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200-UP-1 Pilot-Scale Groundwater Treatment System Operating Procedures

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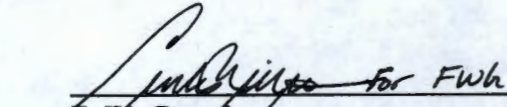
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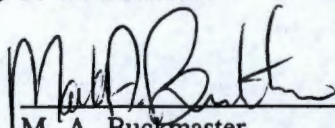
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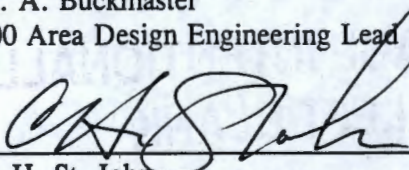
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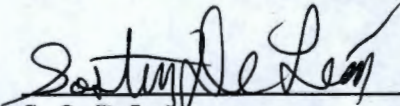
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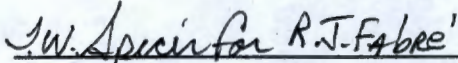
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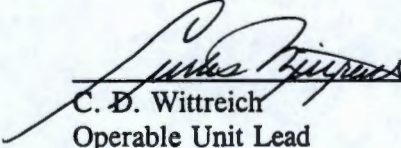
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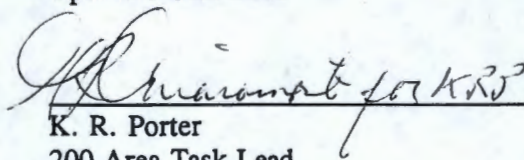
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1.0 INTRODUCTION

1.1 PURPOSE

The purpose of this document is to describe the procedures for operating the 200-UP-1 Pilot-Scale Treatment System for the removal of uranium and technetium from groundwater in the 200 West Area. Procedures for performing routine activities, including ion exchange (IX) resin changeout, filter changeout, and system dewatering, have been included as part of this operating procedure (OP).

The treatment system is being evaluated for its effectiveness at selectively removing uranium and technetium from the groundwater using IX resin.

1.2 SCOPE

This treatability test will be performed at the 200-UP-1 Operable Unit near the U-17 Crib just southeast of the U-Plant in 200 West Area. The treatment system includes:

- Extraction wells from which the contaminated groundwater is obtained
- Return wells for reinjecting treated groundwater to the aquifer
- Two 20,000-gal storage tanks, one for storage of influent (contaminated groundwater) and one for storage of treated effluent
- A 10,000-gal process water tank that provides water for chemical makeup (if required) and other ancillary uses
- An influent pump station with prefilters and control panel for pumping water through the treatment system into the effluent storage tank
- A process treatment skid with main process control panel
- An effluent pumping station with filters and control panel for pumping treated effluent to the return well.

The overall system will be connected with a series of 2-in.-high pressure hoses fitted with quick disconnect fittings and power and signal cables. A portable generator will provide 480-VAC, 3-phase power that will power the pumps and be transformed to 240/120-VAC single phase for powering ancillary equipment.

The Pilot-Scale Treatment System is operated with the extraction well pump(s) and effluent pump running on a 24 hr/day basis for filling the influent tank and disposing of treated effluent from the effluent storage tank. The treatment system is operated for 6 to 8 hr/day (under normal conditions). A programmable logic controller is used to monitor critical operating parameters and shut the system down in case of abnormal conditions.

1.3 PRE-STARTUP CHECK

If the system has been modified, ensure that the appropriate acceptance test has been performed on new components. Acceptance test results are to be documented in the Field Log Book.

Refer to Process Flow Diagram, drawing number 0200W-DD-JOOO3, for system operations.

1.3.1 Safety and Readiness Walkthrough

Perform a safety and readiness walkthrough (a physical inspection) of the system, including the storage tanks, extraction and return wells, hoses, process system, annunciator panel, and generator to verify that the system is functional, properly connected, and ready for safe operation. If discrepant conditions are found, note them in the logbook and on discrepancy log sheet and correct before startup. In checking the hoses, perform a walkdown of the hoses connecting the system following the flow from the Well Pump to the Disposal Well to verify integrity:

- Extraction well pump discharges to the Influent Storage Tank inlet manifold
- Influent Storage Tank outlet manifold to the Influent Pump skid suction
- Influent Pump skid discharge to the Process System skid inlet manifold
- From the Inlet manifold to the lead IX column inlet (at top for down flow), then from the bottom of the lead IX column to the inlet (top) of the polish IX column
- From the polish IX column to the top of the granular activated carbon (GAC) column
- From the outlet (bottom) of the GAC column to the discharge manifold
- Process System skid discharge manifold to the Effluent Storage Tank inlet
- Effluent Storage Tank outlet to the Effluent Pump skid suction
- Effluent Pump skid discharge to the disposal well.

1.3.2 Valves

Verify that all valves are closed (assuming that neither the extraction well(s) nor the effluent pumping system is operating; if so see Section 1.3.5), including sample valves, and verify that electrical switches are in off (or open) positions.

1.3.3 Filter Housing Lids

Verify that filter housing lids are closed and that filters are ready to accept flow.

1.3.4 Pressure Instruments

Verify that the pressure gauges and differential pressure instruments for monitoring differential pressures of the influent and effluent filters, and the IX columns are operable. In addition, verify that the influent and effluent storage tank sight gauges or level transmitters/indicators are operable.

1.3.5 Valving

If the extraction well and/or effluent pumping systems are operating, verify that all treatment system valving are closed.

2.0 STARTUP AND OPERATION

To start operations, the process treatment system will be configured by manually aligning ball valves using level sight gauges and/or tank level indicators on the Influent and Effluent Storage Tanks and using pressure gauges, flowmeters, and differential pressure for controlling the treatment process. The pH, dissolved oxygen, turbidity, and temperature instrumentation is to be used for monitoring process conditions.

If starting the extraction well, systems valves are to be aligned for flow from the Extraction Well Pump(s) to the Influent Storage Tank. When a sufficient volume of extracted groundwater is in the Influent Storage Tank, the treatment system is brought on-line using an Influent Pump to move water through a minimum of two filter columns, through two IX Columns in series flow, then a GAC column, and out to the Effluent Storage Tank. When a sufficient volume of treated effluent is in the Effluent Storage Tank, the water return system is started by pumping water from the effluent storage tank through a minimum of two canister filters and into the return well.

The system utilizes level controls and flow controls with interlocks to prevent overflowing the tanks, protect pumps from loss of flow, warn of breaching of the hoses, and monitor well levels. Differential pressure instrumentation is used on the filters and IX columns to alarm on high differential pressures, indicating the need for changing filters or backwashing or changing media in the columns.

If the extraction well pumps are operating, skip Section 2.2. If the effluent pumping system is operating, skip Section 2.4.

2.1 ELECTRICAL POWER

2.1.1 Generator

If the generator is not running (extraction well and effluent pumps are not operating) verify that the main disconnect switch and the control power switch are off. If the generator is running, verify that control switches are in the appropriate positions for operation to be performed.

2.1.2 Start

Start the generator.

2.1.3 Actuate Main Power Switch(es)

Energize power to the control panel by actuating the main control disconnect switch and the control power switch(es).

2.2 START EXTRACTION WELL PUMP(S)

NOTE: Extraction well pumps may be started in any order.

2.2.1 Extraction Well 1A

Open the following valves for operation of extraction well 1A (all other valves in extraction well 1A system are to be closed):

BV-2, BV-4, BV-6, BV-7, BV-17 (or BV-18 and BV-19 if rotameter loop is to be used) and BV-22.

Valve BV-8 is used to control the flow rate from extraction well 1A. When starting well 1A, open BV-8 approximately 50%.

2.2.2 Extraction Well 1B

Open the following valves for operation of extraction well 1B (all other valves in extraction well 1B system are to be closed):

BV-11, BV-12, BV-13, BV-15, BV-17 (or BV-18 and BV-19 if rotameter loop is to be used) and BV-22.

Valve BV-16 is used to control the flow rate from extraction well 1B. When starting well 1B, open BV-16 approximately 50%.

2.2.3 Valve MBV-1

Open Motor Operated Ball Valve MBV-1 by pressing the MBV-1 reset button and setting the MBV-1 switch to the Manual position.

2.2.4 Control Panel

Verify that the following lights on the influent pumping station control panel or the main control center panel are not illuminated:

- Influent Storage Tank level, "High"
- Influent Storage Tank level, "High, High."

Refer to Section 7.0 if these indicator lights are illuminated.

2.2.5 Start Extraction Well Pump

Start either Extraction Well Pump by holding in the appropriate "Start" pushbutton until flow is established. Watch for flow on FIT-1A and makeup of flow switch FS-1A if starting well 1A or FIT-1B and makeup of Flow Switch FS-1B if starting well 1B. Release the pushbutton once flow is established. If flow cannot be established, refer to step 2.2.7.

2.2.6 MBV-1 Selector Switch

Switch MBV-1 selector switch to the Auto position.

2.2.7 Set Flow Rate

Use throttle valve BV-8 to set flow rate from extraction well 1A to desired level. Use throttle valve BV-16 to set flow rate from extraction well 1B to desired level.

2.2.8 Control Panel

Verify that the following lights on the influent pumping station control panel or the main control center panel are not illuminated:

- Influent Storage Tank Level, "High"
- Extraction Well Level, LSL-1A or LSL-1B, "Low"
- FS-1A or FS-1B
- Influent Storage Tank Level, "High High."

Refer to Section 7.0 if these indicator lights are illuminated.

2.3 START ION EXCHANGE TREATMENT SYSTEM

2.3.1 Ball Valve Configuration

The ion-exchange treatment system may be operated under three possible configurations, depending upon which column is designated lead, polish, and reserve. The ball valves to be open for operating under each configuration are described below. The operator shall verify the system configuration before positioning of valves for operation. The configuration being used will be documented in the Field Log Book.

Regardless of which configuration is used, the following ball valves shall be opened.

- BV-23, BV-29, BV-43, BV-44, BV-45, BV-50, BV-81, BV-82, BV-84, BV-85, BV-89, and BV100. In addition, a minimum of two filter columns must be valved open. Open BV-35 and BV-39 for column F-1A, BV-36 and BV-40 for column F-1B, BV-37 and BV-41 for column F-2A and BV-38 and BV-42 for column F-1B.
- If running Influent Pump P-2A, fully open BV-31 and open BV-32 approximately 30%. BV-32 is used to control the flow rate (and operating pressures) of the treatment system when operating P-2A.
- If running Influent Pump P-2B, fully open BV-33 and open BV-34 approximately 30%. BV-34 is used to control the flow rate (and operating pressures) of the treatment system when operating P-2B.

Configuration 1: Tank 2 is lead, tank 3 is polish, and tank 4 is reserve. (Refer to Figure 1.) For operations using this configuration, open BV-51, BV-54, BV-55, BV-58, BV-61, BV-64, BV-65, and BV-68.

Configuration 2: Tank 3 is lead, tank 4 is polish, and tank 2 is reserve. (Refer to Figure 2.) For operations using this configuration, open BV-61, BV-64, BV-65, BV-68, BV-71, BV-74, BV-75 and BV-78.

Configuration 3: Tank 4 is lead, tank 2 is polish, and tank 3 is reserve. (Refer to Figure 3.) For operations using this configuration, open BV-71, BV-74, BV-75, BV-78, BV-51, BV-54, BV-55 and BV-58.

2.3.2 Motor-Operated Ball Valve

Open motor-operated ball valve MBV-2 by pressing the MBV-2 reset button and setting the MBV-2 switch to the manual position.

2.3.3 Start Influent Pump

Start either Influent Pump P-2A or P-2B by holding in the appropriate "Start" pushbutton until flow is established. Watch for flow on FIT-2 and makeup of FS-2, FS-3, and FS-4. Release the pushbutton once flow is established. If flow cannot be established, refer to Step 2.3.6.

2.3.4 MBV-2 Selector Switch

Switch MBV-2 selector switch to the Auto position.

2.3.5 Set Flow Rate

Use throttle valve (BV-32 for pump P-2A, or BV-34 for pump P-2B) to set flow rate. **Flow rate shall not exceed 70 gal/min (required for a minimum contact time of 4 min). The pressure in the IX column shall not exceed 65 psig (these vessels are rated at 70 psig maximum).** These pressures are determined using PI-7 for tank 2, PI-10 on tank 3, and PI-13 on tank 4.

2.3.6 Annunciator Panel

Verify that the following lights on the annunciator panel are not illuminated.

- Flow switch FS-2
- Flow switch FS-3
- Flow switch FS-4
- Influent Storage Tank Level, "Low"
- Effluent Storage Tank Level, "High"
- Effluent Storage Tank Level, "High High."

Refer to Section 7.0 if these indicator lights are illuminated.

2.4 START EFFLUENT PUMP

When the Effluent Storage Tank has a sufficient volume of treated effluent, an Effluent Pump is started as follows to discharge the treated effluent into the selected disposal well.

2.4.1 Ball Valves

The following ball valves (BV) are to be positioned before startup of the Effluent Pump(s).

- If running Effluent Pump P-5A, open BV-101, BV-105, BV-108, BV-116, BV-117, BV-118, BV-121 and BV-122. Open BV-110 approximately 50% (This valve is used to control the flow rate when operating pump P-5A).
- If running effluent pump P-5B, open BV-101, BV-105, BV-109, BV-116, BV-117, BV-118, BV-121 and BV-122. Open BV-111 approximately 50%. (This valve is used to control the flow rate when operating pump P-5B.)

In addition, a minimum of two filter columns must be valved open. Open BV-112 and BV-114 for columns F3A and F3B, BV-113 and BV-115 for columns F4A and F4B.

2.4.2 Annunciator Panel

Verify that the following annunciator lights on the annunciator panel are not illuminated:

- Disposal Well level, "High"

- Effluent Storage Tank level, "Low."

2.4.3 Pumps P-5A/P-5B

Start either effluent Pump P-5A or P-5B by holding in the appropriate "Start" pushbutton until flow is established. Watch for flow on FIT-3 and makeup of FS-5 and FS-6. Release the pushbutton once flow is established. If flow cannot be established, refer to Step 2.4.3.

2.4.4 Annunciator Lights

Verify that the following annunciator lights on the annunciator panel are not illuminated:

- Disposal Well Level, "High"
- Effluent Storage Tank Level, "Low"
- FS-5
- FS-6

Refer to Section 7.0 if these indicator lights are illuminated.

2.5 BACKWASH PROCEDURE

When new IX resin or GAC is loaded into the process columns and before it is placed into service, it must be backwashed to remove fines and color bodies. The test engineer may also schedule a column backwash to reduce the pressure drop across the column. When a backwash is to be done, the Treatment System will be shut down. Two pumps are available for use for backwashing, the backwash pump (located on the Process Skid) and the gas motor operated pump. If sufficient treated or clean water exists in the Effluent Storage Tank, it may be used for the backwash water source.

Backwashing is performed manually. To set up for backwash, perform the following. (Note: The backwash will require nominally 1000-3000 gal per column depending on size and amount of media. Sufficient backwash water must be available.)

NOTE: The GAC column should be filled 50% with GAC. After filling with GAC, it is advisable to fill the tank with water and allow the tank to soak overnight before backwashing operations begin.

2.5.1 Effluent Storage Tank Connection

Connect a hose from the Effluent Storage Tank or Process Water Tank to the quick disconnect on the suction side of Pump P-3 (or to the suction of the gas motor operated pump).

2.5.2 Backwash Pump Connection

Connect a hose from the discharge of the backwash pump (or to the suction of the gas motor operated pump) to the Process Manifold inlet, just upstream of FS-3. This will provide flow control for the backwash.

2.5.3 Quick Disconnect

Connect a hose from the quick disconnect at the outlet of the manifold (just downstream of BV-50) to the bottom of the column to be backwashed (near BV-58, BV-68, BV-78 or BV-85).

2.5.4 Backwash Solution

The backwash solution will be sent back through the Influent Filters to remove solids and then into the Influent Storage Tank. Connect a hose from a quick disconnect at the top of the IX Column being backwashed to BV-29 at the inlet of the Influent Filters (flow will be through pumps P-2A or P-2B) and a hose from BV-45 (filter outlet) to the outlet manifold of the Influent Storage Tank near MBV-2.

2.5.5 New Media

Backwash new media in each column until the colored backwash solution turns clear (carbon fines, fractured resin beads, or color bodies contribute to the color). As stated above, this may require approximately 1000 to 3000 gal per column and may take approximately 1 to 2 hours. The backwash rate should be sufficient to expand the bed 30% to 50% and should require approximately 20 gal/min for both the IX resin and the GAC. **Be sure not to exceed the 65 psig pressure rating on the IX columns.**

2.5.6 Normal Processing Water Flow

When backwash is complete, secure hoses and valves and make correct hose connections to allow establishing normal processing water flow as described in Section 1.3.

2.5.7 Documentation

Table 1 is provided to document these steps, and a copy of this checklist is to be maintained in the field files.

Table 1. Backwash of IX Columns.

OPERATOR: _____ DATE: _____

Backwash Checklist		Verified/Date
1.	Verify that sufficient backwash water is available for backwashing.	
2.	Connect a hose from the Effluent Storage Tank or Process Water Tank to the suction of the backwash pump (or the gas motor operated pump) as described in Section 2.6.1.	
3.	Connect a hose from the backwash pump (or gas pump) discharge to the inlet of the Process Manifold as in Section 2.6.2.	
4.	Connect a hose from the quick disconnect at the outlet of the process manifold to the bottom of the column being backwashed as in Section 2.6.3.	
5.	Connect a hose from a quick disconnect at the top of the IX Column being backwashed to BV-29 at the inlet of the Influent Filters, and a hose from BV-45 (filter outlet) to the outlet manifold of the Influent Storage Tank near MBV-2.	
6.	Backwash new media at 20 gal/min in each column until the colored backwash solution turns clear (carbon fines, fractured resin beads, or color bodies contribute to the color). As stated above this may require approximately 1000-3000 gal per column, and may take approximately 1 to 2 hours. Do not exceed 65 psig on IX columns (monitor frequently).	
7.	When backwash is complete, secure hoses and valves and make correct hose connections to allow establishing normal processing water flow as described in Section 1.3.	

2.6 SYSTEM DEWATERING PROCEDURE

Routine maintenance activities and freezing weather conditions may require that system components be periodically dewatered. Removal of water from the system is accomplished using compressed air to push the water from the system into either the influent or effluent storage tanks. The separate stages of the system (extraction, process, and effluent pumping system) can be isolated from one another and therefore dewatered separately. Dewatering of the process system in freezing weather is all that is required if the extraction and effluent systems are to remain operating overnight.

CAUTION: Do not exceed 50 psig air pressure when dewatering the system. Relieve the air pressure from the lines after dewatering the system(s) to ensure that freezing weather conditions/ice blockage do not create localized high-pressure areas that may injure maintenance or operating personnel. Do not use compressed air to blow out ice from a line.

2.6.1 Extraction Well Dewatering

- Extraction Well 1A:

- Connect air hose from compressor to air fitting located near BV-3. Turn on air compressor and pressurize air hose to 30-40 psig.
 - Ensure BV-2, BV-6, BV-7, BV-8, BV-17 (or BV-18 and BV-19), BV-22 and MBV-1 are open. All other valves in extraction well 1A system are to be closed (including BV-3).
 - Slowly open BV-3, pressurizing extraction well 1A and forcing the stagnant water into the influent storage tank. Once air is heard entering the tank, elevate the high-pressure flexible hosing beginning at the well head and working towards the influent manifold on the influent storage tank. Close BV-22 to prevent water from re-entering the lines. If extraction well 1B is to be dewatered, Close BV-8 at this time.
 - Relieve air pressure from system through the air vacuum valve by opening BV-4. Air pressure can also be relieved by releasing pressure at the air compressor through the line pressure regulator.
 - Close BV-3 and disconnect air hose.
- Extraction Well 1B:
 - Connect air hose from compressor to air fitting located near BV-14. Turn on air compressor and pressurize air hose to 30-40 psig.
 - Ensure BV-11, BV-13, BV-15, BV-16, BV-17 (or BV-18 and BV-19), BV-22 and MBV-1 are open. All other valves in extraction well 1B system are to be closed (including BV-14).
 - Slowly open BV-14, pressurizing extraction well 1B lines and forcing the stagnant water into the influent storage tank. Once air is heard entering the tank, elevate the high-pressure flexible hosing beginning at the well head and working towards the influent manifold on the influent storage tank. Close BV-22 to prevent water from re-entering the lines.
 - Relieve air pressure from system through the air vacuum valve by opening BV-4. Air pressure can also be relieved by releasing pressure at the air compressor through the line pressure regulator.
 - Close BV-14 and disconnect air hose.

2.6.2 Process Treatment System

- Connect air hose from compressor to air fitting located near BV-30. Turn on air compressor and pressurize air hose to 30-40 psig.

- Ensure all ball valves on the process system that were open during processing are open, including MBV-2. BV-30, BV-31, and BV-33 are to be closed.
- Slowly open BV-30, pressurizing the water line leading from the influent storage tank to the influent pumping station, forcing the stagnant water into the influent storage tank. Once air is heard entering the tank, elevate the high-pressure flexible hosing beginning at the influent pump skid, working towards the effluent manifold on the influent storage tank. Close BV-23 to prevent water from re-entering the line. Close MBV-2.
- Close BV-29 and BV-30. Open BV-31 if pump P-2A was used. Open BV-33 if pump P-2B was used. Slowly open BV-30, pressurizing the water line leading from the influent pumping station to the process treatment skid located in the tent. This forces the stagnant water from the line into the lead column and pushes the water displaced from the lead column through the system and into the effluent storage tank. Watch for flow on FIT-2. When no flow is seen, elevate the high-pressure flexible hosing beginning at the influent pump skid working towards the process tent. Once reaching the tent, place the elevated line on the stand located just outside the tent where the process line enters. This prevents any residual water from the hose inside the tent from collecting outside the heated environment. Close BV-30.
- Relieve air pressure from the air hose using the line pressure regulator on the compressor. Disconnect the air hose. Relieve the pressure in the system by opening BV-30. Use a poly hose to direct the pressure into a container. The air pressure can also be relieved from the system by opening the purge line located at the top of the lead column. Close BV-85.
- Connect air hose from compressor to air fitting located near BV-88. Turn on air compressor and pressurize air hose to 30-40 psig.
- Open BV-87, slowly open BV-88, pressurizing the water line leading from the process treatment skid to the effluent storage tank. Once air is heard entering the effluent storage tank, elevate the high-pressure flexible hosing beginning with the process treatment system and working towards the effluent storage tanks influent manifold. Close BV-100 to prevent water from re-entering the lines.
- Relieve air pressure from the air hose using the line pressure regulator on the compressor. Disconnect the air hose. Relieve the pressure in the system by opening BV-88. Use a poly hose to direct the pressure into a container.

2.6.3 Effluent Pumping Station

- Connect air hose from compressor to air fitting located near BV-106. Turn on air compressor and pressurize air hose to 30-40 psig.
- Ensure all ball valves on the effluent pumping system that were open during processing are open. BV-106, BV-108, and BV-109 are to be closed.
- Slowly open BV-106, pressurizing the water line leading from the effluent pumping station to the effluent storage tank, forcing the stagnant water into the effluent storage tank. Once

air is heard entering the tank, elevate the high-pressure flexible hosing beginning at the effluent pumping skid working towards the effluent manifold on the effluent storage tank. Close BV-101 to prevent water from re-entering the line.

- Close BV-105 and BV-106. Open BV-108 if pump P-5A was used. Open BV-109 if pump P-5B was used. Slowly open BV-106, pressurizing the water line leading from the effluent pumping station to the return well. This forces the stagnant water from the line into the return well. Watch for flow on FIT-3. When no flow is seen, elevate the high-pressure flexible hosing beginning at the effluent pump skid working towards the return well. Close BV-106.
- Relieve air pressure from the air hose using the line pressure regulator on the compressor. Disconnect the air hose. Relieve the pressure in the system by opening BV-107. Use a poly hose to direct the pressure into a container. The air pressure can also be relieved from the system using the air-vacuum valve located on the return well manifold by opening BV-122.

2.7 FILTER CHANGEOUT

The filters periodically require changeout of the filter elements (bags for influent filters or cartridges for effluent filters) when they become clogged with solids. This is evident by increasing differential pressure across the filters as measured by the differential pressure transmitters, which alarm at 30 psig differential. In general, when the filters are to be changed out, the process is shut down, valves are positioned, and residual water is blown out of the filter housings with the air compressor. This minimizes personnel contact with potentially contaminated solutions during the changeout procedure.

2.7.1 Influent Filter Changeout

NOTE: An RCT must be present whenever opening/breaching the system (per Radiation Work Permit [RWP]).

NOTE: After blowing out the water, be sure that all the air is bled out of the lines and verify that there is no pressure before opening filter housings.

- If the process is operating, follow procedures to shut down the process system.
- Be sure that MBV-2 and BV-23 are closed.
- Dewater filter columns following blowout procedures for influent pumping station outlined in Section 2.6.
- Bleed all air pressure from filter column through port located near BV-30. Bleed air into a container to contain any residual water.
- Open filter column, remove filter, and place into a plastic bag. Radiological Control Technicians (RCT) may survey filter housing. Replace filters and securely close filter housings.

2.7.2 Effluent Filter Changeout

NOTE: After blowing out the water, be sure that all the air is bled out of the lines and verify that there is no pressure before opening filter housings.

- If the process is operating, follow procedures to shut down the process system.
- Be sure that BV-101 is closed.
- Dewater filter columns following blowout procedures for effluent pumping station outlined in Section 2.6.
- Bleed all air pressure from filter column through port located near BV-107. Bleed air into a bucket to contain any residual water.
- Open filter column, remove filter, and place into a plastic bag. Replace filters and securely close filter housings.

2.8 ION EXCHANGE RESIN CHANGEOUT PROCEDURE

Ion exchange resin changeouts will occur as scheduled by the test engineer. Changeouts typically occur once the resin has been loaded to capacity with contaminants. The resin changeouts will be performed in accordance with the RWP prepared for the changeout and with the site safety plan and/or any specific safety permits deemed necessary by the site safety specialist or RCT.

Current permits and plans (latest revision, not expired):

- RWP for resin change
- Health and safety plan
- Waste packaging requirements.

Tools and Supplies:

- Glovebag/box that fits manway
- Scaffolding with ladders to hold workers and glove bag/box
- Universal separator (modified drum lid)
- 4-in.-diameter PVC tubing 6 ft in length and large funnel or similar device to load resin into column
- Fittings necessary to attach vacuum hose to both vacuum and separator
- Two rolls of duct tape
- Minimum of six 10-mil reinforced polyethylene drum liners for 55-gal drums

- Minimum of six 55-gal galvanized steel drums
- Drum labels as appropriate.
- Minimum of 50 ft² of reinforced yellow polyethylene tarps for secondary containment around 55-gal drums
- Radiological posting and rope - four surface contamination area (SCA) signs, four radiologically buffered area (RBA) signs, 50 ft of yellow and magenta rope and one Step-off pad
- Minimum of four stations
- Laundry bags for used anti-Cs
- HEPA-filtered vacuum cleaner with vacuum hose (2 @ 15 ft)
- Extension cords to power vacuum
- Vacuum nozzle tubing
- Minimum of two boxes of absorbent wipes
- Minimum of six yellow polyethylene bags for waste generated during wipedown of glovebag
- Minimum of ten stay ties, at least 12 in. long
- Tools for cutting plastic and stay ties
- Two 12-in.-long, 3/4-in.-diameter threaded bolts
- Four nuts that fit above bolts

2.8.1 Spent Resin Removal Process

- A. Dewater IX column by attaching the air compressor hose to the air fitting located at the top of the column to be dewatered (Note: make sure the valve located immediately downstream of this fitting is closed). Pressurize air hose to 30-40 psig. Close the 2-in. ball valve at the top of the tank and open the valves downstream of the column into the effluent storage tank. This configuration will allow the water in the column to be forced downstream into the next column. Open the ball valve downstream of the air fitting, beginning the dewatering process. Continue to provide air at approximately 40 psig for 10 minutes.
- B. Bleed any residual pressure from the IX column into purgewater carboy (with drain line) attached to the same port utilized to dewater the column. (Check pressure using gauge located at top of vessel.) Let the column sit overnight. Verify that the column has been adequately dewatered by opening the sample port located at the bottom of each column.

(Place a container under sample port.) If a significant volume of water remains, repeat steps A and B.

- C. Remove retaining bolts on IX column manhole cover that are in the 12 o'clock and 6 o'clock positions (use a drip pan to contain any water that may drip out as bolts are loosened). Replace each of the two bolts with a 1-ft-long bolt, adjusting them so that they contact the column behind the manhole flange. Tighten a nut on each 1-ft bolt to hold the cover in place.
- D. Remove all remaining bolts and nuts utilizing the 12-in. bolts to hold the manhole cover in place.
- E. Install glove box/bag forming a seal between the bag and the outer edge of the manway.
- F. Place channel iron or similar material in bottom of glovebag to lay the manway cover on. This will allow room for worker's hands when laying the cover on the glovebag floor. (Elevating the cover in this manner will make re-installation easier.)
- G. Stock the glove box/bag with all necessary equipment to perform bead removal (e.g., wrenches, sleeved vacuum hose, wipes, etc).
- H. Remove the nuts on the front of the manway cover (on the 12-in. bolts), slide the manhole cover away from the column, and place it on prepared surface in the glove box/bag.

NOTE: It will not be necessary to replace the manhole cover overnight if work extends into the next day because the glove box/bag provides full containment while the column is open.

- I. The spent resin will be drawn into galvanized steel drums with 10-mil nylon reinforced polyethylene liners inside. A secondary containment area shall be set up under the galvanized collection drums that will contain any spilled resin. The containment should be made of nylon reinforced yellow polyethylene sheeting. The containment should allow a minimum of 4 ft² per drum and allow for personnel movement within the containment area during the drum filling and closure operations. The sides of the sheeting should be folded up to form a small barrier on all sides to prevent beads from rolling off.
- J. Utilizing a HEPA vacuum (with a collection drum in line upstream of the vacuum) with a vacuum hose sleeved through the glove box/bag, remove as much of the spent resin beads as practicable.

NOTE: Operation of the HEPA vacuum, including changing the waste bag on the bottom, will be in accordance with WHC-CM-7-8 Section 9.1, Rev.0.

- K. The modified drum lid should be transferred from the full drums to the empty drums utilizing the empty drum's drum liner to sleeve the lid between drums.
- L. Horse tail full drum liner and install permanent lid on drum.
- M. On completion of the work, the waste bag will be removed from the vacuum in accordance with the above procedure and then transferred to one of the collection drums.

NOTE: A drum dolly will be used to move the full drums. The drums will be stored in an RMA until dispositioned.

- N. Materials within the glovebag will be decontaminated or packaged before removal from the glove bag.

CAUTION: Levels for removable contamination must be below RWP limits before opening the glove box/bag.

2.8.2 New Bead Installation Process

- A. Cover the HEPA filter port on the glove box/bag. Open the sleeving in the top glove box/bag. Start the HEPA vacuum with the nozzle of the hose installed inside the glove box/bag, creating air flow into the opening of the glove box/bag.
- B. Fill column with fresh beads using the access provided through the top of the glove box/bag outlined in step A. If any apparatus used to handle the new beads comes in contact with the inside of the column or manhole, the RCT will need to survey such items, as necessary. Fill column with resin to bottom of manhole (approximately 288 gal).
- C. Remove the material used to cover the HEPA port on the glove box/bag, reseal the top of the glove box/bag.
- D. Replace the manhole cover on the 12-in. bolts and tighten the two nuts that were removed until seal is formed between the manhole and manhole cover with the rubber gasket in between.
- E. Utilize the HEPA vacuum to remove any IX beads that remain in the glove box/bag regardless of their origin (clean or spent) and dispose of them in the waste drums.
- F. Remove glove box/bag and seal for storage or collapse and dispose of as waste.
- G. Replace remaining retaining bolts in manhole cover and tighten down to seat the gasket.
- H. Replace the 12-in. bolts with the original nuts and bolts. (Be certain that the manhole cover is sealed properly when backwashing and when the column is brought on-line.)

3.0 SYSTEM SHUTDOWN PROCEDURES

Shutdown of the treatment system involves turning pumps off, closing all ball valves, and dewatering the system if necessary. For normal operations, only the treatment portion of the system is shut down. The extraction and effluent pumping stations operate 24 hr/day, excluding weekends. A walkdown of the system is made before closing the site to ensure that all ball valves are closed on non-operational systems.

4.0 LEVEL INTERLOCK CHECKLIST

This Section describes testing of level interlocks. The interlocks shall be tested, at a minimum, every 120 days if operating.

4.1 INTERLOCK TESTING

Each interlock will be tested by shorting out the appropriate relays and verifying that each will stop the appropriate pump or close the appropriate valve.

4.2 START EXTRACTION WELL PUMP, P-1A, RESTART AFTER EACH TEST

LSL-1 (Low Level, Extraction Well)	Stop P-1A	_____	_____
LSH-1 (High Level, Influent Tank)	Stop P-1A	_____	_____
LSHH-1 (High-High Level, Influent Tank)	Stop P-1A	_____	_____
FS-1 (Low Flow, Extraction Pump)	Stop P-1A	_____	_____

Start extraction well pump, P-1B, restart after each test

LSL-1 (Low Level, Extraction Well)	Stop P-1B	_____	_____
FS-1B (Low Flow, Extraction Pump)	Stop P-1B	_____	_____

4.3 START INFLUENT PUMPS P-2A OR P-2B, RESTART AFTER EACH TEST

LSL-2 (Low Level, Influent Tank)	Stop P-2A/B	_____	_____
LSH-2 (High Level, Effluent Tank)	Stop P-2A/B	_____	_____
LSHH-2 (High-High Level, Effluent Tank)	Stop P-2A/B	_____	_____
FS-2 (Low/No Flow, Influent Pumps)	Stop P-2A/B	_____	_____
FS-3 (No Flow, Hose to Process Skid)	Stop P-2A/B	_____	_____
FS-4 (No Flow, Hose to Effluent Tank)	Stop P-2A/B	_____	_____

4.4 START EFFLUENT PUMPS P-2A OR P-2B; RESTART AFTER EACH TEST

LSH-3 (High Level, Return Well)	Stop P-5A/B	_____	_____
FS-5 (No Flow, Hose to Effluent Skid)	Stop P-5A/B	_____	_____
FS-6 (No Flow, Hose to Well)	Stop P-5A/B	_____	_____
LSL-3 (Low Level, Effluent Tank)	Stop P-5A/B	_____	_____

5.0 FAILSAFE MOTOR OPERATED VALVE INTERLOCK CHECKLIST

The Failsafe Motor Operated Ball Valves are located on the inlet of both the Influent Storage Tanks. The failsafe feature of Motor Operated Ball Valves MBV-1 and MBV-2 is to prevent an uncontrolled discharge of the potentially contaminated tank contents in the event of a breach in the system.

5.1 MBV-1, MANUAL MODE

- A. Set MBV-1 "Auto" switch to "Manual."
- B. Verify that valve is open; then open panelboard circuit breaker for MBV-1.
- C. Verify closure of valve on loss of power.

5.2 MBV-1, AUTOMATIC MODE

- A. Set MBV-1 "Manual-Auto" switch to "Auto."
- B. Open manual ball valves BV-2, BV-4 BV-6, and BV-7. Start Pump P-1A (Well Pump) and watch for MBV-1 to open.
- C. Open panelboard circuit breaker for MBV-1 and verify closure of valve on loss of power.
- D. Close panelboard circuit breaker to open valve; then shut off Well Pump P-1 and verify that valve closes when P-1 shuts down.

5.3 MBV-2, MANUAL MODE

- A. Set MBV-2 "Manual-Auto" switch to "Manual."
- B. Verify that valve is open; then open panelboard circuit breaker for MBV-2.
- C. Verify closure of valve on loss of power.

5.4 MBV-2, AUTOMATIC MODE

- A. Set MBV-2 "Manual-Auto" switch to "Auto."
- B. Open the manual ball valves as noted in Section 2.3.1 for the respective pump P-2A or P-2B to ensure flow can be established; then start Influent Pump P-2A, or P-2B (Note: These pumps are wired so that both cannot be started at the same time) and watch for valve to open.
- C. Open panelboard circuit breaker for MBV-2 and verify closure of valve on loss of power.
- D. Close panelboard circuit breaker to open valve; then shut off whichever pump is running, P-2A or P-2B, and verify that valve closes when pump shuts down.

6.0 EMERGENCY SHUTDOWN SWITCHES

The emergency shutdown switch (or switches) will shut the Treatment System down in case of an emergency. Items included on this emergency switch include the Well Pump, Influent Pumps, Effluent Pumps, and Failsafe Motor-Operated Valves (MBV-1, MBV-2, MBV-5 and MBV-6). The emergency shutdown system will be tested quarterly.

6.1 VERIFY SYSTEM IS OPERATING

Verify that Well Pump (P-1), Influent Pump (P-2A or 2B), Effluent Pump (P-5A or 5B) (if applicable) are running. Also verify that Failsafe Motor-Operated Valves are open.

6.2 EMERGENCY SHUTDOWN SWITCHES

Actuate Emergency Shutdown Switch(es) and verify shutdown of pumps and closure of valves.

P-1A	_____
P-1B	_____
P-2A/2B	_____
P-5A/5B	_____
MBV-1	_____
MBV-2	_____

7.0 TROUBLE SHOOTING

7.1 EXTRACTION WELL PUMPS

Extraction Well Pumps will not operate under conditions specified below.

- A. Influent Storage Tank level is "High" or "High-High."
- B. Extraction Well level is low.
- C. Flowswitch, FS-1A (for well pump P-1A) or FS-1B (for well pump P-2B) are not satisfied: There is no flow in the line from the well to the Influent Storage Tank.

7.2 PUMP P-2A OR P-2B

Either Pump P-2A or P-2B will not operate under conditions specified below.

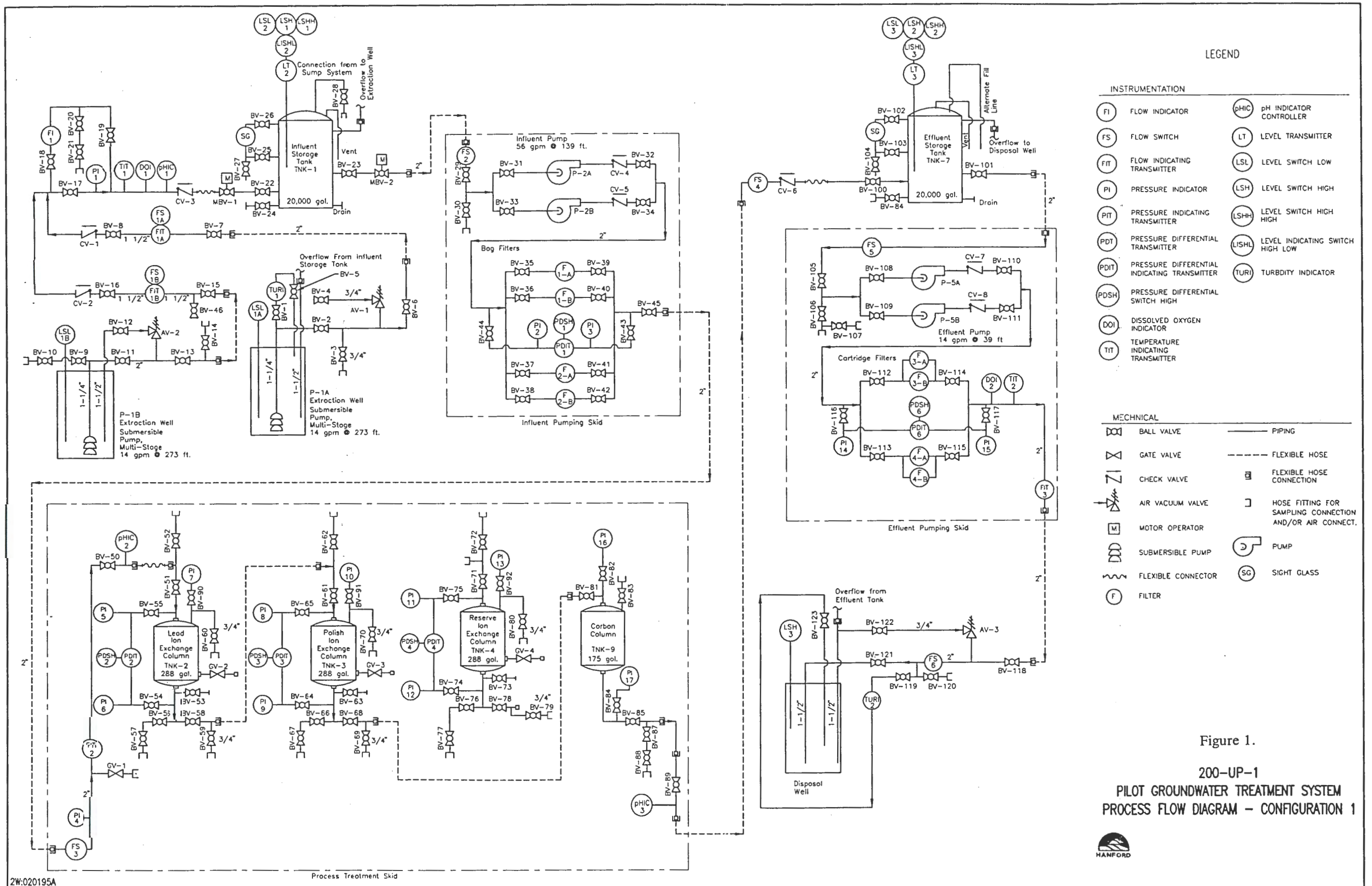
- A. Flowswitches FS-2, FS-3 or FS-4 not satisfied: There is no flow in the lines to the Influent Pumps or to the inlet manifold on the Process Skid, or to the Effluent Storage Tank.
- B. Influent Storage Tank level is "Low."
- C. Effluent Storage Tank level is "High."

7.3 PUMP P-5A P-5B

Either Pump P-5A or P-5B will not operate under the following conditions.

- A. Disposal Well level is "High."
- B. Effluent Storage Tank level is "Low."
- C. Flowswitches FS-5 and FS-6 not satisfied: There is no flow in the lines from the Effluent Storage Tank to the Effluent Pumps or from the Effluent Pump(s) to the Disposal Well.

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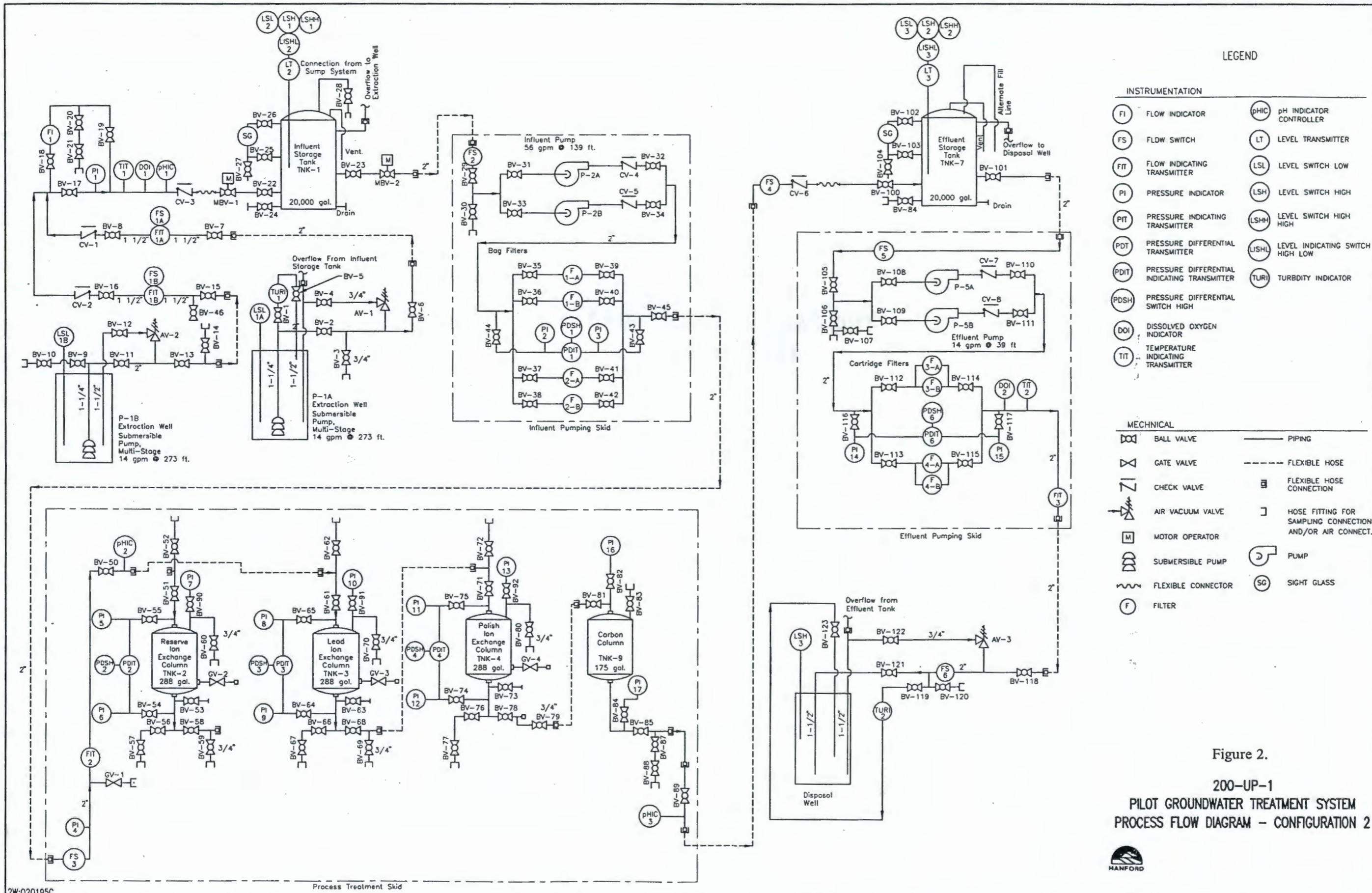
LEGEND

INSTRUMENTATION	
(FI)	FLOW INDICATOR
(FS)	FLOW SWITCH
(FIT)	FLOW INDICATING TRANSMITTER
(PI)	PRESSURE INDICATOR
(PIT)	PRESSURE INDICATING TRANSMITTER
(PDT)	PRESSURE DIFFERENTIAL TRANSMITTER
(PDIT)	PRESSURE DIFFERENTIAL INDICATING TRANSMITTER
(PDSH)	PRESSURE DIFFERENTIAL SWITCH HIGH
(DO)	DISSOLVED OXYGEN INDICATOR
(TIT)	TEMPERATURE INDICATING TRANSMITTER
(pHIC)	pH INDICATOR CONTROLLER
(LT)	LEVEL TRANSMITTER
(LSL)	LEVEL SWITCH LOW
(LSH)	LEVEL SWITCH HIGH
(LSHH)	LEVEL SWITCH HIGH HIGH
(LISHL)	LEVEL INDICATING SWITCH HIGH LOW
(TURI)	TURBIDITY INDICATOR

MECHANICAL	
(Symbol)	BALL VALVE
(Symbol)	GATE VALVE
(Symbol)	CHECK VALVE
(Symbol)	AIR VACUUM VALVE
(Symbol)	MOTOR OPERATOR
(Symbol)	SUBMERSIBLE PUMP
(Symbol)	FLEXIBLE CONNECTOR
(Symbol)	FILTER
(Symbol)	PIPING
(Symbol)	FLEXIBLE HOSE
(Symbol)	FLEXIBLE HOSE CONNECTION
(Symbol)	HOSE FITTING FOR SAMPLING CONNECTION AND/OR AIR CONNECT.
(Symbol)	PUMP
(Symbol)	SIGHT GLASS

Figure 1.
200-UP-1
PILOT GROUNDWATER TREATMENT SYSTEM
PROCESS FLOW DIAGRAM - CONFIGURATION 1

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LEGEND

INSTRUMENTATION			
(FI)	FLOW INDICATOR	(pHIC)	pH INDICATOR CONTROLLER
(FS)	FLD SW	(LT)	LEVEL TRANSMITTER
(FIT)	FLOW INDICATING TRANSMITTER	(LSL)	LEVEL SWITCH LOW
(PI)	PRESSURE INDICATOR	(LSH)	LEVEL SWITCH HIGH
(PIT)	PRESSURE INDICATING TRANSMITTER	(LSHH)	LEVEL SWITCH HIGH HIGH
(PDT)	PRESSURE DIFFERENTIAL TRANSMITTER	(LISHL)	LEVEL INDICATING SWITCH HIGH LOW
(PDIT)	PRESSURE DIFFERENTIAL INDICATING TRANSMITTER	(TUR)	TURBIDITY INDICATOR
(PDSH)	PRESSURE DIFFERENTIAL SWITCH HIGH		
(DOI)	DISSOLVED OXYGEN INDICATOR		
(TIT)	TEMPERATURE INDICATING TRANSMITTER		

MECHANICAL			
(Symbol)	BALL VALVE	(Symbol)	PIPING
(Symbol)	GATE VALVE	(Symbol)	FLEXIBLE HOSE
(Symbol)	CHECK VALVE	(Symbol)	FLEXIBLE HOSE CONNECTION
(Symbol)	AIR VACUUM VALVE	(Symbol)	HOSE FITTING FOR SAMPLING CONNECTION AND/OR AIR CONNECT.
(Symbol)	MOTOR OPERATOR	(Symbol)	PUMP
(Symbol)	SUBMERSIBLE PUMP	(Symbol)	SIGHT GLASS
(Symbol)	FLEXIBLE CONNECTOR		
(Symbol)	FILTER		

Figure 2.
200-UP-1
PILOT GROUNDWATER TREATMENT SYSTEM
PROCESS FLOW DIAGRAM - CONFIGURATION 2



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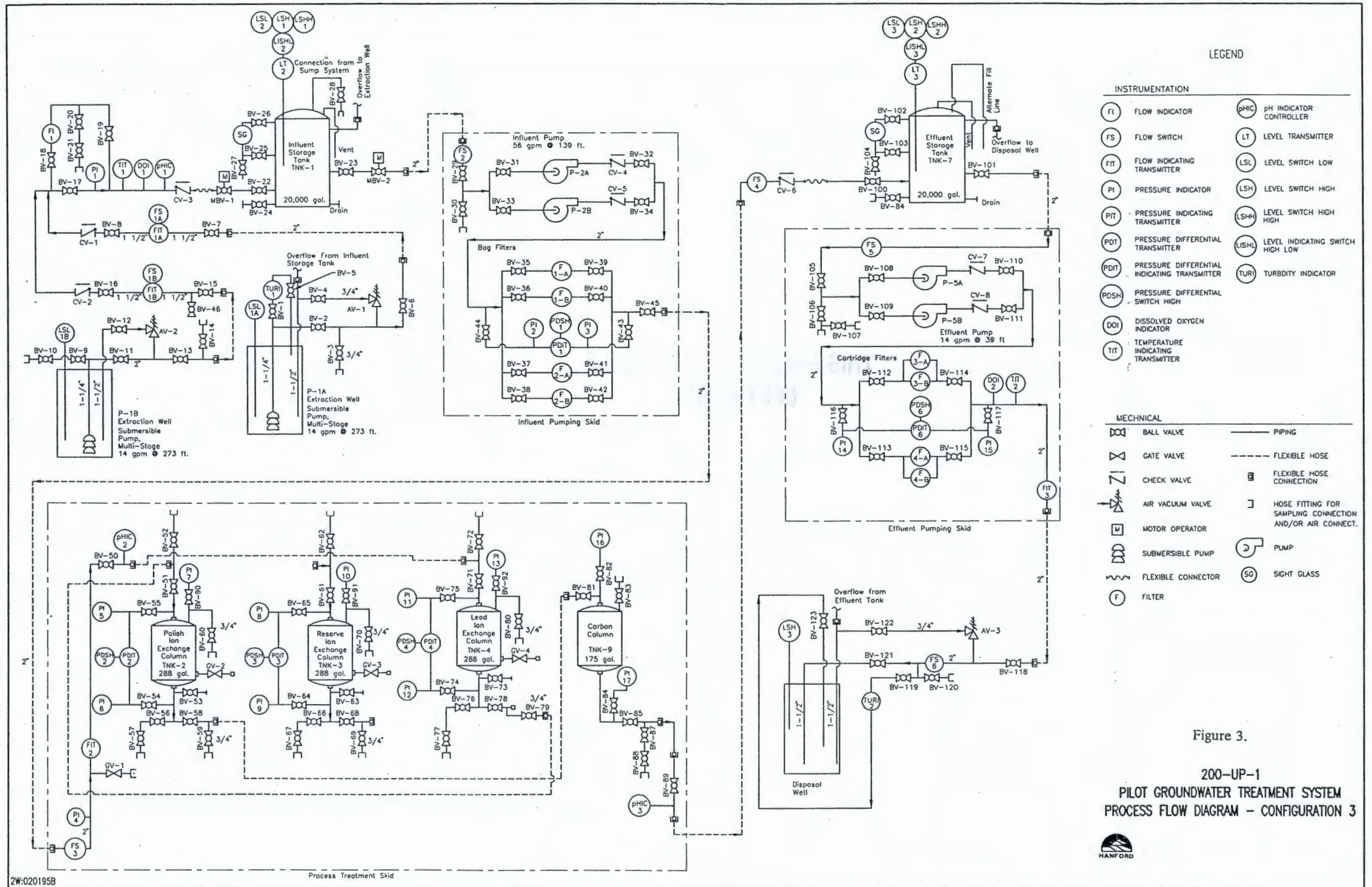


Figure 3.

200-UP-1
PILOT GROUNDWATER TREATMENT SYSTEM
PROCESS FLOW DIAGRAM - CONFIGURATION 3



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