CITY OF ALBUQUERQUE, NEW MEXICO

PUMP STATION NO. 40 CANDELARIA 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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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. 40 CANDELARIA

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Appendix D Manufacturer's Sump Pump Curve and General Information

Appendix E ABCWUA Lockout / Tagout (LOTO)

Appendix F ABCWUA Confined Space Program

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)
HOA	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. 40 Candelaria. 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 (3) 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.

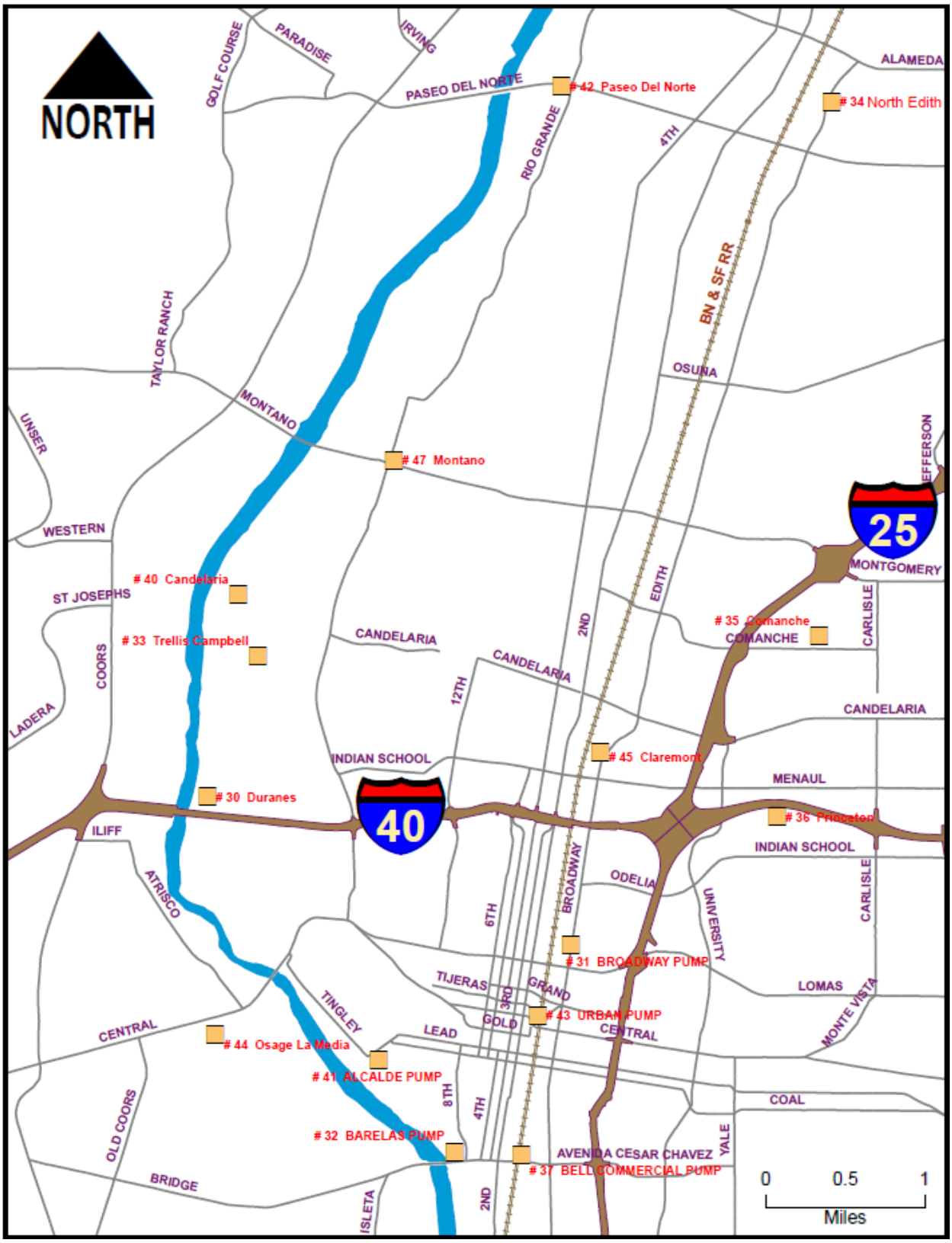


FIGURE 1-1
STORMWATER PUMP STATIONS MAP
Source: City of Albuquerque, DMD, SDD

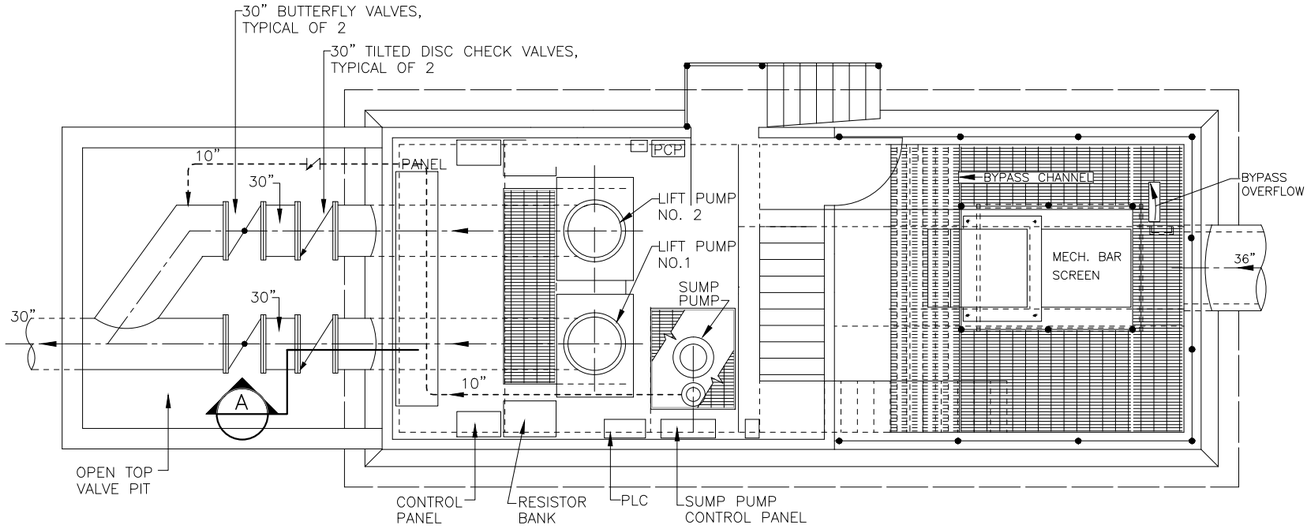
The stormwater pump stations are owned by the City of Albuquerque (COA) and are administered by the Albuquerque Department of Municipal Development (DMD), Engineering Division, Storm Drain Design (SDD). Through an agreement between the City and the Albuquerque Bernalillo County Water Utility Authority (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 Pump Station No. 40 Candelaria

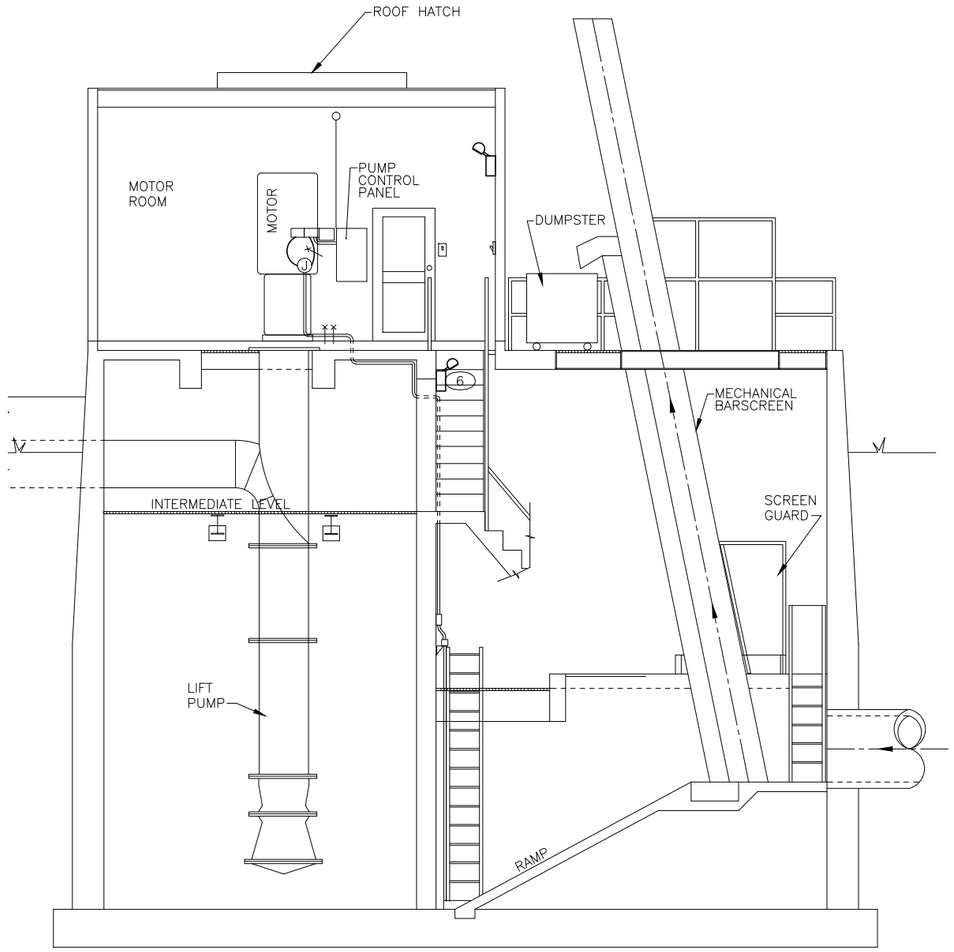
Pump Station No. 40 Candelaria is located west of the intersection of Candelaria Road NW and Trellis Drive NW, at the west end of Candelaria Road NW, and just east of the Paseo Del Bosque Trail, shown in Figure 1-1. The address is 3001 Candelaria Road NW, and is located in zoning map grid G-12. It was constructed in 1961 and receives runoff from a network of storm drains in neighborhood to the southeast. The upgrade was part of the Stormwater Pump Station Rehabilitation Phase III and included the installation new electrical related to power phase to minimize reduction of pumping capability and the installation of a generator for temporary power during power outages.

The network of storm drains feeding the pump station can deliver 13,500 to 33,900 gallons per minute (GPM), while the pump station's two (2) 125 HP lift pumps are capable of discharging approximately 29,000 GPM, as discussed in Section 3.1.1. The lift pumps discharge through a common pipe that empties into the Rio Grande Bosque to the west.

A base plan and profile section of the pump station are provided in Figure 1-2. Additionally, a reference section drawing from a previous construction project at the Candelaria Station is provided in Figure 1-3. Reference drawings are for information only and may not be representative of existing conditions.



PUMP STATION – FLOOR PLAN



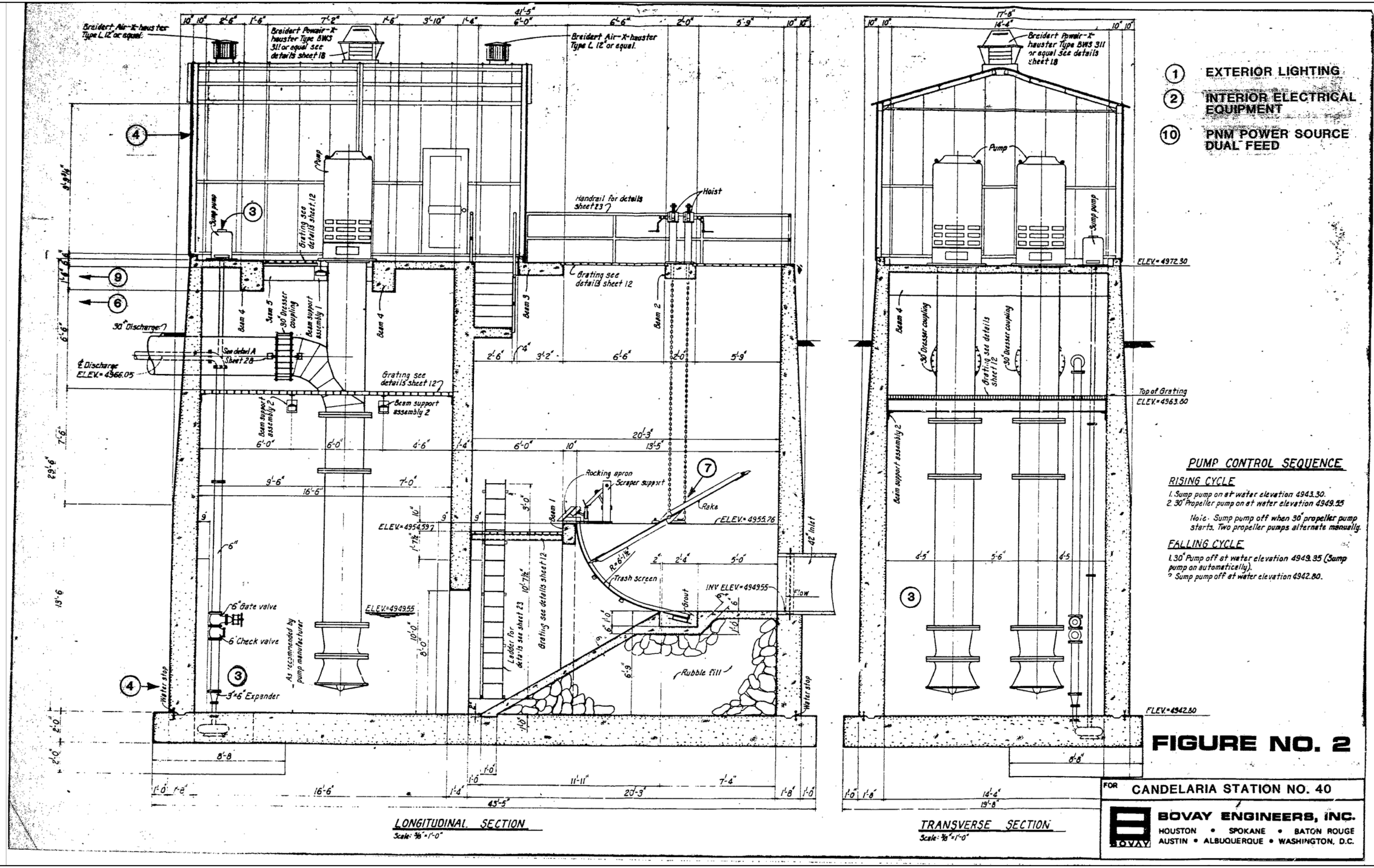
SECTION A

MOLZENCORBIN

City Of Albuquerque Stormwater Pump Stations

Pump Station No. 40 Candelaria Base Plan & Profile

Figure 1-2



1. EXTERIOR LIGHTING
2. INTERIOR ELECTRICAL EQUIPMENT
10. PNM POWER SOURCE DUAL FEED

PUMP CONTROL SEQUENCE

RISING CYCLE

1. Sump pump on at water elevation 4943.30.
2. 30" Propeller pump on at water elevation 4949.35

Note: Sump pump off when 30" propeller pump starts. Two propeller pumps alternate manually.

FALLING CYCLE

1. 30" Pump off at water elevation 4949.35 (Sump pump on automatically).
2. Sump pump off at water elevation 4942.80.

FIGURE NO. 2

FOR CANDELARIA STATION NO. 40

BOVAY ENGINEERS, INC.
HOUSTON • SPOKANE • BATON ROUGE
AUSTIN • ALBUQUERQUE • WASHINGTON, D.C.

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, and 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, Recommended Practice for Fire Protection in Wastewater Treatment Plants.

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, Recommended Practice for Fire Protection in Wastewater Treatment Plants – 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 36-inch diameter 1,265-foot long reinforced concrete pipe (RCP) trunk storm drain at a slope of 0.002 feet per foot and at a depth of 17 feet at the wet well. The trunk line branches into collector storm drains at Trellis Drive. The full flow capacity of the inlet RCP without surcharge is approximately 13,500 gallons per minute (gpm). Assuming the street is flooded at Trellis Drive and the water level in the wet well is at the top of the inlet pipe, the surcharged pipe capacity is approximately 33,900 gpm.

The station wet well and network of storm drains feeding the station combine to provide a local equalization volume for larger flood events. If it is assumed that the station is flooded to the top of the bar screen channel and the main intake pipe is flowing at full depth from the station to the manhole at Trellis Drive and Candelaria Road; the local storage volume can be estimated at 0.38 acre-feet (149,000 gallons).

3.1.2 Lift Pumps

The two (2) lift pumps are Johnston Pump Company vertical, mixed-flow pumps, Model 24MS with underground-style discharge elbow. The bowl size is 24 inches in diameter, and the discharge pipe is 30 inches in diameter. The pumps are driven by 125 HP, 710 RPM full speed Marathon Electric motors with a 460V, 3-phase power supply. Refer to Appendix C for manufacturer's pump curve and data and estimated system hydraulics.

Each of the two (2) lifts pumps is designed to deliver 16,000 gpm at 23 feet of total dynamic head (TDH). Because of their combined discharge configuration and the small wet well volume,

the pumps combined output capacity is approximately 29,000 gpm. This capacity is only fully realized under surcharge conditions. The discharge pipe is approximately 240 feet of 30-inch steel pipe that empties into the Rio Grande Bosque to the west.

The lift pumps require 4.9 feet of submergence over the bottom of the bell to prevent vortexes. Vortexes suck air into the pump from the water surface. Vortexes cause a reduction in capacity and can result in unbalanced operation that may damage the pumps. Stormwater pumping periods tend to be brief and some vortex pumping is tolerable over the lift of the pumps.

The manufacturer's pump curve indicates the pump requires approximately 26 feet of net positive suction head (NPSH) when running at the design flow to prevent cavitation. At the station elevation, the pump would require 1.3 feet of water above the impeller (positive suction head) to meet this requirement. When cavitation occurs, the pump runs noisy and sounds like it is pumping marbles. Prolonged cavitation will result in pitting of the impeller and intake bowl. Stormwater pumping periods tend to be brief, and some cavitation is tolerable over the life of the pump.

3.1.3 Sump Pump

There is one (1) sump pump in the wet well designed to handle small, non-storm infiltration flows. The pump is a 35 HP Flygt submersible, Model CP3201 with a 637-type impeller. The pump is rated for 2,800 gpm at 22 feet TDH. Refer to Appendix D for manufacturer's pump curve and data.

3.1.4 Mechanical Bar Screen

The inlet channel into the wet well is cleaned by a 52-inch wide climber-type mechanical bar screen inclined 80° from horizontal. The unit is an Infilco Degremont Model CS-869 with a 5 HP non-submersible drive motor. A steel dumpster collects the screenings on an outdoor grated deck located approximately five (5) feet above grade. The bar screen rake is activated by high level float switches in the inlet channel. If the bar rack becomes blinded, incoming level will rise

above the top of the inlet channel walls and spill over the top of the adjacent wall into a 5-foot wide bypass channel that will convey un-screened stormwater directly into the wet well and lift pumps. Refer to Appendix B for manufacturer's maintenance schedule.

3.2 Electrical Design Criteria

3.2.1 Electrical Service

The electrical service consists of a single medium voltage (12,470V) feeder from PNM.

3.2.2 Electrical Low Voltage

The storm water low voltage system consists of a 480V Motor Control Center that feeds the lift pumps, sump pump, and bar screen. Each of the two (2) lift pumps are driven by resistor banks that provide variable speed control.

3.2.3 Lift Station Control Panel (LSCP)

The LSCP contains variable speed controls for the lift pumps.

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 des ign 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
Candelaria – Pump Station No. 40	Wet Well	Ambient	Ambient	Not Required	NFPA 820
	Control Room	55	90	Not Required	ASHRAE 62.1

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, equipment description, a listing of 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 for the station is shown in Section 7.

4.1 Mechanical Bar Screen

4.1.1 Overview

Stormwater enters the pump station through a 36-inch reinforced concrete pipe storm drain into a 52-inch wide channel. The stormwater is then conveyed through the mechanical bar screen (Figure 4-1), where debris is pulled out of the channel, up the face of the screen, and deposited into a dumpster.

4.1.2 Equipment Description

The debris from the incoming stormwater is removed by a 52-inch wide climber-type mechanical bar screen manufactured by Infilco Degremont. The vertical bar screen has 2-inch clear openings. The climber rake is driven by a 5 horsepower (HP) non-submersible motor.

The mechanical bar screen is not tagged with a Water Utility Authority Asset Management Program Equipment Tag. A tag number was prescribed to the mechanical bar screen to aid in identification. The tag number is listed below in Table 4-1 and shown on Figure 40-1 in Section 7 to provide clarity.

TABLE 4-1
EQUIPMENT INFORMATION

Equipment No.	Asset Info	Classification Type	Classification
U54011	Station	Bar Screen	Unit

FIGURE 4-1
MECHANICAL BAR SCREEN

4.1.3 Instrumentation and Alarms

Instrumentation includes:

- Alarm float level switch
- Bar screen start level switch
- Bar screen stop level switch
- End of travel switch
- Over torque switch
- Reverse alternator switch

Alarms connected to telemetry include:

- High channel level
- Bar screen run
- Bar screen fail

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. 4000-SU-Candelaria 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, stormwater enters the station wet well. The water level is monitored by a Drexelbrook Universal III level transmitter with an additional sensor for redundancy. There is also a Flygt ENM-10 float level switch that trips a high water level alarm. The two (2) lift pumps (Figure 4-2) cycle on and off in lead/lag/alternate sequence according to the level in the wet well. The lift pumps may be operated independently or simultaneously, depending on the pumping needs of the station.

FIGURE 4-2
LIFT PUMP MOTORS

4.2.2 Equipment Description

Stormwater is pumped by any combination of the two (2) vertical, mixed-flow pumps. The pumps are Johnston Model 24MS and each has a rated capacity of 16,000 gpm at 23 feet of TDH when running at 710 full speed RPM and powered by 125 HP, 460V, 3-phase motors.

The Equipment Tags at this station follow an older tagging convention than is currently used by the Water Utility Authority's Asset Management Program. The current tagging convention for the pumps and motors, as well as the physical Equipment Tag Numbers shown in parentheses, are listed below in Table 4-2.

TABLE 4-2
EQUIPMENT INFORMATION

Equipment No.	Asset Info	Classification Type	Classification
M54001 (540M01)	Station	Lift Pump No. 1 (South)	Motor
M54002 (540M02)	Station	Lift Pump No. 2 (North)	Motor
P54001 (540P01)	Station	Lift Pump No. 1 (South)	Pump
P54002 (540P02)	Station	Lift Pump No. 2 (North)	Pump

4.2.3 Instrumentation and Alarms

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

- Lift Pump 1 Run
- Lift Pump 2 Run
- Lift Pump 1 Fail
- Lift Pump 2 Fail
- High Wet Well Level

4.2.4 Normal Operation

The lift pump start is initiated by one of the two (2) redundant, probe-type level sensors/transmitters located in the wet well. The pumps lift water from the wet well to 30-inch discharge pipes that join together after the valve vault through a wye-type connection. The discharge pipe dead-ends in the Rio Grande Bosque on the other side of the bike path and drainage canal 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 Pump

4.3.1 Overview

Stormwater below the lift pump intakes and small, non-storm infiltration flow is handled by the single wet well sump pump. The sump pump is located inside a small depression in the wet well and has a 10-inch discharge pipe that flows into the north lift pump discharge pipe in the valve vault.

4.3.2 Equipment Description

The sump pump is a Flygt Model CP3201 with a 637-type impeller. The pump is driven by an integral 35 HP 1,170 full speed RPM motor that runs on 460V, 3-phase power and has a rated capacity of 2,800 gpm at 22 feet of TDH. The sump pump is 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 sump pump at this station is not tagged with a Water Utility Authority Asset Management Program Equipment Tag. A tag number was prescribed to aid in identification. The Equipment Tag number is listed below in Table 4-3 and shown on Figure 40-1 in Section 7 to provide clarity.

TABLE 4-3
EQUIPMENT INFORMATION

Equipment No.	Asset Info	Classification Type	Classification
P54003	Station	Sump Pump	Pump

4.3.3 Instrumentation and Alarms

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

- Sump pump run
- Sump pump fail

4.3.4 Normal Operation

The sump pump start is initiated by the wet well level signal at a level below the lift pumps, as described above in Section 4.3.1. The pump then diverts water from the wet well and discharges into the outlet piping until the water either accumulates to the lift pump initiation level or drops below the sump pump turn-off level.

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

As stormwater is pumped from the wet well, it is conveyed in discharge piping through the valve vault. The valve vault consists of check and isolation valves for each lift pump, as well as a check valve for the sump pump. The check valves prevent backflow through inactive pump(s) into the wet well, while the isolation valves allow individual pumps and check valves to be isolated for maintenance or replacement.

4.4.2 Equipment Description

Each lift pump's discharge flows through a 30-inch tilted disk check valve, and a manual 30-inch butterfly isolation valve (Figure 4-3). Both pumps feed a single 30-inch discharge pipe, which daylights into the Rio Grande Bosque to the west of the station. The valves at this station are tagged using an older numbering convention than is currently used by the Water Utility Authority's Asset Management Program. The current tagging convention for the valves, as well as the physical Equipment Tag Numbers shown in parentheses, are listed in Table 4-4.

FIGURE 4-3
VALVE VAULT

TABLE 4-4
EQUIPMENT INFORMATION

Equipment No.	Asset Info	Classification Type	Classification
CV54001 (540V01A)	Station	Lift Pump Check Valve (South)	Check Valve
CV54002 (540V02A)	Station	Lift Pump Check Valve (North)	Check Valve
CV54003 (540V03C)	Station	Sump Pump Check Valve	Check Valve
V54001 (540V01B)	Station	Lift Pump Isolation Valve (South)	Isolation Valve
V54002 (540V02B)	Station	Lift Pump Isolation Valve (North)	Isolation Valve

4.4.3 Instrumentation and Alarms

There is neither instrumentation nor alarms associated with the valve vault.

4.4.4 Normal Operation

Valve positions during normal operation are as follows:

IN SERVICE – Lift Pump No. 1 tilted disk check valve **CV54001 (540V01A)**

IN SERVICE – Lift Pump No. 2 tilted disk check valve **CV54002 (540V02A)**

IN SERVICE – Sump Pump check valve **CV54003 (540V03C)**

OPEN – Lift Pump No. 1 butterfly isolation valve **V54001 (540V01B)**

OPEN – Lift Pump No. 2 butterfly isolation valve **V54002 (540V02B)**

4.4.5 Safety: Information Unique to the System or Process

Refer to Section 9 for general safety guidelines. Due to infiltration and a lack of drainage provisions, the valve vault is regularly filled with water.

5.0 ELECTRICAL SYSTEM

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

5.1 300 kVA Transformer

5.1.1 Overview

This transformer steps the 12,470V distribution down to 480V to match the lift pump motor requirements.

5.1.2 Equipment Description

The transformer is a pad mounted transformer located in the yard. It receives 12,470V from the S&C Electric Company Model PMH-5 switch and supplies the station 400A, 480V disconnect switch.

5.1.3 Controls

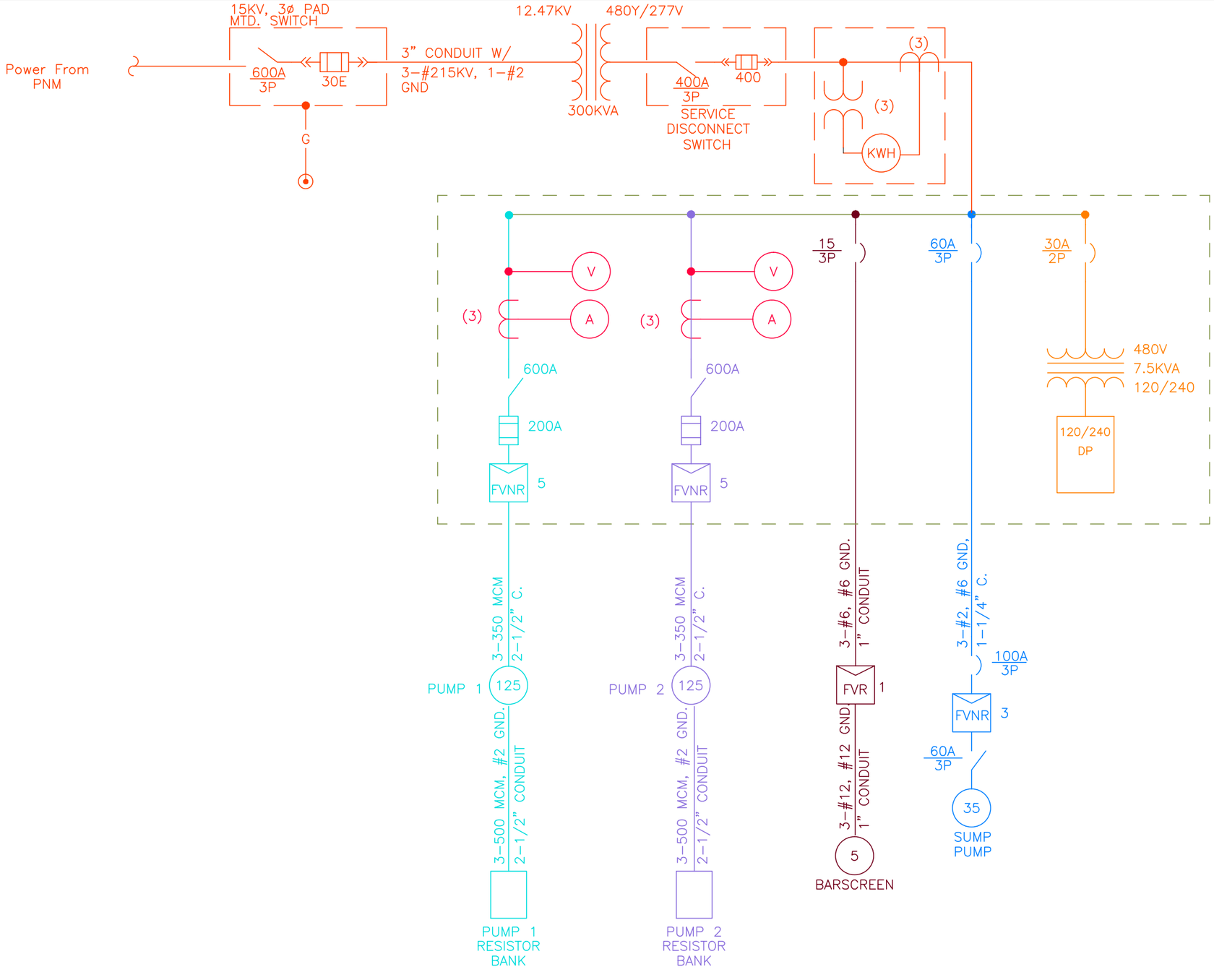
N/A

5.1.4 Normal Operation

The transformer steps 12,470V down to 480V for connection to the station lift pumps.

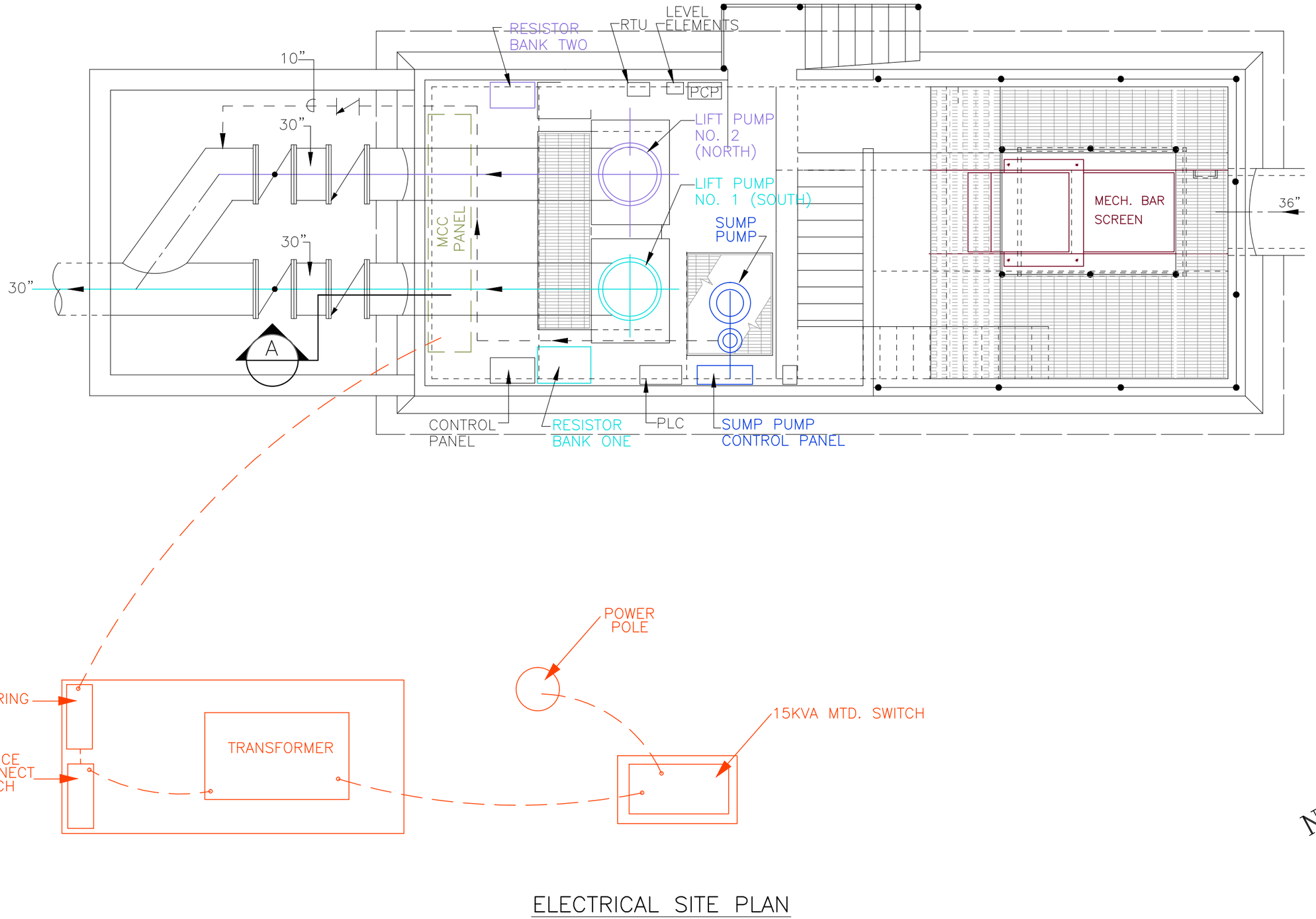
5.1.5 Safety: Information Unique to the System or Process

The transformer is owned and maintained by PNM.



PUMP STATION No. 40 ONE-LINE DIAGRAM

N.T.S.



ELECTRICAL SITE PLAN

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City Of Albuquerque Stormwater Pump Stations

Pump Station No. 40 Candelaria Electrical Site Plan

Figure 5-2

5.2 Station Fused Disconnect Switch

5.2.1 Overview

The station fused disconnect switch is the point where the power can be disconnected from the electrical gear in the station. Additionally, if there is a fault in the electrical system in the pump station. Fuses in the switch will open to disconnect power from the faulted circuitry.

5.2.2 Equipment Description

The station disconnect switch is a 600V rated, 400A fused disconnect switch in a NEMA 3R enclosure. The switch is located in the pump station yard near the transformer.

5.2.3 Controls

Manual operating handle.

5.2.4 Normal Operation

The switch is normally closed, but it may be opened to perform maintenance of the station electrical system.

5.2.5 Safety: Information Unique to the System or Process

The switch is energized at 480V. Therefore, the switch shall be serviced or maintained by qualified electricians equipped with proper protective gear. Contact PNM to disconnect the source before servicing the switch.

5.3 Station 480V Motor Control Center (MCC)

5.3.1 Overview

The 480V MCC has a main lug only power connection. The MCC houses 480V fused switches for the sump pump and the bar screen. The MCC also houses the 480V to 120/240V transformer and the panelboard for station 120V loads. The MCC was manufactured by Square D.

5.3.2 Equipment Description

The 480V MCC contains full voltage non-reversing (FVNR) starters for Lift Pump No. 1 and 2. There are fused switches to supply power to the controllers for the sump pump and the bar screen. The MCC also houses a 7.5 kVA transformer and a panelboard for station 120/240V loads.

5.3.3 Controls

The starters contain alarm relays for run and fail. There is also an auxiliary relay that interconnects to stop the sump pump if the lift pump is started.

Each starter has the following, panel-door mounted accessories:

- phase monitor
- under voltage relay
- overload relay
- overload reset switch mounted on the door

5.3.4 Normal Operation

The Lift Station Control Panel (LSCP) energizes a relay contact to call for a motor to run. A relay contact connected in the starter contactor circuit closes to energize the contactor. The starter contactor connects power to the associated motor.

5.3.5 Safety: Information Unique to the System or Process

The 480V MCC operates at 480V. The disconnect switches shall be operated by trained personnel; the MCC shall be serviced and maintained by trained electricians.

5.4 Lift Pump Starters

5.4.1 Overview

The lift pump starters are FVNR motor control units that contain metering, motor disconnect switch, motor contactor and motor overloads.

5.4.2 Equipment Description

The medium voltage starters were manufactured by Square D. They contain metering, motor disconnect switch, motor contactor and motor overloads.

5.4.3 Controls

On the starter door are an overload reset push button, pilot indicators for reset timeout, control power on and run. The starter contains a relay that interconnects with the Sump Pump Control Panel (SPCP) to stop the sump pump if the lift pump starts.

5.4.4 Normal Operation

When the pump control panel calls for a lift pump to start, the contactor will close, connecting power to the lift pump motor primary circuit.

5.4.5 Safety: Information Unique to the System or Process

The starters operate at 480V. The starters shall be operated by trained personnel; the MCC shall be serviced and maintained by trained electricians. Disconnect and lockout and tagout power at the station fused disconnect switch before performing maintenance on the starters.

5.5 Lift Station Control Panel

5.5.1 Overview

The LSCP receives the wet well level signal and controls start and stop of the lead lift pump. The LSCP switches contactors that insert resistance into the lift pump motor secondary circuit to change the speed of the pump. The LSCP relay contacts are connected to the radio transmitter to broadcast alarms to the Southside Water Reclamation Plant.

5.5.2 Equipment Description

The LSCP is a relay logic controller. The states of the various relays control the pump start and stop, as well as the operating speed.

5.5.3 Controls

The LSCP contains Hand-Off-Auto (HOA) switches for both pumps, a lead pump selector, and manual speed selector for each pump that provides four preset speeds between 85% and 100% full speed. The panel front has pilot lights to indicate the following for both pumps:

- Pump speed indicators; 85%, 90%, 95%, and 100%
- Motor failure
- Excessive vibration
- Starter failure
- High winding temperature

- High bearing temperature
- Speed control failure

5.5.4 Normal Operation

In automatic operation, a 4 to 20 mA signal is applied to the LSCP. When the mA signal reaches a level, level relays are operated to start the lead pump. The lead pump starts at the lowest speed. As the wet well level rises, additional level relays are energized which are connected to increase the speed of the pump.

5.5.5 Safety: Information Unique to the System or Process

The control panel has voltage from more than one (1) source. Disconnect all sources before servicing. The LSCP is energized at 120V. It shall be accessed only by electricians who are trained in the operation and are equipped with proper protective gear.

5.6 Stepped Speed Contactor Panels (SSCP)

5.6.1 Overview

The SSCP contain load contactors that, when energized, connect between the wound rotor motor secondary leads to vary the resistance. Greater resistance in the motor secondary causes the motor to run slower.

5.6.2 Equipment Description

The SSCP contain 4 load contactors, interposing relays and timers.

5.6.3 Controls

The SSCP controls reside in the LSCP.

5.6.4 Normal Operation

Contacts of the level relays in the LSCP are connected to energize the coils of the interposing relays in the SSCP. Contacts of the interposing relays are connected to energize the coils of the contactors. Timers in the SSCP are used in the low speed circuit of the SSCP to delay pump start on minimal level and to smooth the transition between various speeds.

5.6.5 Safety: Information Unique to the System or Process

The SSCP is energized at 750V. It shall be accessed only by electricians who are trained in the operation and are equipped with proper protective gear. Disconnect power, then lockout and tagout power at the associated motor starter before performing maintenance on the stepped speed control panel.

5.7 Resistor Panels

5.7.1 Overview

The resistors that are inserted into or removed from the motor secondary circuits to change motor speed are mounted in the resistor panel.

5.7.2 Equipment Description

There are 4 banks of resistors. The resistors operate at 750V and 1.04 ohms.

5.7.3 Controls

Controls for the resistor panels reside in the LSCP.

5.7.4 Normal Operation

All resistor banks are connected in series to insert maximum resistance to operate the motor at minimum speed. A contactor will close to bypass one bank creating a circuit of less resistance for each increase of speed. At 100%, all resistors are bypassed.

5.7.5 Safety: Information Unique to the System or Process

The resistor panel is energized at 750V. It shall be accessed only by electricians who are trained in the operation and are equipped with proper protective gear. Disconnect power, then lockout and tagout power at the associated motor starter before performing maintenance on the resistor panel.

5.8 Sump Pump Control Panel (SPCP)

5.8.1 Overview

The SPCP operates the sump pump to maintain the level in the wet well below the point where the lift pump starts.

5.8.2 Equipment Description

The SPCP is a relay logic type controller that receives a 4 to 20 mA signal that is representative of the wet well level. The SPCP starts the sump pump to pump the wet well down whenever the start level is reached.

5.8.3 Controls

Controls mounted on the front of the SPCP include:

- HOA switch
- Pump run indicator

- Pump off indicator
- Over temperature indicator
- Elapsed time meter
- Overload indicator
- High level indicator

A cabinet thermostat is mounted inside of the SPCP.

5.8.4 Normal Operation

The 4 to 20 mA signal from the wet well level transmitters is extended from the LSCP and connected to the SPCP. At start level, current relay No. 2 in the SPCP, closes a contact to energize the motor contactor. A seal contact of the motor contactor closes to connect control power directly to the contactor coil. At stop level, a contact in the SPCP current relay No. 1 opens to interrupt power to the motor contactor and the pump stops. At high-high level, current relay No. 1 closes a contact to energize the high level relay. The relay operates the high level pilot light and initiates an alarm circuit to the station radio transceiver.

5.8.5 Safety: Information Unique to the System or Process

The SPCP is energized at 480V. It shall be accessed only by electricians who are trained in the operation and are equipped with proper protective gear. Disconnect power at the 480V MCC, then lockout and tagout power before performing maintenance on the SPCP.

5.9 Bar Screen Control Panel (BSCP)

5.9.1 Overview

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

5.9.2 Equipment Description

The BSCP is a relay logic type controller that receives a level signal 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 radio telemetry panel.

5.9.3 Controls

Controls mounted on the front of the BSCP include:

- Control power switch
- HOA switch
- Alarm silence pushbutton
- Reset pushbutton

Panel front mounted indicators for:

- Control power on indicator
- Torque overload
- High channel level
- Run forward
- Run reverse

Controls inside the BSCP:

- Repeat cycle timer to initiate bar screen run. Interval selectable for once every 5 minutes up to once a day.
- Run duration timer. Selectable duration; set for 5 seconds for a single pass up to 3 minutes.

Controls at the bar screen mechanism:

- Reverse-Off-Forward (ROF) switch
- Start level switch

- Alarm level switch
- Torque overload limit switch
- End of travel limit switch
- Reverse motion alternator limit switch

5.9.4 Normal Operation

A contact of the repeat cycle timer 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, then 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 run in reverse. The bar screen runs in reverse until the end of travel switch opens, then stops. If the debris is not automatically removed, the bar screen rake can be manually operated to clear the screen. For more information on operating the rake in Hand mode, refer to SOJP No. 4000-SU-Candelaria Pump Station in Section 7.

5.9.5 Safety: Information Unique to the System or Process

The BSCP is energized at 480V. It shall be accessed only by electricians who are trained in the operation and are equipped with proper protective gear. Disconnect power at the MCC, then lockout and tagout power before performing maintenance on the BSCP.

5.10 Station Level Control Panel (SLCP)

5.10.1 Overview

The SLCP receives 4 to 20 mA signals from the wet well level transmitters and forwards a 4 to 20 mA signal to LSCP.

5.10.2 Equipment Description

The SLCP contains an analog module to which level signals from the station level transmitters are connected as inputs.

5.10.3 Controls

Level transmitter selector switches are mounted on the front of the SLCP. Controls are inside the SLCP. An analog module with 2 inputs and one output is mounted inside the SLCP.

5.10.4 Normal Operation

The output signals from both level transmitters are connected through a stop/lockout style pushbutton to the analog module. The analog module outputs a 4 to 20 mA signal equivalent to the highest level input. To select use of one of the level transmitters instead of the other a pushbutton selector opens the 4 to 20 mA circuit of the unwanted transmitter, making it the low signal. The analog module forwards the resulting high signal.

5.10.5 Safety: Information Unique to the System or Process

Care must be taken that both level signals are not de-selected, resulting on no level input into the LSCP.

6.0 HVAC SYSTEMS OPERATION

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

6.1 Exhaust Fan System

6.1.1 Overview

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

6.1.2 Equipment Description

The existing exhaust fan is roof mounted up blast exhaust fan. The capacity of the exhaust fan is estimated at approximately 1,800 CFM.

6.1.3 Controls

The exhaust fan is activated by a line voltage thermostat.

6.1.4 Normal Operation

The line voltage 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 temperatures in the control room are equal to or above 90°F. When temperatures in the control room are below 90°F, the exhaust 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.

7.0 STANDARD JOB OPERATING PROCEDURES

This section includes Standard Operating Job Procedures (SOJP) for the system and equipment for Pump Station No. 40 Candelaria. The SOJPs provide the detailed instructions for testing each component necessary to ensure that the facilities will be prepared to operate during the summer storm season of July 1st through September 30th. 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.

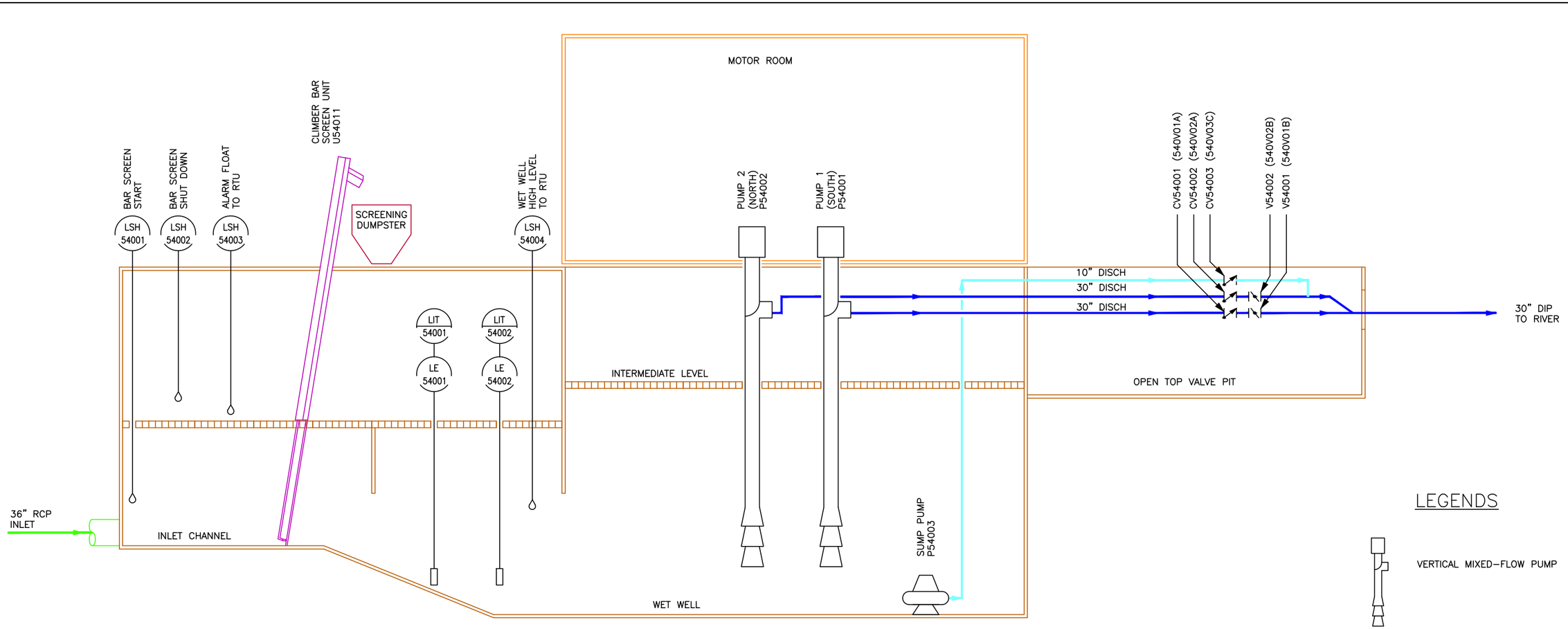
7.1 List of SOJPs

Below is a list of the SOJPs developed for Pump Station No. 40 Candelaria and are included in this section.

SOJP_4000_SU_Candelaria Pump Station
SOJP_4000_N_ Candelaria Pump Station
SOJP_4000_SD_ Candelaria Pump Station

SOJP_4000_SU_Candelaria Exhaust Fan
SOJP_4000_N_ Candelaria Exhaust Fan
SOJP_4000_SD_ Candelaria Exhaust Fan

LAST MODIFIED: Apr 21, 2015 - 9:04am BY USER: dbella
DWG. LOCATION: I:\ABQ\ENGR\ABQ13\11-StormPS Condition&Asset\DWGS\
DWG. NAME: PS40_P&ID.dwg



LEGENDS

- VERTICAL MIXED-FLOW PUMP
- SUMP PUMP
- PRIMARY LOCATION ACCESSIBLE TO OPERATOR
- FIELD MOUNTED DISCRETE INSTRUMENT
- FLOAT SWITCH
- PROBE
- BUTTERFLY VALVE
- CHECK VALVE

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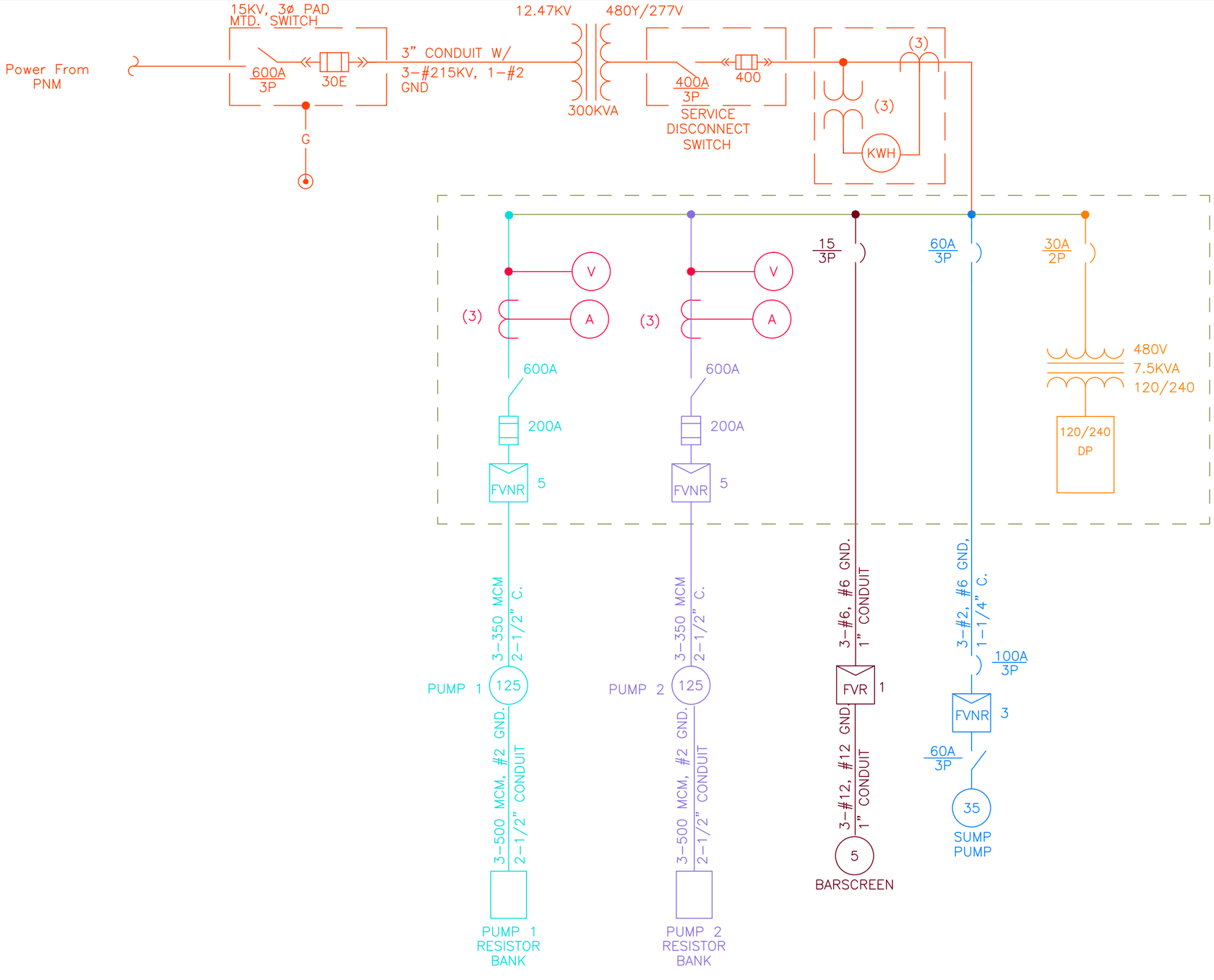
City Of Albuquerque Stormwater Pump Stations

Pump Station No. 40 Candelaria P&ID

Figure 40-1



PUMP STATION No. 40 ONE-LINE DIAGRAM

N.T.S.

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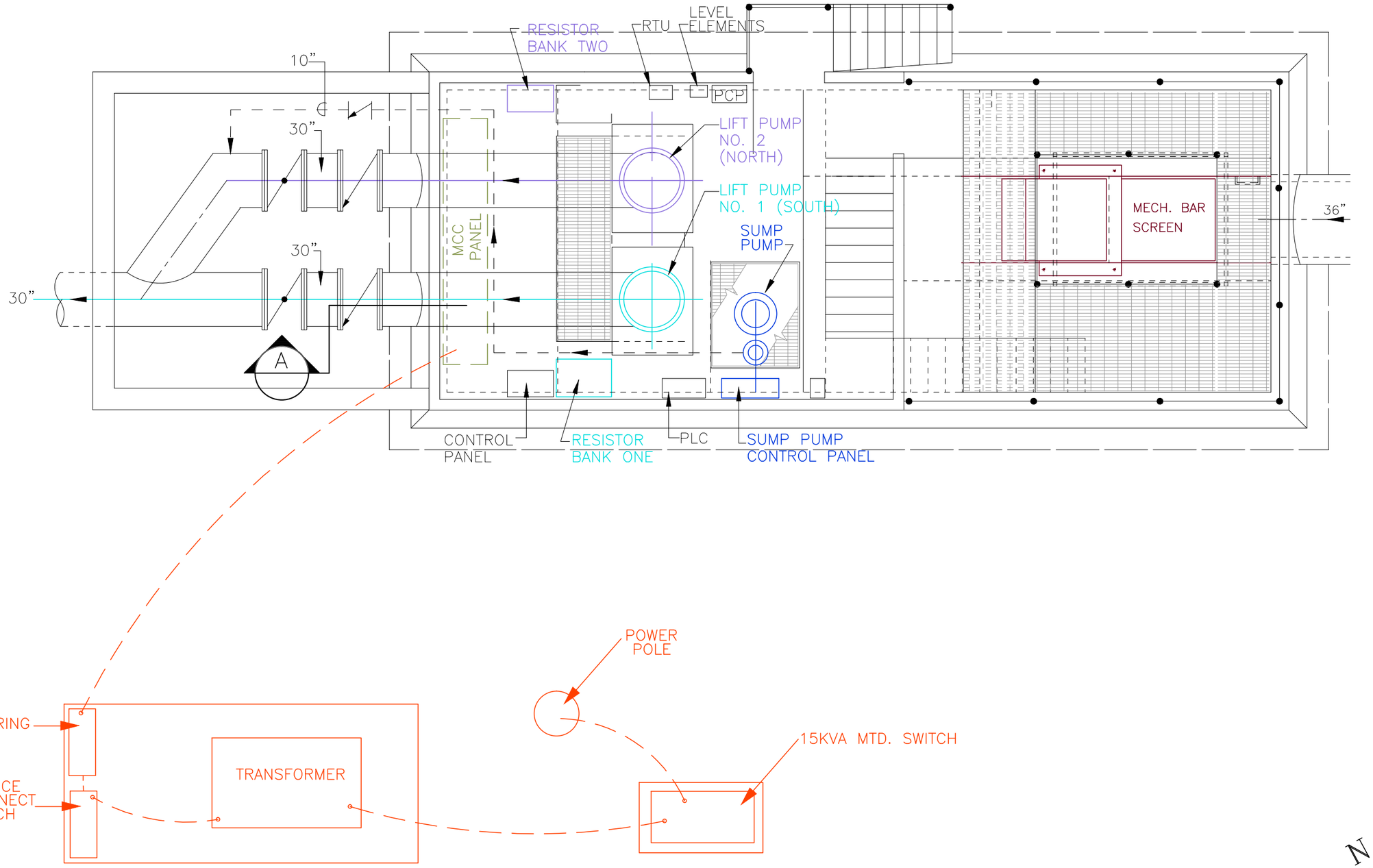
City Of Albuquerque Stormwater Pump Stations

Pump Station No. 40 Candelaria Electrical One-Line Diagram

Figure 40-2



ELECTRICAL SITE PLAN

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City Of Albuquerque Stormwater Pump Stations

Pump Station No. 40 Candelaria Electrical Site Plan

Figure 40-3

REF (Filename): SOJP_4000_SU_CANDELARIA PUMP STATION.doc
Revision Date: 6/26/2015
Revised By: Molzen Corbin
Approved by:

SOJP NO.: 4000-SU-CANDELARIA PUMP STATION

TITLE: CANDELARIA 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. 40 Candelaria Operations Manual

SYSTEM SCHEMATICS

Figure 40-1 Pump Station No. 40 Candelaria P&ID
Figure 40-2 Pump Station No. 40 Candelaria Electrical One-Line Diagram
Figure 40-3 Pump Station No. 40 Candelaria Electrical Site Plan

CANDELARIA 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. No PLC at this station no code entry is needed.

Exit

1. To exit site: Make sure all the doors are secure and exit.
2. Call Plant control to 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. 1 check valve **CV54001**
   IN SERVICE – Lift Pump No. 2 check valve **CV54002**
   IN SERVICE – Sump Pump check valve **CV54003**
   OPEN – Lift Pump No. 1 butterfly isolation valve **V54001**
   OPEN – Lift Pump No. 2 butterfly isolation **V54002**

Note: The Equipment Tag Numbers on the equipment at this station follows an older numbering convention than is currently used by the Water Authority (shown above). Refer to Figure 40-1 for the physical tag numbers, which are shown in parentheses.

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.
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 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 control station (at the bar screen). 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.

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Approved by:

SOJP NO.: 4000-N-CANDELARIA PUMP STATION

TITLE: CANDELARIA 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. 40 Candelaria Operations Manual

SYSTEM SCHEMATICS

Figure 40-1 Pump Station No. 40 Candelaria P&ID
Figure 40-2 Pump Station No. 40 Candelaria Electrical One-Line Diagram
Figure 40-3 Pump Station No. 40 Candelaria Electrical Site Plan

CANDELARIA PUMP STATION

NORMAL OPERATION

GENERAL

Stormwater is conveyed into the pump station inlet channel through 1,100 feet of 36-inch diametter reinforced concrete pipe. 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 an outdoor dumpster above grade. The inlet channel was not constructed with high-flow bypass provisions below the floor grating. As such, if the high channel alarm is tripped, the operator must visit the station to manually clear the screen in order to facilitate proper pump station operation. After passing through the bar screen, stormwater enters the pump station's wet well.

The pump station has a duty-standby configuration for the two (2) lift pumps and one (1) wet well sump pump. Stormwater is pumped by any combination of the two (2) 125 HP vertical mixed flow pumps, each capable of pumping 16,000 gallons per minute (gpm). Due to the small volume of the wet well and the combined discharge configuration of the pumps, the combined discharge capacity is approximately 29,000 gpm. The inlet pipe capacity is such that only one (1) pump will need to be operated under typical conditions. The active pump should be rotated regularly to prevent overuse. If the station is subjected to a surcharge condition (i.e., if streets in the drainage area are flooded) then two (2) pumps may be operated to cope with the additional capacity. For more information about operational configurations refer to Section 3.1.2 and Appendix C of the Pump Station No. 40 Operations Manual.

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.

NORMAL OPERATION CONDITIONS

During normal operation, the HAND-OFF-AUTO (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 Lift Pump Control Panel.

The active level transmitter is selected automatically as the transmitter with the highest level indications or manually with a switch at the Station Level Control Panel.

Valve Positions at Pump Station No. 40 Candelaria during Normal Operation are as follows:

IN SERVICE – Lift Pump No. 1 tilted disk check valve **CV54001**
IN SERVICE – Lift Pump No. 2 tilted disk check valve **CV54002**
IN SERVICE – Sump Pump check valve **CV54003**
OPEN – Lift Pump No. 1 butterfly isolation valve **V54001**
OPEN – Lift Pump No. 2 butterfly isolation valve **V54002**

Note: The Equipment Tag Numbers on the equipment at this station follow an older convention than is currently used by the Water Authority Asset Management Program (shown above). Refer to Figure 40-1 for the physical tag numbers, which are shown in parentheses.

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. No PLC at this station no code entry is needed.

Exit

1. To exit site: Make sure all the doors are secure and exit.
2. Call Plant control to 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 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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SOJP NO.: 4000-SD – CANDELARIA PUMP STATION

TITLE: CANDELARIA 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. 40 Candelaria Operations Manual

SYSTEM SCHEMATICS

Figure 40-1 Pump Station No. 40 Candelaria P&ID
Figure 40-2 Pump Station No. 40 Candelaria One-Line Diagram
Figure 40-3 Pump Station No. 40 Candelaria Site Plan

CANDELARIA PUMP STATION

SYSTEM SHUTDOWN

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. No PLC at this station no code entry is needed.

Exit

1. To exit site: Make sure all the doors are secure and exit.
2. Call Plant control to advise of your departure.

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 power source before servicing. Failure to disconnect power source can result in fire, shock or serious injury. Follow ABCWUA LOTO (lock out, tag out) procedures. Refer to Appendix E.
2. Select the **OFF** position with the HAND-OFF-AUTO (HOA) switch on the door of the Bar Screen Control Panel (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 shut down 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 power source before servicing. Failure to disconnect power source can result in fire, shock or serious injury. Follow ABCWUA LOTO (lock out, tag out). Refer to Appendix E.
2. Select the **OFF** position for the selected pump with the HOA switch on the door of the Lift Station Control Panel (LSCP).
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 sump pump is as follows:

1. Disconnect, lock and tag power source of the sump pump before servicing. Failure to disconnect power source can result in fire, shock or serious injury. Follow ABCWUA LOTO (lock out, tag out). Refer to 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.
   Note: The sump pump is not equipped with an isolation valve.

Albuquerque Bernalillo County
Water Utility Authority

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SOJP NO.: 4000-SU-CANDELARIA EXHAUST FAN

TITLE: CANDELARIA 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

CANDELARIA EXHAUST FAN SYSTEM

SYSTEM START-UP

GENERAL

The exhaust fan system provides minimal ventilative cooling for 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

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SOJP NO.: 4000-N-CANDELARIA EXHAUST FAN

TITLE: CANDELARIA 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

CANDELARIA EXHAUST FAN SYSTEM

NORMAL OPERATIONS

GENERAL

The exhaust fan system provides minimal ventilative cooling in the control room.

NORMAL OPERATION PROCEDURE

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

1. The line voltage 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

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SOJP NO.: 4000–SD-CANDELARIA EXHAUST FAN

TITLE: CANDELARIA 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

CANDELARIA 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 for Johnston Pumps is Pumps and Service, located in Albuquerque, NM. The station operator may check oil levels in the reservoir and fill with the manufacturer's specified oil as needed. 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.

Removal of the motors and/or pumps requires lifting the individual units from the exterior of the building with a portable crane and spotting the pumps in the motor room, as well as at the discharge level. The roof of the station is equipped with a hatch through which the motors and pump shafts must be lifted. The crane should be of appropriate height to lift the entire pump shaft out of the building. The approximate weight of any equipment should be verified before removal.

8.1.3 Sump Pump

Maintenance is to be performed only by qualified personnel who are familiar with this type of equipment. The local sales and service representative for Flygt Pumps is James, Cooke, and Hobson (JCH), 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 pump will need to be lifted with either a portable crane or a winch. The sump pump location is equipped with guide rails to prevent swinging during removal and aid in alignment during reinstallation.

8.1.4 Valves

Maintenance is to be performed only by qualified personnel who are familiar with this type of equipment. Due to infiltration and a lack of drainage provisions, the valve vault is regularly flooded. The valve vault should be pumped of excess water prior to performing maintenance, as well as before the winter season. All manual valves should be cycled annually to ensure proper operation. Inspect for leakage around mating surfaces and replace gaskets as needed. 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 for the station 480V service, the 480 to 240/120V transformer and panelboard, and feeder taps for the sump pump and the bar screen control panels.

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 Lift Station Control Panel (LSCP)

The LSCP receives the wet well level signal and controls start and stop of the lead lift pump.

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 control panel
- Check/tighten all connections
- Operate all switches
- Test all pilot indicators
- Connect variable 4 to 20 mA source and check control relative to rising signal

5-Year:

- Conduct annual maintenance
- Infrared scan

8.2.3 Stepped Speed Contractor Panel (SSCP)

The SSCP contain load contactors that, when energized, connect between the wound rotor motor secondary leads to vary the resistance.

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 control panel
- Check/tighten all connections
- Operate all switches
- Test all pilot indicators
- Plug or cover all unused openings
- Connect variable 4 to 20 mA source and check control relative to rising signal

5-Year:

- Conduct annual maintenance
- Infrared scan

8.2.4 Resistor Panel

The resistors that are inserted into or removed from the motor secondary circuits to change motor speed are mounted in the resistor panel.

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 control panel
- Check/tighten all connections

5-Year:

- Conduct annual maintenance

8.2.5 Sump Pump Control Panel

The Sump Pump Control Panel (SPCP) operates the sump pump to maintain the level in the wet well below the point where the lift pump starts.

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 control panel
- Check/tighten all connections
- Operate all switches
- Test all pilot indicators
- Plug or cover all unused openings
- Connect variable 4 to 20 mA source and check control relative to rising signal

5-Year:

- Conduct annual maintenance
- Infrared scan

8.2.6 Bar Screen Control Panel (BSCP)

The BSCP operates the bar screen 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

8.3 HVAC Equipment

8.3.1 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.

<u>Direct Drives:</u>

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:

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 procedures to help prevent accidents. Consequently, to reduce the danger, anyone engaged in the operation of a stormwater 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 adhering to 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 (1) 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 New Mexico Occupation Health & Safety Bureau (OHSB) and 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 (2) 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 station 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 (5) 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 (2) 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. 40 Candelaria Equipment List

Equipment Number	Description	Manufacturer	Model Number	Serial Number	Size, Capacity	Local Source for Parts and Service
CP54000	Lift Pump Control Panel	EG PUMP CONTROLS				
CP54003	Sump Pump Control Panel	EG PUMP CONTROLS	240079-3	DIAG#D-3795-1	35HP	
CP54011	Barscreen Control Panel	INFILCO DEGREMONT	ASSEMBLY	51189H01		MISCOWater; Albuquerque, NM
CV54001 (540V01A)	Lift Pump 1 Check Valve	WATEROUS			30 IN.	Baker Utility Supply; Albuquerque, NM
CV54002 (540V02A)	Lift Pump 2 Check Valve	WATEROUS			30 IN.	Baker Utility Supply; Albuquerque, NM
CV54003 (540V03C)	Sump Pump Check Valve	WATEROUS			10 IN.	Baker Utility Supply; Albuquerque, NM
E54000	Motor Control Center	SQUARE D				
E54001	Lift Pump 1 (South) MCC	GENERAL ELECTRIC	DS7762		125HP	
E54002	Lift Pump 2 (North) MCC	GENERAL ELECTRIC	DS7762	CAT#0506X0620F02	125HP	
E54010	Lighting	SQUARE D				
LE54001	Wet well Level element	DREXELBROOK	700-0005-054			
LE54002	Wet well Level element	MILTRONIC	700-0005-054			
LSH54001	Influent Level Switch. Barscreen Start	FLYGT	ENM-10			James, Cooke, and Hobson; Albuquerque, NM
LSH54002	Barscreen Shut down switch	FLYGT	ENM-10			James, Cooke, and Hobson; Albuquerque, NM
LSH54003	Alarm float switch to RTU	FLYGT	ENM-10			James, Cooke, and Hobson; Albuquerque, NM
LSH54004	Wet well high level to RTU	FLYGT	ENM-10			James, Cooke, and Hobson; Albuquerque, NM
LT54001	Wet well level transmitter	DREXELBROOK	UNIVERSAL III 409-1030-001	13643		
LT54002	Wet well level transmitter	DREXELBROOK	UNIVERSAL III	20502		
M54001	Lift Pump 1 (South) Motor	MARATHON ELECTRIC	VL584KWR126AA	Y40702	125HP, 710RPM, 440V, 3PHASE, 60HZ	Electric Motor; Albuquerque, NM
M54002	Lift Pump 2 (North) Motor	MARATHON ELECTRIC	VL584KWR126AA	Y40701	125HP, 710RPM, 440V, 3PHASE, 60HZ	Electric Motor; Albuquerque, NM

Pump Station No. 40 Candelaria Equipment List

Equipment Number	Description	Manufacturer	Model Number	Serial Number	Size, Capacity	Local Source for Parts and Service
P54001	Lift Pump 1 (South)	JOHNSTON PUMP	VERTICAL PUMP		16,000 GPM @ 23' TDH, 30 IN DISCHARGE	Hennesy Equipment Sales; Phoenix, AZ
P54002	Lift Pump 2 (North)	JOHNSTON PUMP	VERTICAL PUMP	RU49087	16,000 GPM @ 23' TDH, 30 IN DISCHARGE	Hennesy Equipment Sales; Phoenix, AZ
P54003	Sump Pump	FLYGT	CP3201		2,800 GPM @ 22' TDH, 10 IN. DISCHARGE	James, Cooke, and Hobson; Albuquerque, NM
T54000	Telemetry System	MOTOROLA	F7563A	085SNG0437		
U54011	Barscreen Unit	INFILCO DEGREMONT	CS-869	CS-869	WIDTH 4'-4"	MISCOWater; Albuquerque, NM
V54001 (540V01B)	Lift Pump 1 Butterfly Isolation Valve	ELECTRODYNE			30 IN.	
V54002 (540V02B)	Lift Pump 2 Butterfly Isolation Valve	ELECTRODYNE			30 IN.	
XA54025	Intrusion alarm system	SENTROL				

APPENDIX B

Manufacturer's Mechanical Bar Screen Maintenance Schedule

Infilco Degremont Inc

IDI 95-341

MAINTENANCE SCHEDULE

Item	Hours	Weekly	Monthly	Semi-Annually
Pin Racks - Grease (May be extended after field experience)		X		
Drive shaft - Permalube cartridge				
Check, replace as req'd	Quarterly; replace after 9 months.			
Follower shaft - Permalube cartridge				
Check, replace as req'd			X	
Cam Tracks - Grease		X	X	
Gear Box				
Leak Check		X		
Level Check	5,000			
Oil Change	20,000			
Cam Follower rollers				
Exchange	20,000			
Fasteners - Check Torque				
Pin Rack Bolts		XInitially	X	
Latch Bolts		XInitially	X	
Rake-to-Rake Arm Bolts		XInitially	X	
Wiper Bolts		XInitially	X	
Pillow block to Rack Arm		XInitially		X
Spring Nuts and Threaded Rod				X
Wear - Check				
Rollers and Bushings				X
Sprockets				X
Cam Followers				X
Latch				X
Wiper Blade				X

APPENDIX C

Manufacturer's Lift Pump Curve and General Information

EC-1008

PER STAGE	IMP. DIA.	IMP. EXIT	IMPELLER PART NO. 7129 IMPELLER PATTERN NO. 6803	THRUST CONSTANT 125 WR² 76 LB. FT²/STAGE	PUMP SHAFT DIAM. 2 11/16"

SUBMERGENCE REQ'D OVER BOTTOM OF BELL TO PREVENT VORTEXES 59 INCHES

FEET TOTAL BOWL HEAD

45 40 35 30 25 20 15

$16\frac{3}{8}-\frac{3}{16}$ T-5V

$15\frac{5}{16}-\frac{3}{16}$ T-5V

$14\frac{1}{4}-\frac{3}{16}$ T-5V

NPSH

75 80 82 84 85 84 82 80 75

SHUT OFF	HEAD	H.P.
$16\frac{3}{8}$-5V	71	221
$15\frac{5}{16}$-5V	62	179.5
$14\frac{1}{4}$-5V	54	152

8000 10000 12000 14000 16000 18000 20000

U.S. GALLONS PER MINUTE

FEET N.P.S.H. REQUIRED ● SUCTION IMPELLER

40 30 20 10 0

PER STAGE

200 150 100 50

BRAKE HORSEPOWER

PERFORMANCE BASED ON MULTISTAGE TESTS
PUMPING CLEAR COLD WATER SP. GR. 1.0

FOR 1 STAGE MULTIPLY HEAD & EFF. BY 1.0

FOR 2 STAGES MULTIPLY HD. & EFF. BY 1.0

DATE 11-18-86

Johnston Pump Company
Brookshire, Texas 77423
ESTABLISHED 1909

24MS MIXED-FLOW PUMP

IMPELLER — BRONZE
CLASS 'C' FIN.

705 RPM

BOWL — CAST IRON

CURVE SHEET NO
EC-1008

IP-341

Johnston Pump Company

MODEL JP AND JM PROPELLER AND MIXED FLOW PUMPS

GENERAL INFORMATION

The application of propeller and mixed flow pumps requires consideration of a number of factors as listed below.

I. OPERATING RANGE

A. Propeller pumps have a characteristic of high shut-off head and horsepower. Operation of propeller pump at a lower capacity or higher head than shown on the published performance curve may result in unstable operation, excessive noise, driver failure and shaft breakage.

B. Mixed flow pumps also have these characteristics but to a much lesser degree. A mixed flow pump, if required, can be engineered to operate at higher than normal head range as shown on the performance curves. The head and horsepower at shut-off condition are listed on the performance curves.

II. LUBRICATION OF BEARINGS

A. Oil lubricated lineshaft bearings are recommended for almost all applications. Two notable exceptions to this are applications with a positive suction pressure such as a flanged suction pump and those instances where traces of oil are objectionable because of contamination of the liquid.

B. Water lubricated open lineshaft construction can be furnished but lubrication of lineshaft bearings above the discharge elbow becomes a problem if the total pumping head is low and an underground discharge elbow is used. Air and vacuum valves are a necessity when a water lubricated pump is furnished with an underground discharge elbow. (See Section III-A below).

C. Grease lubricated bowl and lineshaft bearings can be furnished for special applications. The grease is supplied through special lines built into the pump. Grease pumps (manual or automatic) or a hand grease gun can be used to supply the grease.

D. Fresh water flushed bearings can be furnished to keep the bearings flushed clean of any sand or other abrasives present in the water being pumped. If a supply of fresh water is available, this flushing arrangement is highly recommended. The total quantity of flushing water required is usually quite small.

III. SPECIAL VALVES

A. The most common valve used with propeller and mixed flow pumps is an air and vacuum valve. This valve allows the air to escape from the column pipe as the pump is started. This is of special importance on a water lubricated pump with an underground discharge as it allows the water to rise into the upper section of column and lubricate the bearings. This will take place of course only if the bowl head is adequate to lift the water to the baseplate. These valves are also useful in helping to control special problems such as surging and water hammer.

B. By-pass valves are usually mounted in the column pipe directly above the bowl assembly. Their pupose is to prevent an excessively high head from being imposed on the pump which would cause trouble as described under I, Operating Range.

C. Siphon breaker valves are installed at the highest point in the discharge piping of a pump which is pumping over an embankment or levee and is using a siphoning action to reduce the total pumping head. When the pump is operating, the flow of water is away from the pump and the valve is closed. If the pump is stopped and, as is the normal case, the water level on the other side of the levee is higher than on the pump side, the water will start to flow backwards through the discharge pipe towards the pump. This reverse flow causes the siphon breaker valve to open, allowing air to enter the pipe and the siphoning action will be broken. This prevents accidental flooding of land on the pump side of the levee.

GENERAL INFORMATION (CONTINUED)

IV. VORTICES AND CAVITATION

These two terms are often thought to describe the same condition, whereas they are, in fact, separate and distinct.

A vortex is a "whirlpool" caused by a combination of factors such as sump design, inlet velocity and direction of flow, submergence and position of the bowl assembly in the sump. Air entering the pump through these vortices causes noise and vibration, but not cavitation. Various methods can be used to prevent vortices. These include the use of umbrellas or suction splitters, floats, lower inlet velocities, baffles in the sump and increased submergence.

Recommendations regarding the design of sumps are given in the "Standards of the Hydraulic Institute."

Cavitation is caused by inadequate NPSH at the entrance to the impeller or propeller. Use the NPSH curves to select a bowl assembly to suit the requirements of the installation. If limited NPSH is available, a large pump operating at a slow speed should be used.

V. MISCELLANEOUS

A. If the driver requires cooling water to cool the oil, check the minimum pumping head to make sure that water can be supplied to the driver at the corrct pressure. If the pumping head is too low, cooling water from some other source must be provided.

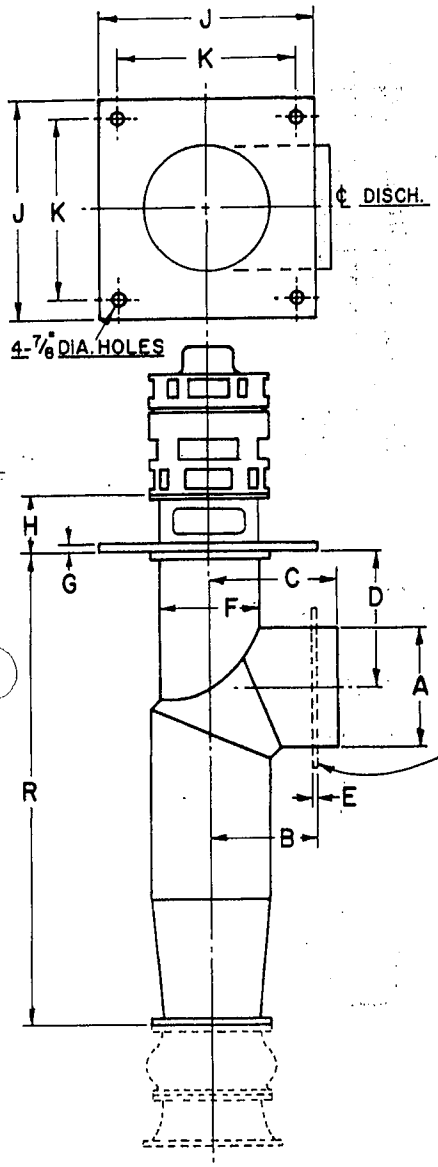
B. The diameter of the maximum sphere that can be passed through the pump is listed in the data pages. This does not mean that the pump will handle solids of this size. This listing is given only to give a relative indication of the sizes of the water passages in the various pumps.

C. Strainers are listed for all propeller and mixed flow pumps but their use is recommended only in those instances where installation of suitable trash racks is not possible. A strainer clogged with debris can cause driver overheating and failure, shaft breakage, cavitation and bearing failure.

D. Most pump drivers have a service factor which will permit operation at pumping conditions which require more horsepower than the nameplate rating of the driver. However, because the horsepower requirement of all propeller pumps and some mixed flow pumps rises sharply with an increase in the pumping head, it is not recommended practice to use this safety factor in selecting the driver size for these pumps.

MODEL JP AND JM PROPELLER AND MIXED FLOW PUMPS

UNDERGROUND DISCHARGE ELBOW DIMENSIONS



A	B	C	D	E	F	G	H	J(1)	K
8-5/8	8	12	18	3/4	8-5/8	1	16	18	15
10-3/4	10	14	18	3/4	8-5/8	1	16	18	15
12-3/4	12	16	18	3/4	8-5/8	1	16	18	15
14	14	18	24	3/4	12-3/4	1	16	24	21
16	14	22	24	3/4	12-3/4	1	16	24	21
18	16	24	24	3/4	14	1	16	24	21
20	18	26	24	3/4	18	1-1/4	21	30	27
24	22	28	30	3/4	18	1-1/4	21	30	27
30	26	34	30	3/4	24	1-1/4	21	36	33
36	30	38	36	1	30	1-1/4	21	42	39
42	36	46	42	1	36	1-1/4	21	42	39
48	40	52	42	1	36	1-1/4	21	48	45
54	46	58	48	1	42	1-1/2	22	56	53
60	48	60	54	1	48	1-1/2	22	64	61

(1) The standard base plate is not necessarily large enough to cover a dia. hole suitable to pull the pump. Check the customer's foundation for any oversize base plate requirements.

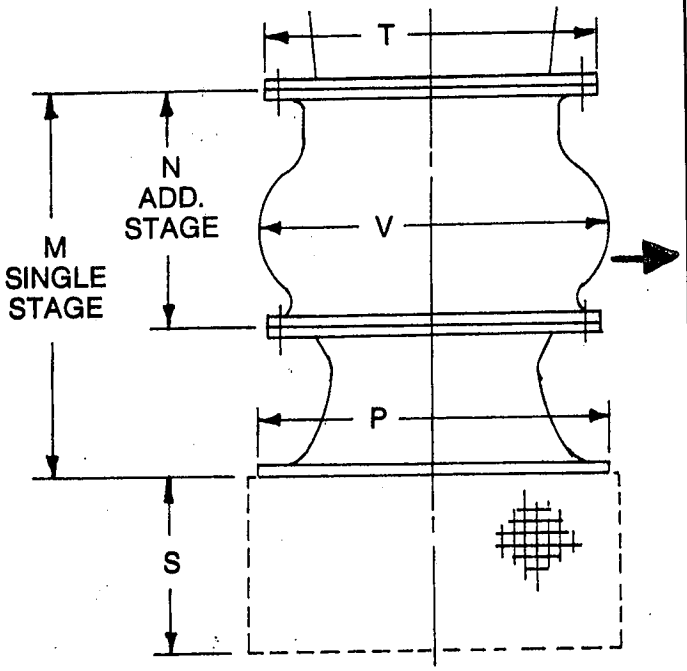
COLUMN SIZE	WALL THICKNESS
8-5/8	.277
10-3/4	.279
12-3/4	.330
14-30	.250
36-48	.375

8", 10" and 12" column and elbow assemblies will be fabricated using pipe with outside diameters of 8-5/8", 10-3/4" and 12-3/4".

MIXED FLOW OR PROPELLER BOWL SIZE
MINIMUM "R" DIMENSIONS

	8	10	12	14	16	18	20	24	30	36	42	48
8	26											
10	39	27										
12	53	41	29									
14		60	48	36								
16		74	62	50	38							
18			76	64	52	40						
20				77	67	54	41					
24				110	98	86	74	50				
30							115	91	55			
36							162	138	102	66		
42									149	113	77	
48										157	121	88
54											166	130

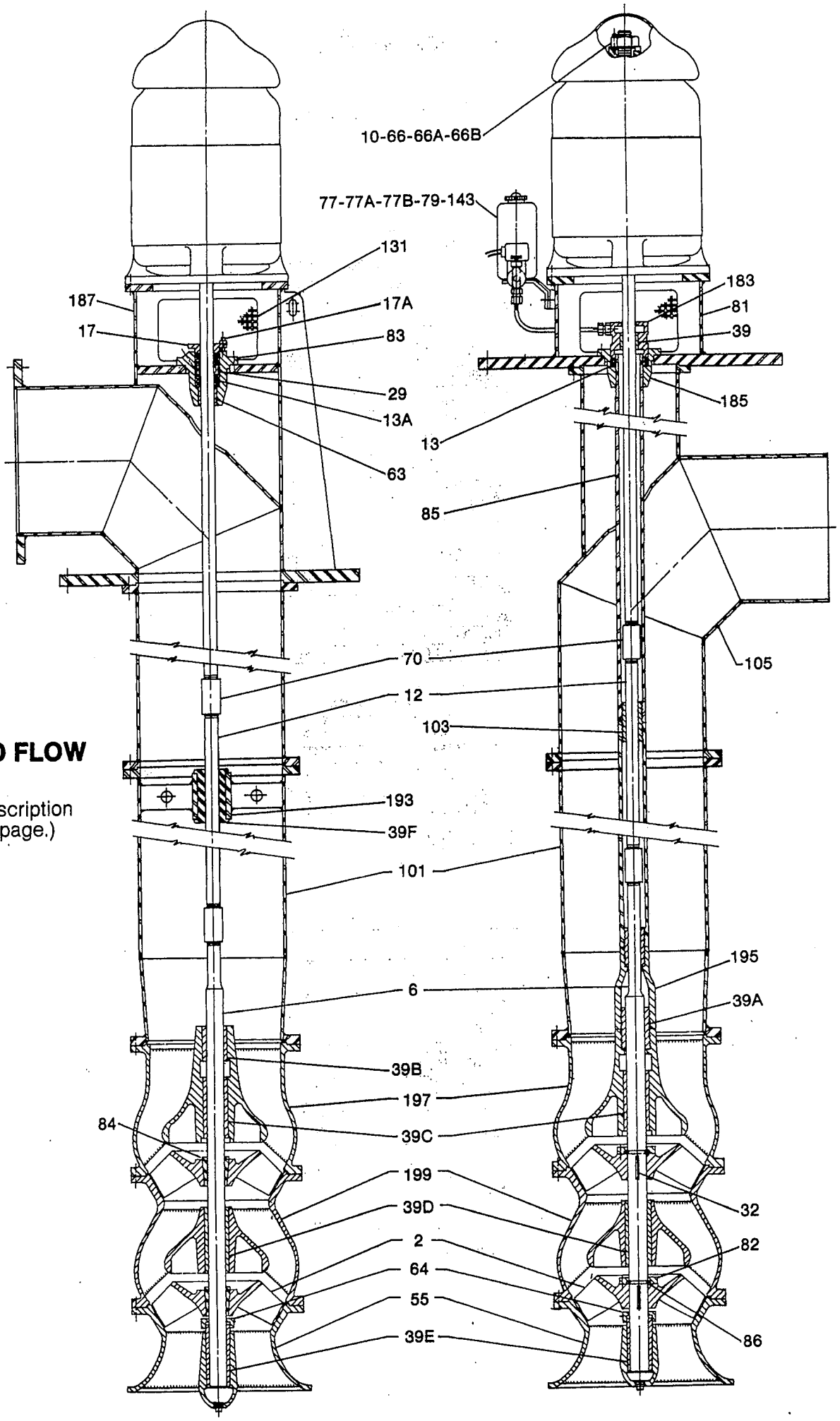
LS, MS, PS MIXED FLOW BOWL DATA



BOWL SIZE	M	N	P	S	T	V
8	13	8	12	6	11-1/2	10-1/8
10	16-1/2	10	14	7	13-3/8	12-5/8
12	19-3/4	12	17	8	16-3/8	15-1/16
14	23	14	19-7/8	9	18-5/8	17-9/16
16	26-1/2	16	22-1/2	10	20-3/4	20-1/16
18	29-3/4	18	25-1/2	11	23	22-1/2
20	33	20	28-1/2	12	25-3/8	25
24	39-1/2	24	33-1/2	12	30	29-7/8
30	49-1/2	30	42	14-1/2	36	37-1/8
36	59-1/2	36	50-1/2	16	42-5/8	44-1/2
42	69	42	59	18	49-1/4	51-3/4
50	82	50	70	20	58-1/2	62

BOWL SIZE	BOWL SHAFT DIA.	WGHT. OF ROTATIING PARTS/STG	THRUST CONSTANT "K"	WR^2 PER STAGE LB.FT^2(2)	MAXIMUM (1) SPHERE SIZE		WEIGHTS FIRST STAGE	WEIGHTS ADD'L STAGE
					LS 5V PS 6V	MS 5V PS 5V		
8	1"	12	14	.32	7/8	1-1/4	114	64
10	1-1/2"	31	21	.96	1-1/4	1-5/8	195	124
12	1-11/16"	44	31	2.3	1-5/8	2	290	160
14	1-15/16"	70	42	4.8	1-7/8	2-3/8	415	255
16	2-7/16"	120	55	10.6	2-1/8	2-5/8	620	365
18	2-7/16"	135	70	17.0	2-3/8	3	775	465
20	2-11/16"	185	87	29.0	2-3/4	3-3/8	1030	640
24	2-11/16"	290	125	76.0	3-1/4	4	1780	1125
30	3-7/16"	550	194	222	4	5	2750	1810
36	4"	950	282	560	4-3/4	6	4500	2900
42	4-1/2"	1300	384	1060	5-5/8	7	6300	4050
50	5"	1800	542	2590	6-3/4	8-1/4	11600	7650

(1) Maximum sphere sizes listed are not a guarantee that pumps will handle liquid solids of these sizes.
(2) Based on bronze impellers.



MIXED FLOW PUMP

(See description on next page.)

Johnston Pump Company

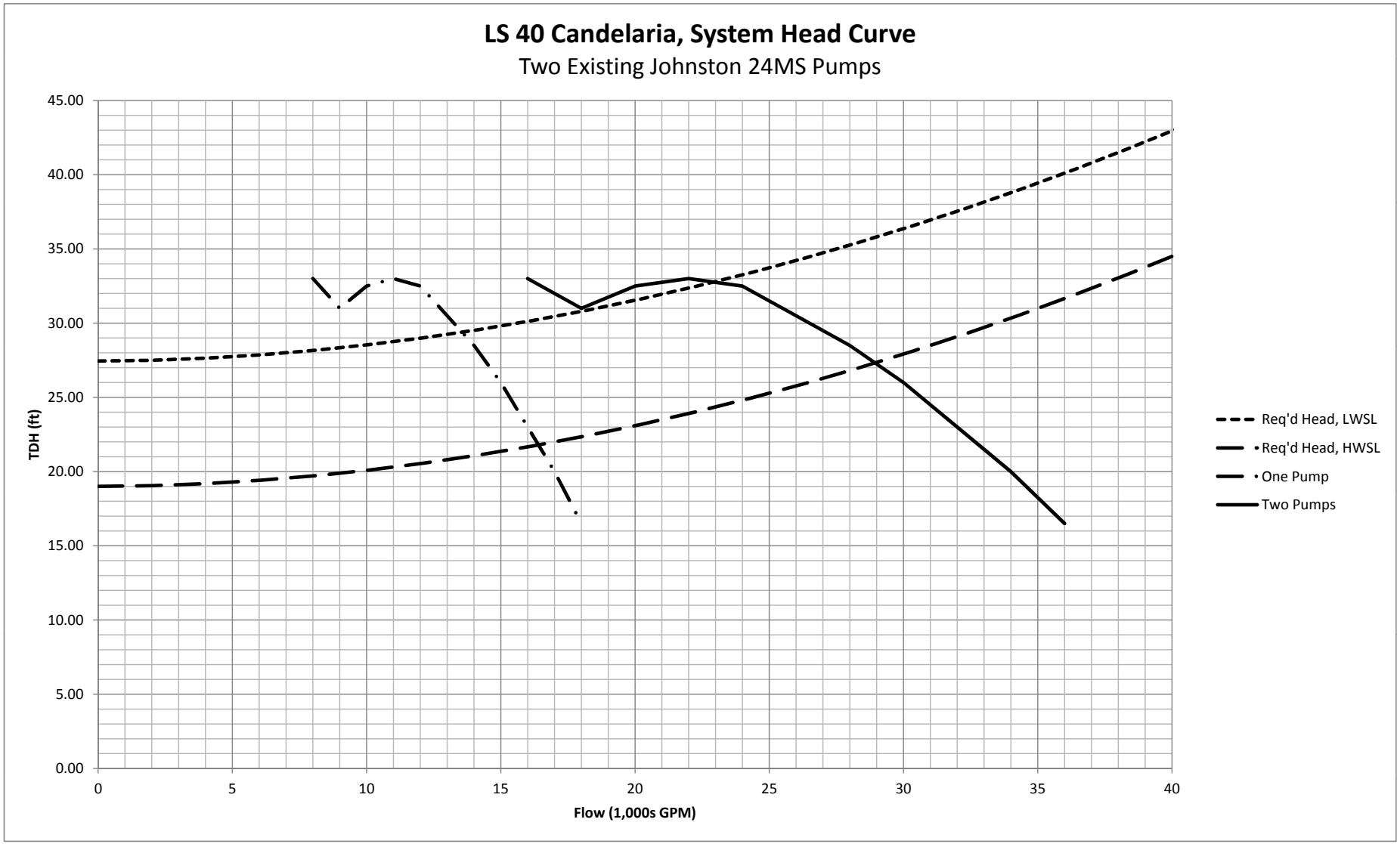
MIXED FLOW PUMP

ELBOW ASSEMBLY				
ITEM No.	PART		MATERIAL	A.S.T.M. No.
10	SHAFT, HEAD	PRODUCT LUBE	ST. STEEL	A 582-416
		OIL LUBE	STEEL	A 108-GR1045
13	PACKING (2 RINGS OIL LUBE)			
13A	PACKING (6 RINGS PROD. LUBE)			
17	GLAND		BRONZE	B 584-836
17A	GLAND STUDS & NUTS		BRASS	
29	RING, LANTERN		BRONZE	B 584-836
39	BUSHING, BEARING		H. L. BRZ.	B 584-938
63	BUSHING, STUFFING BOX		H. L. BRZ.	B 584-938
66	NUT, SHAFT ADJUSTING		STEEL	A 108-GR1018
66A	NUT, LOCKING SCREWS		STEEL	
66B	GIB KEY		STEEL	A 108-GR1018
77A	SOLENOID VALVE, OILER			
77B	OIL LINE FITTINGS		COPPER	
77 & 79	OIL RESERVOIR & BRACKET		STEEL	
81	PEDESTAL, DRIVER		FAB. STL.	A 53 & A 36
83	STUFFING BOX		C. I.	A 48 CL-30
85	TUBE, SHAFT ENCLOSING		STEEL	A 120
105	ELBOW		FAB. STL.	A 53 & A 36
131	GUARD, COUPLING		GALV. STL.	A 526
143	GAUGE, SIGHT FEED OILER			
183	NUT, TUBE TENSION		C. I.	A 48 CL-30
185	PLATE, TUBE TENSION		C. I.	A 48 CL-30
187	HEAD, SURFACE DISCHARGE		FAB. STL.	A 53 & A 36

COLUMN ASSEMBLY				
ITEM No.	PART		MATERIAL	A.S.T.M. No.
12	LINE SHAFT	PRODUCT LUBE	ST. STEEL	A 582-416
		OIL LUBE	STEEL	A 108-GR1045
39 F	BUSHING, BEARING		RUBBER	C 425-65
70	COUPLING, SHAFT		STEEL	A 108-GR1137
101	COLUMN PIPE		STEEL	A 53 & A 36
103	BEARING, DRIVE SHAFT		BRONZE	B 584-836
193	BEARING, RETAINER*		FAB. STL.	A 36

*FAB. TYPE SHOWN

BOWL ASSEMBLY			
ITEM No.	PART	MATERIAL	A.S.T.M. No.
2	IMPELLER	BRONZE	B 584-836
6	PUMP SHAFT	ST. STEEL	A 582-416
32	KEY, IMPELLER	ST. STEEL	A 582-416
39A	BEARING, SCREW UPPER O. L.	BRONZE	B 584-836
39B	BEARING, UPPER DISCH. BOWL	H. L. BRZ.	B 584-938
39C	BEARING, LOWER DISCH. BOWL	H. L. BRZ.	B 584-938
39D	BEARING, INTER. BOWL	H. L. BRZ.	B 584-938
39E	BEARING, BELL	H. L. BRZ.	B 584-938
55	SUCTION BELL	C. I.	A 48 CL-30
64	COLLAR, PROTECTING	BRONZE	B 584-836
82	THRUST RING RETAINER	BRONZE	B 584-836
84	LOCK COLLET	STEEL	A 108-GR1213
86	THRUST RING	ST. STEEL	A 582-416
195	ADAPTER, TUBE	C. I.	A 48 CL-30
197	DISCHARGE BOWL	C. I.	A 48 CL-30
199	INTERMEDIATE BOWL	C. I.	A 48 CL-30


LS 40 Candelaria, System Head Curve
Two Existing Johnston 24MS Pumps
TDH (ft)
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
0
5
10
15
20
25
30
35
40
Flow (1,000s GPM)
Req'd Head, LWSL
Req'd Head, HWSL
One Pump
Two Pumps

APPENDIX D

Manufacturer's Sump Pump Curve and General Information

SUBMITTAL DATA

MECHANICAL EQUIPMENT

AUGUST 29, 1986

PHASE I REHABILITATION
STORM WATER PUMPING STATION

BOVAY ENGINEERS
ALBUQUERQUE, NEW MEXICO

SECTION 604 SUBMERSIBLE SUMP PUMPS: FLYGT CORP.

Sta 30 Duranes
Sta 32 Bareleg
Sta 40 Candelaria

3 - 10" CP-3201-637 pumps with 35 HP, 480/3/60, 1200 RPM motor, electrical cable, ss cable grip, ss lifting chain, 10" cast iron discharge elbow w/ss anchor bolts, ss upper guide bar bracket and ss intermediate guide bar bracket

1 - 10" CP-3201-637 spare pump as above with electrical cable

3 - Control Panels - submittals to be made later

PREPARED FOR: RODGERS CONSTRUCTION INC.
ALBUQUERQUE, NEW MEXICO

PREPARED BY: JAMES, COOKE & HOBSON, INC.
RICK W. HOBSON
ALBUQUERQUE, NEW MEXICO
(505) 292 7100

This submittal has been reviewed for compliance with general requirements of design and arrangement only, and is not a contract document and acknowledgement of compliance does not relieve Contractor of responsibility for performance of the work in compliance with all provisions and requirements of the Contract documents. Job measurements and coordination of all dimensions for proper fit of all parts of the work and performance of all equipment supplied to meet specification requirements are and remain specific responsibilities of the Contractor.

☑ Compliance acknowledged subject to the foregoing; distribute

☐ Compliance acknowledged as noted and subject to the foregoing; distribute

☐ Compliance acknowledged as noted and subject to the foregoing; Revise and resubmit for record; distribute.

BOVAY ENGINEERS, INC.
ALBUQUERQUE, NEW MEXICO

By MSD Date 9/8/86

PUMP DESIGN

The pumps shall be capable of handling raw, unscreened stormwater. The discharge connection elbow shall be permanently installed in the wet well along with the discharge piping. The pumps shall be automatically connected to the discharge connection elbow when lowered into place and shall be easily removed for inspection or service. There shall be no need for personnel to enter pump well. Sealing of the pumping unit to the discharge connection elbow shall be accomplishedby a simple linear downward motion of the pump. A sliding guide bracket shallbe an integral part of the pump unit. The entire weight of the pump unit shall be guided by two guide bars and pressed tightly against the discharge connection elbow with metal-to-metal contact. No portion of the pump shall bear directly on the floor of the sump. The pump, with its appurtenances and cable, shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 ft.

PUMP CONSTRUCTION

A. Major pump components shall be of gray cast iron, Class 30, with smooth surfaces devoid of blow holes and other irregularities. Where watertight sealing is required, O-rings made of nitrile rubber shall be used. All exposed nuts and bolts shall be of stainless steel 304. All surfaces coming into contact with sewage, other than stainless steel, shall be protected by a PVC epoxy coating. Pump exterior shall be sprayed with PVC epoxy primer, with chloric rubber paint finish.

B. All mating surfaces where watertight sealing is required shall be machined and fitted with nitrile rubber O-rings. Fitting shall be such that sealing is accomplished by metal-to-metal contact between machined surfaces. This will result in controlled compression of nitrile rubber O-rings without requirement of a specific torque limit. No secondary sealing compounds, rectangular gaskets, elliptical O-rings,m grease or other devicesshall be used.

C. The cable entry water·seal design shall preclude specific torque requirements to insure a watertight and submersible seal. The cable entry shall be comprised of a single cylindrical elastomer grommet, flanked by washers, all having a close tolerance fit against the cable outside diameter and the entry inside diameter and compressed by the entry body containing a strain relief function, separate from the function of sealing the cable. The assembly shall bear against a shoulder in the pump top. The cable entry junction chamber and motor shall be separated by a stator lead sealing gland or terminal board, which shall isolate the motor interior from foreign material gaining access through the pump top.

D. The pump motor shall be squirrel-cage, induction, shell type design, housed in an air-filled, watertight chamber, NEMA Design B type. The stator winding and stator leads shall be insulated with moisture resistant Class F insulation which will resist a temperature of 155 degrees C (311 degrees F). The stator shall be dipped and baked three times in Class F varnish. The motor shall be designed for continuous duty, capable of sustaining a minimum of ten (10) starts per hour. The rotor bars and short circuit rings shall be made of aluminum. At the design point the motor shall not draw more than 30 KW at nominal voltage at utility supply quality.

E. The junction chamber, containing the terminal board, shall be sealed from the motor by elastometer compression seal (O-ring). Connection between the cable conductors and stator leads shall be made with threaded compressed type binding post permanently affixed to a terminal board and thus perfectly leak proof.

F. Each unit shall be provided with an adequately designed cooling system, consisting of a water jacket which encircles the stator housing. The water jacket shall be provided with a separate circulation of the pumped liquid. Cooling media channels and ports shall be non-clogging by virtue of their dimensions. Provision for external cooling and flushing shall also be provided.

G. Thermal sensors shall be used to monitor stator temperatures. The stator shall be equipped with three (3) thermal switches, embedded in the end coils of the stator winding (one switch in each stator phase). These shall be used in conjunction with the supplemental to external motor over protection and wired to the control panel.

H. The pump shaft shall be of carbon steel C1034 and shall be completely isolated from the pumped liquid.

I. Each pump shall be provided with a tandem mechanical rotating shaft seal system. Seals shall run in an oil reservoir. Lapped seal faces must be hydrodynamically lubricated at a constant rate. The lower seal unit, between the oil sump and motor housing, shall contain one stationary tungsten-carbide ring and one positively driven rotating carbon ring. Each interface shall be held in contact by its own spring system. The seals shall require neither maintenance nor adjustment but shall be easily inspected and replaceable.

J. Each pump shall be provided with an oil chamber for the shaft sealing system. The oil chamber shall house a pressure equalizer ring filled with air for oil pressure compensation. Seal lubrication shall require an oil chamber capacity no greater than 2.6 gals (10 liters). The drain and inspection plug, with positive anti-leak seal, shall be easily accessible from the outside.

K. The pump shaft shall rotate on two (2) permanently lubricated bearings. The lower bearing shall be a single row deep groove ball bearing and the lower bearing a two row angular contact ball bearing.

L. The impeller shall be of gray cast iron, Class 30, dynamically balanced, double shrouded non-clogging design having a long thrulet without acute turns. The impeller shall be capable of handling solids, fibrous materials, and other matter found in normal storm water applications. The impeller shall be capable of passing a minimum 3 inch solid sphere. The fit between the impeller and the shaft shall be a sliding fit with one key.

M. The volute shall be of single piece design and shall have smooth fluid passages large enought at all points to pass any size solid which can pass through the impeller.

N. A wear ring system shall be installed to provide efficient sealing between the volute and impeller. The wear ring shall consist of a stationary ring made of nitrile rubber molded with a steel ring insert which is drive fitted to the volute inlet and rotating stainless steel ANSI 304 ring which is drive-fitted to the impeller eye.

O. The pump motor cable, installed, shall be suitable for submersible pump application with P122-MSHA approval and this shall be indicated by a code or legent permanently embossed on the cable. Cable sizing shall conform to NEC specifications for pump motors.

DESIGN CRITERIA

1.	Type	10" submersible sump pump
2.	Horsepower	35 each
3.	Power	460 volt, three phase
4.	Nominal Capacity Range	1000 to 2800 gpm
5.	T.D.H. operating points (per pump):	
	a. 2800 gpm @ 22 ft. T.D.H.	
	b. 2100 gpm @ 36 ft. T.D.H.	
6.	Size of Discharge	10"
7.	Number of Units	4, 3-placed, 1 spare
8.	Impeller Code	637

6", 8", 10", 12" CP-3201

OUTLINE DIMENSIONS

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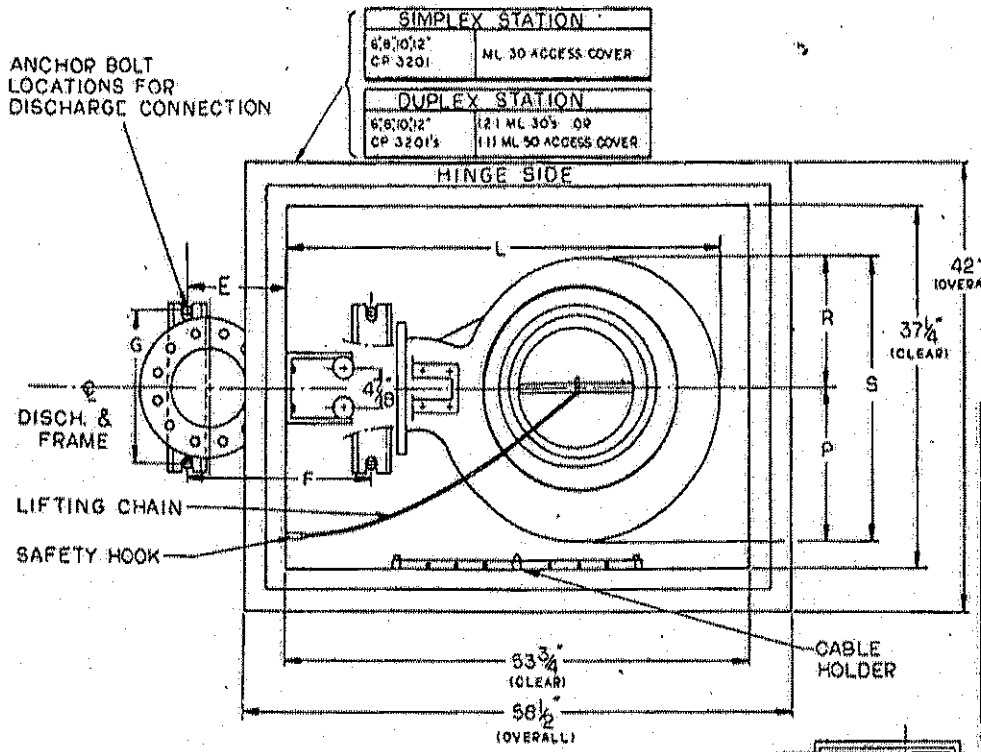

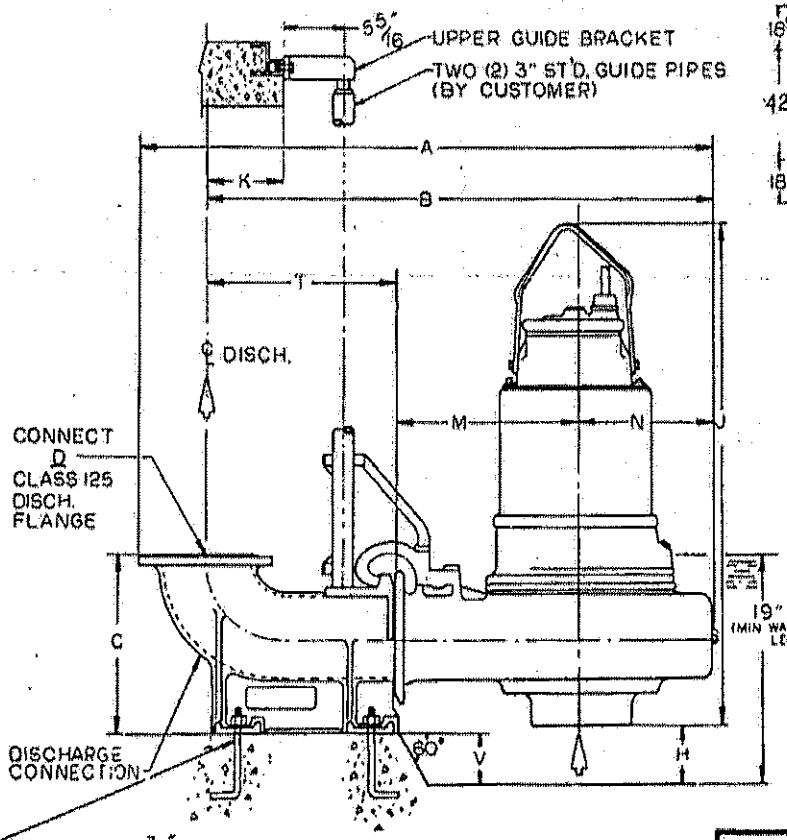

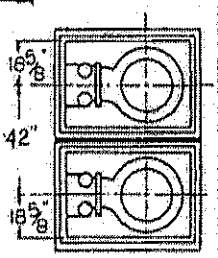

DUPLEX STATION (2) ML-30 ACCESS COVERS SHOWN)

PUMP MODEL	6" HH	6" HV	8" STD	10" STD	12" HV
A	49½	51½	58	61	64½
B	43¾	45	51¼	53	55
C	17⅜	17⅜	17⅜	17⅜	31½
D	6	8	8	10	12
E	2⅜	3½	3½	12⅛	7⅜
F	11	11	11	19 11/16	19 11/16
G	9½	9½	9½	9½	20¾
H	6⅜	8⅜	7½	6	11
J	49¼	49½	50½	50½	52
K	5⅜	6⅜	6⅞	8½	11⅞
L	38⅛	38½	44½	44½	43½
M	17⅜	17⅜	19⅜	19⅜	19⅜
N	10½	10½	14½	14½	13⅜
P	11⅛	11⅛	16⅛	16⅛	15½
R	9⅜	9⅜	13	13	11⅜
S	21	21	29⅛	29⅛	27⅛
T	15½	16⅜	16⅜	16⅜	21⅜
V	3	2¾	5¼	5¼	—

ALL DIM IN INCHES

WEIGHT IN LBS.

PUMP	1158	1168	1235	1235	1224
DISCH	119	146	161	214	275

FOR ELECTRICAL INFORMATION SEE PAGES 7A & 7B IN THE WASTEWATER CATALOG

NOTE:

1. APPLICABLE DIMS FOR 6"HH MODEL WERE CALCULATED USING FLYGT DISCHARGE CONNECTION 309 77 06.

FLYGT

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SUPERSEDES 3/79	ISSUED 2/82

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ELECTRICAL DATA

MOTOR DATA

HP	Ø	Vnom	Rated Amps	Start Amps	Rated KW	Start KVA	Rated KVA	NEC Code Letter #	Poles/ RPM
29	3	200	83	440	25	152	28.8	F	4/1740
29	3	230	72	440	25	175	28.7	G	4/1740
29	3	460	36	220	25	175	28.7	G	4/1740
29	3	575	29	180	25	179	28.9	G	4/1740
35	3	230	92	520	30	207	36.6	G	6/1170
35	3	460	46	260	30	271	36.6	J	6/1170
35	3	575	37	280	30	279	36.8	J	6/1170
47	3	230	110	760	39	302	43.8	H	4/1755
47	3	460	55	410	39	326	43.8	H	4/1755
47	3	575	44	320	39	318	43.8	H	4/1755

Ref: National Electrical Code, Section 430.7

POWER FACTORS AND EFFICIENCIES

Pump Motor Horsepower	Motor Eff. 100% Load	Motor Eff. 75% Load	Motor Eff. 50% Load	P. F. 100% Load	P. F. 75% Load	P. F. 50% Load
29	.87	.85	.85	.87	.79	.67
35	.87	.86	.86	.82	.74	.63
47	.90	.90	.88	.89	.85	.77

##Motor efficiencies and power factors shown are for "Rated KW" as shown in Motor Data chart

CABLE DATA

Pump–Volts	Max. Length	Cable Size	Cable Diameter	Conductors
29 H.P. 200V	200 ft.	(1) #6/3-2-1 for 460/575V	31mm (1.2")	(3) #6AWG (PWR) (2) #10AWG T.S.) (1) #8AWG (GND)
29 H.P. 230V	265 ft.			
29 H.P. 460V	520 ft.			
29 H.P. 575V	800 ft.			
35 H.P. 230V	205 ft.			
35 H.P. 460V	410 ft.	(2) #6/3-3-1 for 200,230V		(6) #6AWG (PWR) (2) #10AWG (T.S.) (2) #8AWG (GND)
35 H.P. 575V	520 ft.			
47 H.P. 230V	175 ft.			
47 H.P. 460V	350 ft.			
47 H.P. 575V	520 ft.			

T.S.=Thermal Switch

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CP/CT 3201
ELECTRICAL DATA

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MOTOR DESIGN – Dry, shell type, NEMA design B, induction squirrel cage motor. Class F insulation rated 155°C, 40°C ambient plus 115°C rise. Combined service factor of 1.10 (Combined effect of voltage, frequency, and specific gravity not to exceed this value.

ELECTRICAL SERVICE SPECIFICATIONS –
Voltage Tolerance: +10%, -14%
Frequency Tolerance: +5%
Voltage Balance (Phase-to-Phase): ±1%

CABLE SPECIFICATIONS – Material: Jacket-Dupont Hypalon (Chlorosulfanated – Polyethylene).
Insulation: Dupont Nordel (Ethylene Propylene-Diene).

MOTOR PROTECTION – Motor and Power Line protection for overload and short circuit conditions must conform to N. E. C. standards, ref. NATIONAL ELECTRICAL CODE, 1975 edition, Article 430. The stator is protected by three thermal switches (one per phase) imbedded in the windings. These switches are wired in series and two leads are brought up to the pump terminal board for connection to the control panel. The switches must be connected so that the pump is turned off if the stator overheats.

PUMP CONTROLS – A full line of pump control panels is available to provide proper protection and, where desired, automatic control for simplex and duplex stations in three versions: Standard, Intrinsically Safe, and Intrinsically Safe (California Code). Refer to catalog section "E" for a complete description of the Flygt control panels that are available.

35 HP - 1170 RPM
3ϕ: 200, 230/460, 575V

STD. C-3201

Wastewater Impeller 637

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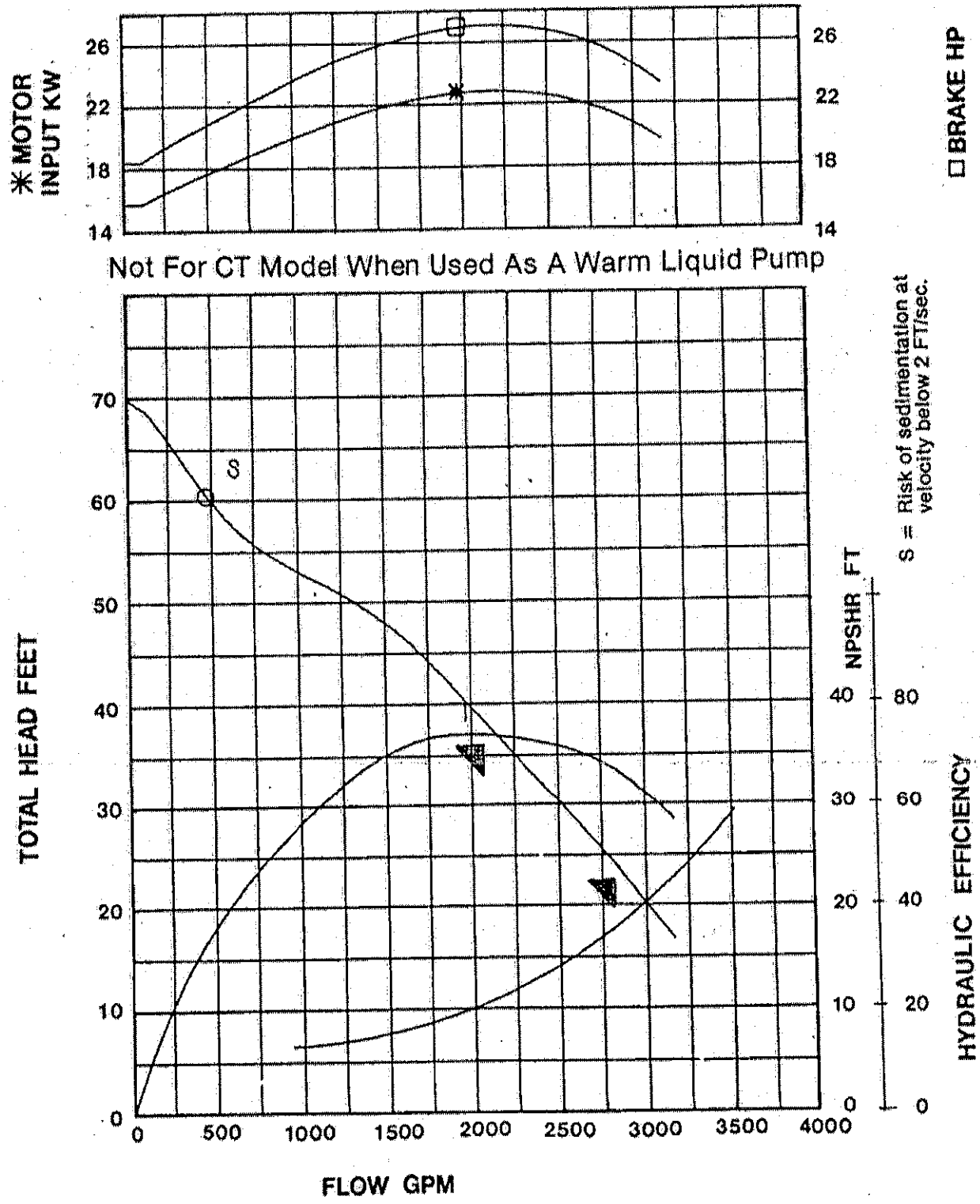

PERFORMANCE CURVES ARE BASED ON TESTS WITH CLEAR WATER AT AMBIENT TEMPERATURE.

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APPENDIX E

Albuquerque Bernalillo County Water Utility Authority

Lockout/Tagout (LOTO)

Albuquerque Bernalillo County
Water Utility Authority

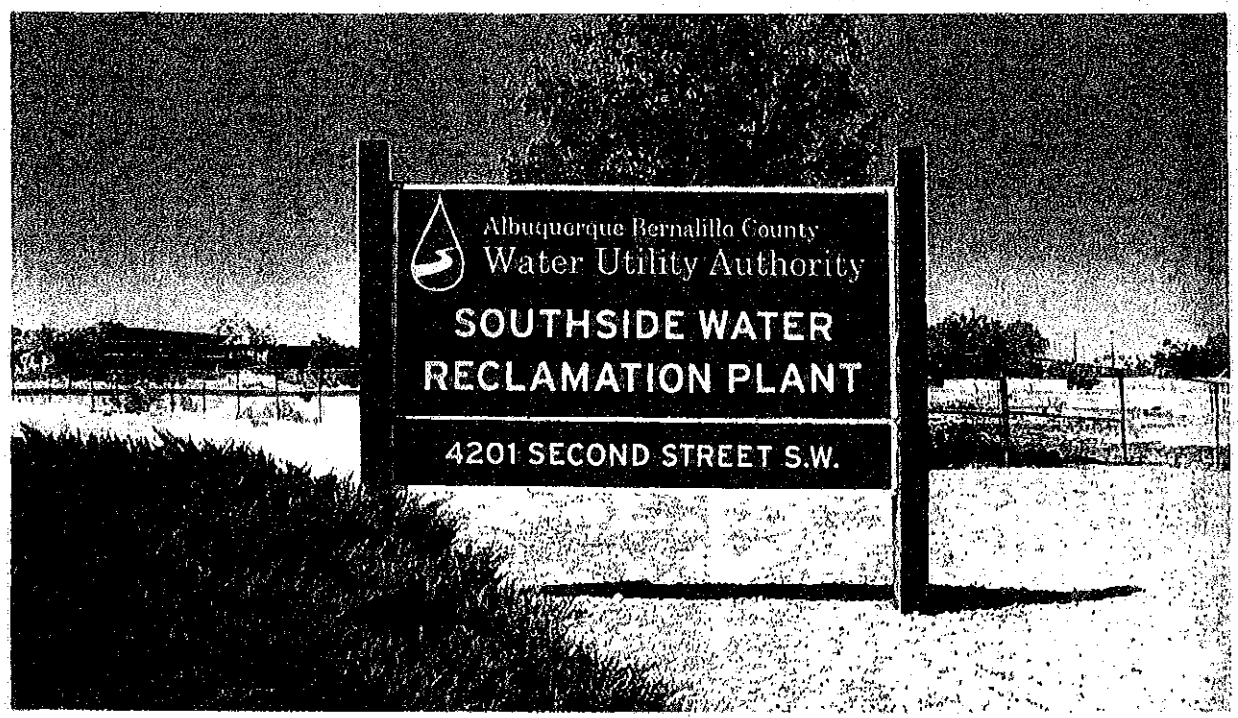
Southside Water Reclamation Plant

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

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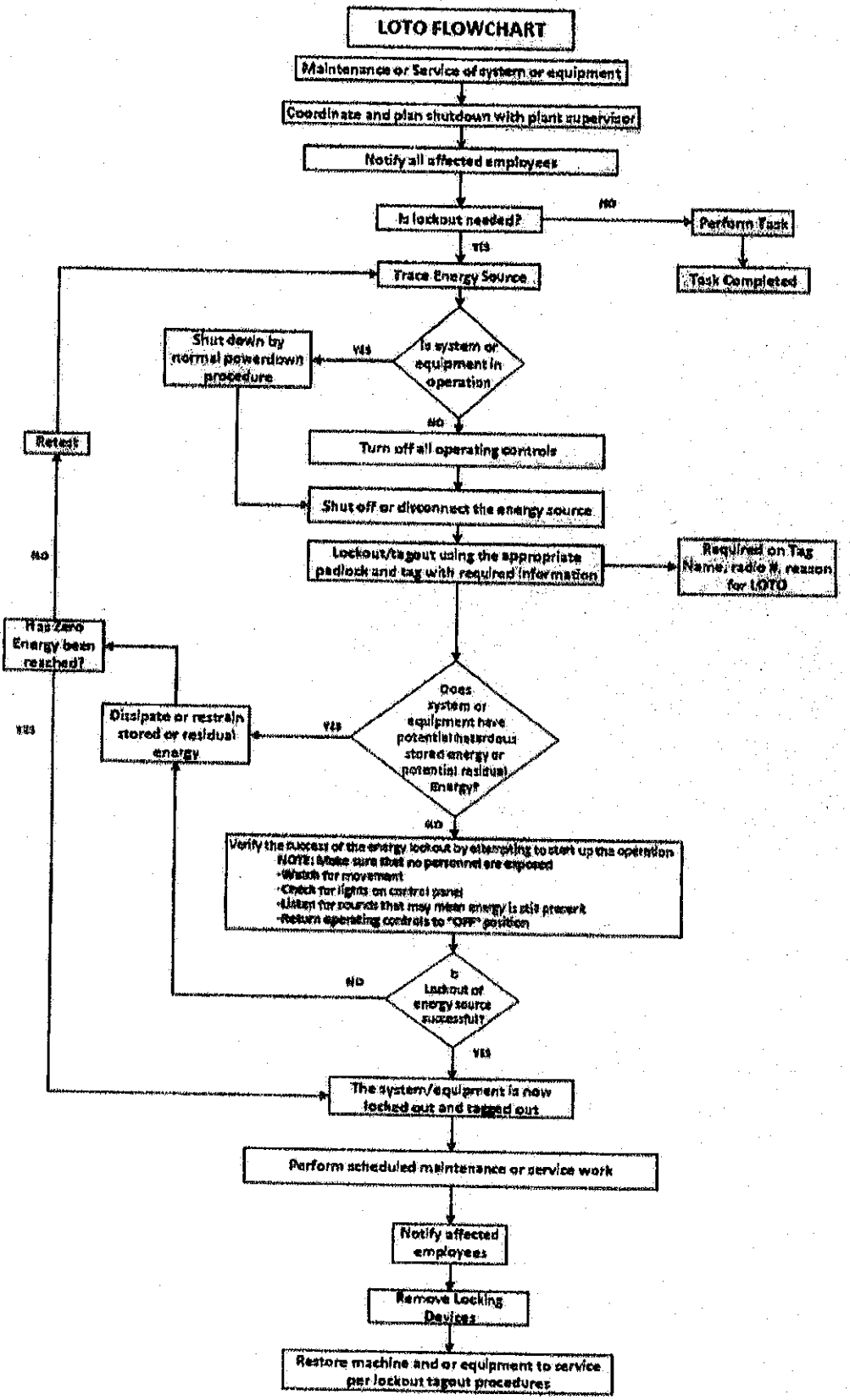
Lockout/Tagout

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

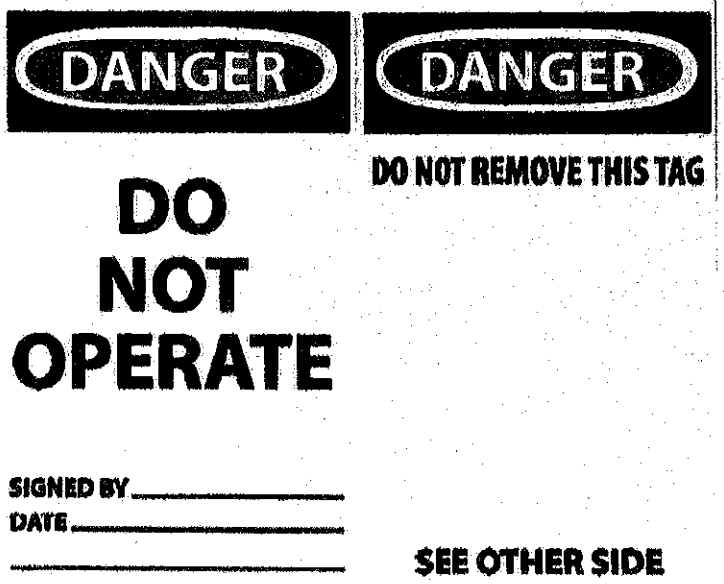
(A) Outside personnel/contractors shall be advised that the SWRP has and enforces the use of LOTO procedures. They will be informed of the use of locks and tags and notified about the prohibition of attempts to restart or re-energize machines or equipment that are locked out or tagged out.

(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

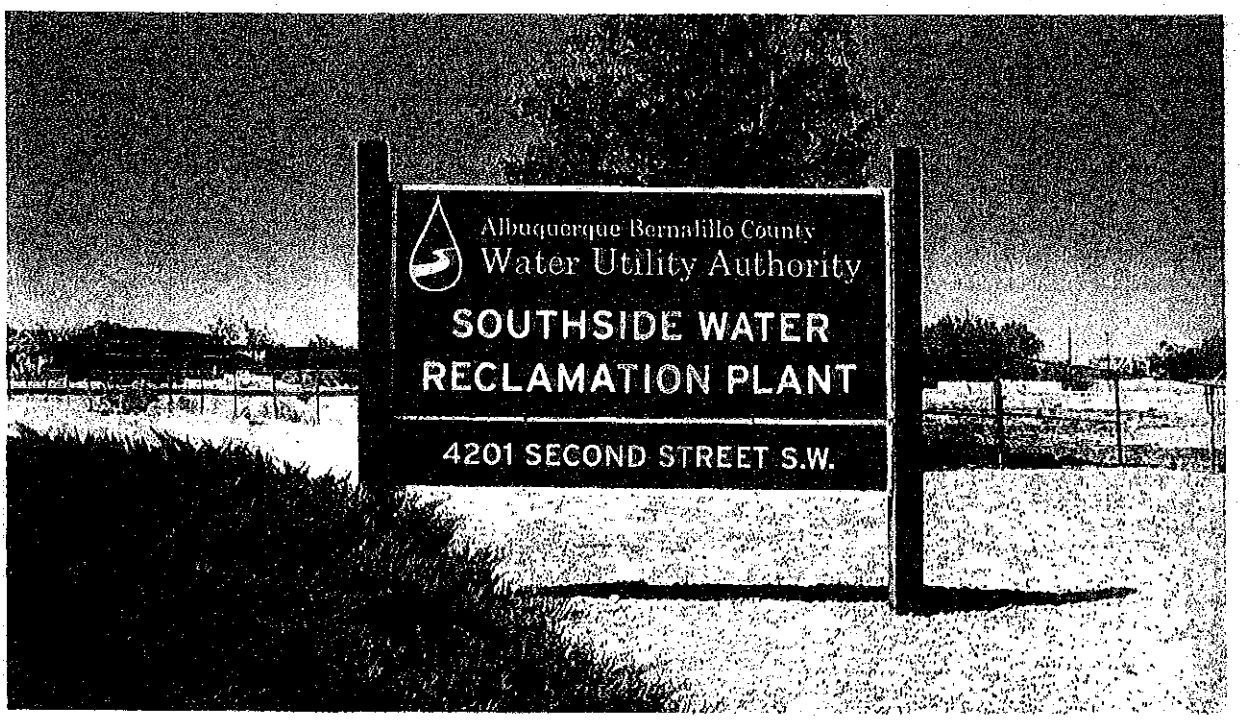
APPENDIX F

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: _____

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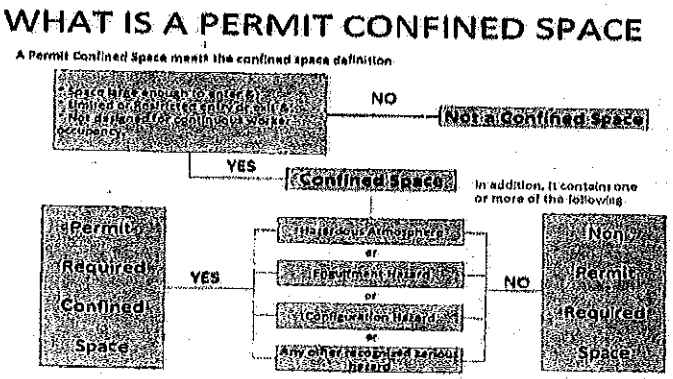
ALBUQUERQUE BERNALILLO COUNTY WATER UTILITY AUTHORITY
CONFINED SPACE ENTRY PROGRAM

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_____
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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.