5.3.1.3 Utility Water

The utility water system will be used to extract, store, and distribute water for consumptive process uses. Water will be extracted from wells drilled in a suitable formation in the vicinity of the CPP.

The utility water system equipment will include the utility water tank and utility water pumps.

5.3.1.4 Potable Water

Powertech (USA) will permit a public water supply system for the Dewey-Burdock Project that is anticipated to include a public water supply well, a disinfection system, a treated water storage tank, and a pressure distribution system. The public water supply system will be permitted through the DENR Drinking Water Program.

5.3.1.5 Process Wastewater

The process wastewater system will be designed to receive, treat, and discharge wastewater generated at various stages of the process. The wastewater system will be divided into two main categories of wastewater: high TDS wastewater and low TDS wastewater. High TDS wastewater consists of waste eluant brine from the CPP and the reject streams from process bleed or restoration RO systems if these systems are in use. Low TDS water sources include process bleed and extracted restoration water that have not been concentrated by RO.

High TDS wastewater will flow by gravity from the solids removal tank to the high TDS wastewater tank. This wastewater then will be pumped to the liquid waste disposal system.

Low TDS wastewater will be collected in the low TDS wastewater tank and then pumped to a radium precipitation tank where barium chloride will be added to co-precipitate barium and radium sulfates. Treated wastewater will flow from the radium precipitation tank to the radium settling ponds for removal of the precipitate by settling.

Wastewater system equipment inside the CPP will include the solids removal tank, the high TDS wastewater tank, the low TDS wastewater tank, the wastewater pumps, the radium precipitation tank and agitator. Refer to Section 5.4.1.1 for a discussion of liquid waste disposal system equipment.

5.3.1.6 Domestic Wastewater

Domestic waste (septic waste) will be disposed in on-site wastewater disposal systems constructed at the CPP and Satellite Facility. Domestic wastewater disposal systems will be designed to meet applicable DENR and Fall River County or Custer County regulations and will be permitted through DENR and/or Fall River or Custer County. Domestic wastewater systems are anticipated to include septic tanks and drainfields and may include dosing tanks and pressure dosing systems for liquid effluent.

5.3.1.7 HVAC System

The heating, ventilating and air conditioning (HVAC) system in the CPP will be designed to provide routine heating, cooling and required air changes in occupied areas, as well as mitigate the potential for human exposure to radionuclides. The primary exposure concerns will be radon gas and uranium oxide dust or particulates.

The general HVAC system for the CPP will be designed both for controlling the temperature in the CPP and for preventing the buildup of fugitive radon emissions by ensuring a minimum number of air changes.

Radon gas is a decay product of uranium and will be mobilized and dissolved into the pregnant lixiviant during ISR uranium extraction. The potential for radon emissions from the process arises when the pressurized flow from the production wells and booster pumps is exposed to atmospheric pressure. The two process systems with the potential for radon emissions are the IX vessels via the air/vacuum relief valves and the shaker screens where the loaded resin and resin transfer water will be pumped onto an open screen at atmospheric pressure.

The shaker screens each will have a dedicated vent hood directly overhead. The vent hoods will be connected to an exhaust fan designed to create sufficient air flow and velocity to minimize the concentration of radon in the vicinity of the shaker screens. The exhaust fans will discharge the air through a vent in the roof of the building. The vent will be located away from air intakes for the building.

Systems that have the potential to emit dust particles containing uranium include the filter presses, the dryers, and the drum filling stations.

The filter presses will be installed in a dedicated filtration room, and the vacuum dryers will be installed in a dedicated dryer room. These two rooms will be serviced with dedicated HVAC equipment that includes particulate filtration to minimize the potential for personnel exposure within the rooms and to prevent the emission of particles.

5.3.2 Satellite Facility

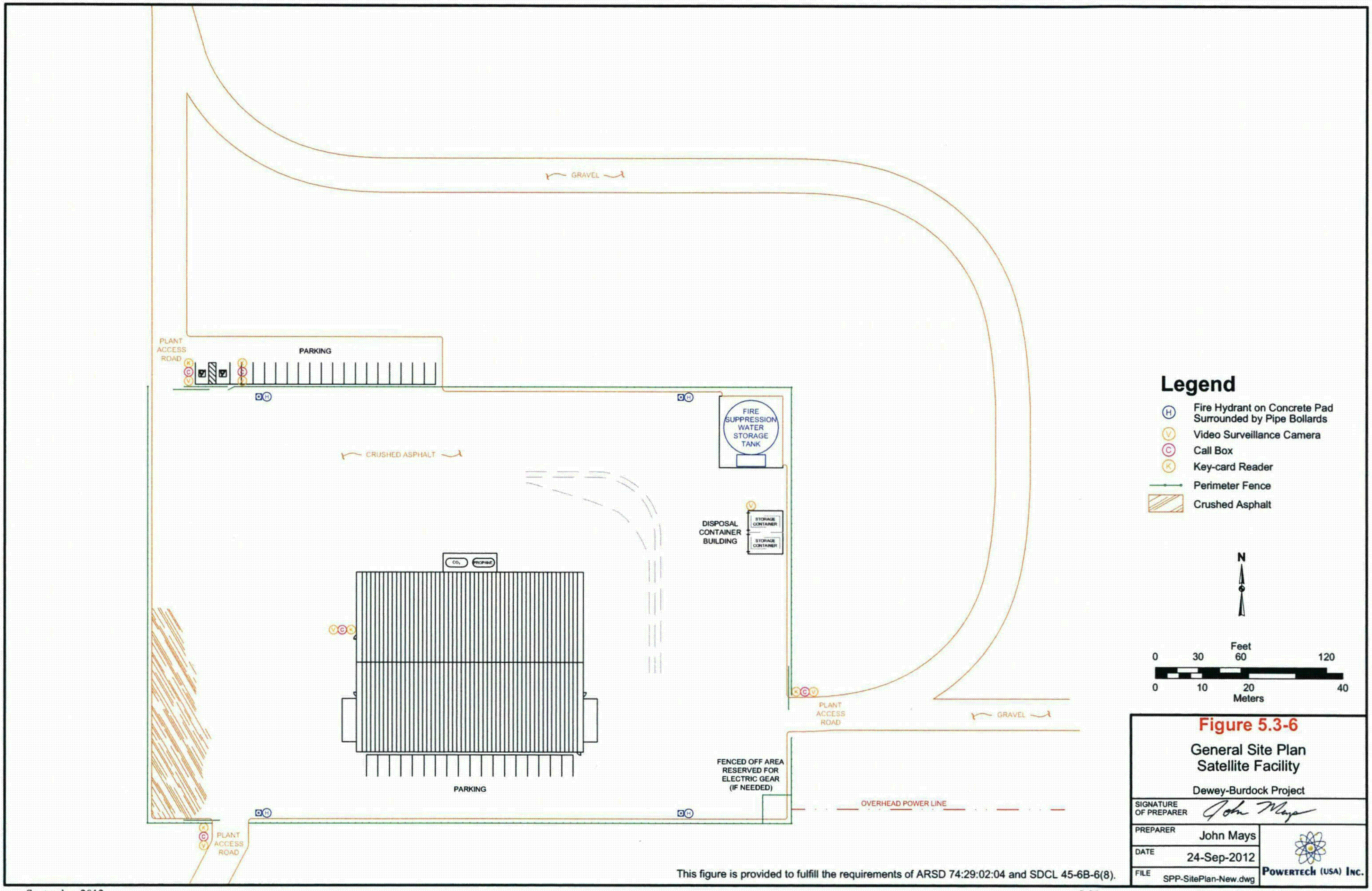
A Satellite Facility will be located in the Dewey portion of the permit area as shown on Figures 5.3-1 and 5.3-2. The Satellite Facility will be located in Section 29, T6S, R1E. It will include IX equipment to recover uranium and aquifer restoration equipment for well fields in the Dewey portion of the permit area. Uranium-loaded IX resin will be trucked from the Satellite Facility to the CPP for elution, precipitation, drying and packaging. As with the CPP site, the site for the Satellite Facility has been designed to provide security and ease of access for operating purposes. The site is designed with ample areas for access by resin transfer trucks as well as truck transports for chemical delivery. Figure 5.3-6 shows the site layout of the Satellite Facility.

Powertech (USA) proposes to install up to eight underground pipelines between the CPP and the Satellite Facility to transport the various fluids present during ISR operations. Conduits for electronic communication and control purposes also may be installed between the CPP and the Satellite Facility. The fluids that may be transported include, but are not limited to: barren and pregnant lixiviant, restoration water, RO reject brines, wastewater resulting from well drilling and maintenance operations, and supply water from the Madison Limestone or other aquifers. All infrastructure associated with ISR activities will be located within the permit boundary.

5.3.2.1 Satellite Facility Equipment

Figure 5.3-7 presents the detailed layout of the Satellite Facility. The Satellite Facility will house uranium recovery equipment (IX vessels) and aquifer restoration equipment. Uranium will be recovered using pressurized, downflow IX vessels as described for the CPP in Section 5.3.1.1.1. Loaded resin will be transferred from the IX vessels to a tanker truck that enters the building. Each tanker truck will have one or more compartments with sloped bottoms and screened bottom outlet nozzles. Resin transfer will be accomplished through resin transfer piping and hoses that connect the IX vessels to the tanker truck. With the connections made and transfer valves opened, resin transfer water will be pumped into the top of the IX vessel with the bottom discharge valve of the vessel open. This will force the resin to flow out of the vessel and into the tanker truck. Water and resin will enter the tanker, and water will exit the tanker through a screened outlet port and be returned to the resin transfer water tank. The resin, which cannot pass the screen, will remain in the tanker truck. When the resin has been flushed from the vessel and piping, the excess transfer water will be drained from the truck, the valves controlling the transfer will be closed and the hoses disconnected from the truck.

The truck then will transport the resin to the CPP where the truck will be connected via hoses to the resin transfer water headers. To transfer resin out of the tanker truck, water will be introduced to the tanker truck from the resin transfer water tank, and water and resin will flow out of the tanker truck to the elevated shaker screens described in Section 5.3.1.1.2. Following elution of the resin, the transfer process will be reversed. When the tanker truck returns to the


GRAVEL
PLANT
ACCESS
ROAD
PARKING
CRUSHED ASPHALT
FIRE
SUPPRESSION
WATER
STORAGE
TANK
DISPOSAL
CONTAINER
BUILDING
STORAGE
CONTAINER
STORAGE
CONTAINER
CO_2
PROPANE
PARKING
FENCED OFF AREA
RESERVED FOR
ELECTRIC GEAR
(IF NEEDED)
OVERHEAD POWER LINE
PLANT
ACCESS
ROAD
PLANT
ACCESS
ROAD
GRAVEL
Legend
Fire Hydrant on Concrete Pad Surrounded by Pipe Bollards
Video Surveillance Camera
Call Box
Key-card Reader
Perimeter Fence
Crushed Asphalt
N
Feet
0 30 60 120
0 10 20 40
Meters
Figure 5.3-6
General Site Plan
Satellite Facility
Dewey-Burdock Project
SIGNATURE OF PREPARER
PREPARER John Mays
DATE 24-Sep-2012
FILE SPP-SitePlan-New.dwg
POWERTECH (USA) INC.
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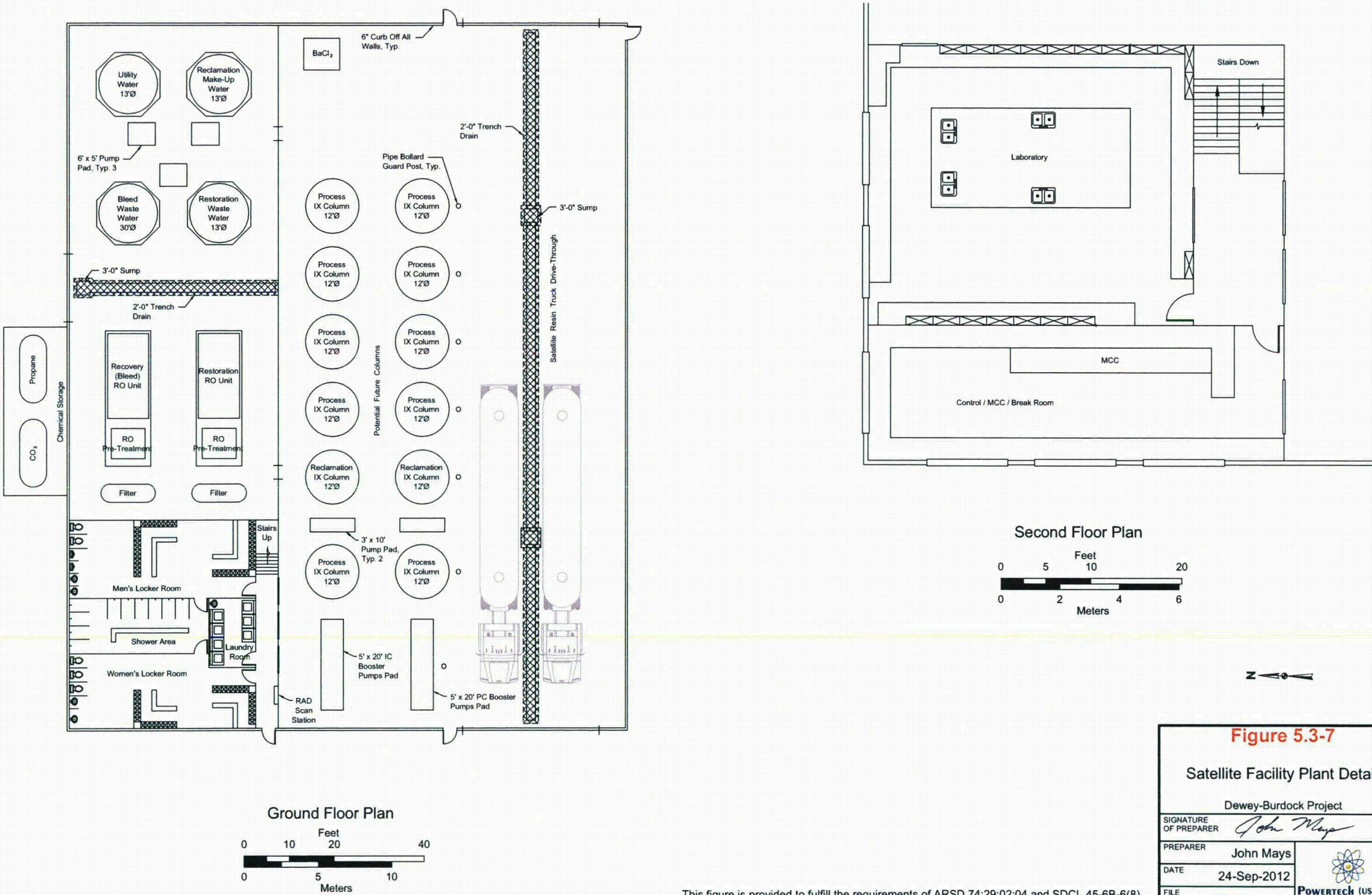

This figure is provided to fulfill the requirements of ARSD 74:29:02:04 and SDCL 45-6B-6(8).

Figure 5.3-7

Satellite Facility Plant Detail

Dewey-Burdock Project

SIGNATURE OF PREPARER	[signature]
PREPARER	John Mays
DATE	24-Sep-2012
FILE	SPP-Floorplan.dwg

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Satellite Facility, the regenerated resin will be transferred back into the IX vessel using the same methods.

Restoration system equipment will include a restoration water tank, a restoration makeup water pump, and a restoration RO system, if used.

The Satellite Facility HVAC system will be designed to provide routine heating, cooling and required air changes in occupied areas, as well as mitigate the potential for human exposure to radionuclides.

Chemical storage at the Satellite Facility will be limited to carbon dioxide used to enhance uranium recovery in IX vessels and to fortify barren lixiviant, barium chloride used for radium precipitation, and small quantities of laboratory reagents. Laboratory waste will be disposed with the liquid process waste and not in the domestic wastewater system. A byproduct storage building will be located in a separate building as described in Section 5.3.1.2.9. The Satellite Facility also will include a utility water system, potable water system, domestic wastewater disposal system, and process wastewater system, including ponds and either a deep disposal well system or land application system (refer to Section 5.4.1.1).

5.3.3 Well Fields

This section describes the well field design, construction, and methods of operation. Well fields will be developed using a phased approach, in which each well field will be delineated, designed, constructed, operated, restored, and decommissioned.

5.3.3.1 Well Field Design

Each ISR well field will consist of a series of injection and production wells completed within the target mineralization zone. Prior to design and layout of the wells, the ore bodies will be delineated with exploration holes. These holes will be geologically and geophysically logged. Before drilling, each injection and production well will be assigned lateral coordinates, a ground surface elevation, depth to top of screened interval, and length of screened interval.

5.3.3.1.1 Injection and Production Wells

For all injection and production wells, the top of the screened interval will be at or below the base of the confining unit overlying the mineralized zone. The screened interval will be completed only across the targeted ore zone.

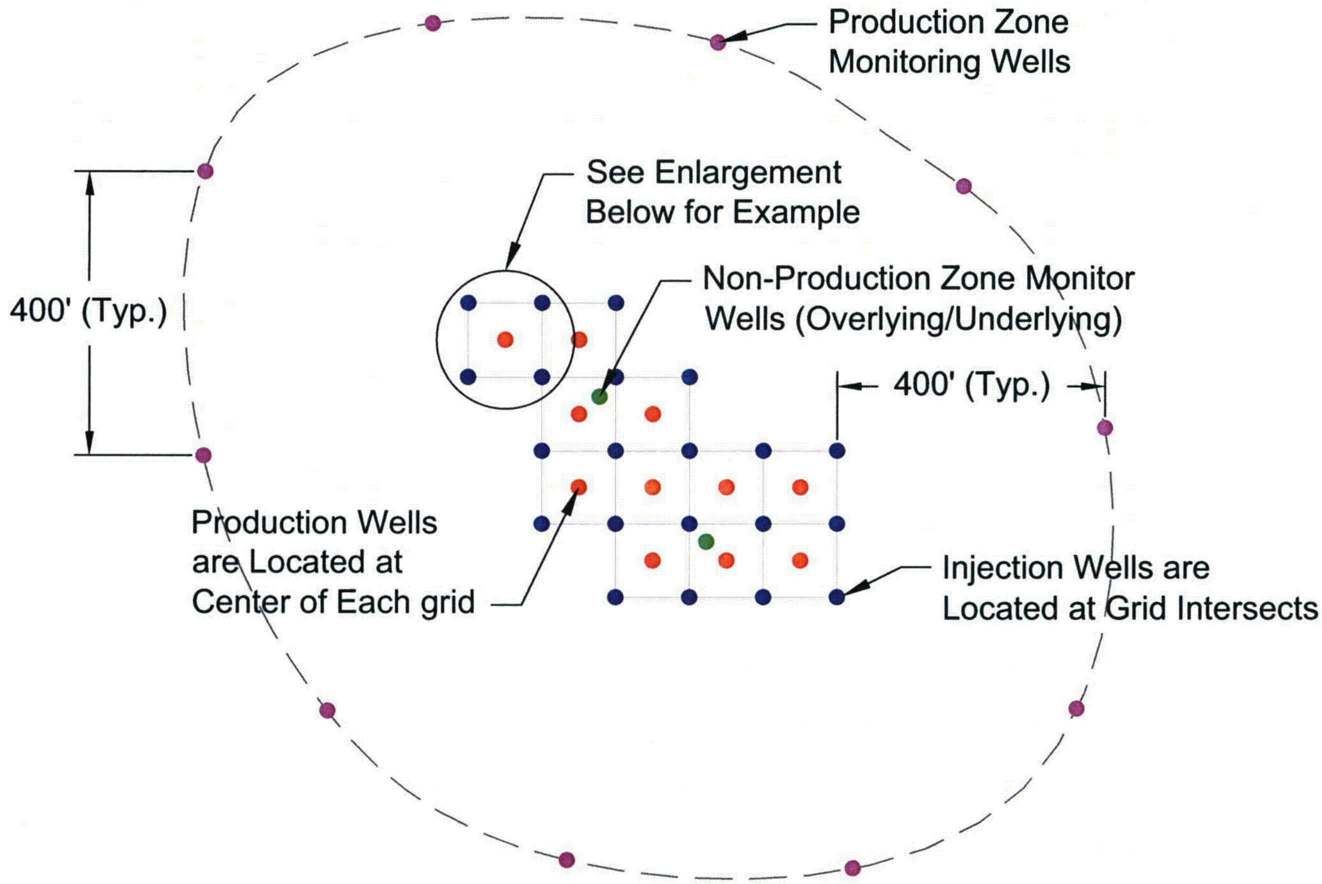
A typical (100 x 100 ft grid) well field layout is illustrated on Plate 5.3-3. This typical layout is based on the lateral distribution and grade of one of the uranium deposits within the permit area.

The well patterns may differ from well field to well field, but a typical pattern will consist of five wells, with one well in the center and four wells surrounding it oriented in four corners of a square measuring between 50 and 150 feet on a side. Typically, a production well will be located in the center of the pattern, and the four corner wells will be injection wells. Figure 5.3-8 depicts a typical 5-spot well field pattern. The pattern dimensions will be modified as needed to fit the characteristics of each ore body. Other well field designs may be considered and evaluated in the well field hydrogeologic data packages (refer to Section 5.3.3.4).

All injection and production wells will be completed for use as either injection or production wells, so that flow patterns can be changed as needed to recover uranium and restore groundwater quality in the most efficient manner.

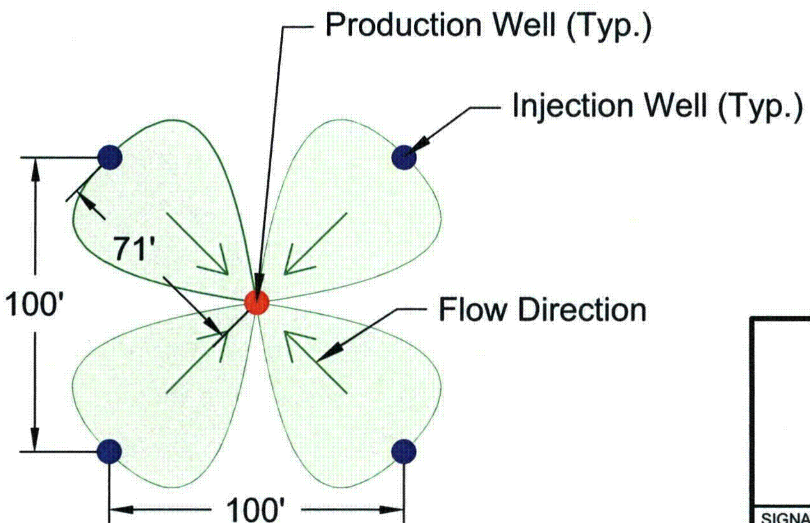
Figure 5.3-9 depicts the project ore bodies proposed for uranium recovery and shows all lower Fall River ore bodies in blue (Fall River ore depth ranges from approximately 200 to 600 feet), all ore bodies within the upper Chilson Member of the Lakota Formation in green and middle/lower Chilson ore bodies in red (Chilson ore depth ranges from approximately 200 to 800 feet). No well fields will be located within 1,600 feet of the permit boundary in order to establish an operational buffer between the well fields and the permit boundary. In addition, no well fields are proposed for partially saturated or unsaturated Fall River ore bodies in the eastern portion of the permit area. All well fields and perimeter monitor wells will be located within the permit boundary.

Production and injection wells will be connected to a header house, as shown on Plate 5.3-4. Well head connection details for injection and production wells are illustrated on Figures 5.3-10 and 5.3-11, respectively. Typically, one header house will service up to 20 production wells and 80 injection wells. Piping between the wells and header house will consist of high density polyethylene (HDPE) pipe with heat-welded joints, buried at least 5 feet below grade. The piping will be designed to withstand an operating pressures of 150 psig. The piping will terminate at the header house where it will be connected to manifolds equipped with control valves, flow meters, check valves, pressure sensors, oxygen and carbon dioxide feed systems (injection only), and programmable logic controllers. Electrical power to the header houses will be delivered via overhead power lines and via buried cable. Electrical power to individual wells will be delivered via buried cable from the header house.



- Production Well
- Injection Well
- Non-Production Zone Monitor Well
- Production Zone Monitor Well

TYPICAL FIVE SPOT GRID PATTERN



Modified from Power Resources

This figure is provided to fulfill the requirements of ARSD 74:29:02:04 and SDCL 45-6B-6(8).

Figure 5.3-8

Typical 5-Spot Well Field Pattern

Dewey-Burdock Project

SIGNATURE OF PREPARER	
PREPARER	John Mays
DATE	16-Sep-2012
FILE	FiveSpotPattern.dwg

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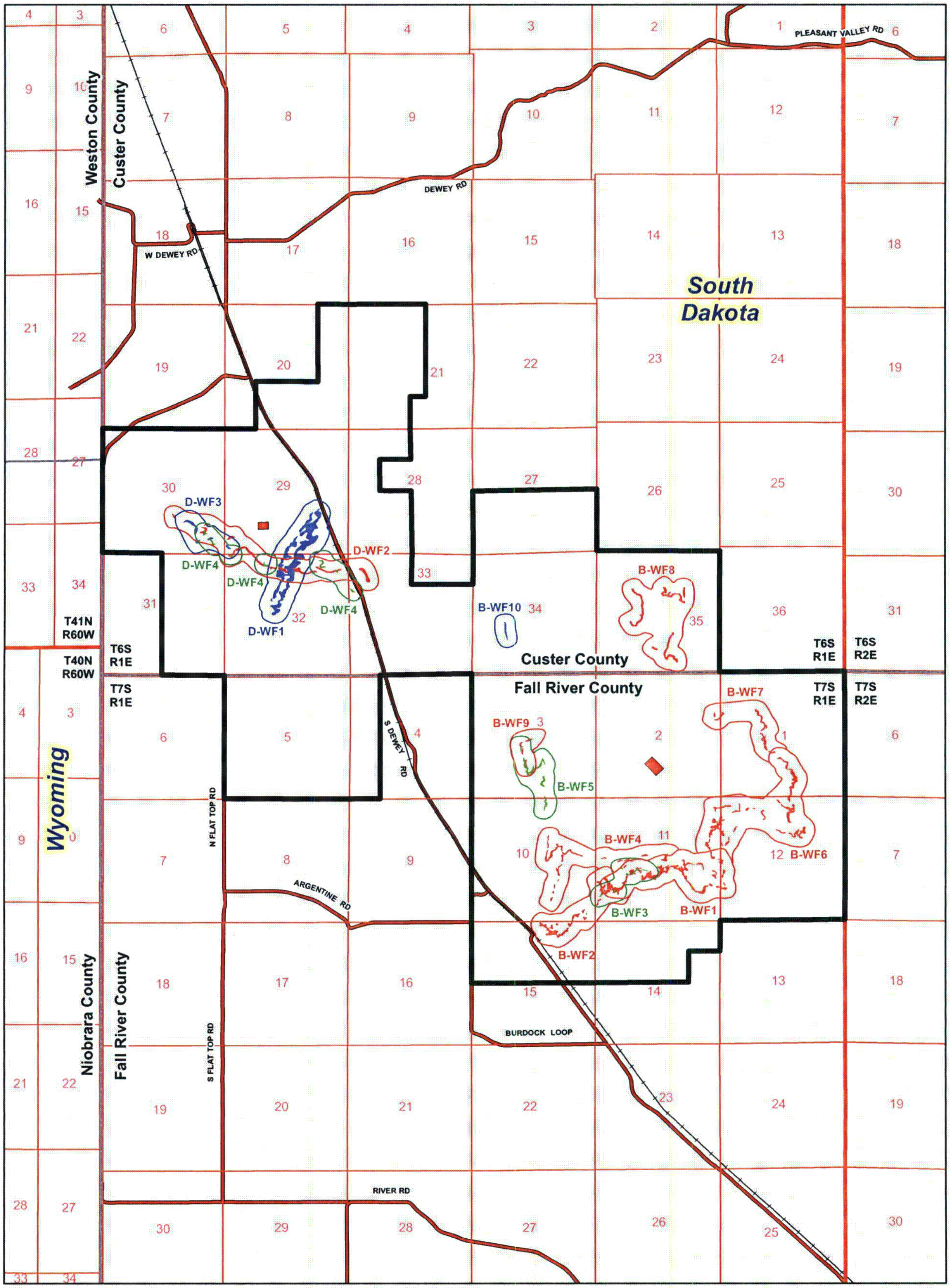

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Feet: 0, 2,000, 4,000, 8,000
Meters: 0, 1,000, 2,000

Legend

- Permit Boundary
- Processing Plants
- BNSF Railroad
- County Roads

Potential Well Field Areas
- Lower Fall River
- Upper Chilson
- Middle/Lower Chilson

Ore Bodies
- Lower Fall River
- Upper Chilson
- Middle/Lower Chilson

N

Figure 5.3-9

Potential Well Field Areas

Dewey-Burdock Project

SIGNATURE OF PREPARER	John Mays (signature)
PREPARER	John Mays
DATE	09-Nov-2012
FILE	WF-PotentialConfig.mxd

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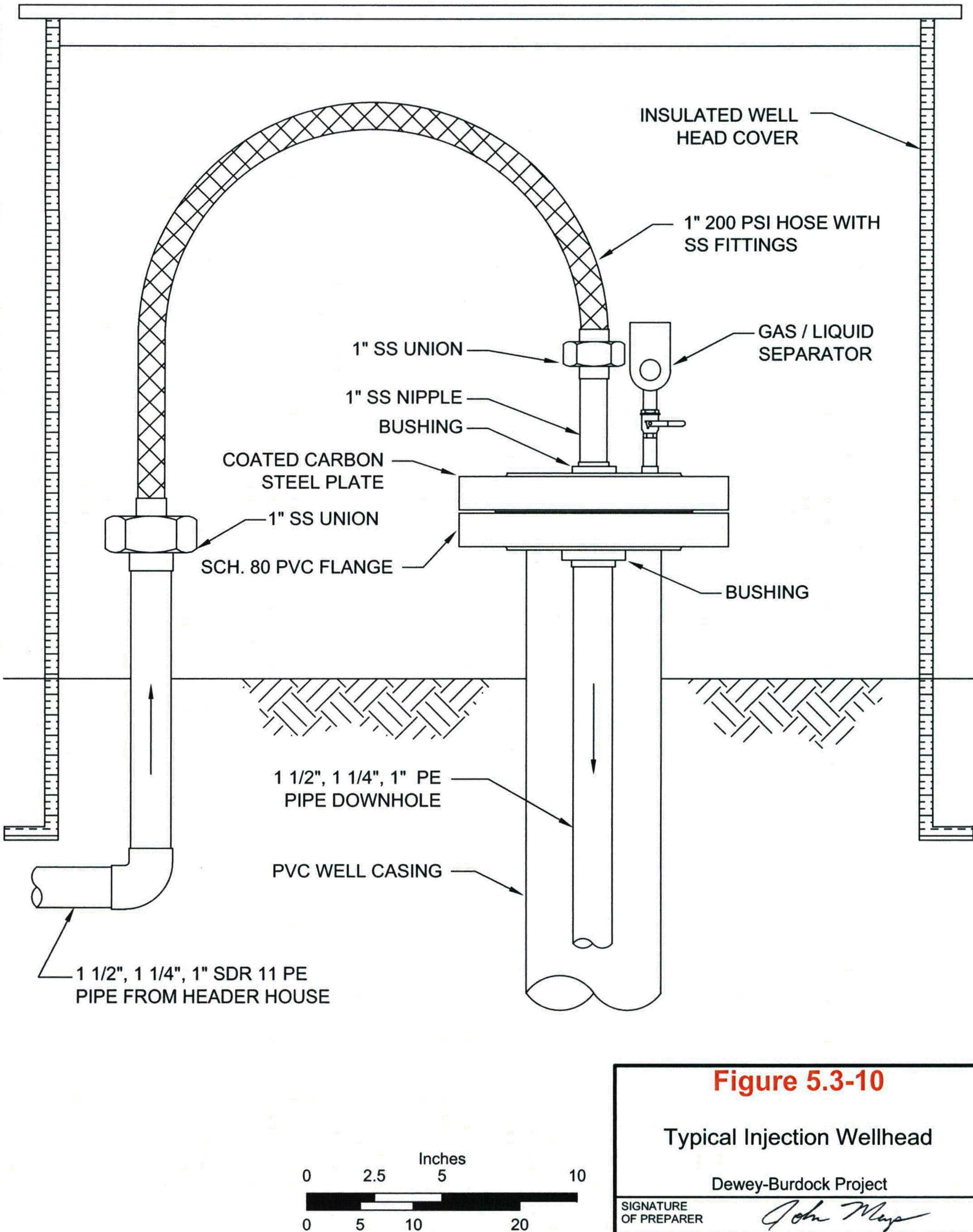

Figure 5.3-10

Typical Injection Wellhead

Dewey-Burdock Project

SIGNATURE OF PREPARER	John Mays
PREPARER	John Mays
DATE	16-Sep-2012
FILE	Wells-InjWellhead.dwg

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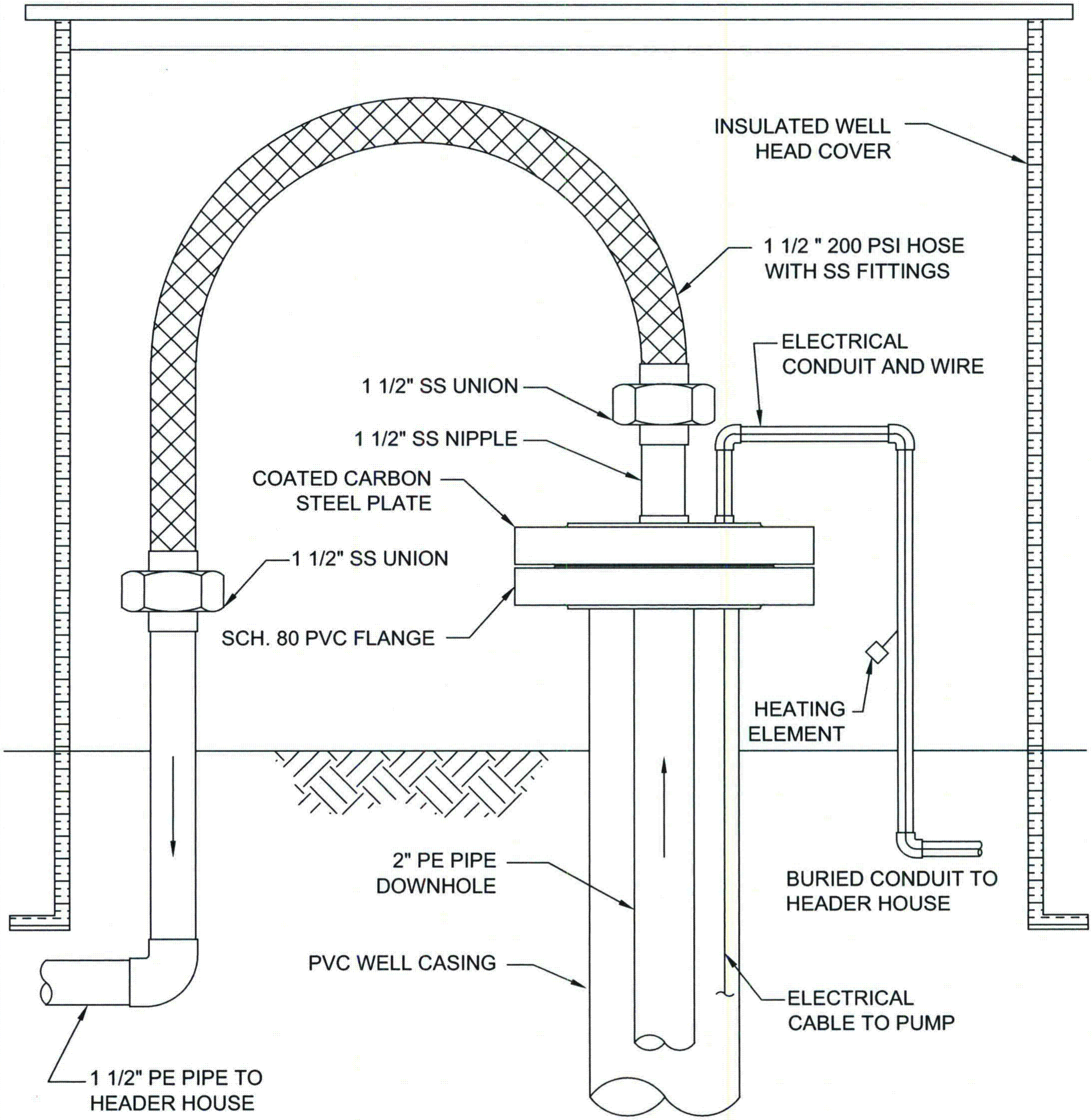

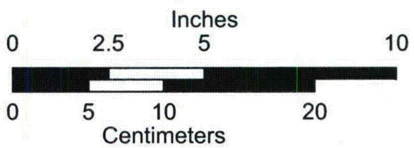

Figure 5.3-11

Typical Production Wellhead

Dewey-Burdock Project

SIGNATURE OF PREPARER	John Mays (signature)
PREPARER	John Mays
DATE	16-Sep-2012
FILE	Wells-ProdWellhead.dwg

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As a well field expands, additional header houses will be constructed. They will be connected to one another via buried piping that is sized to accommodate the necessary injection and production flow rates and pressures. In turn, header pipes from entire well fields will be connected to either the Satellite Facility or CPP. A piping detail that shows the connection between the main header piping and laterals to header houses is shown on Plate 5.3-4.

5.3.3.1.2 Monitor Wells

Monitor wells will be installed in and around each well field to detect the potential migration of ISR solutions away from the target production zone. Perimeter monitor wells will be completed in the production zone around the perimeter of each well field. Non-production zone monitor wells will be completed within each well field in the overlying and underlying aquifers.

5.3.3.1.2.1 Perimeter Monitor Wells

Perimeter monitor wells will be positioned around the perimeter of each well field as illustrated on Plate 5.3-3 and Figure 5.3-8. The perimeter monitor well "ring" serves two purposes: 1) to monitor any horizontal migration of fluid outside of the production zone, and 2) to determine baseline water quality data and characterize the area outside the production pattern area.

Perimeter monitor wells will be located no farther than 400 feet from the well field patterns. They will be evenly spaced with a maximum spacing of either 400 feet or the spacing that will ensure a 70 degree angle between adjacent perimeter monitor wells and the nearest injection well. This maximum distance is based on and consistent with standard monitoring practices at operating ISR facilities. It also is supported by site-specific data and evaluation through numerical groundwater modeling. The numerical groundwater modeling report presented in Appendix 6.2-A demonstrates that the maximum perimeter monitor ring spacing of 400 feet is adequate to detect an excursion and that an excursion can be controlled.

Perimeter wells will be screened across the entire thickness of the production zone, which will be determined following completion of delineation drilling for each well field. In cases where a localized confining unit is present between stacked ore bodies within one of the primary geologic units (Fall River or Chilson), the monitoring approach may be modified such that perimeter monitor wells are screened only within the portion of the hydrogeologic unit in which the ore body is located. In all cases, the screens will fully penetrate the hydrogeologic unit to be monitored, i.e., spanning the entire interval between the overlying and underlying confining beds. As described in Section 3.2.2, the Fuson Shale is pervasive throughout the permit area and forms a confining unit between the Fall River and Chilson. No monitor well will be screened across the Fuson Shale. Prior to initiating ISR operations in each well field, pre-operational pumping tests will be conducted to confirm that the perimeter monitor wells are hydraulically connected to the production zone. Additional information is found in Section 5.3.3.3.

5.3.3.1.2.2 Non-Production Zone Monitor Wells

Depending on site-specific conditions, non-production zone monitor wells may consist of two types of monitor wells, termed overlying and underlying. The overlying and underlying monitor wells will be used to obtain baseline water quality data and used in the development of compliance limits for the overlying and underlying zones that will be used to determine if vertical migration of lixiviant is occurring. The screened zone for the overlying and underlying monitor wells will be determined from electric logs by qualified geologists or hydrogeologists. Each of the non-production zone monitor well types is described below.

Overlying Monitor Wells

The overlying monitor wells will be designed to provide monitoring of any upward movement of ISR solutions that may occur from the production zone and to guard against potential leakage from production and injection well casing into any overlying aquifer. The term "overlying aquifer" refers to any hydrogeologic unit(s) above the production zone and separated by a confining layer. The terms "overlying aquifer" and "overlying hydrogeologic unit" are used interchangeably when describing well field design and operations.

All overlying hydrogeologic units will be monitored. Monitor wells completed in the first overlying hydrogeologic unit will be designated with the prefix MO and will have a density of at least one well per 4 acres of well field pattern area. Monitor wells completed in subsequent overlying hydrogeologic units will be designated with prefixes MO2, MO3, etc. and will have a density of at least one well per 8 acres of well field pattern area.

Underlying Monitor Wells

The underlying monitor wells will be designed to provide monitoring of any downward movement of ISR solutions from the production zone. Monitor wells completed in the first underlying hydrogeologic unit will be named with the prefix MU and will have a density of one well per 4 acres of pattern area. Only the first underlying hydrogeologic unit will be monitored, unless the production zone is the lowermost hydrogeologic unit above the Morrison Formation, in which case the Unkpapa Sandstone will be the underlying aquifer. Excursion monitoring will not occur in the Unkpapa Sandstone. The justification for not performing excursion monitoring is as follows:

1) The Unkpapa Sandstone shows substantially higher potentiometric head than the Fall River and Chilson throughout the permit area. During ISR operations, the potentiometric head will be reduced (creating a cone of depression) in the Chilson and Fall River due to a net withdrawal (production flow greater than injection flow) in order to maintain well field bleed. Flow into the Unkpapa from production zones in the Fall River and Chilson operating at a substantially lower potentiometric head would be impossible.
2) The Morrison Formation is prevalent across the entire permit area, with a thickness ranging from 60 to 140 feet, and will act as an aquitard to prevent flow between the Unkpapa and the Fall River and Chilson. This was demonstrated by the pumping tests conducted by Powertech (USA), where no response occurred in the Unkpapa during pumping of either the Fall River or Chilson.
3) The Unkpapa is a low-yield aquifer determined by a recent water supply well installation by Powertech (USA). Water samples from the Unkpapa can no longer be obtained from well 704 because this well was cemented off in the Unkpapa in 2009 and perforated in the Chilson due to low yield from the Unkpapa.
4) NRC guidance in NUREG/CR-6733 (NRC, 2001) allows that, "Where confining layers are shown to be very thick and of negligible permeability, requirements for vertical excursion monitoring can be relaxed or eliminated."

5.3.3.1.2.3 Monitor Well Layout

The generalized monitoring scheme is depicted in Figure 5.3-12. This approach will be used when there are no substantial confining layers between ore bodies within the Fall River or Chilson.

Local confining units within the Fall River or Chilson generally are anticipated to be utilized in the monitoring scheme. The presence or absence of these will be confirmed with delineation drilling and mapped in more detail in the process of developing each well field hydrogeologic data package (refer to Section 5.3.3.4). Figures 5.3-13 and 5.3-14 depict the conceptual monitoring schemes for the initial Burdock and Dewey well fields, respectively. Following is a brief summary of the conceptual monitor well layouts. Note that additional monitor wells may be installed as needed.

For Burdock Well Field 1 (Figure 5.3-13), the anticipated production zone is the Lower Chilson. Since the production zone is anticipated to be in the lowermost hydrogeologic unit above the Morrison Formation, no monitoring would occur in the underlying hydrogeologic unit (Unkpapa). Refer to the previous section for additional explanation. Monitor wells would be installed in the first overlying hydrogeologic unit (Middle Chilson) with a minimum density of

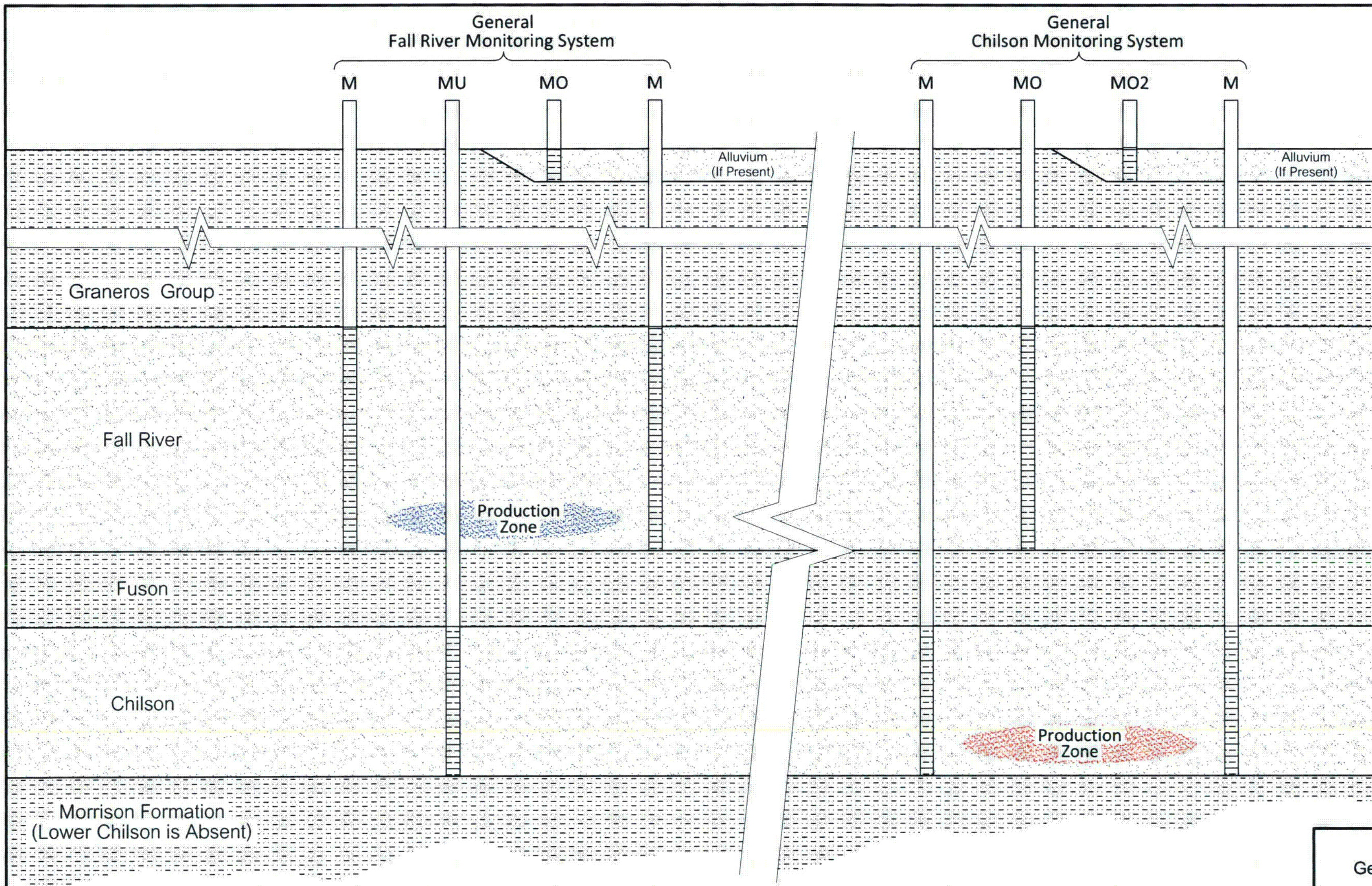

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Figure 5.3-12

Generalized Monitor Well Configuration

Dewey-Burdock Project

SIGNATURE OF PREPARER	John Mays
PREPARER	John Mays
DATE	16-Sep-2012
FILE	MonWell-GenConf.dwg

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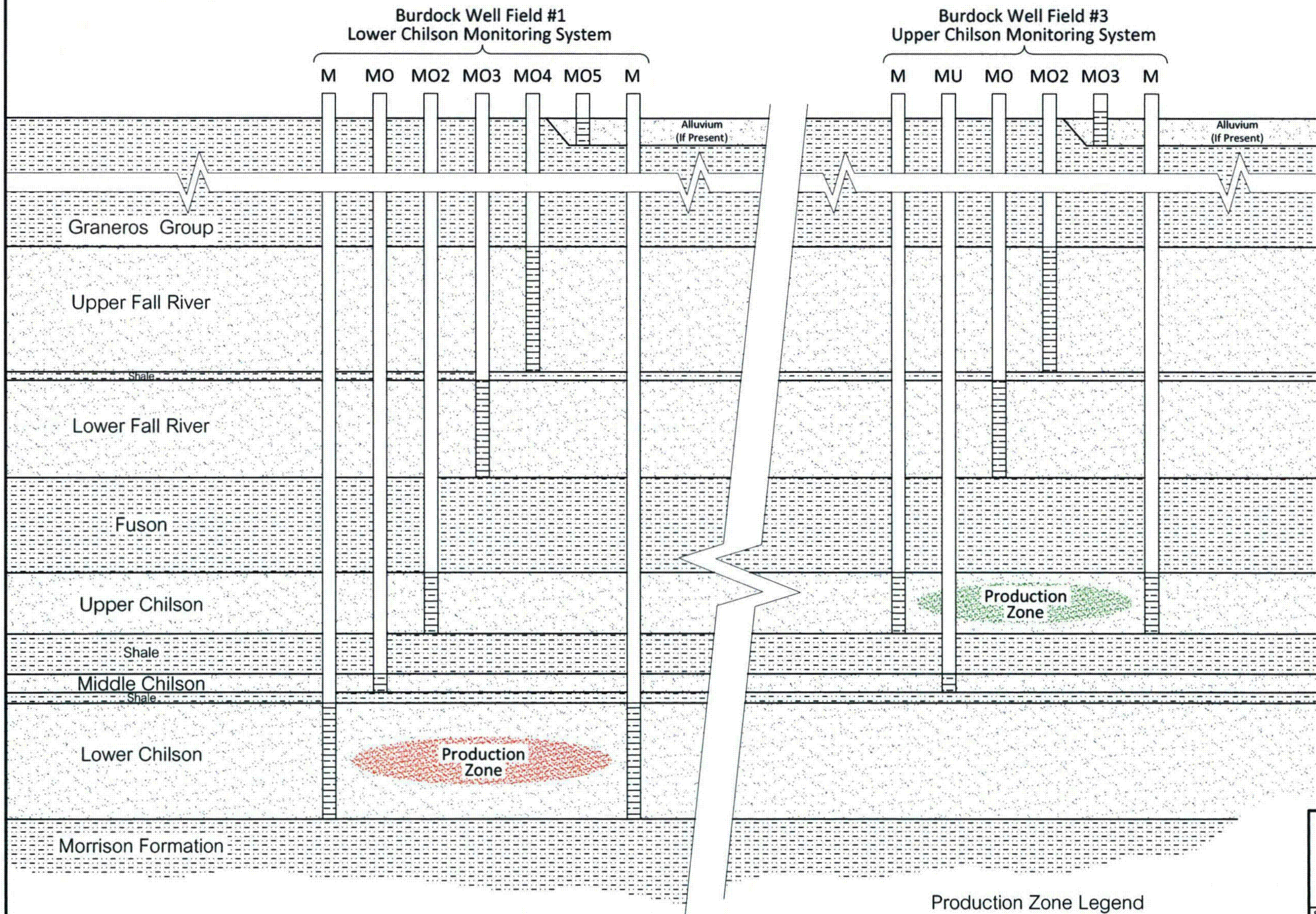

M - Monitor Ring in Production Sand
MU - Monitor Underlying Sand
MO - Monitor Overlying Sand (1 per 4 acres)
MO2, MO3, MO4, MO5 - Monitor Overlying Sand (1 per 8 acres)

This figure is provided to fulfill the requirements of ARSD 74:29:02:11(7).

Figure 5.3-13

Anticipated Burdock Monitor Well Configuration

Dewey-Burdock Project

SIGNATURE OF PREPARER	John Mays
PREPARER	John Mays
DATE	16-Sep-2012
FILE	MonWell-BurdConf.dwg

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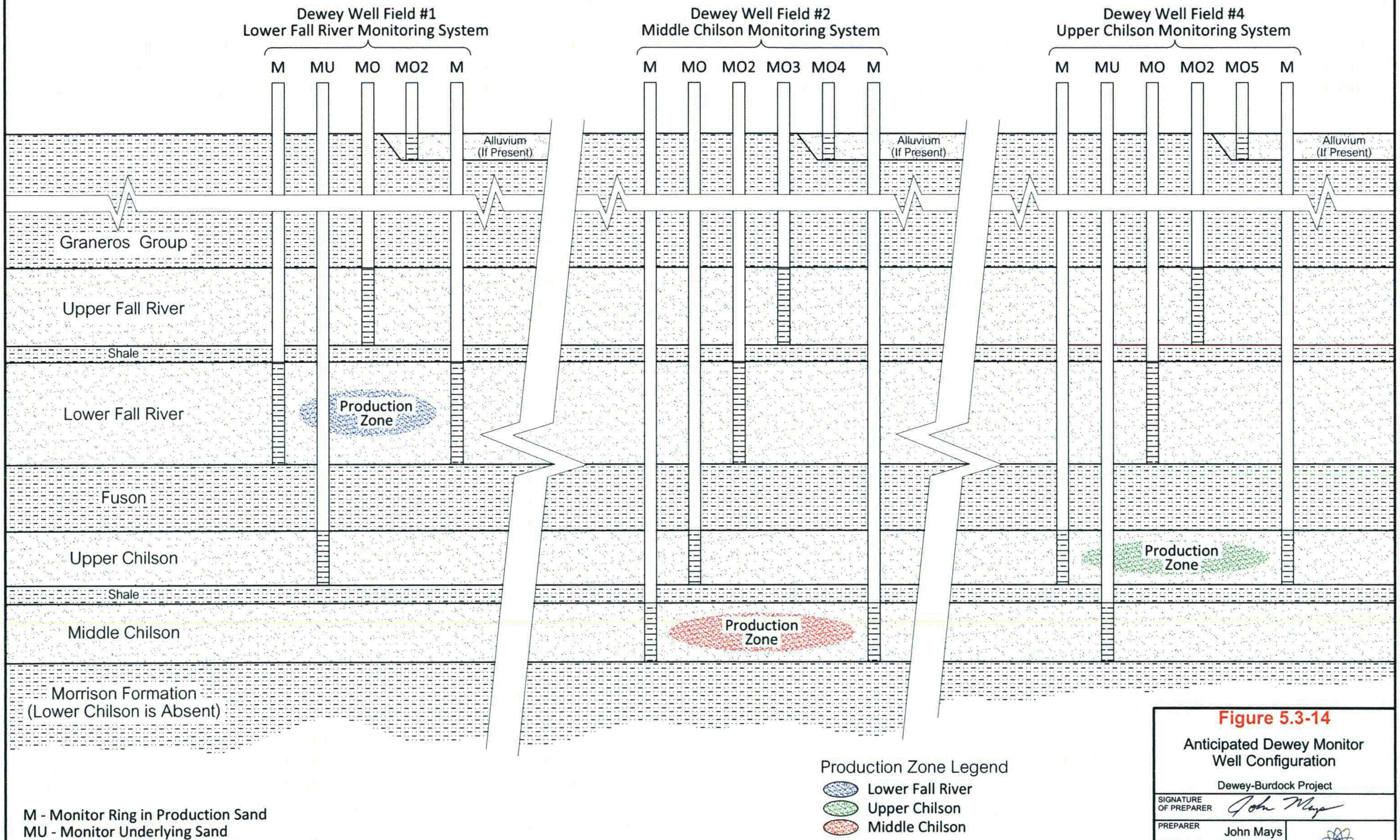

M - Monitor Ring in Production Sand
MU - Monitor Underlying Sand
MO - Monitor Overlying Sand (1 per 4 acres)
MO2, MO3, MO4, MO5, MO6 - Monitor Overlying Sand (1 per 8 acres)

This figure is provided to fulfill the requirements of ARSD 74:29:02:11(7).

Figure 5.3-14

Anticipated Dewey Monitor Well Configuration

Dewey-Burdock Project

SIGNATURE OF PREPARER	John Mays
PREPARER	John Mays
DATE	16-Sep-2012
FILE	MonWell-DeweyConf.dwg

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one well per 4 acres. Monitor wells would be installed in all other overlying hydrogeologic units with a minimum density of one well per 8 acres. This includes the Upper Chilson, Lower and Upper Fall River, and alluvium (where present).

For Burdock Well Field 3 (Figure 5.3-13), the anticipated production zone is the Upper Chilson. In this case the immediately overlying hydrogeologic unit would be the Lower Fall River Formation and would be monitored at a minimum density of one well per 4 acres. Other overlying hydrogeologic units would be monitored at a minimum density of one well per 8 acres, including the Upper Fall River and alluvium (where present). The first underlying hydrogeologic unit would be the Middle Chilson and would be monitored at a minimum density of one well per 4 acres.

For Dewey Well Field 1 (Figure 5.3-14), the anticipated production zone is the Lower Fall River. In this case overlying hydrogeologic units would only include the Upper Fall River and alluvium (where present). The first underlying hydrogeologic unit would be the Upper Chilson. Similar conventions are shown for Dewey Well Fields 2 and 4.

5.3.3.2 Well Construction and Integrity Testing

Well construction materials, methods, development, and integrity testing are described in the following subsections. All injection and production wells will be completed in accordance with South Dakota Well Construction Standards in ARSD 74:02:04 and EPA Standards for Class III UIC wells.

5.3.3.2.1 Well Construction Materials

Well casing material typically will be thermoplastic such as polyvinyl chloride (PVC) with at least SDR 17 wall thickness. The wells typically will be 4.5 to 6-inch nominal diameter and will meet or exceed the specifications of ASTM Standard F480 and NSF Standard 14. In order to provide an adequate annular seal, the drill hole diameter will be at least 2 inches larger than the outside diameter of the well casing.

The annulus will be pressure-grouted and sealed with neat cement grout composed of sulfate-resistant Portland cement in accordance with South Dakota well construction standards. Water used to make the cement grout will not contain oil or other organic material. Cement grout could contain adequate bentonite to maintain the cement in suspension in accordance with Halliburton cement tables.

Casing will be joined using methods recommended by the casing manufacturer. PVC casing joints approximately 20 feet apart will be joined mechanically (with a watertight O-ring seal and a high strength nylon spline) to ensure watertight joints above the perforations or screens. Casings and annular material will be routinely inspected and maintained throughout the operating life of the wells.

5.3.3.2.2 Well Construction Methods

Typical production and injection well installation will begin by drilling a pilot bore hole through the ore zone to obtain a measurement of the uranium grade and thickness. The ore depth is anticipated to range from 200 to 800 feet. Typical monitor well construction will begin with drilling a pilot bore hole through the target completion zone. For all wells, the pilot bore hole will be geologically and geophysically logged. After logging, the pilot bore hole will be reamed to the appropriate diameter to the top of the target completion zone. A continuous string of PVC casing will be placed into the reamed borehole. Casing centralizers will be installed as appropriate. With the casing in place a cement/bentonite grout will be pumped into the casing. The grout will circulate out the bottom of the casing and up the casing annulus to the ground surface. The volume of grout necessary to cement the annulus will be calculated from the bore hole diameter of the casing with sufficient additional allowance to achieve grout returning to surface. Grout remaining inside the well casing may be displaced by water or heavy drill mud to minimize the column of the grout plug remaining inside the casing. Care will be taken to assure that a grout plug remains inside the casing at completion. The casing and grout then will be allowed to set undisturbed for a minimum of 24 hours. When the grout has set, if the annular seal observed from the ground surface has settled below the ground surface, additional grout will be placed into the annular space to bring the grout seal to the ground surface. Figure 5.3-15 depicts the typical well construction schematic.

After the 24-hour (minimum) setup period, a drill rig will be mobilized to finish well construction by drilling through the grout plug and through the target completion zone to the specified total well depth. The open bore hole then will be underreamed to a larger diameter. The following discussion represents the anticipated typical well construction methods. The actual methods may vary.

A well screen assembly (if used) will be lowered through the casing into the open hole. The top of the well screen assembly will be positioned inside the well casing and centralized and sealed inside the casing using K packers. With the drill pipe attached to the well screen, a 1-inch diameter tremie pipe will be inserted through drill pipe and screen and through the sand trap

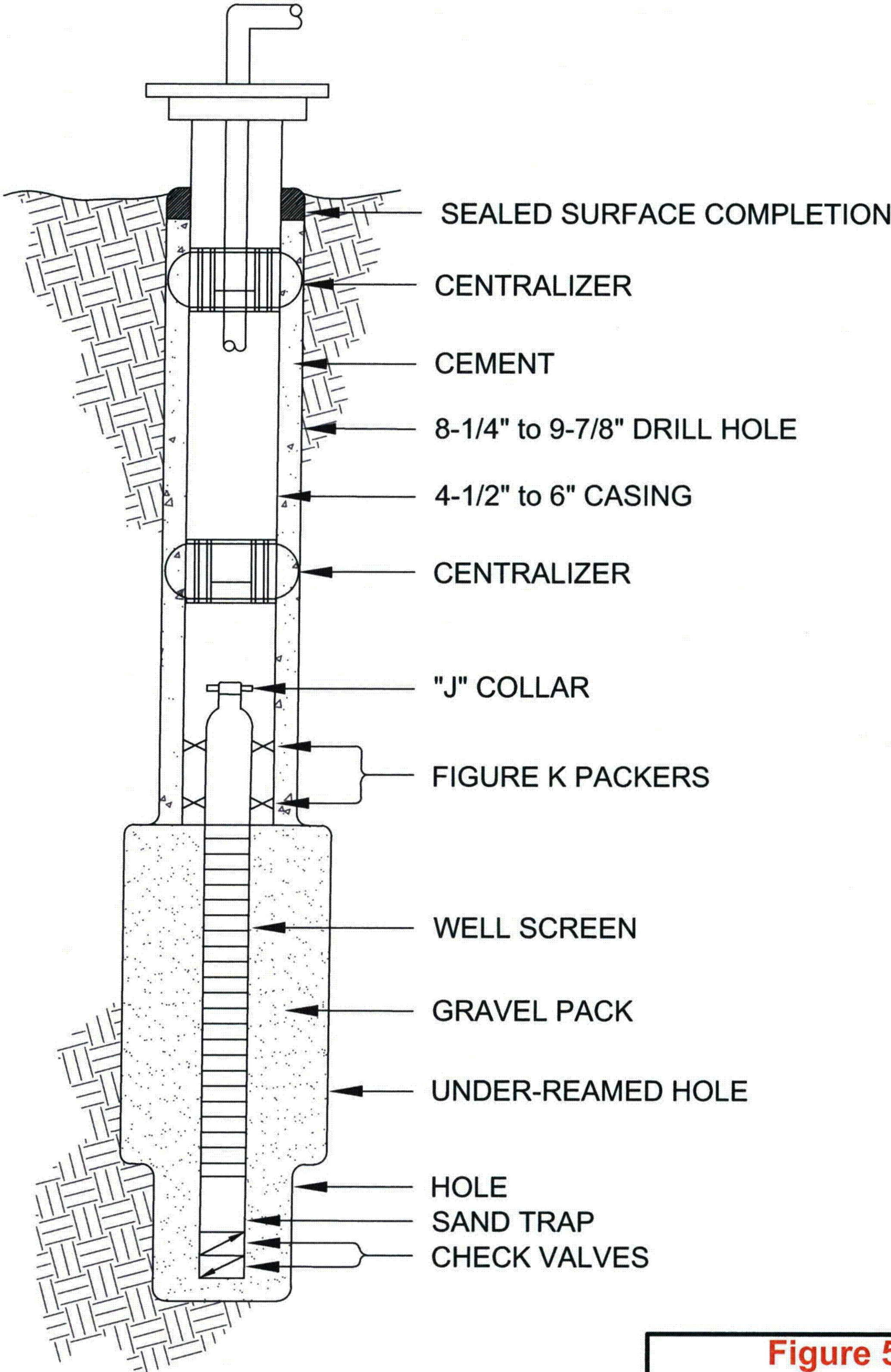


Figure 5.3-15

Typical Well Construction

Dewey-Burdock Project

SIGNATURE OF PREPARER	John Mays
PREPARER	John Mays
DATE	16-Sep-2012
FILE	Wells-TypConstruction.dwg

POWERTECH (USA) INC.

This figure is provided to fulfill the requirements of ARSD 74:29:02:04 and SDCL 45-6B-6(8).

check valves at the bottom of well screen assembly. Filter sand (if used), composed of well-rounded silica sand sized to optimize hydraulic communication between the target zone and well screen, then will be placed between the well screen and the formation. The volume of sand introduced will be calculated such that it fills the annular space. The sand will not extend upward beyond the K packers due to packer design. A well completion report then will be prepared for each well.

5.3.3.2.3 Geophysical Logging

Ore grade gamma log, self potential and single point resistivity electric logs will be run in the pilot holes prior to reaming the hole to final diameter to run casing. These logs will determine the location and grade of uranium and the sand and clay unit depths to properly plan each pattern.

5.3.3.2.4 Well Development

The primary goals of well development will be to allow formation water to enter the well screen, flush out drilling fluids, and remove the finer clays and silts to maximize flow from the formation through the well screen. This process is necessary to allow representative samples of groundwater to be collected, if applicable, and to ensure efficient injection and production operations. Wells will be developed immediately after construction using air lifting, swabbing, pumping or other accepted development techniques which will remove water and drilling fluids from the casing and borehole walls along the screened interval. Prior to obtaining baseline samples from monitor wells, additional well development will be conducted to ensure that representative formation water is sampled. The water will be pumped sufficiently to show stabilization of pH and conductivity values prior to sampling to demonstrate that development activities have been effective.

5.3.3.2.5 Mechanical Integrity Testing

All injection, production, and monitor wells will be field tested to demonstrate the mechanical integrity of the well casing. The mechanical integrity testing (MIT) will be performed using pressure-packer tests. The bottom of the casing will be sealed with a plug, downhole inflatable packer, or other suitable device. The casing will be filled with water and the top of the casing will be sealed with a threaded cap, mechanical seal or downhole inflatable packer. The well casing then will be pressurized with water or air and monitored with a calibrated pressure gauge.

Internal casing pressure will be increased to 125 percent of the maximum operating pressure of the well field, 125 percent of the maximum operating pressure rating of the well casing (which is always less than the maximum pressure rating of the pipe), or 90 percent of the formation fracture pressure (calculated according to EPA-approved methods), whichever is less. A well must maintain 90 percent of this pressure for a minimum of 10 minutes to pass the test.

If there are obvious leaks, or the pressure drops by more than 10 percent during the 10-minute period, the seals and fittings on the packer system will be checked and/or reset and another test will be conducted. If the pressure drops less than 10 percent the well casing will have demonstrated acceptable mechanical integrity.

If a well casing does not meet the MIT criteria, the well will be removed from service. The casing may be repaired and the well re-tested, or the well may be plugged and abandoned. Well plugging procedures are described in Section 6.3.3. If a repaired well passes MIT, it will be employed in its intended service following demonstration that the well meets MIT criteria. If an acceptable test cannot be demonstrated following repairs, the well will be plugged and abandoned.

In addition to the integrity testing after well construction, MIT will be conducted on any well following any repair where a downhole drill bit or under-reaming tool is used. Any well with evidence of subsurface damage will require a new MIT prior to the well being returned to service. MIT also will be repeated once every 5 years for all active wells.

MIT documentation will include the well designation, test date, test duration, beginning and ending pressures, and the signature of the individual responsible for conducting the test. Results of the MIT will be maintained on-site and will be available for inspection by regulatory agencies.

5.3.3.3 Pump Testing

The following pump testing procedures will be used to establish that the production and injection wells are hydraulically connected to the perimeter production zone monitor wells, that the production and injection wells are hydraulically isolated from non-production zone vertical monitor wells, and to detect potentially improperly plugged wells or exploration holes. Pump testing results will be included in the well field hydrogeologic data packages described in Section 5.3.3.4.

Pump Testing Design

An extensive pump test program will be designed and implemented prior to operation of each well field to evaluate the hydrogeology and assess the ability to operate the well field. Prior to pump testing several important well field development steps will be completed:

1) Delineation drilling at spacing sufficient to finalize well field design. As standard procedure, all delineation holes will be plugged and abandoned after drilling.
2) Detailed mapping of the ore bodies targeted for ISR operations and the lithology of overlying and underlying sand units and aquitards.
3) Revision of the conceptual geology and hydrogeology including definition of aquitards and sand units to be produced or monitored.
4) Design of the production and injection wells including well locations and screened intervals.
5) Design of the monitor well system based on production and injection well locations and refined conceptual geology and hydrogeology.
6) Specification of all monitor well locations and screened intervals.
7) Installation of all monitor wells and production wells to be used during pump testing.
8) Plugging and abandoning all water supply wells within ¼ mile of the well field or that have been determined through preliminary evaluation to be potentially impacted by ISR operations or to impact ISR operations.

Pump Testing Procedures

Appropriate wells as needed for characterization and regulatory purposes will be monitored during the pumping test, including but not necessarily limited to the following wells:

1) Pumping wells,
2) Monitor wells within the production zone,
3) Perimeter production zone monitor wells,
4) Monitor wells in the immediately overlying non-production zone sand unit,
5) Monitor wells in each subsequently overlying non-production zone sand unit,
6) Monitor wells in the alluvium, if present,
7) Monitor wells in the immediately underlying non-production zone sand unit, if the production zone does not occur immediately above the Morrison,
8) Any additional wells installed for investigating other hydrogeologic features, and
9) Any other wells within proximity to the well field that have been identified as having the potential to impact or be impacted by ISR operations.

In general, the monitoring system wells will be monitored using downhole data logging pressure transducers, which will be corrected for variations in barometric pressure. Some manual measurements with electronic meters also may be made.

Prior to testing, static potentiometric water levels will be measured in every well in the monitoring system. Where a sufficient number of data points exist, these data will be used to map the pre-operational potentiometric surface for each unit including alluvium, where present. Because of the high density of wells and artesian conditions at the site, any leakage across aquitards due to improperly plugged boreholes or wells typically will become apparent while preparing potentiometric surface maps. Water samples will be collected from selected monitor wells and analyzed for baseline parameters. The water quality will be evaluated to identify any potential areas of leakage across aquitards due to improperly plugged boreholes or wells.

Pump testing will involve inducing stress on the production zone sand unit by operating pumping wells. The goal of the test will be to demonstrate suitable conditions for ISR operations. This will be done by causing drawdown in the production zone extending to all perimeter monitor wells, creating a cone of depression across the well field area to test the confinement between the production zone and the overlying and underlying sand units and alluvium, if present, and addressing potential leakage through confining units via improperly sealed or unplugged exploration boreholes, or associated with naturally occurring geologic features. The presence or lack of response in vertical monitor wells will be used for evaluation of confinement between these units and for identification of leakage due to anomalies such as improperly plugged boreholes. If leakage is present, the relative responses in the overlying, underlying, and/or alluvial monitor wells will indicate the proximity and direction toward the source of leakage.

If saturated alluvium is present within the well field, alluvial monitor wells will be installed and monitored above the production zone and within an appropriate distance from the well field. The water level in the alluvium will be measured prior to testing and monitored during pump testing. If there are anomalous conditions that cause communication between the production zone and alluvium such as an improperly plugged borehole, these conditions will be identified through responses in the alluvial monitor wells.

The pumping test duration will be sufficient to create a suitable response in the perimeter monitor wells, typically a minimum drawdown of 1 foot. If hydrogeologic conditions dictate, less response may be adequate to show a direct cause and effect from pumping.

The flow rate of the pumping test will be based on well capacity and design requirements. More than one pumping well may be required to create drawdown in all perimeter monitor wells.

Measurements during pump testing will include instantaneous and totalized flow, periodic pressure transducer measurements, barometric pressure, and time. A step rate test will be performed initially. There will be an initial stabilization phase with no flow, a stress period of constant flow, and a recovery period with no flow.

Pump Test Evaluation

Evaluation of pump test data will address the following:

1) Demonstration of hydraulic connection between the production and injection wells and all perimeter monitor wells and across the production zone.
2) Verification of the geologic conceptual model for the well field.
3) Evaluation of the vertical confinement and hydraulic isolation between the production zone and overlying and underlying units.
4) Calculation of the hydraulic conductivity, storativity, and transmissivity of the production zone sand unit.
5) Evaluation of anisotropy within the production zone sand unit.

5.3.3.4 Well Field Hydrogeologic Data Packages

Pump testing data and results will be included in the well field hydrogeologic data packages, which will be prepared in accordance with NRC license requirements. Upon completion of field data collection and laboratory analysis, the well field hydrogeologic data packages will be assembled and submitted for review by the Safety and Environmental Review Panel (SERP) for evaluation. The SERP is described in Section 5.7.2.3. The SERP evaluation will determine whether the results of the hydrologic testing and the planned ISR operations are consistent with standard operating procedures and technical requirements stated in the NRC license. The evaluation will include review of the potential impacts to human health and the environment. Relevant portions also will be included in injection authorization data packages, which will be submitted to EPA for review and verification. If anomalous conditions are present, the SERP evaluation indicates potential to impact human health or the environment, or to meet NRC license requirements, the well field hydrogeologic data package will be submitted to NRC. The well field hydrogeologic data package and written SERP evaluation will be maintained at the site and available for regulatory agency review.

Each well field hydrogeologic data package will contain the following:

1) A description of the proposed well field (location, extent, etc.).

2) Map(s) showing the proposed production and injection well patterns and locations of all monitor wells.
3) Geologic cross sections and cross section location maps.
4) Isopach maps of the production zone sand and overlying and underlying confining units.
5) Discussion of how pump testing was performed, including well completion reports.
6) Discussion of the results and conclusions of the pump testing, including pump testing raw data, drawdown match curves, potentiometric surface maps, water level graphs, drawdown maps and, when appropriate, directional transmissivity data and graphs.
7) Sufficient information to show that wells in the monitor well ring are in adequate communication with the production patterns.
8) Baseline water quality information including proposed upper control limits (UCLs) for monitor wells and target restoration goals (TRGs).
9) Any other information pertinent to the proposed well field area tested will be included and discussed.

In addition to the well field hydrogeologic data packages, Powertech (USA) will prepare and submit injection authorization data packages to EPA for each well field. The injection authorization data packages will contain much of the information described previously for well field hydrogeologic data packages, including well field designs, pump testing results, calculated formation fracture pressure for each header house and the designated maximum injection pressure for each header house.

5.3.3.5 Well Field Operation

Refer to Section 5.1.3 for an overview of well field operations. The following sections describe key operating provisions in greater detail, including hydraulic well field control, injection pressure, and the water balance.

5.3.3.5.1 Hydraulic Well Field Control

Powertech (USA) will maintain hydraulic control of each well field from the first injection of lixiviant through the end of aquifer restoration. During uranium recovery, the groundwater removal rate in each well field will exceed the lixiviant injection rate, creating a cone of depression within each well field. During aquifer restoration, the groundwater removal rate in each well field will exceed the injection rate of permeate and clean makeup water from the Madison Limestone or another suitable formation. If there are any delays between uranium recovery and aquifer restoration, production wells will continue to be operated as needed to maintain water levels within the perimeter monitor rings below baseline water levels. This activity may be intermittent or continuous.

Verification of hydraulic control will be performed through water level measurements in perimeter monitor wells. Water levels will be measured using pressure transducers or manual electronic meters and recorded at a frequency appropriate to confirm hydraulic well field control.

5.3.3.5.1.1 Flare Control

Flaring (movement of lixiviant outside of the well field pattern area) will be limited by maintaining hydraulically balanced well fields and adequate bleed during uranium recovery and aquifer restoration. The financial assurance calculations for aquifer restoration that are reviewed and approved by NRC will account for flare. Powertech (USA) has provided a flare estimate in Appendix 6.7-A that is justified by numerical groundwater modeling and is comparable to values that have been approved recently by NRC for other ISR facilities.

5.3.3.5.2 Injection Pressure

The maximum injection pressure for ISR injection wells will be regulated by both EPA UIC permit condition and NRC license condition. Class III UIC regulations in 40 CFR § 144.28(f)(g)(i) limit the injection pressure in ISR injection wells to a level below the formation fracture pressure. Similarly, NRC guidance in NUREG-1569 (NRC, 2003) requires demonstration that down-hole injection pressure will be maintained below the formation fracture pressure. Powertech (USA) will maintain the injection pressure of ISR injection wells below the formation fracture pressure as required by EPA permit and NRC license conditions.

Powertech (USA) will specify the maximum injection pressure for each header house. The designated maximum pressure will be posted near the injection trunk line gauge used to monitor injection pressure. The maximum injection pressure will be calculated as the lowest value of the following:

- The lowest value of maximum allowable wellhead pressure for all injection wells connected to the header house based on fracture pressure calculations using methodology approved by EPA in the Class III UIC permit.
- The manufacturer-specified maximum operating pressure for the well casing.
- The manufacturer-specified maximum operating pressure of the injection piping and fittings.

The anticipated range of injection pressure, measured at each header house, is 20 to 150 psig.

5.3.3.5.3 Water Balance

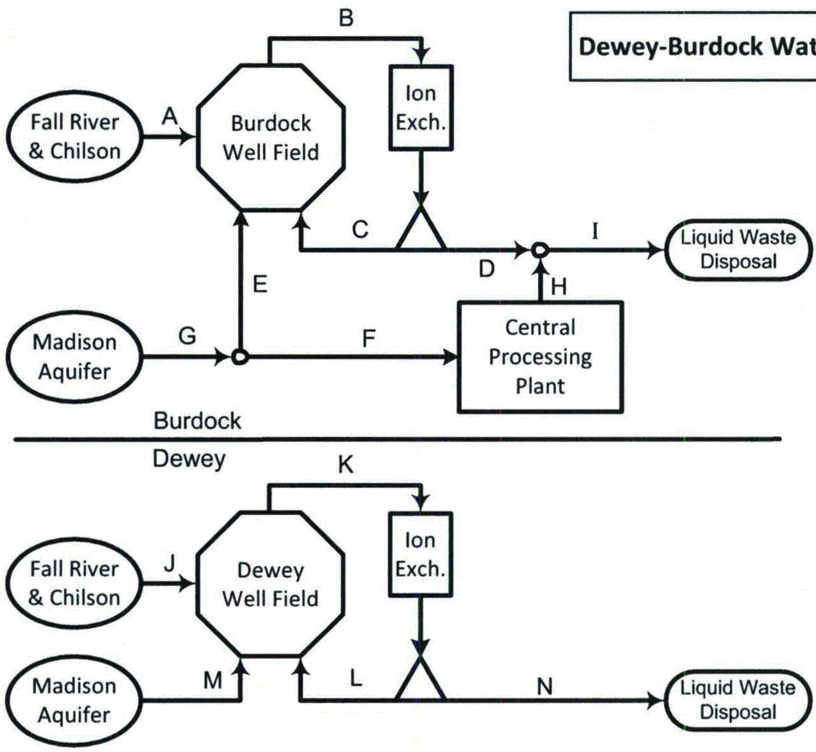
Typical water balances during uranium recovery and aquifer restoration are presented in Figure 5.3-16. The figure depicts typical flow rates during the uranium recovery and aquifer restoration phases. Table 5.3-2 shows the typical design flow rates during concurrent uranium recovery and aquifer restoration. Detailed descriptions of the water balances for the Dewey-Burdock Project are provided below along with a discussion of liquid waste disposal capacities.

5.3.3.5.3.1 Uranium Recovery Water Balance

During uranium recovery without concurrent aquifer restoration, the flow rates will be the same for either wastewater disposal option. The typical production bleed will be approximately 0.875%. The typical well field production will be approximately 4,800 gpm (Stream B) from Burdock well fields and 3,200 gpm (Stream K) from Dewey wells fields. Note that these are typical flow rates provided to illustrate the water balance when the Dewey and Burdock well fields are operating simultaneously. An important value is the sum of Streams B and K, which represents the typical project-wide production flow rate. The maximum project-wide gross pumping rate from producing well fields is anticipated to be 8,000 gpm (Streams B plus K). This will be limited by NRC license conditions. Although the NRC license application currently requests a maximum gross pumping rate of 4,000 gpm, Powertech (USA) anticipates submitting an amendment application to NRC to increase the maximum allowable gross pumping rate in order to provide operational flexibility. It is important to note that the net withdrawal from the Inyan Kara typically will be only 0.875% of this amount, or the amount of the typical production bleed. Multiplying the typical production bleed rate by the maximum anticipated gross pumping rate of 8,000 gpm yields typical production bleed flow rates of 42 gpm (Stream A) at Burdock and 28 gpm (Stream J) at Dewey. This demonstrates that the vast majority of water pumped from the production zone will be reinjected, such that the net withdrawal rate will be only a small fraction of the gross pumping rate.

Wastewater resulting from uranium recovery operations at the Dewey area will consist almost entirely of production bleed. At the Burdock area, wastewater also will include process solutions (such as resin transfer water and brine generated from the elution and precipitation circuits), affected well development water, laboratory wastewater, laundry water, and plant wash down water. Wastewater flow rates, which are represented by Streams I and N, will typically be approximately 54 gpm and 28 gpm, respectively. As described in Section 5.4.1.1.3, all wastewater associated with ISR operations will be treated prior to disposal via deep disposal wells and/or land application.

Dewey-Burdock Water Balance



Stream ID	Description
A	Burdock Aquifer Bleed
B	Burdock Extraction Composite
C	Burdock Reinjection
D	Burdock Well Field Bleed
E	Burdock Madison Make-up
F	Burdock Fresh Brine Make-up
G	Burdock Madison, Total
H	Burdock CPP Brine
I	Burdock Liquid Waste
J	Dewey Aquifer Bleed
K	Dewey Extraction Composite
L	Dewey Reinjection
M	Dewey Madison Make-up
N	Dewey Liquid Waste

Water Balance Flow Rates (gpm)											
Operation Phase	Aquifer Bleed Option	Disposal Option	Burdock								
			Stream ID								
			A	B	C	D	E	F	G	H	I
Recovery	0.875%	DDW	42	4800	4758	42	0	12	12	12	54
		LA	42	4800	4758	42	0	12	12	12	54
Restoration	Without Groundwater Sweep	DDW	2.5	250	175	75	73	0	73	0	75
		LA	2.5	250	0	250	248	0	248	0	250
	With Groundwater Sweep	DDW	42	250	175	75	33	0	33	0	75
		LA	42	250	0	250	208	0	208	0	250

Water Balance Flow Rates (gpm)							
Operation Phase	Aquifer Bleed Option	Disposal Option	Dewey				
			Stream ID				
			J	K	L	M	N
Recovery	0.875%	DDW	28	3200	3172	0	28
		LA	28	3200	3172	0	28
Restoration	Without Groundwater Sweep	DDW	2.5	250	175	73	75
		LA	2.5	250	0	248	250
	With Groundwater Sweep	DDW	42	250	175	33	75
		LA	42	250	0	208	250

Figure 5.3-16: Typical Project-wide Flow Rates during Uranium Recovery and Aquifer Restoration

Table 5.3-2: Typical Project-wide Flow Rates during Concurrent Uranium Recovery and Aquifer Restoration

Typical Project-wide Flow Rates		Wastewater Disposal Option			
		Deep Disposal Well		Land Application	
Restoration Option		Without Groundwater Sweep	With Groundwater Sweep	Without Groundwater Sweep	With Groundwater Sweep
Fall River & Chilson	gpm	75	154	75	154
Madison Limestone	gpm	158	78	508	428
Wastewater Disposal	gpm	232	232	582	582

5.3.3.5.3.2 Aquifer Restoration Water Balance

Powertech (USA) proposes two options for disposal of wastewater associated with ISR operations at the Dewey-Burdock Project: (1) injection of treated wastewater in non-hazardous Class V DDWs, and/or (2) land application of treated wastewater using center pivots (refer to Section 5.4.1.1). The disposal option selected will determine the method of aquifer restoration used. RO treatment with permeate injection will be used in the DDW option, and groundwater sweep with injection of clean makeup water from the Madison Limestone or another suitable formation will be used in the land application option. The aquifer restoration methods are described in detail in Section 6.2. Both disposal options are included in the water balance to illustrate the different wastewater disposal flow rates in each option. In the DDW option, the groundwater withdrawn during aquifer restoration will be treated by RO. The concentrated brine solution will be disposed in the DDWs, while the permeate will be reinjected along with makeup water from the Madison Limestone or another suitable formation into the well fields. This will reduce the overall wastewater flow rate. Flow rates will be higher if land application is used, because the entire restoration stream will be disposed in the land application system.

Although a 1% or less restoration bleed will be adequate to maintain hydraulic control of well fields undergoing active aquifer restoration, additional bleed may be recovered to enhance aquifer restoration through a process known as groundwater sweep. As described in Section 6.2.2.3, Powertech (USA) may withdraw up to one pore volume of water through groundwater sweep over the course of aquifer restoration. This will result in an average restoration bleed of approximately 17%. The wastewater disposal systems have been designed to accommodate both options, and both options are depicted in the water balance.

The typical restoration extraction flow rate from the Dewey and Burdock well fields will be approximately 250 gpm each for a total of 500 gpm. The total project-wide restoration extraction flow rate will be approximately 500 gpm, while the specific contribution from the Dewey and Burdock well fields will vary. If groundwater sweep is not used, approximately 2.5 gpm less will be injected than is recovered. For the DDW option, RO treatment of the restoration solution typically will result in 175 gpm of permeate returning to each of the Dewey and Burdock well fields (Stream C for Burdock and Stream L for Dewey) and 75 gpm of wastewater being routed to the DDWs (Stream I for Burdock and Stream N for Dewey). If land application is used for wastewater disposal, all 250 gpm of the restoration extraction solution will be sent to the land application systems. In this case clean makeup water from the Madison Limestone or another suitable formation will be injected instead of permeate. Regardless of the disposal option, the balance of water required to maintain the restoration bleed of 1% will be supplied from the Madison Limestone or another suitable formation.

If groundwater sweep of one pore volume is used, overall restoration bleed will average approximately 17%, resulting in 42 gpm being removed from the ore zone aquifer under both disposal options. Similar to the aquifer restoration option without groundwater sweep, the resulting wastewater disposal flow rates typically will be 75 gpm for the DDW option and 250 gpm for the land application option.

Note that Streams F and H, which represent the flows from the Madison to the CPP and from the CPP to wastewater disposal, are typically zero during aquifer restoration without concurrent uranium recovery. While there will be times during this phase when wastewater will be generated from the CPP, they will be infrequent due to the small number of resin transfers and elution and precipitation cycles during this phase. During this phase the water supply needs for the CPP will be nearly zero in the typical water balance.

5.3.3.5.3.3 Concurrent Uranium Recovery and Aquifer Restoration Water Balance

A typical water balance for concurrent uranium recovery and aquifer restoration is shown in Table 5.3-2. The table shows the typical combined flow from the Fall River Formation and Chilson Member and the flow from the Madison. It also shows the typical wastewater disposal flow rates under the different restoration options. The typical values for Fall River and Chilson flow rates were obtained by adding the Streams A and J in Figure 5.3-16 for both uranium recovery and aquifer restoration. The typical Madison Formation makeup water flow rate was obtained by adding Streams G and M in Figure 5.3-16 for uranium recovery and aquifer restoration. The wastewater disposal flow rate was obtained by adding the Streams I and N in Figure 5.3-16 for uranium recovery and aquifer restoration. The typical wastewater flow rates during concurrent uranium recovery and aquifer restoration will be approximately 232 gpm for the DDW option and 582 gpm for the land application option.

5.3.3.5.3.4 Wastewater Disposal Capacity

The wastewater disposal capacity is described in Section 5.4.1.1. In the DDW option, the wastewater disposal capacity will be up to 300 gpm. This is about 30 percent more than the maximum anticipated wastewater flow rate in the DDW option (232 gpm during concurrent uranium recovery and aquifer restoration as shown in Table 5.3-2).

In the land application option, the wastewater disposal capacity will be at least 620 gpm on an annual average basis (accounting for zero discharge during the time of year when land application will not be used). This is approximately 7 percent greater capacity than the maximum shown in Table 5.3-2 (582 gpm during concurrent uranium recovery with aquifer restoration, groundwater sweep option). In addition, significant surplus capacity will be provided with standby center pivots in each land application area. Refer to Section 5.4.1.1 and the GDP.

5.3.3.6 Approach to Well Field Development with Respect to Partially Saturated Conditions

Refer to Section 3.4.2.2.4 for a description of partially saturated conditions. The only instance where hydrologically unconfined (partially saturated) conditions exist within an area proposed for ISR operations occurs in the eastern portion of the permit area. Powertech (USA) does not intend to conduct ISR operations in the Fall River sands in the eastern portion of the permit area where the Fall River is partially saturated (i.e., hydraulically unconfined). Powertech (USA) is, however, proposing to conduct ISR operations in the underlying Chilson at these locations. The Chilson is physically and hydraulically isolated from the Fall River by the Fuson Shale. Although the Chilson is not fully saturated near the eastern edge of the permit area, the mineralization occurs near the base of the formation. As a result, any ISR operations will occur within the portion of the Chilson where confining layers and sufficient head above the ore body will provide ample means to control ISR solutions.

Geologic Cross Section B-B' (Plate 3.2-14) shows the potentiometric surfaces as well as the interbedded shales and siltstones within the Fall River and Chilson. The cross section depicts the location of the mineralization in the Chilson in relation to the Chilson potentiometric surface. Near the eastern portion of the permit area the potentiometric surface is nearly 100 feet higher than the mineralization. Locally occurring shale units may serve to further confine the mineralization within the Chilson. As such, Powertech (USA) does not anticipate that ISR operations will occur where there is less than 50 feet of potentiometric head over the ore body.

After license/permit issuance but prior to well field development, delineation drilling and well field pumping tests will be conducted to fully characterize the existing geologic and hydrogeologic conditions and to confirm sufficient head is available to perform normal ISR operations. As an integral component of the characterization activities, a detailed evaluation will be made, based on actual site conditions, regarding the application of ISR under partially saturated conditions should it be necessary. Partially saturated conditions, if encountered, would be similar in many respects to what has been licensed at other ISR projects (e.g., Moore Ranch in Wyoming) and would be addressed similarly with modeling.

5.3.3.7 Approach to Well Field Development with Respect to Historical Mine Workings

As described in Section 3.2.5.2 the former Darrow and Triangle open-pit mines and associated underground workings in the eastern portion of the permit area extracted ore from the Fall River Formation. There are no underground mines within the permit area that are not associated with, adjacent to, or extensions of the open pits, all of which are within the Upper Fall River Formation. These open-pit mines and underground workings did not penetrate the underlying Fuson Shale, which physically and hydraulically separates the Fall River from the underlying Chilson Member of the Lakota Formation across the entire permit area.

Powertech (USA) will not conduct ISR operations in ore bodies in the Fall River in the vicinity of the Darrow and Triangle pits. Powertech (USA) proposes to conduct ISR operations within the Chilson in this area. Because of the physical and hydraulic separation of the Chilson from the overlying Fall River Formation, ISR operations in the Chilson will not affect the Fall River or create or enhance migration of constituents of concern from the surface (open-pit) or underground mines.

Figure 3.2-8 shows the spatial relationship between the potential ISR well fields and the historical mine areas. An examination of this figure shows that proposed Burdock Well Field 7 (B-WF7) underlies portions of the historical Darrow mine area. The targeted production zone for B-WF7 is the Lower Chilson. Figure 3.2-12 illustrates the stratigraphic separation of this Lower Chilson sand unit from the historical mining operations in sands of the Fall River Formation. The gamma activity shown within the Lower Chilson sand on the type log is representative of the proposed uranium recovery horizon in B-WF7. This interval is over 200 feet below the base of the Fall River Formation and is separated by 40 feet of the Fuson Shale confining unit, as well as two interbedded shale intervals within the Chilson Member – one 12 feet thick and the other 23 feet thick.

As also shown on Figure 3.2-8, potential Burdock Well Field 8 (B-WF8) is below and horizontally adjacent to the surface expression of an area of past mining disturbance in Section 35, T6S, R1E. Excavation in this area was underway when the Edgemont mill was closed. This operation was on land owned by the Spencer family, and Donald Spencer (2011) related that all mining operations ceased before reaching the ore horizon. The pit was backfilled and reclaimed. Powertech (USA)'s targeted uranium recovery horizon for B-WF8 is the Lower

Chilson. This unit is at least 200 feet beneath the base of the Fuson Shale and is well below the historical mining disturbance in the Fall River Formation.

Powertech (USA) also will install and sample operational monitor wells in the Fall River, Chilson, and alluvium between the surface (open-pit) mines and well field areas. For additional information, refer to Section 5.5.2.3.

5.3.3.8 Approach to Well Field Development with Respect to Alluvium

This section summarizes Powertech (USA)'s approach to well field development in areas of Beaver Creek and Pass Creek alluvium, including alluvial characterization, pump testing, and operational monitoring. This section consolidates information presented elsewhere in the application and includes references to the applicable sections.

Alluvial Characterization

Powertech (USA) completed an alluvial drilling program in 2011 to characterize the thickness, extents, and saturated thickness (if water was present) of the alluvium along Beaver Creek and Pass Creek. Alluvial characteristics will be further evaluated during well field delineation drilling described in Section 5.3.3.3.

Pump Testing

As described in Section 5.3.3.3, an extensive pump testing program will be designed and implemented prior to operation of each well field to evaluate the hydrogeology and assess the ability to operate the well field. Monitor wells will be completed in the alluvium, if present.

Operational Monitoring

Section 5.3.3.1.2.2 describes how alluvium will be treated as an overlying hydrogeologic unit and monitored appropriately during operational groundwater monitoring. Powertech (USA) also will monitor potential changes in alluvial water quality throughout the permit area through the monitoring network described in Section 5.5.2.3.

5.3.4 Ponds

5.3.4.1 Pond Design

Lined ponds will be used to temporarily store liquid waste generated at the Satellite Facility and CPP. The pond lining systems will vary according to pond use. Ponds containing untreated liquid waste or ponds used in the treatment process (e.g., radium settling ponds) will be provided with two geosynthetic liners, a clay liner, and a leak detection system. Ponds containing treated water will be provided with a single geosynthetic liner underlain by a clay liner. The pond capacity will vary according to the liquid waste disposal option. Greater capacity is required for the land application option, since liquid waste will be stored during times of year when the land application systems are not operated.

The pond design for both liquid waste disposal options is summarized below. Appendix 5.3-A provides detailed pond design information, and Appendix 5.3-B contains pond construction specifications, testing and QA/QC procedures. Section 5.3.4.2 provides detailed descriptions of pond sizing calculations.

Land Application Option

The land application disposal option will include the following ponds:

- **Two (2) Radium Settling Ponds** - one near each land application area (Dewey and Burdock). Each pond will have an operating capacity of 39.4 acre-feet. Radium settling ponds for the land application disposal option were designed such that a single pond has sufficient capacity for radium removal of the entire project-wide wastewater stream at the maximum expected production bleed of 3% while maintaining a minimum retention time of 14.1 days.
- **Two (2) Spare Ponds** - one at each area. Each pond will have an operating capacity of 39.4 acre-feet. The spare ponds will be designed with the same dimensions and liner system as the radium settling ponds so that they can be used as either spare radium settling ponds or spare central plant ponds.
- **Two (2) Outlet Ponds** - one at each area. Each pond will have an operating capacity of 4.9 acre-feet. The outlet ponds will be designed to temporarily store treated water from the radium settling ponds and provide extra capacity for the radium settling ponds during large precipitation events.
- **Eight (8) Storage Ponds** - four at each area. Each pond will have an operating capacity of 63.8 acre-feet. The storage ponds will be used to store treated water during the winter months when no liquid waste disposal by land application systems is available. The total storage required at each area was obtained using the SPAW model, which is discussed in more detail in Appendix 5.3-A and the GDP.
- **Two (2) Spare Storage Ponds** - one at each area. Each pond will have an operating capacity of 63.8 acre-feet. The spare storage ponds will be designed with the same dimensions and liner system as the storage ponds so that they can be used in the event of an upset condition.
- **One (1) Central Plant Pond** - located at the CPP, with an operating capacity of 36.2 acre-feet. The storage capacity design for the central plant pond allows for over 18 months of CPP liquid waste storage, which will be required during initial uranium

recovery operations when no groundwater sweep water is available to blend with CPP liquid waste.

Deep Disposal Well Option

The DDW liquid waste disposal option will include the following ponds:

- **Two (2) Radium Settling Ponds** - one at each area. Each pond will have an operating capacity of 15.9 acre-feet. Radium settling ponds for the DDW option were designed such that a single pond has sufficient capacity for radium removal of the entire project-wide liquid waste stream at the maximum expected production bleed of 3% while maintaining a minimum retention time of 12.7 days.
- **Two (2) Spare Ponds** - one at each area. Each pond will have an operating capacity of 15.9 acre-feet. The spare ponds will be designed with the same dimensions and liner system as the radium settling ponds so that they can be used as either spare radium settling ponds or spare central plant ponds.
- **Two (2) Outlet Ponds** - one at each area. Each pond will have an operating capacity of 5.1 acre-feet. The outlet ponds will be designed to temporarily store treated water from the radium settling ponds and provide extra capacity for the radium settling ponds during large precipitation events.
- **Two (2) Surge Ponds** - one at each area. Each pond will have an operating capacity of 8.4 acre-feet. The surge ponds will provide surge capacity for treated liquid waste flowing out of the radium settling ponds. They have been sized to accommodate 7 days of water production.
- **One (1) Central Plant Pond** - located at the CPP, with an operating capacity of 15.9 acre-feet.

In the event that both deep disposal wells and land application are used, the pond capacity will be in between the two sizes discussed above.

All ponds have been designed to accommodate the design flows of liquid waste plus the precipitation from the 100-year, 24-hour precipitation event, while maintaining 3 feet of freeboard.

Seismic stability analyses for the pond designs are discussed in Sections 3.11.4 and 3.11.5 of the Dewey-Burdock Pond Design Report (Appendix 5.3-A), which concludes, "The factors of safety indicate that the inner and outer slopes are stable under static and maximum credible earthquake seismic loading conditions."

5.3.4.2 Pond Sizing and Sludge Accumulation

The capacity of all of the ponds for each liquid waste disposal option is summarized in Section 5.3.4.1. Following is more detailed discussion on the sizing calculations for the radium settling ponds, storage ponds, and central plant pond.

Radium Settling Ponds

In either liquid waste disposal option, the liquid waste will be treated for radium removal through co-precipitation with barium sulfate in the radium settling ponds. Barium chloride will be added to the liquid waste from the Satellite Facility and low-TDS liquid waste from the CPP, and the resulting solution will be discharged into the radium settling ponds, where the radium will co-precipitate with barium sulfate.

The radium settling ponds have been sized to provide adequate settling time even after 20 years of operation, during which time barium sulfate sludge will accumulate in the ponds. The calculated resulting retention time after 20 years is estimated to be at least 15 days for either liquid waste disposal option. As stated in the Pond Design Report (Appendix 5.3-A), "a literature survey of radium settling ponds has indicated that typical retention times range from 8 to 14 days." Therefore, radium settling ponds at the Dewey-Burdock Project will have adequate retention times even after 20 years of service. In addition, the Satellite Facility and CPP each will have a spare pond suitable for use as a settling pond if the primary ponds need to be temporarily removed from service for sludge removal or repair.

Storage Ponds

Appendix 5.3-A and the GDP describe how the SPAW (Soil-Plant-Atmosphere-Water) model was used to estimate the water budget for the storage ponds. The model results show that the total required irrigation storage pond volume having a 1-percent exceedance probability is 216 acre-feet at both the Dewey and Burdock sites. An additional 31 acre-feet of active capacity was added to the ponds at each site, for a total primary storage capacity of 247 acre-feet. This additional capacity acts as contingency storage for days at the beginning of the irrigation season when weather conditions may limit land application. In addition, a spare storage pond will be provided with 61.8 acre-feet usable capacity. The total available capacity is therefore about 43 percent greater than the capacity required for a 1-percent exceedance probability. The surplus capacity will allow the land application season to be reduced by at least 2 months if needed (e.g., during an abnormally wet year or late spring).

Central Plant Pond

The purpose of the central plant pond is to temporarily store wastewater originating from the CPP during uranium recovery and aquifer restoration operations until the CPP wastewater can be blended with other sources of wastewater and treated to meet discharge standards.

The CPP wastewater stream will consist of process solutions (such as resin transfer water and brine generated from the elution and precipitation circuits), and also may contain laboratory wastewater, laundry water, plant washdown water, plant sump water, and other minor sources of liquid waste excluding domestic sewage. The CPP wastewater will be blended with well field production bleed and aquifer restoration bleed prior to final treatment to applicable standards for removal of uranium and other radionuclides.

A summary of the central plant pond size and storage capacity under each disposal option is presented in Table 5.3-3. The central plant pond has been designed to accommodate the CPP wastewater design flow plus direct precipitation from the 100-year, 24-hour storm event, while maintaining 3 feet of freeboard. As shown in Table 5.3-3, the central plant pond capacity will depend on the wastewater disposal option. The active wastewater storage capacity, excluding freeboard and reserve capacity for precipitation, will be 15.2 ac-ft for the DDW option, which is sufficient storage for approximately 287 days at the typical CPP wastewater production rate of 12 gpm. The central plant pond active wastewater storage capacity for the land application disposal option will be 35.0 ac-ft. This capacity will allow storage of up to 660 days of CPP wastewater production at 12 gpm. The central plant pond capacity allows for adequate storage for CPP wastewater during the initial project startup period when uranium recovery is occurring, but before aquifer restoration activities have started. During this time, CPP wastewater will need to be stored for approximately 18 months until groundwater sweep water is available for blending with the CPP wastewater. In addition, the larger capacity will also provide more flexibility for blending the wastewaters during normal operation. This will be necessary because the land application disposal option will be more sensitive to higher dissolved solids concentrations. A larger central plant pond also will allow for additional excess storage during the winter months when no land application will occur.

The flow rate of the CPP wastewater from the central plant pond to the radium settling pond will be adjusted according to the concentration of dissolved solids in the CPP wastewater stream. When well field bleed has relatively lower concentrations of dissolved solids, for example when restoration is near completion in a particular well field, the percentage of CPP wastewater in the disposal stream can be higher, or when well field bleed has a relatively higher concentration of

Table 5.3-3: Central Plant Pond Size and Capacity

Parameters	Units	Deep Disposal Well Option	Land Application Option
Central Plant Pond Total Capacity	ac-ft	15.9	36.2
100-year Precipitation Volume	ac-ft	0.7	1.2
Central Plant Pond Wastewater Storage Capacity	ac-ft	15.2	35.0
CPP Wastewater Flow Rate	gpm	12	12
Wastewater Storage Capacity in Time of Operation[1]	yr	0.79	1.81
	d	287	660

[1] During uranium recovery and concurrent uranium recovery and aquifer restoration. Refer to the water balance presented in Section 5.3.3.5.3.

dissolved solids (e.g., near the end of uranium recovery in a particular well field), the percentage of CPP wastewater in the disposal stream can be lower. Powertech (USA) also may choose to treat the high TDS wastewater from the CPP prior to discharge to the central plant pond or further treatment and discharge to the radium settling ponds.

5.3.4.3 Pond Leak Detection

The radium settling ponds, spare ponds, and central plant pond designs include a dual geosynthetic and clay liner system with a leak detection system (refer to Section 3.6 in Appendix 5.3-A). The primary liner and secondary liner will be separated by a geonet, which will provide a physical separation and allow fluid flow between the two liners. A minimum grade of 2 percent will be maintained across the bottom of the ponds toward a leak detection sump. Any leakage from the primary liner will be contained by the secondary liner and collected in the leak detection sump. The sump will be routinely monitored for the presence of fluid as described in Section 5.3.4.5. This leak detection sump will be monitored through a pipe installed within the impoundment wall. This pipe will allow a submersible pump to be installed within the sump for the purpose of monitoring and/or removal of fluid should a leak occur.

Detection within the leak detection sump will initiate measures to take the pond out of use, remove its contents to another pond, and initiate an investigation into the cause of, and ultimately the repair of, the condition creating the leak. The ponds are designed to be completely emptied with the use of a submersible pump.

5.3.4.4 Pond Construction

Detailed construction specifications, testing, and QA/QC procedures for the ponds are provided in Appendix 5.3-B. The following is a summary of the construction specifications and testing and inspection program for pond construction. In the following specifications "engineer" refers to a professional engineer licensed in South Dakota.

Construction specifications include the following:

i) Clearing, grubbing and stripping: The natural ground surface shall be cleared and stripped and/or grubbed of all organic and objectionable materials. The limits of stripping shall generally be 10.0 feet outside of the work activity areas.

ii) Excavation and fill placement: Excavation shall be to the lines and grades shown on the pond drawings. Excavations shall not exceed a vertical tolerance of plus or minus 0.1 foot, and a horizontal tolerance of 0.5 foot. Fill and backfill shall be placed within a vertical tolerance of plus or minus 0.1 foot, and a horizontal tolerance of 0.5 foot, unless otherwise approved by the Engineer. All precautions necessary to preserve, in an undisturbed condition, all areas outside the lines and grades shown on the drawings, will be taken. Fill will be constructed in near horizontal layers with each layer being completed over the full length and breadth of the zone before placement of subsequent layers. Each zone will be constructed with materials meeting the specified requirements, and shall be free from lenses, pockets and layers of materials, which are substantially different in gradation from the surrounding material in the same zone. All over-sized material shall be removed from the fill material either prior to being placed, or after it is dumped and spread but prior to compaction. The Engineer will conduct testing, as discussed below, to establish suitability of all fill materials used. No fill material shall be placed until the Engineer has inspected and approved the foundation or in-place lift.

iii) Rolling: Compaction of each layer of fill shall proceed in a systematic, orderly and continuous manner that has been approved by the Engineer, to ensure that each layer receives the compaction specified. Compaction equipment shall be routed parallel to the embankment axis or the long axis of the fill zone, and overlap between roll patterns shall be a minimum of 12 inches. The rolling pattern for compaction of all zone boundaries or construction joints shall be such that the full number of passes required in one of the adjacent zones, or on one side of the construction joint, extends completely across the boundary or joint. Compaction equipment shall be of the types and sizes specified in Section 4.6 of Appendix 5.3-A.

iv) Compaction and moisture control: All material, after placing, spreading and leveling to the appropriate layer thickness shall be uniformly compacted in accordance with the requirements for each type of fill as indicated in Table 5.3-4.

v) Finishing: Finished grades shall slope uniformly between given spot and contour elevations. All grades shall provide for natural runoff of water without low spots or pockets.

Testing and Inspection Program

Inspection of earthwork will involve testing and visual examination of all materials being used for construction to establish compliance with the material requirements, moisture conditioning, spreading procedures, layer thicknesses, and compaction requirements. To ensure that satisfactory quality control is maintained and that the design objectives are achieved, specific testing requirements will be implemented for all materials placed within the Work area. Tests to be carried out will be divided into two categories; control tests and record tests. Control tests will be used to verify whether the materials comply with the specifications prior to placement. Record tests will be used during placement and after completion of the work to assess whether the work and materials meet the requirements of the specifications.

Control tests will include: i) particle size distribution for fill materials, soil liner, filter sand and riprap; ii) moisture content of fill materials and the soil liner; iii) Modified Proctor compaction tests (ASTM D1557) of fill materials and the soil liner: iv) Atterberg limits of fill materials and

Table 5.3-4: Compaction Requirements

Material	Compaction Specifications	Moisture Content
Prepared Subgrade	92% of Maximum Dry Density by ASTM D1557	+/- 3% of Optimum
Random Fill	92% of Maximum Dry Density by ASTM D1557	+/- 3% of Optimum
Soil Liner	92% of Maximum Dry Density by ASTM D1557	0 to +5% of Optimum

soil liner; v) and other tests of fill materials taken from borrow areas and on the fill, as necessary to assess whether the fill material is in compliance with the technical specifications.

The record tests will include: i) particle size distribution for fill materials, soil liner and filter sand; ii) field density test on fill materials and the soil liner; iii) moisture content of the fill materials and soil liner; iv) laboratory compaction and particle size distribution of materials recovered from select field density test locations; v) in-situ laboratory permeability tests on fill materials and the soil liner; vi) Atterberg limit tests on fill materials and the soil liner; vii) other tests on fill compacted in place as necessary to assess whether the compacted fill is in full compliance with the technical specifications.

Testing Frequencies

Geotechnical tests will be conducted to establish compliance of the work with the technical specifications. Standard procedures will be used for all tests. Tables 5.3-5 through 5.3-10 (also provided in Appendix 5.3-B) show the test methods and frequency of testing for various materials.

5.3.4.5 Pond Inspection

An inspection program will be implemented for all ponds. A detailed checklist will be developed and followed to document the observations of each significant geotechnical, structural, and hydraulic feature, including control equipment. Inspections will be conducted by trained personnel who are knowledgeable of the pond construction and safety features. Inspections will be documented and the reports retained on site for reference and inspection by regulatory authorities. Inspections will include but are not limited to the following:

- Daily inspections of the liner, liner slopes, and other earthwork features
- Daily inspections of pond freeboard to ensure adequate containment capacity is available for the 100-year, 24-hour storm
- Daily checks for water accumulation in leak detection systems
- Monthly inspection of the functionality of leak detection systems
- Quarterly inspections of embankment settlement and slope stability; unscheduled inspections will be performed after occurrence of significant earthquakes, tornadoes, intense local rainfall, or other unusual events

If these inspections reveal any damage or defects that could result in leakage, this information will be reported to the NRC within 24 hours as required by the NRC license. Appropriate repairs will be implemented as soon as possible.

Table 5.3-5: Test Methods

Test Designation[(1),(2)]	Type of Test	Test Methods (ASTM)
C1, R1	Atterberg Limits	D4318
R2a C2, R2b	Nuclear Method Moisture Content Laboratory Moisture Content	D6938 D2216
C3, R3	Particle Size Distribution	D422[(3)]
C4, R4	Laboratory Compaction	D1557
R5a R5b R5c	Nuclear Method Field Density Sand Cone Field Density Water Replacement Field Density	D6938 D1556 D5030
C6, R6	Laboratory Permeability Test	D5084
C7, R7	Riprap Particle Size Distribution	Pebble Count

Notes:

1. C- Denotes Control Tests
2. R- Denotes Record Tests
3. Hydrometer tests down to the 2-micron size will be carried out as directed by the Engineer but will generally not be required. All samples are to be wash graded over a #200 sieve.

Table 5.3-6: Test Frequency- Prepared Subgrade

Test Designation	Type of Test	Frequency (1 per)
R1	Atterberg Limits	2,000 yd^2
C2, R2a, R2b	Moisture Content	1,000 yd^2
C3, R3	Particle Size Distribution	2,000 yd^2
C4, R4	Laboratory Compaction	2,000 yd^2
R5a	Nuclear Density	1,000 yd^2
R5b	Sand Cone Density	5,000 yd^2

Table 5.3-7: Test Frequency- Random Fill

Test Designation	Type of Test	Frequency (1 per)
R1	Atterberg Limits	5,000 yd^3
C2, R2a, R2b	Moisture Content	2,500 yd^3
C3, R3	Particle Size Distribution	5,000 yd^3
C4, R4	Laboratory Compaction (Modified Proctor)	5,000 yd^3
R5a	Nuclear Density	1,000 yd^3
R5b	Sand Cone Density	10,000 yd^3
C6, R6	Laboratory Permeability Test	5,000 yd^3

Table 5.3-8: Test Frequency - Soil Liner

Test Designation	Type of Test	Frequency (1 per)
R1	Atterberg Limits	1,000 yd^3
C2, R2a, R2b	Moisture Content	500 yd^3
C3, R3	Particle Size Distribution	1,000 yd^3
C4a, R4a	Laboratory Compaction	1,000 yd^3
R5a	Nuclear Density	1,000 yd^3
R5b	Sand Cone Density	2,500 yd^3
C6, R6	Laboratory Permeability Test	1,000 yd^3

Table 5.3-9: Test Frequency - Filter Sand

Test Designation	Type of Test	Frequency (1 per)
C3, R3	Particle Size Distribution	250 yd^3

Table 5.3-10: Test Frequency - Riprap

Test Designation	Type of Test	Frequency (1 per)
C7, R7	Riprap Particle Size Distribution	1,000 yd^3

If significant water is found in the leak detection system, the water in the standpipes will be sampled immediately for indicator parameters to confirm that the water in the detection system is from the pond. The indicator parameters will be chloride and conductivity. If the analysis confirms a leak, a secondary sample shall be collected and analyzed within 24 hours. Upon confirmation of a leak by the second analysis, the pond will be taken out of service until repairs can be completed. The leak will be reported to the NRC within 24 hours of the confirmation. A pond removed from service because of a confirmed leak will be dewatered by transferring the contents to a spare pond. Regardless of the disposal option used at the project, the Dewey and Burdock areas each will have a spare pond of identical capacity, construction, and dimensions as the primary radium settling ponds. At the Burdock area, the spare pond also may serve as a spare for the central plant pond.

5.3.5 Instrumentation and Emergency Shutdown

Powertech (USA) will install automated control and data recording systems at the Satellite Facility and CPP which will provide centralized monitoring and control of the process variables including the flow rate and pressure of production, injection, and waste streams. The systems will include alarms and automatic shutoffs to detect and control a potential release or spill.

Pressure and flow sensors will be installed, for the purpose of leak detection, on the main trunklines that connect the CPP and Satellite Facility to the well fields. In addition, the flow rate of each production and injection well will be measured automatically. Measurements will be collected and transmitted to both the CPP and Satellite Facility control systems. Should pressures or flows fluctuate outside of normal operating ranges, alarms will provide immediate warning to operators which will result in a timely response and appropriate corrective action.

Both external and internal shutdown controls will be installed at each header house to provide for operator safety and spill control. The external and internal shutdown controls will be designed for automatic and remote shutdown of each header house. In the event of a header house shutdown, an alarm will occur and the flows of all injection and production wells in that header house will be stopped automatically. The alarm will activate a blinking light on the outside of the header house and will cause an alarm signal to be sent to the CPP and Satellite Facility control rooms.

An external header house shutdown will activate an electrical disconnect switch located on the outside of the header house or at the transformer pole which will shut down all electrical power to the header house. This will mitigate potential electrical hazards while de-energizing the header house and operating equipment. The production pumps will be de-energized which will result in flow stopping from all production wells. A control valve that will close when de-energized will be used on the injection header, which will stop the flow to all injection wells.

Internal shutdown controls will not involve de-energization of the header house but will result in the same alarm condition and shutdown of flow to all production and injection wells feeding the header house.

Each header house also will include a sump equipped with a water level sensor so that if a leak occurs, and the water level approaches a preset level, the sensors will cause an automatic shutdown of the header house. A pressure switch will be installed on the injection header to ensure that fluid pressures do not exceed the maximum designated pressure of the injection wells served by that header house (refer to Section 5.3.3.5.2). If the injection pressure reaches the maximum set value in the pressure switch, an automatic header house shutdown will occur.

If an excursion or pipeline leak were to occur, procedures will be in place to address and correct it. Well field operators will conduct daily visual inspections of well field facilities, including header houses and all visible pipes, connections, and fittings. Operating flow rates and pressures of all injection wells, production wells, and associated buried piping systems also will be monitored and recorded on a daily basis. The CPP and Satellite Facility control rooms both will receive the pressure and flow data transmitted from the well fields, trunklines, and header houses. This information will provide the plant operators access to instantaneous data on well field operating conditions, enabling them to respond appropriately to unexpected or upset conditions, and allow them to direct well field operators to specific locations where immediate attention is needed.

A detailed description of the deep disposal wells operation and control is included in Section 2.K, "Injection Procedures," of Appendix 3.4-A, which includes the Class V UIC permit application. The automated control system on the Class V deep disposal wells will include control switches to alert the operator if certain operating conditions are encountered. A high injection pressure switch (set below the permitted maximum) and a low annulus differential pressure switch (set above the permitted minimum) will shut off injection pump power and will alert the operator so that the well can be fully isolated and secured. The alarm will sound in the central control room of the CPP and/or Satellite Facility, whichever is nearer. In the event that any of the set points are exceeded, injection operations will cease immediately until the problem is identified and corrected. The system then will be manually restarted by an operator when operating parameter compliance is verified.

5.3.6 Backup Power

Loss of power to the project site will cause production wells to stop operating, resulting in shutdown of all production and injection flows. This condition avoids flow imbalance within the well fields, but a well field bleed would not be maintained during the power failure. The time span for the aquifer to recover from operational drawdown back to its natural groundwater gradient is much longer than the duration of a typical power outage. Since ISR solutions would not begin to travel to the monitoring ring until the cone of depression caused by the bleed had recovered and groundwater had returned to its natural gradient, excursions are very unlikely within the short time period of a typical power outage.

Power outages in the permit area would not likely last more than a few days or weeks under most conceivable scenarios. Powertech (USA) will use generators onsite and may also contract for temporary generators to operate well field pumps sufficiently to maintain a cone of depression within the well field if unforeseen power outages occur with expected duration of more than a few weeks. Backup generators will be installed to maintain continuous instrumentation, monitoring and alarms in the CPP, Satellite Facility, and well fields. Backup power also will be provided for lights and emergency exits.

5.3.7 Topsoil and Spoil Handling

Topsoil will be salvaged from building sites, permanent storage areas, primary and secondary access roads, ponds and chemical storage areas prior to construction in accordance with SDCL 45-6B-7(11). Typical earth moving equipment such as rubber tired scrapers and front-end loaders will be used for topsoil stripping. Trees, large rocks, and other waste materials which may hinder redistribution of topsoil will be separated from the topsoil before stockpiling.

Plates 5.3-1 and 5.3-2 show the proposed locations of topsoil and spoil stockpiles for the processing facilities and ponds in the land application and deep disposal well option, respectively. Topsoil and spoil stockpile locations for the well fields will be designated during final well field design, and Plates 5.3-1 and 5.3-2 will be updated accordingly. Topsoil and spoil stockpiles will be located in a manner to facilitate reclamation by placing the piles near the locations where they will be used. Topsoil and spoil piles associated with the CPP, Satellite Facility and associated ponds will be placed near the processing facilities. Topsoil and spoil piles for the access roads and well fields will be placed near the roads and well fields to minimize the haul distance.

The estimated topsoil stockpile volumes for the processing facilities and ponds are 100,000 to 200,000 cubic yards in the Burdock area and 50,000 to 100,000 cubic yards in the Dewey area. In the initial Burdock well field, the anticipated topsoil salvage depth is estimated to range from 0 to 3 feet and average approximately 1.0 foot (from the baseline soil survey in Appendix 5.3-A). In the initial Dewey well field, the anticipated topsoil salvage depth is estimated to range from 0 to 1.67 feet and average approximately 0.15 foot. The total anticipated topsoil stripping area over the life of the Dewey-Burdock Project is estimated to be approximately 250 acres in the deep disposal well option and 440 acres in the land application option. The maximum area of construction disturbance and associated topsoil stripping at any one time will be approximately 100 acres in the deep disposal well option and 300 acres in the land application option.

Salvaged topsoil will be stored in designated topsoil stockpiles in accordance with SDCL 45-6B-40. These stockpiles will be located such that losses from wind erosion are minimized. Additionally, topsoil stockpiles will not be located in any drainage channels or other locations subject to flooding. Berms will be constructed around the perimeter of stockpiles and the stockpiles will be seeded with the approved seed mix to help minimize erosion. Additionally, all topsoil piles will be identified with highly visible signs.

During excavations of mud pits associated with exploration drilling and delineation drilling activities, topsoil will be separated from the subsoil with a backhoe. First the topsoil will be removed and placed at a separate location and then the subsoil will be removed and deposited next to the mud pit. Usually within 30 days of the initial excavation, use of the mud pit will be complete, the subsoil will be redeposited in the mud pit followed by replacing topsoil. During the construction of well fields and pipeline ditch construction, topsoil and subsoil will be temporarily accumulated near the excavation during construction, then redistributed after construction activities are complete. The temporary stockpiles will be marked in the field, constructed to minimize wind erosion, and placed outside of drainages.

In only limited instances will more material be excavated (spoil) than is required for facility construction. This will include pond and diversion channel construction. Spoil will be handled in accordance with ARSD 74:29:07:14 requirements. Spoil will be stockpiled separately from topsoil stockpiles and identified with highly visible signs. The footprint of the spoil stockpiles will have the topsoil stripped prior to placement of the spoil. The spoil stockpiles will be located such that losses from wind and water erosion are minimized and will not be located in drainage channels. Berms will be constructed around the perimeter of the spoil stockpiles.

Spoil material is not anticipated to be acid forming, toxic, or a source of water pollution. The baseline soil sampling results in Appendix 3.3-A show that only in limited instances were the pH levels within sampled soil profiles deemed unsuitable as a plant growth medium according to the guideline used for comparison. If any spoil material is suspected of being acid forming, toxic, or capable of causing water pollution, Powertech (USA) will sample the material and have it analyzed for pH and other parameters deemed necessary by DENR. If the material is determined to have potential to cause water pollution, Powertech (USA) will prepare a plan for mitigating the condition in accordance with ARSD 74:29:07:14(3) and (4). Potential mitigation measures include disposing the spoil material in an appropriately permitted landfill and using suitable spoil material excavated from another area as a replacement during backfill. Since it is not anticipated that spoil material will be acid forming, toxic, or a source of water pollution, only minimal changes in the postmining topography are expected due to disposing unsuitable spoil material.

5.3.8 Roads

Roads in the permit area are classified as existing county roads, existing private roads, primary access roads, secondary access roads, and light-use roads (tertiary access roads). The roads are depicted on Plate 5.3-5. Construction of roads within the permit area will conform to ARSD 74:29:07:12.

Existing County and Private Roads

South Dewey Road (County Road 6463) is located within the permit boundary as shown on Plate 5.3-5. The maintenance of this existing road will remain the responsibility of Fall River County and Custer County. Powertech (USA) will work with both counties to help pay for maintenance costs and dust control of affected county roads.

Powertech (USA) will use existing private roads within the permit area to the maximum extent possible to minimize disturbance due to access road construction.

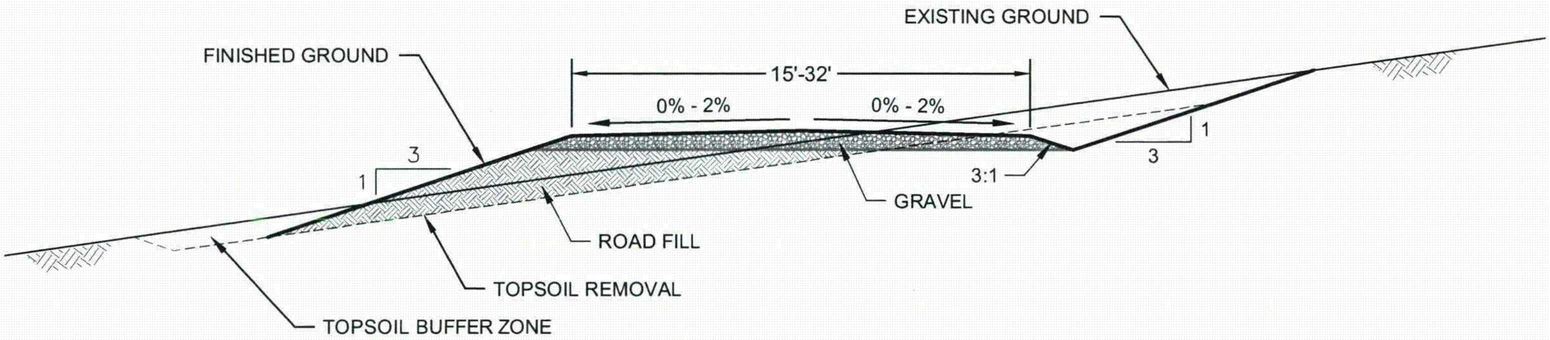
Primary Access Roads

The CPP and Satellite Facility each will be accessed by one primary access road from South Dewey Road, as shown on Plate 5.3-5. The typical cross section for the access roads is presented in Figure 5.3-17.

Topsoil will be salvaged from the roadbed area prior to construction. Topsoil will be placed in designated stockpiles near the access roads. Topsoil handling is described in the previous section. Topsoil will be redistributed on the roadbed when the road is removed and reclaimed as described in Section 6.4.3.3. To the extent possible, existing private roads will be upgraded and used for primary access roads. If existing private roads require upgrades, topsoil will be removed and stockpiled. Roads will be upgraded to the typical access road standards as presented in Figure 5.3-17.

Access road side slopes and disturbed areas will be seeded with the approved seed mixture. The surfacing of the roads will be gravel. Road surfaces, ditching, and cross drainage will provide adequate drainage. Crossing of major drainages will include the installation of culverts, which are shown on Plate 5.3-5. Culverts will be sized and constructed to avoid plugging, collapsing and minimizing erosion at the inlet and outlet of the culverts. The table on Plate 5.3-5 provides a summary of the preliminary culvert sizing for the primary and secondary access roads. The well field designs are preliminary, and the access road alignments and culverts sizes and locations are subject to change. Powertech (USA) will coordinate revisions with DENR during final design of each well field. Primary access road culverts will be designed to convey the discharge from a 10-year, 24-hour precipitation event.

Maintenance of all access roads will be performed routinely and will include grading, gravel replacement, and dust control as needed.



This figure is provided to fulfill the requirements of ARSD 74:29:07:12.

Road Type	Top Width (ft)
Primary Access Road	28 - 32
Secondary Access Road	15 - 24

Figure 5.3-17

Typical Access Road Cross Section

Dewey-Burdock Project

SIGNATURE OF PREPARER	Dale E Brown
PREPARER	Dale Brown
DATE	26-Sep-2012
FILE	ACCESS_TYP.DWG

POWERTECH (USA) INC.

Secondary Access Roads

Secondary access roads will be used for the transportation of personnel and equipment within the permit area. Parking areas and roads near the CPP and Satellite Facility and laydown areas also are classified as secondary access roads. Secondary access roads are shown on Plate 5.3-5.

Secondary access road construction, topsoil handling, drainage and surfacing will be the same as the primary access road. The travel width of secondary access roads will be narrower as shown in Figure 5.3-17 due to the lower traffic demands compared to primary access road. Secondary access road culverts will be designed to convey at a minimum the discharge from a 2-year, 6-hour precipitation event.

Light-Use Roads (Tertiary Access Roads)

These roads are essentially non-constructed, two-track trails. Existing ranch or private roads established by previous landowners will be used to the extent possible. The primary use of these roads will be to access monitoring sites using light trucks or other passenger vehicles. The locations of these roads are shown on Plate 5.3-5.

Light-use roads will be maintained as necessary to minimize erosion. Crossing of major drainages will be kept at a minimum and such crossings will be dry weather only crossings.

5.3.9 Water Management and Erosion Control

Pursuant to ARSD 74:28:02:11, a sediment control plan will be implemented during and after ISR operations to reduce soil loss within the permit area. Ditches, diversions, sediment traps/ponds, culverts, and other best management practices (BMPs) will be used to control surface water flow within the permit boundary. Plates 5.3-6 through 5.3-8 show the plan for water control. See Appendix 5.3-B for details on diversions in and around the facility areas.

Powertech (USA) has evaluated flood inundation boundaries and will construct facilities outside of these boundaries to avoid potential impacts to facilities from flooding and potential impacts to Beaver Creek and Pass Creek in the event of any potential spills or leaks. Where possible, facilities will be located outside of the 100-year flood inundation boundaries. Pipelines will be buried below the frost line and will not be subject to flooding. Pipeline valve stations will be located outside of the 100-year flood inundation boundaries. Facilities which must be located within flood inundation boundaries will be protected from flood damage by the use of straw bales, collector ditches, and/or berms. If it is necessary to place a well head within a flood inundation boundary, diversions or erosion control structures will be constructed to divert flow and protect the well head. The well head also will be sealed to withstand brief periods of submergence. Figures 5.3-10 and 5.3-11 show that all ISR wells and monitor wells will be sealed.

Estimates of peak flood discharges and water levels produced by floods on Pass Creek, Beaver Creek and local small drainages are provided in Section 3.5.2.3 and Appendix 3.5-A. Plate 3.5-1 depicts the modeled flood inundation areas for all surface water features during the 100-year, 24-hour storm event in relation to proposed facilities and infrastructure. As described in Appendix 3.5-A, HEC-HMS models were used to calculate peak discharges, and HEC-RAS models were used to compute water-surface profiles and inundated areas for the respective runoff events.

Any disturbance to the prevailing hydrologic balance of the affected land and of the surrounding area and to the quality and quantity of water in surface water systems both during and after ISR operations and during reclamation will be minimized in accordance with SDCL 45-6B-41. No diversions will be constructed on perennial stream channels, and only relatively minor quantities of surface runoff will be captured in sediment ponds. Therefore, little or no impacts to the surface water hydrologic balance will occur. Surface water quality will be protected through erosion control BMPs and sediment control measures described below. Section 5.6.5 describes mitigation measures to protect surface and groundwater from potential leaks or spills.

5.3.9.1 Diversion Channels

Following is a description of the diversion channels that will be constructed within the permit area for the processing facilities and ephemeral stream channels.

Diversion channel designs for the processing facilities in the DDW option are provided on Plates 5.3-13 and 5.3-14. These supersede the diversion channel designs for the processing facilities in the DDW option in Appendix 5.3-B. In accordance with ARSD 74:29:07:09(6), the diversions around the CPP, Satellite Facility and associated radium settling ponds and central plant pond have been designed for the 6-hour PMP event. Diversions were not designed for the PMP event around the storage ponds or spare storage ponds, since these ponds are not part of uranium processing and will store only treated water. In the land application option, no diversions will be required around the processing facilities, radium settling ponds or central plant pond due to the small drainage area above these facilities.

With the exception of Beaver Creek, all stream channels within the permit area are ephemeral. Pass Creek above the permit area could be considered intermittent, but it is ephemeral within the permit area since there is no groundwater component and flows only occur in response to precipitation or snowmelt events. No diversions are planned on Beaver Creek or Pass Creek, and no diversions are planned on perennial or intermittent streams.

Plates 5.3-6 and 5.3-7 provide the locations of planned ephemeral stream channels within the permit area. The designs for the diversions associated with the initial well fields and land application areas are presented on Plates 5.3-9 through 5.3-11. Diversion designs for future well fields, if needed, will be provided to DENR for review and verification prior to construction.

Diversions of ephemeral channels will be designed to maintain channel velocities equal to or less than 5 feet per second for the discharge from a 2-year, 6-hour precipitation event and have the ability to contain the discharge from a 100-year, 24-hour precipitation event.

Interim revegetation will be performed on the bottoms and side slopes of all diversions to reduce erosion. In instances where the diversion channel velocity during the design storm exceeds 5 feet per second, other erosion control measures will be implemented such as geosynthetic liners, geosynthetic filter media, or riprap. Diversions will be constructed with 3:1 or shallower side slopes to reduce the risk of slope failure, promote interim revegetation, and allow safe passage for humans, wildlife and livestock. Diversion bottom elevations will tie to undisturbed upstream and downstream channel elevations to eliminate increased erosion potential. Diversions will not discharge onto topsoil or spoil stockpiles or other unconsolidated material such as newly reclaimed areas. Culvert or bridge crossings over the diversions are not planned. If it becomes necessary to cross a diversion in the future, Powertech will submit design drawings to DENR for review and approval prior to construction.

5.3.9.2 Erosion Control

Powertech (USA) will minimize erosion of disturbed, reclaimed and native areas through proper land management and farming techniques. Typically, following ground disturbance, areas will be prepared and seeded as soon as possible to reduce the possibility of erosion. Also, erosion control measures will be used to reduce overland flow velocity, reduce runoff volume or trap sediment. Examples include rip-rap, vegetative sediment filters, check dams, mulches, cover crops, and other measures. Plates 5.3-6 through 5.3-8 show the sediment control measures that will be used in the permit area.