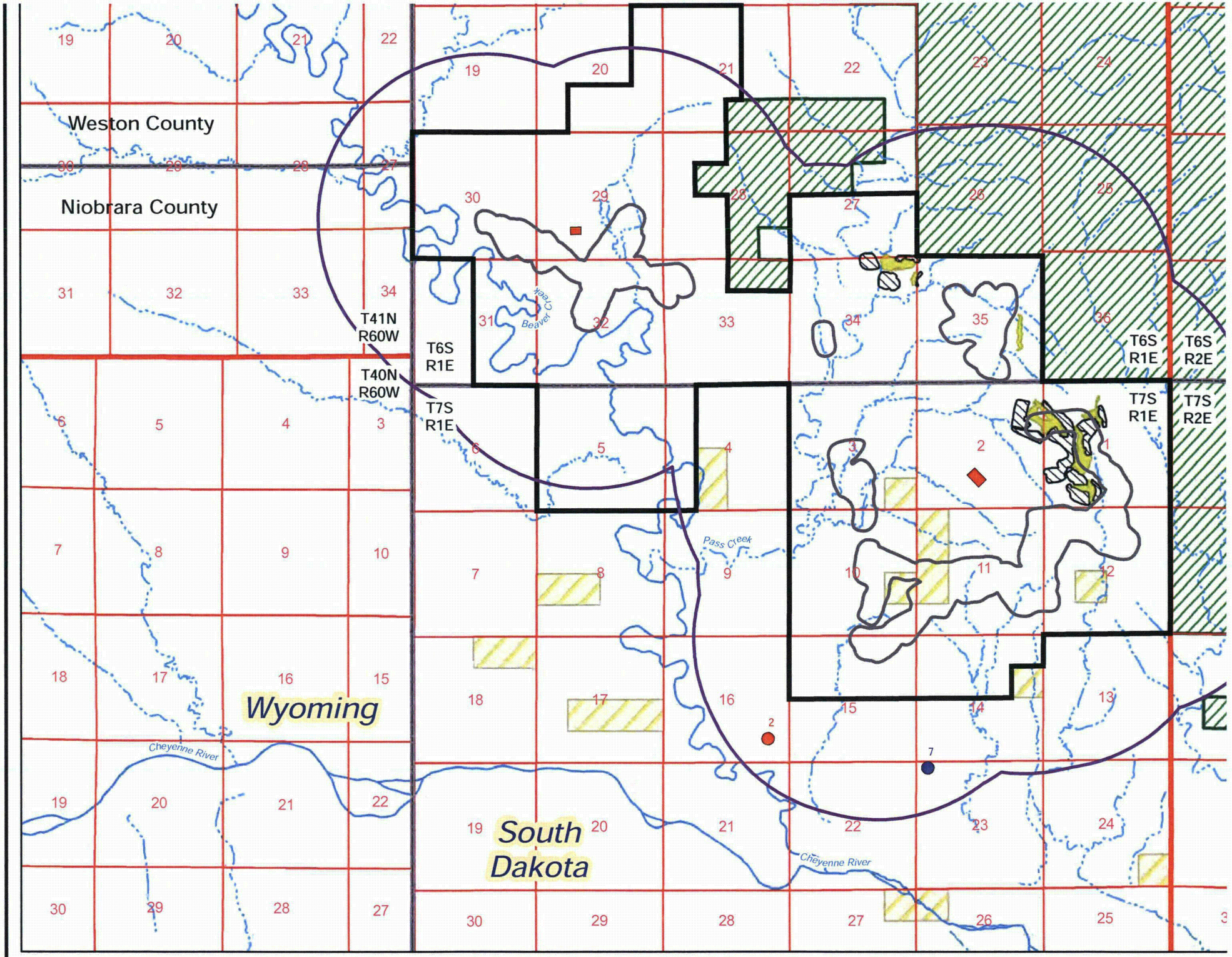
Table 5.5-1: Monitor Wells Included in Operational Monitoring Program

Well ID	Qtr-Qtr	Section	Township	Range	Relative Position
Alluvium					
676	SESW	34	6S	1E	Downgradient of land application
677	SWSW	27	6S	1E	Downgradient
678	SWNE	4	7S	1E	Downgradient
679	NESW	9	7S	1E	Upgradient
707	SWNE	34	6S	1E	Downgradient of Triangle Pit
708	SESW	3	7S	1E	Downgradient of land application
709	SENW	15	7S	1E	Downgradient of well field
TBD	NWNW	20	6S	1E	Upgradient
TBD	NENE	31	6S	1E	Downgradient of well field
TBD	NWSE	32	6S	1E	Downgradient of well field
TBD	NWNW	20	6S	1E	Downgradient of land application
Fall River					
631	SWSW	23	6S	1E	Upgradient
681	NWNE	32	6S	1E	Production zone
688	NESW	11	7S	1E	Overlying production zone
694	NWNW	15	7S	1E	Upgradient
695	SESE	32	6S	1E	Downgradient
698	SENW	2	7S	1E	Downgradient
706	NENE	21	6S	1E	Upgradient
TBD	SWNE	34	6S	1E	Downgradient of Triangle Pit
TBD	NWSE	2	7S	1E	Downgradient of Darrow Pit
Chilson					
43	SWSE	34	6S	1E	Downgradient of Triangle Pit
680	NESW	11	7S	1E	Production zone
689	NENW	32	6S	1E	Production zone
696	NWNW	15	7S	1E	Downgradient
697	SESE	32	6S	1E	Downgradient
705	NENE	21	6S	1E	Upgradient
3026	SESE	12	7S	1E	Upgradient
TBD	SWSE	2	7S	1E	Downgradient of Darrow Pit
Unkpapa					
690	NESW	11	7S	1E	
693	NENW	32	6S	1E	
703	SWSE	1	7S	1E	

TBD – To be determined; well not yet installed.



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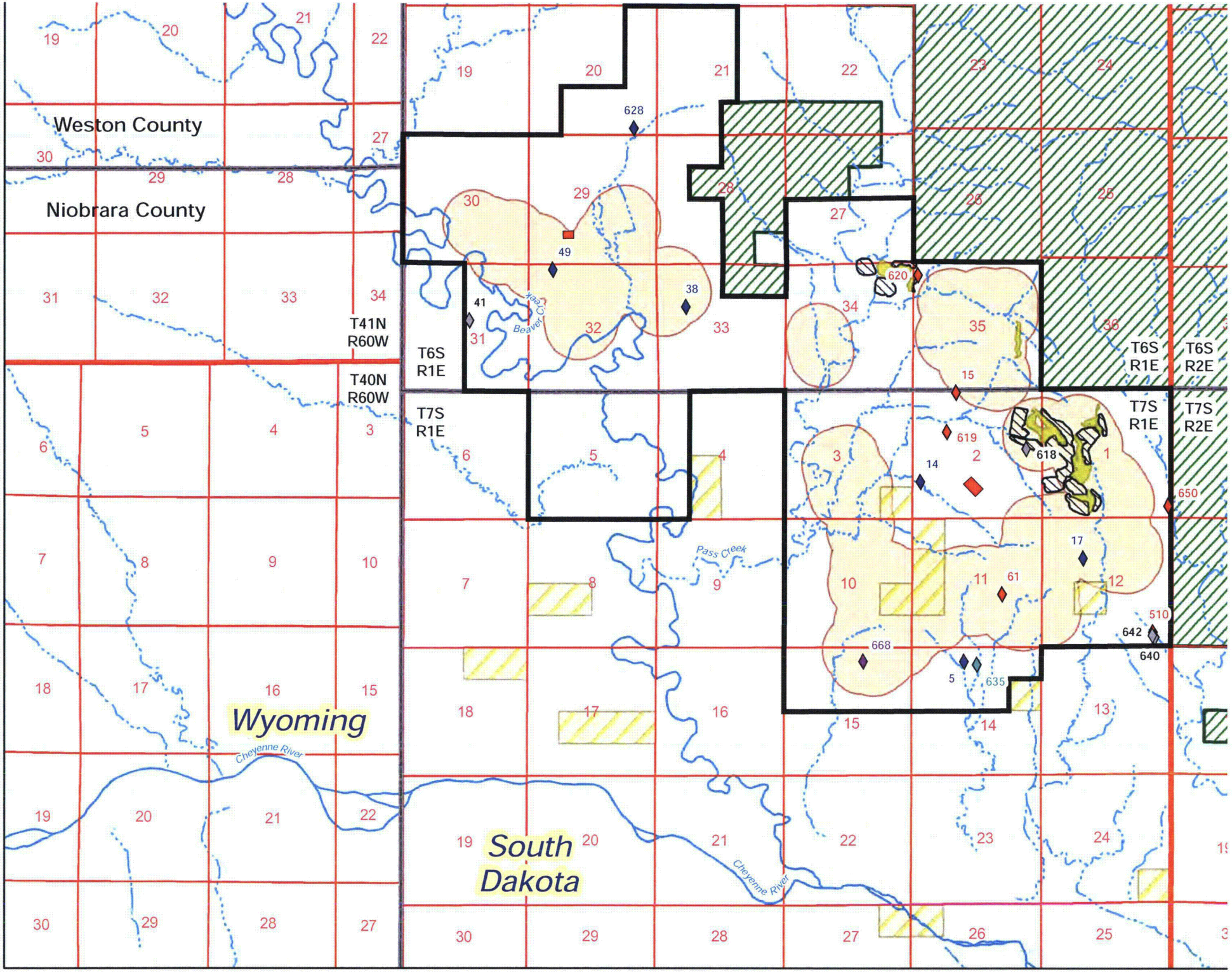

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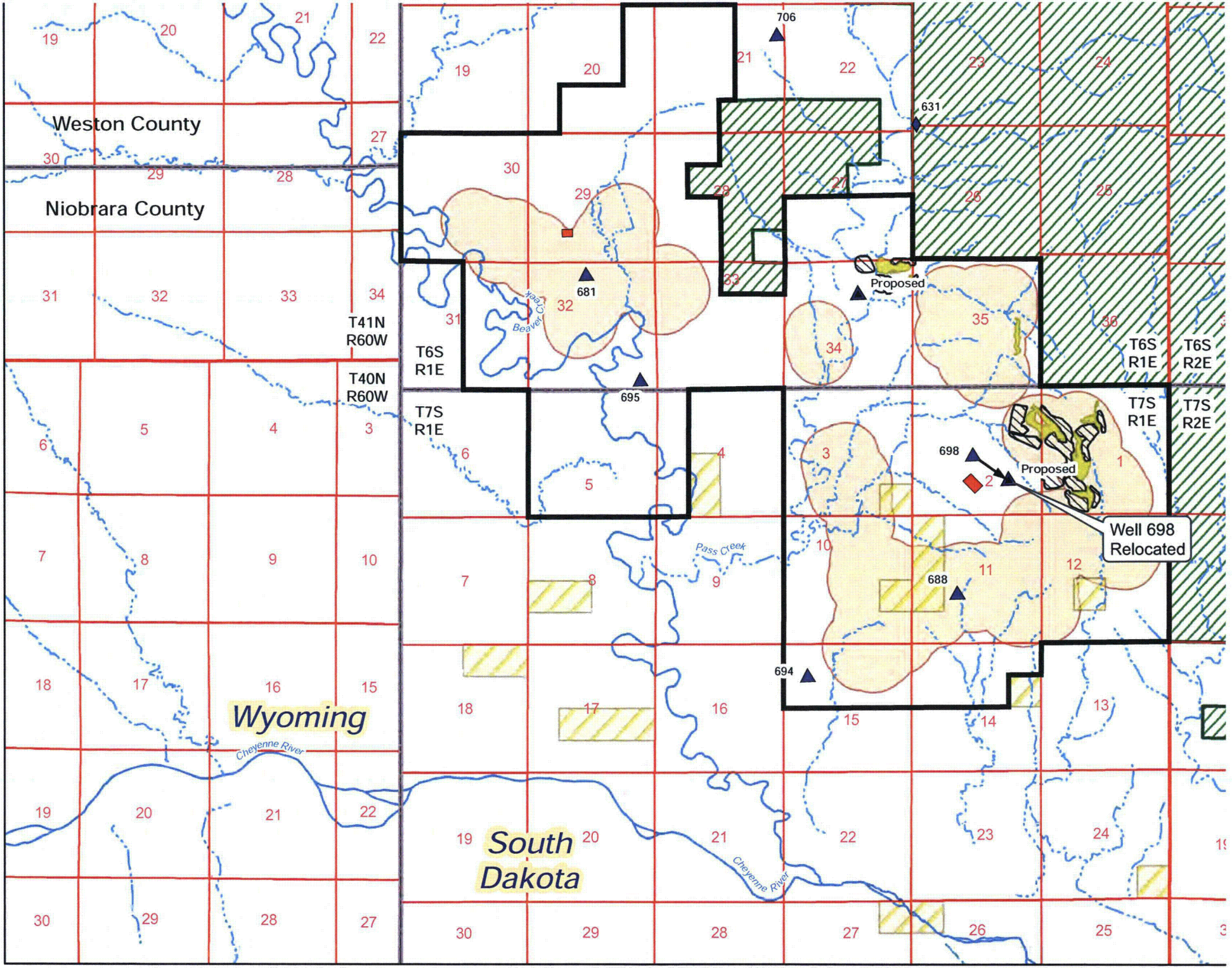

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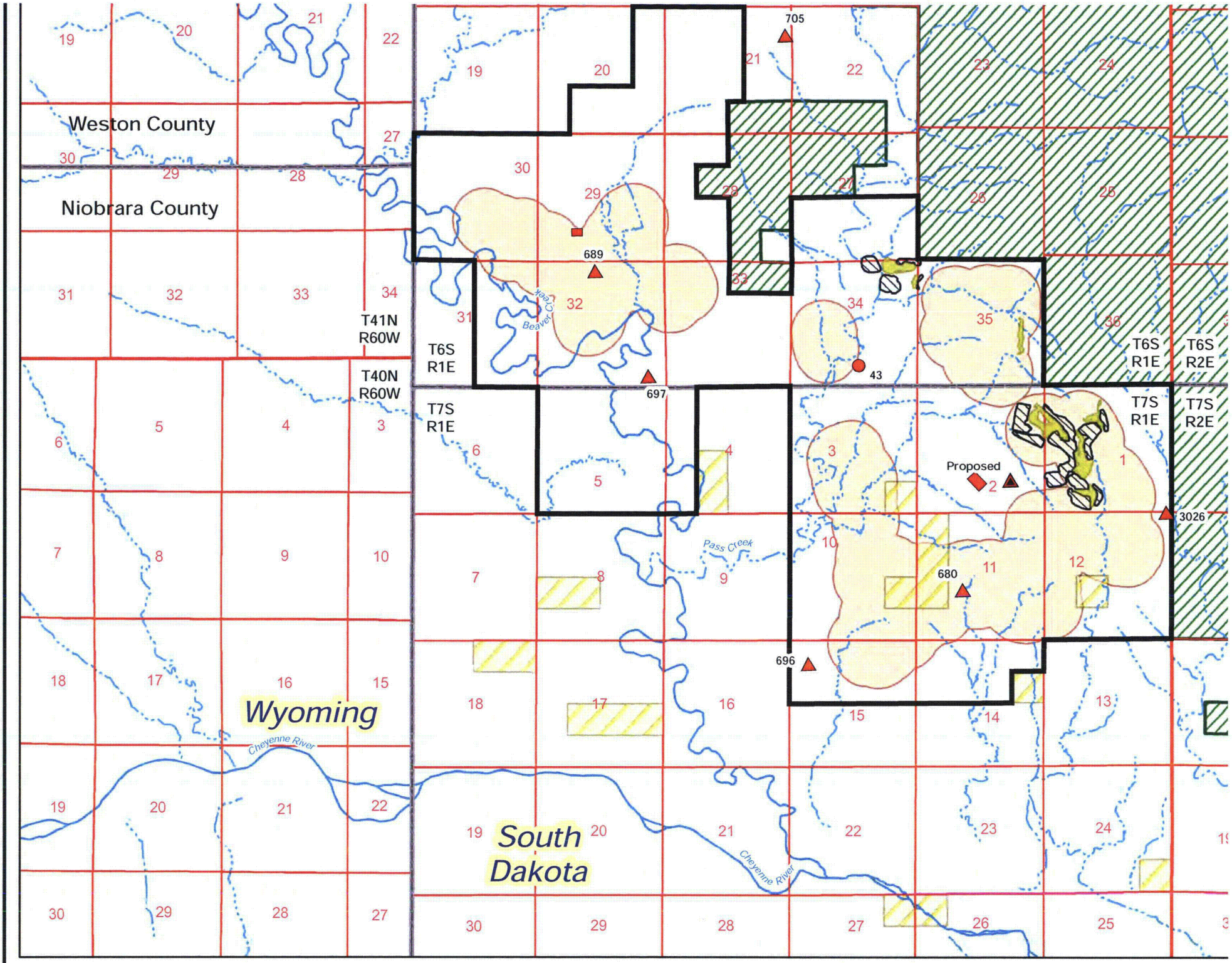

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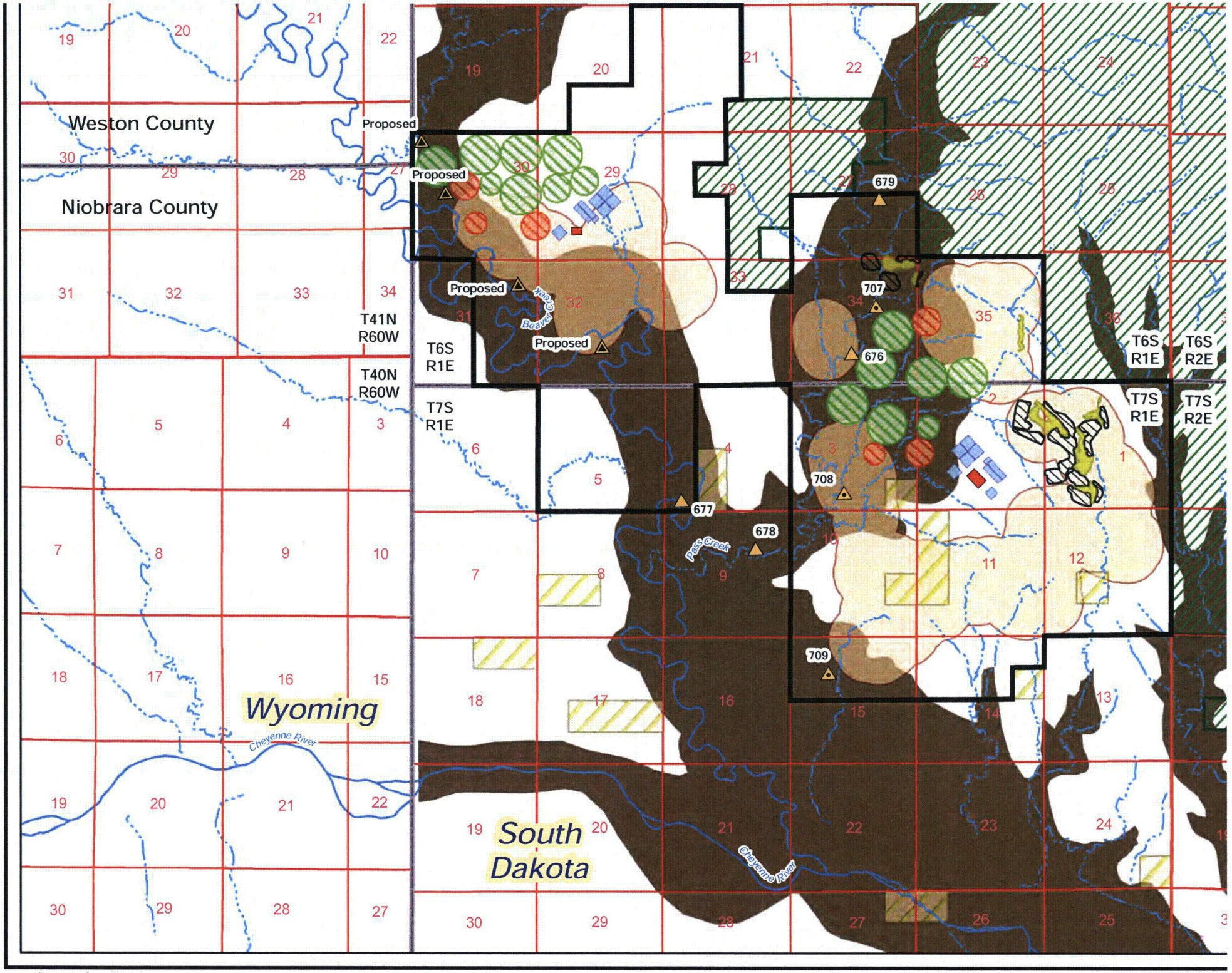

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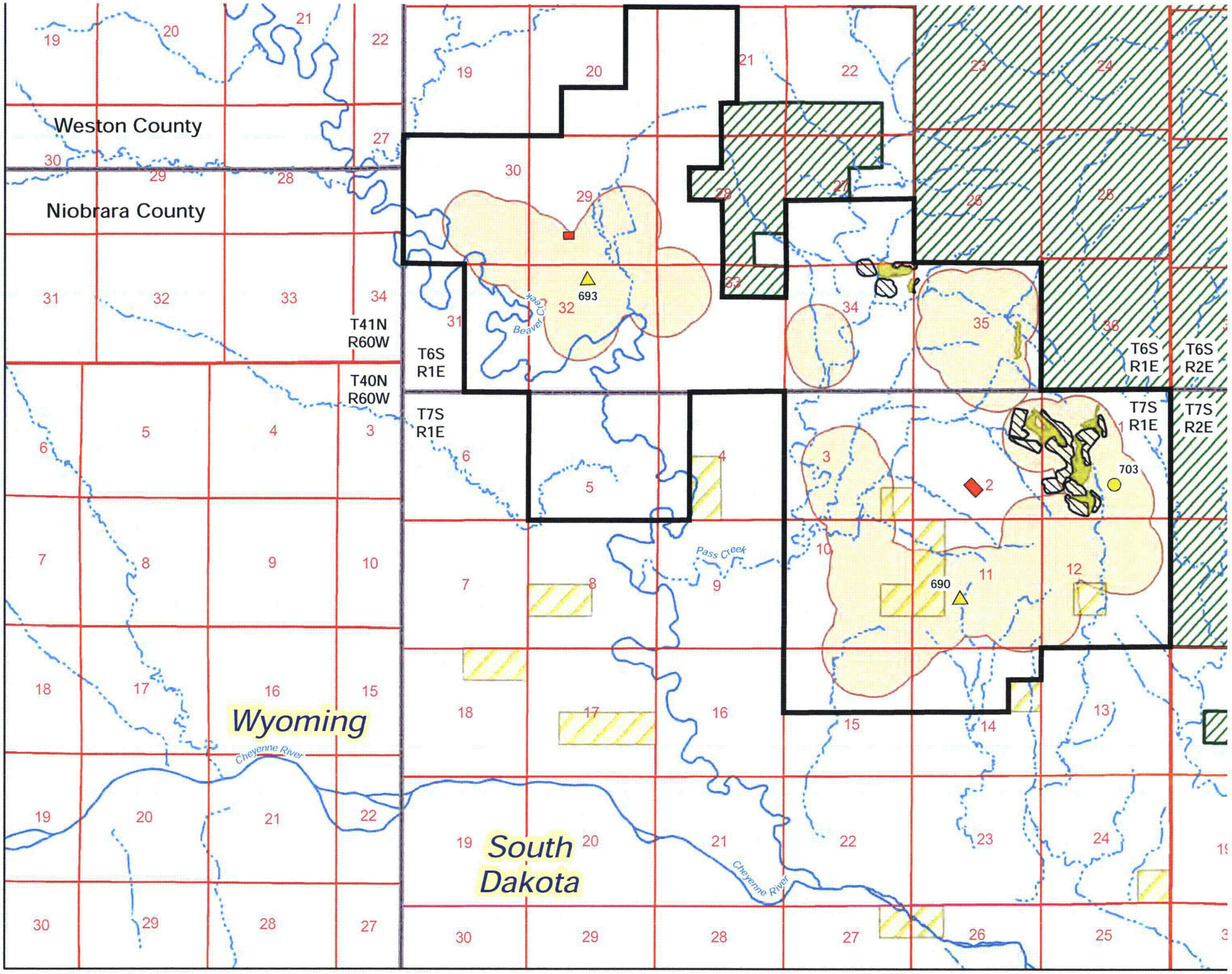

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In addition, Powertech (USA) will monitor additional alluvial monitor wells within and downgradient of the land application systems if land application is used. These wells will be monitored as required by the GDP, and the well locations are provided in the GDP.

Monitoring conducted as part of the operational monitoring program will be conditional upon landowner access and suitable conditions allowing proper collection of a sample. If access is not available during the time of monitoring, a second attempt will be made to collect a sample during the monitoring period. If a well cannot be accessed continually, Powertech (USA) will establish an alternate monitoring location or remove the well from the operational groundwater monitoring program.

5.5.2.5 Sampling Methods

Groundwater sampling methods will be the same as the methods utilized for baseline characterization. Static water level will be measured before sample collection when access is available. Measurement techniques will include pressure transducers, a portable electronic water level meter, or an ultrasonic water level sensor. For flowing artesian wells, the shut-in pressure will be measured, where access is available, using a 15 or 30 psi NIST pressure gauge. Prior to measuring the pressure, the well will be shut in and the pressure allowed to stabilize before recording the hydrostatic pressure.

Three casing volumes will be purged prior to sample collection where possible, except that flowing artesian wells will be assumed to contain representative formation water without purging. In all cases, field parameters will be measured and recorded and samples will not be collected until field pH, conductivity and temperature have stabilized. The criterion used to assess stability will be three consecutive measurements of each of the field parameters with values for each parameter within 10%.

All groundwater samples will be collected in clean sample containers and field preserved, where required. The sample containers will be kept cool (less than 4°C) until delivery to the contract laboratory.

5.5.2.6 Reporting

Powertech (USA) will provide DENR with the results of all operational groundwater monitoring, including domestic wells, stock wells, irrigation wells, and monitor wells. These will be provided in the annual environmental monitoring report described in Section 5.7.2.6.

5.5.3 Operational Surface Water Monitoring Program

During ISR operations, 24 impoundments and 10 stream sampling sites, depicted on Plate 5.5-1, will be monitored as part of the operational monitoring program. Impoundments within and surrounding the permit area were evaluated based on location in relation to ISR operations (i.e., downgradient of proposed well fields, CPP, etc.). Table 5.5-2 lists all of the impoundments identified during the baseline surveys. The table lists all of the impoundments and identifies which impoundments are located downgradient (i.e., potentially subject to surface runoff) from ISR operations. The table also denotes the 24 impoundments included in the operational monitoring program and provides justification for impoundments not included. All 24 impoundments identified for operational monitoring will be visited on a quarterly basis throughout construction and operation. In addition, Powertech (USA) will visit all 24 of the impoundments included in the operational monitoring program four times (including pre-operational samples already collected) prior to operations to satisfy NRC pre-operational monitoring requirements. Water samples will be collected, when available, and analyzed for constituents listed in Table 6.2-1.

The previous stream sampling sites described in Section 3.5.3.1 were evaluated against NRC regulatory guidance (NRC, 1980a) to establish an operational monitoring program. Four sites (BVC01, BVC04, PSC01, and PSC02) used for baseline monitoring will be replaced with operational monitoring sites that better meet NRC guidance as follows:

- BVC11 will be located where Beaver Creek exits the permit area. This monitoring location will replace BVC01, which was approximately 2 stream miles farther downstream, below the confluence with Pass Creek.

- BVC14 will be located where Beaver Creek enters the permit area. This monitoring location will replace BVC04, which was approximately 12 stream miles upstream from the permit area.

- PSC11 will be located where Pass Creek exits the permit area. This monitoring location will replace PSC01, which was approximately 2 stream miles upstream from the PSC11 location, within the permit area.

- PSC12 will be located where Pass Creek enters the permit area. This monitoring location will replace PSC02, which was about 2 stream miles upstream from the permit area

A total of 10 stream sampling sites will be included in the operational monitoring program. In addition to the four new sites described above, Powertech (USA) will establish two additional

Table 5.5-2: Impoundments Included in the Operational Monitoring Program

Site	Type/Name	Down-Gradient of ISR Operations*	Included in Operational Monitoring Program	Justification for Not Including in Operational Monitoring Program
Sub01	Stock Pond	No		Not downgradient and outside of permit area
Sub02	Triangle Mine Pit	No	**Yes**	
Sub03	Mine Dam	Yes	**Yes**	
Sub04	Stock Pond	Yes	**Yes**	
Sub05	Mine Dam	Yes	**Yes**	
Sub06	Darrow Mine Pit Northwest	Yes	**Yes**	
Sub07	Stock Dam	Yes	**Yes**	
Sub08	Stock Pond	Yes	**Yes**	
Sub09	Stock Pond	Yes	**Yes**	
Sub10	Stock Pond	Yes	**Yes**	
Sub11	Stock Pond	Yes	**Yes**	
Sub20	Stock Pond	Yes	**Yes**	
Sub21	Stock Pond	Yes	**Yes**	
Sub22	Stock Pond	Yes	**Yes**	
Sub23	Stock Pond	No		Not an impoundment, but an infrequent, small pool of water due to inadequate stormwater control at county road crossing
Sub24	Stock Pond	No		Outside of permit area; not located in a permit area drainage
Sub25	Stock Pond	No		Outside of permit area; not downgradient
Sub26	Stock Pond	No		Outside of permit area; not downgradient
Sub27	Stock Pond	Yes		Outside of permit area; downstream of Sub28
Sub28	Stock Pond	Yes		Outside of permit area; downstream of Sub08 and Sub09 with no proposed ISR operations between Sub08 or Sub09 and Sub28
Sub29	Stock Pond	Yes	**Yes**	
Sub30	Stock Pond	Yes	**Yes**	
Sub31	Stock Pond	Yes	**Yes**	
Sub32	Stock Pond	Yes	**Yes**	
Sub33	Stock Pond	Yes	**Yes**	
Sub34	Stock Pond	Yes	**Yes**	
Sub35	Stock Pond	Yes	**Yes**	
Sub36	Stock Pond	Yes	**Yes**	

Table 5.5-2: Impoundments Included in the Operational Monitoring Program (Cont'd)

Site	Type/Name	Down-Gradient of ISR Operations*	Included in Operational Monitoring Program	Justification for Not Including in the Operational Monitoring Program
Sub37	Stock Pond	Yes		Downstream of Sub36
Sub38	Stock Pond	No		Outside of permit area; not downgradient
Sub39	Stock Pond	No		Not downgradient
Sub40	Darrow Mine Pit Southeast	Yes	**Yes**	
Sub41	Stock Pond	Yes		Only downgradient of potential perimeter monitor wells
Sub42	Stock Pond	No		Not downgradient
Sub43	Stock Pond	No		Not downgradient
Sub44	Stock Pond	No		
Sub45	Stock Pond	No		Outside of permit area; not downgradient
Sub46	Stock Pond	No		Outside of permit area; not downgradient
Sub47	Stock Pond	No		Outside of permit area; not downgradient
Sub48	Stock Pond	No		Outside of permit area; not downgradient
Sub49	Darrow Mine Pit	Yes	**Yes**	
Sub50	Darrow Mine Pit	Yes	**Yes**	
Sub51	Stock Pond	No		Outside of permit area; not downgradient
Sub52	Stock Pond	No		Outside of permit area; not downgradient
Sub53	Stock Pond	No		Outside of permit area; not downgradient
Sub54	Stock Pond	No		Outside of permit area; not downgradient

* Potentially subject to surface runoff from Satellite Facility, CPP, ponds, potential land application areas, pipelines, or potential well field areas.

sites on unnamed tributaries in the southeast portion of the permit area. Details for each of the operational stream sampling sites are provided in Table 5.5-3.

Prior to ISR operations, Powertech (USA) will sample each site monthly (including samples already collected) for 12 consecutive months in accordance with NRC license requirements. Grab samples will be collected from sites BVC11, BVC14, CHR01, and CHR05. Passive samplers will be installed at the remaining sites to collect samples during ephemeral flow events. Water samples will be analyzed for constituents listed in Table 6.2-1.

5.5.3.1 Sampling Methods and Parameters

Impoundments will be sampled by collecting grab samples. Prior to sampling, the sampler will conduct a visual survey of the impoundment to identify an appropriate sample location. This will include an area free of ice or floating debris and with sufficient water depth to permit sample collection without disturbing sediments. If necessary, a clean, long-handled dip sampler will be used. Typically the sample location will be near the impoundment embankment where the water is deepest. Grab samples will be collected in clean sample containers provided by the contract laboratory. Water will be obtained by filling the containers from the top 10 cm (4 in) of the water column. Samples will be field-preserved where required. The sample containers will be kept cool (less than 4°C) until delivery to the contract laboratory. In the event that a sample cannot be collected from an impoundment during the quarterly visit, the reason will be stated on a field sheet.

Streams will be sampled by grab sampling or with automatic samplers. Perennial stream sampling locations include those on Beaver Creek and the Cheyenne River. These will be sampled by collecting grab samples as described above. Passive samplers (single-stage samplers) will be installed at all other stream sampling sites from April through October. These will collect samples automatically when the flow rate in the channel reaches a field-adjustable minimum depth threshold. Following the runoff event the water will be manually transferred from the temporary sample container to clean sample bottles and submitted to the contract laboratory for analysis.

Representative water of that collected in the grab samples will be analyzed in the field for pH, conductivity and temperature. Impoundment and stream samples will be analyzed for the parameters presented in Table 5.5-4, which has been prepared according to NRC regulatory guidance to monitor potential impacts to surface water from uranium ISR facilities.

Table 5.5-3: Operational Stream Sampling Locations

Site ID	Name	Sample Type	Location in NAD 27, South Dakota State Plane South (feet)	
			Northing	Easting
BVC11	Beaver Creek Downstream	Grab	433,638	1,022,546
BVC14	Beaver Creek Upstream	Grab	446,829	1,012,976
CHR01	Cheyenne River Upstream	Grab	423,009	1,016,699
CHR05	Cheyenne River Downstream	Grab	405,925	1,047,227
PSC11	Pass Creek Downstream	Passive sampler	431,452	1,028,064
PSC12	Pass Creek Upstream	Passive sampler	446,470	1,031,222
BEN01	Bennett Canyon	Passive sampler	416,196	1,047,473
UNT01	Unnamed Tributary	Passive sampler	422,482	1,039,166
UNT02	Unnamed Tributary	Passive sampler	424,478	1,035,236
UNT03	Unnamed Tributary	Passive sampler	425,438	1,029,910

Table 5.5-4: Operational Surface Water Monitoring Parameter List and Analytical Methods

Parameter	Units	Analytical Method
pH	pH units	A4500-H B
Total dissolved solids (TDS)	mg/L	A2540 C
Total suspended solids (TSS)	mg/L	A2540 D
Hardness, total as $CaCO_3$	mg/L	A2340 B
Chloride	mg/L	A4500-Cl B; E300.0
Sulfate	mg/L	A4500-SO4 E; E300.0
Arsenic, dissolved	mg/L	E200.8
Cadmium, dissolved	mg/L	E200.8
Chromium, dissolved	mg/L	E200.8
Selenium, dissolved	mg/L	E200.8, A3114 B
Uranium, dissolved	mg/L	E200.8
Uranium, suspended	mg/L	E200.8
Ra-226, dissolved	pCi/L	E903.0
Ra-226, suspended	pCi/L	E903.0
Th-230, dissolved	pCi/L	E907.0
Th-230, suspended	pCi/L	E907.0
Pb-210, dissolved	pCi/L	E909.0M
Pb-210, suspended	pCi/L	E909.0M
Po-210, dissolved	pCi/L	RMO-3008
Po-210, suspended	pCi/L	RMO-3008

5.5.3.2 Reporting

Powertech (USA) will provide DENR with the results of all operational surface water monitoring, including impoundment and stream sampling results. These will be provided in the annual environmental monitoring report described in Section 5.7.2.6.

5.5.4 Land Application Effluent Monitoring

The following describes the effluent water quality monitoring program that will be implemented if land application is used as a wastewater disposal option. Land application system reporting also is described.

5.5.4.1 Monitoring Frequency and Parameters

Powertech (USA) will collect and analyze effluent water quality samples using a progressive sampling schedule that includes volume-based grab samples in accordance with ARSD 74:29:05:15 and time-based grab samples designed to detect any changes in the land application water quality. ARSD 74:29:05:15 specifies the following sampling requirements: "Sampling of solution to be applied to the land shall consist of not less than one grab sample per 100,000 gallons of solution. If less than 100,000 gallons is to be applied to land, at least one grab sample must be taken and analyzed for the required parameters. Each grab sample must be of sufficient volume so the sample can be split. Each split of the sample must be of a volume sufficient to allow for analysis for all operational monitoring parameters. At every fifth sampling, one split sample of each five consecutive grab samples shall be preserved and analyzed for the required monitoring parameters." To meet these requirements, Powertech (USA) proposes to collect a grab sample of the water pumped from the storage ponds to the land application systems at a frequency of at least one sample per 100,000 gallons. This will be accomplished by manually filling the sample containers or installing an automated grab sampler. At every fifth sampling, five consecutive grab samples will be composited and analyzed for the parameters shown in Table 5.5-5.

Justification for a relatively small list of sample parameters for the volume-based grab sampling is based on the large storage capacity available in the storage ponds at each land application site. Based on an anticipated land application rate of 297 to 653 gpm, grab samples representing each 100,000 gallons of effluent will be collected every 2.6 to 5.6 hours, and composite samples representing each 500,000 gallons of effluent will be collected every 12.8 to 28.1 hours. By comparison, the available storage capacity at each site will be 247.2 ac-ft, which is equal to 86 to 188 days of water storage at the typical pumping rates of 297 to 653 gpm, respectively. Changes

Table 5.5-5: Volume-Based Effluent Water Quality Sampling Parameter List

Constituent	Units	Analytical Method
Field pH	s.u.	Field
Laboratory pH	s.u.	A4500-H B
Field conductivity	umhos/cm	Field
Conductivity @ 25°C	umhos/cm	A2510 B

in water quality in the storage ponds will occur very slowly, since the storage capacity far exceeds the pumping rate and since changes in well field water quality will occur slowly. The primary source of land application water, production and restoration bleed, will result from multiple well fields undergoing differing phases of uranium recovery and aquifer restoration. This water will be combined in the storage ponds, where increasing concentrations in water quality constituents from well fields undergoing production will tend to be offset by decreasing concentrations in water quality constituents from well fields undergoing aquifer restoration.

In addition to the volume-based effluent sampling, Powertech (USA) will collect grab samples monthly during operation of each land application system and have them analyzed for the parameters listed in Table 6.2-1. In addition to the parameters in Table 6.2-1, monthly effluent samples will be analyzed for compliance with the anticipated NRC effluent limits listed in Table 5.4-1. These anticipated NRC effluent limits are the 10 CFR Part 20, Appendix B, Table 2, Column 2 established limits for discharge of radionuclides to the environment.

Prior to operation of the land application systems each year, Powertech (USA) will sample the storage ponds and have the samples analyzed for the parameters in Table 6.2-1.

5.5.4.2 Land Application System Reporting

Powertech (USA) will establish and maintain records and prepare and submit reports for land application system operation in accordance with the requirements of ARSD 74:29:05. Refer to Section 5.7.2.6 for a description of land application system reporting, including written notice to implement land application and a written report following each land application cycle, which is defined as the last land application operational period during each calendar year. Additional reporting will be done in accordance with DENR requirements in the approved GDP.

5.5.5 Pond Monitoring

Section 5.3.4.5 describes the monitoring and inspection program that will be implemented to document pond conditions, including inspections of liners, liner slopes and other earthwork features; measurement of pond freeboard to ensure that adequate containment capacity is available; monitoring for water accumulation in leak detection systems; and routine inspections of leak detection system functionality, embankment settlement, and slope stability.

5.5.6 Soil Sampling

5.5.6.1 Land Application Systems

If land application is used to dispose treated wastewater, soil sampling will occur as described in the GDP. Baseline soil samples will be collected prior to operation of each land application system. During operation, soil samples will be collected each year from each land application pivot that was active during that year. Soil samples also will be collected from each catchment area each year.

Potential impacts will be mitigated by monitoring soil concentrations during operations and implementing a contingency plan if concentrations approach trigger values. The proposed trigger values for arsenic and selenium are the average baseline concentrations plus 2 standard deviations. In addition, Powertech (USA) will monitor additional constituents listed in Table 6.4-1 of the GDP. Powertech (USA) will analyze the annual monitoring results and propose additional trigger values if increasing trends are observed. This analysis will be completed annually and provided in the written report submitted to DENR each year that is described in Section 5.7.2.6.

5.5.6.2 General Permit Area Soil Sampling

During operation, Powertech (USA) will collect and analyze soil samples from the air particulate monitoring locations as required by the NRC license. The anticipated sample requirements include sampling surface soils (0-5 cm) annually from each air particulate monitoring location once per year and having the samples analyzed for natural uranium, radium-226, and lead-210. This sampling will provide detection of potential aerial deposition of radionuclides from the Dewey-Burdock Project.

In addition, as described in Section 6, Powertech (USA) will conduct radiological surveys during decommissioning to identify areas for cleanup operations. A pre-reclamation survey will be used to identify cleanup areas, and a post-reclamation survey will be used to ensure that radium and other radionuclides do not exceed NRC standards. The radiological surveys will use gamma-ray detectors that are calibrated to soil radium-226 concentrations.

5.5.6.3 Vegetable Garden Soil Sampling

In accordance with NRC license conditions, Powertech (USA) will sample vegetable garden soil within 2 miles (3.3 km) of the permit area prior to operations. Plant-to-soil concentration factors will be then be used to estimate the levels of radionuclide concentrations in locally grown

vegetables. Powertech (USA) anticipates modifying the NRC monitoring program to exclude vegetable garden soil sampling if the pre-operational sample results along with modeling potential radiological impacts demonstrate no significant exposure pathway from vegetable gardens to potential human receptors.

5.5.7 Vegetation Sampling

5.5.7.1 Land Application Systems

If land application is used to dispose treated wastewater, vegetation sampling will occur as described in the GDP. Vegetation samples will be collected annually from the land application areas. Vegetation samples also will be collected from each catchment area each year. Powertech (USA) will monitor for the potential buildup of metals, metalloids, and radionuclides in irrigated vegetation. The vegetation sampling parameters are listed in Table 6.5-1 of the GDP application. Metals and metalloids to be monitored include natural uranium, selenium and arsenic. Prior to operation, Powertech (USA) will develop trigger values for arsenic and selenium based on the preoperational concentrations and the variability in each parameter. Should routine operational monitoring indicate an increasing trend in constituent concentrations with potential to approach trigger values, a contingency plan will be implemented as described in Section 8.4 of the GDP application. The proposed trigger values will be provided to DENR for review and approval prior to initiating land application. The results of annual monitoring and evaluation of potential increasing trends will be provided in the written report submitted to DENR each year that is described in Section 5.7.2.6.

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5.5.7.2 General Permit Area Vegetation Sampling

During operation, Powertech (USA) will collect and analyze vegetation samples from the air particulate monitoring locations as required by the NRC license. The anticipated sample requirements include sampling vegetation annually from each air particulate monitoring location once per year and having the samples analyzed for radium-226 and lead-210. The air particulate monitoring locations are located in areas having the highest predicted airborne radionuclide concentrations due to operation of the Dewey-Burdock Project.

In addition, Powertech (USA) will sample general grazing vegetation during the first year of operations in accordance with NRC license conditions. Powertech (USA) anticipates modifying the NRC monitoring program to exclude vegetation or forage sampling after the first year of operations if the initial monitoring results demonstrate that there is no ingestion pathway from grazing animals to potential human receptors. This will not impact vegetation sampling described in 5.5.7.1.

5.5.8 Livestock and Fish Sampling

In accordance with NRC license conditions, Powertech (USA) will collect livestock samples during the first year of operations for comparison to baseline. The anticipated sample requirements include collecting tissue samples at the time of slaughter of cattle, pigs and other livestock grazing within the permit area and analyzing samples for natural uranium, radium-226, lead-210, polonium-210 and thorium-230. Powertech (USA) anticipates modifying the NRC monitoring program to exclude livestock sampling after the first year of operations if the initial monitoring results demonstrate that there is no ingestion pathway from grazing animals to potential human receptors.

Powertech (USA) will collect samples of fish species with the potential for human consumption in accordance with NRC license conditions. The anticipated sample requirements include semiannual sampling of species with the potential for human consumption (green sunfish and channel catfish) if present in water bodies potentially affected by contamination.

5.5.9 Air Monitoring

Powertech (USA) will conduct an airborne radiation monitoring program at the Dewey-Burdock Project in accordance with NRC license conditions. The airborne radiation monitoring program will be designed to detect potential worker doses from radon and radionuclide particulates. It will include measurement of radon decay products and radionuclide particulates in the facilities and at effluent release points (e.g., vents).

Powertech (USA) also will conduct an airborne effluent and environmental monitoring program in accordance with NRC license conditions. The anticipated sampling requirements include continuously operating air monitoring stations located around the permit boundary. Filters from air particulate samplers operating continuously will be analyzed quarterly for natural uranium, thorium-230, radium-226, and lead-210. Radon gas will be measured monthly using passive track-etch detectors at each air monitoring station.

5.5.10 Meteorological Monitoring

The meteorological station at the site will continue to be operated by SDSU, or Powertech (USA) may install and operate a new meteorological station. A meteorological station within the permit area will be operated in accordance with NRC license requirements.

5.6 Potential Impacts and Mitigation

5.6.1 Land Use

5.6.1.1 Potential Land Use Impacts

Rangeland and agricultural cropland are the primary land uses within the permit area and the surrounding area. A portion of the land within the permit area will be temporarily converted from its previous use as rangeland and cropland to ISR use on a progressive, phased basis during construction and operation of ISR well fields, processing facilities, and associated infrastructure. However, most of the permit area will be undisturbed, and surface operations (e.g., wells and processing facilities) will affect only a small portion of it. Section 5.3.7 describes the total anticipated disturbance (topsoil stripping) area over the life of the project.

The land likely will experience an increase in human activity also contributing to land disturbance. The disturbance associated with drilling, pipeline installation, and facility construction will be limited and temporary as vegetation will be re-established through concurrent reclamation. The construction of access roads will be minimized to the extent possible by using and upgrading existing roads.

Operation of the project facilities will restrict the use of a portion of the land as rangeland and cropland for the duration of operations. This includes fenced well field areas, facility areas, and land application areas. This temporary change in land use will last until these areas are reclaimed and released for unrestricted use. Given the relatively small size of the impacted areas, the exclusion of grazing from well field and facility areas over the course of the project is

expected to have minimal impact on local livestock production. Following reclamation, the permit area will be returned to the approved postmining land uses.

Recreational use, which is limited primarily to large game hunting, also will be temporarily impacted within the permit boundary. Hunting is currently open to the public on approximately 5,700 acres. Approximately 240 acres of federal land are managed by the BLM. SDGF&P leases around 3,000 acres annually of privately owned land and currently designates this acreage as walk-in hunting areas (refer to Section 3.1.2). Due to safety concerns, Powertech (USA) will work with BLM, SDGF&P and private landowners to limit hunting within the permit area to the extent practicable.

5.6.1.2 Mitigation of Potential Land Use Impacts

The following procedures will be used to minimize the potential impacts to land use.

- Disturbance will be limited to only what is necessary for operations; this will be done by using existing access roads as practicable and combining access road and utility corridors.
- Development of Quality Assurance/Quality Control (QA/QC) plan to monitor the effectiveness of mitigation methods.
- Restrict normal vehicular traffic to designated roads and keep required traffic in other areas of the well field to a minimum.
- Use Class V deep disposal wells to the extent practicable for disposal of liquid wastes to mitigate potential land use impacts from land application systems.
- Conduct site ISR reclamation in interim steps to minimize potential land use environmental impacts. Sequential well field development will minimize land area impacted at any one time.
- Ponds will be reclaimed and re-vegetated and the land released for postmining uses.
- After groundwater restoration is completed, each well field and associated pipelines and facilities will be decommissioned. This includes plugging and abandoning all wells in accordance with DENR requirements. As areas are restored, they will be backfilled, contoured, and smoothed to blend with the natural terrain in accordance with the surface reclamation plan.
- All processing facilities will be decontaminated and removed unless they are to be used for other future activities as agreed in writing by the surface owner.
- Prior to completion of reclamation, landowners will be contacted and given the option to retain the roads for their private use or have the roads reclaimed by Powertech (USA). If the roads are deemed beneficial to others (i.e., hunters, ranchers and residents) and the

landowner agrees, the roads will not be reclaimed. Only roads related to ISR operations will be reclaimed.

5.6.2 Soils

5.6.2.1 Potential Soil Impacts

The two main drainage basins in the permit area have different soil types. The soil mapping unit descriptions are in Section 3.3. The Beaver Creek basin soils are composed of Haverson loam, with 0-2 percent slopes throughout the drainage. The Pass Creek basin soils are composed of Barnum silt loam in the south half of the drainage and Barnum-Winetti complex, with 0-6 percent slopes. The historical mine pits also were classified as Barnum silt loam and Barnum-Winetti complex.

Potential soil impacts to disturbed areas include:

- Compaction
- Loss of productivity
- Loss of soil
- Salinity
- Soil contamination

These impacts could potentially occur via:

- Clearing vegetation
- Compaction
- Excavation
- Leveling
- Redistribution of soil
- Stockpiling

Severity of potential impacts to soil is dependent upon type of disturbance, duration of disturbance and quantity of acres disturbed. Construction and operation activities have the potential to compact soils. Soils most sensitive to compaction, clay loams, are not present within the permit area; however, due to the use of heavy machinery and high volume within certain area, some soils have the potential for compaction. Compaction of the soil can lead to decreased infiltration, thereby increasing runoff. Soils compacted during construction and operations will be restored (i.e., disced and reseeded) as soon as possible following use.

Based on the soil mapping unit descriptions, the hazard for wind and water erosion within the permit area varies from negligible to severe. The potential for wind and water erosion is mainly a factor of surface characteristics of the soil, including texture and organic matter content. Given the very fine and clayey texture of the surface horizons throughout the majority of the permit area, the soils are more susceptible to erosion from water than wind.

If land application is used to dispose treated wastewater, there could be potential impacts to the soil from the buildup of salts, changes in SAR, buildup of radionuclides, buildup of metals and metalloids, and decrease in soil fertility. Mitigation of each of these potential impacts is described in the GDP and summarized in the following section.

Facility development will displace topsoil temporarily, which could adversely affect the structure and microbial activity of the soil. Loss of vegetation would expose soils and could result in a loss of organic matter in the soil. Excavation could cause mixing of soil layers and breakdown of the soil structure. Removal and stockpiling of soils for reclamation could result in mixing of soil profiles and loss of soil structure. Compaction of the soil could decrease pore space and cause a loss of soil structure as well. This could result in a reduction of natural soil productivity. Increased erosion and decreased soil productivity may cause a potential long-term declining trend in soil resources. Long-term impacts to soil productivity and stability could occur as a result of large-scale surface grading and leveling, until successful reclamation is accomplished. Reduction in soil fertility levels and reduced productivity could affect diversity of reestablished vegetative communities. Infiltration could be reduced, creating soil drought conditions. Vegetation could undergo physiological drought reactions (Lost Creek, 2007).

Overall, the potential environmental impacts to the soil within the permit area may be increased compared to areas outside the permit area but typically will not result from the ISR process itself, but rather from ancillary activities such as wastewater disposal and construction. The facility will be operated to minimize erosion and surface disturbance and then restored, leaving little impact on soils.

5.6.2.2 Mitigation of Potential Soil Impacts

The following measures will be used to minimize the potential impacts to soil resources.

- Design of facilities to minimize surface disturbance.
- Salvage and stockpile soil from disturbed areas (refer to Section 5.3.7).

- Reestablish temporary or permanent native vegetation as soon as possible after disturbance utilizing the latest technologies in reseeding and sprigging, such as hydroseeding (refer to Section 6.4.3.4).

- Decrease runoff from disturbed areas by using structures to temporarily divert and/or dissipate surface runoff from undisturbed areas (refer to Section 5.3.9).

- Retain sediment within the disturbed areas by using silt fencing, sediment ponds, and other ASCMs (refer to Section 5.3.9).

- Fill pipeline and utility trenches with appropriate material and regrade and reseed surface soon after completion.

- Drainage design will minimize potential for erosion by creating slopes less than 4 to 1 and/or provide rip-rap or other soil stabilization controls.

- Construct roads using techniques that will minimize erosion, such as surfacing with a gravel road base, constructing stream crossings at right angles with adequate embankment protection and culvert installation.

- Implement spill prevention and cleanup standard operating procedures to minimize soil contamination from vehicle accidents and/or well field spills or leaks; collect and monitor soils and sediments for potential contamination including areas used for land application, transport routes for yellowcake and ion exchange resins, and well field areas where spills or leaks are possible.

- Excavate contaminated soil as described in Section 6.3.3 and replace with uncontaminated soil as needed.

- Specific mitigation measures for potential soil impacts from land application are addressed in the GDP and summarized as follows:
    - The expected land application water quality is described in Section 5.4.1.1.4.1. With an anticipated TDS concentration of 1,000 to 5,000 mg/L, the water will pose a low to moderate risk to the growth of moderately salt-sensitive crops such as alfalfa. Soil salinity levels will be controlled by blending the land application water in the ponds and by leaching salts below the root zone during land application. Powertech (USA) will operate the land application systems to balance the downward migration of water, which has potential alluvial groundwater impacts, with the leaching that will be used to control salt buildup in the root zone.
    - The anticipated SAR levels in the land application water are 2 to 6, which should pose a low risk to soil infiltration rates. Should soil SAR increase and pose a risk to soil infiltration, Powertech (USA) will apply amendments such as sulfur or gypsum at agronomic rates.

- Since Powertech (USA) will treat the land application water to meet effluent limits, including the 10 CFR 20, Appendix B, Table 2, Column 2 standards for release of radionuclides to the environment, it is unlikely that radionuclides will build up to potentially harmful levels. This will be verified through operational soil monitoring and additional surveys during decommissioning.
- During decommissioning, Powertech (USA) will conduct land cleanup in accordance with NRC license and DENR permit requirements. This includes cleaning up surface soils to standards for radium-226 and natural uranium that will be established as conditions in the NRC license as protective of human health and the environment. This applies to the entire permit area and is not limited to the land application areas.
- The concentrations of metals and metalloids, including arsenic and selenium, are anticipated to be low as shown in Table 5.4-3 Nevertheless, there is potential for buildup of metals and metalloids over time in the land application areas. Potential impacts will be mitigated by monitoring soil concentrations during operations and implementing a contingency plan if concentrations approach trigger values. The contingency plan will consist of one or more of the following items:
  - Verify sample results and precisely delineate affected areas through additional soil sampling and analysis.
  - Modify land application system operating parameters to reduce the discharge rate in specific pivots or throughout the land application area.
  - Implement water treatment if necessary for radionuclides, metals or metalloids.
  - Implement a phytoremediation plan to control buildup of selenium in soil.
  - Excavate soil contaminated above the reclamation standards established in the NRC license and LSM permit and dispose excavated soil in an appropriately permitted disposal facility.
- Powertech (USA) may apply fertilizer to the land application areas to maximize crop production and maintain adequate soil fertility.

5.6.3 Groundwater

5.6.3.1 Potential Groundwater Impacts

Potential groundwater impacts include groundwater consumption, drawdown in nearby water supply wells, and potential groundwater quality impacts. Each of these is discussed below.

5.6.3.1.1 Potential Groundwater Consumption

Inyan Kara Aquifer

ISR circulates significant quantities of water through the ore zone, but only a small fraction of that water is a net withdrawal because most water is reinjected into the deposit. During ISR operations (including both production and restoration), a small portion of the solution extracted from the aquifer will be "bled" from the system. Bleed is defined as excess production or restoration solution withdrawn to maintain a cone of depression so native groundwater continually flows toward the center of the production zone. This bleed constitutes the net water withdrawal from the Inyan Kara aquifer. Nominal bleed rates of 0.5 to 1% are planned over the life of the project, with a design average bleed rate of 0.875%. Instantaneous production bleed may vary in the range of 0.5 to 3% for short durations, from days to months. If necessary, additional aquifer restoration bleed (up to 17%) will be used briefly during aquifer restoration to recover additional solutions and draw a greater influx of water into the ore zone from the surrounding Inyan Kara aquifer. This is known as groundwater sweep.

Table 5.6-1 summarizes the typical Inyan Kara water usage for the Dewey-Burdock Project. During uranium recovery (production), Powertech (USA) proposes to pump up to 8,000 gpm from the Inyan Kara aquifer. The typical production bleed rate will be 0.875%. Therefore, the net production withdrawal will typically be up to 70 gpm. During aquifer restoration, Powertech (USA) proposes to pump up to 500 gpm from the Inyan Kara aquifer. The restoration bleed will vary from about 1% to 17%. Therefore, the net aquifer restoration withdrawal will be up to 85 gpm. During concurrent production and restoration, the anticipated maximum gross and net usage from the Inyan Kara (on an annual average basis) will be 8,500 gpm and 155 gpm, respectively.

Madison Limestone

Table 5.6-2 summarizes the anticipated typical water consumption from the Madison Limestone. This includes approximately 12 gpm usage at the CPP plus aquifer restoration water. In the DDW option, the water withdrawn from the well fields will be treated with RO, and resulting permeate will be reinjected along with Madison Limestone water into the well fields. Based on an estimated permeate recovery rate of 70%, the Madison Limestone requirement will be 65 to 145 gpm at 17% and 1% aquifer restoration bleed, respectively.

Table 5.6-1: Typical Inyan Kara Water Usage

Usage	Amount
Production Only	
Gross Inyan Kara Pumping, gpm	8,000
Net Inyan Kara Usage (0.875% bleed), gpm	70
Aquifer Restoration Only	
Gross Inyan Kara Pumping, gpm	500
Net Inyan Kara Usage (1% bleed), gpm	5
Net Inyan Kara Usage (17% bleed), gpm	85
Concurrent Production and Restoration	
Gross Inyan Kara Pumping, gpm	8,500
Net Inyan Kara Usage (1% aquifer restoration bleed), gpm	75
Net Inyan Kara Usage (17% aquifer restoration bleed), gpm	155

Table 5.6-2: Typical Madison Water Usage

Usage	Amount
Production Only	
CPP usage, gpm	12
Aquifer Restoration Only	
Deep Disposal Well Option	
CPP usage, gpm	12
Madison Usage (1% bleed), gpm	145
Madison Usage (17% bleed), gpm	65
Land Application Option	
CPP usage, gpm	12
Madison Usage (1% bleed), gpm	495
Madison Usage (17% bleed), gpm	415
Concurrent Production and Restoration	
Maximum Anticipated Madison Usage (DDW option), gpm	157
Maximum Anticipated Madison Usage (land application option), gpm	507

In the land application option, all of the water withdrawn during aquifer restoration will be treated and disposed. The water will be replaced with water from the Madison Limestone or another suitable aquifer except for the restoration bleed, which will vary from 1% to 17%. Since the aquifer restoration pumping rate will be up to 500 gpm, between 415 and 495 gpm from the Madison Limestone will be reinjected into well fields undergoing aquifer restoration.

5.6.3.1.2 Potential Drawdown

Inyan Kara Aquifer

Petrotek Engineering Corporation (Petrotek) prepared a numerical groundwater flow model using site-specific data to predict hydraulic responses of the Fall River and Chilson aquifers to ISR production and restoration operations at the Dewey-Burdock Project. A primary model objective was to predict drawdown on a local and regional scale.

The numerical groundwater model domain encompasses nearly 360 square miles with north-south and east-west dimensions of 100,000 ft (18.9 miles). The northern and eastern boundaries of the model domain represent the updip limits of saturated conditions within the Inyan Kara aquifer system. The southern and western boundaries of the model extend at least 10 miles beyond the permit area. The Dewey Fault forms a no-flow boundary along the northwestern and northern boundaries of the model domain. Four layers were modeled. From shallowest to deepest these include the Graneros Group, Fall River Formation, Fuson Shale, and the Chilson Member of the Lakota Formation.

The model was calibrated to average 2010-2011 water level data by varying recharge to the Fall River and Chilson aquifers. Transient calibrations also were performed by simulating results of the 2008 aquifer tests conducted in support of the NRC license application. The calibrated model was then verified through simulation of aquifer tests conducted in 1982 by TVA.

Operational simulations were performed for gross Inyan Kara production rates ranging from 4,000 to 8,000 gpm. Restoration was simulated as a 1% bleed for a 500 gpm, gross restoration flow rate (5 gpm net extraction). Additional restoration bleed also was simulated for the groundwater sweep option. The results of the numerical groundwater modeling are presented in Appendix 5.6-A. Figures 6-38 and 6-39 in Appendix 5.6-A depict the modeled maximum drawdown for the Fall River and Chilson, respectively, at an 8,000 gpm gross production rate with a 1% production bleed and 1% aquifer restoration bleed applied to a 500 gpm gross restoration rate plus groundwater sweep. This represents a maximum net Inyan Kara water usage

rate of 147.2 gpm, or an amount approximately equal to the typical net Inyan Kara usage during concurrent production and restoration in Table 5.6-1.

Figure 6-38 in Appendix 5.6-A shows the maximum predicted drawdown in the Fall River Formation, and Figure 6-39 in Appendix 5.6-A shows the maximum predicted drawdown in the Chilson. Maximum drawdown outside the permit area during the simulation was slightly greater than 12 feet within the Fall River and approximately 10 feet in the Chilson. The groundwater model report in Appendix 5.6-A shows that potential drawdown impacts will be short-lived, with recovery to within 1 to 2 feet of pre-ISR levels within one year after the end of ISR operations.

The potential to unlawfully impair existing water rights or domestic wells will be addressed in Inyan Kara aquifer water appropriation permits obtained through the DENR Water Rights Program. The Inyan Kara water rights applications demonstrate that Inyan Kara water is available for the proposed use and the proposed diversions can be developed without unlawful impairment of existing rights.

Madison Limestone

Powertech (USA) has developed a conceptual groundwater flow model of the Madison Limestone in the vicinity of the permit area. The model results are provided with the water appropriation permit application for the Madison that has been submitted to the DENR Water Rights Program. The conceptual model demonstrates that Madison water is available for the proposed use and the proposed diversions can be developed without unlawful impairment of existing rights.

5.6.3.1.3 Potential Groundwater Quality Impacts

Potential groundwater quality impacts include potential impacts to the ore zone, potential impacts to aquifers surrounding the ore zone, potential impacts to overlying and underlying aquifers, and potential impacts to the alluvium. Each of these is addressed below.

5.6.3.1.3.1 Potential Impacts to Ore Zone Groundwater Quality

A potential environmental impact to groundwater as a result of ISR is the degradation of water quality in the ore zone within the well field areas. The interaction of the lixiviant with the mineral and chemical constituents of the aquifer will result in an increase in trace elements and salinity during uranium recovery operations. This will result from oxidation of uranium and other trace constituents and through the IX process, which will exchange dissolved uranium for chloride or bicarbonate ions.

During aquifer restoration, Powertech (USA) will restore groundwater quality consistent with NRC license conditions, the primary restoration goals being baseline water quality or an EPA-established maximum contaminant level (MCL) on a parameter-by-parameter basis. Therefore, the potential impacts to ore zone groundwater quality will be temporary and will end with NRC approval of successful aquifer restoration in each well field.

5.6.3.1.3.2 Potential Impacts to Inyan Kara Groundwater Quality Outside of the Ore Zone

Horizontal excursions have the potential to contaminate groundwater horizontally outside of the ore zone. Horizontal excursions could be caused by a temporary well field imbalance, in which the inward hydraulic gradient normally maintained by production and restoration bleed is temporarily altered. Horizontal excursions, if left uncontrolled, would have the potential to impact the groundwater quality of USDWs surrounding the ore zone. However, as described in Section 5.6.3.2, an extensive monitoring system will be implemented to ensure that potential excursions are rapidly detected and corrected. Therefore, potential impacts to Inyan Kara groundwater quality outside of the ore zone would be brief and localized.

By properly designing, pump testing, and operating each well field and its associated monitor well network, Powertech (USA) will minimize the risk of excursions and the potential impacts resulting from excursions. By routinely sampling monitor wells for changes in water level and concentrations of highly mobile and conservative excursion parameters, Powertech (USA) will ensure that any potential excursions are identified and corrected quickly. As described by NUREG-1910, Supplement 1 (NRC, 2010), "An excursion is defined as an event where a monitoring well in overlying, underlying, or perimeter well ring detects an increase in specific water quality indicators, usually chloride, alkalinity and conductivity, which may signal that fluids are moving out from the wellfield ... The perimeter monitoring wells are located in a buffer region surrounding the wellfield within the exempted portion of the aquifer. These wells are specifically located in this buffer zone to detect and correct an excursion before it reaches a USDW ... To date, no excursion from an NRC-licensed ISR facility has contaminated a USDW."

5.6.3.1.3.3 Potential Impacts to Overlying or Underlying Aquifers

Potential impacts to overlying or underlying aquifers could occur from a vertical excursion of ISR solutions into an overlying or underlying aquifer. This could be caused by vertical hydraulic head gradients between the production aquifer and the underlying or overlying aquifers. A vertical hydraulic head gradient could be caused by pumping from either the underlying or

overlying aquifers for water supply in the vicinity of the ISR facility. Discontinuities in the thickness and spatial heterogeneities in the vertical hydraulic conductivity of confining units could also lead to vertical movement of solutions and excursions.

Another potential source of vertical excursions is potential well integrity failures during ISR operations. Inadequate construction, degradation, or accidental rupture of well casings above or below the uranium-bearing aquifer could allow lixiviant to travel from the well bore into the surrounding aquifer. Deep monitor wells drilled through the production aquifer and confining units that penetrate aquitards could potentially create pathways for vertical excursions as well.

Section 5.6.3.2 describes how an extensive monitoring system and MIT program will be implemented to prevent vertical excursions and to provide rapid detection and corrective action in the event of a vertical excursion. Potential impacts to overlying or underlying aquifers would be brief and localized.

5.6.3.1.3.4 Potential Impacts to Alluvium

The primary potential to impact alluvial water quality would be a pipeline leak or spill. Potential impacts and mitigation measures for leaks and spills are addressed in Sections 5.6.4.1 and 5.6.4.2.

If land application is used for liquid waste disposal, the alluvial groundwater quality could be impacted in the vicinity of the land application areas. The GDP and Section 5.6.3.2 describe mitigation measures that will protect alluvial groundwater quality during land application.

5.6.3.1.4 Potential Impacts to Groundwater Hydrologic Balance

Any disturbance to the prevailing hydrologic balance of the affected land and of the surrounding area and to the quantity of groundwater both during and after ISR operations and during reclamation will be minimized in accordance with SDCL 45-6B-41. Powertech (USA) will be required to demonstrate that water is available for the proposed diversions in the Inyan Kara and Madison in order to obtain water appropriation permits from the DENR Water Rights Program. The water appropriation permit applications will demonstrate limited potential impacts to the groundwater hydrologic balance due to limited drawdown.

5.6.3.1.5 Potential Subsidence in ISR Well Fields

There is no potential for subsidence in the ISR well fields due to limited drawdown in the ore zone and other aquifers and due to the nature of uranium ISR, which does not affect the structural integrity of the ore zone sands. Refer to Section 5.6.3.1.2 and Appendix 5.6-A, which describe how potential drawdown in the Inyan Kara aquifer will be limited, and the potentiometric water level is anticipated to recover to pre-ISR levels rapidly after the end of ISR activities. Section 5.6.3.1.2 also describes how potential drawdown in the Madison Limestone will be only a small portion of the confining pressure above the top of the Madison.

The following information from the ISR GEIS addresses subsidence potential in ISR well fields in the Nebraska-South Dakota-Wyoming Uranium Milling Region, which includes the proposed permit area (NRC, 2009, Section 4.4.3.2):

> "The removal of uranium mineral coatings on sediment grains in the target sandstones during the uranium mobilization and recovery process will result in a change to the mineralogical composition of uranium-producing formations. However, the uranium mobilization and recovery process in the target sandstones does not result in the removal of rock matrix or structure, and therefore no significant matrix compression or ground subsidence is expected. In addition, the source formations for uranium in the Nebraska-South Dakota-Wyoming Milling Region occur at depths of tens to hundreds of meters [hundreds of feet] ... and individual mineralization fronts are typically 0.6 to 7.5 m [2 to 25 ft] thick ... At these depths and thicknesses and considering that rock matrix is not removed during the uranium mobilization and recovery process, it is unlikely that collapse in the target sandstones would be translated to the ground surface. Therefore, impacts to geology from ground subsidence would be expected to be SMALL."

5.6.3.2 Mitigation of Potential Groundwater Impacts

Following is a list of mitigation measures for potential impacts to groundwater. Specific mitigation measures for potential impacts to water supply wells, corrective actions for excursions, and protection of groundwater quality in and around land application areas are provided below.

- Perform MIT on all wells prior to use and repeat every 5 years.
- Minimize groundwater use during operations by limiting production and restoration bleed to the minimum amount needed to ensure hydraulic well field control.
- Monitor well pressures to detect leaks.
- Install and operate an extensive monitoring system to detect potential horizontal or vertical excursions of ISR solutions.
- Plug and abandon or mitigate any of the following should they pose the potential to impact the control and containment of well field solutions within the permit area:
    - Historical wells and exploration holes
    - Holes drilled by Powertech (USA) for delineation and exploration
    - Any well failing MIT
- Maintain pumping and injection rates (well field balance) to ensure radial hydraulic flow into and through the production zone.
- Monitor to detect and define unanticipated surface spills, releases, or similar events that may infiltrate into the groundwater system.
- Implement a spill prevention and cleanup plan to minimize potential impacts to groundwater, including rapid response cleanup and remediation capability, techniques, procedures, and training.
- Monitor nearby domestic, livestock, irrigation, and designated monitor wells as appropriate during operations.
- Select restoration method to minimize water consumption during groundwater restoration.
- During groundwater restoration, monitor groundwater using standard industry practices to determine the progression and effectiveness of restoration.
- Implement an extensive land application monitoring system that includes compliance wells, intermediate wells, and vadose zone monitoring.
- Site land application areas at locations where natural conditions make it highly unlikely that the land application water will reach the alluvium.
- Apply land application water at agronomic rates.
- Treat the land application water and/or DDW water to remove radionuclides.

Mitigation of Potential Impacts to Water Supply Wells

The following procedures will be followed to evaluate and mitigate potential impacts to water supply wells. During the design of each well field, all nearby water supply wells will be evaluated for the potential to be impacted by ISR operations or the potential to interfere with ISR operations. If needed, this evaluation also will include groundwater modeling. The results of the evaluation will be contained within a well replacement plan described in the hydrogeologic data package for each well field (refer to Section 5.3.3.4).

At a minimum, all domestic wells within the permit area will be removed from drinking water use and all stock wells within ¼ mile of well fields will be removed from private use. Depending on the well construction, location and screen depth, Powertech (USA) may continue to use the well for monitoring or plug and abandon the well.

The well owner will be notified in writing prior to removing any well from private use. Powertech (USA) will work with the well owner to determine whether a replacement well or alternate water supply is needed.

Section 5.5.2 describes the operational groundwater monitoring plan that will be used to assess potential impacts to domestic, livestock and irrigation wells. The monitor well ring will provide advance warning before any wells outside the ring have potential to be impacted. If routine monitoring of a water supply well indicates diminished water quantity or quality, the well owner will be notified in writing and the well will be removed from use. Powertech (USA) will work with the well owner to determine if well replacement is necessary. Well replacement procedures are described below. The monitoring and well replacement or abandonment procedures to be implemented by Powertech (USA) will assure that there will be no effects on anyone or any water well outside the monitor well ring.

Water Supply Well Replacement Procedures

Replacement wells will be located an appropriate distance from the well fields and will target an aquifer outside of the ore zone that provides water in a quantity equal to that of the original well and of a quality which is suitable for the same uses as the original well, subject to the lease agreement and South Dakota water law.

Lease agreements for the entire permit area currently allow Powertech (USA) to remove and replace the water supply wells as needed. The following is an excerpt from the lease agreements

with each landowner. (Note: all lease agreements formerly held by Denver Uranium have been assigned to Powertech (USA).)

> *DENVER URANIUM shall compensate LESSOR for water wells owned by LESSOR at the execution of this lease, as follows: Any such water which falls within an area to be mined by DENVER URANIUM, shall be removed from LESSOR's use. Prior to removal, DENVER URANIUM shall arrange for the drilling of a replacement water well or wells, outside of the mining area, in locations mutually agreed upon between LESSOR and DENVER URANIUM, as may be necessary to provide water in a quantity equal to the original well and of a quality which is suitable for all uses the original water well served at the time such well was removed from LESSOR's use.*

An example of a replacement well is provided in Figure 5.6-1, which shows use of the project Madison well to supply water by pipeline to local stock tanks.

Excursion Control

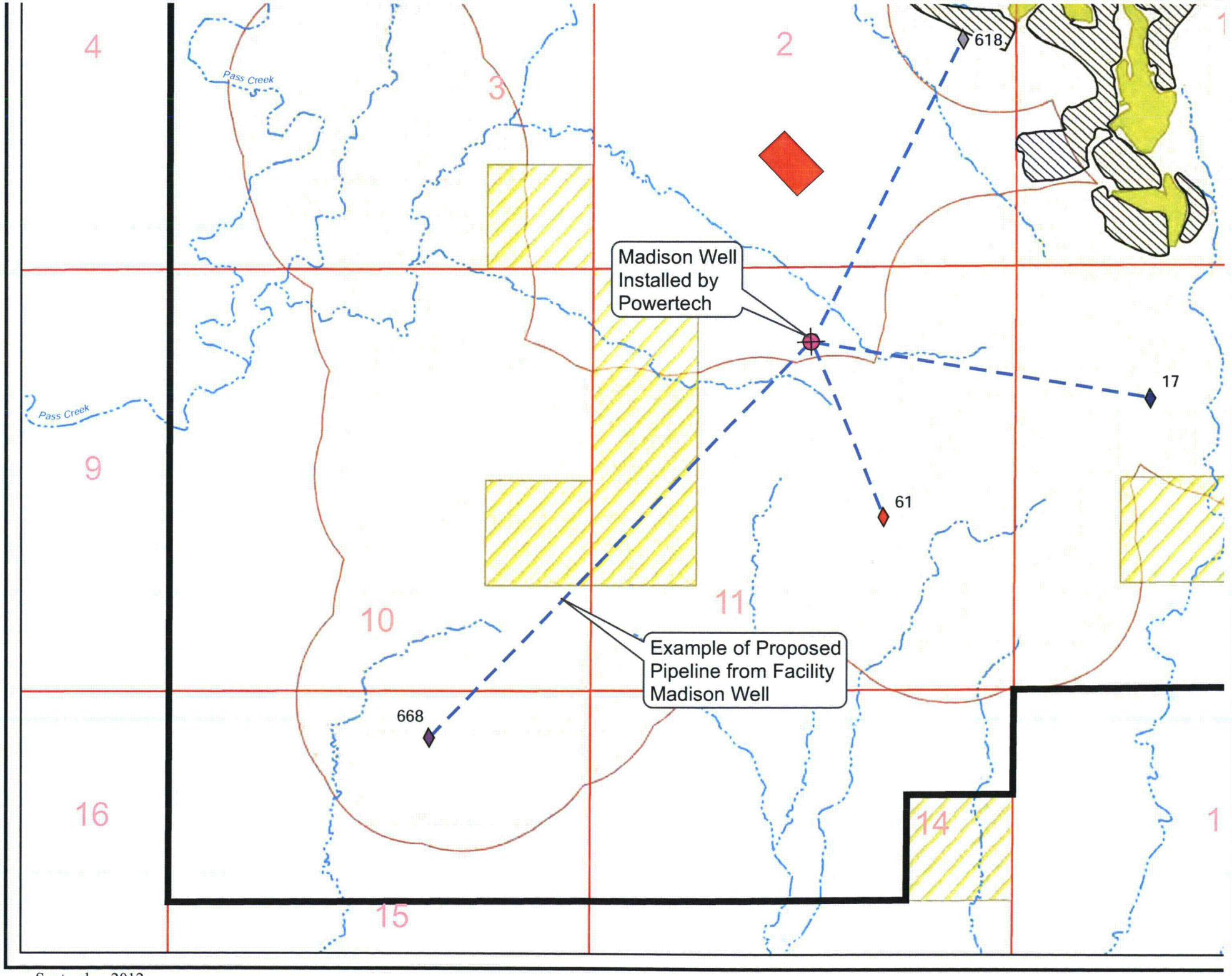
The following mitigation measures will be used to prevent potential horizontal or vertical excursions of ISR solutions.

Pre-operational excursion preventative measures will include, but will not be limited to:

1. Proper well construction and MIT of each well before use;
2. Monitor well design schema based upon delineation drilling to further characterize the zones of mineralization and to identify the target completion zones for all monitor wells; and
3. Pre-operational pumping tests with monitoring systems in place to obtain a detailed understanding of the local hydrogeology and to demonstrate the adequacy of the monitoring system.

Operational excursion preventative measures will include but will not be limited to:

1. Regular monitoring of flow and pressure on each production and injection well;
2. Regular flow balancing and adjustment of all production and injection flows appropriate for each production pattern;
3. Operation of bleed, and continuous measurement of bleed rate;
4. Monitoring hydrostatic water levels in monitor wells to verify the cone of depression; and



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5. Regular collection of samples from all monitor wells to determine the presence of any indicators of the migration of ISR solutions horizontally or vertically from the production zone.

6. Perform MIT on all wells prior to use and repeat every 5 years.

Monitor wells will be positioned to detect any ISR solutions that may potentially migrate away from the production zone due to an imbalance in well field pressure. The monitoring well detection system described in Section 5.3.3.1.2 is a proven method used at historically and currently operated ISR facilities. Prior to injecting chemicals into each well field, pre-operational pump testing will be conducted to demonstrate hydraulic connection between the production and injection wells and all perimeter monitor wells (see Section 5.3.3.3). The results of the pump testing will be included within the hydrogeologic data packages prepared for each well field as described in Section 5.3.3.4. Additional monitor wells will be installed within overlying and underlying hydrogeologic units. The pre-operational pump testing will demonstrate vertical confinement and hydraulic isolation between the production zone and overlying and underlying units. The monitoring system and operational procedures have proven effective in early detection of potential excursions of ISR solutions for a number of reasons:

- Regular sampling for indicator parameters (such as chloride) that are highly mobile can detect ISR solutions at low levels well before an excursion is created.
- Monitoring hydrostatic water levels in perimeter monitor wells will provide immediate verification of the cone of depression, draw rapid attention in the event of a change, and provide the ability for measurement and implementation of corrective response.
- Bleed will create a cone of depression that will maintain an inward hydraulic gradient toward the well field area.
- The natural groundwater gradient and slow rate of natural groundwater flow is small relative to ISR activities and the induced gradient caused by the production and restoration bleed.

Controls for preventing migration of ISR solutions to overlying and underlying aquifers consist of:

- Regular monitoring of hydrostatic water levels and sampling for analysis of indicator species;
- Routine MIT of all wells on a regular basis (at least every 5 years) to reduce any possibility of casing leakage;
- Completion of MIT on all wells before putting them into service or after work which involves drilling equipment inside of the casing;

- Proper plugging and abandonment of all wells which do not pass MIT or that become unnecessary for use;
- Proper plugging and abandonment of exploration holes with potential to impact ISR operations; and
- Sampling monitor wells located within the overlying and underlying hydrogeologic units on a frequent schedule.

These controls work together to prevent and detect ISR solution migration. Plugging any exploration holes that pose the potential to impact the control and containment of ISR solutions prevents connection of the production zone to overlying and underlying units. The EPA UIC requirements for MIT assure proper well construction, which is the first line of defence for maintaining appropriate pressure without leakage. Sampling the monitor wells will enable early detection of any ISR solutions should an excursion occur.

Excursion Corrective Actions

Powertech (USA) will implement the following corrective action plan for excursions occurring during production or restoration operations. Corrective actions to correct and retrieve an excursion may include but will not be limited to:

- Adjusting the flow rates of the production and injection wells to increase the aquifer bleed in the area of the excursion;
- Terminating injection into the portion of the well field affected by the excursion;
- Installing pumps in injection wells in the portion of the well field affected by the excursion to retrieve ISR solutions;
- Replacing injection or production wells; and
- Installing new pumping wells adjacent to the well on excursion status to recover ISR solutions.

In the event of an excursion, the sampling frequency will be increased to weekly. NRC will be notified within 24 hours by telephone or email and within 7 days in writing from the time an excursion is verified. DENR will be notified in writing within 7 days from the time an excursion is verified. In addition, if the excursion has potential to affect a USDW, EPA will be notified verbally within 24 hours and in writing within 5 days. A written report describing the excursion event, corrective actions taken and the corrective action results will be submitted to all involved regulatory agencies within 60 days of the excursion confirmation.

If wells are still on excursion status when the report is submitted, the report also will contain a schedule for submittal of future reports describing the excursion event, corrective actions taken,

and results obtained. If an excursion is not corrected within 60 days of confirmation, Powertech (USA) will terminate injection into the affected portion of the well field until the excursion is retrieved, or provide an increase to the reclamation financial assurance obligation in an amount that is agreeable to NRC and that would cover the expected full cost of correcting and cleaning up the excursion. The financial assurance increase will remain in force until the excursion is corrected. The written 60-day excursion report will state and justify which course of action will be followed. If wells are still on excursion status at the time the 60-day report is submitted to NRC, and the financial assurance option is chosen, the well field restoration financial assurance obligation will be adjusted upward. When the excursion is corrected, the additional financial assurance obligations resulting from the excursion will be removed.

Protection of Groundwater Quality in and around Land Application Areas

Powertech (USA) will operate the proposed land application systems in accordance with an approved GDP, the primary purpose of which is to protect groundwater quality in accordance with State standards. Mitigation measures to protect groundwater quality in the land application areas are described above and include implementing an extensive land application monitoring system that includes compliance wells, intermediate wells and vadose zone monitoring; siting land application areas at locations where natural conditions make it unlikely that land application water will reach alluvial groundwater; applying land application water at agronomic rates; and treating land application water to remove radionuclides. These mitigation measures will ensure compliance with groundwater quality standards in and around the land application areas during and after ISR operations and during reclamation.

5.6.4 Surface Water

5.6.4.1 Potential Surface Water Impacts

Potential surface water impacts include increased sediment load due to surface disturbance, very limited stream channel disturbance, potential encroachment on wetlands, and potential water quality impacts from leaks or spills. Each of these is described below.

5.6.4.1.1 Potential Sedimentation

Construction activities within the well fields, along the pipeline corridors and roads, and at the CPP and Satellite Facility have the potential to increase the sediment yield of the disturbed areas. The potential impacts will be minimal due to the relatively small size of the disturbance areas relative to the watershed areas and due to the implementation of the sediment control plan described in Section 5.3.9 and the mitigation measures described in Section 5.5.4.2.

5.6.4.1.2 Potential Impacts to Stream Channels and Riparian Areas

As described in Section 5.3.9, 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 the stream channels. Some facilities must be located within stream channels, such as pipeline corridors and access roads. These will cross the stream channels perpendicular to the flow direction to minimize disturbance. Primary and secondary access road stream channel crossings will include culverts as described in Section 5.3.8.

Ephemeral stream channels also will be disturbed temporarily at the upstream and downstream ends of the diversion channels described in Section 5.3.9.1, which describes the erosion protection measures that will be used for diversion channels.

Facilities potentially constructed in the cottonwood gallery riparian zone along Pass Creek include a limited number of access roads, pipelines and utility corridors. Following is a discussion of potential impacts associated with these facilities.

To a limited extent, access roads will be constructed within the cottonwood gallery riparian zone. Most of these roads will be light-use roads (tertiary access roads), which are described in Section 5.3.8 as essentially non-constructed, two-track trails. To the extent possible, existing two-track roads will be used. The route for any new light-use roads that will be required within the cottonwood gallery riparian zone will be selected to minimize impacts to the riparian zone and to minimize erosion.

One secondary access road is planned through the cottonwood gallery riparian zone. This road is depicted on Plate 5.3-5 (Sheet 2) in the NWNW Section 3, T7S, R1E. It is an existing road near a dwelling that crosses Pass Creek and the riparian zone using a well-established route. Since the proposed secondary access road will be an upgrade to an existing road, potential impacts to Pass Creek will be minimized. Powertech (USA) intends to continue to use the existing low-water crossing and not install a bridge or culvert at this location. Erosion control measures described in Section 5.3.9 will be used for any disturbance areas that could contribute sediment to Pass Creek.

The plant-to-plant pipeline(s), if constructed, will cross the riparian zone near the existing low-water crossing. In addition, a utility corridor consisting of an overhead power line and buried pipeline is planned across the Pass Creek riparian zone in the SESW Section 34, T6S, R1E (refer to Plate 5.3-1, Sheet 2). The pipeline and utility routes through the riparian zone will be selected to minimize potential impacts. The Pass Creek pipeline crossings will be trenched or bored. Mitigation measures to minimize impacts will include use of sediment control measures, avoiding construction during early spring while runoff from snowmelt is occurring, and complying with applicable U.S. Army Corps of Engineers permitting requirements.

Disturbance to the cottonwood gallery riparian zone will be relatively small due to the limited number of utility crossings and use of existing roads. Special care will be taken in this area to control sediment. During construction, silt fences, straw beds, and other sediment control measures will be used to minimize any potential water quality impacts.

5.6.4.1.3 Potential Impacts to Wetlands

The majority of the potential wetlands in the permit area occur along Beaver Creek and Pass Creek. Potential well field areas all occur away from Beaver Creek and Pass Creek, and potential wetlands along Beaver Creek and Pass Creek will not be impacted by construction activities. The remaining potential wetlands are dispersed throughout the permit area as small depressions and ponds, historical mine pits, and an area around a flowing artesian well. The wetlands within the historical mine pits are not planned to be disturbed. There may be some encroachment impacts to small, depressional wetland areas.

Construction, operation, or reclamation activities, which cause disturbance or impacts to jurisdictional wetlands, will be performed in accordance with appropriate Nationwide Permits issued by the U.S. Army Corps of Engineers, if applicable. These may include Nationwide Permit (NWP) 44 non-coal mining activities, which requires Pre-construction Notification (PCN) for all activities, NWP 12 utility line activities, which requires PCN for an area where a Section 10 permit is required, discharges that result in the loss of >0.1 acre, and NWP 14 linear transportation projects, which requires a PCN for 0.5 acre in non-tidal waters. NWP 44 has an acreage limit of 0.5 acre for Waters of the U.S. (WoUS). NWP 12 and 14 also have 0.5-acre disturbance limits. Impacts to Other Waters of the U.S. (OWUS) are not considered under the acreage limit. Appendix 3.8-B contains the USACE jurisdictional determination for the permit area.

5.6.4.1.4 Potential Surface Water Quality Impacts from Leaks or Spills

Potential surface water quality impacts from leaks or spills are addressed in Section 5.6.5.1. Mitigation measures are described in Section 5.6.5.2.

5.6.4.2 Mitigation of Potential Surface Water Impacts

The following procedures will be used to minimize the potential impacts to surface waters.

- Minimize disturbance of surface areas and vegetation which, in turn, will minimize erosion and runoff rates.
- Minimize physical changes to drainage channels unless changes are made to upgrade drainage.
- Use erosion and runoff control features such as proper placement of pipe, grading to direct runoff away from water bodies, and use of riprap (broken rock and/or concrete) at these intersections to make bridges or culverts more effective, if necessary.

- Use sediment trapping devices such as hay or straw bales, fabric fences, and devices to control water flow and discharges to trap sediments moved by runoff.
- Maintain natural contours as much as possible, stabilizing slopes and avoiding unnecessary off-road travel with vehicles; maintaining natural contours as much as possible, stabilizing slopes and avoiding unnecessary off-road travel with vehicles.
- The land application of treated wastewater will occur at agronomic rates to avoid irrigation runoff into surface water; catchment areas also will prevent land application water from entering surface water.
- Prepare and implement a Stormwater Pollution Prevention Plan that is consistent with state and federal standards for construction and operation activities.
- Facilities will be constructed outside of flood inundation areas to the extent practicable.
- Best management practices will be utilized during ISR operations.

Powertech (USA) will comply with South Dakota surface water quality standards for surface water sites during and after ISR operations and during reclamation. Operational surface water monitoring will occur at 10 stream sampling sites listed in Table 5.5-3. Four of these sites are on stream segments with designated beneficial uses (Beaver Creek and the Cheyenne River). Section 3.5.4.1.1 describes how the sampled segments of Beaver Creek and the Cheyenne River have beneficial uses for warmwater semipermanent fish life propagation and limited-contact recreation. Section 3.5.4.1.1 describes how baseline samples collected from Beaver Creek met the ARSD 74:51:01:48 criteria for warmwater semipermanent fish life propagation waters except for some measurements of total suspended solids (TSS). Similarly, Cheyenne River baseline samples met the criteria except for some TSS measurements and one dissolved oxygen measurement.

Routine operational monitoring of surface water sites will be used to demonstrate compliance with the antidegradation policy for surface waters in ARSD 74:51:01:34, which requires existing beneficial uses to be maintained and protected. The mitigation measures described above will ensure that the Dewey-Burdock Project will not cause significant changes in surface water quality. To verify the effectiveness of mitigation measures, Powertech (USA) will analyze surface water samples for the parameter list in Table 5.5-4.

5.6.5 Spills and Leaks

5.6.5.1 Potential Impacts from Spills and Leaks

Potential impacts from spills and leaks include potential impacts to soil, surface water, and groundwater resulting from a spill or leak in the well fields, processing facilities, transportation vehicles, or ponds. Each of these is described below.

5.6.5.1.1 Well Fields and Pipelines

Well field features such as header houses, well heads or pipelines could contribute to pollution in the unlikely event of a release of ISR solution due to pipeline or well failure. A spill or leak in these areas could potentially impacts soils, surface water and groundwater. Potential impacts will be minimized by routine MIT of all injection, production and monitor wells and hydrostatic leak testing of all pipelines during construction; implementing an instrumentation and control system to monitor pressure and flow and immediately detect and correct an anomalous condition; and implementing a spill response and cleanup program in accordance with NRC license requirements and DENR permit conditions.

5.6.5.1.2 CPP and Satellite Facility

The CPP will serve as the hub for production operations at the project; therefore, the CPP will likely have the greatest potential for spills or accidents potentially resulting in the release of pollutants. Potential releases also could occur from the Satellite Facility. Potential releases could result from a tank or process vessel failure, pipe rupture, or transportation incident.

Failure of a process vessel, tank, or pipeline within the CPP or Satellite Facility will be contained within the building via concrete containment curbs and directed into a sump (equipped with a level alarm) that will transport the solution the appropriate tank or disposal system. The concrete containment curb for the CPP has been designed to contain the entire contents of the two largest liquid-containing vessels (yellowcake thickeners) in the extremely unlikely event that both vessels should fail simultaneously and spill their entire contents. The sumps will provide additional temporary containment capacity such that the total containment capacity of curbs and sumps will be greater than 200% of the largest liquid-containing tank or vessel in the CPP. The Satellite Facility similarly will have a curb and sump system that together will provide approximately 350% of the volume of the largest liquid-containing vessel or tank (utility water tank).

The design of the CPP and Satellite Facility will be such that any spill will be contained within the respective building, regardless of sump pump operation. In the event of a total electrical failure, such that no pumps would be operational, a spill due to a vessel failure would be contained within the building in which the vessel failure occurred.

Chemical storage areas adjacent to the CPP will be provided with secondary containment as discussed in Section 5.3.1.

5.6.5.1.3 Transportation Vehicles

An accident involving transportation vehicles within or to and from the permit area could potentially release pollutants to the environment. Transportation vehicles will include, but are not limited to: vehicles delivering bulk chemical products, transport of uranium-loaded resin from the Satellite Facility or another satellite facility to the CPP, transport of solid 11e.(2) byproduct material from the project site to an approved disposal site, or transport of dried yellowcake product from the CPP.

Chemicals and products delivered to or transported from the permit area will be transported in accordance with all applicable federal and state regulations. As part of Powertech (USA)'s Environmental Management Program, emergency response procedures will be developed and implemented to ensure a rapid response to any transportation incidents. All personnel will be appropriately trained in emergency response procedures to facilitate proper response from Powertech (USA) employees in transportation incidents.

Potential impacts would differ according to material type, quantity and concentration. Transportation risks for yellowcake shipments, uranium-loaded resin shipments, process chemicals/fuel, and 11e.(2) byproduct material are described in the NRC license application. These are briefly summarized below.

Yellowcake Shipments

A specialized, appropriately licensed transportation company will transport the yellowcake to a conversion facility. Powertech (USA) will develop an Emergency Preparedness Program that will be implemented should a transportation accident occur. The primary potential impact associated with an accident involving the spill of yellowcake would be potential impacts to soil in the immediate spill area. The potential impacts will be minimized by implementing the Emergency Preparedness Program and salvaging affected soils.

Uranium-loaded Resin Shipments

Resin shipments typically will occur in bulk transport trailers. Resin shipments potentially will include uranium-loaded resin shipments between the Satellite Facility and CPP or between another satellite facility outside of the permit area to the CPP. They also would include barren or eluted resin shipments from the CPP to a satellite facility. A transportation accident involving uranium-loaded resin would have a lower risk than the relatively low risk from an accident involving yellowcake due to the much lower concentration of uranium in the resin and the chemical bond between the uranium and IX resin. The primary potential impact associated with an accident involving the spill of resin would be potential impacts to soil in the immediate spill area. The potential impacts will be minimized by salvaging affected soils.

Process Chemicals and Fuel

A number of shipments of chemicals and fuel will be made each week throughout operations. Process chemicals delivered to the permit area will include carbon dioxide, oxygen, salt, soda ash, barium chloride, hydrogen peroxide, sulfuric acid, hydrochloric acid, and caustic soda. All applicable DOT hazardous materials shipping regulations and requirements will be followed during shipment of process chemicals and fuel to minimize the potential for transportation accidents. Powertech (USA) also will develop standard operating procedures for unloading process chemicals and fuel within the permit area to minimize the potential for spills.

11e.(2) Byproduct Material

All solid 11e.(2) byproduct material generated in the permit area will be transported to an appropriately licensed disposal facility. Most of the solid 11e.(2) byproduct material shipping

will occur during site reclamation and decommissioning. The potential risk of a transportation accident is low, since solid 11e.(2) byproduct material is generally less radioactive than yellowcake and most of the waste will be in a solid form that is easy to contain. All applicable DOT regulations and requirements will be followed during shipment to minimize the potential for a spill resulting from a transportation accident. The primary potential impact associated with an accident involving the spill of solid 11e.(2) byproduct material would be potential impacts to soil in the immediate spill area. The potential impacts will be minimized by salvaging affected soils.

5.6.5.1.4 Ponds

A pond leak would have the potential to impact surface and groundwater in the vicinity of the pond. The risk and potential impacts will be minimized by natural conditions that make potential groundwater impacts unlikely, by the design and construction of liners and leak detection systems, and by routine inspection and monitoring. Natural conditions make it highly unlikely that a leaking pond would impact groundwater. In the Burdock area, the ponds will be underlain by approximately 50 to 100 feet of Graneros Group shales. The thickness of the Graneros Group beneath the Dewey area ponds will be approximately 500 feet. The confining properties of the Graneros Group will minimize the potential for vertical migration of solutions from a potential pond leak into groundwater.

Section 5.3.4.1 describes how the pond designs include lining systems that will vary according the pond use. At a minimum, ponds will be provided with a geosynthetic liner underlain by a clay liner. Ponds containing untreated wastewater 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. Routine inspection described in Section 5.3.4.5 includes daily checks for water accumulation in leak detection systems. The potential impacts from a primary liner leak will be minimized by implementing standard operating procedures to take the pond out of use and remove its contents to another pond. Sufficient freeboard will be maintained in each type of pond such that the contents of a leaking pond can be transferred to another pond with the same level of lining system.

5.6.5.2 Mitigation of Potential Impacts from Spills and Leaks

The following is a list of mitigation measures for potential impacts from spills and leaks.

- Conduct routine MIT of all injection, production and monitor wells.

- Perform leak testing on all pipelines and aboveground piping systems.
- Equip well field header houses with wet alarms for early detection of leaks.
- Bury well field pipelines for freeze protection and protection from vehicles.
- Implement engineering and administrative controls at the CPP to prevent both surface and subsurface releases to the environment, and to mitigate the effects should an accident occur.
- Train employees in the handling, storage, distribution, and use of hazardous materials.
- Provide rapid response cleanup and remediation capability, techniques, procedures, and training for potential spills.
- Develop written spill reporting procedures, including the procedures to report potential spills of reagents, fuel and other chemicals to the State of South Dakota and the personnel responsible for reporting spills.
- Design and construct ponds with lining and leak detection systems appropriate to the pond use.
- Perform routine inspection of pond leak detection systems to rapidly detect a potential leak from the primary liner.
- Implement standard operating procedures to take a pond out of use in the event of a leak and transfer its contents to another pond with the same lining system.
- Conduct fueling operations and storage of hazardous materials and chemicals in bermed/curbed areas and in a manner that minimizes potential impacts to surface water.
- Curb relevant facilities and structures at the CPP and Satellite Facility to minimize or eliminate escape of process fluids during spills.
- Perform all shipments of yellowcake, uranium-loaded resin, process chemicals/fuel, and 11e.(2) byproduct material in accordance with DOT regulations.
- Promptly salvage soils from any spill areas to avoid potential impacts to surface or groundwater.

5.6.6 Potential Accidents

The accident scenarios with potential to occur at the Dewey-Burdock Project are those typical of other ISR facilities. These scenarios have been evaluated in NUREG/CR-6733, A Baseline Risk-Informed, Performance-Based Approach for In Situ Leach Uranium Extraction Licensees (NRC,

2001), and are discussed below. Three primary engineering controls will include 1) downflow, pressurized IX columns, 2) building ventilation, and 3) use of a modern vacuum yellowcake dryer. Also included in the engineering controls will be alarms to indicate suboptimal operating conditions of the effluent control systems and concrete curbs and sumps to contain any process spills. Administrative controls such as training for emergency scenarios will be in place to provide appropriate worker protection in the event that the effluent control systems fail under an emergency situation. In brief, the engineering controls coupled with appropriate administrative controls will mitigate any potential health and safety impacts of system failures at the facility.

A series of potential accident scenarios which could occur at an ISR facility were evaluated in NUREG/CR-6733 and included the following:

- Yellowcake thickener failure and spill
- Radon release in enclosed process areas
- Pregnant lixiviant and loaded resin spills
- Yellowcake dryer hazard analysis

The estimated radiological consequence resulting from these accidents ranged from no significant radiological exposures, in the case of the thickener failure and pregnant lixiviant/loaded resin spill, to a significant radiological exposure which could result in doses to workers exceeding those allowed in 10 CFR Part 20. Due to the short-term nature of the above scenarios and assuming spills and releases are mitigated promptly, no scenario was expected to result in a significant radiological dose to members of the public.

During an accident, administrative controls will be in place such as standard operating procedures for spill response and cleanup, programs for radiation and occupational monitoring, and training for workers in radiological health and emergency response. Administrative controls coupled with proper use of PPE such as respirators are the best tools to reduce worker doses and will be provided.

Other approaches to mitigate system failures that may result in exceeding exposure limits include but are not necessarily limited to the following:

1) A team of responders, trained for radiation health and emergency response, will be available. Specific training will include: response monitoring, PPE use and response to fires, large lixiviant spills or IX system failure.

2) Powertech (USA) will train local emergency response personnel in the potential hazards present within the permit area.

3) A yellowcake thickener failure and spill would result in the immediate evacuation of normal operating personnel within the spill area and cleanup of the saturated product prior to drying. Employees performing the cleanup would utilize the appropriate PPE to minimize exposure to any product that may dry during cleanup. Yellowcake residue that may remain within the thickener area would be washed into a sump, thus mitigating the potential for exposure to employees.

4) Unplanned radon release into an enclosed area would result in manual shutdown of the release point (if automated shutoff system failed) and promotion of ventilation within the area manually (if automated ventilation system failed). Employees performing manual shutdown within the area of the release would utilize the appropriate PPE (such as atmosphere-supplying respirators designed to protect against gases) to minimize exposure to radon and radon decay products. Radon samples would be taken and if above normal working levels, normal operating workers would be evacuated and only return to normal duties within the release area upon re-establishment of normal working levels.

5) A pregnant lixiviant spill would be mitigated in a manner consistent with the location and degree of spill. Response personnel would utilize the appropriate PPE to protect against radon and radon decay products exposure as discussed above and cleanup would result.

6) A yellowcake dryer upset response would be dictated by the severity of the upset. Mitigation response may include a combination of additional site-specific response actions such as:

   - Workers, including the spill response team, will have access to respiratory equipment in the yellowcake dryer area.
   - All practicable measures will be taken to control emissions at the source. The operator will reduce exposure to airborne effluent releases by implementing emission controls (such as wetting) and institutional controls (such as extending the area of upset so as to exclude any personnel not responding to the upset).
   - Siting of the CPP near the center of the proposed license area will serve to protect against off-site exposures in the event of a yellowcake dryer upset.
   - Individual dose standards will be strictly implemented to assure exposures are limited and reduced to the maximum extent reasonably achievable and to limit contamination to the designated upset area.
   - All drying and packaging operations will terminate until cleanup is complete, the area has been cleared for potential exposure, and equipment has been restored to proper operating conditions and efficiencies.
   - Cessations, corrective actions and restarts will be reported to NRC within 10 days of the upset or off-normal performance.

5.6.7 Potential Natural Disaster Risk

NRC guidance in NUREG/CR-6733 evaluates potential risks associated with ISR facilities for the release of radioactive materials or hazardous chemicals due to the effects of an earthquake or tornado strike. The NRC determined that in the event of a tornado strike, chemical storage tanks could fail, resulting in the release of chemicals. This risk will be minimized by implementing the secondary containment measures for chemical storage described in Section 5.3.1. NUREG/CR-6733 concluded that the risk of a tornado strike on an ISR facility is very low and that no design or operational changes are necessary to mitigate the potential risks, but that it is important to locate chemical storage tanks far enough from each other to prevent contact of reactive chemicals in the event of an accident. Chemical storage tanks will be separated at the Dewey-Burdock Project as described in Section 5.3.1.

Considering the relative remoteness of the permit area, the potential consequences of a tornado strike would be considerably less than if the facilities were in a more populated area. Nevertheless, there are risks to workers that will be addressed. Powertech (USA) will prepare and have available onsite for regulatory inspection an Emergency Response Plan that will contain emergency procedures to be followed in the event of severe weather or other emergencies. Included in the plan will be procedures for notification of personnel, evacuation procedures, damage inspection and reporting. It also will address cleanup and mitigation of spills that may result from severe weather. In advance of preparing the Emergency Response Plan, Powertech (USA) offers the following discussion on these issues.

Initially, Powertech (USA) will provide adequate training to its employees and visitors regarding communication systems used at the facilities. In the event of a report of a tornado sighting in the vicinity of the facility, the Radiation Safety Officer (RSO), Radiation Safety Technician (RST) and/or Safety Engineer will ensure that the proper alarm (preset signal) has been sounded at both the Burdock and Dewey facilities. Additionally, all supervisors will be personally contacted via phone or radio and advised of the emergency. The supervisors and radiation safety staff will direct the evacuation of employees to one or more previously-specified nearby locations. Once it is safe to access the facilities, supervisory staff and radiation safety staff will begin the process of assessing potential damage to the facilities, including header houses and well heads. This process will include radiological surveys and assessment of potential non-radiological hazards as well. NRC, DENR, BLM and other regulatory agencies as appropriate will be notified and advised of the damage, if any was observed. After consultation with the regulatory agencies the cleanup and mitigation efforts will commence.

NRC determined that the potential radiological consequences of materials released and dispersed due to earthquake damage at an ISR facility are no greater than for a tornado strike. NUREG-0706 (NRC, 1980b) determined that mitigation of earthquake damage could be attained following adequate design criteria. NUREG/CR-6733 concluded that risk from earthquakes is very low at uranium ISR facilities and that no design or operational changes are required to mitigate the risk, but that it is important to locate chemical storage tanks far enough from each other to prevent contact of reactive chemicals in the event of an accident.

All buildings, structures, foundations, and equipment will be designed in accordance with recommendations in the latest versions of the International Building Code and ASCE-7 published by the American Society of Civil Engineers. Maps published in ASCE-7, and the latest version of the USGS Earthquake Ground Motion Tool, along with information regarding soil characteristics provided by the project professional geotechnical engineer, will be used to determine seismic loadings and design requirements.

5.6.8 Potential Fire and Explosion Risk

Accident Consequences – Fires and Explosions

An explosion, although unlikely, could result from: a prematurely sealed drum of yellowcake, in a dryer, from the use of propane in the thermal fluid heater or space heaters, or from the mixing of oxygen gas with combustible materials. Of these, an explosion from the drum of yellowcake has the greatest potential to impact radiological safety of the workers. An explosion in a sealed drum would be contained within the dryer room. Powertech (USA) will develop a standard operating procedure for measuring the temperature in yellowcake drums prior to drum sealing.

According to NRC, multiple hearth dryers pose a greater hazard than the vacuum dryers that will be used by Powertech (USA) (NUREG-1910, NRC, 2009). Multiple hearth dryers operate at higher temperatures and may be fed directly with gas. The vacuum dryers to be used at the Dewey-Burdock Project operate at lower temperatures and are not fed directly by gas. They therefore pose less of a hazard for explosion. In the unlikely event of an unmitigated explosion accident of a yellowcake dryer, doses to the workers could have a moderate impact depending on the type of accident, but exposure to the general public would result in a dose below the 10 CFR Part 20 public dose limit, resulting in only a small impact to the public (NUREG-1910).

Preventative and Mitigation Measures – Fires and Explosions

As noted in Section 5.3.1, the design criteria for chemical storage and feeding systems includes applicable sections of the International Building Code, International Fire Code, OSHA

regulations, RCRA regulations, and Homeland Security regulations. Propane-fired heating devices will be installed to meet applicable NFPA/FM safety standards. Additional measures for preventing fires and explosions include:

- The oxygen tanks will be located a safe distance from the CPP and other storage tanks and will be designed to meet industry standards of NFPA-50.
- Cleaning of equipment for oxygen storage and conveyance systems will follow the standards specified in CGA G-4.1.
- Powertech (USA) will develop emergency response procedures for oxygen accidents. All employees who may be exposed to hazards associated with oxygen will be properly trained with regard to the hazards, accident prevention and mitigation, and emergency response procedures.
- Header houses will be equipped with fans to provide continuous ventilation in order to prevent buildup of oxygen.
- The oxygen lines to each header house will be equipped with automatic low pressure shut-off valves to minimize the delivery of oxygen through a broken pipe or a valve stuck in the open position, which could potentially supply oxygen to a fire.
- Procedures will be in place for confined space work or hot work for monitoring of oxygen build-up prior to start of work.
- Fire extinguishers will be placed at accessible locations in all buildings and vehicles for quick response and training will be provided for appropriate personnel in use of fire extinguishers.
- Powertech (USA) personnel and local emergency responders will receive training for responding to a fire or explosion.
- The CPP and Satellite Facility are designed to contain and reduce the exposures to individuals in the event of an accident. Emergency response procedures would be implemented and employees would be directed as to what actions to perform in the event of an accident. For instance, a respiratory protection program will be in place and will be executed as necessary for worker protection during accident assessment and cleanup phases. In addition to the above mentioned protections other safeguards and mitigatory protocols are always in place during operation of a CPP facility. For example, a bioassay program for worker safety and contamination control programs involving personnel survey, clothing survey and equipment survey before release to unrestricted areas are common practices workers are subject to on a regular basis. These types of protocols are also utilized to assess if an accidental exposure took place during the course of an unintentional incident.

Preventative and Mitigating Measures – Wildfire

In order to protect facilities from wildfires, all facility buildings will be located within an area that is maintained in a vegetation-free state by the use of a crushed aggregate or asphalt surface

and by appropriate weed-control measures. The creation of this buffer zone is expected to prevent fire from damaging equipment that could lead to a chemical accident by acting as a firebreak.

Within the well fields, vegetation will be controlled around each header house and around each well head cover to reduce the amount of combustible material adjacent to these structures. In the event of an approaching wildfire, operators will be trained to shut down well field operations and, if necessary, to evacuate facilities until the danger to personnel has passed. Damage, if any, will be assessed and remediated prior to re-starting operations.

Powertech (USA) will maintain firefighting equipment on site and will provide training for local emergency response personnel in the specific hazards present in the permit area.

The emergency response plan will include descriptions of the following provisions of 29 CFR Part 1910:

- Notification and evacuation procedures
- Personal protective equipment
- General firefighting safety rules
- Reporting procedures
- Electrical and gas emergencies

5.6.9 Potential Radiological Impacts and Effluent Control System

5.6.9.1 Potential Radiological Impacts

In accordance with NRC guidance, Powertech (USA) modeled the potential radiological impacts on human and environmental receptors (e.g., air and soil) using site-specific radionuclide release estimates, meteorological and population data, and other parameters. The estimated radiological impacts resulting from routine site activities then were compared to applicable public dose limits as well as naturally occurring background levels. The complete analysis is available in the NRC license application. Following is a brief summary of the results.

The primary radioactive airborne effluent will be radon-222 gas. Radon-222 is dissolved in the pregnant lixiviant that comes from the well field into the facility for separation of uranium. At the locations where the lixiviant solution is initially exposed to atmospheric pressure and ambient temperatures, radon gas will be evolved. The locations where this will occur (IX vessels and shaker screens in the CPP and IX vessels in the Satellite Facility) will be provided with dedicated local exhaust, which will be vented outside of the buildings. Small amounts of radon-

222 also may be released from the well field, solution spills, filter changes, RO system operation during groundwater restoration, DDW surge tanks, land application areas, and maintenance activities.

The potential radiological impact analysis considered all potential exposure pathways from all potential sources in the permit area. Atmospheric radon gas is expected to be the predominant pathway for impacts on human and environmental media. Impacts of radon-222 releases can be expected in all quadrants surrounding the site, the magnitude of which is driven predominantly by wind direction and atmospheric stability. As a noble gas, radon-222 itself has very little radiological impact on human health or the environment. Radon-222 has a relatively short half-life (3.2 days) and its decay products are short lived, alpha emitting, nongaseous radionuclides. These decay products have the potential for radiological impacts to human health and the environment. Potential exposure pathways include ingestion, inhalation, direct exposure, and adsorption. All exposure pathways, with the possible exception of absorption, can be important depending on the environmental media impacted. All of the pathways related to emissions of radionuclides are evaluated by modeling, including potential exposure from air, water, soil, flora and fauna.

The potential radiological impact analysis concludes that the primary sources of radon-222 releases will be production well fields, the CPP and Satellite Facility. Lesser releases are anticipated to occur from DDWs, land application areas, and other minor activities. Modeling was used to simulate potential impacts to receptors including the nearest residence. The modeling shows that the maximum annual total effective dose equivalent (TEDE) for an adult at the nearest residence will be approximately 2% of the 10 CFR Part 20 public dose limit of 100 mrem/year. If land application is not used, the calculated TEDE is less than 2% of the public dose limit.

Powertech (USA) also evaluated the potential public and occupational doses for public exposure to radon decay products. Conservatively assuming that a worker not associated with the Dewey-Burdock Project (e.g., a rancher) is in the permit area for 2,000 hours per year, the expected annual occupational dose would be less than 2% of the of the public dose limit.

Modeled impacts to soils in the general permit area resulting from deposition of radium-226 indicate that the radium-226 concentration after ISR operations will be within the range of normal background variability observed during baseline characterization. In the land application areas, modeled impacts to soils show that the radiological impacts of the land application process

will be minimal and meet the criteria for license termination for unrestricted use in 10 CFR § 20.1402.

5.6.9.2 Effluent Control System

Potential radiological impacts to human and environmental receptors will be mitigated through implementation of an effluent control system satisfying NRC license requirements and using best available control technology. The effluent control system is described in detail in the NRC license application and will include controls for radon and radon decay products as well as controls for radionuclide particulates.

Radon

Potential impacts from radon will be controlled through use of pressurized, downflow IX vessels and ventilation systems. The IX vessels normally will operate as sealed, pressurized vessels, so that radon releases from the IX vessels only will occur during resin transfer operations. Dedicated local exhaust at the IX vessels and shaker screens will be directed to a manifold that is exhausted to the atmosphere outside the building via an induced draft fan. The primary release point will be located away from building intakes to prevent introducing exhausted radon back into the facility. Exhausting radon-222 gas to the atmosphere outside the plant minimizes opportunity for in-growth of radon particulate decay products in occupied work areas and therefore minimizes employee airborne exposure.

The general HVAC systems in the CPP and Satellite Facility will reduce employee exposure further by removing radon from plant air. The general HVAC systems will be exhausted through separate vents. These systems will be connected via ductwork and manifolds to the process vessels. Airflow through any openings in the vessels will be from the process areas into the vessels and then into the ventilation systems, maintaining negative flow into the vessels and controlling any releases. Tank ventilation of this type has been utilized successfully at other ISR facilities and proven to be an effective method for minimizing employee exposure. Redundant exhaust fans will direct collected gases to discharge piping that will exhaust to the outside atmosphere. Fan redundancy will minimize employee exposure should any single fan fail.

The general building ventilation systems will be designed to maintain air flow from the process areas with the least potential for airborne releases to areas with the most potential for airborne releases and then exhaust to outside areas. Ventilation systems will exhaust outside the buildings and draw in fresh air. During favorable weather conditions, open doorways and convection vents in the roofs will provide supplemental work area ventilation.

The CPP will be located near the center of the permit area, and the radon exhaust point will be located on or near the CPP roof. Based on use of modern ISR equipment, engineering controls such as building ventilation, and routine sampling and monitoring described below, radon effluent and worker exposure to radon decay products will be maintained at levels that are as low as reasonably achievable (ALARA).

An operational monitoring program will be utilized to measure radon-222 that may result in the atmosphere outside the buildings and other specified locations within the permit area. This will be done in accordance with NRC license conditions. Potential release points as well as general air in the plant will be sampled routinely for radon decay products to assure that concentration levels of radon and decay products are maintained ALARA. Results of monitoring obtained during initial plant operation will be used to adjust monitoring programs (location, frequency, etc.) and upgrade ventilation and/or other effluent control equipment as may be necessary.

Radionuclide Particulates

Potential radiological air particulate effluents will be generated primarily from dried uranium concentrate in the yellowcake drying and processing areas. The yellowcake drying and packaging area will be serviced by a dedicated ventilation system. By design, vacuum dryers do not discharge uranium. The vacuum drying system is proven technology, which is being used successfully at several facilities where uranium oxide is being produced, including ISR facilities. The off-gas treatment system of the vacuum dryers will include a baghouse, condenser, vacuum pump, and packaging hood. The potential radionuclide particulate releases from the drying process and associated off-gas treatment system are discussed below.

The yellowcake will be dried at approximately 250°F in the rotary vacuum drying process. The off-gases generated during the drying cycle will be filtered through a baghouse, which will be located on the top of the dryer, to remove particles down to approximately 1 micron in size. The gases then will be cooled and scrubbed in a surface condenser to further remove the smaller size fraction particulates and the water vapor during the drying process. Two rotary vacuum dryers will be located in a separate building attached to the CPP. This attached building will contain the dryers, the baghouses on the dryers, and a condenser scrubber and vacuum pump system for each dryer.

The vacuum dryers will be steel vessels heated externally and fitted with rotating plows to stir the yellowcake. Each drying chamber will have a top port for loading the wet yellowcake and a bottom port for unloading the dry powder. A third port will be provided for venting through the

baghouse during the drying procedure. The baghouse and vapor filtration unit will be mounted directly above the drying chamber so that any dry solids collected on the bag filter surfaces can be batch discharged back to the drying chamber. The baghouse will be heated to prevent condensation of water vapor during the drying cycle. It will be kept under negative pressure by the vacuum system.

The condenser will be located downstream of the baghouse and will be water cooled. It will be used to remove the water vapor from the non-condensable gases emanating from the drying chamber. The gases will be moved through the condenser by the vacuum system. Dust passing through the bag filters will be wetted and entrained in the condensing moisture within this unit. The vacuum pump will be rotary water sealed, providing negative pressure on the entire system during the drying cycle. It also will be used to provide negative pressure during transfer of the dry powder from the drying chamber to 55-gallon steel drums. The water seal of the rotary vacuum pump will capture entrained particulate matter remaining in the gas streams.

The packaging system will be operated on a batch basis. When the yellowcake is dried sufficiently, it will be discharged from the drying chamber through a bottom port into 55-gallon steel drums. A level gauge, a weigh scale, or other suitable device will be used to determine when a drum is full. Particulate capture will be provided by a sealed hood that fits on the top of the drum, which will be vented through a sock filter to the condenser and the vacuum pump system when the powder is being transferred.

There will be three discharge locations associated with the yellowcake drying and packaging system. These include: i) the yellowcake discharge valve located directly below the dryer, through which drums are filled with yellowcake, ii) the condensed water vapor that is removed from the condenser and recycled to the yellowcake thickener, and iii) very small amounts of air that are drawn through the vacuum pump and are exhausted into the dryer room of the CPP. The system of treating gases emanating from the dryer chamber with baghouse filters and water condenser is designed to capture virtually all particles from the vapor stream leaving the dryer (NUREG-1910, NRC, 2009). Furthermore, NUREG-1569 (NRC, 2003) states, "When a vacuum dryer is used for yellowcake, then dust emissions from drying may also be assumed to be negligible."

The emission control system will be instrumented sufficiently to operate automatically and to shut itself down for malfunctions such as heating or vacuum system failures. The system will alarm if there is an indication that the emission control system is not performing within operating

specifications. If the system is alarmed due to the emission control system, the operator will follow standard operating procedures to recover from the alarm condition, and the dryer will not be unloaded or reloaded until the emission control system is returned to normal service.

To ensure that the emission control system is performing within specified operating conditions, instrumentation will be installed that signals an audible alarm at the dryer and in the CPP control room if the air pressure (i.e., vacuum level) falls below the specified threshold. The operation of this system will be monitored routinely during dryer operations. The operator will perform and document inspections of the vacuum level hourly or more frequently during dryer operations. Additionally, the air pressure differential gauges for other emission control equipment will be observed and documented at least once per shift during dryer operations.

The discharge locations associated with the yellowcake drying and packaging systems will be monitored routinely via filter collection and radiochemical analysis in accordance with NRC license conditions. General plant air also will be monitored routinely for airborne radionuclides.

5.6.10 Air Quality

This section describes the potential non-radiological air quality impacts. Potential radiological impacts are described in Section 5.6.9.

5.6.10.1 Potential Air Quality Impacts

Potential air quality impacts during construction activities will include emissions from heavy equipment, vehicles, and drill rigs; dust from traffic; and dust from surface-disturbing activities. Most dust will be generated from vehicular traffic on the unpaved roads; therefore, speed limits will be imposed for employee vehicles and transport trucks in order to mitigate the amount of dust generated from unpaved roads. Temporarily disturbed areas also will be reseeded and restored as soon as possible to minimize erosion of soil and fugitive dust emissions.

During operation, non-radiological gaseous emissions will include fugitive dust, vehicle combustion emissions, and stationary source emissions, including propane heating emissions and carbon dioxide released during uranium processing in the CPP. Fugitive dust will be lower during operation than construction due to decreased surface disturbing activities.

Powertech (USA) has prepared a detailed emissions inventory for all project phases (construction, operation, aquifer restoration, and reclamation/decommissioning). The emissions inventory has been provided to NRC and will be provided to the DENR Air Program. Based on

the emissions inventory, stationary source emissions of criteria pollutants are not expected to meet the minor or major source thresholds for air quality construction permitting. This includes NO_x, PM_{10}, CO, SO_2, and hazardous air pollutants (which exclude CO_2).

5.6.10.2 Mitigation of Potential Air Quality Impacts

Mitigation measures for potential air quality impacts, including potential impacts to areas defined as critical air quality resources by SDCL 45-6B-92(8) such as nearby residences and recreation areas, will include but will not be limited to the following:

- Reduce fugitive dust emissions via standard dust control measures (e.g., water application on roads and disturbed areas and implementation of speed limits).
- Encourage employee carpooling.
- Reduce fugitive dust by coordinating dust-producing activities during construction and minimizing disturbed areas.
- Promptly reclaiming and reseeding disturbed areas.
- Maintain vehicles to meet applicable EPA emission standards.
- Obtain a South Dakota air quality permit, if required. Powertech (USA) has submitted a permit application to the DENR Air Quality Program requesting an exemption from South Dakota air permitting as a minor source of emissions. The permit application includes a detailed emissions inventory that demonstrates that total stationary sources of emissions of criteria pollutants will be well below the 25 tons/year threshold.
- Maintain emission control systems to ensure that the annual TEDE is within the 10 CFR Part 20 public dose limit (refer to Sections 5.6.9.1 and 5.6.9.2).
- Model potential air quality impacts. Powertech (USA) currently is performing detailed ambient air quality modeling that is being coordinated with NRC and EPA. The modeling will evaluate the potential impacts of emissions from the Dewey-Burdock Project on ambient air quality to nearby residences and potential near-field impacts within 50 km of the proposed permit area (including Jewel Cave National Monument). In addition, the modeling specifically will address potential impacts on air quality related values (AQRVs) at the Wind Cave National Park, the nearest Class I area. The modeling results will be publicly available and will be submitted to DENR upon request.

5.6.11 Ecological Resources

5.6.11.1 Potential Ecological Resources Impacts

The following section discusses the potential ecological impacts of operations at the project site.

5.6.11.1.1 Vegetation

Well field and production facilities will be constructed within Big Sagebrush Shrubland, Greasewood Shrubland, Ponderosa Pine Woodland, and Upland Grassland vegetation communities. Potential direct impacts include the short-term loss of vegetation (modification of structure, species composition, and aerial extent of cover types). Potential indirect impacts include the short-term and long-term increased potential for non-native species invasion, establishment, and expansion; exposure of soils to accelerated erosion; shifts in species composition or changes in vegetative density; reduction of wildlife habitat; reduction in livestock forage; and changes in visual aesthetics.

Construction activities and increased soil disturbance could stimulate the introduction and spread of undesirable and invasive, non-native species within the permit area. Non-native species invasion and establishment has become an increasingly important result of previous and current

disturbance in South Dakota. No threatened or endangered vegetation species were observed within the permit area; therefore, no impacts are anticipated.

Potential impacts to riparian areas and wetlands will be very limited. Section 5.6.4.1.3 describes mitigation of potential impacts to wetlands, including constructing facilities away from Beaver Creek and Pass Creek and conducting construction, operation, or reclamation activities that have the potential to disturb jurisdictional wetlands in accordance with appropriate USACE permits. Riparian areas occur primarily in a relatively narrow corridor along Pass Creek (refer to the mapped Cottonwood Gallery on Plate 3.7-1). A comparison between Plates 3.7-1 and 3.5-1 shows that the extents of the Cottonwood Gallery are generally within the 100-year flood inundation boundary along Pass Creek. Section 5.6.4.1.2 describes how Powertech (USA) will construct facilities outside of the flood inundation boundaries with few exceptions such as individual wells and pipelines. This is supported by Plate 3.5-1, which shows that facilities have been designed to avoid the Pass Creek flood inundation area including land application areas and well fields.

5.6.11.1.2 Wildlife and Fisheries

ISR uranium production is unlike open-pit mining, since it uses less intrusive extraction methods that have less impact on the surrounding area.

Despite the relatively limited surface disturbance, there are potential direct and indirect impacts on local wildlife populations. These potential impacts are both short-term (until successful reclamation is achieved) and long-term (persisting beyond successful completion of reclamation). However, the latter category is not expected to be significant due to the relatively limited habitat disturbance. The potential direct impacts on wildlife include: injuries and mortalities caused by collisions with project-related traffic or habitat removal actions such as topsoil stripping, particularly for smaller species with limited mobility such as some rodents and herptiles; and restrictions on wildlife movement due to construction of fences. The likelihood for the impacts resulting in injury or mortality is greatest during the construction phase due to increased levels of traffic and physical disturbance during that period. Overall traffic will increase from current levels and will persist during operations, but should occur at a reduced and possibly more predictable level than during the construction phase. Speed limits will be enforced during all construction and maintenance operations to reduce impacts to wildlife throughout the year, but particularly during the breeding season.

Most of the habitat disturbance associated with the ISR facilities will consist of scattered, confined drill sites for well fields that will not result in large expanses of habitat being dramatically transformed from its original character, as would be the case with open-pit mining. Therefore, most potential indirect impacts relate to the displacement of wildlife due to increased noise, traffic, or other disturbances associated with the development and operation of the project, as well as from small reductions in existing or potential cover and forage due to habitat alteration, fragmentation, or loss. Indirect impacts typically persist longer than direct impacts. However, because ISR results in fewer large-scale habitat alterations, there will not be a need for reclamation actions that result in dramatic differences between pre-mining and post-mining vegetative communities.

Multiple site visits and targeted surveys conducted for the baseline surveys, combined with existing agency databases that encompass the permit area and input from local residents, indicate that the permit area and surrounding vicinity are occupied by a wide variety of common wildlife and fish species, with only a few species of particular concern occurring in the area. The most notable species of interest is the bald eagle, which is still considered threatened at the state level. Bald eagle winter roost sites and a successful nest site were documented within the permit area during surveys conducted in 2007 and 2008. Two other species tracked by the SDNHP were confirmed or suspected to have nested in the permit area in 2008, the long-eared owl and long-billed curlew. Eight additional SDNHP species were documented in or near the permit area during baseline surveys. However, those observations consisted of birds flying over the area, or sightings made in the surrounding perimeter. No grouse leks have been recorded within 6 miles of the permit area during agency or project-specific surveys completed in recent years.

Suitable habitat (trees and native uplands) for all three nesting SDNHP species occurs in the permit area. However, the limited disturbance of ISR and the presence of apparently suitable (due to low density of other nesting individuals) alternate nesting habitat throughout the permit area and surrounding area combine to minimizing the potential for both direct and indirect impacts for those species and others that require similar habitats. One of those species, the long-eared owl, nested within 75 meters, but largely beyond view of, an existing gravel county road, suggesting the pair has at least some level of tolerance for vehicular traffic near active nest sites. Other wildlife species of concern, such as other nesting raptors, that occur in the area also may experience direct and/or indirect impacts from increased travel and noise in the area during project construction and operation. However, the presence of potential alternate nesting and foraging habitat in the immediate vicinity, the mobility of those species, and the location of most

nest sites relative to planned disturbance combine to reduce impacts to most nesting SDNHP birds as well as other species of interest.

Some vegetative communities present currently in the permit area can be difficult to reestablish through artificial plantings, and natural seeding of those species would likely take many years. However, the current habitat of greatest concern (Big Sagebrush Shrubland) occurs only in scattered stands that are relatively small and widely-spread across the permit area. Results from lek searches, breeding bird surveys, and small mammal trapping, as well as regular site visits in all seasons, strongly suggest that sage obligates other than pronghorn occur in limited numbers in the permit area, if at all. The vegetative communities that indicated the strongest associations between terrestrial species and habitats during baseline surveys (Cottonwood Gallery and Ponderosa Pine) will not be significantly impacted by construction or operation of the proposed project. It is possible that the potential implementation of land application systems may enhance nesting, brood-rearing, and/or foraging habitat for some species. Consequently, although individual animals associated with some specific habitats could be impacted by the proposed ISR operations, the small percentage of projected surface disturbance within the permit area relative to its overall size, and the low density of nesting efforts relative to habitat presence in that area, suggest that their populations as a whole will experience minimal impacts from the project. Advanced planning of construction siting and activities in concert with continued monitoring can reduce impacts further and assist with the development of mitigation options, if necessary. Potential impacts to these species and others are discussed in greater detail in the following sections.

5.6.11.1.3 Big Game

Big game could be displaced from portions of the permit area to adjacent areas, particularly during construction of the well fields and facilities, when disturbance activities will be greatest. Disturbance levels will decrease during actual ISR operations, and will consist primarily of vehicular traffic on new and existing improved and unimproved (two-track) roads throughout the permit area. Similar disturbance already is present in the area due to existing ISR exploration, ranching, and railroad operations. Pronghorn antelope would be most affected, as they are most prevalent in the area. However, no areas classified as crucial pronghorn habitat occur on or within several miles of the permit area, and this species is not as common in the general area as elsewhere within the region due to the limited presence of sagebrush in the area. Mule deer would not be impacted substantially given their somewhat limited use of these lands, the paucity of winter forage and security cover, and the availability of suitable habitat in adjacent areas.

SDGF&P does not consider the permit area to be within the crucial habitat range of any big game species. A letter from SDGF&P confirming this statement and updating the status of big game species as of May 2010 is provided in Appendix 5.6-B. Sightings of those species in that vicinity are often seasonal and less common.

5.6.11.1.4 Other Mammals

Medium-sized mammals (such as lagomorphs, canids, and badgers) may be displaced temporarily to other habitats during the initial construction activities. Direct losses of some small mammal species (e.g., voles, ground squirrels, mice) may be higher than for other wildlife due to their more limited mobility and likelihood that they would retreat into burrows when disturbed, and thus be potentially impacted by topsoil scraping or staging activities. However, given the limited area expected to be disturbed by the project, such impacts would not be expected to result in major changes or reductions in mammalian populations for small or medium-sized animals. This is supported by NRC guidance in NUREG-1910 (NRC, 2009), which states, "Displaced species may re-colonize in adjacent, undisturbed areas or return to their previously occupied habitats after construction ends and suitable habitats are reestablished." Few bats were recorded in the area despite extra efforts to observe them during the baseline surveys. Those that were seen were near water bodies near treed habitats, which are not currently scheduled for disturbance. The mammalian species known to be, or potentially, present in the permit area have shown an ability to adapt to human disturbance in varying degrees, as evidenced by their continued presence in other mining and residential areas of similar, or greater, disturbance levels elsewhere in the region. Additionally, small mammal species in the area have a high reproductive potential and tend to re-occupy and adapt to altered and/or reclaimed areas quickly.

5.6.11.1.5 Raptors

ISR activities in the permit area would not impact regional raptor populations, though individual birds or pairs may be affected. ISR activity could cause raptors to abandon nest sites proximate to disturbance, particularly if activities encroach on active nests during a given breeding season. Powertech (USA) will develop a bald eagle mitigation plan for review and verification by SDGF&P. A copy of the plan will be provided to DENR. Other potential direct impacts would be injury or mortality due to collisions with project-related vehicular traffic. Construction activities that occur within or near active raptor territories could also cause indirect impacts such as reduction or avoidance of foraging habitats for nesting birds. However, surface disturbance will only occur in a small percentage of the overall permit area, and the low density of nesting

raptors relative to the apparent availability of suitable habitat suggests that alternate nesting habitat is available for all known nesting raptor species in the permit area.

Eight intact raptor nests were documented within the project survey area (permit area and 1-mile perimeter) during 2008. Six of the eight nest sites are within the permit area, with the remaining two located in the 1-mile perimeter. USFWS guidelines recommend avoiding construction activities within 660 feet if the activity will be visible from a nest (USFWS, 2007). Construction activities in relation to bald eagles and other raptors will be addressed in the bald eagle mitigation plan previously described.

Except for the bald eagle, the same species that nest in the permit area are known to regularly nest and fledge young at or near surface mines and ISR facilities throughout the region. Those efforts have succeeded due to a combination of raptors becoming acclimated to the relatively consistent levels of disturbance and gradual encroachment of production operations, and successfully executed state-of-the-art mitigation techniques to maintain viable raptor territories and protect nest productivity. Some individuals nest on active production facilities themselves, including both great horned owls and red-tailed hawks. The lack of bald eagle examples is more likely related to the general absence of nesting bald eagles in the vicinity, rather than an increased sensitivity to production activities. Bald eagles are discussed further in Section 5.6.11.1.11. Due to the paucity of river cliffs in the permit area, falcons and other raptors known to nest in that habitat are not as abundant as those that nest in trees or even on the ground.

Based on the location of known nest sites relative to future construction sites, no raptor nests will be disturbed physically by the project during either construction or operations. Additionally, Powertech (USA) has incorporated the baseline wildlife information into the planning process and sited all plant facilities (areas of greatest sustained future disturbance) outside the recommended buffer zone for all raptor nests in the permit area, including the bald eagle nest site. Some new infrastructure will be located within the suggested buffer areas. However, pipelines will be buried, and new overhead power lines will be constructed using designs and specifications to reduce injuries and mortalities on overhead power lines. Land application center pivots, if used, can be put into place prior to the nesting season, and run automatically with little human contact once they are turned on. Additionally, new roads, power lines, and pipelines will be constructed in the same corridors to the extent possible to reduce overall disturbance, and along existing access roads when available to minimize new surface disturbance.

5.6.11.1.6 Upland Game Birds

ISR activities in the permit area would potentially impact the foraging and nesting habitat of mourning doves, though such disturbance is not expected to have any marked impacts on this species. No woody corridors will be disturbed by the proposed activities, and additional trees are present in the cottonwood gallery along the Cheyenne River, located approximately 2 miles south of the permit area. Additionally, doves are not restricted to treed habitats, nor are they subject to any special mitigation measures for habitat loss.

Annual monitoring surveys conducted by SDGF&P biologists and a year-round baseline study for the project have demonstrated that sage-grouse do not currently inhabit that area, and have not for many years. As described previously, those surveys encompassed the entire permit area and the vast majority of its 2.0-km (1.2-mi) perimeter, particularly as part of baseline monitoring. The nearest known sage-grouse lek is approximately 6 miles north of the permit area (SDGF&P records). Given the lack of sage-grouse observations in the area and the scattered stands of marginal quality sage-grouse habitat, the project will not result in negative impacts to existing or potential sage-grouse leks, or important sagebrush habitats.

5.6.11.1.7 Other Birds

The project could potentially impact nine avian species tracked by SDNHP that are known to occur or could potentially occur as seasonal or year-round residents. Direct impacts could include injury or mortality due to encounters with vehicles or heavy equipment during construction or maintenance operations. Indirect impacts could include habitat loss or fragmentation and increased noise and activity that may temporarily deter use of the area by some species. Surface disturbance would be relatively minimal and would be greatest during construction. Enforced speed limits and use of common right-of-way corridors will reduce impacts to wildlife throughout the year, particularly during the breeding season.

5.6.11.1.8 Waterfowl and Shorebirds

Construction and operation of the ISR project would have a negligible effect on migrating and breeding waterfowl and shorebirds. Existing habitat is limited and seasonally available in the permit area, so it does not currently support large groups or populations of these species. Multiple approaches are being considered to minimize impacts to wildlife that may be associated with the operation of the ponds. Any new treated water sources could enhance current habitat conditions for these species, though such effects would be temporary in nature.

5.6.11.1.9 Reptiles and Amphibians

As with waterfowl, potential habitat for aquatic and semi-aquatic amphibians and reptiles is limited within the permit area and occurs primarily along Beaver Creek in the western portion of the area. Other water bodies are ephemeral, and thus offer only short-term habitat. Activities associated with the project are not expected to disturb existing surface water or alter the topography in the area. Those species residing in rocky outcrops located in potential disturbance areas could be impacted by construction and maintenance operations. However, few non-aquatic herptile species were observed in the permit area and surrounding perimeter. Any impacts that would occur would affect individuals, but would not likely impact the population as a whole.

5.6.11.1.10 Fish and Macro-Invertebrates

The planned locations for new facilities and infrastructure do not overlap any perennial aquatic features; therefore, no loss of aquatic habitat would occur as the result of their construction. The risk of impaired water quality will be reduced or avoided through project siting, and implementation of standard construction erosion and sediment control measures. The location of project facilities (CPP, Satellite Facility, pipelines, well fields, access roads and power lines), as well as the proposed land application sites (center pivot irrigation sites), will avoid direct impacts to perennial streams.

Due to the arid climate and proposed location of new project facilities, operation of the well fields is not expected to alter aquatic habitat or water quality in perennial streams. No surface water will be diverted for use in the operation, and no process water will be discharged into aquatic habitat.

Pass Creek provides only seasonal drainage and does not support fish or significant amphibian habitat. Some of the proposed land application sites west of the Satellite Facility would be located in general proximity to Beaver Creek, the primary aquatic habitat in the project vicinity. All land application areas will be surrounded by catchment areas that will prevent runoff. Beaver Creek will not be directly affected by the well field operations or land application sites. Section 3.5.4.1.1 describes how Beaver Creek and the Cheyenne River near the permit area are classified as warmwater, semipermanent fisheries. No coldwater fisheries are present in the permit area, and no impacts to coldwater fisheries will occur as a result of the Dewey-Burdock Project.

5.6.11.1.11 Threatened, Endangered, or Candidate Species and Species Tracked by SDNHP

Federally Listed Species

As described in the preceding sections of this document, no federally listed vertebrate species were documented in the project survey area (permit area and 1-mile perimeter) during the year-long survey period, or during previous targeted surveys conducted for the original claims (TVA, 1979). Additionally, the USFWS has issued a block clearance for black-footed ferrets in all black-tailed prairie dog colonies in South Dakota except northern Custer County, and in the entire neighboring state of Wyoming. That clearance indicates that ferrets do not currently, and are not expected to, occupy the permit area. Only one small black-tailed prairie dog colony was present in the permit area itself during the 2007-2008 baseline surveys, and local landowners are actively working to remove the animals from their lands. Consequently, the proposed project will have no direct, indirect, or cumulative effects on black-footed ferrets.

State-Listed Species

ISR activities within the permit area are not likely to adversely affect bald eagles, the only state-listed species known to inhabit the permit area. Bald eagles were documented at winter roosts and an active nest within the permit area. However, most roost sites and the lone nest site are at least 1.0 mile from the nearest planned facility. Additionally, no more than two or three bald eagles were observed during any given winter survey despite the numerous available (and unoccupied) mature trees along Beaver Creek, Pass Creek, and the pine breaks located in and near the permit area. Three proposed land application sites (center pivot irrigation systems) would fall within the one-mile buffer of the bald eagle nest. However, those systems are typically automated, and the minimal disturbance associated with potential maintenance of those systems should not be significant enough to impact nesting or roosting bald eagles along Beaver Creek.

Potential direct impacts to bald eagles include the potential for injury or mortality to individual birds foraging in the permit area due to electrocutions on new overhead power lines. Although not expected, disturbance activities near an active nest could result in abandonment and, thus, the loss of eggs or young. The increased human presence and noise associated with construction activities, if conducted while eagles are wintering within the area, could displace individual eagles from using the area during that period.

Given the low number of wintering and nesting bald eagles in the permit area, potential impacts would be limited to individuals rather than a large segment of the population. The use of

existing or overlapping right-of-way corridors along with best management practices will minimize potential direct impacts associated with overhead power lines. If necessary, the majority of other potential impacts could be mitigated if construction activities were conducted outside the breeding season and/or winter roosting months, or outside the daily roosting period, should eagles be present within 1 mile of construction. Any bald eagles that might roost or nest in the area once the project is operational would be doing so in spite of continuous and ongoing human disturbance, indicating a tolerance for such activities.

Indirect impacts as a result of noise and human presence associated from project-related operations could include area avoidance by avian species. Potential winter foraging habitat could be further fragmented by linear disturbances such as overhead power lines and new roads associated with the project. Given the size of the project, those disturbances would occur within narrow corridors over relatively short distances. Nevertheless, the use of common right-of-way corridors to consolidate new infrastructure will reduce these potential indirect impacts.

The only other state-listed species recorded in the general area was the river otter. An otter carcass was discovered lodged in debris in the stream channel at fisheries sampling station BVC04 in mid-April 2008. That site is approximately 12 river miles upstream from the permit area boundary in eastern Wyoming. The carcass had washed away by the July 2008 fisheries sampling session. The monthly sampling at BVC04 during the monitoring period confirmed no additional observations of otters. Likewise, no evidence of otters was report by biologists along any drainage elsewhere in the survey area during the year-long baseline survey period. Given the fact that no stream channels will be physically impacted in the permit area, the lack of otter sightings or sign in the permit area itself, and the stringent water processing and water quality monitoring that will occur, this project is not likely to directly or indirectly impact river otters.

Species Tracked by SDNHP

Ten terrestrial species tracked by the SDNHP were recorded during baseline surveys, including the bald eagle. Seven of the ten were observed within the permit area, and three were seen in the 2-km perimeter. One additional species, the plains topminnow, was observed in Beaver Creek and the Cheyenne River, at least 1 mile outside the permit area. Three SDNHP species are known or suspected to have nested in the permit area in 2008. However, two of the three nest sites are at least 1 mile from the nearest planned new facility, and all three were closer to existing disturbances in 2008 than they would be to new activities outside those existing areas.

The seven SDNHP species recorded in or flying over the permit area could potentially experience the same type of direct and/or indirect impacts from construction and operation of the proposed operation as those described previously for other species: e.g., injury, mortality, avoidance, displacement and increased competition for resources. Those potential impacts will be minimized by the timing, extent, and duration of the proposed activities. Enforced speed limits during all phases of the project will further reduce potential impacts to wildlife throughout the year, particularly during the breeding season. Once facilities and infrastructure are in place, animals remaining in the permit area would demonstrate an acclimation to those disturbances.

5.6.11.2 Mitigation of Potential Ecological Resources Impacts

The following is a list of proposed mitigation measures for such potential impacts:

- Design fencing to permit big game passage to the extent practicable.
- Use existing roads when possible and limit construction of new access roads to provide for access to more than one well site or well field, if possible.
- Enforce speed limits to minimize collisions with wildlife, especially during the breeding season.
- Adhere to timing and spatial restrictions within specified distances of active raptor nests during the breeding season as determined by appropriate regulatory agencies.
- Develop a bald eagle mitigation/management plan for review and approval by the USFWS. The plan also will be provided to the SDGF&P for review and input, although the USFWS will have the final approval authority. The approved plan and any associated permits will be incorporated into the LSM permit. The bald eagle mitigation/management plan is anticipated to address the following:
    - Ensure that annual bald eagle monitoring and survey data for nest and winter roost sites are available within the permit area and buffer area for the life of mine to:
        - determine normal habitat use and movements,
        - determine the location and status of nests and winter roost sites, and
        - document the occurrence and outcome of nesting bald eagle pair(s).
    - Establish buffer zones protecting important bald eagle habitat where necessary and stipulating seasonal restrictions on ISR-related disturbances within buffer areas in order to avoid jeopardizing bald eagles during any project phase. Such buffer zones and their associated seasonal restrictions would be established:

- in keeping with current USFWS recommendations,
- around nest sites, and
- around documented winter roost sites).

o If necessary, obtain a USFWS-issued permit and any necessary State permits for eagle take and/or nest relocation or removal, the application for which would address the following:

- demonstration that the proposed activity meets the requirements of 50 CFR § 22.26 or § 22.27, which contain the federal requirements for take and removal/relocation of eagle nests, respectively;
- methods to relocate the nest(s) or construct an alternate nest and/or improve conditions at alternate nest sites, if mitigation measures are required around documented winter roost sites);
- a demonstration that suitable nesting and foraging (including winter) habitat is available to the area nesting population of bald eagles that could accommodate any bald eagles displaced by the take or nest removal/relocation; and
- implementation of monitoring and reporting procedures to determine the response of bald eagles to the take or nest relocation(s).

• If direct impacts to raptors or other migratory bird species of concern occur, a Monitoring and Mitigation Plan for those species will be prepared and approved by the USFWS, including one or more of the following provisions:

o Relocation of active and inactive raptor nests that could be impacted by construction or operation activities in accordance with the approved raptor monitoring and mitigation plan.

o Creation of raptor nests and nesting habitat through enhancement efforts such as nest platforms to mitigate other nest sites impacted by ISR operations.

o Obtaining appropriate permits for all removal and mitigation activities.

o Establishing buffer zones protecting raptor nests where necessary and restricting ISR-related disturbances from encroaching within buffers around active raptor nests from egg-laying until fledging to prevent nest abandonment, or injury to eggs or young.

  - Reestablishing the ground cover necessary to attract and sustain a suitable raptor prey base after drilling, construction, and future ISR operations and site reclamation/decommissioning
  - Required use of raptor-safe construction for overhead power lines according to current guidelines and recommendations by the USFWS

- Restore pre-mining native habitats for species that nest and forage in those vegetative communities.
- Restore diverse landforms, replace topsoil, and construct brush piles, snags, and/or rock piles to enhance habitat for wildlife.
- Conduct weed control as needed to limit the spread of undesirable and invasive, non-native species on disturbed areas.

Adjusting the timing of various construction, operational, and reclamation activities to avoid the breeding season can also be an effective way to minimize impacts related to such activities in the permit area. As a practical matter, worker crews conducting construction or reclamation activities typically work during daylight hours, so potential impacts to year-round residents, particularly more nocturnal species such as bats, rodents and others, should not be increased significantly. Following completion of construction in a given area, access roads would be blocked with berms or fencing to prevent use by casual traffic. Site reclamation/ decommissioning, including surface reclamation, will be completed in the same manner, with activities timed to minimize disturbance to nesting or migrating species. Relevant agency standards for reclamation will be followed and this phased, systematic approach will allow more mobile wildlife species to relocate into adjoining, undisturbed habitat and then return following completion of construction or reclamation in a particular area. Thus, the sequential, phased nature of this approach will decrease potential direct and indirect impacts on all wildlife species and their habitat.

5.6.12 Cultural Resources

5.6.12.1 Potential Cultural Resources Impacts

As discussed in Section 3.11, a Level III Cultural Resources Evaluation was conducted in the permit area. Personnel from the Archaeology Laboratory, Augustana College, Sioux Falls, South Dakota, conducted on-the-ground field investigations between April 17 and August 3, 2007. Potential impacts to historic and cultural resources will be minimized by implementing the mitigation measures described below.

5.6.12.2 Mitigation of Potential Cultural Resources Impacts

The following summary of protection of historic and cultural resources within the proposed permit area was obtained from the Draft Supplemental Environmental Impact Statement (Draft SEIS) for the Dewey-Burdock Project (NRC, 2012, p. xxxix):

> Within the area of potential effect at the proposed Dewey-Burdock site, 18 historic sites are either listed in the National Register of Historic Places (NRHP) or eligible for listing in the NRHP. Based on the proposed location of ISR facilities and infrastructure, avoidance of 12 of these sites is possible during the construction phase and, therefore, no impacts are anticipated. Avoidance and mitigation, such as fencing and data recovery excavations, are recommended for the remaining six NRHP-eligible sites. In addition, avoidance is recommended for two unevaluated historic burial sites located in proximity to proposed construction activities until their NRHP eligibility is determined. Avoidance and mitigation is also recommended for 4 unevaluated site[s] located within 76 m (250 ft) of proposed wellfields or land application areas.

The mitigation measures to protect historic and cultural resources will include but will not be limited to:

- Administering a historic and cultural resources inventory before engaging in any development activity not previously assessed by NRC or any cooperating agency.
- Any disturbances to be associated with such development will be addressed in compliance with the National Historic Preservation Act (NHPA), the Archeological Resources Protection Act, and their implementing regulations.
- Prior to construction, establishing an agreement between NRC, South Dakota State Historic Preservation Office (SHPO), BLM, interested Native American tribes, Powertech (USA) and other interested parties that outlines the mitigation process for each affected historic resource. As part of this agreement, Powertech (USA) will develop an Unexpected Discovery Plan that will outline the steps required if unexpected historic and cultural resources are encountered (Draft SEIS, p. xxxix).
- Avoidance, where possible, of eligible or potentially eligible sites.
- Fencing known historic properties in areas where construction, well field development, and ISR operations will occur so disturbance to these areas can be avoided.
- Making the location of historic properties known to employees in advance of ground disturbing activities.
- Addressing any disturbances in compliance with Powertech's (USA) Memorandum of Agreement (MOA) with the South Dakota State Archeologist and any future MOAs developed by Powertech (USA) or NRC under the NHPA. Powertech (USA) executed the MOA with the South Dakota State Archeologist in September 2008. The MOA, which is provided in Appendix 3.11-B, establishes procedures to avoid or mitigate

potential effects on archaeological and historic sites pursuant to SDCL 45-6D-14 and 45-6B. Provisions include:

- Investigating archeological or historic sites threatened or potentially threatened by proposed ground disturbing activity prior to disturbance to determine their significance or research potential.
- Notifying ARC at least 30 days in advance of surface disturbance that could potentially impact an archeological or historic site.
- Providing a quarterly report to ARC summarizing Powertech (USA)'s efforts to carry out the terms of the MOA.
- Temporarily halting surface disturbance activities if historic or archeological sites are discovered or unanticipated effects on historic or cultural sites are found during any phase of the project. Powertech (USA) will not resume activities until clearance to proceed is granted by ARC.

- Implementing mitigation measures if it becomes necessary to disturb an eligible or potentially eligible site, potentially including data recovery excavations coordinated with ARC.
- Immediately ceasing any work resulting in the discovery of previously unknown cultural artifacts to ensure that no unapproved disturbance occurs. Powertech (USA) will notify appropriate authorities per any license conditions and will not proceed with activities without appropriate approvals from NRC or other agencies as appropriate. Any such artifacts will be inventoried and evaluated, and no further disturbance will occur until authorization to proceed has been received. Powertech (USA) recognizes that the NHPA environment is not static, but rather is ongoing up to and through final financial assurance release following successful reclamation.

5.6.13 Noise

5.6.13.1 Potential Noise Impacts

Potential noise impacts will result from the operation of construction equipment, passenger vehicle and material shipment vehicle traffic, and, to a very limited extent, from the operation of ISR and wastewater facilities including center pivots if used for land application. The potential impacts to nearby receptors will be small due to the remote location, limited disturbance, and lack of nearby residences.

Section 3.12 describes how the minimum distance between a residence and the primary county road in the permit area (S. Dewey Road) is 3,700 feet. Based on the analysis in Section 3.12, the maximum anticipated noise from a heavy truck traveling on the S. Dewey Road at a residence within the permit area will be 41 dBA, which is well within the 55 dBA level identified by EPA as preventing activity interference and annoyance. Based on this analysis, increased vehicle

traffic associated with passenger vehicles and material shipment vehicles will not have significant impacts on nearby residences.

Noise originating from construction equipment will be apparent locally over the short term where construction activities are occurring. This primarily will include facility construction at the CPP and Satellite Facility and well field construction. Table 5.6-3 identifies typical noise levels 50 feet away from construction equipment. These noise levels were obtained from NRC guidance document NUREG-1910 (NRC, 2009). As described in Section 3.12, noise from point sources diminished by about 6 dBA for each doubling of distance according to the following relationship, where it is assumed that the noise radiation is uniform, non-directional, and freely propagating (Bell and Bell, 1994):

$$N_1 - N_2 = 20 \log (r_2/r_1)$$

In this equation, N_1 and N_2 are the noise levels (sound pressure levels) at points 1 and 2, and r_2 and r_1 are the distances from the receptor to point 2 and 1, respectively.

Table 5.6-3 includes estimates of noise levels from construction equipment using this relationship for distances of 1,600 feet and 5,900 feet, which are the minimum anticipated distances between a residence and a well field and CPP, respectively. This table shows that noise levels resulting from construction equipment typically will be lower than the annoyance threshold level even at the minimum distance from a residence. Since most construction activity will be located at a much greater distance from residences, the noise levels generally will be lower than those shown in Table 5.6-3. Due to distance and topographic interference, potential noise impacts likely will be within the range of normal baseline variability for most construction activities and most residences.

5.6.13.2 Mitigation of Potential Noise Impacts

Potential noise impacts include the generation of noise resulting from operating heavy equipment and process machinery. Noise from process machinery will be contained within process structures and, as such, should have no discernible impacts on the public or the environment. With respect to potential noise impacts from heavy equipment, typical mitigation measures that will be implemented at the project to minimize noise impacts may include the following:

- Minimize construction activities during the night.

Table 5.6-3: Noise Levels for Construction Equipment

Equipment Type	Noise Level at 50 feet[1] (dBA)	Noise Level at 1,600 feet[2] (dBA)	Noise Level at 5,900 feet[3] (dBA)
Heavy Truck	82-96	52-66	41-55
Bulldozer	92-109	62-79	51-68
Grader	79-93	49-63	38-52
Excavator	81-97	41-67	40-56
Crane	74-89	44-59	33-48
Concrete Mixer	75-88	45-58	34-47
Compressor	73-88	43-58	32-47
Backhoe	72-90	42-60	31-49
Front Loader	72-90	42-60	31-49
Generator	71-82	41-52	30-41
Jackhammer/Rock Drill	75-99	45-69	34-58
Pump	68-80	38-50	27-39

Notes: [1] NUREG-1910, Table 4.2-1 (NRC, 2009).
[2] Minimum anticipated distance between potential perimeter monitor well and nearby residence.
[3] Minimum distance between CPP and nearby residence.

- Use sound abatement controls on operating equipment and facilities.
- Use personal hearing protection for workers in any high noise areas.

These mitigation measures will ensure that noise levels will remain within relevant EPA guidelines for off-site receptors and OSHA standards for workers.

5.6.14 Visual and Scenic Resources

5.6.14.1 Potential Visual and Scenic Resources Impacts

Potential short-term impacts to visual and scenic resources during construction will result from surface disturbance activities and facility construction. Temporary disturbance areas will be reclaimed upon completion of construction and debris created during construction will be removed as soon as possible to limit the areal extent affected during construction.

The sources of potential longer-term impacts to visual and scenic resources will include the presence of the CPP, Satellite Facility, well head covers, header houses, access roads, overhead power lines, ponds, and wastewater disposal facilities (DDWs and/or land application systems). These potential longer-term visual and scenic resources impacts will remain until the completion of reclamation/decommissioning, upon which the permit area will closely resemble the pre-mining condition.

5.6.14.2 Mitigation of Potential Visual and Scenic Resources Impacts

Mitigation measures for potential visual and scenic resources impacts will include:

- Use exterior lighting only where needed to accomplish facility tasks and improve safety.
- Limit the height of exterior lighting units.
- Use shielded or directional lighting to limit lighting only to areas where it is needed.
- Design of facilities to minimize surface disturbance.
- Construction and placement of structures taking into consideration the topography in order to conceal well heads, plant facilities, and roads from public vantage points.
- Satisfy BLM guidelines by using building materials and paint that complement the natural environment.
- During construction of roads, consider the topography that a given road follows as well as the potential area of disturbance.

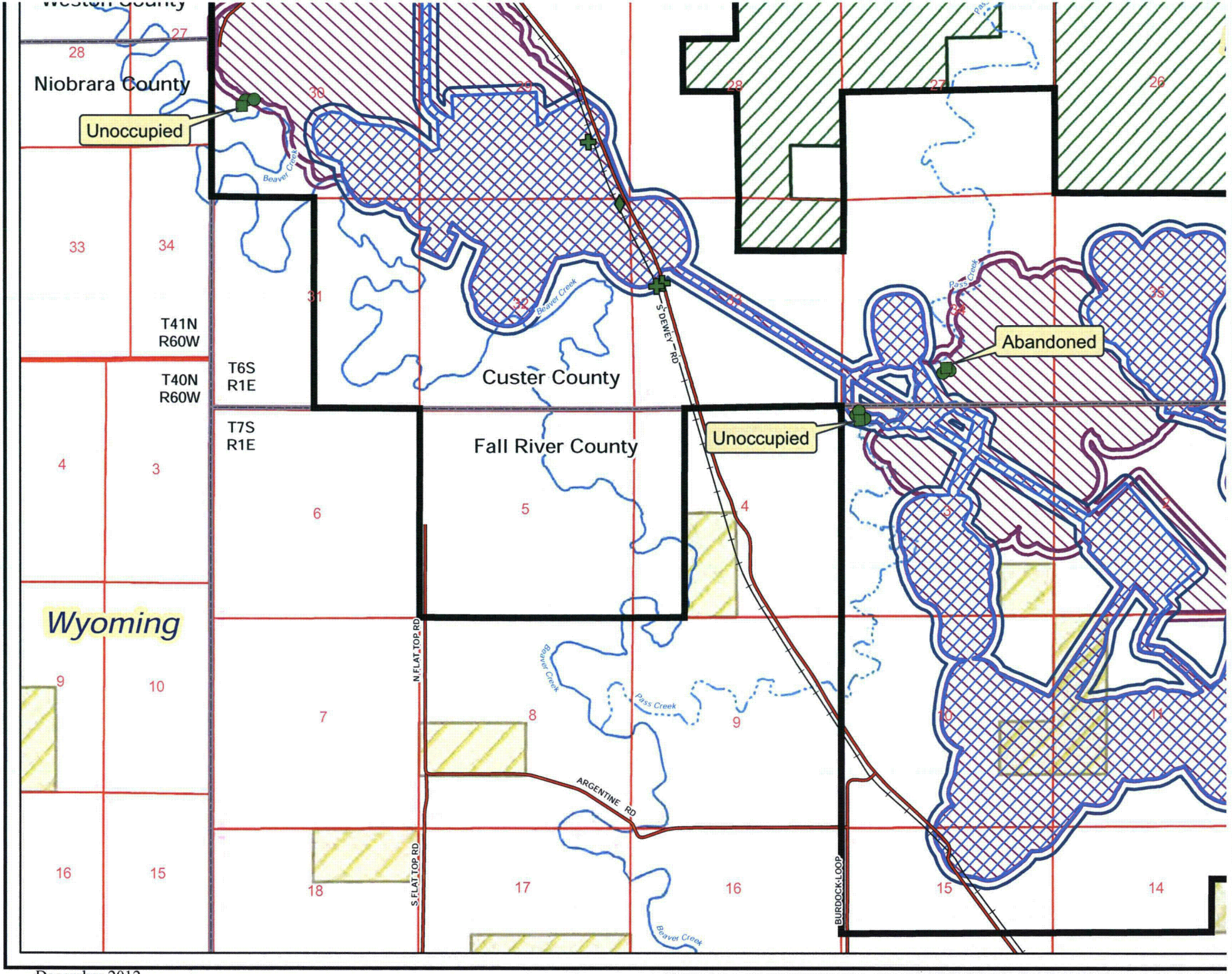
- Minimize access road construction through the use of existing roads.
- Locate access roads and utilities in common corridors where possible.
- Implement speed limit policies and dust control measures including routinely applying water spray to roads and construction areas to minimize fugitive dust.
- Promptly reclaim and reseed temporary disturbance areas.
- Promptly remove debris associated with construction activities.

5.6.15 Protection of Man-Made Structures

Figure 5.6-2 depicts man-made structures within 200 feet of the proposed affected area boundaries. These include dwellings, farm structures (e.g., barns and sheds), a railroad switch house, and concrete culverts. Following is a summary of how these structures will be protected in accordance with SDCL 45-6B-32(4).

Several dwellings and farm structures are within 200 feet of the proposed affected area boundaries. Currently these include one occupied dwelling, two unoccupied but habitable dwellings, and one abandoned dwelling that is not habitable. There are no habitable dwellings within potential well field pattern areas. It is anticipated that construction activities within 200 feet of dwellings or farm structures will be limited to the installation of perimeter monitor wells, pipelines and overhead power lines. Powertech (USA) does not anticipate drilling any wells within 50 feet or installing any pipelines within 25 feet of any habitable dwelling or any usable farm structures, except that Powertech (USA) may install small-diameter domestic water supply pipelines to replace domestic water supply wells as described in Section 5.6.3.2. Potential impacts will be minimized by avoiding these structures during facility design and construction.

The railroad, railroad switch house, and concrete railroad culverts will be protected by avoiding construction activities near the railroad. The only construction activity anticipated within 200 feet of the railroad is the installation of perimeter monitor wells in or near the railroad right-of-way in the vicinity of D-WF1 and B-WF2. Any perimeter wells inside the railroad right-of-way would be offset from the railroad a sufficient distance to allow the work to be performed safely and to protect the stability of the railroad. In addition, Powertech (USA) may install one or more plant-to-plant pipelines between the CPP and Satellite Facility. As depicted on Figures 5.3-1 and 5.3-2, such pipelines would cross the railroad right-of-way near the Satellite Facility. These pipelines, if installed, would be bored underneath the railroad, and the bored length would be encased in a protective material such as steel well casing. Any construction activities within the BNSF right-of-way would be coordinated with the railroad to avoid impacts.



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No significant disturbance will occur to the S. Dewey Road as a result of the Dewey-Burdock Project. Powertech (USA) will coordinate the construction of access road approaches with Custer and Fall River counties.

5.7 Operations

During operation of the facility, Powertech (USA) via the company's Safety and Environmental Review Panel (SERP) will ensure that the facility will apply to all applicable laws and regulations. Powertech (USA) will maintain the health and safety of the workers, general public, and the environment while the facility is in operation. This includes maintaining potential occupational and public exposures to ionizing radiation ALARA in accordance with NRC license conditions.

5.7.1 Corporate Organization and Administrative Procedures

This section provides functional positions within the Powertech (USA) organization that have direct responsibility to ensure corporate commitment to operating the facility in a manner that is protective of human health and the environment, including the principle of ALARA. The organizational accountability of these functional positions is also presented.

5.7.1.1 Corporate and Facility Organization

The organizational structure of Powertech (USA) and the facility is shown in Figure 5.7-1. The organization structure defines the Chief Operating Officer (COO) as having direct supervision over the Vice President of Environmental Health & Safety Resources and the Facility Manager of the Dewey-Burdock Project.

5.7.1.2 Chief Operating Officer

The COO is empowered by the Board of Directors to have the responsibility and authority for the radiation safety and environmental compliance programs at all Powertech (USA) facilities. The COO is directly responsible for ensuring that Powertech (USA) personnel comply with corporate industrial safety, radiation safety, and environmental protection programs. The COO is also responsible for company compliance with all regulatory license/permit conditions/stipulations, regulations, and reporting requirements. The COO has the responsibility and authority to terminate immediately any activity that is determined to be a threat to employees, public health,

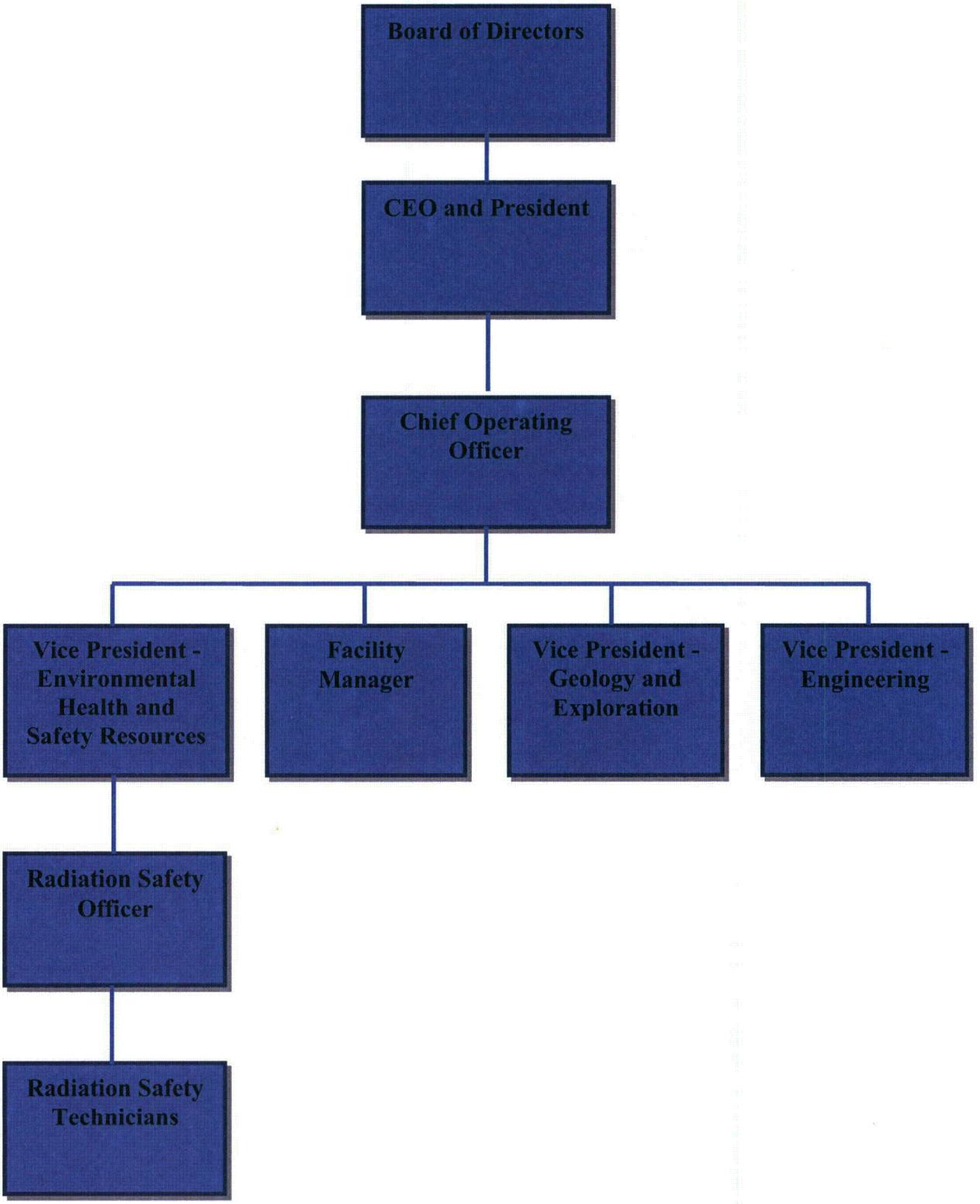


Figure 5.7-1: Organizational Structure

or the environment, or a violation of state or federal regulations. The COO has the authority to assign corporate resources (e.g., capital equipment, personnel, budget) to ensure corporate environmental, health, and safety goals and directives are met.

5.7.1.3 Vice President of Environmental Health & Safety Resources

The Vice President of Environmental Health & Safety Resources is responsible for all radiation protection, health and safety, and environmental programs for Powertech (USA) and ensuring these programs meet applicable regulatory requirements and industry best management practices. The Vice President is responsible for ensuring that all company operations comply with all applicable laws and regulations. The Vice President reports directly to the COO.

5.7.1.4 Facility Manager

The Facility Manager will be responsible for all operations at the project facility. The Facility Manager will be responsible for compliance with all applicable laws and regulations as well as corporate health, safety and environmental programs. The Facility Manager will have the authority to terminate immediately any operation of the facility that is determined to be a threat to employees, public health, or the environment, or a violation of laws or regulations. The Facility Manager reports directly to the COO. The Facility Manager has the authority to assign facility resources (e.g., capital equipment, personnel, budget) to ensure corporate environmental, health, and safety goals and directives are met. The Facility Manager will act promptly on recommendations made by the Radiation Safety Officer (RSO) to correct deficiencies identified in the radiation or environmental monitoring programs, but will not have the authority to unilaterally override the RSO's decision to suspend, postpone, or modify an activity.

5.7.1.5 Radiation Safety Officer

The RSO will be the person in charge of and responsible for the radiation protection and ALARA programs. The RSO will ensure that equipment and laboratory facilities are adequate for monitoring and evaluating the relative attainment of the ALARA objective. The RSO will develop, review, and enact changes in the program so that protection against uranium, radon and decay products and the ALARA principle are maintained during the operation of the facility. These changes include new equipment, process changes, and changes in the operating procedures.

The RSO will possess the authority to enforce regulations and administrative policies that may affect any aspect of the radiological protection program. The RSO will have the authority to suspend, postpone, or modify any activity that the RSO determines is not in compliance with

regulations and administrative policy. The RSO will also be a member of the SERP described in Section 5.7.2.3 and will meet the qualifications outlined in NRC guidance.

The RSO will report directly to the Vice President of Environmental Health & Safety Resources.

5.7.1.6 Radiation Safety Technicians

Powertech (USA) will utilize Radiation Safety Technicians (RSTs). The RSTs will be members of the radiation safety staff. Qualifications and training requirements will be in accordance with NRC license requirements. The RST will meet the minimum training requirements of the RSO and will be a qualified designee to replace the RSO in daily visual inspection of all work and storage areas in the facility to determine if standard operating procedures (SOPs) are being followed properly and good radiation practices are being implemented. The RST will perform this function when the RSO is not available, e.g., during off shifts.

5.7.2 Management Control Program

This section describes administrative controls within the Powertech (USA) organization that are intended to ensure the facility is operated in a manner that is protective of human health and the environment, including the principle of ALARA.

5.7.2.1 Routine Activities

All routine activities involving handling, processing, or storing of radioactive or hazardous material at the Dewey-Burdock Project will be documented by written SOPs. Each SOP will be reviewed and approved in writing by the RSO or RST prior to implementation. Any proposed changes to an SOP must also be reviewed and approved in writing by the RSO or the RST. The RSO will review each SOP at least annually to ensure it follows any newly established radiation protection practices.

Up-to-date copies of the SOPs, along with accident response and radiological fire protection plans, will be made available to all employees. All SOPs will be managed in a manner which allows for tracking of revisions and dates of the revisions.

5.7.2.2 Non-Routine Activities

Any activities with potential for significant exposure to radioactive material and not documented by existing SOPs will require radiological work permits (RWPs). RWPs are job-specific permits that will describe the details of the job to be performed, precautions necessary to maintain

radiation exposures ALARA, and the necessary radiological monitoring and sampling. The RSO or RST must review and sign off on the RWP before the associated work is to be performed.

5.7.2.3 Safety and Environmental Review Panel

A SERP consisting of at least three members will be established. One member will be the RSO. Another member will be someone with authority to implement managerial and financial changes (e.g., the Facility Manager). Another member will be someone with authority to make operational changes (e.g., the Production Superintendent, who will report to the Facility Manager). The SERP may include others on a temporary or permanent basis whenever the SERP requires additional technical or scientific expertise; these may be other employees or consultants. At least one member of the SERP shall be designated as chairman.

The purpose of the SERP will be to evaluate, discuss, approve, and record any changes to any SOP, the facility, or tests and experiments involving safety or the environment. The changes will not require an NRC license amendment pursuant to 10 CFR § 40.44 as long as the changes do not:

- Create a possibility of an accident unlike what is evaluated in the NRC license application (as updated),
- Create a possibility of a malfunction of a structure, system, or control unlike what is evaluated in the NRC license application (as updated), or
- Result in a departure from the method of evaluation described in the NRC license application (as updated) used in establishing the final safety evaluation report or the environmental assessment or technical evaluation reports or other analyses and evaluations for NRC license amendments.

Records of the evaluations made by the SERP will be made. Any change approved by the SERP will be documented in writing by showing the affected operating procedure, facility, and/or test and experiment before and after the change along with the date of the change. The SERP will evaluate each well field hydrogeologic data package as it is developed. The SERP evaluation will determine whether the results of the hydrologic testing and the planned ISR operations are consistent with SOPs and technical requirements stated in the NRC license. The evaluation will include review of the potential impacts to human health and environment. If anomalous conditions are present, the SERP evaluation indicates potential to impact human health or the environment, or it is required by NRC license conditions, the well field hydrogeologic data

package will be submitted to NRC for review. All well field packages and written SERP evaluations will be maintained at the site and available for regulatory review.

The SERP will have the authority to raise issues regarding the health and safety of the workers, general public, and/or the environment due to the operation of the facility to the Facility Manager and the Vice President of Environmental Health & Safety Resources.

An annual report will be prepared which describes actions taken by the SERP including changes to operating procedures, the facility, or tests and experiments that involve safety or the environment enacted since the previous report was issued. The report also will document the reason for each change, whether the change required an NRC license amendment, and the basis for determination.

5.7.2.4 Radioactive Material Postings

All entrances to the facility will be conspicuously posted with the following statement: "ANY AREA WITHIN THIS FACILITY MAY CONTAIN RADIOACTIVE MATERIAL."

5.7.2.5 Recordkeeping

All records will be maintained as hard copy originals or stored electronically.

The following information will be permanently maintained both on-site and at an off-site location until NRC license termination:

- Records of the results of measurements and calculations used to evaluate the release of radioactive effluents to the environment.
- Records of spills, excursions, facility stoppages, contamination events, and unusual occurrences.
- Records of inspections of ponds.
- Records of the occupational monitoring.
- Information related to the radiological characterization of the facility.
- Drawing and photographs of structures, equipment, restricted areas, well fields, and storage areas with radioactive materials and all of their modifications.
- Records of survey and calibrations will be maintained for at least 3 years.

All records will be stored in manner to prevent record loss from fire, flood, or other unforeseen events beyond the control of Powertech (USA). All records will be legible throughout the retention period described above.

5.7.2.6 Reporting

Powertech (USA) has committed to developing written operating procedures within the management control program to address all NRC license reporting requirements. These will be prepared after NRC license issuance but prior to ISR operations. Specific reporting requirements will include items such as reports of theft or loss of licensed material, notification of incidents, reports of exposures of radioactive material exceeding limits, and effluent monitoring reporting.

Powertech (USA) will prepare and submit reports in accordance with the requirements of SDCL 45-6B-36, ARSD 74:29:05:18 and ARSD 74:29:05:20. The following reports will be provided to DENR at the specific frequency.

Updated Baseline Surface and Groundwater Report

Powertech (USA) has committed to collecting additional surface water and groundwater samples prior to operations (refer to Sections 5.5.2 and 5.5.3). The results will be provided to DENR in an updated baseline surface and groundwater report prior to ISR operations.

Annual Environmental Monitoring Report

Powertech (USA) will prepare and provide to DENR an annual environmental monitoring report, which will include the results of the following operational monitoring programs.

- Operational groundwater monitoring, including domestic wells, stock wells, irrigation wells and monitor wells.
- Operational surface water monitoring, including streams and impoundments.
- Soil sampling, including soil samples collected from the air particulate monitoring locations and from the land application areas (if used).
- Vegetation sampling, including vegetation samples collected from the air particulate monitoring locations and from the land application areas (if used).
- Livestock and fish sampling.
- Environmental air monitoring, including air particulate and radon gas sampling at operational environmental air monitoring stations.

Annual Financial Assurance Report

Powertech (USA) will provide an annual financial assurance report to DENR within 60 days prior to the anniversary date of the permit each year including the following elements:

- Annual filing of map and fee in accordance with SDCL 45-6B-36.
- A brief discussion of the coming year's operational plans including any anticipated revisions that might require department or board approval.
- An annual disturbance and reclamation summary, including:
    - Total amount of disturbed lands;
    - Total amount of land that has undergone interim reclamation;
    - Total amount of land that has undergone final reclamation but has not yet satisfied the postclosure reclamation requirements; and
    - Total amount of land that has undergone final reclamation and has satisfied the postclosure reclamation requirements.
- An updated financial assurance cost estimate that accounts for economic and site-specific factors such as inflation, changes in costs of materials, changes in waste disposal costs, changes in specific reclamation costs such as well plugging, and changes in other site-specific decommissioning/reclamation costs such as the level of effort and duration required for groundwater restoration. The updated financial assurance cost estimate will account for the next year of proposed activities.

Land Application System Reporting

Powertech (USA) will establish and maintain records and prepare and submit reports for land application system operation in accordance with the requirements of ARSD 74:29:05.

Prior to operating the land application systems each year, Powertech (USA) will provide written notice to the DENR of the intent to implement land application. In accordance with ARSD 74:29:05:18, the written report will include the following information:

1) The date on which application will start;
2) The amount of solution to be applied to land;
3) The estimated duration of land application; and
4) The chemical characterization of the solution in the storage ponds.

Per ARSD 74:29:05:20, Powertech (USA) will submit a written report to DENR following each land application cycle, which is defined as the last land application operational period during each calendar year. Prior to the end of each year, Powertech (USA) will prepare and submit a written report including the following information for each of the land application systems (Dewey and Burdock):

1) The total amount of land application solution applied;
2) The total hydraulic loading rate per acre;
3) The total metals loading rate per acre, including all of the trace and minor elements and radiological parameters in Table 6.2-1;
4) The duration of the land application cycle;
5) All land application effluent and storage pond sampling data; and
6) A general discussion of the success of the system.

Well Completion Reports

Powertech (USA) will submit well completion reports within 1 month of completing each injection, production, or monitor well. Well completion will be defined as the point at which the well screen has been installed and initial well development has occurred. In accordance with SDCL 46-6-11, the well completion reports will be provided to DENR on a form supplied by the Chief Engineer.

Well Plugging Reports

Powertech (USA) will provide an annual well plugging report to DENR including the following elements for each plugged well in accordance with ARSD 74:02:04:71:

1) The name and complete mailing address of the owner;
2) The legal description of the well or hole location;
3) The completion date;
4) The casing or hole size, type of well, and well or hole depth;
5) A general description of the condition of the well;
6) A description of the plugging procedure;
7) The grout or material used to plug the well or test hole; and
8) The date and the signature of the license representative.

Postclosure Monitoring Report

During postclosure monitoring, Powertech (USA) will provide an annual report to DENR describing the following:

- Treatment system operation (if applicable);
- Operation of monitoring systems;
- Monitoring results; and
- Inspection and maintenance activities.

5.7.2.7 Historical and Cultural Resources Inventory

Powertech (USA) will administer a historic and cultural resources inventory before engaging in any development activity not previously assessed by NRC or any cooperating agency. Any disturbances to be associated with such development will be addressed in compliance with the NHPA, the Archeological Resources Protection Act, and their implementing regulations. Any disturbances also will be addressed in compliance with Powertech (USA)'s MOA with the South Dakota State Archeologist and any future MOAs developed by Powertech (USA) or NRC under the NHPA. Powertech (USA) executed the MOA with the South Dakota State Archeologist in September 2008. The MOA, which is provided in Appendix 3.11-B, establishes procedures to avoid or mitigate potential effects on archaeological and historic sites pursuant to South Dakota statutes 45-6D-14 and 45-6B.

Powertech (USA) will immediately cease any work resulting in the discovery of previously unknown cultural artifacts to ensure that no unapproved disturbance occurs. Powertech (USA) will notify appropriate authorities per any license conditions and will not go forward without appropriate approvals from NRC or other agencies as appropriate. Any such artifacts will be inventoried and evaluated, and no further disturbance will occur until authorization to proceed has been received. The procedure described in this section will continue up to and through final license termination.

5.7.3 Management and Audit Program

Powertech (USA) will conduct a management and audit program in accordance with NRC license requirements that will evaluate compliance with and effectiveness of the radiation protection, operational monitoring, and environmental monitoring programs. The management and audit program will function to ensure vigilance toward the protection of human health and the environment. It will be designed to provide quality assurance based upon reviews and evaluations of the effectiveness of radiation protection provided for workers and members of the public. A brief summary of the management and audit program includes:

- Daily health physics inspections to determine if good radiation practices are being implemented.
- Weekly health physics inspections of all facility areas to examine the general radiation control practices and observe the required changes in procedure and equipment.
- Monthly health physics review of all radiation monitoring and exposure data for the month.
- Implementation of a radiation protection program ensuring compliance with NRC license conditions.
- Establish the effluent control and monitoring systems and ensure effluent monitoring locations are optimized for the intended function.
- Implement a waste storage system that will include a pond monitoring program to ensure the ponds are operated and maintained in a manner that prevents the movement of waste(s) to undesirable areas. Contingency plans will be built into the program to address all reasonable system failures.
- Implementation of an annual ALARA and radiation protection program audit.

5.7.4 Qualifications for Personnel Implementing the Radiation Safety Program

Powertech (USA) will establish the minimum qualifications, including education and experience, for the RSO and RST in accordance with NRC license conditions.

5.7.5 Radiation Safety Training

Powertech (USA) will establish radiation safety training programs to ensure all employees and visitors have an adequate level of knowledge to recognize and be aware of potential radiological hazards associated with activities they will be involved with at the facility. Written procedures will be established for initial training, refresher training, visitor training, contractor training, RSO training, and training documentation.

5.7.6 Facility Security

The following describes the security measures that will be implemented to prevent unauthorized site access and removal or access of NRC-licensed materials stored within the permit area:

- All areas where licensed material is stored (e.g., well fields, CPP, Satellite Facility) will be fenced.
- All gates accessing areas where licensed material is stored will be posted as described in Section 5.7.2.4 and locked when facility personnel are not immediately available to prevent unauthorized access to or removal of licensed materials.

- Facility fences, gates, and postings will be inspected daily as part of the inspection programs.
- A 24-hour per day, 7-day per week staff will be on duty at the facility.
- Visitors to the facility will enter through an access point at the main CPP entrance where they will sign in and receive required radiation safety training.

Powertech (USA) will control and maintain constant surveillance of licensed material that is in a controlled or unrestricted area and is not in storage. An example of licensed material not being in storage is licensed material being transported from the Satellite Facility to the CPP. Passive and administrative controls to prevent unauthorized access to and removal of licensed material not in storage include:

- SOPs assessing the possible transportation security risks and identifying measures to mitigate these risks.
- Locks and/or tamper indicators on all openings where licensed material is kept.
- Off-site vehicles transferring licensed materials will always be secure if left unattended.
- Off-site vehicles transferring licensed materials will be visible by an employee at all times when left unattended outside of a restricted area.

The requirements of 49 CFR 172 will apply to shipments of licensed material which Powertech (USA) offers for transport for commercial use. Powertech (USA) will develop SOPs for these cases and will evaluate the ability of potential commercial contractors offering transportation services to comply with the requirements of 49 CFR 172 prior to entering into a contracting agreement.

5.7.7 Radiation Safety Controls and Monitoring

Active and passive effluent control techniques and monitoring will ensure that occupational and public doses of ionizing radiation will be ALARA. Effluent control techniques are briefly summarized in Section 5.6.9.2 and will include use of pressurized, downflow IX vessels, ventilation systems, modern vacuum yellowcake dryers, and emission control systems. Radiation safety monitoring is described in Section 5.6.9.2 and will include monitoring air quality and potential worker exposure within the processing facilities and environmental monitoring throughout the permit area.

6.0 RECLAMATION PLAN

6.1 Introduction

This reclamation plan was developed by WWC Engineering personnel including Mr. John Berry and Mr. Dale Brown and Powertech (USA) personnel including Mr. Richard Blubaugh and Mr. John Mays. These individuals are competent and have experience managing and planning for reclamation in accordance with ARSD 74:29:07:18.

The initial and most critical goal of reclamation is to stabilize the primary disturbance (surface and subsurface) to reduce off-site impacts. The overall long-term objective of reclamation is to return future areas of disturbance to a beneficial land use after ISR activities have ceased. During the period of active ISR, interim management of disturbed lands through revegetation techniques, sediment control, dust, and management of noxious weeds will be conducted to minimize potential impacts to land, water, air, wildlife, and humans. As uranium ISR and groundwater restoration are completed within various portions of the permit area, long-term reclamation treatments will be implemented to ensure the creation of a stable and environmentally sound postmining land use.

6.2 Groundwater Restoration

The plans for groundwater restoration are discussed below. Groundwater restoration in each well field will be conducted in accordance with NRC license requirements.

6.2.1 Target Restoration Goals

Groundwater restoration, or aquifer restoration, will be performed pursuant to NRC requirements to protect USDWs. The groundwater restoration program for all well fields will be conducted pursuant to 10 CFR Part 40, Appendix A, Criterion 5, which sets forth groundwater quality standards for uranium milling facilities. Currently, Criterion 5 states that groundwater quality at such facilities shall have primary goals of baseline (background) or an MCL, whichever is higher, or an alternate concentration limit (ACL). An ACL is a site-specific, constituent-specific, risk-based standard that demonstrates that maintaining groundwater quality at the requested level at a designated point of compliance (POC) will be adequately protective of human health and the environment at the point of exposure (POE) and that groundwater quality outside the boundary of the aquifer exemption approved by EPA will meet background (baseline) levels or MCLs. Satisfaction of prior class-of-use can be proposed as a factor in demonstrating justification for an ACL.

In the event that an ACL is requested, Powertech (USA) will be required by NRC license conditions to submit an ACL application to NRC staff in accordance with regulatory requirements under 10 CFR Part 40, Appendix A, Criterion 5(B)(5). Any ACL application will be in the form of a license amendment application that addresses, at a minimum, all of the relevant factors in 10 CFR Part 40, Appendix A, Criterion 5(B)(6), including but not limited to:

(a) Potential adverse effects on ground-water quality, considering:
  (i) The physical and chemical characteristics of the waste in the licensed site including its potential for migration;
  (ii) The hydrogeological characteristics of the facility and surrounding land;
  (iii) The quantity of ground water and the direction of ground-water flow;
  (iv) The proximity and withdrawal rates of ground-water users;
  (v) The current and future uses of ground water in the area;
  (vi) The existing quality of ground water, including other sources of contamination and their cumulative impact on the ground-water quality;
  (vii) The potential for health risks caused by human exposure to waste constituents;
  (viii) The potential damage to wildlife, crops, vegetation, and physical structures caused by exposure to waste constituents;
  (ix) The persistence and permanence of the potential adverse effects.

(b) Potential adverse effects on hydraulically-connected surface water quality, considering:
  (i) The volume and physical and chemical characteristics of the waste in the licensed site;
  (ii) The hydrogeological characteristics of the facility and surrounding land;
  (iii) The quantity and quality of ground water, and the direction of ground-water flow;
  (iv) The patterns of rainfall in the region;
  (v) The proximity of the licensed site to surface waters;
  (vi) The current and future uses of surface waters in the area and any water quality standards established for those surface waters;
  (vii) The existing quality of surface water including other sources of contamination and the cumulative impact on surface water quality;
  (viii) The potential for health risks caused by human exposure to waste constituents;
  (ix) The potential damage to wildlife, crops, vegetation, and physical structures caused by exposure to waste constituents; and
  (x) The persistence and permanence of the potential adverse effects.

Should it become necessary to submit an ACL application, Powertech (USA) will follow relevant NRC guidance and policy in effect at the time that an ACL would be requested.

Prior to operation, the baseline groundwater quality will be determined through the sampling and analysis of water quality indicator constituents in wells screened in the mineralized zone(s)

across each well field. Section 5.5.1.2.1 describes the methods used to select baseline wells, sample the wells, and calculate baseline water quality statistics. Table 6.2-1 lists the parameters to be analyzed in baseline sampling. The target restoration goals (TRGs) will be established as a function of the average baseline water quality and the variability in each parameter according to statistical methods approved by NRC.

6.2.2 Groundwater Restoration Process

Groundwater restoration will be conducted in accordance with NRC license requirements in a manner that will protect human health and the environment. The methods for achieving this objective are discussed in the following sections.

6.2.2.1 Groundwater Restoration Methods

During groundwater restoration, Powertech (USA) will restore groundwater quality consistent with the groundwater protection standards contained in 10 CFR Part 40, Appendix A, Criterion 5(B)(5), in accordance with NRC license requirements. The technology selected will depend on the wastewater disposal option as described below. In the deep disposal well option, reverse osmosis (RO) treatment with permeate injection will be the primary restoration method. If land application is used, then groundwater sweep with injection of clean makeup water from the Madison Limestone or another suitable formation will be used to restore the aquifer. In either case, groundwater restoration will be conducted in accordance with NRC license requirements, which will establish the minimum number of pore volumes and the pore volume calculation method. Refer to Powertech (2011) for additional information.

6.2.2.1.1 Deep Disposal Well Option

In the deep disposal well option, the primary method of groundwater restoration will be RO treatment with permeate injection. In this method, water will be pumped from one or more well fields to the CPP or Satellite Facility for treatment. Treatment will begin with removal of uranium and other dissolved species in IX columns. The water then will pass through the restoration RO unit, which will remove over 90% of dissolved constituents using high pressure RO membranes. The treated effluent, or permeate, will be returned to the well field(s) for injection. The RO reject, or brine, will undergo radium removal in radium settling ponds and then will be disposed in one or more deep disposal wells.

The RO units will operate at a recovery rate of approximately 70%. Therefore, about 70% of the water that is withdrawn from the well fields and passed through the restoration RO unit will be

Table 6.2-1: Water Quality Parameter List

Test Analyte/Parameter	Units	Analytical Method
Physical Properties		
pH ≠	pH units	A4500-H B
Total Dissolved Solids (TDS) +	mg/L	A2540 C
Conductivity	µmhos/cm	A2510 B
Common Elements and Ions		
Alkalinity (as $CaCO_3$)	mg/L	A2320 B
Bicarbonate Alkalinity (as $CaCO_3$)	mg/L	A2320 B (as HCO_3)
Calcium	mg/L	E200.7
Carbonate Alkalinity (as $CaCO_3$)	mg/L	A2320 B
Chloride, Cl	mg/L	A4500-Cl B; E300.0
Magnesium, Mg	mg/L	E200.7
Nitrate, NO_3^- (as Nitrogen)	mg/L	E300.0
Potassium, K	mg/L	E200.7
Sodium, Na	mg/L	E200.7
Sulfate, SO_4	mg/L	A4500-SO4 E; E300.0
Trace and Minor Elements		
Arsenic, As	mg/L	E200.8
Barium, Ba	mg/L	E200.8
Boron, B	mg/L	E200.7
Cadmium, Cd	mg/L	E200.8
Chromium, Cr	mg/L	E200.8
Copper, Cu	mg/L	E200.8
Fluoride, F	mg/L	E300.0
Iron, Fe	mg/L	E200.7
Lead, Pb	mg/L	E200.8
Manganese, Mn	mg/L	E200.8
Mercury, Hg	mg/L	E200.8
Molybdenum, Mo	mg/L	E200.8
Nickel, Ni	mg/L	E200.8
Selenium, Se	mg/L	E200.8, A3114 B
Silver, Ag	mg/L	E200.8
Uranium, U	mg/L	E200.7, E200.8
Vanadium, V	mg/L	E200.7, E200.8
Zinc, Zn	mg/L	E200.8
Radiological Parameters[1,2]		
Gross Alpha††	pCi/L	E900.0
Gross Beta	pCi/L	E900.0
Radium, Ra-226[§]	pCi/L	E903.0

≠ Field and Laboratory
+ Laboratory only
††Excluding radon, radium, and uranium
[1] For alluvial compliance and interior well sampling, the concentrations of trace and minor elements and radiological parameters will be the dissolved portion, except mercury, which will be the total, unfiltered concentration in accordance with ARSD 74:54:01:04.
[2] The parameter list for alluvial compliance and interior wells also will include radon-222 and radium-228.

recovered as nearly pure water, or permeate. In order to avoid excessive restoration bleed and consumptive use of Fall River and Chilson groundwater, permeate will be supplemented with clean makeup water from the Madison Limestone or another suitable formation. Permeate and makeup water will be reinjected into the well field(s) at an amount slightly less than the amount withdrawn from the well field(s). This will be done to maintain a slight restoration bleed, which will maintain hydraulic control of the well field(s) throughout active aquifer restoration. The restoration bleed typically will be 1% of the restoration flow rate unless groundwater sweep is used in conjunction with RO treatment with permeate injection, in which case the restoration bleed will average approximately 17%. Refer to the "Optional Groundwater Sweep" discussion in Section 6.2.2.1.3.

6.2.2.1.2 Land Application Option

In the land application option, the primary method of groundwater restoration will be groundwater sweep with Madison Limestone water injection. A GDP application through DENR was submitted in March 2012 for the land application option. This method will begin the same as the method described above for RO treatment with permeate injection; water will be pumped to the CPP or Satellite Facility for removal of uranium and other dissolved species in IX columns. The partially treated water will undergo radium removal in radium settling ponds and then will be disposed in the land application systems.

RO will not be used if there are no deep disposal wells available to accept the RO brine. Instead, clean makeup water from the Madison Limestone or another suitable formation will be injected into the well field(s) at a flow rate sufficient to maintain the restoration bleed. As before, the restoration bleed typically will be 1% of the restoration flow rate unless the optional groundwater sweep method is used.

The water quality of the Madison Limestone is expected to be equal to or better than the baseline ore zone water quality, and injection of Madison Limestone water therefore will be similar to injection of permeate under the deep disposal well option.

6.2.2.1.3 Optional Groundwater Sweep

Although a 1% restoration bleed will be adequate to maintain hydraulic control of well fields undergoing active aquifer restoration, additional bleed may be required at times. For example, additional restoration bleed may be used to recover flare of ISR solutions outside of the well field pattern area. In addition to the restoration methods described above, 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%.

6.2.2.2 Effectiveness of Groundwater Restoration Techniques

This section describes how the groundwater restoration process that will be conducted in accordance with NRC license requirements is the same process that has been used successfully at other NRC and agreement state-licensed facilities. The preferred groundwater restoration method is RO treatment with permeate injection. This is the aquifer restoration method that will be used if deep disposal wells are used to dispose treated wastewater. As described in Section 2.5.3 of NUREG-1910 (NRC, 2009), this method of aquifer restoration is responsible for returning "total dissolved solids, trace metal concentrations, and aquifer pH to baseline values." RO treatment with permeate injection has proven effective at achieving successful aquifer restoration as described in Uranium One (2008):

> Results of the effectiveness of groundwater sweep (or lack of it) were clearly demonstrated in the Christensen Ranch Wellfield Restoration report (CRWR) (COGEMA 2008[a]). Example plots from that report of mean well field water quality at the end of mining, groundwater sweep, RO and stabilization monitoring... indicate minimal improvement following groundwater sweep at MU3 and MU5 and an actual increase [in dissolved constituents] at MU6. Following application of RO, the TDS values at MU5 and MU6 decreased to levels below the target Restoration Goal. Uranium increased in MU5 and MU6 following groundwater sweep...and then was significantly lowered during RO. Approximately 1.8, 4.8 and 1.5 PVs of groundwater were removed from MU3, MU5 and MU6, respectively, during groundwater sweep. This water removal was totally consumptive by design, in that none of it was returned to the aquifer.
>
> Based on the results, minimal benefit, if any, was derived from [the groundwater sweep] phase of restoration. Eliminating groundwater sweep, an unnecessary, ineffective and consumptive step in the restoration process, will reduce the number of PVs required to reach restoration goals.
>
> Terminating RO once water quality has stabilized will minimize the consumptive use of groundwater and reduce the number of PVs of treatment.

6.2.2.3 Pore Volume Calculations and Restoration Pore Volumes

The formulas for determining the pore volume and the volume of restoration composite (RC) to be withdrawn during groundwater restoration are as follows:

Pore volume = (well field pattern area) x (thickness) x (porosity) x (flare factor)

RC volume = (pore volume) x (number of pore volumes for groundwater restoration)

The thickness is the average thickness of the mineralized zones as determined by down-hole radiological logging. This is the same as the average screened interval, since screens will be completed only across the targeted ore zone (see Section 5.3.3.1.1). The average thickness in the permit area is 4.6 feet.

The porosity (collective open space of the formation) of the ore zone within the permit area was determined by laboratory analysis of core samples. Based on 11 measurements of ore zone porosity from core samples of the Fall River and Chilson host sands, the average porosity of the ore zone sands within the permit area is 30 percent (0.30).

The proposed flare factor is 1.44, accounting for both horizontal and vertical flare of lixiviant during ISR operations. Support for the flare factor is contained in the numerical groundwater modeling results presented in Appendix 6.2-A. Appendix 6.2-A describes how horizontal flare from a modeled balanced well field was determined to be 1.19. Vertical flare is expected to be similar to or less than the horizontal flare since the horizontal conductivity is greater than vertical conductivity. An overall flare factor of 1.44 is supported by the numerical modeling results presented in Appendix 6.2-A.

The flare factor and number of pore volumes required for groundwater restoration are both a function of the properties of the particular sandstone formations and ore deposits, as well as the operational factors of aquifer bleed rates, the balancing of pattern flow rates, the use of RO during groundwater restoration and the timeliness of beginning groundwater restoration operations following cessation of recovery operations. For the Dewey-Burdock Project, the values of the flare factor and the number of pore volumes removed for groundwater restoration are comparable to those that have been approved recently for other ISR facilities and are consistent with the best practicable technology for groundwater restoration.

The overall (horizontal and vertical) flare factor for ISR uranium projects has varied from 1.44 at Irigaray/Christensen Ranch (COGEMA, 2008 and COGEMA, 2005) to 1.95 at Churchrock/Crownpoint (HRI, 2001). The overall well field flare factor for the Dewey-Burdock Project is estimated to be 1.44, which is equal to the flare factor in approved NRC license applications at ISR facilities located nearby in the State of Wyoming and is supported by numerical groundwater modeling.

The number of pore volumes, including flare, of groundwater to be removed to achieve aquifer restoration is estimated to be 6.0. This number has been proposed for NRC review and verification (Powertech, 2011) and is subject to change pending NRC review of the financial assurance estimate prior to ISR operations. This number is consistent with the best practicable technology that includes the following operational practices:

(i) Daily balancing of injection and extraction flow rates during production. This flow rate balancing is designed to ensure that a proper aquifer bleed is maintained both at the well field level and also within each 5-spot pattern within the well field.
(ii) Timeliness of beginning restoration operations. For any particular well field, aquifer restoration operations will begin as soon as is reasonably possible following the cessation of recovery operations.
(iii) Maintenance of aquifer bleeds. Hydraulic control of well fields through the net withdrawal of the aquifer bleed stream will be continuously maintained from the beginning of recovery operations until the end of active aquifer restoration.

While the number of pore volumes required for aquifer restoration historically has proven to have been significantly higher for some of the early ISR uranium projects, the methods and timing of restoration likely contributed to these larger numbers. The following information was obtained from the Moore Ranch license application (Uranium One, 2008).

> The average number of PVs extracted and treated/reinjected/or disposed was 13.6 for Irigaray and 12.4 for Christensen ... Circumstances at both those ISR projects resulted in increased PVs to achieve restoration goals including the following:
>
> - Production and restoration were not conducted sequentially, and were plagued with extended periods of shut-in and standby, with delays of up to several years in some cases;
> - Groundwater sweep, the initial phase of restoration, was often largely ineffective and in some cases may have exacerbated the problem; and
> - RO was continued in some well fields after it was apparent that little improvement in water quality was occurring.
>
> Restoration was not performed immediately following the completion of production, and in some cases, there were long periods of inactivity during the production and restoration phases. At Irigaray, production was interrupted for a period of almost six years in MU1 through MU5 ... Similarly, there was a three-year break in production in MU6 through MU9, when the operation was in standby status. Restoration did not commence at MU1 through MU3 until a year after production had ended. At MU4 and MU5, restoration

operations did not begin until two years following production. Restoration commenced shortly after the end of production at MU6 through MU9. However the project was on standby status between the completion of groundwater sweep and the beginning of the RO phase of production, resulting in a break of one to two years, depending on the MU. Restoration was initiated sooner after the end of production at Christensen Ranch, with the exception of MU3 and MU4. However, there were periods of standby between groundwater sweep and RO treatment/injection of up to a year. These delays between and during production and restoration operations most likely increased the number of PVs required to complete aquifer restoration.

Pore volume and restoration composite calculations are presented in Appendix 6.7-A.

6.2.2.4 Potential Environmental Impacts of Groundwater Restoration

Based on the success of groundwater restoration at other ISR facilities, Powertech (USA) expects that the proposed groundwater restoration techniques will be successful at returning the production zones to TRGs. The purpose of restoring the groundwater to these indicator parameters is to protect USDWs adjacent the aquifer exemption boundary. Using proven best practicable technology for groundwater restoration combined with federal and state regulatory requirements will ensure that potential impacts to groundwater quality outside the production zone are mitigated.

The preferred method of restoration consists of using the groundwater treatment method with RO reject brines being treated for radium removal and disposed in Class V disposal wells. This method minimizes the amount of groundwater that will be consumed during restoration, and minimizes the surface disturbance to land within the permit boundary. Disposal of wastewater in deep disposal wells is the best practicable technology and is the standard method used at most ISR facilities. The alternate method of land application would consume more groundwater since none of the restoration water would be recycled to the well field, but would be used in a once-through process leading to land application.

The proposed restoration methods will consume groundwater. Groundwater recovered during groundwater restoration is typically disposed of directly in the wastewater system. Consumption of groundwater is an unavoidable consequence of groundwater treatment; potential impacts and water usage during operations is discussed in more detail in Section 5.6.3.

6.2.2.5 Groundwater Restoration Monitoring

Refer to Section 5.5.1.3 for a discussion of groundwater restoration monitoring, including monitoring the progress of active restoration, excursion monitoring during groundwater restoration, and stability monitoring.

6.3 Decontamination and Decommissioning

Following regulatory approval of successful groundwater restoration in all well fields, Powertech (USA) will decommission all well fields, processing facilities, ponds, and equipment within the permit area. Decontamination and decommissioning activities will be done in accordance with NRC license and DENR LSM permit requirements. During decommissioning, all well field equipment (including pumps, tubing, pressure transducers, well head covers and surface piping and equipment), pipelines, header houses, processing buildings/equipment, and pond liners will be surveyed for radiological contamination and decontaminated for unrestricted release, transferred to an NRC or NRC agreement state-licensed facility, or disposed at an appropriately permitted facility. Surface soils will be surveyed for radiological contamination and affected soils removed and appropriately disposed. Surface reclamation and revegetation will be conducted in accordance with DENR LSM permit requirements. The decontamination and decommissioning program described below will ensure that the permit area is closed in a manner that permits release for unrestricted use.

6.3.1 Disposal of Process Buildings, Equipment and Other Facilities

The procedures for removing and disposing of structures and equipment include the establishment of surface contamination limits, preliminary radiological surveys of process building surfaces, equipment and piping systems; strategic cleanup and removal of process building materials and equipment, sorting materials according to contamination levels and salvageability, and preparing materials for transport and offsite use or disposal. Although not mentioned hereafter, the procedures also apply to tools and other equipment, such as backhoes.

All decommissioning activities will be done in accordance with NRC license requirements and the provisions of ARSD 74:29:07:13.

6.3.1.1 Establishment of Surface Contamination Limits

Powertech (USA) will use surface contamination release limits approved by NRC to release material and equipment that potentially has come into contact with NRC licensed material.

Surface contamination release limits for surfaces on structures intended for unrestricted release following decommissioning are subject to Criterion 6(6) of Appendix A to 10 CFR 40. Acceptable dose-based surface contamination release limits will be established using the RESRAD-Build model or an equivalent model and will be provided in the final decommissioning plan, which will be submitted to NRC 12 months prior to any planned decommissioning. In the decommissioning plan, Powertech (USA) will assume that all premises, equipment, or scrap likely to be contaminated in excess of limits, but that cannot be measured, is contaminated in excess of limits and will be treated accordingly.

6.3.1.2 Preliminary Radiological Surveys and Contamination Control

Powertech (USA) will develop one or more characterization plans will be followed to demonstrate compliance with the surface contamination limits for building materials, systems, and equipment. The characterization plan(s) will include guidance and SOPs to conduct the preliminary surveys and control contamination. Powertech (USA) will prepare procedures for performing radioactivity measurements on the interior surfaces of pipes, drain lines, and ductwork, and include the procedures in the decommissioning plan. Such plans will include measurements at all traps and other access points where contamination is likely to be representative of system-wide contamination.

Areas within buildings showing evidence of possible penetration of process solutions will be evaluated for possible subsurface contamination. If building materials, slabs and soils beneath the slabs are not contaminated, the buildings shall be released for unrestricted use, provided the building surfaces meet the release criteria and radiological monitoring requirements of the characterization and verification plans. Otherwise, the buildings will be demolished, the slabs removed, and the underlying soils removed (if contaminated). All materials contaminated above release limits will be prepared for offsite disposal at a licensed disposal facility. Contamination control will be addressed using operational SOPs, in conjunction with radiological surveys.

Concrete slabs will be surveyed and if found to contain radionuclides in excess of the release limits, an attempt will be made to decontaminate the concrete slab(s). If after a second survey radionuclides are in excess of the release limits, the concrete will be broken up and disposed at a licensed 11e.(2) disposal site. If the survey results indicate that the concrete is not contaminated above release limits, it may be disposed in an appropriately permitted landfill, used for fill elsewhere, or left in place for use by the landowner.

6.3.1.3 Removal of Process Building and Equipment

Powertech (USA) will develop plans for the strategic removal of process building and equipment, based on inventory, the results of the radiological surveys, decontamination options and available methods, reuse/disposal pathways, and information obtained during the effort. To the extent possible, Powertech (USA) intends to decontaminate salvageable equipment for unrestricted release. Decontamination methods may include a combination of washing, high pressure sprays, or steam cleaning. Cleaned surfaces will be air-dried prior to radiological monitoring. The ALARA principle applies to decommissioning activities. As such, surface contamination will be reduced to levels as far below applicable limits as practical.

Powertech (USA) will document the results of radiological surveys for all building materials, systems, and equipment. These items will be sorted as follows:

- Salvageable and contaminated above release limits (not releasable but potentially disposable or transferrable)
- Salvageable and contaminated below release limits (releasable) for unrestricted use
- Not salvageable and contaminated above release limits (offsite disposal at a facility licensed to accept 11e.(2) byproduct material)
- Not salvageable and contaminated below release limits (offsite disposal at a permitted facility)

In the first case, the item may be transferred to another NRC or agreement state licensee. If it cannot be transferred or decontaminated to be released for unrestricted use, it will be disposed at a licensed disposal facility. In all cases, Powertech (USA) will strictly maintain an inventory of all process building and equipment and the results of radiological surveys.

6.3.1.3.1 Building Materials, Equipment and Piping to be Released for Unrestricted Use

Powertech (USA) will develop an approved SOP for release of items for unrestricted use and thoroughly document all items eligible for release for unrestricted use. To the extent possible, releasable items having a salvageable value will be sold on the industrial market. Releasable items having no net salvageable value will be sent to a municipal landfill.

6.3.1.3.2 Preparation for Disposal at a Licensed Facility

All materials and plant equipment unsuitable for unrestricted release will be prepared for offsite disposal at a licensed facility. Building materials, tools, and equipment destined for offsite

disposal will be prepared for transportation and disposal in accordance with 49 CFR and other applicable requirements.

6.3.1.4 Pond Decommissioning

All liquid waste from ponds will be disposed by deep well injection in one or more deep disposal wells within the permit area or by land application. Any sludge accumulated in the ponds and the primary pond liners will be removed and disposed as 11e.(2) byproduct material. The leak detection equipment, including piping, aggregate, and secondary liners, will be surveyed for contamination. The soil underneath the ponds also will be surveyed for radiological contamination. Any materials in which concentrations exceed limits for unrestricted use will be disposed as 11e.(2) byproduct material at a licensed disposal facility. All pond materials including secondary liners will be removed and disposed as 11e.(2) byproduct material or as solid waste. Confirmation surveying and sampling will be conducted in accordance with applicable requirements to ensure all contaminated material has been removed. The excess pond material used to construct pond embankments or stored in designated spoil stockpiles will be used to backfill the ponds. The backfill will be compacted to avoid subsidence. The area then will be contoured, topsoil replaced, and revegetated as described in Section 6.4.3.

6.3.2 Well Field Decommissioning

6.3.2.1 Injection, Production and Monitor Wells

All pumps and tubing will be removed from the wells along with well head covers and surface piping and equipment. Pressure transducers also will be removed from the wells. Piping, pumps, and equipment will be surveyed for radiological contamination and decontaminated or disposed following procedures described in Sections 6.3.1.2 and 6.3.1.3.

Injection, production and monitor wells will be plugged and abandoned following the procedures in Section 6.3.3.

6.3.2.2 Header House Decommissioning

During decommissioning of each well field, the affected header houses will be moved to a new location in the permit area, decontaminated for unrestricted release or disposed at licensed facility. The soil underneath and surrounding the header houses will be surveyed for radiological contamination and contaminated soil will be disposed at a licensed disposal facility. The area around each header house then will be contoured, topsoil replaced, and revegetated as described in Section 6.4.3.

6.3.2.3 Pipeline and Utility Decommissioning

Topsoil will be windrowed along pipeline and utility routes, and buried piping and utilities will be excavated. Piping will be decontaminated for unrestricted release or disposed in a licensed disposal facility. A grinder or shredder may be used to reduce the volume of disposed pipe material. Topsoil will then be replaced and the area will be seeded as discussed in Section 6.4.3.

6.3.3 Well Plugging and Abandonment

Powertech (USA) will plug all wells in accordance with ARSD 74:02:04:67 with bentonite or cement grout. The weight and composition of the grout will be sufficient to control artesian conditions and meet the well abandonment standards of the State of South Dakota. Cementing will be completed from total depth to surface using a drill pipe. Records will be kept of each well cemented including at a minimum the following information:

- well ID, total depth, and location
- driller, company, or person doing the cementing work
- total volume of grout placed down hole
- viscosity and density of the grout

Powertech (USA) will remove surface casing or cut off surface casing below ground and set a cement surface plug on each well plugged and abandoned.

6.3.4 Soil Decontamination

Surface soils will be cleaned up in accordance with NRC license requirements and DENR permit requirements. The following section describes the methods for establishing site-specific cleanup criteria, monitoring during excavation of contaminated soil, and verification sampling following clean up.

6.3.4.1 Cleanup Criteria

Surface soils will be cleaned up in accordance with requirements contained in 10 CFR Part 40, Appendix A, including considerations of ALARA goals and the chemical toxicity of uranium. In accordance with NRC license conditions, Powertech (USA) will establish a radium benchmark dose, determine the natural uranium soil standard as a function of background concentrations and potential impacts, and perform a uranium chemical toxicity assessment. Cleaning up soils within the permit area to meet cleanup criteria approved by NRC will ensure that public exposure is within permissible limits and that radionuclide levels in soil are ALARA.

6.3.4.2 Excavation Control Monitoring

The purpose of excavation control monitoring will be to guide the removal of contaminated material to the point where it is highly probable that an area meets the cleanup criteria.

Gamma surveys will be relied on to guide soil remediation efforts. At least 12 months prior to commencing reclamation, Powertech (USA) will submit a decommissioning plan to NRC that will contain descriptions of methodology for both pre- and post-reclamation gamma-ray surveys This will include the use of a methodology for gamma-ray surveys for excavation control monitoring and final status surveys that will provide 95% confidence that the survey units will meet the cleanup guidelines.

The post-operation (pre-decommissioning) radiological survey will consist of an integrated area gamma survey and confirmation soil sampling and analysis to verify the areas requiring cleanup. The areas that will receive particular attention are those that are expected to have higher readings than surrounding areas and include diversion ditches, surface impoundment areas, well fields (particularly those areas where spills or leaks may have occurred), process structures, storage areas, and on-site transportation routes for contaminated material and equipment. Areas associated with wastewater disposal also will receive close attention. The surveys will identify soil contamination that exceeds the cleanup criteria and will be used to guide the cleanup efforts. After cleanup, the surveys will be used, in conjunction with surface soil sample analyses, to verify cleanup to the site cleanup criteria. Remediation will continue in areas not meeting action levels. This iterative procedure will be applied until all areas are determined to meet the action levels.

6.3.4.3 Surface Soil Cleanup Verification and Sampling Plans

Powertech (USA) will comply with the NRC license cleanup standards to ensure that public exposure is within permissible limits and that radionuclide levels in soil are ALARA. Compliance with cleanup criteria will be evaluated in terms of soil concentrations, which will be supplemented by field surveys employing gamma-ray measurements. A final gamma survey of the affected area and buffer zone will be performed using the GPS-based equipment or conventional equipment. Affected areas are those areas that have greater potential to be impacted by uranium solutions, dried uranium product (yellowcake) or liquid or solid waste streams that contain uranium or other radionuclides associated with uranium recovery operations. The areas that are most likely to be considered affected areas include diversion ditches, surface impoundment areas, well fields (particularly those areas where potential spills or leaks may have occurred),

process structures, storage areas, on-site transportation routes for contaminated material and equipment, and areas associated with wastewater disposal.

A calculation of the potential peak annual total effective dose equivalent (TEDE) within 1,000 years to the average member of the critical group that would result from applying the radium standard (not including radon) on the site will be submitted to NRC for approval. Details will be provided in the decommissioning plan to be submitted for NRC review at least 12 months prior to decommissioning activities.

6.3.4.4 Quality Assurance

Prior to operations, Powertech (USA) will prepare a Quality Assurance Project Plan (QAPP) in accordance with NRC regulatory requirements. The QAPP will establish the quality assurance and control measures for field measurement, sample collection, and laboratory analysis for all decommissioning activities. The QAPP also will establish performance criteria for field and laboratory data precision, accuracy, completeness, and representativeness. The program will be designed to ensure that the permit area is closed in a manner that permits release for unrestricted (i.e., any) use.

Powertech (USA) management will check all aspects of data collection and input to verify that procedures are being followed. The collection and handling of samples from the facility decommissioning, soil cleanup, and other radiological cleanup areas will be reviewed and approved by management. Laboratory results for these samples will be evaluated and validated to requirements in the QAPP. Other aspects of the reclamation including adherence to the SOPs and adherence to the decommissioning plan will be evaluated periodically by Powertech (USA) management. The construction process will be monitored to confirm that appropriate physical and radiological safety procedures are followed. Excavation processes will be monitored to ensure that contaminated materials are not handled carelessly and that any spillage is collected and contained. The conveyance of contaminated materials through the site, e.g., to stockpiling areas, will be monitored to prevent dispersal of these materials in the environment. Construction and sampling activities will be documented and reviewed throughout the reclamation process.

6.3.5 Health Physics and Radiation Safety during Decommissioning

The health physics and radiation safety program for decommissioning will ensure that occupational radiation exposure levels will be kept ALARA during decommissioning. A radiation safety officer or radiation safety technician will be on site during any decommissioning activities where a potential radiation exposure hazard exists. In general, the radiation safety

program will be used as the basis for development of the decommissioning health physics program. Health physics surveys conducted during decommissioning will be guided by applicable NRC regulations and license conditions.

6.3.6 Records and Reporting Procedures

At the conclusion of site decommissioning and surface reclamation, a report containing all applicable documentation will be submitted to the NRC. Records of all contaminated materials transported to a licensed disposal site will be maintained for 5 years, or as otherwise required by applicable regulations at the time of decommissioning.

6.4 Plans and Schedules for Reclaiming Disturbed Lands

Final reclamation will be initiated during the course of ISR on affected lands that will not be disturbed again and where it will not adversely affect other ISR activities in accordance with ARSD 74:29:08:03. All disturbed lands will be reclaimed to meet the designated postmining land uses. All buildings and structures will be decontaminated to regulatory standards and demolished and trucked to an approved disposal facility. Baseline soils, vegetation, and radiological data will be used as a guide in evaluating the final reclamation. As required by ARSD 74:29:08:01, concurrent reclamation will be conducted during all phases of the operation.

6.4.1 Postmining Land Use Plan

Surrounding existing land uses include rangeland and woodland grazing, residential development, and agriculture. A multiple-use Reclamation Plan was formulated that is in keeping with the land use objective for the adjacent properties and will provide a significant beneficial use of the permit area at closure. The specific types of reclamation proposed are rangeland (ARSD 74:29:07:20) and agricultural or horticultural crops (ARSD 74:29:07:21). In conformance with ARSD 74:29:06:01, these reclamation types were discussed in conference with DENR and the property owners of the affected area in a meeting held on May 10, 2012. Appendix 6.4-A contains the postmining land use consultation forms for all landowners within the permit area. As discussed in Section 3.1.2, there are existing residences within the permit area. Powertech (USA) does not plan to build any homesites within the permit area.

According to ARSD 74:29:06:02 (2), the rangeland and agricultural or horticultural crop land use types must be compatible with surrounding lands and must be: (a) obtainable according to data on expected need and market; (b) supported by commitments from public agencies where appropriate; (c) practicable on the basis of private financial capability for completion of the proposed operation; (d) planned pursuant to a schedule included in the reclamation plan that

integrates the mining operation and reclamation with the postmining land use; (e) consistent with existing state and local land use plans and programs; and (f) of a beneficial use. Following is a description of how the postmining land uses of rangeland and agricultural or horticultural crops meet all of the criteria listed above.

(a) Obtainable According to Data on Expected Market and Need

Appendix 6.4-D describes how for rangeland, two of the criteria to determine revegetation success will be usable forage production and revegetation sustainability. These two parameters will demonstrate that the reclaimed rangeland has at least the same livestock carrying capacity as reference areas. For agricultural or horticultural cropland, the final bond release criterion will be a demonstration that the productive capacity is equal to or exceeds that of similar crop production areas in nearby comparison areas. Powertech (USA) will maintain adequate financial assurance to ensure that areas can be reclaimed to the approved postmining land uses.

(b) Supported by Commitments from Public Agencies where Appropriate

Powertech (USA) is not aware of the need for any commitments from public agencies to support the postmining land uses of rangeland or agricultural or horticultural cropland.

(c) Practicable based on Powertech (USA)'s Financial Ability to Perform Reclamation

As described in Section 6.7.1, Powertech (USA) will maintain financial assurance instruments to cover the cost of all reclamation and decommissioning activities, including reclamation and revegetation of affected areas.

(d) Planned Pursuant to a Schedule that Integrates Mining and Reclamation with Each Postmining Land Use

Sections 6.5 and 6.6 present the schedules for reclamation and reclamation monitoring. Well field reclamation will be carried out concurrently with ISR operations. After uranium recovery is no longer economical in each well field, groundwater restoration will be completed followed by well field reclamation. The minimum period of vegetation establishment for rangeland and agricultural or horticultural cropland prior to evaluation for final financial assurance release will be 3 years.

(e) Consistent with Existing State and Local Land Use Plans and Programs

The postmining land uses of rangeland and agricultural or horticultural cropland are the same as the predominant premining land uses in the proposed permit area. Therefore, they are expected to be consistent with existing state and local land use plans and programs.

(f) Beneficial Use

The postmining land uses of rangeland and agricultural or horticultural cropland are the same as the predominant premining land uses in the proposed permit area. These uses will have economic value to the landowners and thus they meet the definition of "beneficial use" in ARSD 74:29:01:01.

The proposed postmining land uses within the permit boundary are presented on Plate 6.4-1, which also depicts the proposed postmining topography. Due to limited disturbance, the proposed postmining topography is the same as the premining topography and is consistent with the postmining land use.

6.4.1.1 Rangeland

In conformance with ARSD 74:29:06:02(1), rangeland reclamation will follow guidelines established in ARSD 74:29:07:20 including: the reclaimed rangeland will have the capability to support a livestock carrying capacity that is equivalent to that of the surrounding area or to that of the reference area, if used; reclaimed slopes will not exceed 3:1 unless steeper slopes are approved by DENR; newly seeded areas will be fenced if it is necessary to preclude livestock or wildlife from impairing establishment of the required vegetation; and reclamation will be considered complete when the reclaimed range is capable of withstanding proper stocking rates for 2 consecutive years prior to bond release. Powertech (USA) has developed reclamation practices through consultation with the Custer County and Fall River County conservation districts and DENR to ensure that the requirements for reclaiming the land to rangeland are accomplished. Monitoring per the recommendations outlined in Powertech (USA)'s Dewey-Burdock Project Reclamation Performance Criteria document (provided in Appendix 6.4-D) will determine rangeland reclamation success. The monitoring plan has been developed in accordance with ARSD 74:29:06:02(3), which requires support and maintenance activities documenting successful implementation of reclamation.

6.4.1.2 Agricultural or Horticultural Crops

In conformance with ARSD 74:29:06:02(1), agricultural or horticultural crops reclamation will follow guidelines established in ARSD 74:29:07:21. The reclaimed agricultural or horticultural land will have the capability of producing crops consistent with similar crop production areas in the surrounding region, and the reclamation will be considered complete when productive capability is equivalent to or exceeds similar crop production areas in the surrounding region for 2 consecutive crop years. Monitoring will be performed in accordance with ARSD 74:29:06:02(3), which requires support and maintenance activities documenting successful implementation of reclamation.

Alfalfa is the only crop currently proposed for reclamation of designated agricultural or horticultural cropland in the proposed permit area. Alfalfa is the only crop currently grown in the proposed permit area and is grown in several areas nearby, so comparative production figures from nearby areas will be readily available. Alfalfa production in reclaimed cropland will be compared with that in undisturbed areas within or adjacent to the permit area. According to the landowner who grows alfalfa within the proposed permit area, the average annual alfalfa production over the past 10 years is 1.75 tons per acre (personal communication between John Putnam and Lisa Scheinost, Powertech (USA), January 4, 2013). Powertech (USA) will provide DENR with annual crop yields within the permit area beginning in 2013, with updates each year prior to and during ISR operations and during reclamation.

All disturbed areas with a delineated postmining land use of agricultural or horticultural crops will have an alternate postmining land use of rangeland. In the event that these agricultural or horticultural croplands are not desired by the landowner to be used as cropland following reclamation, the land will be designated as rangeland and will follow guidelines established in ARSD 74:29:07:20 for rangeland reclamation, as described above.

6.4.2 Interim Revegetation

Interim revegetation is the process of temporarily stabilizing grounds which are scheduled to be re-disturbed before the completion of mining. Portions of the permit area which will receive interim revegetation treatments include topsoil stockpiles, well fields, and pipelines. Because of the limited availability of salvageable topsoil material, some disturbed areas subject to interim reclamation will be directly seeded without the replacement of topsoil material. Straw mulch may be applied at the time of seeding to further improve and accelerate planting success; however, such applications will be site specific. Topsoil stockpiles which are to remain

undisturbed for more than 2 years will be regraded to a stable configuration, bermed, and seeded in accordance with ARSD 74:29:08:02. Interim seeding will be done with the same seed mixture as the final seeding mixture shown in Table 6.4-1 to ensure that all interim reclamation is compatible with final reclamation when it occurs. The letter of concurrence with this seed mixture from the local NRCS office is provided in Appendix 6.4-B, and letters of concurrence with this seed mixture from landowners are presented in Appendix 6.4-A.

6.4.3 Surface Disturbance Reclamation

Due to the nature of ISR activities, minimal and intermittent surface disturbance will be associated with the project, and will be mainly associated with the CPP, Satellite Facility, and ancillary facilities such as ponds. Additional intermittent disturbance will occur in the well fields, including well drilling, pipe installations, and road construction.

Surface disturbances associated with the construction of the CPP, Satellite Facility, and ponds will be for the life of those activities. Topsoil will be stripped and stockpiled from these areas prior to construction. Disturbances associated with the well field drilling and pipeline installation are limited and will be reclaimed as soon as possible after these components are completed. The topsoil will be temporarily stripped and stockpiled from well field disturbance areas prior to well field construction. Surface disturbance associated with the development of

Table 6.4-1: Reclamation Seed Mixture

Seed Species	PLS Full Rate (lb/ac)	Percent in Mixture	PLS Rate (lb/ac)
Western wheatgrass	9.72	20	1.94
Sideoats grama	7.26	20	1.45
Slender wheatgrass	7.03	20	1.41
Green needlegrass	7.26	20	1.45
Little bluestem	4.57	20	0.91
Total		100	7.16

Source: NRCS, 2012; see Appendix 6.4-B

Note: This mix was specified by NRCS for a "drill" seeding application. If mix is to be broadcast, a packing/covering operation must be performed after the seeding. Also, seeding rates must be increased by 2.5 times for a broadcast operation.

access roads also will occur; topsoil will be stripped from the road areas and stockpiled prior to construction.

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.

Powertech (USA) will restrict grazing on newly seeded areas if it is necessary to preclude livestock or wildlife from impairing establishment of the required vegetation. Possible means to restrict grazing could include, but are not limited to, fencing and working with landowners to voluntarily withhold grazing from areas containing reclamation.

6.4.3.1 Spoil Replacement and Grading

Following is a description of the general spoil replacement and grading activities followed by specific methods for mud pits, processing areas, land application areas, and access roads.

General Methods

During reclamation, spoil will be replaced from areas previously excavated, including pond and diversion channels. Spoil will be replaced in lifts and compacted as necessary to match premining conditions.

Due to the nature of uranium ISR, there will be very few construction activities that will require significant grading or contouring during reclamation. Finish grading will be achieved with typical earth moving equipment such as motor graders. Disturbed areas will be contoured to blend in with the natural terrain. Reclaimed slopes will not be steeper than 3:1 unless DENR approves steeper slopes. The postmining contours will be approximately the same as premining contours, as shown on Plate 6.4-1. Protection of areas outside of the affected graded areas from slides or other damage will be accomplished by avoiding the use of highwalls, contouring disturbed areas to blend in with the natural terrain, and not constructing reclaimed slopes steeper than 3:1 unless DENR approves steeper slopes.

The finished, contoured surface will be ripped as needed prior to topsoil replacement to relieve compaction, aid infiltration, promote root penetration, and prevent topsoil slippage and instability.

A sediment control plan will be implemented during all project phases, including final grading, to reduce soil loss within the proposed permit area. The sediment control measures discussed in Section 5.3.9 will be maintained and inspected until contributing areas are reclaimed. Sediment control structures are described in Section 5.3.9.3 and include silt fence, check dams, sediment

traps, and sediment ponds. During final grading, Powertech (USA) will identify potential sources of pollution and determine BMPs to be used, including erosion and sediment controls.

In accordance with ASD 74:29:07:04(4) and (5), all disturbed areas will be graded to eliminate depressions that could accumulate water and to match premining topography, and any altered drainages will be returned to original functionality during the final grading process.

Specific Methods

Following is a description of the spoil replacement and grading methods for well field mud pits, processing facilities, land application areas, and access roads.

Mud Pits

As described in Section 5.3.7, topsoil will be separated from subsoil during excavation of mud pits. When use of each mud pit is complete, the subsoil will be redeposited in the mud pit followed by replacing topsoil. Prior to topsoil replacement, the subsoil will be graded to match premining topography.

CPP and Satellite Facility

During reclamation, the CPP and Satellite Facility process buildings and equipment will be removed as described in Section 6.3.1.3. The processing facility areas will be regraded to approximate premining topography, and topsoil stockpiled near the facilities will be replaced. Section 6.5 describes how facility reclamation, including the CPP and Satellite Facility, will occur following well field reclamation. The expected duration of final grading and reclamation activities at the CPP and Satellite Facility is approximately 2 years, as shown in Figure 5.2-1.

Land Application Areas

The topography in the land application areas will remain unchanged except for minor areas of grading to reduce slopes. Prior to disturbance, topsoil will be stripped from these areas. Topsoil will be temporarily replaced in the areas of minor grading. Topsoil may be spread on the catchment areas and catchment berms, or it may be temporarily stockpiled near the catchment areas for replacement during final reclamation. Following groundwater restoration in all well fields and disposal of all wastewater via deep disposal wells and/or land application, land application areas will be reclaimed. Disturbed areas will be regraded to approximate premining contours, including areas of minor grading to reduce slopes or construct catchment areas and catchment berms. Topsoil will be stripped prior to regrading and replaced after regrading. The

anticipated duration of land application reclamation is 1 year. It will be done during the CPP and main facility decommissioning phase shown on Figure 5.2-1.

Access Roads

Access road reclamation is described in Section 6.4.3.3.

6.4.3.2 Topsoil Replacement

Refer to Section 5.3.7 for a description of topsoil handling during construction. In areas that will be disturbed for prolonged periods during the life of the project (i.e., more than one construction season), topsoil will be salvaged and stored in designated topsoil stockpiles. Topsoil will be removed by scrapers under most circumstances, although other mobile equipment may be used occasionally. The topsoil salvaged for pipeline construction corridors may be bladed to the side to permit pipeline construction and then bladed back after construction is complete. Field salvage operations will be monitored by qualified field personnel. Topsoil stripping depths will vary throughout the permit area, but are expected to average approximately 19.5 inches (refer to Appendix 3.3-A). During reclamation, topsoil temporarily stored in stockpiles will be redistributed over the originally disturbed area. The replacement depth will be calculated based on the stockpile volume and the area to be reclaimed. The amount of topsoil salvaged is estimated to be the same as the amount replaced, such that there is not anticipated to be excess or limited topsoil. Powertech (USA) does not anticipate using topsoil substitutes. The topsoil will be graded to blend with the adjacent topography.

In areas of temporary disturbance such as those affected by the installation of monitor wells and pipelines, topsoil will be separated from subsoil during construction and replaced following subsoil replacement. The topsoil will be replaced over the entire disturbed area using a uniform depth based on the amount of topsoil that was salvaged. The topsoil will be replaced at an approximately 1:1 ratio from the area from which it was stripped to ensure that sufficient topsoil will be available for final reclamation in accordance with ARSD 74:29:07:07(2)(c). Following topsoil replacement, interim revegetation will be performed to control erosion as described in Section 6.4.2. Interim revegetation will use the same seed mixture as the final seeding mix to ensure that the topsoil or subsoil capacity and productive capability is not diminished by the distribution and can be restored in accordance with the requirement of ARSD 74:29:07:07(2)(a). Revegetating areas of interim reclamation and using erosion control BMPs as necessary will ensure that the topsoil in areas of temporary disturbance will be protected from erosion in accordance with the requirement of ARSD 74:29:07:07(2)(b).

As described in Section 5.3.7, Powertech (USA) will analyze topsoil prior to stripping in the processing areas and the first well field in each of the Dewey and Burdock areas to determine whether fertilizer or other amendments will be required to establish and sustain vegetative growth during reclamation. In addition, in areas of poor baseline vegetative cover, Powertech (USA) may analyze the topsoil to determine whether fertilizer or other amendments will be required to establish and sustain a vegetative cover on reclaimed areas. See also Section 6.4.3.4 for a discussion of areas with low vegetative cover densities that likely will have low revegetation potential if disturbed. These include the Darrow Mine surface pits/spoil piles and the "alkali area." In only very limited areas, which are anticipated to include the historical mine pits and the alkali area (notwithstanding the processing areas and initial well fields, which are described in Section 5.3.7), Powertech (USA) will sample the topsoil and subsoil prior to disturbance. If the evaluation demonstrates that its chemical or physical characteristics would seriously inhibit plant growth and that it is not feasible to remedy by chemical treatment, overburden replacement, or like measures, Powertech (USA) will request that the revegetation performance criteria not apply for these limited areas as allowed by SDCL 45-6B-46(2).

6.4.3.3 Access Road Reclamation

All roads and portions of roads constructed and utilized for access to the facilities and well fields will be removed and reclaimed unless exempted from reclamation by the request of the landowner/lessee, in which case the landowner/lessee will accept the responsibility for their long-term maintenance and ultimate reclamation. In this case, Powertech (USA) will request in writing to the board that a road or portion of a road remain un-reclaimed in accordance with ARSD 74:29:07:12(10).

Prior to reclamation, any contamination which resulted from the ISR operation will be cleaned to NRC-approved standards and the contaminated material disposed offsite at an appropriately permitted facility.

Access roads will be reclaimed by removing imported road surfacing material and ripping road surfaces and shallow subsoil to loosen the subsoil. Culverts will be removed and premining drainages re-established. Any spoil temporarily stockpiled during access road construction will be replaced. Access road areas will be graded to approximate premining contours. Topsoil will be replaced in a uniform manner and the area revegetated.

Access roads will be reclaimed when they are no longer needed. Well field access roads will be reclaimed during reclamation of each well field unless they are used to access other well fields or monitoring locations. The primary access roads will be reclaimed during the CPP and main facility decommissioning phase shown on Figure 5.2-1. The expected duration of access road reclamation is less than 1 year for each access road, but may occur over several years due to phased well field decommissioning/reclamation.

6.4.3.4 Revegetation Methods and Final Seed Mix

The permanent seed mixture for the rangeland reclamation type is presented in Table 6.4-1. Per DENR regulations, the seed mix has been chosen to be compatible with the postmining rangeland use. The local conservation district, landowners and DENR were consulted when selecting the seed mix (Appendices 6.4-A and 6.4-B). To reduce wind and water erosion, topsoil stockpiles and other various temporary disturbances in the well field area will be seeded. The temporary seed mix is the same as the permanent seed mixture.

Based on existing cropland within the permit area, alfalfa is the only agricultural or horticultural crop currently proposed for reclamation of designated agricultural or horticultural cropland in the permit area.

Seeding may be done with a rangeland drill or with a broadcast seeder where practical. If broadcast, the seeding rate will be increased in accordance with NRCS recommendations. After topsoil preparation is completed affected lands will be seeded during the first normal period of favorable planting conditions unless an alternative plan has been approved. Areas seeded with the rangeland seed mixture will not be treated with any type of soil amendment or irrigated to improve reclamation success unless required to address problems resulting from the land application of treated wastewater (see Section 6.8.4). Any gullies or rills that would preclude the successful establishment of vegetation or achievement of the postmining land use will be removed or stabilized as part of the revegetation and reclamation process. Techniques utilized to monitor reclamation success are discussed in Section 6.6.

Some areas have low baseline vegetative cover densities and likely will have low revegetation potential if disturbed. These include the Darrow Mine surface pits/spoil piles and the "alkali area." The historical mine pits and spoil piles have low revegetation potential primarily due to the physical characteristics of the soil (i.e., lack of organic matter). The alkali area is an area of known discharge from the Fall River and/or Chilson through historical exploration holes. This area may have high levels of salinity and alkalinity that are currently devoid of vegetation and would continue to inhibit vegetation if disturbed. In accordance with SDCL 45-6B-46(2), planting may not be required on affected land with chemical and physical characteristics that are "toxic, deficient in plant nutrients, or composed of sand, gravel, shale, or stone to such an extent to seriously inhibit plant growth and such conditions cannot feasibly be remedied by chemical treatment, fertilization, replacement of overburden, or like measures." In only very limited areas, which are anticipated to include the historical mine pits and the alkali area, Powertech (USA) will sample the topsoil and subsoil prior to disturbance. If the evaluation demonstrates that its chemical or physical characteristics would seriously inhibit plant growth and that it is not feasible to remedy by chemical treatment, overburden replacement, or like measures, Powertech (USA) will request that the revegetation performance criteria in Appendix 6.4-D not apply for these limited areas as allowed by SDCL 45-6B-46(2).

6.4.3.5 Weed Control and Refuse Management

Powertech (USA) will maintain an active weed control program for noxious weeds occurring on the property in accordance with ARSD 74:29:07:15 and SDCL 45-6B-43. Objectives of the program will be:

- Conduct a yearly property inspection.
- Identify locations of weed growth.
- Treat weeds annually through chemical control.

Powertech (USA) has consulted with the local weed and pest boards in preparation of the weed control program for the Dewey-Burdock Project. The weed control plan is provided in appendix 6.4-C along with consultation letters.

Along with the weed control program, Powertech (USA) will manage refuse according to state and federal requirements in accordance with ARSD 74:29:07:05. Powertech (USA) is not proposing to use any of the land in the permit area for deposit or disposal of refuse.

6.4.3.6 Erosion Control Practices

Erosion control measures will be implemented during all phases of construction, operation, reclamation, and closure. Refer to Section 5.3.9 for details on erosion control measures. Temporary sedimentation, erosion control, and drainage control structures will be removed when

no longer needed. Sediment and erosion control structures will be inspected on a quarterly basis to ensure compliance with all applicable reclamation, design, and operating criteria. Maintenance and repair work needed to keep the structures in proper operating order will be performed as necessary. This work will include the removal and proper disposal of sediment captured by the structures and repair or replacement of old ASCM structures. If during the term of the postclosure period erosion and sedimentation becomes a problem in any area, new structures will be installed to adequately address any problems. Conversely, if the need for sediment and erosion controls in an area becomes unnecessary, the synthetics will be removed for aesthetic purposes.

6.4.4 Revegetation of Land Application Areas

The revegetation techniques for land application areas will depend on the vegetation grown in the land application areas. If native vegetation is irrigated and the species composition of the native vegetation does not change significantly during irrigation, then reseeding is not anticipated to be necessary to meet the reclamation performance criteria. However, if the species composition of the native vegetation significantly changes during the course of land application, Powertech (USA) will develop a plan that either demonstrates that after termination of land application a permanent, self-perpetuating ground cover at least equal in character and extent to the original will remain or detail a revegetation program that has been approved by SDGF&P and the local conservation district.

If crops such as alfalfa or wheatgrass are planted in the land application areas, Powertech (USA) will revegetate the land application areas during reclamation by preparing the topsoil and using the seeding mixture and methods described in Section 6.4.3.4.

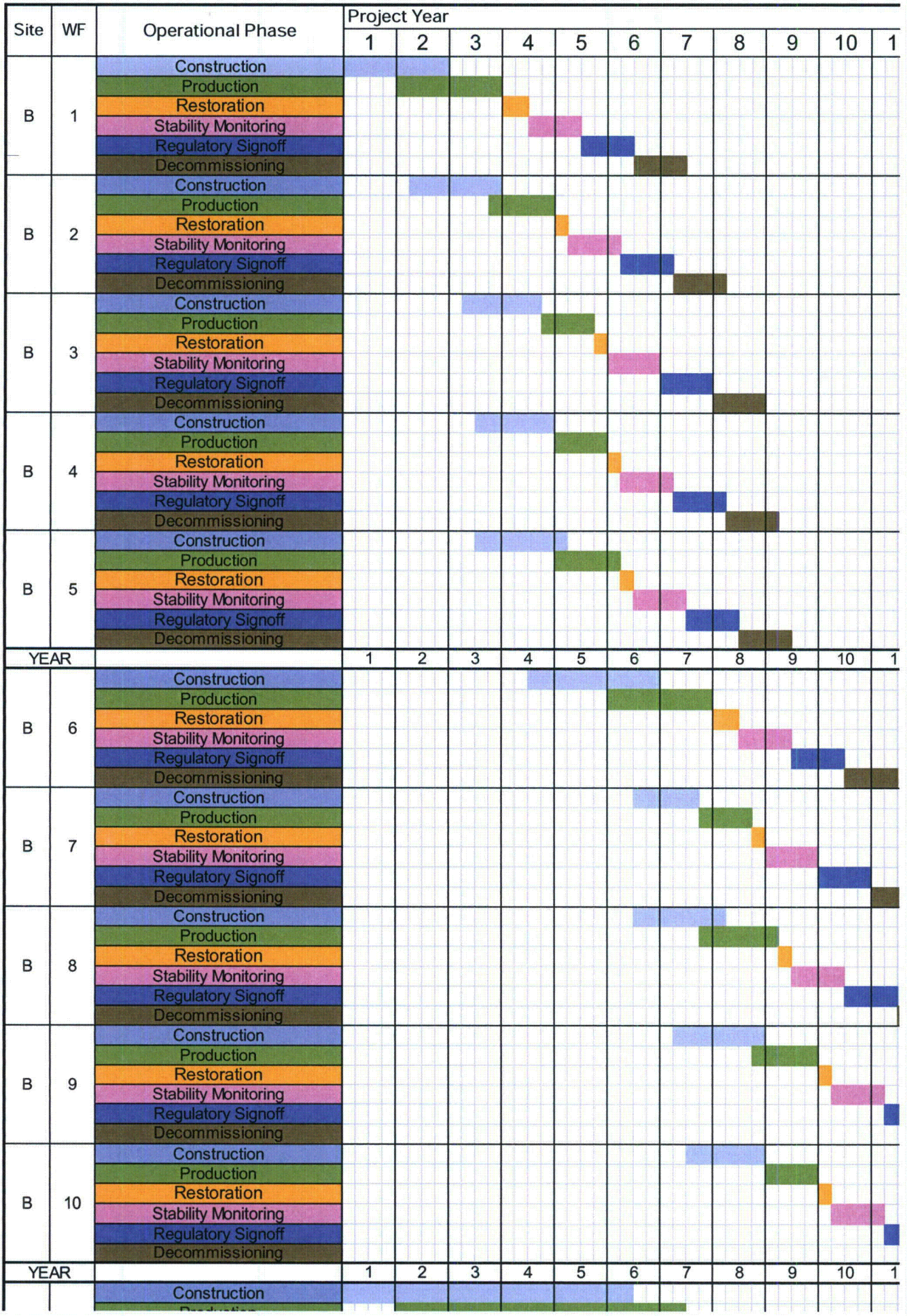
6.5 Reclamation Timetable

Reclamation will be carried out in an ongoing process concurrent with ISR operations in accordance with NRC license conditions and ARSD 74:29:08. It is anticipated that groundwater restoration, including stability monitoring, will be completed for each well field in less than 2 years. Decontamination, decommissioning, and surface reclamation will follow after regulatory approval of successful groundwater restoration. The reclamation for each well field will be carried out with all reasonable diligence. Each phase of reclamation, including each well field and final facility reclamation, is expected to be completed within 5 years in accordance with SDCL 45-6B-46. Figure 6.5-1 depicts the proposed project schedule including phased

decommissioning/reclamation for each well field. Facility reclamation (CPP, Satellite Facility, and ponds) will occur following well field reclamation.

6.6 Reclamation Monitoring

Powertech (USA) will monitor revegetation success for compliance with ARSD 74:29:07:06. The goal of the reclamation program is to stabilizes the soil and return the disturbed areas to a function similar to undisturbed areas. Primary revegetation success will be determined using performance standards for current carrying capacity and vegetative ground cover. The Dewey-Burdock Project Reclamation Performance Criteria document is included as Appendix 6.4-D. The minimum period of vegetation establishment for rangeland and agriculture land prior to evaluation for final financial assurance release will be 3 years. The success of the final revegetation and final financial assurance release will be determined by DENR.


Site
WF
Operational Phase
Project Year
1 2 3 4 5 6 7 8 9 10 1
B 1
B 2
B 3
B 4
B 5
YEAR
B 6
B 7
B 8
B 9
B 10
Construction
Production
Restoration
Stability Monitoring
Regulatory Signoff
Decommissioning

6.7 Financial Assurance

6.7.1 Financial Assurance Estimate

In compliance NRC license conditions and with ARSD 74:29:02:08, Powertech (USA) will maintain financial assurance instruments to cover the cost of reclamation including the costs of groundwater restoration; well plugging and abandonment; decommissioning, dismantling and disposal of all buildings and other facilities; reclamation and revegetation of affected areas; and postclosure monitoring.

Powertech (USA) commits to supplying a financial assurance mechanism in a form and in an amount approved by NRC, DENR, EPA and BLM prior to the commencement of operations.

A financial assurance estimate is provided in Appendix 6.7-A. This appendix provides a summary of costs by year for the deep disposal well option and the land application option, respectively. The financial assurance model is based on the Dewey-Burdock Project being in operation for one full year prior to a third party taking over reclamation of the facility. Reclamation would include facility decommissioning, groundwater restoration, stability monitoring, well field reclamation, soil reclamation, and radiological surveys. The by-year costs are based on year 1 being the pre-operational construction phase, year 2 the full year of ISR operations, and year 3 the beginning of the financial assurance-funded reclamation activities. Groundwater restoration and stability monitoring would be conducted in years 3-4. Final decommissioning, including building demolition and soil reclamation, would be conducted during years 5-6.

The financial assurance estimate in Appendix 6.7-A assumes that the Dewey and Burdock portions of the permit area would be developed simultaneously. This would begin with construction of the CPP, Satellite Facility, and initial well field in each area. Subsequent well fields would be developed sequentially in both of the Dewey and Burdock portions of the permit area. As an alternative to this development scenario, Powertech (USA) is considering developing the Satellite Facility and Dewey-area well fields initially, followed by the CPP and Burdock-area well fields. If Powertech (USA) chooses to pursue this alternate development scenario, a revised financial assurance estimate will be provided, likely prior to LSM permit issuance.

The financial assurance cost estimate reflects costs as of 2009. The cost factors found in Appendix 6.7-A, Table 2 and elsewhere were obtained from vendor quotes, from the 2009 RS Means cost estimating handbooks, from recent ISR license applications, and from calculations as

described. All electrical power costs are conservatively based on a per kWh hour cost of $0.07; the results of a power study (Lyntek, 2010) showed estimated 2013 power costs of $0.0595 to $0.0691 per kWh, depending on the supplier. The costs of 11e.(2) byproduct material disposal, as listed in Appendix 6.7-A are based on the assumption that Powertech (USA) will secure a byproduct disposal contract with Denison Mines Corporation for disposal at their byproduct disposal facility at White Mesa, UT. The cost estimate is based on a transportation distance of 785 miles from the permit area to the White Mesa facility near Blanding, UT. Transportation costs to alternate 11e.(2) byproduct material disposal facilities will be similar or less. For example, the Pathfinder Mines Corporation Shirley Basin Facility is approximately 250 miles away, the Energy Solutions LLC Clive Disposal Site near Clive, UT is approximately 700 miles away, and the Waste Control Specialists LLC facility near Andrews, TX is approximately 900 miles away.

While it is likely that the facility buildings will have a salvage value, the demolition cost estimate assumes that all buildings will be shredded and disposed at an appropriate landfill. Decommissioning costs include a final gamma survey.

Labor costs associated with the reclamation operations will be a combination of contract labor and direct hires, listed in Appendix 6.7-A. A full-time Radiation Safety Officer will be employed through final decommissioning.

Powertech (USA) will revise these financial assurance cost estimates after NRC license and LSM permit issuance based on NRC, DENR, EPA and BLM approval of the methodologies for cost estimate calculations. In the event that additional factors are utilized for adding or subtracting from approved cost estimates, Powertech (USA) will provide a written explanation of such factors when submitting revised cost estimates after license and permit issuance.

Powertech (USA) commits to providing annual financial assurance updates to DENR as described in Section 5.7.2.6.

6.8 Postclosure Monitoring Plan

When ISR operations are completed and reclamation is in the final stages of vegetation establishment, Powertech (USA) will inspect and maintain activities to ensure compliance and reduction of potential environmental impacts in accordance with SDCL 45-6B-91. It is not anticipated that any new environmental impacts will be identified after this stage of the project.

Following is a description of the proposed postclosure monitoring plan for various environmental media.

6.8.1 Water Quality Monitoring

Postclosure surface water monitoring will be conducted to ensure that there will not be future impacts to surface water resources, including Beaver Creek, Pass Creek, potentially affected tributaries, and impoundments. Monitoring will be performed annually at the operational surface water monitoring sites described in Tables 5.5-2 and 5.5-3. The samples will be analyzed for the parameters listed in Table 5.5-4.

If land application is used, postclosure alluvial groundwater monitoring will be conducted for each perimeter of operational pollution (POP) zone as described in the GDP. Postclosure monitoring of bedrock groundwater resources is not proposed due to the following reasons:

1) An extensive operational monitoring program will be performed, including monitoring overlying and underlying hydrogeologic units and monitoring the perimeter of the production zone. This will ensure that any potential horizontal or vertical excursions are rapidly detected and corrected.

2) Ore zone groundwater quality will be restored in accordance with NRC license conditions. Prior to NRC approval of successful groundwater restoration, Powertech (USA) will demonstrate that the target restoration goals or ACLs have been achieved and that groundwater restoration has been conducted in a manner that will protect human health and the environment. This will be demonstrated through a minimum 12-month stability monitoring period following groundwater restoration activities.

3) Protection of USDWs outside of the aquifer exemption boundaries will be assured by EPA, which has the authority and responsibility to do so through administration of the Class III and V UIC permits.

4) NRC will release the site for unrestricted (i.e., DENR-approved postmining) use only after NRC approval of successful groundwater restoration, well field decommissioning, and site decommissioning. The timely return of the surface to the landowners will be the primary focus of the reclamation and decommissioning activities.

6.8.2 Air Quality Monitoring

No postclosure air quality monitoring is proposed for the Dewey-Burdock Project on the basis that no potential air quality impacts will remain following DENR approval of successful reclamation.

6.8.3 Vegetation Monitoring

Reclaimed land will be inspected on an annual basis, coinciding with the growing season, to ensure compliance with the final Reclamation Plan and postmining land use. If the vegetation is not achieving the goals of the final Reclamation Plan and postmining land use, steps will be taken to correct or mitigate the situation. If a change in the seed mixture is necessary to ensure vegetative success, these changes will be submitted to DENR for approval.

Monitoring methods used to document reclamation success are included in Powertech (USA)'s Dewey-Burdock Project Reclamation Performance Criteria (Appendix 6.4-D).

6.8.4 Land Application Monitoring

As discussed in Section 5.4.1.1.2, Powertech (USA) may use land application as a method of disposing treated wastewater. If land application is used, there could be potential impacts to the soil and vegetation from the buildup of salts, changes in SAR, buildup of radionuclides, buildup of metals and metalloids, and decrease in soil fertility.

In conformance with ARSD 74:29:05:19, Powertech (USA) has formulated a monitoring and mitigation plan to detect potential soil and vegetation impacts related to land application of treated wastewater. The specific monitoring and mitigation measures are addressed in Sections 5.5.6.1 and 5.5.7.1 and GDP Sections 6.4 and 6.5. Revegetation of land application areas is addressed in Section 6.4.4.

6.8.5 Sediment and Erosion Control Structures

Sediment and erosion control structures will be inspected on a quarterly basis to ensure compliance with all applicable reclamation, design, and operating criteria. Maintenance and repair work needed to keep the structures in proper operating order will be performed as necessary. This work will include the removal and proper disposal of sediment captured by the structures and repair or replacement of ASCMs as needed. If during the term of the postclosure period erosion and sedimentation becomes a problem in any area, new structures will be installed to adequately address any problems. Conversely, if the need for sediment and erosion controls in an area becomes unnecessary, the synthetics will be removed for aesthetic purposes.

6.8.6 Postclosure Financial Assurance

Prior to release of the reclamation financial assurance instrument by DENR, a portion of the reclamation financial assurance will be dedicated to the postclosure bond. A detailed financial

assurance estimate for postclosure activities will be submitted to DENR for approval prior to the beginning of the postclosure monitoring period.

6.8.7 Postclosure Monitoring Duration

Powertech (USA) will conduct postclosure monitoring for 30 years following operations, or until release of this requirement has been granted by DENR.

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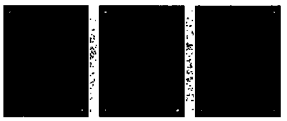

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Table 1.1-2: Administrative Rules of South Dakota (Continued)

Regulation	Information Required	Permit Application Reference
ARSD 74:29:06:04	Alternative postmining land use.	Noted
ARSD 74:29:06:05	Approval for future mineral exploration.	Noted
ARSD 74:29:06:06	Confidential information.	Noted
ARSD 74:29:07:01	General requirements for all reclamation types.	Section 6.4
ARSD 74:29:07:02	Minimizing of adverse impacts.	Section 5.6
ARSD 74:29:07:02 (1)	Design of facilities to minimize surface disturbance.	Sections 5.3, 5.6.2.2 and 5.6.14.2
ARSD 74:29:07:02 (2)	Clearing of land in small sections.	Sections 5.3.3 and 5.3.7
ARSD 74:29:07:02 (3)	Visual screening	Section 5.6.14
ARSD 74:29:07:02 (4)	Minimize impacts to surface and groundwater.	Sections 5.3.3, 5.3.9, 5.6.3, 5.6.4 and 6.2
ARSD 74:29:07:02 (5)	Control of access.	Section 5.7.6
ARSD 74:29:07:02 (6)	Preventative measures to minimize harmful impacts to wildlife.	Sections 5.6.11.1.2 and 5.6.11.2
ARSD 74:29:07:02 (7)	Location of waste facilities, spoil piles, and topsoil stockpiles to facilitate implementation of reclamation and to minimize environmental impacts.	Section 5.3
ARSD 74:29:07:02 (8)	Minimizing the production of mine waste and spoil.	Section 5.4.3
ARSD 74:29:07:02 (9)	Design and location of facilities so they are compatible with surrounding land uses (i.e. waste facility and haul road).	Section 5.3
ARSD 74:29:07:02 (10)	Integration of mine operations planning with the Reclamation Plan.	Sections 5.3 and 6.4
ARSD 74:29:07:03	Grading and Backfilling - Necessity	Section 6.4.3.1
ARSD 74:29:07:04 (1)	Reclaimed slopes must be visually and functionally compatible with surrounding area, suitable for the postmining land use, structurally stable, and not exceed the angle of repose for fill slopes or other slopes composed of unconsolidated material.	Section 6.4.3.1; Plate 6.4-1
ARSD 74:29:07:04 (2)	Erosion and sedimentation control during final grading, and protection of areas outside of the affected land.	Sections 5.3.9 and 6.4.3.1
ARSD 74:29:07:04 (3)	Grading and backfilling timetable.	Sections 6.4.3.1 and 6.5; Figures 5.2-1 and 6.5-1
ARSD 74:29:07:04 (4)	Depressions not allowed.	Section 6.4.3.1
ARSD 74:29:07:04 (5)	Drainages preserved.	Section 6.4.3.1
ARSD 74:29:07:04 (6)	Highwall reduction.	Not applicable, since highwalls will not be used.
ARSD 74:29:07:04 (7)	Landforms must blend in with and complement the visual continuity of the surrounding area.	Section 6.4.3.1
ARSD 74:29:07:05	Disposal of refuse.	Section 5.4
ARSD 74:29:07:06 (1)	Vegetative species and composition postmining land use.	Section 6.4.3.4

Table 1.1-2: Administrative Rules of South Dakota (Continued)

Regulation	Information Required	Permit Application Reference
ARSD 74:29:07:06 (2)	Vegetative success - reference areas.	Section 6.4.3.4; Appendix 6.4-D
ARSD 74:29:07:06 (3)	Reference areas.	Appendix 6.4-D; Plate 6.4-2
ARSD 74:29:07:06 (4)	Seeding and planting.	Section 6.4.3.4; Appendix 6.4-B
ARSD 74:29:07:07 (1)	Salvageable topsoil.	Section 5.3.7
ARSD 74:29:07:07 (2)	Interim reclamation.	Sections 6.4.2 and 6.4.3.2
ARSD 74:29:07:07 (3)	Topsoil analyzed to determine if fertilizer or other amendments required.	Sections 5.3.7 and 6.4.3.2
ARSD 74:29:07:07 (4)	Signing of topsoil stockpiles.	Section 5.3.7
ARSD 74:29:07:07 (5)	Estimate of topsoil to complete reclamation.	Sections 5.3.7 and 6.4
ARSD 74:29:07:07 (6)	Use of excess topsoil for reclamation purposes elsewhere.	Section 6.4.3.2
ARSD 74:29:07:07 (7)	Separation of rocks and trees from topsoil.	Section 5.3.7
ARSD 74:29:07:07 (8)	Segregation of topsoil and subsoil stockpiles.	Section 5.3.7
ARSD 74:29:07:08 (1)	Compliance with South Dakota water rights laws and regulations.	Section 5.6.3.1.2
ARSD 74:29:07:08 (2)	Compliance with South Dakota water quality laws and regulations.	Sections 5.6.3.2 and 5.6.4.2
ARSD 74:29:07:08 (3)	Compliance with dredge and fill laws in Sections 401 and 404 of the Clean Water Act.	Sections 5.6.4.1.3 and 5.6.4.2
ARSD 74:29:07:08 (4)	Removal of temporary or large sedimentation, erosion, or drainage control structures.	Section 5.3.9
ARSD 74:29:07:08 (5)	Permanent diversion structure design.	Section 5.3.9.1
ARSD 74:29:07:08 (6)	Diversion of unchannelized surface water.	Section 5.3.9
ARSD 74:29:07:09 (1)	Surface runoff diversions - side slopes and erosion protection.	Section 5.3.9
ARSD 74:29:07:09 (2)	Surface runoff diversions - stable sides in rock.	Section 5.3.9
ARSD 74:29:07:09 (3)	Surface runoff diversions - erosion protection.	Section 5.3.9
ARSD 74:29:07:09 (4)	Surface runoff diversions - culverts or bridges where necessary.	Section 5.3.9
ARSD 74:29:07:09 (5)	Surface runoff diversions - minimize hazards to humans, wildlife or livestock.	Section 5.3.9
ARSD 74:29:07:09 (6)	Surface runoff diversions - diversions around milling or processing facilities must be capable of carrying the flow from the 6-hour PMP event.	Section 5.3.9
ARSD 74:29:07:09 (7)	Surface runoff diversions - all other diversions must be capable of carrying a minimum of the 2-year, 6-hour event.	Section 5.3.9
ARSD 74:29:07:09 (8)	Surface runoff diversions - may not discharge on topsoil storage areas, spoil, or other unconsolidated material.	Section 5.3.9

Approximately 87 percent of the total number of sites recorded are prehistoric. Historic sites comprise approximately 5 percent of total sites recorded, while multi-component (prehistoric/historic) sites comprise the remaining 8 percent.

The small number of Euro American sites documented was not unanticipated given the peripheral nature of the permit area in relation to the Black Hill proper. The disparity existing between the number of historic and prehistoric sites observed in the permit area is also not unexpected; however, the sheer volume of sites documented in the area is noteworthy. The land evaluated as part of the Level III cultural resources evaluation has an average site density of approximately one site per 48.8 acres. Even greater site densities were reported in 2000 during the investigation of immediately adjacent land parcels for the Dacotah Cement/BLM land exchange (Winham et al., 2001). This indicates that the permit area is not unique, in regard to the number of documented sites, and is typical of the periphery of the Black Hills.

The high density of sites observed in the permit area, specifically those of prehistoric affiliation, is both consistent with previous findings in the immediate vicinity (Winham et al., 2001) and strongly indicative of the intense degree to which this landscape was being exploited during prehistoric times. Data indicate a slight rise in the number of sites observed from earlier periods into the Middle Plains Archaic, and then a major increase into the Late Plains Archaic/Plains Woodland period before an equally significant drop-off into Late Prehistoric times. In general, this trend is largely consistent with the majority of available paleodemographic data from the region (Rom et al., 1996). Despite the high density of sites within the permit area, there is a lack of evidence indicative of extended or long-term settlement localities in the region. Though the reason behind this phenomenon remains unclear, the bulk of preliminary data from the current investigation appear to mirror this trend.

The landscape comprising the permit area is erosional in nature, leading to many sites being heavily deflated. The extend of the erosion processes is evidenced by the large number of sites recommended by Augustana as not eligible for listing on the National Register of Historic Places because of their location on deflated landforms. This equates to approximately half of the total number of identified sites in the permit area. Notable exceptions to these deflated localities include the valleys and terraces along Beaver and Pass Creeks, as well as many places within and adjacent to some of the more heavily wooded areas.

Nearly 200 hearths were identified within 24 separate sites areas during Augustana's investigation. These features varied considerably from one another in both size and form (and

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. These are estimated values based on the approximate topsoil stripping limits and topsoil salvage depths obtained from the baseline soil survey. Prior to stripping, the precise topsoil stripping limits will be determined based on construction-level designs, and the salvage depths will be determined based on additional testing. 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 3.3-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.

In the processing areas and the first well field in each of the Dewey and Burdock areas, Powertech (USA) will analyze the topsoil prior to stripping to determine whether fertilizer or other amendments will be required to establish and sustain vegetative growth during reclamation. Prior to sampling, Powertech (USA) will submit a sampling and analysis plan that includes sampling density and parameters to DENR for review and verification. The sampling results and evaluation of whether adequate nutrients are available and whether fertilizer or other amendments will be required to establish and sustain vegetative growth will be submitted to DENR for review and verification prior to topsoil stripping. The need for topsoil sampling in the subsequent well fields will be coordinated with DENR based on the results of the initial sampling and the success of interim revegetation in the initial Dewey and Burdock well fields.

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

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 a) these ponds will store only treated water en route to the land application that will not contain radionuclides in excess of allowable discharge limits, b) the treated water storage ponds are not associated with uranium processing or wastewater treatment, and c) NRC guidance in Regulatory Guide 3.11 indicates that diversion designs for isolated areas where pond failure would neither jeopardize human life nor create damage to property or the environment beyond Powertech (USA)'s financial assurance capabilities do not need to use extremely conservative flood design criteria. Powertech (USA) will not change the use of the treated water storage ponds or spare storage ponds without obtaining DENR authorization through a technical revision or permit amendment, the application

for which would include diversion designs for the 6-hour PMP event. 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.

used (typically November through early March). Additional design information for the land application systems is presented in the GDP. Figure 5.3-1 depicts the proposed facilities in the land application option.

Each of the two land application systems will have up to 315 acres of irrigated area and an additional 65 acres of center pivots on standby. Each of the two land application systems is designed for an average annual application rate of 310 gpm and an instantaneous application rate of 297 to 653 gpm.

In the land application option, groundwater withdrawn during aquifer restoration will not be treated with RO. Instead, the aquifer restoration water will be disposed directly in land application systems following treatment to remove uranium and radium. The water balance for the land application option is presented in Section 5.3.3.5.3.

Following is a summary of how the proposed land application systems satisfy specific site evaluation and compatibility criteria in ARSD 74:29:05:16.

Potential Impacts to Wildlife Grazing in Land Application Areas (ARSD 74:29:05:16(1))

Potential impacts to wildlife grazing in the land application areas will be minimized through treating the land application effluent prior to application, monitoring vegetation within land application areas, and evaluating the monitoring results annually to detect potential increasing trends in constituent concentrations. As a condition of the GDP, the land application water quality will be required to meet effluent limits established by DENR that are protective of groundwater quality. Section 5.4.1.1.4.1 describes the anticipated land application water quality. Trace metal concentrations are anticipated to be at or below ARSD 74:54:01:04 human health standards. Radionuclide concentrations will be below 10 CFR Part 20, Appendix B, Table 2, Column 2 effluent limits for release of radionuclides to the environment. The suitability of land application vegetation to wildlife grazing will be verified through annual vegetation monitoring in the land application areas. Section 5.5.6.2 describe how vegetation in the land application areas will be sampled each year. Section 5.5.6.2 describes how this information will be evaluated annually and the results reported to DENR to determine whether there is any risk to wildlife.

Compatibility with Site Geology and Soils ((ARSD 74:29:05:16(2) and (4))

The site geology is well suited to land application. The depth to alluvial groundwater, where encountered, is greater than the maximum anticipated infiltration depth of the land application water. The Graneros Group shales will prevent the land application water from reaching bedrock

aquifers. The thickness of the Graneros Group is approximately 500 to 550 feet beneath the proposed Dewey land application area and approximately 25 to 250 feet beneath the proposed Burdock land application area. Refer to Cross Sections 3.2-23 through 3.2-27, which depict the thickness of the Graneros within the proposed land application areas.

Geologic conditions make it unlikely that land applied water will reach the alluvium. These conditions include the limited presence of alluvium in the Dewey land application area and the thickness and composition of the material beneath the land application areas. In the Dewey area, most of the planned primary pivot areas do not overlie alluvium. Of the 315 acres of primary center pivots planned in the Dewey area, only about 55 acres (17 percent) occur within the extents of mapped alluvium (refer to Figure 6.1-1 in the GDP application). While most of the planned Dewey standby pivot areas overlie mapped alluvium, the potential for land applied water to reach the alluvium in the standby areas is much lower, since Powertech (USA) does not anticipate using these areas regularly.

In all potential land application areas (Dewey and Burdock), the thickness and composition of the material between the pivot areas and alluvial groundwater, where present, will act to prevent land applied water from reaching alluvial groundwater. In the Burdock area, the depth to the top of the alluvial gravel within the planned pivot areas ranges from about 12 to 35 feet and is typically 15 to 25 feet. The depth to alluvial groundwater, where present, is typically 13 to 35 feet. In the Dewey area, there are only limited areas in which the planned pivot areas overlie saturated alluvium. Based on ambient sampling conducted in support of the GDP application, the depth to alluvial groundwater, where present beneath the potential Dewey pivot areas, is anticipated to be at least 18 feet. By comparison, the SPAW model simulations predict that the land application water will not percolate deeper than 8 feet.

The soil hydraulic properties beneath the land application areas will help prevent the migration of water into the alluvial groundwater. Soils sampled from test pits in and around the land application areas predominantly contain clay and silt, with lesser amounts of sand and virtually no gravel to depths of 7 to 10 feet. The SPAW modeling simulations considered permeability measurements from soil samples collected in the land application areas.

Compatibility with Groundwater and Surface Water Systems (ARSD 74:29:05:16(3)

Land applied water has a very low potential to reach groundwater or to flow through the alluvium and reach Beaver Creek or Pass Creek based on geologic conditions, Powertech (USA)'s commitment to plug and abandon existing wells within the land application areas,

operating plans, and the implementation of extensive monitoring systems. Each of these is described below with the exception of geologic conditions, which was described previously.

Plugging and Abandoning Existing Wells

Powertech (USA) has not identified any existing wells within the proposed Dewey land application area. Within the proposed Burdock land application area, there are two existing wells, including one former domestic well (well 43) and one stock well (well 15). Prior to operation of the Burdock land application system, both of these wells will be plugged and abandoned with bentonite or cement grout in accordance with the procedures in ARSD 74:02:04:67. This will eliminate the potential for vertical migration of land applied solutions through existing wells.

Operating Plans

The land application rate has been designed specifically to minimize percolation below the rooting zone. The typical application rate is about 19 inches during the land application season of approximately April through October. This is a typical agronomic rate for growing alfalfa and grasses in this region.

Monitoring Systems

Groundwater monitoring will allow Powertech (USA) to track the movement of land applied water through the subsoil beneath the land application areas, determine whether land applied water reaches the alluvium, and track changes in alluvial water quality within the POP zones to prevent migration of land applied water outside of the POP zones or into Beaver Creek or Pass Creek. Monitoring systems will include suction lysimeters installed beneath each land application and catchment area to track the movement of water through the subsoil, interior wells to track changes in alluvial water quality within the POP zones, and compliance wells established at the downgradient edges of the POP zones. Monitoring results from suction lysimeters and interior wells will provide early detection of potential migration of land applied water into and through the alluvium. Early detection of potential impacts will allow Powertech (USA) to adjust the operating parameters, such as the rate of application to various pivots, to avoid potential impacts to alluvial groundwater outside of the POP zone and to avoid potential impacts to Beaver Creek or Pass Creek.

The alluvial groundwater monitoring program associated with the GDP also will detect any potential impacts to Cheyenne River alluvium. The mapped Beaver Creek and Pass Creek alluvium are contiguous with the Cheyenne River alluvium, and the position of the interior and compliance monitor wells will ensure that any land applied water entering Beaver Creek or Pass Creek alluvium will be detected. There is no pathway for land applied water to eventually reach

the Cheyenne River alluvium without first passing a compliance well. Further, Powertech (USA) will monitor other alluvial wells farther downgradient in the Beaver Creek and Pass Creek alluvium (e.g., wells 677 and 678). Periodic monitoring of these downgradient alluvial wells will allow detection of any potential impacts from the land applied water on Beaver Creek, Pass Creek, or Cheyenne River alluvium.

If the results of monitoring show that groundwater outside of the POP zone or surface water in Beaver Creek or Pass Creek have potential to be impacted, Powertech (USA) will initiate a corrective action plan as described in the GDP application. Potential corrective actions include adjusting operating parameters and/or initiating a pump back or pump and treat system to recover alluvial groundwater.

Compatibility of Slopes with Land Application Systems (ARSD 74:29:05:16(5))

In the proposed Dewey land application area, the average slope is approximately 3.5 percent. The maximum slope is between 15 and 25 percent in a small area (approximately 5 acres) at the northern edge of one proposed land application area (refer to page 5.3-B-42 in Appendix 5.3-B). In the proposed Burdock land application area, the average slope is approximately 2 percent. Only about 2 acres of the proposed Burdock land application area has a slope greater than 15 percent (refer to page 5.3-B-43 in Appendix B). These slopes will be compatible with center pivot irrigation.

During final design of the land application systems and catchment areas, Powertech (USA) will evaluate any areas with slopes greater than 15 percent to determine whether they can be avoided or whether they require mitigation. The evaluation will consider the maximum manufacturer-recommended slope based on the center pivot climbing capability and ground clearance requirements. It also will consider whether regrading will be necessary to reduce the potential for runoff and erosion. It is currently anticipated that approximately 5 acres in the proposed Dewey land application area and 2 acres in the proposed Burdock land application area will be regraded to a maximum slope of 15 percent unless these areas are avoided during final design.

Potential for Erosion (ARSD 74:29:05:16(6))

The potential for erosion within the land application areas will be minimized through siting land application areas in relatively flat terrain, maintaining vegetation, optimizing the irrigation rate to avoid runoff, using low-impact sprinkler heads, and capturing any runoff in catchment areas. The average slopes in the proposed land application areas are 2 to 3.5 percent. Small areas with slopes greater than 15 percent are anticipated to be regraded to minimize the potential for erosion and to meet the maximum manufacturer-recommended slopes for the center pivots. Relatively

flat slopes along with maintenance of the land application areas in a vegetated state will limit the potential for erosion. The land application water will be applied at an agronomic rate to prevent runoff into the catchment areas. Should runoff from precipitation or snowmelt occur, the runoff and sediment will be captured in the catchment areas and will not reach perennial or ephemeral stream channels.

Daily inspections of the land application areas and catchment berms during operation of the land application systems will determine whether there are any unplanned effects such as erosion.

Distance to Flowing Streams (ARSD 74:29:05:16(7))

Beaver Creek is the only flowing stream within the proposed permit area. The minimum distance from a proposed Dewey land application area to Beaver Creek is approximately 280 feet. The minimum distance from a proposed Burdock land application area to Beaver Creek is approximately 1.1 miles.

Potential Impacts to Adjacent Land Uses (ARSD 74:29:05:16(8))

Land uses adjacent to the proposed land application areas includes livestock grazing on rangeland and recreational use (primarily hunting) on private lands. No effects from land application on adjacent land uses are anticipated due to the operation of land application systems to minimize overspray and due to Powertech (USA)'s commitment to limit hunting within the proposed permit area. Section 3.1.2 describes how Powertech (USA) will work with BLM, SDGF&P and private landowners to limit hunting within the proposed permit area to the extent practicable.

The land application systems have been sited and will be operated to avoid any potential impacts to nearby cropland. No cropland is within or immediately adjacent to the proposed land application areas, and the land application systems will be operated to avoid overspray as a condition of the GDP. As described above, potential impacts to alluvial groundwater will be limited by geologic conditions, plugging existing wells, applying water at an agronomic rate, and extensive monitoring. This in turn will prevent potential impacts to adjacent cropland via groundwater pathways.

Consideration of Weather Conditions (ARSD 74:29:05:16(9))

Prior to operation of the land application systems, Powertech (USA) will develop a standard operating procedure (SOP) for land application system operation that will include provisions to minimize overspray outside of the center pivot areas. The SOP will include using the results of

meteorological monitoring (wind speed, wind direction and temperature) to modify operating parameters. It will include maximum wind speed/wind direction combinations for land application system operation. The SOP also will address precipitation thresholds to avoid land application during heavy or prolonged precipitation events. Temperature thresholds also will be included to avoid land application when water cannot infiltrate due to frozen ground.

5.4.1.1.3 Wastewater Treatment

Prior to discharge to the storage ponds, Powertech (USA) will treat all wastewater associated with ISR operations to meet the requirements of 10 CFR 20, Appendix B, Table 2, Column 2, which are the established limits for discharge of radionuclides to the environment and include limits for natural uranium, radium-226, lead-210 and thorium-230 (see Table 5.4-1). Powertech (USA) anticipates that the GDP will include effluent limits established according to ARSD 74:54:01:04 groundwater standards and ambient alluvial water quality. Treatment will be accomplished by ion exchange for uranium removal followed by radium removal through co-precipitation with barium sulfate in radium settling ponds. It is not anticipated that thorium-230, lead-210 or other radionuclides will be present at concentrations above the limits. If concentrations in the storage ponds are above the release limits, the effluent will be treated as necessary to satisfy the GDP limits.

5.4.1.1.4 Treated Wastewater Quality

The types of wastewater that will be disposed in the DDWs or land application systems include production bleed, groundwater generated during aquifer restoration, affected groundwater generated during well development, and liquid process waste such as resin transfer water and the brine generated during uranium processing. Of these, the largest contributors will be the production bleed and groundwater generated during aquifer restoration.

Table 5.4-2 presents the estimated end-of-production water quality in the ISR well fields. This represents the untreated water quality extracted from the ore zone at the end of uranium recovery and at the beginning of aquifer restoration. This table represents the worst-case water quality

5.6.3.2 Mitigation of Potential Groundwater Impacts

Following is a list of mitigation measures for potential impacts to groundwater. Specific mitigation measures for potential impacts to water supply wells, corrective actions for excursions, and protection of groundwater quality in and around land application areas are provided below.

- Perform MIT on all wells prior to use and repeat every 5 years.
- Minimize groundwater use during operations by limiting production and restoration bleed to the minimum amount needed to ensure hydraulic well field control.
- Monitor well pressures to detect leaks.
- Install and operate an extensive monitoring system to detect potential horizontal or vertical excursions of ISR solutions.
- Plug and abandon or mitigate any of the following should they pose the potential to impact the control and containment of well field solutions within the permit area:
    - Historical wells and exploration holes
    - Holes drilled by Powertech (USA) for delineation and exploration
    - Any well failing MIT
- Maintain pumping and injection rates (well field balance) to ensure radial hydraulic flow into and through the production zone.
- Monitor to detect and define unanticipated surface spills, releases, or similar events that may infiltrate into the groundwater system.
- Implement a spill prevention and cleanup plan to minimize potential impacts to groundwater, including rapid response cleanup and remediation capability, techniques, procedures, and training.
- Monitor nearby domestic, livestock, irrigation, and designated monitor wells as appropriate during operations.
- Select restoration method to minimize water consumption during groundwater restoration.
- During groundwater restoration, monitor groundwater using standard industry practices to determine the progression and effectiveness of restoration.
- Implement an extensive land application monitoring system that includes compliance wells, intermediate wells, and vadose zone monitoring.
- Site land application areas at locations where natural conditions make it highly unlikely that the land application water will reach the alluvium.
- Apply land application water at agronomic rates.
- Treat the land application water and/or DDW water to remove radionuclides.

and results obtained. If an excursion is not corrected within 60 days of confirmation, Powertech (USA) will terminate injection into the affected portion of the well field until the excursion is retrieved, or provide an increase to the reclamation financial assurance obligation in an amount that is agreeable to NRC and that would cover the expected full cost of correcting and cleaning up the excursion. The financial assurance increase will remain in force until the excursion is corrected. The written 60-day excursion report will state and justify which course of action will be followed. If wells are still on excursion status at the time the 60-day report is submitted to NRC, and the financial assurance option is chosen, the well field restoration financial assurance obligation will be adjusted upward. When the excursion is corrected, the additional financial assurance obligations resulting from the excursion will be removed.

Protection of Groundwater Quality in and around Land Application Areas

Powertech (USA) will operate the proposed land application systems in accordance with an approved GDP, the primary purpose of which is to protect groundwater quality in accordance with State standards. Mitigation measures to protect groundwater quality in the land application areas are described above and include implementing an extensive land application monitoring system that includes compliance wells, intermediate wells and vadose zone monitoring; siting land application areas at locations where natural conditions make it unlikely that land application water will reach alluvial groundwater; applying land application water at agronomic rates; and treating land application water to remove radionuclides. These mitigation measures will ensure compliance with groundwater quality standards in and around the land application areas during and after ISR operations and during reclamation.

5.6.4 Surface Water

5.6.4.1 Potential Surface Water Impacts

Potential surface water impacts include increased sediment load due to surface disturbance, very limited stream channel disturbance, potential encroachment on wetlands, and potential water quality impacts from leaks or spills. Each of these is described below.

5.6.4.1.1 Potential Sedimentation

Construction activities within the well fields, along the pipeline corridors and roads, and at the CPP and Satellite Facility have the potential to increase the sediment yield of the disturbed areas. The potential impacts will be minimal due to the relatively small size of the disturbance areas relative to the watershed areas and due to the implementation of the sediment control plan described in Section 5.3.9 and the mitigation measures described in Section 5.5.4.2.

5.6.4.1.2 Potential Impacts to Stream Channels and Riparian Areas

As described in Section 5.3.9, 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 the stream channels. Some facilities must be located within stream channels, such as pipeline corridors and access roads. These will cross the stream channels perpendicular to the flow direction to minimize disturbance. Primary and secondary access road stream channel crossings will include culverts as described in Section 5.3.8.

Ephemeral stream channels also will be disturbed temporarily at the upstream and downstream ends of the diversion channels described in Section 5.3.9.1, which describes the erosion protection measures that will be used for diversion channels.

- Use sediment trapping devices such as hay or straw bales, fabric fences, and devices to control water flow and discharges to trap sediments moved by runoff.
- Maintain natural contours as much as possible, stabilizing slopes and avoiding unnecessary off-road travel with vehicles; maintaining natural contours as much as possible, stabilizing slopes and avoiding unnecessary off-road travel with vehicles.
- The land application of treated wastewater will occur at agronomic rates to avoid irrigation runoff into surface water; catchment areas also will prevent land application water from entering surface water.
- Prepare and implement a Stormwater Pollution Prevention Plan that is consistent with state and federal standards for construction and operation activities.
- Facilities will be constructed outside of flood inundation areas to the extent practicable.
- Best management practices will be utilized during ISR operations.

Powertech (USA) will comply with South Dakota surface water quality standards for surface water sites during and after ISR operations and during reclamation. Operational surface water monitoring will occur at 10 stream sampling sites listed in Table 5.5-3. Four of these sites are on stream segments with designated beneficial uses (Beaver Creek and the Cheyenne River). Section 3.5.4.1.1 describes how the sampled segments of Beaver Creek and the Cheyenne River have beneficial uses for warmwater semipermanent fish life propagation and limited-contact recreation. Section 3.5.4.1.1 describes how baseline samples collected from Beaver Creek met the ARSD 74:51:01:48 criteria for warmwater semipermanent fish life propagation waters except for some measurements of total suspended solids (TSS). Similarly, Cheyenne River baseline samples met the criteria except for some TSS measurements and one dissolved oxygen measurement.

Routine operational monitoring of surface water sites will be used to demonstrate compliance with the antidegradation policy for surface waters in ARSD 74:51:01:34, which requires existing beneficial uses to be maintained and protected. The mitigation measures described above will ensure that the Dewey-Burdock Project will not cause significant changes in surface water quality. To verify the effectiveness of mitigation measures, Powertech (USA) will analyze surface water samples for the parameter list in Table 5.5-4.

5.6.5 Spills and Leaks

5.6.5.1 Potential Impacts from Spills and Leaks

Potential impacts from spills and leaks include potential impacts to soil, surface water, and groundwater resulting from a spill or leak in the well fields, processing facilities, transportation vehicles, or ponds. Each of these is described below.

5.6.5.1.1 Well Fields and Pipelines

Well field features such as header houses, well heads or pipelines could contribute to pollution in the unlikely event of a release of ISR solution due to pipeline or well failure. A spill or leak in these areas could potentially impacts soils, surface water and groundwater. Potential impacts will be minimized by routine MIT of all injection, production and monitor wells and hydrostatic leak testing of all pipelines during construction; implementing an instrumentation and control system to monitor pressure and flow and immediately detect and correct an anomalous condition; and implementing a spill response and cleanup program in accordance with NRC license requirements and DENR permit conditions.

5.6.5.1.2 CPP and Satellite Facility

The CPP will serve as the hub for production operations at the project; therefore, the CPP will likely have the greatest potential for spills or accidents potentially resulting in the release of pollutants. Potential releases also could occur from the Satellite Facility. Potential releases could result from a tank or process vessel failure, pipe rupture, or transportation incident.

6.4.1.2 Agricultural or Horticultural Crops

In conformance with ARSD 74:29:06:02(1), agricultural or horticultural crops reclamation will follow guidelines established in ARSD 74:29:07:21. The reclaimed agricultural or horticultural land will have the capability of producing crops consistent with similar crop production areas in the surrounding region, and the reclamation will be considered complete when productive capability is equivalent to or exceeds similar crop production areas in the surrounding region for 2 consecutive crop years. Monitoring will be performed in accordance with ARSD 74:29:06:02(3), which requires support and maintenance activities documenting successful implementation of reclamation.

Alfalfa is the only crop currently proposed for reclamation of designated agricultural or horticultural cropland in the proposed permit area. Alfalfa is the only crop currently grown in the proposed permit area and is grown in several areas nearby, so comparative production figures from nearby areas will be readily available. Alfalfa production in reclaimed cropland will be compared with that in undisturbed areas within or adjacent to the permit area. According to the landowner who grows alfalfa within the proposed permit area, the average annual alfalfa production over the past 10 years is 1.75 tons per acre (personal communication between John Putnam and Lisa Scheinost, Powertech (USA), January 4, 2013). Powertech (USA) will provide DENR with annual crop yields within the permit area beginning in 2013, with updates each year prior to and during ISR operations and during reclamation.

All disturbed areas with a delineated postmining land use of agricultural or horticultural crops will have an alternate postmining land use of rangeland. In the event that these agricultural or horticultural croplands are not desired by the landowner to be used as cropland following reclamation, the land will be designated as rangeland and will follow guidelines established in ARSD 74:29:07:20 for rangeland reclamation, as described above.

6.4.2 Interim Revegetation

Interim revegetation is the process of temporarily stabilizing grounds which are scheduled to be re-disturbed before the completion of mining. Portions of the permit area which will receive interim revegetation treatments include topsoil stockpiles, well fields, and pipelines. Because of the limited availability of salvageable topsoil material, some disturbed areas subject to interim reclamation will be directly seeded without the replacement of topsoil material. Straw mulch may be applied at the time of seeding to further improve and accelerate planting success; however, such applications will be site specific. Topsoil stockpiles which are to remain

undisturbed for more than 2 years will be regraded to a stable configuration, bermed, and seeded in accordance with ARSD 74:29:08:02. Interim seeding will be done with the same seed mixture as the final seeding mixture shown in Table 6.4-1 to ensure that all interim reclamation is compatible with final reclamation when it occurs. The letter of concurrence with this seed mixture from the local NRCS office is provided in Appendix 6.4-B, and letters of concurrence with this seed mixture from landowners are presented in Appendix 6.4-A.

6.4.3 Surface Disturbance Reclamation

Due to the nature of ISR activities, minimal and intermittent surface disturbance will be associated with the project, and will be mainly associated with the CPP, Satellite Facility, and ancillary facilities such as ponds. Additional intermittent disturbance will occur in the well fields, including well drilling, pipe installations, and road construction.

Surface disturbances associated with the construction of the CPP, Satellite Facility, and ponds will be for the life of those activities. Topsoil will be stripped and stockpiled from these areas prior to construction. Disturbances associated with the well field drilling and pipeline installation are limited and will be reclaimed as soon as possible after these components are completed. The topsoil will be temporarily stripped and stockpiled from well field disturbance areas prior to well field construction. Surface disturbance associated with the development of

access roads also will occur; topsoil will be stripped from the road areas and stockpiled prior to construction.

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.

Powertech (USA) will restrict grazing on newly seeded areas if it is necessary to preclude livestock or wildlife from impairing establishment of the required vegetation. Possible means to restrict grazing could include, but are not limited to, fencing and working with landowners to voluntarily withhold grazing from areas containing reclamation.

6.4.3.1 Spoil Replacement and Grading

Following is a description of the general spoil replacement and grading activities followed by specific methods for mud pits, processing areas, land application areas, and access roads.

General Methods

During reclamation, spoil will be replaced from areas previously excavated, including pond and diversion channels. Spoil will be replaced in lifts and compacted as necessary to match premining conditions.

Due to the nature of uranium ISR, there will be very few construction activities that will require significant grading or contouring during reclamation. Finish grading will be achieved with typical earth moving equipment such as motor graders. Disturbed areas will be contoured to blend in with the natural terrain. Reclaimed slopes will not be steeper than 3:1 unless DENR approves steeper slopes. The postmining contours will be approximately the same as premining contours, as shown on Plate 6.4-1. Protection of areas outside of the affected graded areas from slides or other damage will be accomplished by avoiding the use of highwalls, contouring disturbed areas to blend in with the natural terrain, and not constructing reclaimed slopes steeper than 3:1 unless DENR approves steeper slopes.

The finished, contoured surface will be ripped as needed prior to topsoil replacement to relieve compaction, aid infiltration, promote root penetration, and prevent topsoil slippage and instability.

A sediment control plan will be implemented during all project phases, including final grading, to reduce soil loss within the proposed permit area. The sediment control measures discussed in Section 5.3.9 will be maintained and inspected until contributing areas are reclaimed. Sediment control structures are described in Section 5.3.9.3 and include silt fence, check dams, sediment

anticipated duration of land application reclamation is 1 year. It will be done during the CPP and main facility decommissioning phase shown on Figure 5.2-1.

Access Roads

Access road reclamation is described in Section 6.4.3.3.

6.4.3.2 Topsoil Replacement

Refer to Section 5.3.7 for a description of topsoil handling during construction. In areas that will be disturbed for prolonged periods during the life of the project (i.e., more than one construction season), topsoil will be salvaged and stored in designated topsoil stockpiles. Topsoil will be removed by scrapers under most circumstances, although other mobile equipment may be used occasionally. The topsoil salvaged for pipeline construction corridors may be bladed to the side to permit pipeline construction and then bladed back after construction is complete. Field salvage operations will be monitored by qualified field personnel. Topsoil stripping depths will vary throughout the permit area, but are expected to average approximately 19.5 inches (refer to Appendix 3.3-A). During reclamation, topsoil temporarily stored in stockpiles will be redistributed over the originally disturbed area. The replacement depth will be calculated based on the stockpile volume and the area to be reclaimed. The amount of topsoil salvaged is estimated to be the same as the amount replaced, such that there is not anticipated to be excess or limited topsoil. Powertech (USA) does not anticipate using topsoil substitutes. The topsoil will be graded to blend with the adjacent topography.

In areas of temporary disturbance such as those affected by the installation of monitor wells and pipelines, topsoil will be separated from subsoil during construction and replaced following subsoil replacement. The topsoil will be replaced over the entire disturbed area using a uniform depth based on the amount of topsoil that was salvaged. The topsoil will be replaced at an approximately 1:1 ratio from the area from which it was stripped to ensure that sufficient topsoil will be available for final reclamation in accordance with ARSD 74:29:07:07(2)(c). Following topsoil replacement, interim revegetation will be performed to control erosion as described in Section 6.4.2. Interim revegetation will use the same seed mixture as the final seeding mix to ensure that the topsoil or subsoil capacity and productive capability is not diminished by the distribution and can be restored in accordance with the requirement of ARSD 74:29:07:07(2)(a). Revegetating areas of interim reclamation and using erosion control BMPs as necessary will ensure that the topsoil in areas of temporary disturbance will be protected from erosion in accordance with the requirement of ARSD 74:29:07:07(2)(b).

As described in Section 5.3.7, Powertech (USA) will analyze topsoil prior to stripping in the processing areas and the first well field in each of the Dewey and Burdock areas to determine whether fertilizer or other amendments will be required to establish and sustain vegetative growth during reclamation. In addition, in areas of poor baseline vegetative cover, Powertech (USA) may analyze the topsoil to determine whether fertilizer or other amendments will be required to establish and sustain a vegetative cover on reclaimed areas. See also Section 6.4.3.4 for a discussion of areas with low vegetative cover densities that likely will have low revegetation potential if disturbed. These include the Darrow Mine surface pits/spoil piles and the "alkali area." In only very limited areas, which are anticipated to include the historical mine pits and the alkali area (notwithstanding the processing areas and initial well fields, which are described in Section 5.3.7), Powertech (USA) will sample the topsoil and subsoil prior to disturbance. If the evaluation demonstrates that its chemical or physical characteristics would seriously inhibit plant growth and that it is not feasible to remedy by chemical treatment, overburden replacement, or like measures, Powertech (USA) will request that the revegetation performance criteria not apply for these limited areas as allowed by SDCL 45-6B-46(2).

6.4.3.3 Access Road Reclamation

All roads and portions of roads constructed and utilized for access to the facilities and well fields will be removed and reclaimed unless exempted from reclamation by the request of the landowner/lessee, in which case the landowner/lessee will accept the responsibility for their long-term maintenance and ultimate reclamation. In this case, Powertech (USA) will request in writing to the board that a road or portion of a road remain un-reclaimed in accordance with ARSD 74:29:07:12(10).

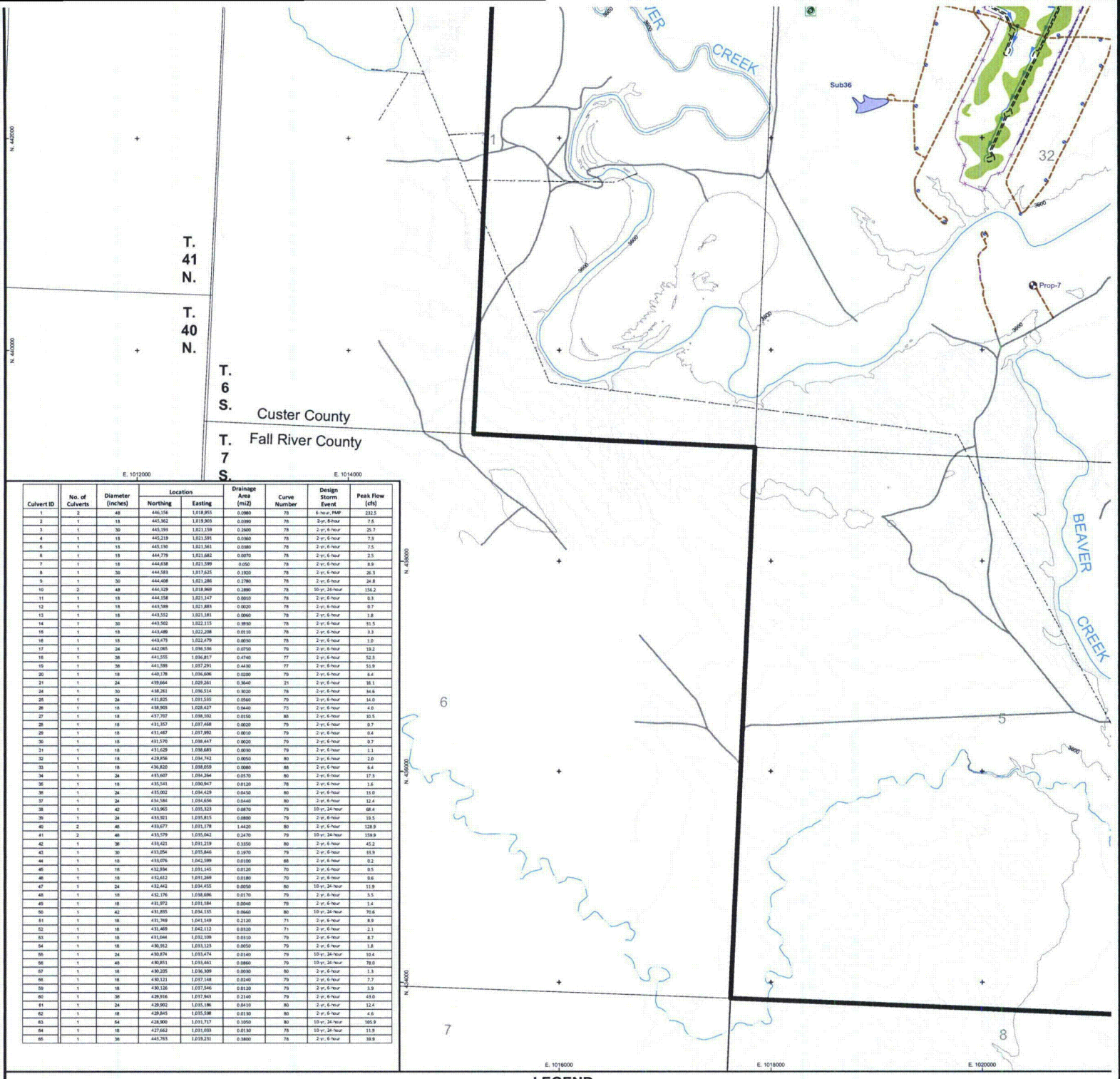
Prior to reclamation, any contamination which resulted from the ISR operation will be cleaned to NRC-approved standards and the contaminated material disposed offsite at an appropriately permitted facility.

Access roads will be reclaimed by removing imported road surfacing material and ripping road surfaces and shallow subsoil to loosen the subsoil. Culverts will be removed and premining drainages re-established. Any spoil temporarily stockpiled during access road construction will be replaced. Access road areas will be graded to approximate premining contours. Topsoil will be replaced in a uniform manner and the area revegetated.

Access roads will be reclaimed when they are no longer needed. Well field access roads will be reclaimed during reclamation of each well field unless they are used to access other well fields or monitoring locations. The primary access roads will be reclaimed during the CPP and main facility decommissioning phase shown on Figure 5.2-1. The expected duration of access road reclamation is less than 1 year for each access road, but may occur over several years due to phased well field decommissioning/reclamation.

6.4.3.4 Revegetation Methods and Final Seed Mix

The permanent seed mixture for the rangeland reclamation type is presented in Table 6.4-1. Per DENR regulations, the seed mix has been chosen to be compatible with the postmining rangeland use. The local conservation district, landowners and DENR were consulted when selecting the seed mix (Appendices 6.4-A and 6.4-B). To reduce wind and water erosion, topsoil stockpiles and other various temporary disturbances in the well field area will be seeded. The temporary seed mix is the same as the permanent seed mixture.



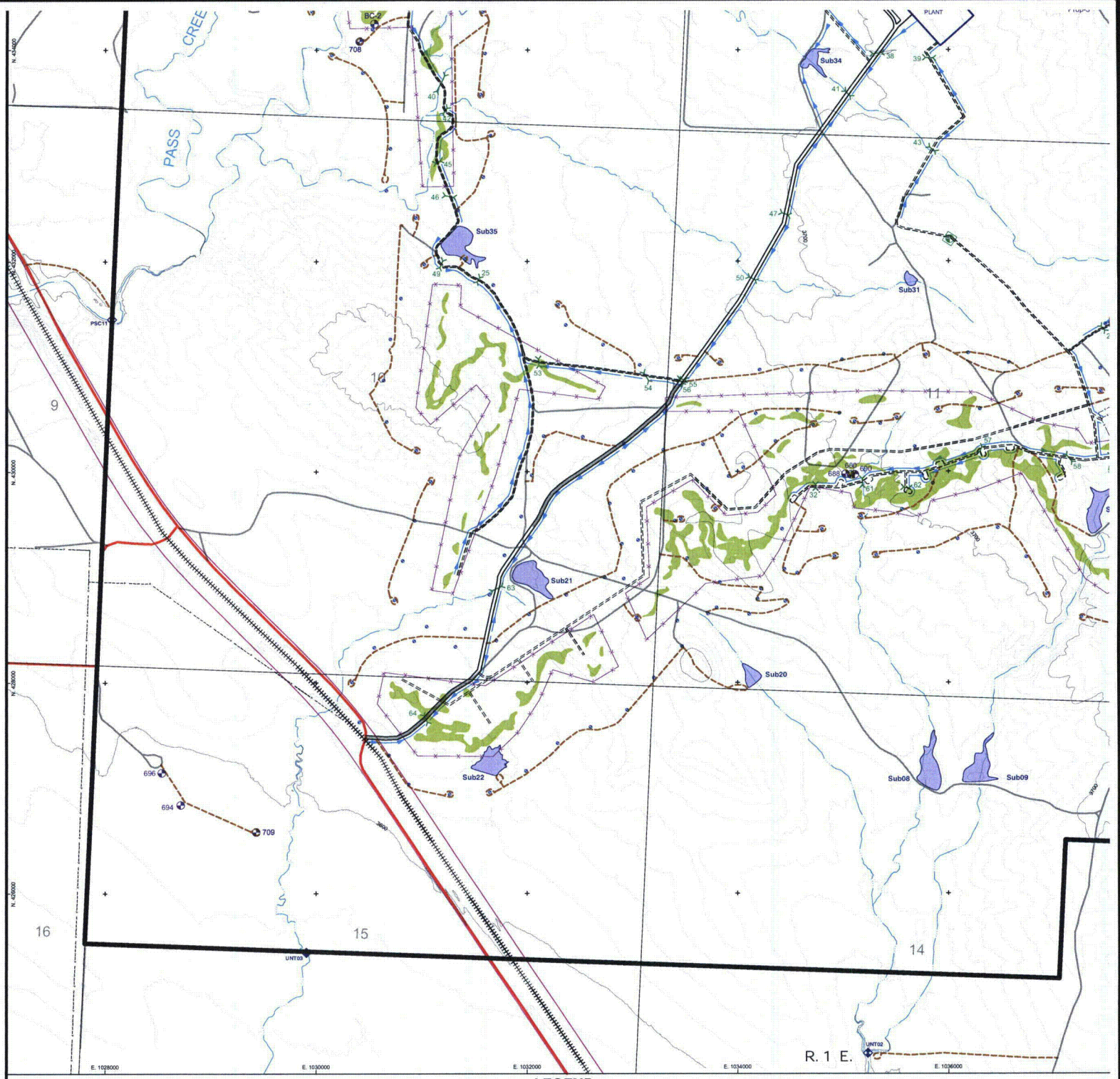
Culvert ID	No. of Culverts	Diameter (inches)	Location		Drainage Area (mi2)	Curve Number	Design Storm Event	Peak Flow (cfs)
			Northing	Easting				
1	2	48	446,156	1,018,955	0.0980	78	6-hour, PMP	232.5
2	1	18	445,362	1,019,903	0.0390	78	2-yr, 6-hour	7.6
3	1	30	445,193	1,021,159	0.2600	78	2-yr, 6-hour	25.7
4	1	18	445,219	1,021,591	0.0360	78	2-yr, 6-hour	7.3
5	1	18	445,130	1,021,561	0.0380	78	2-yr, 6-hour	7.5
6	1	18	444,779	1,021,682	0.0070	78	2-yr, 6-hour	2.5
7	1	18	444,638	1,021,599	0.050	78	2-yr, 6-hour	8.9
8	1	30	444,583	1,017,625	0.1920	78	2-yr, 6-hour	26.3
9	1	30	444,408	1,021,286	0.1780	78	2-yr, 6-hour	24.8
10	2	48	444,329	1,018,969	0.2890	78	10-yr, 24-hour	156.2
11	1	18	444,158	1,021,147	0.0010	78	2-yr, 6-hour	0.3
12	1	18	443,589	1,021,883	0.0020	78	2-yr, 6-hour	0.7
13	1	18	443,552	1,021,181	0.0060	78	2-yr, 6-hour	1.8
14	1	30	443,502	1,022,115	0.3930	78	2-yr, 6-hour	51.5
15	1	18	443,489	1,022,208	0.0110	78	2-yr, 6-hour	3.3
16	1	18	443,479	1,022,479	0.0030	78	2-yr, 6-hour	1.0
17	1	24	442,065	1,036,536	0.0750	79	2-yr, 6-hour	19.2
18	1	36	441,555	1,036,817	0.4740	77	2-yr, 6-hour	52.3
19	1	36	441,599	1,037,291	0.4430	77	2-yr, 6-hour	51.9
20	1	18	440,178	1,036,606	0.0200	79	2-yr, 6-hour	6.4
21	1	24	439,664	1,029,261	0.3640	21	2-yr, 6-hour	16.1
24	1	30	438,261	1,036,514	0.3020	78	2-yr, 6-hour	34.6
25	1	24	431,825	1,031,535	0.0560	79	2-yr, 6-hour	14.0
26	1	18	438,903	1,028,427	0.0440	73	2-yr, 6-hour	4.0
27	1	18	437,707	1,038,102	0.0150	88	2-yr, 6-hour	10.5
28	1	18	431,357	1,037,468	0.0020	79	2-yr, 6-hour	0.7
29	1	18	431,487	1,037,992	0.0010	79	2-yr, 6-hour	0.4
30	1	18	431,570	1,038,447	0.0020	79	2-yr, 6-hour	0.7
31	1	18	431,629	1,038,683	0.0030	79	2-yr, 6-hour	1.1
32	1	18	429,856	1,034,742	0.0050	80	2-yr, 6-hour	2.0
33	1	18	436,820	1,038,059	0.0080	88	2-yr, 6-hour	6.4
34	1	24	435,607	1,034,264	0.0570	80	2-yr, 6-hour	17.3
35	1	18	435,541	1,030,947	0.0120	78	2-yr, 6-hour	1.6
36	1	24	435,002	1,034,429	0.0450	80	2-yr, 6-hour	13.0
37	1	24	434,584	1,034,656	0.0440	80	2-yr, 6-hour	12.4
38	1	42	433,965	1,035,323	0.0870	79	10-yr, 24-hour	68.4
39	1	24	433,921	1,035,815	0.0800	79	2-yr, 6-hour	19.5
40	2	48	433,677	1,031,178	1.4420	80	2-yr, 6-hour	128.9
41	2	48	433,579	1,035,042	0.2470	79	10-yr, 24-hour	159.9
42	1	36	433,421	1,031,219	0.3350	80	2-yr, 6-hour	45.2
43	1	30	433,054	1,035,846	0.1970	79	2-yr, 6-hour	33.9
44	1	18	433,076	1,042,599	0.0100	88	2-yr, 6-hour	0.2
45	1	18	432,934	1,031,145	0.0120	70	2-yr, 6-hour	0.5
46	1	18	432,612	1,031,269	0.0180	70	2-yr, 6-hour	0.8
47	1	24	432,442	1,034,455	0.0050	80	10-yr, 24-hour	11.9
48	1	18	432,176	1,038,696	0.0170	79	2-yr, 6-hour	5.5
49	1	18	431,972	1,031,184	0.0040	78	2-yr, 6-hour	1.4
50	1	42	431,835	1,034,135	0.0660	80	10-yr, 24-hour	70.6
51	1	18	431,749	1,041,149	0.2120	71	2-yr, 6-hour	8.9
52	1	18	431,469	1,042,112	0.0320	71	2-yr, 6-hour	2.1
53	1	18	431,044	1,032,109	0.0110	79	2-yr, 6-hour	3.7
54	1	18	430,912	1,033,123	0.0050	79	2-yr, 6-hour	1.8
55	1	24	430,874	1,033,474	0.0140	79	10-yr, 24-hour	10.4
56	1	48	430,851	1,033,461	0.0860	79	10-yr, 24-hour	78.0
57	1	18	430,205	1,036,309	0.0030	80	2-yr, 6-hour	1.3
58	1	18	430,121	1,037,148	0.0240	79	2-yr, 6-hour	7.7
59	1	18	430,126	1,037,546	0.0120	79	2-yr, 6-hour	3.9
60	1	36	428,916	1,037,943	0.2140	79	2-yr, 6-hour	43.0
61	1	24	429,902	1,035,186	0.0410	80	2-yr, 6-hour	12.4
62	1	18	429,845	1,035,598	0.0130	80	2-yr, 6-hour	4.6
63	1	54	428,900	1,031,717	0.1050	80	10-yr, 24-hour	105.9
64	1	18	427,662	1,031,033	0.0130	78	10-yr, 24-hour	11.9
65	1	36	443,763	1,019,231	0.3800	78	2-yr, 6-hour	39.9

LEGEND

- PERMIT BOUNDARY
- COUNTY ROAD
- EXISTING ROAD
- PROPOSED PRIMARY ACCESS ROAD
- PROPOSED SECONDARY ACCESS ROAD
- PROPOSED LIGHT USE ROAD
- RAILROAD
- APPROXIMATE RAILROAD RIGHT-OF-WAY
- PERENNIAL STREAM CHANNEL
- EPHEMERAL STREAM CHANNEL
- PROPOSED ROAD DITCH
- PROPOSED OVERHEAD POWER
- EXISTING BLACK HILLS ELECTRIC
- PROPOSED WELL FIELD FENCE
- PROPOSED CULVERT
- ORE BODY
- FACILITY POND
- STAGING AREA
- MONITOR WELL
- MADISON WELL
- STREAM MONITORING LOCATION
- DEEP DISPOSAL WELL (SEE NOTE)
- PERIMETER MONITOR WELL
- EXISTING IMPOUNDMENT TO BE MONITORED

This plate is provided to fulfill the requirements of ARSD 7

Note: This plate will be updated in the event that land apj



LEGEND

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- COUNTY ROAD
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- PERIMETER MONITOR WELL
- EXISTING IMPOUNDMENT TO BE MONITORED

This plate is provided to fulfill the requirements of ARSD 7

Note: This plate will be updated in the event that land app

Legal Description		Area (acres)	Surface Owner(s)	Mineral Owner(s)
Township 7S, Range 1E, Fall River County, SD Black Hills Meridian				
Section 1	All	640	Daniel Properties, LLC	BLM Minerals
Section 2	All	640	Daniel Properties, LLC	Daniel Properties, LLC
Section 3	N½; SW¼; N½SE¼; SW¼SE¼	600	Donald and Pat Spencer	Donald and Pat Spencer
	SE¼SE¼	40	BLM	BLM Minerals
Section 4	W½W½	160	Putnam & Putnam, LLP	Putnam & Putnam, LLP
Section 5	All	640	Putnam & Putnam, LLP	Putnam & Putnam, LLP
Section 10	NE¼; W½SE¼; E½SW¼; SW¼NW¼SW¼; SW¼SW¼ minus 3.97 ac in NE portion	366.03	Peterson & Son, Inc.	Peterson & Son, Inc. Black Stone Minerals Company, LP Jean Swirczynski Roy Guess
	NW¼NW¼SW¼	10	TerraTecTonics Corporation	TerraTecTonics Corporation
	E½NW¼SW¼ minus lots in southern portion (1.44 ac)	18.56	Donald and Lynda Andersen	Donald and Lynda Andersen
	14 lots in southern portion of E½NW¼SW¼; 3.97 ac in NE portion of SW¼SW¼	5.1	Kathleen Stritar	Kathleen Stritar
	4 lots in southern portion of E½NW¼SW¼	0.31	Clifford James Lovell and Patricia C. Johnson	Clifford James Lovell and Patricia C. Johnson
	N½NW¼	80	Donald and Pat Spencer	Steven and Elizabeth Laesch Roger C. and Jeanette R. Laesch Christopher and Kelly Ann Viel Rev. Norman and Joyce Laesch Carol A. Laesch Barbara Jacqueline S. Laesch Ellison Frederick and Marilyn Laesch Helen L. and Carl Leroy Kellberg Rev. Richard and Irene L. Mueller William J. Laesch Allen G. and Barbara B. Wilson
	S½NW¼	80	Donald and Pat Spencer	Donald and Pat Spencer
	NE¼SE¼	40	BLM	BLM Minerals

APPENDIX 5.6-C

Conceptual Spill Contingency Plan

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Conceptual Spill Contingency Plan
Dewey-Burdock Project

COVER

The spill contingency plan will be organized with a cover page that includes the following:

Title:	Dewey-Burdock Project Spill Contingency Plan
Original preparation date:	To be determined (TBD)
Revision date:	TBD
Preparer:	TBD
Title of preparer:	TBD

1.0 INTRODUCTION

This section will describe the purpose of the spill contingency plan, which is to describe the spill prevention, containment, response, cleanup, recordkeeping, and reporting procedures for the Dewey-Burdock Project. It will describe how the spill response and reporting procedures will depend on the type and quantity of chemical or solution released and the location of the release. It will cross reference the emergency response plan that will be prepared and made available for regulatory inspection prior to operations.

2.0 EMERGENCY CONTACTS

This section will list contact information for local, state, and federal emergency response officials. Names and telephone numbers for spill response contractors and Powertech (USA) Inc. spill response personnel also will be provided. Example emergency contacts include:

- Powertech (USA) Inc. personnel
  - Facility manager
  - Vice President of Environmental Health & Safety
  - Radiation safety officer (RSO)
  - Radiation safety technicians (RSTs)
- Local contacts
  - Emergency medical, fire and law enforcement - 911
  - Hospitals and healthcare facilities
  - County emergency management offices - Custer and Fall River Counties
- State contacts
  - DENR
  - SDGF&P
- Federal contacts
  - NRC
  - EPA
  - BLM

  - USDOT
  - USFWS
  - USFS
- Spill and/or emergency response contractors

3.0 SITE LOCATION AND TRANSPORTATION ROUTES

This section will include a project location map and maps of the major routes for transporting chemicals to and from the site. Example transportation routes include:

- Shipment of uranium-loaded resin from the Dewey satellite facility to the Burdock CPP
- Shipment of uranium-loaded resin to and from the permit area (either to another CPP or from another satellite facility, if applicable)
- Shipment of yellowcake to a conversion facility in Metropolis, Illinois or Port Hope, Ontario, Canada
- Shipment of 11e.(2) byproduct material to a licensed disposal facility (e.g., the White Mesa site in Blanding, Utah)
- Shipment of used oil and hazardous waste to a recycling or disposal facility

This section also will describe the proximity of chemical storage areas, ponds, and pipelines to the nearest water(s) of the state as defined in ARSD 74:51 and ARSD 74:54.

4.0 APPLICABLE PERMITS AND LICENSES

This section will list all permits and licenses applicable to the spill contingency plan. For each applicable permit/license, the name, issuing agency, description, and relevant spill contingency conditions and requirements will be listed. Example permits/licenses include:

- Construction and industrial NPDES permits issued by DENR, which will include best management practices to prevent surface water contamination in the event of a spill or leak and will include reporting requirements for spills of petroleum products or hazardous chemicals
- Specific permit conditions included in the large scale mine permit issued by DENR
- Specific permit conditions included in the groundwater discharge permit issued by DENR, including the requirement to report within 24 hours any spill, leak, or accidental release which threatens a water of the state in accordance with ARSD 74:54:02:25
- NRC license conditions related to spills and leaks
- EPA Class III and V UIC permit conditions related to excursions with potential to impact nearby USDWs

5.0 MATERIAL INVENTORY

This section will include a table listing process-related chemicals, other chemicals stored or used at the site (e.g., petroleum products and small quantities of hazardous materials), and solutions

with potential for unplanned releases (e.g., process wastewater, production and restoration solutions in well field pipelines, treated wastewater in pipelines and land application areas, etc.). For each chemical or solution, the table will list the quantity and location stored or used on-site. This section also will include maps showing the locations where each chemical or solution is stored or used and the locations of spill response kits.

6.0 SPILL PREVENTION BEST MANAGEMENT PRACTICES

This section will describe the best management practices (BMPs) that will be used to prevent, monitor, and contain spills and leaks. Example BMPs include:

- Engineering controls such as secondary containment curbs, sumps, leak detection systems, pond liners, etc.
- Standard operating procedures (SOPs) for inspections, maintenance and monitoring to prevent major pond, tank or pipeline failures; SOPs for preventing transportation accidents; etc.
- Employee training requirements including training frequency and topics (i.e., procedures for spill prevention, containment, response and cleanup)
- Required spill contingency plan reviews and updates

7.0 SPILL RESPONSE AND CLEANUP PROCEDURES

This section will describe spill response procedures and personnel roles and responsibilities for each chemical or solution that may be spilled or leaked. It will describe chemical handling procedures and hazards, emergency spill response procedures, and the actions necessary to clean up affected areas once initial emergency response actions have been taken.

8.0 REPORTING AND RECORDKEEPING

This section will summarize the reporting requirements, including minimum reportable quantities and reporting timeframes, for each chemical and solution identified in the material inventory. This includes immediate notification requirements, typically within 4 to 24 hours, of any spill having the potential to affect human health or the environment, and written reporting requirements. This section also will identify documentation requirements for spills, leaks or accidental releases. Each spill report is anticipated to include:

- The date, time and location of the spill
- The type and volume of chemical or solution released
- The name, address and telephone number of the spill report preparer and the person responsible for reporting the spill (if applicable)
- The cause or suspected cause of the spill
- The total activity of each radionuclide released (if applicable)
- An explanation of the response actions taken
- An evaluation of the effectiveness of response and cleanup activities

- The immediate known impacts of the spill, including an evaluation of whether a water of the state was impacted or had the potential to be impacted
- A list of agencies notified and an evaluation of reporting criteria
- Copies of sampling results to determine the extent or severity of the spill or effectiveness of cleanup (if applicable)
- Recommendations for preventing recurrence.

9.0 MISCELLANEOUS

Additional information anticipated to be included in the spill contingency plan includes:

- Inventory of spill response equipment
- Spill reporting forms
- Employee training records
- Records of reviews and updates to the spill contingency plan

POWERTECH (USA) INC.

INSTRUMENT OF CONSULTATION (Page 1 of 1)

Part 1. LANDOWNER NAME, ADDRESS AND PROPERTY DESCRIPTION

Surface Owner:	Custer County Roads
Mailing Address:	
Legal Description of Property within Permit Boundary:	County Road Right of Way from the southeastern part of the Dewey-Burdock project to the northwestern part of the project.

Part 2. POST-MINING LAND USE

Proposed Post-Mining Land Use:	Rangeland
As the owner(s) of the property described, I/we have conferred with Powertech (USA) Inc. regarding the proposed post-mining land use and have determined that it is acceptable to me/us (ARSD 74:29:06:01).	
Signature(s):	X
Date:	12-20-12

Part 3. RECLAMATION SEED MIXTURE

Proposed Seed Mix developed by the Natural Resource Conservation Service (NRCS) in Hot Springs, South Dakota March 7, 2012:	Species	Pounds (pure live seed per acre)*
	Western Wheatgrass	1.94
	Sideoats Grama	1.45
	Slender Wheatgrass	1.41
	Green Needlegrass	1.43
	Little Bluestem	0.91
	Total	7.16
	*Seed mix is for "drill" seeding application. If mix is broadcasted, the seeding rate will be increased by 2.5 times.	
As the owner(s) of the property described, I/we have reviewed the proposed reclamation seed mix and find that it is acceptable to me/us (SDCL 45-6B-39).		
Signature(s):	X	
Date:	12-20-12	

POWERTECH (USA) INC.

INSTRUMENT OF CONSULTATION (Page 1 of 1)

Part 1. LANDOWNER NAME, ADDRESS AND PROPERTY DESCRIPTION

Surface Owner:	Fall River County Roads
Mailing Address:	
Legal Description of Property within Permit Boundary:	County Road Right of Way from the southeastern part of the Dewey-Burdock project to the northwestern part of the project.

Part 2. POST-MINING LAND USE

Proposed Post-Mining Land Use:	Rangeland
As the owner(s) of the property described, I/we have conferred with Powertech (USA) Inc. regarding the proposed post-mining land use and have determined that it is acceptable to me/us (ARSD 74:29:06:01).	
Signature(s):	X Michael A. Ostrander
Date:	12/6/12

Part 3. RECLAMATION SEED MIXTURE

Proposed Seed Mix developed by the Natural Resource Conservation Service (NRCS) in Hot Springs, South Dakota March 7, 2012:	Species	Pounds (pure live seed per acre)*
	Western Wheatgrass	1.94
	Sideoats Grama	1.45
	Slender Wheatgrass	1.41
	Green Needlegrass	1.45
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As the owner(s) of the property described, I/we have reviewed the proposed reclamation seed mix and find that it is acceptable to me/us (SDCL 45-6B-39).		
Signature(s):	X Michael A. Ostrander	
Date:	12/6/12	