conducted inside a confined space prior to completion of the appropriate Hot Work Permit.

Facial hair at the facepiece-to-face interface that may interfere with the operation of the full-face piece of the supplied air respirator shall not be permitted. This facial hair may include beards, sideburns, mustaches, long hair and or bangs.

Water Authority employees are required to consider all confined spaces as Permit-Required Confined

Spaces unless they can be reclassified as a Non-Permit Confined Space.

Multiple confined space entries are not to be monitored by a single attendant.

When the Water Authority arranges to have a contractor perform work that involves permit space entry, the Authority shall:
(1) Inform the contractor that the workplace contains permit-required confined spaces and that permit space entry is allowed only through compliance with the Water Authority permit space program;
(2) Apprise the contractor of the hazards identified and the Water Authority's experience to include but not limited to the presence of hydrogen sulfide (H_2S), carbon monoxide (CO), carbon dioxide (CO2), hydrogen chloride (HCL), and methane (CH4) gas in the space, that make the space in question a permit space;
(3) Apprise the contractor of any precautions or procedures that the Water Authority has implemented for the protection of employees in or near permit spaces where contractor personnel will be working;
(4) Coordinate entry operations with the contractor, when both Water Authority personnel and contractor personnel will be working in or near permit spaces;
(5) Meet and debrief the contractor at the conclusion of the entry operations regarding the Water Authority's permit space program regarding any hazards confronted or created in permit spaces during entry operations.

CONFINED SPACE IDENTIFICATION

V. Confined Space Identification

The Water Authority has implemented this written permit space program and it is available for inspection by employees and their authorized representatives. The Water Authority has evaluated the workplace and has determined that the workplace contains permit-required confined spaces. The permit spaces are posted with one or more of the following danger signs:

DANGER
PERMIT-REQUIRED CONFINED SPACE
AUTHORIZED ENTRY ONLY

DANGER
PERMIT-REQUIRED CONFINED SPACE
DO NOT ENTER

The Permit-Required Confined Spaces are also labeled with a number that identifies the confined space for identification and inventory purposes. The inventory label is PRCS followed by the confined space number, for example PRCS 365. This evaluation/inventory system will be used for annual review and to provide employees additional information about the confined space they will be working in. The Water Authority has evaluated the hazards of our permit spaces and the following procedures, practices, and acceptable entry conditions necessary for safe permit space entry operations are specified below.

VI. Permit-Required Confined Space Entry Permit

The Water Authority's confined space entry permit documents compliance with the Water Authority's Permit Space Program and authorizes entry to a permit space. The confined space entry permit is the most essential tool for assuring employee safety during entry operations in permit-required confined spaces with known hazards, or with unknown or potentially hazardous atmospheres. The entry permit process guides the entry supervisor, attendant, and entrants through a systematic evaluation of the permit space to be entered. The entry permit will be used to establish acceptable conditions before each entry and verify that conditions in the confined space are acceptable throughout the duration of an authorized entry.

VII. Permit-Required Confined Space Entry Procedures

(1) When entry into a permit-required confined space is necessary the Operations/Maintenance Superintendent from the appropriate section will select an entry supervisor, attendant, and entrant(s) to initiate the confined space entry procedures. An Operations/Maintenance Supervisor may also select the entry team.

(2) Prior to entry of the permit-required confined space, the entry supervisor, attendant, and entrant shall be responsible for the following:

(a) Completion of the confined space entry permit;
(b) Verify acceptable entry conditions in the confined space;
(c) Isolation of the permit space; establishing communication with the Control Room;
(d) Verifying the availability of the Assisted Self-Rescue service;
(e) Signature of the entry supervisor on the entry permit after its completion.

(3) Remove the entrance cover, hatch, or grating to the confined space to be entered. Any conditions making it unsafe to remove an entrance cover to the confined space shall be eliminated before the cover is removed. When entrance covers are removed, the opening shall be promptly guarded by a railing, temporary cover, or other temporary barrier that will prevent an accidental fall through the opening and that will protect each employee working in the space from foreign objects entering the space.

(4) Before an employee enters the confined space, the internal atmosphere shall be tested, with a calibrated direct-reading gas detector, for oxygen content, for flammable gases and vapors, and for potential toxic air contaminants, in that order. Any entrant who enters the confined space shall be provided an opportunity to observe the pre-entry testing. The approved gas detectors for atmospheric testing are the RKI GX-2012, GX-2009 and GX-2001.

(5) Isolate the confined space from any potential hazards that may be encountered. This includes electrical hazards, mechanical hazards, Engulfment hazards, Entrapment hazards, and physical hazards. Make sure the proper isolation procedures are followed such as lock out/tag out, double block and bleed, blanked, blocked, chocked and disengaged. Document this isolation on the confined space entry permit. Employees are required to observe and assist with this isolating of the permit space.

(6) Ventilate the permit-required confined space with continuous forced air ventilation. The entry supervisor, attendant, and entrant shall be responsible for setting up the mechanical ventilation and it shall be used, as follows:

(a) An employee may not enter the space until the forced air ventilation has eliminated any hazardous atmosphere;
(b) The forced air ventilation shall be so directed as to ventilate the immediate areas where an employee is or will be present within the space and shall continue until all employees have left the space;
(c) The air supply for the forced air ventilation shall be from a clean source and may not increase the hazards in the space.

(7) Test the confined space for a hazardous atmosphere. The entry supervisor, attendant, and entrant shall continuously monitor the atmosphere within the confined space. The pre-entry atmospheric check shall be documented on the entry permit. The entrant must have a calibrated gas detector on

his/her body at all times during entry operations. The entry supervisor, attendant, or designee shall monitor the atmosphere within the permit space from outside the confined space using a calibrated gas detector with a sample draw pump and tubing. This atmospheric testing will ensure that the continuous forced air ventilation is preventing the accumulation of a hazardous atmosphere. There may be no hazardous atmosphere within the space whenever any employee is inside the space.

(8) If a hazardous atmosphere is detected during entry;

(a) Each employee shall leave the space immediately;

(b) The space shall be evaluated to determine how the hazardous atmosphere developed;

(c) Measures shall be implemented to protect employees from the hazardous atmosphere before any subsequent entry takes place.

(9) The entry supervisor, attendant, and entrant shall establish the communication procedures to be used by the authorized entrants and attendants to maintain contact during entry operations. The preferred communication procedures are visual and voice contact at all times; every effort should be made to maintain this type of contact between the attendant and entrant. Visual contact at all times and the Authority radio system are also acceptable communication procedures. Any other communication procedures necessary must be preapproved by the entry supervisor.

(10) The attendant shall establish contact with the Control Room and inform the control room operator that a permit-required confined space entry is taking place. Give the control room operator the location of the confined space, authorized attendant, authorized entrant, and the purpose of the entry in case an emergency arises and emergency medical services needs to be contacted. A copy of the entry permit may also be posted in the Control Room if it is going to be a prolonged entry. The confined space entry permit must be located at the confined space during all entry operations.

(11) The entry supervisor shall select an Authority Assisted Self-Rescue Team required for the permit-required confined space entry. The entry supervisor will select an Assisted Self-Rescue team leader and team members. This Assisted Self-Rescue team will be responsible for rescue procedures associated with the confined space entry. Log this information down on the entry permit.

(12) The entry team (entry supervisor, attendant and entrant) shall procure all required personal protective equipment required for the permit entry. Don all equipment properly and set up the DBI-SALA confined space entry/retrieval system required for Assisted Self-Rescue.

(13) The entry supervisor shall certify that the confined space is safe for entry and that the pre-entry measures required by the confined space entry permit have been taken. The entry supervisor will then sign the permit-required confined space entry permit and allow work to commence.

(14) The entry supervisor shall assign a person to take periodic atmospheric tests of the atmosphere inside the confined space during entry operations. If an attendant is assigned this task it cannot interfere with his attendant duties. The interval between atmospheric readings shall be every 15 minutes unless specified otherwise by the entry supervisor. The names or initials of the person conducting these tests and an indication of when the tests were performed must be noted on the entry permit.

(15) When the confined space entry is completed the entry supervisor will make sure the permit is cancelled and closed out; all equipment is returned to its proper location and the entrance cover is replaced to the confined space.

Water Utility Authority

CONFINED SPACE ENTRY PERMIT

PERMIT VALID FOR 8 HOURS MAXIMUM ONLY. ALL COPIES OF PERMIT WILL REMAIN AT JOB SITE UNTIL JOB IS COMPLETED.
DATE: _____ PERMIT SPACE TO BE ENTERED: _____
PURPOSE OF ENTRY: _____
AUTHORIZED DURATION OF THE ENTRY PERMIT (Hours): _____
AUTHORIZED ENTRANTS (Full Name): _____, _____,
_____, _____.
AUTHORIZED ATTENDANTS (Full Name): _____, _____.
ENTRY SUPERVISOR (Full Name): _____
HAZARDS OF THE PERMIT SPACE TO BE ENTERED

EMPLOYEES COULD BE EXPOSED TO THE FOLLOWING:	YES	NO	N/A	LIST
Engulfment/Entrapment	( )	( )	( )	_____
Presence of toxic gases	( )	( )	( )	_____
Presence of explosive/flammable gases	( )	( )	( )	_____
Oxygen deficiency	( )	( )	( )	_____
Bio-hazards	( )	( )	( )	_____
Wet conditions, slip, trip, and fall hazards	( )	( )	( )	_____

Mitigation: _____

ISOLATION OF THE PERMIT SPACE (Lock out/tag out devices specific to entry)	YES	NO	N/A	LIST & INITIAL ISOLATION
Electrical systems locked out and tagged out	( )	( )	( )	_____
Mechanical systems (blocked, chocked, disengaged)	( )	( )	( )	_____
Gas systems (blanked) locked out and tagged out	( )	( )	( )	_____
Liquid systems (double block, bleed) locked out	( )	( )	( )	_____
Secure area (Post, Flag, Barricade)	( )	( )	( )	_____

Mitigation _____

VENTILATION MODIFICATION	YES	NO	N/A	MODEL & FLOW RATE
Mechanical	( )	( )	( )	_____
Mechanical explosion proof	( )	( )	( )	_____
Natural ventilation only	( )	( )	( )	

ATMOSPHERIC CHECK AFTER ISOLATION AND VENTILATION
DATE: _____ TIME: _____ TESTER: _____ CALIBRATION DATE: _____
(Must be within 2 month period)
Percent Oxygen _____ % (Must be between 19.5% to 23.5%)
Explosive Gases _____ %LEL (Must be less than 10% LEL)
Toxic Gas (H2S) _____ PPM (Must be less than 5 PPM)
Toxic Gas (CO) _____ PPM (Must be less than 35 PPM)
Other (Specify) _____ PPM (Must be less than PEL)

COMMUNICATION PROCEDURES	YES	NO	N/A	LIST
Authority Radio System or Cellular Phone	( )	( )	( )	_____
Contact established with Control Room/Dispatch	( )	( )	( )	_____

RECLASSIFICATION (NON-PERMIT CONFINED SPACE)
If all hazards have been eliminated or mitigated, then this permit-required confined space can be reclassified as a non-permit confined space.

All hazards mitigated:	YES	NO
	( )	( )

Certification by: _____ Date: _____ Time: _____
(If "NO" continue with permit-required confined space procedures. If "YES" refer to WUA non-permit confined space procedures or OSHA 1910.146(C)(7) for further clarification on reclassifying a PRCS to non-permit confined space)

ASSISTED SELF-RESCUE & EMERGENCY SERVICES	YES	NO	N/A
Authority Assisted Self-Rescue on Site	( )	( )	( )
911 Emergency Medical Service Available	( )	( )	( )

Authority Assisted Self-Rescue Team (Full Name): _____, _____
Assisted Self-Rescue Team Leader: _____
All confined space, CPR, and first aid certifications current? YES ( ) If not do not proceed

PROTECTIVE CLOTHING AND EQUIPMENT IN ADDITION TO REGULAR HARD HAT, SAFETY SHOES AND SAFETY GLASSES

	YES	NO	N/A	LIST
Review MSDS, Post at Confined Space	( )	( )	( )	
Respiratory protection (Check one): ☐ SCBA ☐ Airline ☐ Cartridge type	( )	( )	( )	_____
Eye protection (Check one): ☐ Chemical goggles ☐ Face shield ☐ Dust goggles	( )	( )	( )	_____
Gloves (Check Type): ☐ Chemical ☐ Leather ☐ Other _____	( )	( )	( )	_____
Protective clothing (Check Type): ☐ Chemical suit ☐ Rubber apron ☐ Rubber boots	( )	( )	( )	_____
Electrical shock protection ☐ Flash suit ☐ Rescue hook ☐ Hot stick	( )	( )	( )	_____
Full body harness with lifeline, **(Mandatory)**	( )	( )	( )	_____
Rescue davit & retrieval winch **(Mandatory)**	( )	( )	( )	
Hearing protection _____	( )	( )	( )	
Fall protection _____	( )	( )	( )	
Lighting (Explosive Proof) _____	( )	( )	( )	
Hot work permit	( )	( )	( )	
Fire extinguishers _____	( )	( )	( )	
First Aid kit	( )	( )	( )	

I have reviewed the work authorized by this permit and the information contained here-in.
Permit Approved By:
ENTRY SUPERVISOR: _____
(Printed Name) (Signature)
Reviewed By: (Unit Superintendent) _____
(Printed Name) (Signature)
Reviewed By (Safety Manager) _____
(If Available #239-4122) (Printed Name) (Signature)

ATMOSPHERE TEST RESULTS, RECORD CONTINUOUS MONITORING RESULTS EVERY 15 MINUTES OR AS NECESSARY TO ENSURE PERMIT COMPLIANCE.
(Permissible safe limits for personnel are 19.5 - 23.5% Oxygen, less than TWA for toxics and less than 10% LEL.)
Instrument Model _____ Serial # _____ Date Calibration Performed? _____ Calibration Performed by Whom? _____

Tester_____ Time_____ Oxygen_____%, LEL._____%, H2S_____PPM, CO_____
Tester_____ Time_____ Oxygen_____%, LEL._____%, H2S_____PPM, CO_____
Tester_____ Time_____ Oxygen_____%, LEL._____%, H2S_____PPM, CO_____
Tester_____ Time_____ Oxygen_____%, LEL._____%, H2S_____PPM, CO_____
Tester_____ Time_____ Oxygen_____%, LEL._____%, H2S_____PPM, CO_____
Tester_____ Time_____ Oxygen_____%, LEL._____%, H2S_____PPM, CO_____
Tester_____ Time_____ Oxygen_____%, LEL._____%, H2S_____PPM, CO_____
Tester_____ Time_____ Oxygen_____%, LEL._____%, H2S_____PPM, CO_____
Tester_____ Time_____ Oxygen_____%, LEL._____%, H2S_____PPM, CO_____
Tester_____ Time_____ Oxygen_____%, LEL._____%, H2S_____PPM, CO_____

VIII. Duties of Authorized Entrants

(1) Complete all required confined space training prior to entry operations.

(2) Know the hazards that may be faced during entry, including information on the mode, signs or symptoms, and consequences of the exposure. Review the appropriate Material Safety Data Sheet (MSDS) for each chemical hazard that may be encountered;

(3) Properly use equipment as required by the Water Authority's permit-required confined space program. This equipment must be properly maintained and includes:

(a) Testing and monitoring equipment (RKI GX-2012, GX-2009 or GX-2001);
(b) Ventilating equipment needed to obtain acceptable entry conditions;
(c) Communications equipment;
(d) Personal protective equipment;
(e) Lighting equipment needed to work safely and to exit the space quickly in an emergency;
(f) Barriers and shields;
(g) Equipment, such as ladders, needed for safe ingress and egress by authorized entrants;
(h) Rescue and emergency equipment;
(i) Any other equipment necessary for safe entry into and rescue from permit spaces.

(4) Communicate with the attendant as necessary to enable the attendant to monitor entrant status and to enable the attendant to alert entrants of the need to evacuate the space as required by the permit-required confined space program.

(5) Alert the attendant whenever the entrant recognizes any warning sign or symptom of exposure to a dangerous situation or the entrant detects a prohibited condition.

(6) Exit from the permit space as quickly as possible whenever:

(a) An order to evacuate is given by the attendant or the entry supervisor;
(b) The entrant recognizes any warning sign or symptom of exposure to a dangerous situation;
(c) The entrant detects a prohibited condition; or
(d) An evacuation alarm is activated.

IX. Duties of Attendants

(1) Complete all required confined space training prior to entry operations.

(2) Know the hazards that may be faced during entry, including information on the mode, signs or symptoms, and consequences of the exposure. Review the appropriate MSDS for each chemical hazard that may be encountered;

(3) Is aware of possible behavioral effects of hazard exposure in authorized entrants;

(4) Continuously maintain an accurate count of authorized entrants in the permit space and ensures that the means used to identify authorized entrants accurately identifies who is in the permit space;

(5) Remain outside the permit space during entry operations until relieved by another attendant;

(6) Communicate with authorized entrants as necessary to monitor entrant status and to alert entrants of the need to evacuate the confined space;

(7) Monitor activities inside and outside the space to determine if it is safe for entrants to remain in the space and orders the authorized entrants to evacuate the permit space immediately under any of the following conditions:

(a) If the attendant detects a prohibited condition;
(b) If the attendant detects the behavioral effects of hazard exposure in an authorized entrant;
(c) If the attendant detects a situation outside the space that could endanger the authorized entrants; or
(d) If the attendant cannot effectively and safely perform all the duties required;

(8) Activate assisted Self-Rescue Procedures or summon emergency services as soon as the attendant determines that authorized entrants may need assistance to escape from permit space hazards;

(9) Take the following actions when unauthorized persons approach or enter a permit space while entry is underway:

(a) Warn the unauthorized persons that they must stay away from the permit space;
(b) Advise the unauthorized persons that they must exit immediately if they have entered the permit space; and
(c) Inform the authorized entrants and the entry supervisor if unauthorized persons have entered the permit space;

(10) Perform non-entry rescue as specified by the Water Authority Assisted Self-Rescue procedures; and

(11) Perform no duties that might interfere with the attendant's primary duty to monitor and protect the authorized entrants.

X. Duties of Entry Supervisors

(1) Know the hazards that may be faced during entry, including information on the mode, signs or symptoms, and consequences of the exposure. Review the appropriate MSDS for each chemical hazard that may be encountered;

(2) Check that the appropriate entries have been made on the permit, all tests specified by the permit have been conducted and all procedures and equipment specified by the permit are in place before endorsing the permit and allowing entry to begin;

(3) Terminate the entry and cancel the permit when;

(a) The entry operations covered by the entry permit have been completed; or
(b) A condition that is not allowed under the entry permit arises in or near the permit space;

(4) Verify Authority Assisted Self-Rescue services are available and that the means for summoning them are operable;

(5) Remove unauthorized individuals who enter or who attempt to enter the permit space during entry operations; and

(6) Reevaluate the permit space in the presence of any authorized entrant who has reason to believe

that the evaluation of that permit space may not have been adequate;

(7) Determine, whenever responsibility for a permit space entry operation is transferred and at intervals dictated by the hazards and operations performed within the space, that entry operations remain consistent with terms of the entry permit and that acceptable entry conditions are maintained.

(8) The Entry Supervisor shall provide at least one authorized attendant outside the permit space into which entry is authorized for the duration of entry operations. Multiple spaces are not to be monitored by a single attendant according to the Water Authority's Permit Space Program.

NON-PERMIT CONFINED SPACE

XI. Non-Permit Confined Space

(1) A non-permit confined space means a confined space that does not contain or, with respect to atmospheric hazards, have the potential to contain any hazard capable of causing death or serious physical harm. The only hazard posed by the confined space is an actual or potential hazardous atmosphere.

(2) A space classified by the Authority as a permit-required confined space may be reclassified as a non-permit confined space under the following procedures:

(a) If the permit space poses no actual or potential atmospheric hazards and if all hazards within the space are eliminated without entry into the space, the permit space may be reclassified as a non-permit confined space for as long as the non-atmospheric hazards remain eliminated.

(b) If it is necessary to enter the permit space to eliminate hazards, such entry shall be performed as a permit-required confined space entry. If testing and inspection during that entry demonstrate that the hazards within the permit space have been eliminated, the permit space may be reclassified as a non-permit confined space for as long as the hazards remain eliminated.

(c) The Authority shall document the basis for determining that all hazards in a permit space have been eliminated through a certification that contains the date, the location of the space, and the signature of the person making the determination. The certification shall be made available to each employee entering the space. This non-permit confined space certification shall be documented through the Confined Space Entry Permit.

(d) If hazards arise within a permit space that has been declassified to a non-permit required confined space, each employee in the space shall exit the space. The entry supervisor shall then reevaluate the space and determine whether it must be reclassified as a permit space.

(3) The Water Authority has determined that many of the permit-required confined spaces around its facilities may be declassified or reclassified to a non-permit required confined space if the proper reclassification procedures have been followed and documented. This reclassification procedure requires an entry supervisor, authorized attendant, or authorized entrant to perform an analysis of the hazards within the confined space and demonstrate and certify that these hazards have been eliminated.

(4) The certification that these confined space hazards have been eliminated will be accomplished through the first page of the Water Authority's Confined Space Entry Permit. The first page of the confined space entry permit will require an employee to document his or her basis for making a non-permit confined space reclassification and document the procedures followed. If the confined space cannot be reclassified as a non-permit confined space then it shall be treated as a permit-required confined space and the appropriate procedures shall be followed.

(5) All confined spaces shall be considered permit-required confined spaces until the pre-entry procedures completed on the Confined Space Entry Permit demonstrate that the space can be maintained in a safe condition for entry by natural ventilation or mechanical ventilation alone.

(6) When there are changes in the use or configuration of a non-permit confined space that might increase the hazards to entrants, the Authority shall reevaluate that space and, if necessary, reclassify it as a permit-required confined space.

XII. Non-Permit Confined Space Entry Procedures

(1) Prior to initiating the entry, the entry supervisor, attendant, and entrant shall:

(a) Obtain the Confined Space Entry Permit/Reclassification Form for the confined space to be entered. The Confined Space Entry Permits are on file in the SWRP Control Room or appropriate Maintenance/Operations shop.

(b) Assess whether or not recent changes due to construction, equipment failures, or other causes may have generated actual or potential hazards not anticipated in the Reclassification Permit.

(c) Designate authorized entrant(s).

(d) Designate authorized attendant(s).

(e) Designate Assisted Self-Rescue team members, minimum of two including the team leader.

(f) Establish contact with the Assisted Self-Rescue Team Leader and the Control Room. Advise them of all relevant details of the proposed entry, providing at least, the following information:

(1) Exact location of the confined space to be entered.

(2) Number of people who will be performing the entry.

(3) Estimated length of time the work will take.

(4) Radio call number of the authorized attendant.

(g) Verify that all required personal protective equipment, rescue equipment, and hazardous gas monitors are available for the entry to take place.

(h) The authorized attendant and authorized entrant shall check the calibration on the hazardous gas monitor and verify the operability of the gas detection equipment.

(2) Any conditions making it unsafe to remove an entrance cover to the confined space shall be eliminated before the cover is removed.

(3) When the entrance cover(s) are removed, the opening shall be promptly guarded by a railing, temporary cover, or other temporary barrier that will prevent an accidental fall through the opening.

(4) Test atmospheric conditions in the confined space to determine if acceptable entry conditions exist before entry is authorized to begin and are being maintained during the course of entry operations;

(a) When testing for atmospheric hazards, test for oxygen first, test for combustible gases and vapors second, and then for toxic gases and vapors.

(5) Acceptable atmospheric conditions inside the confined space shall be 19.5% to 23.5% oxygen, less than 10% LEL, less than 5 ppm H_2S, and less than 35 ppm CO.

(6) The authorized attendant and authorized entrant shall continuously and independently monitor the atmosphere inside the non-permit confined space during entry operations. The entrant must have a calibrated gas detector on his/her body at all times during entry operations. The attendant shall monitor the atmosphere within the space from outside the confined space using a calibrated gas detector with a sample draw pump and tubing.

(7) The authorized attendant shall maintain contact with the Control room and the Assisted Self-Rescue team leader during entry operations.

(8) The authorized attendant shall notify the Control Room and the Assisted Self-Rescue team leader upon completion of the work inside the confined space.

(9) The confined space entrance shall be properly secured by entrant(s) before leaving the site.

(10) All equipment used during the entry operation shall be returned to proper storage.

ASSISTED SELF-RESCUE AND EMERGENCY SERVICES

XIII. Assisted Self-Rescue and Emergency Services

(1) The Water Authority will provide Assisted-Self Rescue Services to all employees required to enter permit-required confined spaces. Assisted Self-Rescue means trained, equipped rescuers standing by outside the confined space, prepared to perform vertical direct retrieval operations. Water Authority employees will not perform horizontal confined space rescue, an outside contractor like ROCCO will be contracted out to perform horizontal confined space rescue. Water Authority employees who have been designated to provide vertical permit space Assisted Self-Rescue shall be considered Assisted Self-Rescue Team members and shall take the following measures:

(a) Assisted Self-Rescue Team members shall be trained as permit space entrants and attendants at a minimum, including training in the potential hazards of all permit spaces from which rescue may be needed. Assisted Self-Rescue Team members shall demonstrate proficiency to perform assigned rescue duties;

(b) Assisted Self-Rescue Team members will be provided with and properly trained in the use and need for PPE, such as SCBA or fall arrest equipment, which may be required to perform permit space rescues. Every team member shall be properly trained to perform his or her functions and make rescues, and to use any rescue equipment, such as ropes and harnesses, that may be needed in a rescue attempt. Assisted Self-Rescue Team members shall demonstrate proficiency in the use of that PPE;

(c) Assisted Self-Rescue Team members shall be trained in the first aid and medical skills needed to treat victims overcome or injured by the types of hazards that may be encountered in the permit spaces until Emergency Medical Services arrive. At least one member of the rescue team must have current certifications in CPR, Basic First Aid, and Hazwoper 40; and

(4) Assisted Self-Rescue Team members shall practice making permit space rescues at least once every 12 months, by means of simulated rescue operations in which they remove dummies, manikins, or actual persons from the actual permit spaces or from representative permit spaces.

(2) Assisted Self-Rescue Team members shall focus on their own safety before considering the safety of the victim. Members shall be able to test the atmosphere to determine if it is IDLH. Members shall be able to identify information pertinent to the rescue from entry permits, hot work permits, and MSDSs.

(3) To facilitate non-entry rescue, employees will use the DBI-SALA confined space entry/retrieval systems whenever an authorized entrant enters a permit space, unless the retrieval equipment would increase the overall risk of injury or would not contribute to the rescue of the entrant. The DBI SALA retrieval systems meet the following requirements:

(a) Each authorized entrant (includes rescue entrants) must use a full body or chest harness, with a

retrieval line attached at the center of the entrant's back near shoulder level, above the entrant's head.

(b) The other end of the retrieval line shall be attached to the DBI-SALA rescue davit retrieval system outside the permit space in such a manner that rescue can begin as soon as the rescuer becomes aware that rescue is necessary. The rescue davit retrieval system shall be available to retrieve personnel from vertical type permit spaces more than 5 feet deep.

(4) If an injured entrant is exposed to a substance for which a MSDS or other similar written information is required to be kept at the worksite, that MSDS or written information shall be made available to the medical facility treating the exposed entrant.

(5) Assisted Self-Rescue Team members shall properly package and retrieve victims from a permit space that has a limited size opening (less than 24 inches in diameter), limited internal space, or internal obstacles or hazards. Airline respirators shall be used when required.

(6) The Chief Engineer, Safety Manager, Superintendents, and Assisted Self-Rescue Team members shall develop a plan for each of the kinds of permit space rescue operations at the facility that may be required. This rescue plan shall be developed in writing and shall be updated annually or as needed. Rescue operation plans of representative permit spaces with: Internal configuration, Elevation, Portal size and Space access.

XIV. Assisted Self-Rescue Procedures

Once an employee is assigned to an Assisted Self-Rescue Team or is selected to be an Assisted Self-Rescue team leader the following procedures shall be followed:

(1) Obtain all required personal protective equipment (PPE) as well as monitoring, communication, and rescue equipment to make a rescue feasible. SCBAs and mechanical ventilation are an example of PPE required to be on site at all times. Most of the required PPE will be housed in the Safety Equipment Building adjacent to the Operations and Maintenance Facility;

(2) Set up the required DBI-SALA rescue/retrieval equipment at the confined space to be entered before entry operations begin. This will ensure immediate Assisted Self-Rescue services are available at all times;

(3) Assisted Self-Rescue Team members will evaluate the confined space and scheduled work to be completed and assist with the isolation of the confined space and mitigation of all confined space hazards;

(4) Assisted Self-Rescue Team members will come up with a rescue plan that details how to rescue authorized entrants should an emergency situation arise. This rescue plan can be verbal among the rescue team members or it can be a written plan as long as all rescue team members understand how rescue procedures will be conducted and their roles;

(5) The Assisted Self-Rescue Team shall outfit every authorized entrant with a chest or full body harness equipped with fall protection, a retrieval line attached at the center of the entrant's back near shoulder level, above the entrant's head, and a retrieval hoist system. The confined space entry/rescue equipment authorized by the Water Authority is the DBI-SALA hoist systems;

(6) Continuously monitor the atmospheric conditions and potential hazards during entry operations. Two gas detectors are required during entry/rescue procedures, one detector on the entrant and the

other outside the confined space monitoring the internal atmosphere. Perform required duties until entry operations are completed. Assisted Self-Rescue Team members have the authority to stop permit space entry operations should a prohibited condition be detected;

(7) Once entry operations have been completed and the confined space entry permit has been cancelled, return all rescue equipment and personal protective equipment to its proper location. Please make sure the entrance cover to the confined space is properly secured.

DEFINITIONS

XV. Definitions

Acceptable entry conditions means the conditions that must exist in a permit space to allow entry and to ensure that employees involved with a permit-required confined space entry can safely enter into and work within the space.

Assisted Self-Rescue means Water Authority employees trained to provide vertical confined space rescue procedures.

Attendant means an individual stationed outside a permit space who monitors the authorized entrants and who performs all attendant's duties assigned in the Water Authority Permit Space Program.

Authorized entrant means an employee who is authorized by the Water Authority to enter a permit space.

Bio-Hazard or Biological Hazard refers to biological substances that pose a threat to the health of living organisms, primarily that of humans. This can include medical waste or samples of a microorganism, virus or toxin that can affect human health. It can also include substances harmful to animals.

Blanking or blinding means the absolute closure of a pipe, line, or duct by the fastening of a solid plate (spectacle blind or skillet blind) that completely covers the bore and that is capable of withstanding the maximum pressure of the pipe, line, or duct with no leakage beyond the plate.

Confined space means a space that:

(1) Is large enough and so configured that an employee can bodily enter and perform assigned work; and

(2) Has limited or restricted means for entry or exit (for example, tanks, vessels, silos, storage bins, hoppers, vaults, and pits are spaces that may have limited means of entry.); and

(3) Is not designed for continuous employee occupancy.

Double block and bleed means the closure of a line, duct, or pipe by closing and locking or tagging two in-line valves and by opening and locking or tagging a drain or vent valve in the line between the two closed valves.

Emergency means any occurrence (including any failure of hazard control or monitoring equipment) or event internal or external to the permit space that could endanger entrants.

Engulfment means the surrounding and effective capture of a person by a liquid or finely divided (flowable) solid substance that can be aspirated to cause death by filling or plugging the respiratory system or that can exert enough force on the body to cause death by strangulation, constriction, or crushing.

Entrapment/engulfment means converging walls; to swallow up or overwhelm by or as if by overflowing and enclosing.

Entry means the action by which a person passes through an opening into a permit-required confined space. Entry includes ensuing work activities in that space and is considered to have occurred as soon as any part of the entrant's body breaks the plane of an opening into the space.

Entry permit means the written or printed document that is provided by the Water Authority to allow and control entry into a permit space and that contains the information required in **1910.146(f) Entry permit.**

Entry supervisor means the person (such as the operations/maintenance supervisor or superintendent) responsible for determining if acceptable entry conditions are present at a permit space where entry is planned, for authorizing entry and overseeing entry operations, and for terminating entry as required by the Water Authority Permit Space Program.

Hazardous atmosphere means an atmosphere that may expose employees to the risk of death, incapacitation, and impairment of ability to self-rescue (that is, escape unaided from a permit space), injury, or acute illness from one or more of the following causes:

(1) Flammable gas, vapor, or mist in excess of 10 percent of its lower flammable limit (LFL);

(2) Airborne combustible dust at a concentration that meets or exceeds its LFL;

(3) Atmospheric oxygen concentration below 19.5 percent or above 23.5 percent;

(4) Atmospheric concentration of any substance for which a dose or a permissible exposure limit is published in Subpart G, Occupational Health and Environmental Control, or in Subpart Z, Toxic and Hazardous Substances, of this part and which could result in employee exposure in excess of its dose or permissible exposure limit;

(5) Any other atmospheric condition that is immediately dangerous to life or health.

Hot work permit means the Water Authority written authorization to perform operations (for example, riveting, welding, cutting, burning, and heating) capable of providing a source of ignition.

Immediately dangerous to life or health (IDLH) means any condition that poses an immediate or delayed threat to life or that would cause irreversible adverse health effects or that would interfere with an individual's ability to escape unaided from a permit space.

Inerting means the displacement of the atmosphere in a permit space by a noncombustible gas (such as nitrogen) to such an extent that the resulting atmosphere is noncombustible.

Isolation means the process by which a permit space is removed from service and completely protected against the release of energy and material into the space by such means as: blanking or blinding; misaligning or removing sections of lines, pipes, or ducts; a double block and bleed system; lockout or tagout of all sources of energy; or blocking or disconnecting all mechanical linkages.

Line breaking means the intentional opening of a pipe, line, or duct that is or has been carrying

flammable, corrosive, or toxic material, an inert gas, or any fluid at a volume, pressure, or temperature capable of causing injury.

Mitigate or Mitigation means to become less harsh or to eliminate the hazard.

Non-permit confined space means a confined space that does not contain or, with respect to atmospheric hazards, have the potential to contain any hazard capable of causing death or serious physical harm.

Oxygen deficient atmosphere means an atmosphere containing less that 19.5 percent oxygen by volume.

Oxygen enriched atmosphere means an atmosphere containing more than 23.5 percent oxygen by volume.

Permit-required confined space means a confined space that has one or more of the following characteristics:

(1) Contains or has a potential to contain a hazardous atmosphere;
(2) Contains a material that has the potential for engulfing an entrant;
(3) Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section; or
(4) Contains any other recognized serious safety or health hazard.

Permit-required confined space program means the Water Authority's overall program for controlling, and, where appropriate, for protecting employees from, permit space hazards and for regulating employee entry into permit spaces.

Permit system means the Water Authority's written procedure for preparing and issuing permits for entry and for returning the permit space to service following termination of entry.

Prohibited condition means any condition in a permit space that is not allowed by the permit during the period when entry is authorized.

Rescue service means the personnel designated to rescue employees from permit spaces. This rescue service could be provided by a contractor such as ROCCO.

Retrieval system means the equipment (including a retrieval line, chest or full-body harness, wristlets, if appropriate, and a lifting device or anchor) used for non-entry rescue of persons from permit spaces.

SWRP means the Southside Water Reclamation Plant.

TRAINING

XVI. Training

Training shall be provided by the Water Authority so that all employees whose work is regulated by the permit space program acquire the understanding, knowledge, and skills necessary for the safe performance of the duties assigned.

(A) Training shall be provided to each affected employee:

(1) Before the employee is first assigned duties under the permit space program;

(2) Before there is a change in assigned duties;

(3) Whenever there is a change in permit space operations that presents a hazard about which an employee has not previously been trained;

(4) Whenever the Water Authority has reason to believe either that there are deviations from the permit space entry procedures or that there are inadequacies in the employee's knowledge or use of these procedures.

(B) The training shall establish employee proficiency in the duties required by the permit space program and shall introduce new or revised procedures, as necessary, for compliance.

(C) The Water Authority shall certify that the training required of this program has been accomplished. The certification shall contain each employee's name, the signatures or initials of the trainers, and the dates of training. The certification shall be available for inspection by employees.

XVII. Respirator Fit Testing

Before a Water Authority employee may be required to use any respirator with a negative or positive pressure tight-fitting face-piece, the employee must be fit tested with the same make, model, style, and size of respirator that will be used. Water Authority employees will use the SCOTT AV-3000 full facepiece respirator or the SCOTT XCEL half facepiece respirator.

(A) The Water Authority shall ensure that employees using a tight-fitting facepiece respirator pass an appropriate qualitative fit test (QLFT) or quantitative fit test (QNFT).

(B) Employees using a tight-fitting facepiece respirator are to be fit tested prior to initial use of the respirator and whenever a different respirator facepiece (size, style, model, or make) is used. Employees must pass a qualitative fit test at least annually thereafter.

(C) The Water Authority shall conduct an additional fit test whenever the employee reports, or the employer, PLHCP, supervisor, or program administrator makes visual observations of, changes in the employee's physical condition that could affect respirator fit. Such conditions include, but are not limited to, facial scarring, dental changes, cosmetic surgery, or an obvious change in body weight.