4.0 Environmental Consequences

This chapter describes the environmental consequences, also referred to as “impacts” or “effects,” associated with the Project and alternatives described in Chapter 2.0. Impacts are analyzed based on application of applicant-committed measures described in Section 2.3.9, Applicant-committed Environmental Protection Measures. The analysis considers the existing conditions within the affected environment presented in Chapter 3.0, identifies the types of impacts from the Project and alternatives, and quantifies the impacts to the extent practicable for disclosure in this EIS. The types of impacts disclosed include the following:

- **Direct Impacts** – The effects that are caused by the action and occur at the same time and place. Examples include the elimination of original land use due to the erection of a structure.
- **Indirect Impacts** – The effects that are indirectly caused by the action. They occur later or are farther removed in distance, but are still reasonably foreseeable and related to the action by a chain of cause and effect. Indirect impacts may reach beyond the natural and physical environment (e.g., environmental impact) to include growth-inducing effects and other effects related to induced changes to resource users (e.g., non-environmental impact).

Final location of wells and infrastructure within each mine unit would be determined in detail based on the results of hydrologic testing performed prior to mine unit development, as described in Section 2.3.2, Mine Unit Construction. While precise location has not been determined for Project components within individual mine units, disturbance and impacts associated with them are sufficiently captured for analysis through assumptions for each alternative presented in Chapter 2.0, Proposed Action and Alternatives.

The impact analysis is designed to show relative differences in alternatives as they pertain to specific resources, resource uses, or social and economic features. It is not intended to predict the exact amount, timing, or location of effects that could occur should the alternative be selected for implementation. The numbers generated in this analysis are approximations, and are intended for comparison of impacts only.

Each resource section includes a discussion of the resource-specific analysis area and assumptions used in the analysis, followed by the direct and indirect impacts of each alternative. As part of the impact analysis for each resource, discussions on the following are included:

- **Mitigation and Mitigation Effectiveness** – BLM-imposed mitigation measures designed to reduce, minimize, or mitigate environmental effects that could occur as a result of the Project, as well as anticipated benefits from implementation of those measures.
- **Residual Impacts** – Impacts anticipated to remain after mitigation measures have been applied.
- **Irreversible and Irretrievable Impacts** – Permanent loss of future use of a resource (irreversible), and temporary loss of a renewable resource (irretrievable impacts) that would occur as a result of the Project.
- **Relationship between Local Short-term Uses and Long-term Productivity** – Both adverse and beneficial short-term uses of the human environment, and any detrimental impacts on the achievement or maximization of long-term productivity anticipated due to the Project

The cumulative impacts of each alternative, when added to past, present, and reasonably foreseeable future activities, are discussed in Chapter 5.0.

4.1 Air Quality

The analysis of air quality impacts involves estimating emissions from Project activities and air pollutant concentrations at receptors at and beyond the boundaries of the GHPA. The analysis area for air quality impacts includes the areas at the boundary of GHPA and a 5-km buffer.

Air quality issues associated with construction and operation of the Project were identified by BLM through internal scoping, consultation with cooperating agencies, and through comments provided during the scoping process. Issues identified included fuel combustion and fugitive dust emissions from the following:

- Construction equipment and vehicles for site preparation, reclamation, and decommissioning of surface facilities;
- Well-drilling equipment and vehicles for drilling production and monitor wells;
- Natural gas- or propane-fired heating units for the satellite facility;
- Trucks for transporting construction materials as well as the product of the Gas Hills Project (uranium-laden ion-exchange resin); and
- Light-duty vehicles for commuting by construction crew and employees.

Direct and indirect impacts were analyzed primarily on the basis of anticipated emissions of criteria pollutants within the analysis area, determined by analyzing the capacity and number of equipment and machines and frequency and duration of operation for each of these emission sources. Methods used for determining impacts are summarized in this section and a detailed description of the methods is included in **Appendix E**.

The following assumptions were used for analysis of impacts to air resources:

- Light vehicles such as pickup trucks weigh 2 tons;
- Heavy trucks weigh 10 tons unloaded and 38 tons loaded;
- Speeds on roads within the GHPA would be limited to 10 mph on 2-track roads, 30 mph on secondary roads, and 40 mph on primary roads (Sections 2.3.2.4, Access Roads, Header Houses, and Underground Utilities and Section 2.3.1.3, Access Roads);
- Air impacts primarily would be generated from within the GHPA and along project transportation routes; and
- Drill rig engines are conservatively assumed to have the same horsepower rating as heavy truck engines.

4.1.1 No Action Alternative

Under the No Action Alternative, in-situ uranium extraction would not take place within the GHPA. The Carol Shop facility, 1 road, and previously disturbed land would be reclaimed, resulting in the reclamation of approximately 40 acres. Exploratory drilling would continue at the rate of approximately 5 acres of disturbance per year.

4.1.1.1 Pollutant Emissions

Under the No Action Alternative, no additional air impacts would be generated within the GHPA by the Project. Air quality in the analysis area would continue to have short-term emissions from exploratory well drilling. Reclamation activities would contribute surface disturbance of 40 acres during reclamation of the Carol Shop facility, road, and topsoil piles, and about 5 acres each year from continued exploratory drilling. These activities would result in the potential to release about 122 tons of PM_{10} and

12 tons of $PM_{2.5}$ during the first year, and about 70 tpy annually thereafter. Mobile combustion sources also would continue to release negligible amounts of other criteria pollutants and HAPs.

4.1.1.2 Greenhouse Gases

Regulated GHGs are comprised of various gases that are known as CO_2 equivalents (CO_2e), which include CO_2, methane, and N_2O. Under the No Action Alternative, emission of GHGs would continue from exploration drilling of a conservatively estimated 40 wells per year, but no Project-related construction would occur. Reclamation also would produce diesel-related GHG emissions at an estimated annual rate of 10 percent of that required if the Project is constructed. Estimated production of GHGs under the No Action Alternative is summarized in **Table 4.1-1**.

Table 4.1-1 Yearly Greenhouse Gas Production under the No Action Alternative

Case	Diesel Consumption (gallons) [a]	Power Consumption (megawatt-hours/year)	Diesel-related GHG (tpy)	Indirect Power-related GHG (tpy)	Total GHG (tpy)
			CO_2e	CO_2e	CO_2e
No Action (stationary sources)	0	0	0	0	0
No Action (mobile sources)	2,198,694	0	24,405	0	24,405
Total No Action	**2,198,694**	**0**	**24,405**	**0**	**24,405**

[a] Assumes drill rigs operate 2,800 hours per year, 1 pickup truck commuting to Riverton 50 weeks per year, and reclamation activities would occur at a rate equal to 10 percent of that required for the Proposed Action.

4.1.2 Proposed Action Alternative

Sources of impacts to air quality associated with the Proposed Action Alternative would include: emissions of fugitive dust from construction disturbances, from wind erosion of unreclaimed areas, and from travel on unpaved roads; emissions of priority pollutants from combustion engines; and emissions of GHGs from combustion engines. The potential for emissions is dependent on the type and amount of activity occurring within a localized area at any point in time. The following analysis was designed to estimate the maximum potential impact of the Project to air quality by looking at Project activities that would contribute the most to air quality impacts, assuming activities would occur in a very small area and at the same point in time, and by assuming weather conditions that would cause the least dispersion of any air pollutants. Screening level modeling was used to perform the impacts analyses.

Project activities during construction, operation, and reclamation would vary as described in Section 2.3, Proposed Action, of this document. **Table 4.1-2** includes a summary of the estimated types of equipment used as well as frequency and duration of operation during each project activity. These estimates were used to calculate the impacts discussed in this section. Additional discussion of methods used to calculate impacts to air quality are included in **Appendix E**.

In general the greatest impact to air quality would occur during construction of mine units, when the operation of drill rigs, as well as the largest amount of surface disturbance, would occur. Total disturbance and the potential for production of fugitive dust from general construction activities would be similar during reclamation. Emissions of dust from truck traffic on roads would be less since there would be fewer trucks (i.e., no drill rigs) during the reclamation phase of the Project. Emissions from engines also would be less during reclamation than emissions during construction as drill rigs would not be operating.

4.1.2.1 Pollutant Emissions

Project activities would generate fugitive dust emissions from surface area disturbance during construction and reclamation activities, as well as from wind erosion of disturbed areas and topsoil stockpiles. Other criteria pollutant emissions would occur from fuel combustion during construction and drilling activities. The primary pollutants emitted would be PM_{10}, $PM_{2.5}$, oxides of nitrogen (NO_X), CO, and SO_2. These emissions potentially would impact air quality in the GHPA.

Emissions of PM_{10} and $PM_{2.5}$ would occur from travel on access roads (unpaved roads), wind erosion at disturbed areas, and from drilling activities. Emissions of NO_X, volatile organic compounds (VOC), CO, and SO_2 would be associated with the construction, operation, reclamation, and decommissioning activities for the Project. Total emissions would include emissions from fuel combustion and fugitive dust emissions arising from the following sources:

- Construction equipment and vehicles used for site preparation, reclamation, and decommissioning of surface facilities;
- Well-drilling equipment and vehicles used for drilling production, injection, and monitor wells;
- Natural gas- or propane-fired heating units used at the Carol Shop facility and proposed satellite facility;
- Trucks for transporting construction materials as well as the uranium-laden ion-exchange resin; and
- Light-duty vehicles for commuting by construction crew and employees.

Air pollutant emissions due to Project operation would occur from hauling product, commuter traffic, and maintenance traffic activities along roads over the lifetime of the Project. Emissions would include exhaust from heavy duty trucks used for transportation, maintenance vehicles, and equipment, as well as fugitive dust from maintenance activities, wind erosion, and other vehicular traffic.

Activities for reclamation that could produce air pollutant emissions include: exhaust from heavy duty trucks used for transportation materials for disposal; construction equipment and exhaust and fugitive dust from vehicles and activities associated with removal of surface structures, buried utilities, evaporation ponds, and roads.

The estimated capacity and number of equipment and machines, and frequency and duration of operation for each of these emission sources is provided in **Table 4.1-2** (U.S. NRC 2004). The hourly emission rates in pounds per hour for the stationary sources (satellite facility heaters) and off-road construction equipment and machines during various phases of the Gas Hills Project are listed in **Table 4.1-3** (U.S. NRC 2004).

The hourly emission rates shown in **Table 4.1-3** are short-term averages of the emission rates used in the modeling to predict short-term impacts (hourly and daily) from construction, operations, and reclamation activities. These maximum emission rates represent the activities that would be most likely to result in pollutant concentrations that would potentially violate NAAQS. Modeled impacts are discussed in the following section. Hourly emission rates are used to determine hourly and daily concentrations of air pollutants (impacts), which are compared to the NAAQS that are expressed as 1-hour (SO_2 and NO_2), 8-hour (CO), and 24-hour (PM) average concentrations. For more discussion on air quality modeling, see **Appendix E**.

Table 4.1-2 Emissions Sources for Project Construction and Operation

Period	Stage/Purpose	Equipment Name	Model No./Capacity	No. of Units	Freq. of Operation	Duration of Operation
Construction	Initial Construction/ Wellfield Road Construction	Scraper	CAT 651	1	8 hrs/day, 5 days/wk	2 months
		Bulldozer	CAT D9	1	8 hrs/day, 5 days/wk	2 months
		Motor Grader	JD 570B	1	8 hrs/day, 5 days/wk	2 months
	Initial Construction/Well	Truck-mounted Rotary Drilling Rig, Semi-type Diesel Tractor Truck	GD1500	14	8 hrs/day, 5 days/wk	12 mo/yr
		Pump Pulling Vehicle	1-ton gas or diesel	2	8 hrs/day, 5 days/wk	12 mo/yr
		Motor Grader	JD 570B	1	8 hrs/day, 5 days/wk	3 mo/yr
		Backhoe	JD 710D	3	8 hrs/day, 5 days/wk	12 mo/yr
		Forklift	Case 586D	2	8 hrs/day, 5 days/wk	12 mo/yr
		Cementer	6 Cylinder Gas.	4	8 hrs/day, 5 days/wk	12 mo/yr
		Light-duty Truck	-	8 - 10	8 hrs/day, 7 days/wk	12 mo/yr
		Heavy-duty Water Truck	1500 gal	4 - 8	8 hrs/day, 7 days/wk	12 mo/yr

Table 4.1-2 Emissions Sources for Project Construction and Operation

Period	Stage/Purpose	Equipment Name	Model No./Capacity	No. of Units	Freq. of Operation	Duration of Operation
Construction (cont.)	Construction Material Transport	Heavy-duty Truck – Material Transport	Diesel Semi-Tractor and Trailer	1	1 trip/day	2 mo/yr
	Commuting	Light-duty Vehicle from Riverton	Diesel Pickup/ passenger car	15	1 trip/day	6 mo/yr
		Light-duty Vehicle from Casper		15	1 trip/day	6 mo/yr
Operation	Satellite Facility	Natural Gas- or Propane-fired Heater	0.4-0.5x106 Btu/hr[a]	6	24 hrs/day	6 mo/yr
	Product Transport	Truck to Highland Uranium Project site via Riverton	Diesel Semi-Tractor and Trailer	2	1 trip/day	12 mo/yr
	Commuting	Light-duty Vehicle from Riverton	Pickup/passenger car	15-18	1 trip/day	12 mo/yr
		Light-duty Vehicle from Casper	-	10-12	1 trip/day	12 mo/yr
Decommissioning/ Reclamation	Reclamation	Scraper	CAT 651	1	2 x 8 hr shift/ day*	2 – 3 yrs
		Motor Grader	JD 570B	1	2 x 8 hr shift/ day*	2 – 3 yrs
		Backhoe	CAT 245	2	2 x 8 hr shift/ day*	2 – 3 yrs
		Heavy-duty Truck	Diesel	3	2 x 8 hr shift/ day*	2 – 3 yrs
		Light-duty Truck	Pickup	15	2 x 8 hr shift/ day*	2 – 3 yrs
	Commuting	Light-duty Vehicle from Riverton	Pickup/pass. car	10	1 trip/day	2 – 3 yrs
		Light-duty Vehicle from Casper	-	10	1 trip/day	2 – 3 yrs

[a] Btu/hr – British thermal units per hour

Source: U.S. NRC 2004.

Table 4.1-3 Estimated Maximum Hourly Air Pollutant Emissions from Combustion

Maximum Hourly Emission Rate (pounds/hour)			
Pollutant	**Construction**	**Operations**	**Decommissioning/ Reclamation**
SO_2	1.9	2.9	1.0
NO_X	28.5	43.6	15.1
CO	6.1	9.4	3.2
VOC	2.3	3.5	1.0
PM[a]	2.0	3.1	1.1

[a] Emissions of PM from combustion sources are estimated to be identical for PM_{10}, and $PM_{2.5}$.

4.1.2.2 Criteria Pollutant Impacts

Assumptions

A generally accepted method of estimating fugitive dust emissions is to use a typical construction project. The average daily fugitive dust emissions for a typical construction project are estimated to be 1.2 tons PM_{10} per acre per month for construction activities (USEPA 1995). Use of this value is a generally accepted approach for impact analysis and is conservative, since Project construction would not involve demolition of existing structures and other activities with the potential to result in high short-term fugitive dust emissions.

Each truck was modeled as a source of both dust and combustion emissions. The source of dust emissions is the truck wheel, but for the purposes of modeling, dimensions of 5.6 meters lateral and 1.5 meters vertical were set. This is a very conservative approach since all of the emissions start in a relatively small volume. The generic road segment used estimated a silt content of 5.1 percent and moisture content of 2.4 percent.

Analysis Approach

Screening dispersion modeling was performed to assess potential PM_{10} impacts of fugitive dust from disturbed areas during construction. Air modeling was performed using the USEPA screening model; SCREEN3. SCREEN3 is a single source Gaussian plume model which provides maximum ground-level concentrations for point, area, flare, and volume sources. SCREEN3 is a screening version of the Industrial Source Complex 3 model (ISC3). For this study, SCREEN3 model version 96043 was used to evaluate impacts from fugitive dust. The GHPA was modeled as an area source using full meteorology (the case meteorological data set as defined in the SCREEN3 model that includes low wind speed and a highly stable atmosphere) as well as regulatory model default values for mixing heights (heights of inversion layers) and anemometer (device for measuring wind speed) heights. Impacts that would be representative of activities in the analysis area were assessed at a distance of 50 meters from the disturbance. See **Appendix E** for further discussion on modeling using SCREEN3.

Screening dispersion modeling also was performed using SCREEN3 to assess combustion emissions from truck and drill rig engines and fugitive dust emissions from dirt roads, disturbed ground, and all construction activities. Trucks were modeled as volume sources using full meteorology, as well as regulatory model default values for mixing heights and anemometer heights. Impacts from roads were assessed at a distance of 10 meters to 5,000 meters from roads in the analysis area, and impacts that are representative of emissions from construction were assessed at a distance of 50 meters from the disturbance. Emissions from internal combustion engines were calculated from emissions factors based on engine rated horsepower. Drill rig engines were assumed to have the same horsepower rating as

heavy truck engines; therefore, emission rates from both types of engines were assumed to be the same.

Impact Conclusions

Estimated emissions would result in minor short-term impacts on local air quality that would be restricted to the construction period. The construction impacts would diminish as a result of reclamation activities that would continue for 2 to 3 years after construction was completed and disturbed areas were reclaimed. Vehicular exhaust and crank case emissions from gasoline and diesel drivers would comply with applicable USEPA mobile emission regulations (40 CFR 85). BMPs related to air quality, including applicant-committed measures listed in Section 2.3.9, Applicant-committed Environmental Protection Measures, would minimize impacts, and include:

- All disturbed mine unit well, pipeline, and utility trench acreage would be reclaimed and revegetated as soon as possible after construction has been completed.
- Site speed limits of 40 mph on primary roads, 30 mph on secondary roads, and 10 mph on 2-track roads would be implemented to reduce generation of dust.

Concentrations of PM_{10} estimated based on the conservative screening level dispersion modeling analysis for the Proposed Action are shown in **Table 4.1-4** and indicate that impacts due to fugitive dust emissions from roads and disturbed areas during Project construction and operation would represent approximately 1 percent of the direct impacts allowable under NAAQS. Maximum combined impact and background would be less than 20 percent of the air quality standard.

Table 4.1-4 Maximum SCREEN3 Model Results for Construction Fugitive Dust

Pollutant	Averaging Time	Impact ($\mu g/m^3$)	Background ($\mu g/m^3$)	Total Impact ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)	Percent of NAAQS
PM_{10}	24-hour	0.8	10.2	11.0	150	7
	Annual	0.2	9	9.2	50	18
$PM_{2.5}$	24-hour	0.2	6.9	7.1	35	20
	Annual	0.1	2.6	2.7	15	17

Note: Based on a particulate emissions rate of 1.2 tons/acre/month for a typical construction project (USEPA 1995).

Results of the conservative screening level dispersion modeling analysis for engines and roads during the life of the Project for the Proposed Action are shown in **Tables 4.1-5** and **4.1-6**, and indicate that the impacts from engines and road traffic would be well within the NAAQS and WAAQS.

Modeling results indicate that these activities would result in impacts that are well within allowable concentrations under NAAQS.

Air Quality Related Values

Federal land managers responsible for managing Class I areas, such as wilderness areas and national parks, are concerned with potential impacts from nearby activities on air quality related values (AQRVs) such as, visibility impairment, ozone effects on vegetation, and effects of pollutant deposition on soils and surface waters. For each of these areas of concern, federal land managers' air quality guidance recommends that a screening test be applied for proposed sources greater than 50 km from a Class I area to determine whether or not any further analysis is necessary. No Class I areas are located less than 50 km from the GHPA. The screening test considers a source located greater than 50 km from a

Table 4.1-5 Maximum SCREEN3 Model Results for Combustion Emissions from Heavy Vehicle Engines

Pollutant	Averaging Time	Impact ($\mu g/m^3$)	Background ($\mu g/m^3$)	Total Impact ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)	Percent of NAAQS
NO_2	1-hour	12.1	NA	12.1	188	6.4
	Annual	0.5	NA	0.5	100	0.5
CO	1-hour	3.5	NA	3.5	40,000	0.0
	8-hour	2.5	NA	2.5	10,000	0.0
SO_2	1-hour	1.1	NA	1.1	196	0.6
	3-hour	1.1	NA	1.1	700	0.2
SO_2	24-hour	0.5	NA	0.5	365	0.1
	Annual	0.0	NA	0.0	80	0.0
PM_{10}	24-hr	0.5	10.2	10.7	150	7.1
	Annual	0.0	9.0	9.0	50	18.0
$PM_{2.5}$	24-hr	0.1	6.9	7.1	35	20.1
	Annual	0.0	2.6	2.6	15	17.2

Note: Values shown in this table are associated with emissions for 1 500-HP truck.

Table 4.1-6 Maximum SCREEN3 Model Results for Fugitive Dust from Roads During All Project Phases Compared to NAAQS

Pollutant	Averaging Time	Impact ($\mu g/m^3$)	Background ($\mu g/m^3$)	Total Impact ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)	Percent of NAAQS
PM_{10}	24-hour	39.9	10.2	50.1	150	33.4
	Annual	4.0	9	13.0	50	25.9
$PM_{2.5}$	24-hour	4.0	6.9	10.9	35	31.2
	Annual	0.4	2.6	3.0	15	19.9

Note: Values shown in this table are associated with fugitive dust from unpaved roads due to a 20-ton truck traveling 30 miles an hour, and are based on a calculated rate of particulate emissions. **See Appendix E** for the method for calculating emission rates.

Class I area to have negligible impacts with respect to Class I AQRVs if its total SO_2, NO_X, PM_{10}, and sulfuric acid (H_2SO_4) annual emissions (in tons per year, based on 24-hour maximum allowable emissions), divided by the distance (in km) from the Class I area (Q/D ratio) is 10 or less. Based on their guidance, federal land managers would not request any further Class I AQRV impact analyses from such sources as impacts are anticipated to be negligible (USFS 2010).

The Project would not emit H_2SO_4; Project annual emissions of SO_2, NO_x, and PM_{10} are used to derive the potential AQRV impacts as shown in **Table 4.1-7**. This approach provides a conservative analysis of potential impacts to Class I areas since it includes the pollutants of interest to the federal land managers, and is calculated using the highest 24-hour emission rates as if those highest emissions occurred every hour of the day for a full year.

Table 4.1-7 Estimated Maximum Hourly Air Pollutant Emissions from Project Activities

Maximum Hourly Emission Rate (tpy)[a]			
Pollutant	**Construction**	**Operations**	**Decommissioning/ Reclamation**
SO_2	3.5	4.2	0.6
NO_X	52.3	26.1	8.7
PM	3.7	1.9	0.6
Total	**59.5**	**32.2**	**9.9**

[a] Annual emissions (tpy) are based on the potential to emit at the highest hourly rates and conservatively assumes 8,760 hours of engine operation per year. The number and type of engine used for each Project activity is listed in **Table 4.1-2**.

Construction activities would produce much higher engine emissions than operation or reclamation. The number of hours that engines would operate during reclamation would be similar to hours of operation during construction; however, these hours would occur over a longer time period than for construction. Because fewer engines would operate at any point in time, emissions would be lower.

The nearest Class I area is the Bridger Wilderness located about 80 miles (128 km) west of the project area. The Q/D ratio test is calculated based on 144.8 tpy total emissions divided by 128 km resulting in a ratio of 1.1, which is well below 10; therefore, impacts to AQRVs from the Project are anticipated to be negligible and no further AQRV analysis is required.

Hazardous Air Pollutants (HAPs)

HAPs are air toxins that pose the greatest threat to human health. HAP emission rates for each pollutant are below 1 tpy, and the aggregate levels of all HAPs emissions also are less than 1 tpy. **Table 4.1-8** lists the HAPs emitted during each phase of the Project.

Table 4.1-8 Hazardous Air Pollutant Emissions (tpy)

Pollutant	Construction	Operation	Reclamation
Benzene	$1.95x10^{-02}$	$9.77x10^{-03}$	$1.69x10^{-03}$
Toluene	$8.56x10^{-03}$	$4.28x10^{-03}$	$7.41x10^{-04}$
Xylenes	$5.97x10^{-03}$	$2.98x10^{-03}$	$5.16x10^{-04}$
Aceteldahyde	$1.61x10^{-02}$	$8.03x10^{-03}$	$1.39x10^{-03}$
Formaldehyde	$2.47x10^{-02}$	$1.24x10^{-02}$	$2.14x10^{-03}$
Propylene	$5.40x10^{-02}$	$2.70x10^{-02}$	$4.67x10^{-03}$

Note: Includes the number and type of engine used for each Project activity listed in **Table 4.1-2**.

4.1.2.3 Greenhouse Gases

Annual emissions of GHGs CO_2e from construction and operations sources are directly related to the consumption of fuels (combustion). Purchased power contributing to GHG emissions at the power plants that furnish power to the grid supplying power to the Project are considered in the cumulative impact analysis (Chapter 5.0). **Table 4.1-9** shows the estimated GHG emissions for the Project from direct combustion of fossil fuels, dominated by diesel, and includes natural gas used for process heating.

Table 4.1-9 Greenhouse Gas Production under the Proposed Action

Case	Diesel Consumption (gallons)	Natural Gas Usage (therms)	Power Consumption (megawatt/ hours/year)	Diesel-related GHG (tpy)	Natural Gas-related GHG (tpy)	Total GHG (tpy)
				CO_2e	CO_2e	CO_2e
Proposed Action (stationary sources)	0	546,942	9,746	0	3,014	3,014
Proposed Action (mobile sources)	19,746,935	--	0	219,191	--	219,191
Proposed Action Total	**19,746,935**	**546,942**	**9,746**	**219,191**	**3,014**	**222,205**

Note: Conservatively based on maximum fuel consumption within the GHPA provided by Cameco.

Mitigation

Because impacts to air quality above the NAAQS would not be anticipated, no additional mitigation measures to avoid, minimize, or mitigate impacts would be required.

Residual Impacts

No impacts to air quality above the NAAQS would be anticipated from the Project. Because no additional mitigation has been applied, the residual impacts are the same as those described above.

4.1.3 Resource Protection Alternative

4.1.3.1 Pollutant Emissions

The RPA would involve the same level of fuel combustion and fugitive dust emissions as the Proposed Action Alternative with the exception that diesel fuel use would be reduced by approximately 2 percent due to a reduction in truck trips to the Smith Ranch-Highland facility.

4.1.3.2 Criteria Pollutant Impacts

Impacts from pollutant emissions under the RPA would be the same as described for the Proposed Action except that the number of truck trips would be reduced to 122 annual trips to the Smith Ranch-Highland facility as opposed to 325 annual trips under the Proposed Action. This reduction would result in a 2 percent reduction in emissions of criteria pollutants from diesel combustion relative to the Proposed Action. Therefore, activities conducted under the RPA would result in impacts that are well within allowable concentrations under the NAAQS.

4.1.3.3 Greenhouse Gases

Impacts from GHGs under the RPA would be the same as described for the Proposed Action except that the number of truck trips would be reduced to 122 annual trips to the Smith Ranch-Highland facility as opposed to 325 annual trips under the Proposed Action. This reduction would result in approximately a 2 percent reduction in the diesel consumed for the Project, and would result in a reduction of about 5,000 tpy, or about 2 percent, of GHGs from product transport relative to the Proposed Action.

Mitigation

No additional mitigation measures would be required.

Residual Impacts

No residual impacts would be anticipated.

4.1.4 Irreversible and Irretrievable Commitment of Resources

Air quality impacts in the GHPA would be reversible. Once Project activities are completed the air quality would return to its pre-Project state. Since no exceedences of the NAAQS are anticipated for the Project, irretrievable impacts to air quality would not be anticipated.

4.1.5 Relationship between Local Short-term Uses and Long-term Productivity

Construction and operational activities that would occur under the Proposed Action and RPA would produce emissions of PM and criteria air pollutants that would cease after completion of the Project and would not result in continued, long-term impacts to air quality. GHG emissions would likewise cease following completion of the project but the GHGs would remain in the atmosphere over the long-term.

4.2 Cultural Resources and Native American Concerns

For cultural resources and Native American concerns, the analysis area is called the area of potential effect (APE). Under Section 106 of the NHPA, the APE is defined as "those areas in which impacts are planned or are likely to occur. Specifically, the APE is defined as the geographic area or areas within which an undertaking may directly or indirectly cause changes in the character or use of historic properties, if any such properties exist. Additionally, the APE is influenced by the scale and nature of an undertaking and may be different for different kinds of effects caused by the undertaking (36 CFR 800.16[d])."

Under this regulation, the APE should include:

- All alternative locations for all elements of the Project;
- All locations where the Project may result in disturbance of the ground;
- All locations from which elements of the Project (e.g., processing and waste water disposal facilities, header houses, power lines) may be visible or audible;
- All locations where the Project may result in changes in traffic patterns, land use, public access, etc.; and
- All areas where there may be indirect as well as direct effects.

For purposes of this EIS analysis, the APE for direct and indirect effects encompasses the processing facilities, waste water disposal facilities, roads, header houses, power lines, wells, pipelines, electrical lines, and communication cables within the GHPA, plus access roads outside of the GHPA. For visual effects, the APE encompasses the GHPA, access roads, and areas from which any aspect of the Project is visible. This generally is 3 to 5 miles, or the foreground-middleground distance zone as defined in the VRM manual, but could be more or less depending on the scope of the project and landscape features. Only those historic properties located in the APE were reviewed to determine whether they would be subject to impacts that could affect their eligibility for the NRHP.

Primary issues related to cultural resources and Native American concerns were by BLM through internal scoping, consultation with cooperating agencies, and through comments provided during the scoping process, and include:

- Drilling of exploratory boreholes, installation of wells, and construction of associated project facilities that could affect historic properties such as prehistoric or historic archaeological sites, districts, buildings, structures, and objects, and traditional cultural properties (TCPs);
- Previously undiscovered cultural resources, including burials and associated funerary objects, could be discovered and adversely affected during ground-disturbing activities associated with project construction;
- Unauthorized artifact collection and vandalism;
- Introduction of visual or auditory elements that diminish the integrity of a historic property's setting; and
- Potential impacts to Native American properties of traditional religious and cultural importance including TCPs, sacred sites, or other sites that may be of tribal concern.

Potential impacts to cultural resources and Native American concerns were identified based on review of existing literature and site records, as well as the results of past and recent Class III pedestrian inventories conducted within the GHPA and through the Native American Consultation efforts. Potential

effects are quantified where possible. In cases where quantitative data are not available, best professional judgment or qualitative assessments are used to describe impacts.

Section 106 of the NHPA requires that federal agencies consider the potential effect of an undertaking on historic properties and provide the Advisory Council on Historic Preservation an opportunity to comment. Historic property, as defined by the regulations that implement Section 106, means "any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the NRHP maintained by the NPS." The term includes properties of traditional religious and cultural importance to any Native American tribe that meet the National Register criteria.

The impact analysis of cultural resources is based on the following assumptions.

- The number of sites that would be impacted by the Project is directly correlated with the degree, nature, and quantity of surface disturbance within the APE.
- Protection of historic properties would occur in accordance with the 2003 PA (as amended in 2012), SHPO consultation requirements, and other federal regulations.
- Places of cultural and religious importance to Native Americans, including TCPs, would be protected in accordance with tribal consultation requirements and other federal regulations.
- The values that render a cultural resource eligible for the NRHP would dictate what type and kind of impacts are of concern.
- Formal consultation with Native American tribes to identify places of cultural and religious importance to the tribes, including TCPs, would take place throughout the NEPA process and up to project completion.

4.2.1 No Action Alternative

Under the No Action Alternative, no uranium mining or corresponding activities would take place within the GHPA. As a result, none of the potential direct impacts to historic properties as identified for the Proposed Action Alternative would occur. Under this alternative the Carol Shop facility, 1 road, and previously disturbed land would be reclaimed, resulting in the reclamation of approximately 40 acres. These activities would occur within previously disturbed areas; therefore, the potential for identifying new cultural resources at these locations would be minimized. Exploratory drilling would continue at the rate of approximately 5 acres a year, and cultural resource clearances would continue to be protected pursuant to 43 CFR 3809.420(b)(8). Indirect impacts such as illegal collecting of artifacts and vandalism would be expected to continue at current levels.

4.2.2 Proposed Action Alternative

4.2.2.1 Impacts on Cultural Resources and Native American Traditional Values

Although effects to historic properties are determined on a site-specific basis with each individual disturbance, certain activities associated with the Proposed Action Alternative would have a greater potential to adversely affect these properties. Activities that could result in direct effects to historic properties include ground-disturbance activities such as installation of surface infrastructure (processing facilities, waste water disposal facilities, roads, header houses, and power lines), as well as subsurface infrastructure (wells, pipelines, electrical lines, and communication cables). These physical impacts could result in the vertical and horizontal displacement of soil containing cultural materials and the resulting loss of integrity and information, and the alteration of a site's setting.

Based on previous and recent archaeological inventories, a total of 78 cultural resources are located within the GHPA. Of these, 23 are eligible for listing on the NRHP and 55 are not eligible. A total of 9 NRHP-eligible sites and 16 ineligible sites are located in proposed disturbance areas and could be directly affected by ground-disturbing activities associated with the Proposed Action Alternative. For

those sites located in proposed disturbance areas, 9 required Native American consultation to determine eligibility, and all were determined to be eligible for listing on the NHRP.

Avoidance would be recommended for the historic properties located within proposed disturbance areas. If avoidance is not feasible, the historic properties would be treated in accordance with a historic properties treatment plan, which is described later in this section. Avoidance also would be recommended for sites of religious or cultural significance to Native American tribes. Appropriate avoidance distances would be determined in consultation with interested tribes. If any sites of religious or cultural significance to Native American tribes cannot be avoided by the recommended distances, mitigation measures would be developed in consultation with interested tribes and incorporated into a historic properties treatment plan.

Potential indirect effects could include vandalism, inadvertent damage, and illegal artifact collection due to increased numbers of people in and increased access to the GHPA. Other potential indirect effects could include the introduction of visual or auditory elements that diminish the integrity of the property's significant historic features, including setting. Portions of the GHPA are visible from a segment of the historic Casper to Lander Road. However, recent archaeological investigations of the road found that the segment had been destroyed by previous disturbance; therefore, the segment is considered a non-contributing segment to the road's overall eligibility (Larson et al. 2012). No visual mitigation measures are necessary for the Casper to Lander Road. Additional areas that could be visually affected by the Project may be identified by interested tribes during the consultation efforts.

The Castle Gardens Rock Art Site is located approximately 8 miles north of the GHPA. Although the site would not be physically or visually impacted by the Project, there is concern that an increase in the numbers of people in the area may increase visitation to the site and consequently increase the potential for vandalism. However, since Project employees would not be living in the Gas Hills areas and the Castle Gardens Road is not proposed as a primary or alternative access route, no indirect effects to the site would be anticipated.

The potential for the discovery of unanticipated archaeological deposits during construction activities exists within proposed disturbance areas and could result in direct effects. Unanticipated discoveries could result in displacement or loss (either complete or partial) of the discovered material. Displacement of archaeological deposits affects the potential to understand the context of the site and limits the ability to extrapolate data regarding prehistoric settlement and subsistence patterns.

In 2003, a PA among the Wyoming SHPO, U.S. NRC (as lead federal agency), BLM and PRI was developed to ensure identified historic properties were appropriately managed and protected during the Gas Hills Uranium Recovery Project (U.S. NRC 2003). On May 22, 2012, the PA was amended to extend the terms of the original 2003 PA, identify Cameco as the Project proponent, and designate the BLM as the lead federal agency to fulfill the requirements of Section 106 of the NHPA. As the lead federal agency, the BLM would ensure that the measures in the amended PA are carried out. The PA, as amended, defines general and specific obligations that would be undertaken to ensure the objectives and requirements of the NHPA would be fulfilled. Additionally, the PA, amended, assigns roles and responsibilities for implementation of the PA, which ensures all interested parties are given an opportunity to comment on the effects of an undertaking to historic properties and any mitigation for such effects.

In accordance with the PA, as amended, in consultation with the Wyoming SHPO and interested tribes, the BLM would determine whether construction of the Project would have an adverse effect on any historic properties. If the BLM determines that a property would be adversely affected, measures to avoid, minimize, or mitigate such effects would be proposed in accordance with the PA. Measures to avoid, minimize, or mitigate effects may include, but would not be limited to, 1 or more of the following:

- Avoidance through changes in the construction or operational design;
- Data recovery, which might include the systematic professional excavation and removal of archaeological resources;
- The use of landscaping or other techniques that would minimize or eliminate visual effects on a site's setting;
- Historic American Buildings Survey/Historic American Engineering Record/Historic American Landscapes Survey or other agreed upon historic recordation process; or
- Other mitigation determined by the BLM through consultation with the SHPO, interested tribes, and other consulting parties.

The PA, as amended, requires that unavoidable adverse effects to historic properties would be mitigated through implementation of a historic properties treatment plan. The treatment plan would address the historic property adversely affected and set forth means to mitigate the Project's effects. A detailed description of treatment proposed for historic properties or portions of historic properties, as well as the rationale, would be provided in the plan. If data recovery is the preferred treatment option for a site, then the BLM would ensure that the developed treatment is based on an appropriate research design and is reviewed and approved by the BLM, SHPO, interested tribes, and other consulting parties.

As provided in the PA, if any previously unknown archaeological deposits were discovered during Project mining/construction, all activities would cease within 300 feet of the discovery and the BLM would be notified of the find. Steps would be taken to protect the site from vandalism or further damage until the BLM could evaluate the nature of the discovery. Evaluation and mitigation would be carried out by Cameco in consultation with the BLM, SHPO, and interested tribes.

If human remains are inadvertently discovered during project construction/mining activities, Cameco would cease all construction/mining activities within 300 feet in all directions of the human remains. Cameco would immediately notify the appropriate parties as identified in the PA. Human remains and grave goods found on federal land would be treated in accordance with the Native American Graves Protection and Repatriation Act of 1990 and its implementing regulations (43 CFR §10).

Mitigation

Recommended additional measures to avoid, minimize, or mitigate impacts include the following:

CR-1: To minimize unauthorized collecting of archaeological material or vandalism to known archaeological sites, Cameco and their contractors, and all construction personnel, would attend mandatory training and be educated on the significance of cultural resources and the relevant federal regulations intended to protect them.

CR-2: Native American sites including, but not limited to, rock art, cairns (rock piles), and stone circles would be avoided by a minimum of 0.25 mile unless closer activities are approved through completion of consultation with the affected tribes and written permission is given by the BLM-Authorized Officer.

Implementation of mitigation measure CR-1 would reduce, but not eliminate, the potential for unauthorized collecting of archaeological material within the GHPA as a result of increased access and increased numbers of people in the GHPA. Implementation of mitigation measure CR-2 would reduce the potential for direct and visual impacts to sites of tribal importance through appropriate avoidance measures and involvement with affected tribes.

Residual Impacts

The Proposed Action Alternative would result in the loss of cultural resources not eligible for the NRHP. Although these sites would be recorded to BLM standards and the collected information integrated into local and statewide databases, the sites ultimately would be destroyed by project construction. Historic properties identified within proposed disturbance areas would be mitigated in accordance with the PA, as amended, and approved treatment. Although adverse effects to historic properties would be mitigated through implementation of data recovery or other forms of mitigation, some of the cultural values associated with these sites cannot be fully mitigated; therefore, it is anticipated that residual impacts to these resources would occur.

4.2.3 Resource Protection Alternative

Under the RPA there would be 818 acres of surface disturbance compared to 1,315 acres of surface disturbance under the Proposed Action Alternative. The decrease in surface disturbance would reduce the potential to directly impact unknown historic properties that may be buried and discovered during ground-disturbing activities associated with the Project. If previously unknown historic properties or human remains are discovered during ground-disturbing activities associated with the Project, the discovery would be handled as described for the Proposed Action Alternative. Potential impacts to known historic properties would be the same as described for the Proposed Action Alternative. Unavoidable adverse effects to known historic properties would be minimized or mitigated in accordance with the PA.

4.2.3.1 Mitigation

No additional mitigation measures would be required beyond those discussed for the Proposed Action Alternative.

4.2.3.2 Residual Impacts

The types of residual impacts that could occur under the RPA would be the same as described for the Proposed Action. However, under the RPA there would be a reduction in acres of surface disturbance during mine unit construction which potentially could reduce the degree of residual impacts. Total construction disturbance, including Project infrastructure outside the mine units, would decrease from 1,315 acres as detailed in the Proposed Action to 818 acres under the RPA. Total operations disturbance, including Project infrastructure outside the mine units, would decrease from 633 acres as detailed in the proposed action to 317 acres under the RPA (**Table 2.4-1**). This could represent a reduction in potential direct impacts to historic properties within these areas, although this reduction would not necessarily correspond to a reduction in data recovery.

4.2.4 Irreversible and Irretrievable Commitment of Resources

Historic properties could be irreversibly and irretrievably lost if inventory, avoidance, and/or mitigation efforts are not sufficient to identify and protect these properties.

4.2.5 Relationship between Local Short-term Uses and Long-term Productivity

The Project would result in the loss of short-term use and long-term productivity of cultural resources not eligible for the NRHP and located in proposed disturbance areas. For historic properties located in proposed disturbance areas that cannot be avoided, data recovery or other types of mitigation would be conducted prior to project construction. The scientific information obtained through mitigation would be preserved for the long term. However, the property itself ultimately would be lost. There would be a long-term loss of cultural resources due to illegal collecting of artifacts and vandalism associated with human activity in, and access to, the GHPA.

4.3 Geology

This section describes the potential impacts to geological resources from the alternatives, including geologic hazards and mineral resources.

Potential issues associated with geological resources were identified by the BLM through internal scoping, consultation with cooperating agencies, and through comments provided during the scoping process. Issues associated with geologic hazards include the potential of proposed activities to destabilize conditions that could result in the development of hazards from seismicity and landslides within the study area for these hazards. Issues associated with mineral resources included interference with existing mineral extraction operations, reduced access to other mineral resources, and interference with future mineral extraction operations. The study area for impact analysis for geologic hazards and mineral resources is the GHPA.

Analysis of the risk from the Project to geological hazards was performed through reviewing the following.

- The location of active faults based on information available from USGS and WSGS (2006) and discussed in Section 3.3.3.1, Seismic Hazards.
- Ground motion estimates based on recent updates of the USGS seismic hazard mapping by the USGS (Petersen et al. 2008). There are Quaternary faults in the area around the Project which may rupture at any time; however, only those faults with movement in the last 10,000 years are considered to be active as determined by the USGS (2006). The closest potentially active faults are 25 miles to the south as discussed in Section 3.3.3.1, Seismic Hazards.
- Landslide risk information based on data provided on landslide maps of the WSGS (2004) as shown in **Figure 3.3-3** and discussed in Section 3.3.3.2, Landslides.

An assumption used in the analysis of impacts to mineral resources is that there is a low potential for the occurrence of mineral resources other than uranium within the GHPA (BLM 2009a; Stillwell et al. 2009).

4.3.1 No Action Alternative

4.3.1.1 Geologic Hazards

Under the No Action Alternative the proposed in-situ uranium recovery activities and associated surface disturbance would not occur, although the Carol Shop facility and a portion of the existing road would be removed and reclaimed. Therefore, disturbance associated with the Project would not occur on existing landslide deposits or on steep slopes that could lead to instability or slope failure. Continued exploration activities would continue within the GHPA under existing management at a rate of 5 acres or less each year. In addition, no infrastructure would remain to be impacted by ground motion associated with seismic activity.

4.3.1.2 Mineral Resources

Under the No Action Alternative, present management of mineral resources, including exploration drilling, would continue and no effects on access to oil and natural gas or other mineral resources would occur other than the restraints on development under existing management.

4.3.2 Proposed Action Alternative

4.3.2.1 Geologic Hazards

During construction, disturbance of approximately 7.6 acres of existing landslide deposits (**Figure 3.3-3**) would occur in Mine Unit 2, potentially causing instability and slope failure. Given the occurrence of landslide deposits along the Beaver Rim and in other areas within and near the GHPA, there is a

potential for initiation of slope failure and associated landslide movement where construction disturbance occurs on steep slopes regardless of whether existing landslide deposits have been disturbed. During operations, surface disturbance would be reduced through interim reclamation and the risk of landslide movement would likewise be reduced. However, reclamation and decommissioning to remove Project infrastructure would involve re-disturbance of areas impacted during construction which potentially could result in landslide movement.

Seismic hazards are not likely to pose a risk in the GHPA given that the most likely source fault for ground movement is the South Granite Mountains fault zone, which is 25 miles south of the GHPA. Furthermore, seismic hazard maps (Petersen et al. 2008) estimate predicted ground motions in the GHPA to be less than 10 percent of the acceleration of gravity. While a ground motion in this range would be felt by most people, damage would be slight.

Deep disposal of wastewater would be implemented under the Proposed Action as 1 element of the water management plan for the Project. While induced seismic activity has been observed at a few locations associated with deep wastewater disposal wells (most notably at the Rocky Mountain Arsenal near Denver, Colorado, in the 1960s), most of this activity is minor (Nicholson and Wesson 1990) and most disposal wells are operated without induced seismic activity. The risk of induced seismic activity associated with the proposed deep disposal of wastewater is considered to be low.

Mitigation

The following mitigation measures are proposed to avoid, minimize, or mitigate Project-related impacts associated with geologic hazards.

GEO-1: Where surface disturbance is proposed for locations with slopes greater than 25 percent, an engineering plan would be submitted for review by the AO prior to the initiation of surface disturbing activities. The plan would include engineering drawings, geotechnical studies, drainage design, cut and fill estimates, and final reclamation contours to demonstrate mitigation of mass movement potential.

Implementation of this mitigation measure would reduce, but not totally eliminate, landslide risk from construction activities on steep slopes. If no construction occurs on the steep slopes of the escarpment, the probability of a naturally induced landslide is small.

Residual Impacts

Implementation of mitigation measure GEO-1 would not totally eliminate risk from disturbance on slopes greater than 25 percent.

4.3.2.2 Mineral Resources

The Project would have limited to no impact on exploration and development of other mineral resources in the area, including deep disposal of wastewater. The major mineral resources in the area, oil and gas, are considered to have little development potential in the GHPA (Stillwell et al. 2009). Furthermore, there are no current oil and gas leases in the GHPA and the closest current lease is approximately 2.5 miles outside the GHPA. The Project would not be expected to preclude development of other minerals in the area (bentonite, gold, sand, gravel, coal, and jade) since these commodities are not present within the GHPA.

The BLM estimates that approximately 60,000 cubic yards of sand and gravel for Project access roads would be obtained from an off-site location yet to be determined since there is not an adequate supply of this material within the GHPA. This estimated sand and gravel volume would represent a minor impact on the local deposits of this resource.

Mitigation

No additional mitigation measures would be required.

Residual Impacts

Since no additional mitigation measures have been applied, the residual impacts are the same as described above.

4.3.3 Resource Protection Alternative

Potential impacts from geological hazards and impacts to mineral resources associated with the RPA would be the same as for the Proposed Action Alternative.

Mitigation

No additional mitigation measures would be required.

Residual Impacts

No additional residual impacts would be anticipated.

4.3.4 Irreversible and Irretrievable Commitment of Resources

Over the 25-year life of the Project, Cameco plans to remove 25 to 62.5 million pounds of uranium (PRI 2009). Removal of the uranium constitutes an irreversible and irretrievable commitment of mineral resources from the GHPA. The removal of 60,000 cubic yards of sand and gravel for use on Project access roads would be an irretrievable commitment of these resources from a source outside the GHPA.

4.3.5 Relationship between Local Short-Term Uses and Long-Term Productivity

Recovery of uranium from the target ore zones permanently would remove this resource for short-term uses and eliminate the long-term productivity of uranium from the GHPA unless deeper mineral reserves are identified in the future. Implementation of the proposed in-situ uranium recovery would not prevent extraction of other mineral resources after completion of the Project.

4.4 Land Use

This section describes potential impacts to land use and land management that could result from the Project. The GHPA is largely comprised of federal lands, with some private and state-owned lands, as described in Section 3.4, Land Use.

Impacts to land use were identified using the assumption that livestock grazing and recreation are the primary existing land uses in the GHPA. Mining is a historical, but not current, existing land use. Impacts to livestock grazing and recreation are fully described in their respective sections (Section 4.5, Livestock Grazing, and Section 4.9, Recreation), and the reader is referred to these sections.

The BLM considered the potential for impacts from the Project to special management areas or areas with special designation. However, given that these lands are located at least 10 miles from the GHPA (Section 3.4, Land Use) there would be no impact from the Project. Therefore, these areas are not discussed further in this document.

4.5 Livestock Grazing

The primary issues associated with livestock grazing resources include direct and indirect impacts associated with the loss of forage, potential impacts to existing water sources and range improvements, and potential impacts to seasonal livestock movement within grazing allotments. Issues associated with livestock grazing due to construction and operation of the Project were identified by the BLM through internal scoping, consultation with cooperating agencies, and through comments provided during the scoping process.

Potential impacts to livestock grazing resources were identified based on the locations of these resources in relation to the proposed surface disturbance. The locations of proposed surface disturbance and potential subsidence areas were compared to the grazing allotment and range improvement locations to determine the acreage lost within each grazing allotment, and which, if any, range improvements would be affected.

The following assumptions were used in the analysis of impacts to livestock grazing resources:

- The installation of fencing to protect processing and mine unit facilities would prevent access to livestock grazing in the mine units during the life of each mine unit. The fencing around the mine units would not include perimeter monitoring wells;
- Surface disturbance and the long-term presence of Project facilities would reduce forage, and therefore would result in the potential suspension or reduction of AUMs, in grazing allotments;
- An increase in the number of roads and vehicular traffic would contribute to difficulties for livestock management and increase the potential for livestock-vehicle collisions; and
- Applicant-committed protection measures (Section 2.3.8, Existing Monitoring Plans) were taken into account in determining impacts.

4.5.1 No Action Alternative

Under the No Action Alternative, the Project would not be approved. Current land use and surface-disturbing activities would continue as currently authorized. Under this alternative the Carol Shop facility, portions of the AML road, and previously disturbed land would be reclaimed, resulting in the reclamation of approximately 40 acres. If successful, reclamation would result in an increase in forage, which would be a minor beneficial impact to livestock grazing. Exploratory drilling would continue at the rate of approximately 5 acres a year. Reclamation of these exploratory sites would be anticipated to occur within the same calendar year as the disturbance. Mining-related activities on BLM-managed lands may not result in over 5 acres of unreclaimed surface disturbance at any time during the life of the NOI filed for each action.

4.5.2 Proposed Action Alternative

Under the Proposed Action, impacts to livestock grazing resources would include a loss of forage and AUMs, limit access to water sources, and interfere with livestock management. At the start of construction, each individual mine unit would be fenced to exclude livestock. Mine units would remain fenced during operation and reclamation. During reclamation, the fence would remain for a period of at least 2 years, or until the vegetation is capable of renewing itself with properly managed grazing and without supplemental irrigation or fertilization. Development and reclamation in each of the 5 mine units would occur in a phased manner with each mine unit taking several years to be constructed. Construction, operation, and reclamation of each mine unit could require several years depending on market and environmental issues; therefore, the discussion of impacts to grazing units conservatively assumes the maximum amount of disturbance. At the beginning and end of the Project, impacts would be less due to the staggered schedule of development and reclamation. Outside of the mine units,

impacts to livestock resources would result from surface-disturbing activities associated with construction and operation of roads, evaporation ponds, aboveground facilities, and overhead power lines.

Short-term impacts are defined as occurring within 3 to 5 years following surface disturbance, while long-term impacts are defined as those lasting longer than 5 years. The majority of the impacts from the Project to livestock grazing would be long-term since fencing of each mine unit during construction, operation, and reclamation would eliminate available forage for livestock. Additional long-term effects from construction and operation activities would result from surface-disturbing activities outside the mine units, increased vehicle traffic, and increased road and utility networks.

Table 4.5-1 identifies the acreage of disturbance per grazing allotment, the number of livestock AUMs affected per allotment, and the percentage of AUMs that would be lost as a result of fencing and surface-disturbing activities under the Proposed Action. The number of AUMs lost was calculated based on an average number of active AUMs per acre for the grazing allotment acreage lost. Surface-disturbing activities associated with construction and operation activities would result in surface disturbance of 1,315 acres on 2 BLM grazing allotments, with the majority of the disturbance occurring in the Gas Hills grazing allotment. No impacts would occur in the Blackjack Ranch and Diamond Springs grazing allotments due to their location on top of Beaver Rim and outside of the areas to be impacted by the Project. Of this disturbance, approximately 195 acres (9 AUMs) of construction disturbance located outside of the mine units would undergo interim reclamation as described in Section 2.3.2.5, Interim Reclamation. This would result in the loss of 1,120 acres (52 AUMs) of available forage due to placement of facilities and fencing of the mine units through the life of the Project.

Table 4.5-1 Impacts to Carrying Capacity by Allotment in the Gas Hills Project Area under the Proposed Action

Grazing Allotment Name	Allotment Disturbance in Project Area (acres)	Active AUMs[a,b] Lost in Project Area (number)	Percent Loss of Total Active AUMs[a,b]
Blackjack Ranch[c]	--	--	--
Diamond Springs[c]	--	--	--
Gas Hills	1,306	62	2
Matador	9	<1	<1
Total	**1,315**	**62**	**--**

[a] An AUM represents the quantity of forage necessary to sustain 1 cow-calf pair or 5 sheep for 1 month.

[b] Projected active AUMs lost and percent active AUM loss were calculated based on a percentage of the stocking rate within the surface disturbance-related impact area compared to the allotment stocking rate as a whole.

[c] The Blackjack Ranch and Diamond Springs grazing allotments are located on top of Beaver Rim, and would not be impacted by surface disturbance associated with the Project.

Fencing the mine units and the linear surface disturbance outside the mine units would result in a loss of forage and AUMs until reclamation is successful and fencing is removed. Access to any surface water resources located within the mine units, especially WCC in Mine Unit 4, also would be limited by the fencing. An increase in the number of roads and traffic could lead to increased mortality and injuries to livestock, and may cause disruptions to livestock management. Construction and operation activities may disrupt livestock management by limiting access to grazing areas and water sources, and restricting or altering livestock movements.

Indirect impacts would include the potential spread of noxious and invasive species, fugitive dust, habitat fragmentation, and the potential conversion of native vegetative communities due to impacts from increased erosion and invasion and spread of noxious and invasive weed species (see Section 4.13, Vegetation).

Long-term impacts to rangelands would be reduced by the implementation of the applicant-committed measures. Final reclamation would occur once mining is complete, and groundwater restoration has been deemed successful in a mine unit (see Section 2.3.5, Mine Unit Restoration and Reclamation, for further description of final reclamation activities). Reclaimed areas would be fenced for a period of at least 2 years or until the vegetation is capable of renewing itself with properly managed grazing and without supplemental irrigation or fertilization. The goal of final reclamation would be to restore the land to a condition that will sustain the pre-mining land use of livestock grazing and wildlife habitat in accordance with WDEQ guidelines. Once reclamation is deemed successful, and the fencing is removed, livestock grazing could return to the mine unit areas. There would be loss of forage and fragmentation of livestock grazing in the mine units for the life of the Project until final reclamation is successful on each mine unit and the fencing is removed. Adherence to the Wyoming BLM Rangeland Health Standards, as described in Section 3.5, Livestock Grazing, would be required during reclamation to return the grazing allotments to the minimal acceptable conditions for rangelands and assist in achieving successful reclamation.

Rangeland Improvements

No known range improvements on BLM grazing allotments would be directly removed or disturbed as a result of surface disturbance activities under the Proposed Action Alternative. Any unidentified range improvements could be impacted by the Project such as potential damage to fences and gates.

Mitigation

The following mitigation measures are proposed to further avoid, minimize, or mitigate Project-related impacts to livestock grazing resources.

GRA-1: Cameco would coordinate annually or more often when necessary with affected livestock operators to discuss: 1) problems encountered during the past grazing season; 2) agreed-upon corrective actions; and 3) planned development and operations during the next grazing season. This meeting would need to occur on a date early enough to allow grazing permittees sufficient time to make decisions and allocate their resources for the upcoming grazing season.

GRA-2: Prior to construction of each mine unit, surveys would be conducted to identify active existing range improvements. Based on the results of these surveys, surface facilities would be located, to the extent practical, 200 meters from existing range improvements. If avoidance is not feasible, range improvements would be relocated to an alternate location per the BLM guidance. Alternate locations would be approved by the landowner.

GRA-3: Damage to livestock and range improvements identified during surveys would be reported as quickly as possible to the BLM and affected livestock operators and corrective action would be taken.

Implementation of GRA-1 would facilitate communication between livestock operators and the applicant, providing livestock operators with the ability to plan their livestock activities around construction operations to minimize impacts. Mitigation measures GRA-2 and GRA-3 would mitigate impacts to livestock, livestock facilities, and range improvements associated with construction and operation activities.

Residual Impacts

Residual impacts to allotments and AUMs under the Proposed Action Alternative would include loss of 1,141 acres of available forage and 53 AUMs over the life of the Project due to fencing of the mine units and placement of facilities. The amount of available forage could be further reduced through the establishment of noxious weed and invasive species individuals or populations, which could remain over the long term regardless of control programs. The amount of available forage near roads also could be

impacted by fugitive dust, making vegetation unpalatable. The increased number of roads could lead to an increased number of vehicle/livestock collisions. There would be no residual impacts to rangeland improvements and facilities.

4.5.3 Resource Protection Alternative

Under the RPA, modifications would be implemented to reduce the surface disturbance of the Project. Surface disturbance would be reduced through the use of the closed loop drilling system which eliminates the excavation of drilling mud pits; the reduced number of evaporation ponds; and annual development planning which would identify procedures to limit surface disturbance to planned areas. The total amount of surface disturbed at 1 time also would be reduced by the addition of construction timing constraints under this alternative through limiting construction of subsequent mine units until successful reclamation was achieved on the mine unit developed 2 prior (e.g., Mine Unit 3 would not be developed until interim reclamation of Mine Unit 1 was shown to make significant progress toward meeting reclamation success criteria).

While surface disturbance would be reduced, the surface of each mine unit still would be fenced during construction, operations, and reclamation. As the mine units still would be fenced under the RPA, the reduction of disturbance within the mine units would not reduce impacts to grazing compared to the Proposed Action. Surface disturbance would be less under the RPA outside the mine units, reducing the amount of available forage that would be lost. **Table 4.5-2** identifies the acreage of disturbance per allotment, the number of livestock AUMs affected per allotment, and the percentage of AUMs that would be lost under the RPA. The number of AUMs lost was calculated based on an average number of active AUMs per acre for the grazing allotment acreage lost. Surface-disturbing activities associated with construction and operation activities would result in surface disturbance of 1,270 acres on 2 BLM grazing allotments, with the majority of the disturbance occurring in the Gas Hills grazing allotment. No impacts would occur in the Blackjack Ranch and Diamond Springs grazing allotments due to their location on top of Beaver Rim and outside of the areas to be impacted by the Project. Of this disturbance, approximately 206 acres (10 AUMs) of construction disturbance located outside of the mine units would be reclaimed under interim reclamation as described in Section 2.3.2.5, Interim Reclamation. This would result in the loss of 1,064 acres (50 AUMs) of available forage due to placement of facilities and the fencing of the mine units through the life of the Project and reclamation period. Impacts to livestock grazing resources under the RPA would be similar as described above for the Proposed Action Alternative, except that fewer acres would be disturbed.

Table 4.5-2 Impacts to Carrying Capacity by Allotment in the Gas Hills Project Area under the Resource Protection Alternative

Grazing Allotment Name	Allotment Disturbance in Project Area (acres)	Active AUMs[a,b] Lost in Project Area (number)	Percent Loss of Total Active AUMs[a,b]
Blackjack Ranch[c]	--	--	--
Diamond Springs[c]	--	--	--
Gas Hills	1261	59	2
Matador	9	<1	<1
Total	**1,270**	**60**	**--**

[a] An AUM represents the quantity of forage necessary to sustain 1 cow-calf pair or 5 sheep for 1 month.

[b] Projected active AUMs lost and percent active AUM loss were calculated based on a percentage of the stocking rate within the surface disturbance-related impact area compared to the allotment stocking rate as a whole.

[c] The Blackjack Ranch and Diamond Springs grazing allotments are located on top of Beaver Rim and would not be impacted by surface disturbance associated with the Project.

Rangeland Improvements

Impacts to range improvements under the RPA would be the same as described under the Proposed Action.

Mitigation

Mitigation measures for livestock grazing would be the same for the RPA as described under the Proposed Action Alternative.

Residual Impacts

Residual impacts would be the same as discussed for the Proposed Action.

4.5.4 Irreversible and Irretrievable Commitment of Resources

The loss of forage from surface disturbances and fencing of mine units would be an irretrievable commitment of resources during the lifetime of the Project for all Action Alternatives. If reclamation is successful, no irreversible commitments are anticipated for livestock grazing resources under any of the action alternatives. The loss of forage under all of the action alternatives would be irreversible if disturbed areas could not be restored to prior land uses due to unsuccessful reclamation, in which case the bond for the Project would not be released.

4.5.5 Relationship between Local Short-term Uses and Long-term Productivity

Short-term uses impacted by the Project would include displacement of livestock from grazing areas and interference with livestock management. Long-term impacts would include the loss of available active AUMs over the lifetime of the Project, and could include the spread and establishment of noxious and invasive weed species. These factors could lead to the long-term loss of available forage and continued reductions in available AUMs until reclamation is deemed successful.

4.6 Noise

The analysis of noise impacts involves estimating anticipated noise levels at sensitive receptors in and near the GHPA under each alternative. Noise sensitive receptors evaluated in this section include historic trails, recreational users, and residences. A discussion of noise impacts on wildlife can be found in Section 4.17, Wildlife and Fisheries. USEPA guidance stipulates that a noise level of 55 dB(A) would constitute an adverse impact at which residential receptors would experience interference and annoyance (USEPA 1974). The distance where most construction equipment produces noise levels at 55 dB(A) is 1,600 feet. Therefore, the analysis area for noise impacts includes the GHPA plus a 1,600-foot buffer.

Noise issues associated with construction and operation of the Project were identified by the BLM through internal scoping, consultation with cooperating agencies, and through comments provided during the scoping process. Issues identified include:

- Impacts to hunters and dispersed recreationists; and
- Impacts to noise sensitive receptors (historic trails and residences).

Direct and indirect impacts were analyzed primarily on the basis of anticipated increases to dB(A) sound levels within the analysis area, determined by analyzing the distance between noise sensitive receptors such as residences and project components. Potential impacts would include disturbance from increased noise to recreationists generated by construction activity and Project operation. Potential impacts to wildlife associated with noise from Project construction and operation are discussed in Section 4.17, Wildlife and Fisheries.

The following assumptions were used for analysis:

- Noise primarily would be generated from within the GHPA and along Project transportation routes; and
- Traffic-related noise can be extrapolated in proportion to projected changes in traffic volume, discussed in Section 4.12, Transportation.

4.6.1 No Action Alternative

No additional noise would be generated within the GHPA by the Project. Noise in the analysis area would continue to consist of existing ambient noise, short-term noise from reclamation activities, facility decommissioning, and exploratory well drilling. Reclamation activities would utilize heavy construction machinery and light vehicles, resulting in noise levels that would potentially range from 74 dB(A) to 85 dB(A). These noise levels typically are experienced within 50 feet of construction equipment (Harris, Miller, Miller, and Hanson [HMMH] 1995). Construction equipment noise levels generally decline at or below 55 dB(A) at a distance of 1,600 feet from the noise source. Noise from reclamation activities would be short-term, typically lasting 1 construction season. Rural ambient noise levels typically are near 40 dB(A) (USEPA 1978).

4.6.2 Proposed Action Alternative

Impacts under the construction phase of the Proposed Action Alternative would include noise from heavy construction machinery and construction activities, as well as light vehicle construction traffic. Noise generated by construction of Project infrastructure and mine units would be expected to occur for 10 to 12 years. Average noise levels for typical construction equipment range from 74 dB(A) for a roller to 85 dB(A) for a bulldozer (HMMH 1995). In general, the dominant noise source from construction equipment is a diesel engine that is continuously operating around a fixed location or with limited movement. This is particularly true if the diesel engine is poorly muffled. Other sources of continuous noise would include field compressors, bulldozers, and backhoes.

Noise levels for typical construction equipment that would likely be used for the Project range between 80 and 90 dB(A) at a distance of 50 feet (15 meters), as shown in **Table 4.6-1**. The anticipated maximum number of machines operating simultaneously average 14 drill rigs. Assuming geometric spreading only (i.e., a decrease of about 6 dB[A] per doubling of distance from a point source), on the basis of the noise levels presented in **Table 4.6-1**, peak estimated noise levels would exceed the USEPA guidelines for residential noise (55 dB[A]) at a distance of approximately 1,600 feet from the noise source (USEPA 1974). Recreational activities, such as hiking and hunting, near the GHPA could be affected by construction-related noise. Potential direct and indirect noise effects to wildlife are discussed in Section 4.17, Wildlife and Fisheries. No impacts to sensitive noise receptors would be anticipated, as no schools, hospitals, or residences are located within 1,600 feet of the GHPA boundary.

Table 4.6-1 Noise Levels at Various Distances from Typical Construction Equipment

Construction Equipment	Noise Level[a] at Distances (dB[A])					
	50 feet	100 feet	200 feet	400 feet	800 feet	1,600 feet
Bulldozer	85	79	73	67	61	55
Concrete Mixer	85	79	73	67	61	55
Concrete Pump	82	76	70	64	58	52
Front-end Loader	85	79	73	67	61	55
Generator	81	75	69	63	57	51
Grader	85	79	73	67	61	55
Shovel	82	76	70	64	58	52
Truck[a]	88	82	76	70	64	58

[a] The equivalent steady-state sound level that contains the same varying sound level during a 1-hour period.

[b] Noise levels for truck mounted drill rigs are expected to be similar.

Source: HMMH 1995.

Impacts from noise during the operations phase of the Proposed Action Alternative primarily would be from project maintenance vehicles and transportation truck traffic. Noise impacts from operations would be anticipated to occur throughout most of the projected 25 year span of the Project and would overlap with construction, reclamation, and decommissioning phases of the Project. Noise from traffic during the operations phase would range from light- to medium or heavy-duty vehicles. Heavy-duty truck traffic would emit noise at the higher end of the noise producing machinery shown in **Table 4.6-1**; however, the overall noise level of continuous site operation from heavy truck traffic would be intermittent. Operations equipment at ISR uranium recovery facilities, such as pumps and compressors, are normally housed within structures, thus limiting the propagation of noise. In conjunction with the existing ambient noise and the lack of noise sensitive receptors, the result would be a negligible impact from noise.

Reclamation and decommissioning activities also would utilize heavy equipment, resulting in noise of similar intensity, but of shorter duration than noise from construction activities. Hence, the impacts from reclamation and decommissioning activities would be less than that for construction activities.

4.6.2.1 Mitigation

Because anticipated impacts to sensitive noise receptors would not be significant, no additional mitigation measures to avoid, minimize, or mitigate impacts would be required.

4.6.2.2 Residual Impacts

No mitigation has been identified, therefore the residual effects are the same as impacts described previously.

4.6.3 Resource Protection Alternative

Under the RPA, trips to the Smith Ranch-Highland facility would be reduced from 325 trips a year to 122 trips a year, which equals a 62 percent reduction from the Proposed Action. Additionally, reclamation activities and associated noise generated would be reduced, resulting in a reduction of disturbance. Although the peak noise level would not be reduced, less frequent vehicle traffic and subsequent travel noise, as well as less reclamation activity, would result in less impact to noise receptors under the RPA than under the Proposed Action.

Mitigation

No additional mitigation measures would be required.

Residual Impacts

No residual impacts would be anticipated.

4.6.4 Irreversible and Irretrievable Commitment of Resources

Elevated noise levels, as described above, that would occur in and near the GHPA during Project construction and operation would be an irretrievable impact. However, Project-related noise would be reversible and would cease after the 25-year life of the Project following decommissioning.

4.6.5 Relationship between Local Short-term Uses and Long-term Productivity

There would be no relationship between local short-term uses and long-term productivity. Long-term uses would return once Project operations cease and noise levels return to ambient levels.

4.7 Paleontological Resources

The analysis area for paleontological resources is the GHPA. The Tertiary formations (Split Rock, White River, Wagon Bed, and Wind River formations) that outcrop within the GHPA have been identified by the BLM's PFYC System (Section 3.7, Paleontological Resources) as having a high potential to contain important fossil resources, defined as vertebrate and/or scientifically significant invertebrate fossils. Other formations (Phosphoria, Tensleep Sandstone, Amsden, Madison Limestone, Gallatin Limestone, and Miocene Rocks) are within the GHPA but are unlikely to be affected by the Project and have moderate to low potential for fossil resources.

Potential issues for paleontological resources were identified by the BLM through internal scoping, consultation with cooperating agencies, and through comments provided during the scoping process, and included the potential for loss of important fossil resources due to the following proposed activities or conditions:

- Ground disturbing activities such as clearing, grading, trenching, and foundation excavation;
- Operational and maintenance activities that would require disturbance of previously unaffected areas within the GHPA; and
- Increased access resulting in vandalism or unauthorized collection.

The impact analysis involved the review of existing conditions to determine the probability of the loss of paleontological resources, and the identification of mitigation measures to protect those resources. Assumptions used for the analysis of impacts to paleontological resources include the following:

- Based on the results of the paleontological survey conducted in July-August 2011 (ARCADIS 2011), the potential for important fossil resources is high, especially in the White River Formation, above which much of the proposed disturbance would take place; and
- The GHPA contains areas that previously have been disturbed by prior mining or exploration activities. The likelihood of the discovery of fossils in these areas is just as likely as in undisturbed areas because proposed excavation for pipelines and drilling reserve pits may be below the depth of previous disturbance. Excavation also increases the chances of encountering bedrock, increasing the likelihood of finding important fossils.

4.7.1 No Action Alternative

Under the No Action Alternative, the Project, with associated ground disturbing activities, would not take place. Under this alternative the Carol Shop facility, 1 road, and previously disturbed land would be reclaimed, resulting in the reclamation of approximately 40 acres. Excavation would not occur to depths greater than originally disturbed; therefore, new impacts to paleontological resources would not be anticipated.

The adverse impacts to paleontological resources that would occur under this alternative would be the result of ongoing geological processes and disturbance through unauthorized collecting from accessible outcrops. Such loss of fossil resources would be considered significant, but the protection of the resource would be by measures outside of the scope of this EIS. The discovery of potential fossil resources through the implementation of the Project would not occur.

4.7.2 Proposed Action Alternative

Impacts (destruction or loss of fossils) would occur from construction activities conducted on formations with potential for important scientific fossil resources. Under the Proposed Action Alternative, construction activities would result in the disturbance of the Tertiary formations with high potential for important fossil resources presented in **Table 4.7-1**. Indirect impacts during construction could include

damage or loss of fossil resources due to the unauthorized collection of scientifically important fossils by construction workers or the public due to increased access to fossil localities near construction areas. Adverse impacts to important fossil resources would be long-term and severe since fossils removed or destroyed are lost to science. It is possible that the Project would have the beneficial impact that ground disturbing activities could result in the discovery of important fossil resources.

Table 4.7-1 Acres Disturbed within Geologic Formations with Potential for Fossils (Proposed Project)

Formation-Deposit	PFYC Rating	Acres Disturbed
Split Rock Formation	3	<1
White River Formation	5	189
Wagon Bed Formation	5	580
Wind River Formation	4 to 5	345

Source: BLM 2008.

Mitigation

Because of the high potential for certain formations within the GHPA to yield scientifically important fossil resources, the following mitigation and protection measures are proposed:

PAL-1: Construction and drilling personnel would be instructed about the types of fossils they could encounter and the steps to follow if fossils were uncovered during mine facility construction. Instructions would stress the nonrenewable nature of paleontological resources and that collection or excavation of fossil materials from federal land without a federal permit is illegal.

PAL–2: If suspected fossil materials were uncovered during construction or mud pit excavation, work would stop immediately to allow the AO to assess the situation and determine if additional mitigation measures would be undertaken before further construction or operations could continue.

PAL-3: During construction and installation of wellfields and related facilities, spot checks of spoil piles would be conducted by a qualified paleontological resources monitor. Spot check inspection would involve visually examining any excavated material for bedrock disturbed during excavation. Where bedrock was identified, it would be visually inspected for fossils of any kind. Where no bedrock was identified, no additional inspection would be recommended. If spot checking indicated the presence of important fossils, a representative sample of these fossils would be collected and the data (including standard geologic descriptions) recorded for each locality. In addition, the BLM would require monitoring of certain high potential areas during active construction (not just spot checks).

PAL4: Fossil specimens recovered on BLM lands during monitoring or spot inspections considered of scientific value would be curated into the collections of a museum repository acceptable to the BLM. Specimens would be prepared to the point of identification, identified, and catalogued into the permanent collections of an established institution. Specimens would not be taken from private properties except upon permission of the landowner. A final technical report would be prepared and submitted following completion of construction. The final report would be prepared according to BLM standards.

PAL-5: Prior to the commencement of ground disturbing activities, a high-value locality identified by the recent ARCADIS (2011) surveys (Section 3.7, Paleontological Resources) would be salvaged to assure that the fossils present could be documented and curated.

Mitigation measures PAL-1 and PAL-3 would increase the potential for rapid identification of any exposed fossil material during Project construction. Implementation of mitigation measures PAL-1, PAL-2, and PAL-3 would reduce the extent of loss of any important fossil resources by requiring immediate cessation of work for evaluation and recordation of fossil materials exposed by Project activities. Mitigation measure PAL-4 would ensure legal disposition of any located fossil material. Mitigation measure PAL-5 would be effective in preserving the scientific value of 1 known, high-value locality. Even with implementation of mitigation measure PAL-3, construction monitoring, some scientifically valuable fossils could be disturbed and lost during excavation and grading over the large number of well sites that would be built. As a consequence, there would be a small incremental loss of fossil material that would be offset by material that is recovered and preserved for the purposes of scientific study.

Residual Impacts

The amount of important fossil material lost or undocumented during construction of the Project would be minimized by application of the proposed mitigation measures.

4.7.3 Resource Protection Alternative

Potential adverse impacts to paleontological resources under the RPA would be similar to those described for the Proposed Action Alternative, although the potential for exposing important fossils would be less due to a reduction in surface disturbance (**Table 4.7-2**). Since there would be no excavation of drilling reserve pits, it is possible that fewer fossil resources would be discovered.

Table 4.7-2 Acres Disturbed within Geologic Formations with Potential for Fossils (RPA)

Formation-Deposit	PFYC Rating	Acres Disturbed
Split Rock Formation	3	<1
White River Formation	5	123
Wagon Bed Formation	5	316
Wind River Formation	4 to 5	226

Source: BLM 2008.

Mitigation

Mitigation measures for the RPA would be the same as for the Proposed Action.

Residual Impacts

Residual impacts for the RPA would be the same as for the Proposed Action.

4.7.4 Irreversible and Irretrievable Commitment of Resources

The destruction or loss of scientifically important fossils would be an irreversible and irretrievable commitment of resources. This loss would be offset by the successful recovery and preservation of any fossil resources identified during surface disturbing activities.

4.7.5 Relationship between Local Short-term Uses and Long-term Productivity

Short-term impacts associated with the exposure of any scientifically important fossils from Project construction and operation would not adversely impact the long-term potential for discovery of potential fossil resources in the area.

4.8 Public Health and Safety

This section describes potential impacts to public health and safety, which include potential exposure of the public and workers to radioactivity based on U.S. NRC studies, use and transportation of hazardous materials (as defined in Section 3.8.2.1, Waste Definitions), as well as generation, transportation, and disposal of hazardous waste. The affected environment for hazardous materials includes air, water, soil, and biological resources that potentially could be affected by an accidental release of hazardous materials during transportation to and from the GHPA or during storage and use for the Project. U.S. NRC's study area for direct and indirect impacts for radiological exposure includes the GHPA and a sufficient distance outside the GHPA to include the nearest communities of Jeffrey City and Waltman. The study area for direct and indirect impacts for generation, transportation, and disposal of hazardous materials and solid waste encompasses the GHPA and the major potential transportation route to the Smith Ranch-Highland facility.

The primary issues associated with public health and safety were identified by the BLM through internal scoping, consultation with cooperating agencies, and through comments provided during the scoping process, and include the following:

- Health impacts from current radiological levels within the GHPA, and from any increase in radon emissions from the ISR process;
- Disclosure of the types and amounts of hazardous materials to be used and the types and amounts of solid and radioactive waste that would be generated;
- Storage of hazardous materials, measures for spill containment, and protection of soil and groundwater; and
- Likelihood of a transportation related release of hazardous or radioactive materials and potential impacts of such a release.

Potential exposure to radiation was determined by reviewing available existing information, including the U.S. NRC EAs (U.S. NRC 2009a,b, 2004), and identifying any potential impacts from the Project. The BLM recognizes the U.S. NRC's expertise in, and jurisdiction over, the control and proper use of radiological materials, and therefore does not undertake independent analysis of radiation exposure but relies upon the expertise of the U.S. NRC. Potential impacts from transportation, handling, and storage of hazardous wastes were identified by reviewing current accident rates and regulations, comparing the handling, storage, and transportation methods proposed for the Project, and determining potential impacts.

Impacts to public health and safety were identified using the following assumptions:

- Enclosed buildings would be sufficiently ventilated to protect workers from excessive radon exposure;
- Historical vehicle accident statistics provide a reasonable estimation of future accident frequencies;
- Because WYDOT incident frequencies from the GHPA to Wyoming State Route 136 and from Wyoming Highway 93 to Processing Plant were not available, they were assumed to be nominal, and would not significantly alter accident rates used for this analysis;
- Trucks utilized in the transportation of potentially hazardous materials have a similar accident frequency compared to trucks currently captured by WYDOT data;
- Not every accident would result in the release of potentially hazardous materials from the truck;

- Radioactivity of any solid waste generated by Project construction or operation would be low-level and disposal methods identified in Section 2.3.1.2, Waste Management, would be sufficient; and
- The transportation, storage, use, and disposal of hazardous materials for mine operations would continue for the life of the mine (approximately 25 years). Shipments of uranium-laden material to the Smith Ranch-Highland facility would cease at the end of mining, but hazardous materials (mainly petroleum-based fuel) would still be transported to the site throughout reclamation activities.

4.8.1 No Action Alternative

Under the No Action Alternative, in-situ uranium mining activities would not take place within the GHPA, and there would be no change to public health and safety associated with exposure to radium or traffic incidents beyond currently authorized actions within the GHPA. Under this alternative, the Carol Shop facility, 1 road, and previously disturbed land would be reclaimed, resulting in the reclamation of approximately 40 acres. While some additional increase in traffic incidents could occur in connection with the reclamation of existing disturbance, the resulting adverse impacts to health and safety would likely be minimal. Exploratory drilling would continue at the rate of approximately 5 acres a year. Any radiologically-contaminated waste generated by these activities would be disposed of according to existing permits. Existing levels of radiation as a result of past mining would continue to be monitored according to U.S. NRC regulations.

4.8.2 Proposed Action Alternative

Under the Proposed Action Alternative, Cameco would construct wells, roads, pipelines, evaporation ponds, and surface facilities. The proposed wells, access roads, and ancillary facilities would be constructed on approximately 1,315 acres throughout the GHPA. Of this total disturbance, 1,025 acres would be associated with mine units and monitoring well rings; 209 acres would be associated with access roads, and the remainder of the disturbance would be attributed to a combination of aboveground facilities, pipelines, evaporation ponds, and topsoil piles (**Table 2-1**).

4.8.2.1 Exposure to Radioactive Materials

Potential impacts to the public from exposure to radioactive materials from the Project would occur from increased concentrations of radon or from distribution of airborne radioactive particles relative to current levels. Both of these are discussed in this section. The U.S. NRC (2009 and 2004) evaluated risk of radon exposure to workers and to the general public. The BLM recognizes the U.S. NRC's expertise in, and jurisdiction over, the control and proper use of radiological materials.

Background Radiological Levels

A likely exposure pathway to radiation is from radon gas. In the Gas Hills region, the elevated amounts of naturally occurring uranium results in the formation of radon-222, a radioactive gas. Radon gas is formed through the radioactive decay of uranium. Uranium and radon are ubiquitous in the U.S., although concentrations vary regionally and depend on the amount of uranium present in the soil, rocks, and water (USEPA 2011c). Exposure to elevated levels of radon gas can increase cancer risk. The USEPA indicates that radon gas may be responsible for 21,000 deaths in the U.S. per year (USEPA 2010). Since radon is heavier than air, radon concentrations tend to be most common in confined spaces with limited air flow, such as residential basements during winter months. Regardless of the setting, whether it is residential or industrial, radon gas emissions typically are mitigated by external venting.

As discussed in Section 3.8.1, Exposure to Radioactive Materials, the gamma exposure rates of the GHPA averaged approximately 175 mrem/yr; slightly more than half the equivalent annual dose the average individual in the U.S. receives from all sources of natural radiation, including contributions from

radioactive material in the soil. The following discussion describes impacts the Project could have on these exposure rates.

Radiological Levels from the Project

Radon emission is a function of uranium decay. Mining activities would not create additional radon but could disturb existing radon gas present within the soils. Because the Project is using ISR, the amount of soil disturbance would be less than for open-pit mining and there would be no underground tunnels or shafts. Elevated radon gas concentrations could be a potential issue in enclosed buildings at the site. Radon concentrations would be mitigated by ventilating enclosed work areas to concentrations as low as is reasonably achievable, ideally below the USEPA standard.

The U.S. NRC (2009a, 2004) evaluated risk of radon exposure to workers and the general public. Regarding worker safety and, pursuant to 10 CFR Part 20, the U.S. NRC would require a radiation safety program that contains the basic elements needed to assure that exposures are kept low. Accordingly, an in-plant radiation safety program would be required for the Project. In addition, during routine radiation safety inspections, if U.S. NRC staff observes in-plant industrial safety deficiencies, those identified deficiencies would be brought to the attention of the facility management.

The radiological effects of radon gas release from the wellfields, satellite buildings, and evaporation ponds during both recovery and restoration operations were modeled by U.S. NRC using an approved computer program (U.S. NRC 2004). The model calculated the concentrations of radon at potential receptor locations at 16 compass points of the GHPA site boundary, the nearest residence, and the nearest communities of Jeffrey City and Waltman. The highest estimated dose from radon exposure was 7 mrem/yr at the eastern boundary of the GHPA. This level is low compared to the 100 mrem/yr dose limit in 10 CFR Part 20 for individual members of the public. The U.S. NRC (2004) concluded that impact from radon gas to “individuals and the population around the Gas Hills Project will be negligible” (U.S. NRC 2004).

In addition, Cameco has indicated that it “will maintain a continuous air monitoring program at locations upwind and downwind relative to the permit boundary to ensure compliance with 10 CFRs 20.1301, 20.1302 and 20.1501. The air monitoring program would include passive gamma and radon monitoring devices.” The monitoring by Cameco would be in addition to the monitoring by DOE of the reclaimed and capped tailings to the north of the GHPA, described in Section 3.8.1, Exposure to Radioactive Materials.

The disposal by burial of drilling mud and cuttings in pits associated with each well or boring would not be expected to increase the amount of background activity in the GHPA since the radioactivity would be diluted to a great degree by the matrix of the drilling mud (largely bentonite clay) and low radioactivity soil and rock materials not associated with the ore zones. Covering the pits would limit any radioactivity emanating from the drilling mud to negligible levels.

The U.S. NRC concluded that the radiological impacts to individuals and the local population would be negligible, and their analysis supports that determination. The BLM recognizes the U.S. NRC’s expertise in, and jurisdiction over, the control and proper use of radiological materials.

4.8.2.2 Hazardous Materials and Solid Waste

Non-radioactive hazardous materials would be transported by commercial carriers or vendors in accordance with the requirements of Title 49 of the CFR. Carriers would be licensed and inspected as required by the WYDOT and USDOT. Permits, licenses, and certificates would be the responsibility of the carrier. Title 49, Parts 71 and 171-180, of the CFR requires that all shipments of hazardous substances be properly identified and placarded. Shipping papers must be accessible and must include information describing the substance, immediate health hazards, fire and explosion risks, immediate precautions, firefighting information, procedures for handling leaks or spills, first aid measures, and emergency response telephone numbers.

During construction and operation, hazardous materials, as defined in Section 3.8.2.1, Waste Definitions, would be transported to and stored at the GHPA for use by Project vehicles and in ISR mine processes. **Table 4.8-1** summarizes these materials.

Table 4.8-1 Hazardous Materials used In Uranium Recovery Process

Material	Use	Maximum Quantity Onsite[a]	Deliveries per Year	Amount per Delivery
Sodium Bicarbonate ($NaHCO_3$)	Injection solution make-up complexer	800 short tons	456	20 short tons
Liquid Oxygen (O_2)	Injection solution make-up oxidant	100,000 gallons	252	4,760 gallons
CO_2	Injection solution pH control	30,000 gallons	60	5,000 gallons
Sodium Chloride (NaCl)	Resin strip	250 short tons	144	17 short tons
Sodium Carbonate (Na_2CO_3)	Resin strip	100 short tons	42	20 short tons
Sulfuric Acid (H_2SO_4)	Carbonate elimination and pH control	100 short tons	48	18 short tons
Sodium Hydroxide (NaOH)	Precipitation pH control	10 short tons	3	20 short tons
Hydrogen Peroxide (H_2O_2)	Precipitation agent for uranium peroxide ($UO_4 \cdot 2H_2O$)	8,000 gallons	24	3,600 gallons
Diesel	Equipment Fuel	3,000 gallons	12	3,000 gallons
Gasoline	Equipment Fuel	3,000 gallons	12	3,000 gallons

[a] Short ton = 2,000 pounds.

Response to On-site Releases

Response to all spills of hazardous materials would be implemented according to a Spill Contingency Plan (SCP). The SCP for the Gas Hills Project would be based on the SCP currently in use at the Smith Ranch-Highland facility, and would ensure any spills that occur during transportation and loading/unloading on-site would be cleaned up as soon as possible. Spills exceeding the reportable quantity would be reported to the U.S. NRC, WDEQ, USEPA, National Response Center, BLM, and the county Emergency Response Coordinator. Releases occurring en-route to or from the Project would be the responsibility of the transportation company. Law enforcement and fire protection agencies also could be involved to initially secure a spill site and protect public safety. Hazardous material transporters are required to maintain an emergency response plan which details the appropriate response, treatment, and cleanup for a material spilled onto land or into water.

For on-site spills, the procedures outlined in the SCP would be used to contain chemicals and wellfield fluids. Specific procedures would be developed for other hazardous materials stored and used at the mine. Any cleanup would be followed by appropriate restoration of the disturbed area, which could include replacing removed soil, seeding the area to prevent erosion, and the return of the land to its previous use. A Spill Prevention Control and Countermeasure Plan (SPCCP) would be part of the SCP. A SPCCP is required by regulation to respond to petroleum and fuel spills.

Potential Effects of a Release

The environmental effects of a release would depend on the material released, the quantity released, and the location of the release. Potential releases could include a small amount of diesel fuel spilled during transfer operations at the mine site to the loss of several thousand gallons of diesel fuel or reagent into a riparian drainage. With the exception of WCC, the Project would not operate in the vicinity of a riparian drainage, and therefore, the release of a hazardous material or waste into a sensitive area (such as stream, wetland, or populated area) is unlikely. Depending on the material released, the amount released, and the location of the release, an accident resulting in a release could affect soils, water, biological resources, and human health. The remediation of spills, whether of non-radioactive hazardous material or radioactive material, would be under the jurisdiction of the U.S. NRC, WDEQ, and USEPA; cleanup would be conducted in compliance with those rules to be protective of human health and the environment.

Residual adverse effects from the use of hazardous materials under the Proposed Action would depend on the substance, quantity, timing, location, and response involved in the event of an accidental spill or release. Operation in compliance with applicable regulations and in accordance with the facility's SCP, as well as the prompt cleanup of potential spills and releases, would minimize the potential of residual adverse effects due to accidental spills or releases of hazardous materials. However, certain media, if impacted by spills, may require long-term cleanup remedies.

During the uranium recovery operations, radioactively-contaminated wastes would be generated. Because these wastes pose a potential hazard to the public and workers if not handled and disposed of properly, they would require disposal in approved facilities. **Table 4.8-2** lists wastes that would be expected to be generated on-site. The radioactive waste that would be expected to be generated is referred to as 11e.(2) waste. The AEA, as revised in 1978 and in 2005 by the Energy Policy Act, defines the 11e.(2) waste as a byproduct or "radioactive material (except special nuclear material) yielded in or made radioactive by exposure to the radiation incident to the process of producing or using special nuclear material." (U.S. NRC 2011b). Waste defined under 11e.(2) can include tailing or waste produced by the extraction or concentration of uranium or thorium ore. Generally, 11e.(2) waste has low levels of radioactivity.

Table 4.8-2 Wastes that Would be Generated by the Proposed Action

Type of Waste/Disposal Facility	Generating Process	Annual Generation Quantity	Maximum Quantity On-site	Loads Per Year
Radioactive Waste				
Byproduct; 11e.(2) waste/ licensed facility	Uranium processing activities	Approximately 300 cubic yards	Approximately 3 cubic yards	Estimated 20 trucks per year
Solid Waste (non-radioactive)				
Municipal waste/ Class D landfill	Waste generated from daily office and personnel activities	Approximately 5 short tons	Approximately 0.5 short ton	Estimated 12 trucks per year
Drilling fluids/on-site burial in mud pits	Spent drilling fluids	Not determined	Not determined	Not applicable

All hazardous or radioactive waste generated by the Project would be transported to licensed disposal facilities in accordance with applicable federal and state regulations. Non-radioactive solid wastes would be disposed of appropriately depending upon waste type. The risk of transportation of radioactive waste would be low and the same emergency management procedures would apply.

In addition to the wastes listed in **Table 4.8-2**, any equipment meeting the U.S. NRC definition of radioactively-contaminated waste would be removed during final Project reclamation and disposed of in a U.S. NRC-licensed facility. Equipment could include process pipe and equipment, tanks and vessels, ion exchange resin, filter media, and the solid residue and liners from the evaporation ponds. As described previously, the U.S. NRC is the lead regulatory agency with jurisdiction to oversee use and disposal of radiological materials, such as uranium, and would regulate wastes from the Project. The U.S. NRC EA for the Project (U.S. NRC 2004) describes the currently approved disposal methods and locations. Cameco has identified the Denison Mines facility in Blanding, Utah, for disposal of radioactive waste.

The U.S. NRC (2004) concluded that no impacts would occur due to radioactive waste generated by the Project, and the BLM recognizes the U.S. NRC's expertise in, and jurisdiction over, the control and proper use of radiological materials.

4.8.2.3 Transportation of Materials

Carriers involved with the transportation of radioactive materials (resin or waste) would comply with U.S. DOT rules regarding Hazard Category 7 (radioactive material). In the event of an accident involving a truck trailer with uranium-laden material or chemicals, Cameco would implement its Safety, Health, and Environmental Quality (SHEQ) Management System Emergency Systems Volume VIII, which would be based on the existing Smith Ranch-Highland plan (PRI 2011a). The emergency systems provide procedures for responding to a transportation spill, preparedness requirements for transporters, and notification procedures. Cameco also would be prepared to assist in a transportation-related emergency response through a cleanup contractor that would be on 24-hour call.

A release of hazardous materials during transport could have implications for public health and safety. The location of the release would be the primary factor in determining its importance. As shown in **Table 4.8-3**, the conservatively estimated probability of a release of hazardous or radioactive material anywhere along the transportation route is very small; the probability of a release within a populated area is smaller; and the probability of a release involving an injury or fatality is smaller still.

In the event of a trucking accident with the release of potentially hazardous materials, proper implementation of the SHEQ Plan would minimize exposure to the public, emergency response personnel, and Cameco workers. Following an Incident Command Structure, Cameco and its contractors would notify appropriate agencies and emergency response personnel and would respond, monitor, and clean the affected site until the site was considered acceptable. For some types of spills, cleanup criteria are established by agencies and would be met before Cameco's responsibility would end. Consequently, the hazard posed by trucking of the resin and hazardous chemicals poses minimal risk to public health or to the environment. Additionally, WYDOT would respond immediately to hazardous materials accidents to minimize the spread of contaminants. If Cameco did not respond, WYDOT would contract emergency cleanup services and relay the cost to the hauling contractor.

Mitigation

Because of the potential for hazardous material spills to impact riparian areas, the following mitigation and protection measure to avoid, minimize, or mitigate impacts is proposed:

Table 4.8-3 Probability of a Transportation-related Release of Hazardous Materials, Proposed Action

Material	Number of Shipments/ Year[a]	Distance per Shipment (miles)	Total Miles, Life-of-Mine[b]	Incident Rate per Million Miles	Calculated Number of Incidents[c]
Resin	325	142	1,153,750	0.0000005[e]	0.58
Radioactive Waste	20	550	275,000	0.0000005[e]	0.14
H_2SO_4	48	79[d]	94,800	0.0000004[f]	0.04
NaOH	3	79[d]	5,925	0.0000004[f]	0.002

[a] Anticipated number of trips for resin, radioactive waste, SO_4, and NaOH transportation per year, conservatively based on maximum uranium production.

[b] Life-of-Mine: 25 years.

[c] Number of incidents = distance X (incident rate).

[d] Distance from Casper, Wyoming using CR 212 (Gas Hills Road).

[e] Table 25, page 4-13 and Table 37, p 5-6, Battelle (2001), includes accidents and en-route leaks, but not loading/unloading incidents. Accident rate for USDOT Hazard Category 7, Radioactive Material.

[f] Incident rate for USDOT Hazard Category 8, Corrosives, Battelle (2001).

HAZ-1: No fuel or other hazardous material would be stored within 500 feet of a riparian area during construction or operation of the Project. Design features involving proper handling and storage of hazardous materials would be used to minimize accidental spills.

Implementation of HAZ-1 would minimize potential impacts from accidental spills or releases into riparian areas within the GHPA.

Residual Impacts

No significant impacts would be anticipated to public health and safety from radiological materials within the GHPA, from hazardous waste and radiological materials associated with the Project, or from the transportation of hazardous or radiological materials associated with the Project; therefore, residual impacts also would not be anticipated.

4.8.3 Resource Protection Alternative

Impacts from the RPA would be the same as described for the Proposed Action, except drill cuttings would be collected during mine unit construction by utilizing a closed loop drilling system and the subsequent elimination of excavated drilling mud pits, and by restricting disturbance within mine units to planned pathways. Additionally, acres of disturbance would be reduced during operations as a result of a decrease in the number of evaporation ponds. Total construction disturbance, including Project infrastructure outside the mine units, would decrease from 1,315 acres as detailed in the Proposed Action to 818 acres under the RPA. Total operations disturbance, including Project infrastructure outside the mine units, would decrease from 633 acres as detailed in the Proposed Action to 317 acres under the RPA (see **Table 2.4-1**).

Processing uranium-laden resin to yellowcake slurry at the GHPA would reduce the number of shipments of material to 122 annual trips to the Smith Ranch-Highland facility as opposed to 325 annual trips under the Proposed Action. Shipments of H_2SO_4, Na_2CO_3, NaOH, and H_2O_2 would increase by a maximum of 12 trips per year for each material to the GHPA. Rates of waste generation would be similar to the Proposed Action.

4.8.3.1 Exposure to Radioactive Materials

Under the RPA, uranium bound to resin would be eluted and concentrated into yellowcake slurry at the GHPA. Ventilation of enclosed structures, as described under the Proposed Action, would ensure the additional processing would not increase the potential for worker exposure to radon. Exposure to surrounding communities also would not be expected to increase. Because uranium is chemically bound in yellowcake slurry, the potential for exposure to radiation from yellowcake slurry is no greater than from uranium bound to resin. Therefore, impacts to public health and safety from radioactive materials under the RPA would be the same as for the Proposed Action.

4.8.3.2 Hazardous Materials and Solid Waste

With regard to hazardous materials and solid waste, potential impacts under the RPA would be similar, with differences in the types and amounts of chemicals that would be used on-site and a difference in the number of trips of product shipped to the Smith Ranch-Highland facility for processing.

Under the RPA, instead of resin, yellowcake slurry would be transported to the Smith Ranch-Highland facility. In addition to materials and volumes described for the Proposed Action Alternative (**Table 4.8-1**), the creation of yellowcake slurry would require additional chemicals listed in **Table 4.8-4**.

Table 4.8-4 Additional Hazardous Materials to be Used for the Yellowcake Slurry Process for the RPA

Material	Use	Maximum Quantity On-Site[a]	Deliveries per year[b]	Amount per Delivery
H_2SO_4	Carbonate elimination and pH control	100 short tons	12	17.5 short tons
Na_2CO_3	Resin strip	100 short tons	12	20 short tons
NaOH	Precipitation pH control	10 short tons	12	20 short tons
H_2O_2	Precipitation agent for uranium peroxide ($UO_4 \cdot 2H_2O$)	8,000 gallons	12	3,600 gallons

[a] Short ton = 2,000 pounds.

[b] In addition to shipments listed in **Table 4.8-1**.

Compared with the Proposed Action Alternative, the amount of hazardous materials on-site would increase under the RPA. With proper implementation of the SPCCP, impacts from this additional storage would be the same as described under the Proposed Action.

In addition to the chemicals listed in **Table 4.8-4**, The RPA calls for the use of closed-loop drilling mud systems to eliminate the burial of used drilling fluids and cuttings in pits adjacent to every boring or well. Rather, the waste drilling fluid and drill cuttings would be transported to an approved off-site disposal facility or buried in a common on-site repository to reduce the amount of ground disturbance.

4.8.3.3 Transportation of Materials

Under the RPA, the risks of impacts from the transportation of yellowcake slurry or hazardous materials would be less than for the Proposed Action (**Table 4.8-5**) due to an overall decrease in the number of trips. There would be an increase in the number of trucks transporting H_2SO_4 and H_2O_2 to the GHPA.

Table 4.8-5 Probability of a Transportation-related Release of Hazardous Materials, RPA

Material	Number of Shipments/ Year[a]	Distance per shipment (miles)	Total Miles, Life-of-Mine[b]	Incident Rate per Million Miles	Calculated Number of Incidents[c]
Yellowcake slurry	122	142	433,100	0.0000005[e]	0.21
Radioactive Waste	20	550	275,000	0.0000005[e]	0.14
H_2SO_4	60	79[d]	118,500	0.0000004[f]	0.05
NaOH	15	79[d]	29,625	0.0000004[f]	0.01

[a] Anticipated number of trips for yellowcake slurry, radioactive waste, H_2SO_4, and N_aOH transportation per year, conservatively based on maximum uranium production.

[b] Life-of-Mine: 25 years.

[c] Number of incidents = distance X (incident rate).

[d] Distance from Casper, Wyoming using CR 212 (Gas Hills Road).

[e] Table 25, page 4-13 and Table 37, p 5-6, Battelle (2001), includes accidents and en-route leaks, but not loading/unloading incidents. Accident rate for USDOT Hazard Category 7, Radioactive Material.

[f] Incident rate for USDOT Hazard Category 8, Corrosives, Battelle (2001).

The potential of exposure to radiation from yellowcake slurry is similar to the potential for exposure to radiation from uranium bound to resin. Because the potential for a transportation-related release of uranium is lower under the RPA, and the potential of harm from the material would not be different, potential impacts to human health and safety from this type of release would be less for the RPA than for the Proposed Action.

Mitigation

No additional mitigation measures would be required.

Residual Impacts

No residual impacts would be anticipated.

4.8.4 Irreversible and Irretrievable Commitment of Resources

Since increases in radiation within the GHPA are not anticipated above existing levels and spills or releases of hazardous materials would not be anticipated to impact the human environment, there would be no irreversible or irretrievable commitment of resources as a result of the Project.

4.8.5 Relationship between Local Short-term Uses and Long-term Productivity

Based on modeling by the U.S. NRC, the Project would not significantly increase radiation within the GHPA above already existing levels. All radiologically-contaminated material and equipment from the Project, such as structures, piping, and liners or sediment from evaporation ponds would be removed during final reclamation and disposed of at an U.S. NRC-licensed facility. These actions potentially would prevent impacts to the long-term productivity and sustainability of public land resources such as grazing and recreation.

4.9 Recreation

Potential recreational activities in the GHPA primarily would be hunting, hiking, and OHV use. In light of historical uranium mining in the GHPA and the presence of more attractive regional recreational opportunities, the area is not highly sought after for its recreational resources.

Potential issues associated with recreation were identified by the BLM through internal scoping, consultation with cooperating agencies, and through comments provided during the scoping process. Issues associated with recreation include:

- Reduction in dispersed recreation activities such as hunting, hiking, and OHV use from project development;
- Potential effects on recreation activities due to visibility of aboveground structures; and
- Reduction in recreational use of the area due to Project-related traffic.

Due to the limited nature of recreation in the GHPA, recreational use numbers have not been developed, and were unavailable for this analysis. A qualitative assessment was made drawing upon historical recreational uses of the GHPA and the surrounding region.

The impact analysis involved qualitatively assessing the change to recreation opportunities and the environment that supports the opportunities. The analysis of impacts to recreation assumed that aboveground Project facilities would limit access, affect OHV use, and affect hunting quality and opportunities by altering normal travel patterns for vehicles and wildlife.

4.9.1 No Action Alternative

Under the No Action Alternative, in-situ uranium mining activities would not occur and no new facilities would be constructed. Approximately 3 miles of roads within the GHPA would be reclaimed and existing facilities would be decommissioned. Reclamation of 3 miles of roads within the GHPA would, to a small degree, limit recreational access; however, the decommissioning of facilities and subsequent reclamation would open more acreage to recreational activities. Currently, authorized activities would continue, and impacts to recreational uses would not change from current levels.

4.9.2 Proposed Action Alternative

Surface disturbance from Project construction potentially would have minor adverse impacts on recreation activities such as hiking and big game hunting. Construction activities and drilling operations would generate increased noise and traffic primarily during the day, which could temporarily diminish hiking, hunting, and other recreational activities. The presence of additional aboveground facilities could diminish the hunting, wildlife viewing, and OHV experiences by displacing individuals as described in Section 4.17.2, Wildlife and Fisheries, by reducing wildlife habitat, increasing noise, increasing human presence, and creating a more industrialized recreational setting. Impacts to recreational users likely would be minor due to acclimation to historical uranium development within the GHPA. Additionally, the Project would not affect developed recreational facilities or sites; aboveground facilities would be painted with low reflective paints and colors to minimize the visual effects of the Project (further described in Section 4.14.2, Proposed Action Alternative); measures would be implemented to limit impacts to game animals (Section 4.17.2, Wildlife and Fisheries); and other more appealing recreation areas are located in the general vicinity. Long-term impacts would include better access to the GHPA as a result of improved roads, as well as more acreage for recreational use after Project facilities are decommissioned and reclaimed.

Mitigation

Mitigation measures to avoid, minimize, or mitigate impacts to the viewshed are described in Section 4.14.2, Proposed Action, and measures to avoid, minimize, or mitigate impacts to wildlife, and thus the opportunity for wildlife viewing, are described in Section 4.17.2, Proposed Action Alternative.

Residual Impacts

Residual impacts would be similar to those described for the Proposed Action Alternative.

4.9.3 Resource Protection Alternative

Under the RPA, trips to the Smith Ranch-Highland facility would be reduced from 325 trips a year to 122 trips a year. Less vehicle traffic and associated travel noise, as well as a slight reduction in disturbed acreage outside the mine units, would result in less impact to recreation under the RPA than for the Proposed Action. Otherwise, impacts to recreation under the RPA would be the same as for the Proposed Action.

Mitigation

No additional mitigation measures would be required.

Residual Impacts

No residual impacts would be anticipated.

4.9.4 Irreversible and Irretrievable Commitment of Resources

Loss and/or incremental reduction of hunting and dispersed recreation opportunities during construction, operations, and reclamation would be an irretrievable loss. This loss would be reversible after Project decommissioning and reclamation activities cease and increased acreage is available for recreational use.

4.9.5 Relationship between Local Short-term Uses and Long-term Productivity

Recreational access would be impacted during the Project development stage as roads would be opened and closed to facilitate construction. Furthermore, hunting and other dispersed recreational opportunities would be impaired in the short term, as would visual aesthetics; however, in the long term, as the area is reclaimed, visual aesthetics, hunting, and other recreational opportunities would be restored to pre-Project levels.

4.10 Socioeconomics

The primary issues related to social and economic values identified by the BLM through internal scoping, consultation with cooperating agencies, and through comments provided during the scoping process, that could be associated with the Project and alternatives include:

- Effects associated with potential changes in long-term local population, workforce, employment, or earnings;
- Potential demands for housing and public services or infrastructure that would exceed capacities in these systems; and
- Potential effects on public sector fiscal conditions regarding demand for services compared to revenue generated.

The methodology for evaluating impacts to social and economic values included comparing Cameco's estimates of employment, production, and expenditures for the Project to 2010 Census information. Methods used in the assessment of environmental justice are described in detail in Section 4.10.2.8, Environmental Justice.

Assumptions used in evaluating impacts include the following:

- The study area used in this analysis includes Converse, Fremont, and Natrona counties;
- Cameco estimates approximately 85 percent of new workers hired for the Project would be local residents from communities within the study area, and the remaining 15 percent of new hires would relocate to surrounding communities from outside the study area;
- Minimal changes to population, demographic, or other metrics tracked by the census have occurred in Converse, Fremont, and Natrona counties since the 2010 census; and
- All Project activities (construction, operation, and reclamation) would occur within the 25 years between 2013 and 2037, inclusive.

4.10.1 No Action Alternative

Under the No Action Alternative, no uranium mining or associated activities would take place in the GHPA. Cameco could continue exploration drilling under current exploration permits and approvals as authorized by the BLM and the State of Wyoming. Reclamation and closure of the existing exploration facilities would proceed as described in Section 2.2, No Action Alternative, using the process described in Section 2.3.5, Mine Unit Restoration and Reclamation.

Cameco would continue to employ 1 individual for property monitoring and oversight. Payroll, including benefits, would be approximately $80,000 per year, which would have minimal economic effects in the context of the central Wyoming economy. No non-local workers would be anticipated so there would be no additional demands for housing, community facilities and services, or educational services.

No adverse environmental justice effects have been identified for the No Action Alternative because this alternative would not result in significant adverse environmental, economic, or public health effects in the study area. Because there would be no significant effects, no disproportionate effects on minority or low-income populations would occur.

It is assumed that Cameco would continue to pay rent to owners of the small amount of private and business property (approximately 400 acres) within the GHPA under the terms of any ongoing arrangements.

4.10.2 Proposed Action Alternative

Under the Proposed Action Alternative, construction, operation, and reclamation of the Gas Hills Project would be anticipated to occur within the GHPA over a projected 25 years. The following discussion analyzes potential social and economic impacts of Project activities to the surrounding 3 counties.

4.10.2.1 Population and Demography

Anticipated population effects of the Proposed Action are presented in **Table 4.10-1**. The effects include both direct and indirect employment increases that are projected to be very modest in the context of the population of the study area. In-migrating workers and their families would number approximately 47 persons during most years of the anticipated life of the Project. This increase would represent 0.03 percent of the 2010 population of the 3-county study area. The estimated total includes 36 adults and 11 children, 9 that would be school-aged children.

No estimates were made of racial or ethnic characteristics of the in-migrating workers or their families, but with the very small proportional increase in residents generated by the Project, measureable impacts to the racial or ethnic makeup of the study area would not be anticipated.

4.10.2.2 Economy and Employment

Development of the Project would be anticipated to begin in 2013 with uranium production starting in the following year. In the first year, the direct work force would consist of approximately 20 contract workers and 20 Cameco employees (Section 2.3.4, Personnel/Work Force). In the second year, 2014, contract workers would remain at 20, but Cameco employees at Gas Hills would increase to 65, and 7 workers would be added at the Smith Ranch-Highland facility to processing Gas Hills uranium. These employment levels would remain constant for approximately 18 years, through 2031, when Project employment would begin a decline to 40 Cameco workers and no contractors in 2034, the last year of production (**Table 4.10-2**). By the final 3 years of production, much of the work would be devoted to groundwater restoration and surface reclamation activities, which would continue until approximately 2037. The Project would terminate at the end of 2037.

The highest employment levels, occurring in years 2014 through 2029, would represent a modest 1.6 percent increase in 2010 study area employment in the natural resources and mining sector, and a 0.5 percent increase in total non-farm employment in the 3-county study area (**Tables 3.10-3** and **4.10-2**).

Based on this analysis, indirect/induced employment generated by the Project would be projected at approximately 92 additional jobs, raising the total impact to 184 jobs for most of the Project life. Local labor would be expected to meet 85 percent of the direct Project jobs and 90 percent of the indirect/induced jobs, leaving a need for 23 workers from outside the local area. The non-local hires would provide skills not available locally. The total employment impact would represent a 0.9 percent increase over the study area's 2010 total non-farm employment.

The study area unemployment rate is notably lower than the national rate, as are the individual unemployment rates for each of the 3 separate counties. There are an estimated 4,082 unemployed persons in the area (**Table 3.10-4**). This number of unemployed would be more than sufficient to provide the 129 workers anticipated to be hired from the local labor force (Summers 2012). Reducing the number of local unemployed individuals by 129 would lower the area unemployment rate by 0.2 percentage points.

The estimated payroll for Cameco Project employees, including the value of benefits, would be projected at approximately $5.2 million per year during years 2 through 18 of the Project life. This would be equivalent to an average of $80,000 per employee. Assuming processing plant workers and contract

Table 4.10-1 New Project-related Employment, Households, and Population Projections for the Proposed Action

New Project-Related Employment			
	Direct[a]	**Indirect/Induced[b]**	**Total New Employees**
Local	78	83	161
Non-local	14	9	23
Total	**92**	92	**184**
New Project-related Households			
	Direct[c]	**Indirect/Induced[d]**	**Total New Households**
New Non-local Workers	14	9	
Single	4	2	6
Married - 1 Worker	9	3	12
Married - 2 Workers	1	2	3
New Households	**14**	**7**	**21**

New Project-related Population Growth					
		Population[e]			
			Children[f]		**Total Population Growth**
	Households	**Adults**	**School-Age**	**Other**	
Single Households	6	6	0	0	6
Married Households	15	30	9	2	41
Total	**21**	**36**	**9**	**2**	**47**

[a] Direct workforce was assumed to be 85 percent local, 15 percent non-local.

[b] Indirect and induced employment in the study area was calculated using an employment multiplier of 2.0: the secondary work force was assumed to be 90 percent local and 10 percent non-local. A Cameco economic impact study estimated the statewide multiplier effect at 2.7 (Taylor et al. 2010); the smaller multiplier was employed here for a more conservative estimate of the employment effects in the 3-county study area.

[c] Direct work force was assumed to be 25 percent single or married without families present; 10 percent of the married worker households were assumed to be 2-worker families.

[d] Indirect workforce would provide local services such as drivers, food service, and local government, and was assumed to be 25 percent single or married without families present; half the married worker households were assumed to be 2-worker families.

[e] Population estimates were based on 1 person per single family household and 2.71 persons per married household.

[f] Eighty percent of children were assumed to be of school age (K-12).

Note: Differences in totals are a result of rounding.

Table 4.10-2 Gas Hills Project Employment by Year

Employees/Year	2013	2014	2019	2024	2029	2032	2033	2034
Cameco Mine Employees	20	65	65	65	65	50	50	40
Cameco Processing Plant Employees	0	7	7	7	7	7	7	7
Contractor Employees	20	20	20	20	20	20	0	0
Total	**40**	**92**	**92**	**92**	**92**	**77**	**47**	**47**

workers would earn a similar amount, payments to these workers would add approximately $2.2 million for a total of $7.4 million annually in direct wages and benefits from the Project. Much of this would be spent locally for items such as food, clothing, fuel, and rent, which would benefit the local economy and generate the "induced" economic activity. Personal incomes generated by the Project would be above the average for the 3-county study area (See **Table 3.10-5**).

Indirect/induced workers supported by Project-related economic activity would be likely to earn somewhat lower average incomes than direct workers. These workers would provide local services such as truck drivers, food service, and local government work, and their earnings also would provide a benefit to the study area economy.

4.10.2.3 Housing

The Project would generate an estimated 21 new households in the study area, creating a demand for a corresponding number of housing units for the life of the Project (**Table 4.10-1**). While the vacancy rates for homeowner units in the study area counties are extremely low, the 2010 census identified a total of over 6,000 vacant housing units in the study area, many of which are likely located in or near Riverton and Casper, the largest cities in the study area. Riverton, in particular, is within reasonable commuting distance of the GHPA; Casper is somewhat farther, but still considered within commuting distance. The number of vacancies in Fremont and Natrona counties, as detailed in **Table 3.10-6**, would be more than sufficient to accommodate the housing demand generated by the Proposed Action; therefore the Gas Hills Project would have minimal effect on the housing market in the study area. Motels, hotels, and campgrounds in the study area provide an ample supply of short-term housing opportunities for new arrivals or for contract workers who might have permanent residences outside the study area, as noted in Section 3.10.4, Housing.

4.10.2.4 Public Facilities and Services

As noted, the Project would be expected to increase the population of the 3-county study area by 0.03 percent. This level of population change would not have a measurable effect on demand for public facilities or services in the 3 counties.

4.10.2.5 Education

The Gas Hills Project would lead to an estimated increase of 7 school-age children in the study area (**Table 4.10-1**). This level of change would have minimal effect on school districts in the study area. Enrollments in most school districts in the study area are below their recent peak levels by substantially more than 7 students (Wyoming Department of Education 2011), which supports the conclusion that there is existing school capacity to accommodate the small Project-related increase.

4.10.2.6 Public Finance

The Gas Hills Project would contribute to public revenues in the study area through mineral severance taxes, county property (ad valorem) taxes, and sales and use taxes. Severance taxes and a portion of county property taxes would be based on the assessed value of Project production. Property taxes also would be assessed on the value of Project property and facilities. Under the Proposed Action, estimated annual production from the Gas Hills Project would range from a low of 158,000 pounds of uranium in the final years of production to a high of 1,473,000 pounds during peak production years. The annual average over 21 years of production would be 895,000 pounds of uranium. There is a 4 percent severance tax on uranium (see Section 3.10.8, Environmental Justice, WDR 2010); Cameco estimated severance taxes would be approximately $1.00 per pound, or an average of $895,000 per year, most of which would accrue to state accounts. A small fraction (8.4 percent in 2011) would be distributed by the state to cities, towns, and counties.

The taxable value per pound of Gas Hills Project uranium production could vary from year to year. For the purposes of this analysis, the value is assumed to be approximately the same as reported for 2010 ($19.08 per pound [WDR 2011]). At this rate, the taxable value of uranium produced for the Project would average $17.1 million per year, and could be as high as $28.1 million in peak production years. The ad valorem tax from this valuation would accrue to Fremont County or Natrona County, depending on which mine unit(s) were in production. The taxable value of the average annual production from the Gas Hills Project would represent a 2.2 percent increase in Fremont County's 2010 total taxable valuation or a 1.7 percent increase in Natrona County's 2010 total taxable valuation (Section 3.10.8, Environmental Justice, and BLM 2008).

The Gas Hills Project would pay sales taxes on materials and equipment purchased in Wyoming for use on the site. The Project also would pay use taxes on materials and equipment purchased outside Wyoming for use in the state. The State of Wyoming collects a 4 percent sales and use tax; Wyoming counties have the option of adding up to an additional 3 percent with voter approval. Converse County and Natrona County have each added 1 percent for a total of 5 percent in those counties. Fremont County has only the 4 percent state tax. Cameco has estimated it would purchase an average of $1.5 million in production supplies annually which would result in sales tax payments of between $62,000 and $77,000, depending on the county. This would be a very small addition to sales tax revenues in the 3 study area counties, which totaled approximately $158 million in fiscal year 2011 (WDR 2011). The proportion of sales tax revenues accruing to the state varies by county from slightly under 55 percent in Natrona and Converse counties to approximately 68 percent in Fremont County.

In addition to sales and use taxes paid directly by Cameco, there would be lesser amounts generated by secondary activities, including contract workers. Purchases by employees for personal use also would contribute additional sales tax revenues to state and county coffers.

4.10.2.7 Social Conditions

With only minimal changes in permanent employment or population expected from the Project, changes in the social structure or traditional lifestyles of study area communities would not be expected. A possible influx of a small number of workers would not noticeably affect the quality of life of people currently living in the area. Transitioning of the Gas Hills Project from exploration and sampling to production activity for approximately 25 years would be expected to support individual lifestyles, but would have little or no effect on the social structure of the community as a whole.

4.10.2.8 Environmental Justice

The USEPA suggests a screening process to identify environmental justice concerns (USEPA 1998), as described in Section 3.10.8, Environmental Justice. The 2-step process addresses the following questions:

- Does the potentially affected community include minority and/or low income populations?
- Are the environmental impacts likely to fall disproportionately on minority and/or low income members of the community and/or a tribal resource?

If the 2-step process indicates that there exists a potential for environmental justice effects to occur, the following were considered in the analysis:

- Whether there exists a potential for disproportionate risk of high and adverse human health or environmental effects;
- Whether communities have been sufficiently involved in the decision-making process; and
- Whether communities currently suffer, or have historically suffered, from environmental and health risks and hazards.

To assess the potential for environmental justice impacts, the socioeconomic characteristics of the study area counties and communities were first analyzed for the presence of minority and/or low-income populations. If minority and/or low-income populations are identified based on the USEPA's Environmental Justice Guidance (USEPA 1998), the Project and alternatives were then evaluated for potential effects that could disproportionately impact any such populations.

As noted in Section 3.10.4, Housing, Fremont County has both a Native American population and a low income population that would be considered "meaningfully greater" in size than the state as a whole, as described in Section 3.10.8.1, Minority Populations, which was selected as the reference geographic area.

The initial analysis indicates that the potential environmental effects of the Proposed Action would not be expected to disproportionately affect any particular population. The area in the immediate vicinity of the Project has no resident population. The nearest residences are a few remote ranches located several miles from the GHPA that have not been identified as minority or low-income in nature. The nearest concentrated residential area is over 22 miles away (approximately 35 miles by road) at the small community of Jeffrey City (2010 population: 58). Larger communities are all farther from the GHPA. Riverton is nearly 50 miles to the west; Casper is 60 miles to the east (approximately 172 miles by road using the preferred transportation route, which is Wyoming State Route 136 to Riverton, and Highways 26 and 20 to Casper). The Native American population is concentrated on the Wind River Reservation. The nearest reservation boundary is approximately 35 miles to the west of the GHPA, although the resident population is located at or beyond Riverton. By the same rationale, there are no concentrations of low income people near the GHPA.

Environmental effects that could occur at a greater distance from the GHPA, such as air quality or traffic effects, would affect the study area's population essentially equally without regard to race, ethnicity, or income level. For example, trucks carrying resin or yellowcake slurry to the Smith Ranch-Highland facility would travel through the Casper area on U.S. Highway 20/26, but would add only a very small increment to the existing traffic volumes on the highway.

Regarding whether "communities have been sufficiently involved in the decision making process", the BLM held 4 public scoping meetings and distributed public notices about the Project through mailings and notices in area newspapers in addition to the formal notice in the *Federal Register*, described in Section 1.5, Public Participation. The BLM has initiated consultation with Native American communities as discussed in more detail in Section 4.2, Cultural Resources and Native American Concerns.

Mitigation

Because significant adverse impacts to economics, social conditions, or environmental justice would not be anticipated, no additional mitigation measures to avoid, minimize, or mitigate impacts would be required.

Residual Impacts

Because no additional mitigation measures would be imposed, residual impacts for the Proposed Action would be the same as the impacts discussed in this section.

4.10.3 Resource Protection Alternative

Social and economic effects from development of the Gas Hills Project under the RPA would differ only slightly from those described for the Proposed Action. The key differences would be employment of an additional 10 workers at the Project for processing resin to slurry, for a total of 102, which would infuse an additional $800,000 into the economy annually, including benefits, for a total of $8.16 million. This increase in direct employment would support employment of an additional estimated 10 indirect/induced workers (**Table 4.10-3**). Percentages of local (85 percent) and non-local (15 percent) direct Project workers are assumed to be the same under this alternative as under the Proposed Action.

The increase in employment would be beneficial to the study area employment and would be similar to what is described in Section 4.10.2.2, Economy and Employment.

The RPA would generate a local population increase of an estimated 53 people, 6 more than the Proposed Action, and an increase of 10 new school-age children instead of 9. It would result in an increase of 24 new households requiring 3 more housing units than the 21 required for the Proposed Action.

All of these effects would be beneficial, but very minor, increases from the estimates of effects for the Proposed Action. The increases in demand for housing, schools and other public facilities and services would remain well within the capacities of the housing market and local service providers to accommodate them.

The increase in jobs and wages above what would occur under the Proposed Action Alternative would result in very minor increases in local sales and use taxes generated by households. It is uncertain to what degree this alternative would affect sales and use taxes relative to the Proposed Action Alternative, but there would be some increase due to the additional equipment required on site. It is assumed that there would be no measurable change in uranium production so there would be no change in mineral severance taxes, but there would be a modest increase in the Fremont County ad valorem property tax base from additional equipment required on the Gas Hills site.

There would be no discernible difference in the effects on social conditions or environmental justice between the RPA and the Proposed Action Alternative.

Mitigation

No additional mitigation measures would be required.

Residual Impacts

No additional residual impacts would be anticipated.

Table 4.10-3 New Project-related Employment, Households, and Population Projections for the RPA

New Project-related Employment			
	Direct[a]	**Indirect/Induced[b]**	**Total New Employees**
Local	87	92	179
Non-Local	15	10	25
Total	102	102	204
New Project-related Households			
	Direct[c]	**Indirect/Induced[d]**	**Total New Households**
New Non-local Workers	15	10	
Single	4	3	7
Married - 1 Worker	10	4	14
Married - 2 Workers	1	2	3
New Households	15	9	24

New Project-related Population Growth					
		Population[e]			
			Children[f]		**Total Population Growth**
	Households	**Adults**	**School-Age**	**Other**	
Single Households	7	7	0	0	7
Married Households	17	34	10	2	46
Total	**24**	**41**	**10**	**2**	**53**

[a] Direct work force was assumed to be 85 percent local, 15 percent non-local.

[b] Indirect employment was calculated using an employment multiplier of 2.0; the indirect work force was assumed to be 90 percent local and 10 percent non-local. A Cameco economic impact study estimated the statewide multiplier effect on jobs at 2.7 (Taylor et al. 2010); the smaller multiplier was employed here for a more conservative estimate of the 3-county study area employment benefits.

[c] Direct work force was assumed to be 25 percent single or married without families present; 10 percent of the married worker households were assumed to be 2-worker families.

[d] Indirect work force would provide local services such as drivers, food service, and local government, was assumed to be 25 percent single or married without families present; half the married worker households were assumed to be 2-worker families.

[e] Population estimates were based on 1 person per single family household and 2.71 persons per married household.

[f] Eighty percent of children were assumed to be of school age (K-12).

Note: Differences in totals are a result of rounding.

4.10.4 Irreversible and Irretrievable Commitment of Resources

Labor and capital committed to the Gas Hills Project would generate local economic productivity, including jobs. These effects would be reversible in the event the Project was terminated. Once invested and expended, however, they would not be retrievable.

4.10.5 Relationship between Local Short-term Uses and Long-term Productivity

The short-term use of resources during construction, operation, and reclamation of the Project would result in beneficial impacts in the form of additional local employment and the generation of both private and public revenue. For the most part, this productivity would end upon completion of reclamation activities, although there could be some long-term productivity enhancement from training and experience gained by workers.

4.11 Soils

The impact analysis area for soil resources is the GHPA. Issues related to soil resources as identified by the BLM through internal scoping, consultation with cooperating agencies, and through comments provided during the scoping process include the following:

- Soil disturbance during construction activities resulting in exposed soils, accelerated soil erosion, sedimentation to nearby waterbodies, and reduced soil productivity;
- Potential for successful reclamation of sensitive soils and soils with physical or chemical reclamation constraints; and
- Potential for soil contamination.

The methodology for evaluating impacts on soil resources involved analyzing soil survey data in relation to the proposed surface disturbance areas. To determine acres of soils disturbed by the Project, the known locations of proposed surface disturbances were overlaid on the NRCS Order 3 soil survey layer in GIS to determine the acreage of soils lost or disturbed using GIS. Temporary impacts to soils are those that are anticipated to be short-term in nature (lasting approximately 3 to 5 years), where after construction the soils would be reclaimed and revegetated back to a productive state. Long-term impacts to soils would be anticipated where surface facilities or long-term access roads would be located for the duration of the Project.

The analysis of the impacts to soil resources is based on the assumption that the Applicant-committed environmental protection measures, including the SWPPP, listed in Section 2.3.8, Existing Monitoring Plans, would be implemented as part of the Project. These proposed measures would reduce or minimize impacts to soil resources when implemented. Additionally, all actions that occur on areas under BLM management would be required to comply with the Lander and Casper RMPs. To minimize construction-related impacts to soil resources, reclamation would be conducted as soon as practical following surface disturbance.

The assumptions used in the analysis of impacts to soils are discussed below.

- Surface disturbance from construction would modify soils by disrupting soil stability, changing vegetative cover that can reduce nutrient recycling, damage biological crusts, decrease productivity, and increase compaction.
- When surface disturbance occurs on highly erodible soils, the potential for accelerated erosion is greater than on less erodible soils. Sensitive soils would incur greater adverse impacts from surface-disturbing activities than non-sensitive soils. Sensitive soils include those that are highly erodible, have a high pH, high salinity or sodicity, have a high clay content, or have a LRP. To be effective on highly erodible soils, more extensive BMPs and more aggressive maintenance techniques than those commonly used are often required.
- Erosion from disturbed areas would be minimal once vegetation is reestablished. Successful establishment of vegetation generally takes a minimum of 3-5 years, depending on soil and precipitation, and requires monitoring during this time.
- The risk of erosion control failure is greater on highly erodible soils than on less erodible soils, because the potential for accelerated erosion is greater. To be effective on highly erodible soils, more extensive erosion controls and more aggressive maintenance techniques than those commonly used are often required.
- Operating motorized vehicles on moist soils, especially heavy equipment, is likely to cause compaction of the surface layer, which could increase runoff, decrease infiltration and aeration, and reduce soil productivity by making it more difficult for plant roots to establish or obtain soil moisture and nutrients.

4.11.1 No Action Alternative

Under the No Action Alternative, the Project would not be developed and associated impacts to soils from construction and operation would not occur. Current land use and surface-disturbing activities would continue as currently authorized. Under this alternative the Carol Shop facility, 1 road, and previously disturbed land associated with existing topsoil stockpiles would be reclaimed, resulting in the reclamation of approximately 40 acres of existing disturbance (Section 2.2, No Action Alternative). Reclamation of these disturbances would result in a net benefit to soil resources. Exploratory drilling would continue at the rate of approximately 5 acres a year and would comply with the standards under the 43 CFR 3809.320, surface management regulations; disturbance would be reclaimed within 1 calendar year. Impacts to soils from exploratory drilling would result in short-term impacts to soils while impacts from reclamation of existing infrastructure would provide the benefit of reducing current surface disturbance. Activities authorized under the 3809 surface management regulations (43 CFR 3809.21 and 3809.301 through 3809.336) may not result in over 5 acres of unreclaimed surface disturbance at any time during the life of the NOI filed for each action. Reclamation of these sites would be anticipated to occur within the same calendar year as the disturbance.

Natural and anthropogenic actions such as erosion, fire, recreation, and grazing would continue to impact soil resources at present levels in the analysis area.

4.11.2 Proposed Action Alternative

4.11.2.1 Construction

The following impact analysis focuses on soil resources that could be affected by construction, operation, and decommissioning of the Project. The methodology for evaluating impacts on soil resources involved analyzing soil survey data in relation to the proposed surface disturbance areas. To determine acres of soils disturbed by the Project, the known locations of proposed surface disturbances were overlaid on the NRCS SSURGO Order 3 soil survey layer to determine the acreage of soils and their limitations. Mitigation measures were developed for identified impacts that exceed the significance thresholds, described above, to mitigate or reduce impacts below significant. These mitigation measures follow the impact analyses.

The Project would result in approximately 1,315 acres of new disturbance to soils. **Table 4.11-1** provides a summary of disturbance area soil characteristics. **Figures 3.11-1** through **3.11-4** illustrate the occurrence of important soil characteristics in the GHPA. Within the mine units, construction would include: delineation drilling; installation of injection, production and monitoring wells; installation of pipelines; and construction of header houses and roads to header houses. Under this alternative, all of the soils within the mine units would be disturbed to some degree by construction. Disturbance would be sequenced; therefore, all of the disturbance within the mine unit would not occur at once.

Table 4.11-1 Disturbance Area Soil Limitation for the Proposed Action (acres)

Type of Disturbance	Water Erodible	Compaction Prone[a]	LRP[b]	Shallow Bedrock[c]	Stony Rocky
Process Water Pipeline	2	2	2	0	1
Roads with Utilities Construction ROW	76	31	60	0	23
Mine Unit 1	60	38	46	0	19
Mine Unit 2	201	13	173	0	37
Mine Unit 3	53	5	51	0	2
Mine Unit 4	169	20	23	9	133

Table 4.11-1 Disturbance Area Soil Limitation for the Proposed Action (acres)

Type of Disturbance	Water Erodible	Compaction Prone[a]	LRP[b]	Shallow Bedrock[c]	Stony Rocky
Mine Unit 5	25	3	4	0	6
Ponds, Drainage Diversion, Runoff Control Berm	11	8	8	0	5
Satellite Building West	3	2	2	0	1
Satellite Building Central	3	2	2	0	1
Topsoil Piles	1	1	1	0	0
Mine Unit 1 Monitoring Well Ring	5	2	4	0	1
Mine Unit 2 Monitoring Well Ring	4	1	4	0	1
Mine Unit 3 Monitoring Well Ring	6	1	6	0	0
Mine Unit 4 Monitoring Well Ring	5	1	1	0	4
Mine Unit 5 Monitoring Well Ring	2	0	0	0	0
Total	**626**	**130**	**387**	**9**	**234**

[a] These soils have 28 percent or more clay within the top 20 inches of soil.

[b] Limited reclamation potential.

[c] Lithic Bedrock 60 inches or less form the soil surface.

Source: USDA-NRCS 2011.

Soil compaction would occur from the movement of heavy equipment and vehicles during construction activities. An increase in bulk density and a reduction in soil porosity would directly correspond with the number of passes made by vehicles and construction equipment. Compaction would increase in depth on deep clayey soils and moist or saturated soils. Approximately 130 acres of compaction prone soils are located within the proposed disturbance areas.

Cameco is proposing to grade and level the soils to construct wells and associated facilities, with the greatest level of effort required in more steeply sloping areas. Topsoil would be salvaged at the well houses and associated facilities prior to any grading or leveling. Drilling pits also would have topsoil salvaged separately from subsoil. During construction, the remaining soil profiles would be mixed with a corresponding loss of soil structure. This could potentially mix deeper subsoils that are chemically unsuitable for revegetation with more suitable subsoils closer to the surface which could affect revegetation efforts during reclamation.

The potential for erosion and sedimentation would increase through the loss of vegetation cover and soil structure as compared to an undisturbed state. Approximately 626 acres of water erodible soils occur in the proposed disturbance areas (as shown in **Table 4.11-1**). Surface disturbance of water erodible soils, specifically those on steep slopes of 25 percent or more, would result in accelerated runoff and erosion. **Table 4.11-2** provides the acres of steep slopes within the mine units and GHPA. **Figure 3.11-4** illustrates steep slopes within the GHPA. Steep slopes would be a concern in Mine Units 2, 3, and 4. Mine Units 2 and 4 have the greatest potential for soil loss due to a high acreage of erodible soils (**Table 4.11-1**). As part of the SWPPP, Cameco has committed to minimize erosion impacts through the use of erosion control and channel stabilizing measures (e.g., ditches and berms, conveyance channels, rock/rip rap, outlet protection, sediment traps or basins, straw bale barriers, silt fence, check dams). Additionally, the SWPPP includes monitoring and maintenance of all control devices and structures

during active construction on 1 of 2 schedule; at least once every 14 days, and within 24 hours of a precipitation event greater than 0.5 inches. After active construction is finished but before complete reclamation has occurred, these structures and devices would be inspected a minimum of once per month with the exception of during extended periods of frozen ground conditions over the entire site. If unacceptable erosion impacts are discovered during inspections, additional BMPs would be employed to mitigate the impacts.

Table 4.11-2 Slopes Over 25 Percent

Disturbance Area	Acres
Gas Hills Permit Area	1,047
GHPA Mine Unit 1	0
GHPA Mine Unit 2	54
GHPA Mine Unit 3	29
GHPA Mine Unit 4	15
GHPA Mine Unit 5	2

Where topsoil was not salvaged, overland travel on moist or wet soils could result in rutting and the mixing of topsoil with subsoil. Soil productivity would decrease, as a result of profile mixing and compaction, along with the loss in vegetative cover. Lander mitigation guidelines restrict construction with frozen material or during periods when the soil material is saturated or when watershed damage is likely to occur. This restriction would reduce the potential for rutting and soil mixing.

During periods of high moisture, shale-derived soils on steep slopes can become unstable resulting in soil creep or large landslides. Where Project components would be located on soils prone to slumping (**Figure 3.3-3**), an increase in the probability for soil mixing, erosion, and sedimentation would occur. In addition, Project components could be damaged, causing a release of lixiviant or other ISR solutions. This could result in large scale contamination to soils. See Section 4.3.2.1 Geologic Hazards, for further discussion on impacts associated with landslide prone areas in the GHPA.

As discussed in more detail in Section 2.3.1.3, Access Roads, construction of new access roads would begin with vegetation removal. For bladed roads, topsoil would be removed and salvaged from the road construction area. As needed, access roads would be graded to allow for safe access and construction. Roads result in removal of vegetation, thereby interrupting nutrient cycling and altering soil productivity. Indirect effects could include generation of side cast materials and an increase in erosion leading to increased sedimentation at drainage crossings. Where the topography is relatively flat and grading occurs, disturbance would be limited to the upper subsoil horizons. As a result, deeper subsoils would not be subject to profile mixing. Where roads occur on steeply sloping areas, cut and fill slopes could be required. Cut and fill slopes result in subsurface soil mixing and a much greater percentage of loose soils prone to erosion. In addition, where construction modifies the slope face (cut and fill) the incidence for slope failure increases.

Two methods of construction are proposed to install pipelines, by spider plow or trenching. Spider plows typically are limited to installation of small diameter flexible pipe. Small diameter pipelines installed by spider plow would create minimal disturbance because trenching would not be required. The pipeline essentially would be plowed into the soil with minimal surface disturbance or soil profile modification. Trenching would be required for installation of large pipelines, but also could be used for small diameter pipes in some instances. Soil mixing and an alteration of soil profiles could occur during the trenching process. As described in Section 2.3.1.4, Pipelines, Cameco has committed to segregating topsoil from subsoil in areas where trenching occurs. Subsoil and topsoil would be replaced in sequence and seeded

at the first seeding window. This would help to maintain soil productivity and reduce the potential for soil mixing.

Biological soil crusts are highly susceptible to disturbance, especially in sandy soils (Belnap and Gardner 1993). Recovery rates generally are slow for lichen and moss recovery, which can take 45 to 250 years, respectively (Belnap and Gillette 1997). Losses of biological soil crusts would be expected where surface disturbance occurs. Surface roughness or crusts (biological or physical) would be damaged by construction activities (i.e., clearing, grading, excavation, vehicle traffic) and likely would be susceptible to wind or water erosion even in locations not rated as erosion prone.

LRP soils have chemical characteristics such as high salts, sodium, or pH that may limit plant growth. Saline soils affect plant uptake of water and sodic soils often have drainage limitations. In addition, the success of stabilization and restoration efforts in these areas may be limited unless additional treatments and practices are employed to offset the adverse physical and chemical characteristics of the soils. Losses in soil productivity, due to wind erosion of topsoil, would be most likely to occur on LRP soils with characteristics of saline, sodic, alkaline, or soils that were formed in locations with some lake sediments.

Adverse impacts would include the loss of soil quality and long-term productivity where facilities and roads would be located during the life of the Project. A decrease in soil productivity and quality also would occur in association with planned soil salvage and stockpiling activities as microbial action would be curtailed, at least to some degree, in the constructed long-term stockpiles. Interim reclamation of disturbed areas not needed for operations would help to reduce erosion from mine units. Once successful final reclamation has been achieved these impacts would be reduced to below significant.

Mitigation

The following mitigation measures are proposed to further avoid, minimize, or mitigate Project-related impacts to soils from construction. If adopted, the implementation of the additional mitigation measures would reduce the potential for soil impacts to less than significant.

SOL-1: As indicated in mitigation measure GEO-1, surface disturbance on slopes over 25 percent would require a site-specific engineering plan. Additionally, a site-specific reclamation plan would be developed and submitted for approval by the AO prior to initiation of surface disturbing activities. The plan would address each of the reclamation requirements detailed in BLM IM No. WY-2009-022 (**Appendix F**).

Mitigation measure SOL-1 would facilitate reclamation efforts by preventing valuable topsoil loss and maintaining soil quality, productivity, and biological characteristics. This measure also would reduce erosion thereby reducing sedimentation to nearby waterbodies.

4.11.2.2 Operation

Disturbance associated with operation would include soil compaction and erosion by continued vehicle and foot traffic. These impacts would continue for the life of the project. Maintenance activities would result in localized soil disturbances typically of short duration if re-disturbance is necessary (such as for pipeline or power line repairs). As stated in Section 4.11.2.1, Construction, as part of the SWPPP, Cameco has committed to minimize erosion impacts through the use of erosion control and channel stabilizing measures.

Soil contamination could result if spills of the lixivant or pregnant solution occurred. A SPCCP would be developed according to federal and state requirements and regulations, as described in Section 3.8, Public Health and Safety. **Table 4.11-3** provides a summary of soil characteristics that would be impacted during operations.

Table 4.11-3 Soils Disturbed During Operations for the Proposed Action (acres)

Type of Disturbance	Water Erodible	Compaction Prone[a]	LRP[b]	Shallow Bedrock[c]	Stony Rocky
Process Water Pipeline	0	0	0	0	0
Roads Operation ROW	13	6	10	0	5
Mine Unit 1[d]	30	19	23	0	10
Mine Unit 2[d]	101	7	87	0	19
Mine Unit 3[d]	27	3	26	0	1
Mine Unit 4[d]	85	10	12	5	67
Mine Unit 5[d]	13	2	2	0	3
Ponds, Drainage Diversion, Runoff Control Berm	11	8	8	0	5
Satellite Building West	3	2	2	0	1
Satellite Building Central	3	2	2	0	1
Topsoil Piles	1	1	1	0	0
Mine Unit 1 Monitoring Well Ring	3	1	2	0	1
Mine Unit 2 Monitoring Well Ring	2	1	2	0	1
Mine Unit 3 Monitoring Well Ring	4	1	4	0	0
Mine Unit 4 Monitoring Well Ring	3	1	1	0	2
Mine Unit 5 Monitoring Well Ring	1	0	0	0	0
Total	**300**	**64**	**182**	**5**	**116**

[a] These soils have 28 percent or more clay within the top 20 inches of soil.

[b] Limited reclamation potential.

[c] Lithic bedrock 60 inches or less from the soil surface.

[d] Disturbance within Mine Units and monitoring well rings is based on operational disturbances described in **Table 2-1** and the following assumptions: disturbance would be distributed equally across Mine Units, and all soils would have equal probability of being impacted.

Source: USDA-NRCS 2011.

Interim surface reclamation would occur after mine unit construction to stabilize the disturbed areas no longer needed during operations. Disturbed surfaces such as road ditches and the soils around header houses or power lines not used during mine unit operations would be stabilized.

Areas that have been compacted would be scarified, ripped, and/or disked as necessary to relieve the compaction and prepare for topsoil placement. Where needed, the surface would be graded and contoured to approximate original contours and to blend with the surrounding topography. Topsoil would be placed in a single lift to avoid compaction. On steep slopes topsoil would be placed along the contour. The soils would then be seeded with a BLM-approved seed mix. Noxious weeds would be controlled, as needed by annual spraying by a certified applicator using a registered herbicide following the timing recommendations.

Mitigation

The following mitigation measures are proposed to further avoid, minimize, or mitigate Project-related impacts to soils. If adopted, the implementation of the additional mitigation measures would reduce the potential for soil impacts to less than significant.

SOL-2: Two-track roads used for Project activities would be monitored quarterly for erosion, braiding, or severe rutting. If any of these were noted the appropriate steps would be taken to prevent further degradation (e.g., water bars, gravel, prohibition of traffic on native surface roads during wet periods).

SOL-3: During interim and final reclamation, compacted areas (typically any area that received repeated traffic or 3 or more passes by heavy equipment) would be decompacted, to the depth of compaction, by subsoiling (method for deep decompaction of soils, using a subsoiler, that does not result in soil mixing) or ripping to the depth of compaction. This would help prepare the seed bed, encourage infiltration and help to prevent accelerated runoff and erosion. Scarification would only be used on shallow soils. This mitigation measure also would apply to decommissioning activities.

Mitigation measure SOL-2 would reduce the potential for surface disturbance to soils and vegetation outside of a road footprint. This would reduce the potential for erosion and sedimentation to nearby drainages and prevent additional surface disturbance. Measure SOL-3 includes ripping, paraplowing, or subsoiling, which typically is the recommended mitigation for deeply compacted soils. Disking does not mitigate compaction, but can be used as a follow-up treatment to subsoiling or ripping to break up large soil clods and help to prepare the seed bed. Scarification only breaks up the surface layer and should only be used on shallow soils. These measures would ensure proper decompaction of compaction soils, to the depth of compaction. In addition, the proposed mitigation would increase the potential for successful reclamation on shallow soils by encouraging infiltration and helping to prevent accelerated runoff and erosion.

4.11.2.3 Decommissioning

During decommissioning and reclamation, the entire surface of each mine unit would be re-disturbed. Wells would be plugged and all subsurface infrastructure and surface facilities would be removed. Because mine units would be completely disabled, the same types and intensities of impacts to those described for construction in Section 4.11.2.1, Construction, would be expected. These impacts would be reduced once successful reclamation was achieved.

Prior to reclamation, all roads would be surveyed for radiological contamination in excess of radiological levels documented as pre-existing baseline conditions. Any contamination which resulted from the ISR operation would be cleaned up to appropriate U.S. NRC standards and the contaminated soils would be disposed of at an U.S. NRC-licensed facility. Following decontamination, the roads would be ripped and/or disked to relieve compaction. Excess imported gravel would be removed and disposed of appropriately. Culverts would be removed and pre-Project drainages reestablished. All reclaimed roads and ditches would be graded and contoured to blend with the surrounding terrain. Topsoil would be replaced and seeded.

State and federal regulatory programs that address mining project reclamation are administered by the WDEQ and BLM (BLM 2009a, 1987; WDEQ-LQD 1997). These regulations help reduce or mitigate impacts to the environment from mining. Under the applicable regulations, mining companies must develop detailed reclamation plans and establish financial assurances for their successful implementation. Such plans address concurrent reclamation and stabilization practices that are implemented as a project proceeds, as well as post mining practices that are implemented during the final stages of project completion. Concurrent reclamation typically consists of revegetation, erosion control, and associated drainage practices that minimize the impacts of clearing and accelerated erosion

during project activities. Final reclamation typically is conducted following completion of mining and processing activities. Development and implementation of a reclamation monitoring and reporting strategy also is required to ensure reclamation success. These standards and procedures would be applied to the Project to mitigate impacts associated with construction, operation, and decommissioning. Final reclamation would be determined by monitoring revegetation success. The success of revegetation in meeting the land use goals would be assessed prior to application for bond release by utilizing the COMA method as described in WDEQ-LQD Rules and Regulations Chapter 3, Section 2(d)(vi)(C) and LQD Guideline No.2-Vegetation.

Mitigation

The following mitigation measures are proposed to further avoid, minimize, or mitigate Project-related impacts to soils during decommissioning. If adopted, the implementation of the additional mitigation measures would reduce the potential for soil impacts to less than significant.

SOL-4: A monitoring plan would be developed and submitted to the BLM for approval. The plan would address the following:

- Soil erosion/movement;
- Vegetation: density, diversity (species composition) and age class (e.g., seeding, mature plant, decadent plant);
- Weeds: density, species composition;
- Photo reference points;
- Compliance with reclamation plan;
- Documenting/monitoring protocols;
- Timing of monitoring during the year; and
- Identification of sites needing additional work or more reclamation activities outlining a site-specific prescription for actions to be implemented, including:
  - Re-seeding of areas not attaining reclamation success,
  - Soil stabilization,
  - Weed control, and
  - Mulching/fertilization or other cultural practices.

Mitigation measure SOL-4 would prevent further degradation or loss of soil resources after reclamation has been completed, would reduce the potential for loss of topsoil, and would reduce the potential for occurrence of large rills and gullies. Mitigation SOL-3 also would apply during decommissioning.

Residual Impacts

The identified mitigation measures, if properly applied, would reduce impacts to soil resources; therefore, residual impacts would be minimal.

4.11.3 Resource Protection Alternative

This alternative would have similar impacts to the Proposed Action, except the overall surface disturbance within the mine units during construction and operation would be less than the Proposed Action. Under the RPA there would be 783 acres of soil disturbance compared to 1,315 acres of soil disturbance under the Proposed Action Alternative. Surface disturbance would be reduced through the use of the closed loop drilling system that eliminates the excavation of drilling mud pits, the reduced

number of evaporation ponds, and annual development planning that would identify procedures to constrain surface disturbance to the planned areas.

As stated in Section 2.4, Resource Protection Alternative, a TMP would be developed as part of the RPA. The TMP would address the need to maintain topsoil viability in the long-term (remaining longer than 1 year) topsoil stockpiles. The overall goal of the TMP would be to limit surface disturbance activities to less than the entire mine unit during construction activities and to eliminate random or unplanned cross-country travel during mine unit operation. This would reduce the potential for rutting and soil compaction across the mine units. This also would help to maintain soil productivity of disturbed soils.

Under the RPA, a reclamation coordinator would be on-site during any surface disturbance, particularly during more intense construction activities such as well drilling and installation of underground utilities. The reclamation coordinator would have sufficient training in soils to provide expert input on the depth of soil to be removed when stripping topsoil and would be responsible for implementing the TMP and adjusting the plan to changing field conditions throughout the life of the Project. An objective of the TMP is to maintain topsoil viability through, as proper segregation of topsoil is critical to successful reclamation. The reclamation coordinator would be responsible for documenting, by using photographs or other means approved by the BLM, that no travel of mechanized equipment occurred outside of flagged areas. This would help reduce the potential for mixing chemically or physically unsuitable subsoils with topsoil.

Annual development planning would help to limit soil disturbance across the entire mine unit. This would reduce compaction and large scale impacts to soil quality. The RPA would include enhanced reclamation goals and timing. Prompt reclamation of disturbed areas would reduce the potential for soil loss through revegetation and soil stabilization. This alternative would not allow construction of Mine Unit 3 until interim reclamation on Mine Unit 1 was shown to make significant progress toward meeting reclamation success criteria. Likewise, construction of Mine Unit 4 would not begin until Mine Unit 2 interim reclamation was successful, and Mine Unit 5 construction would not begin until Mine Unit 3 interim reclamation was demonstrated to be successful. This would help to reduce the overall impacts that occur to soils at 1 time. This also would help to reduce the soil erosion and sedimentation occurring within each watershed at any given time.

Final reclamation goals under this alternative would be evaluated using the USDA reclamation criteria established in the Draft Lander RMP (BLM 2011b). These criteria are based on the NRCS ESD for each mapped ecological site found in the GHPA (USDA-NRCS 2011). These goals potentially could enhance the soil quality and revegetation to closely match the native plant communities relative to an undisturbed state. The RPA potentially would reclaim the areas to a better condition than the currently existing condition. In comparison, the Proposed Action would reclaim the sites to resemble current conditions. The criteria for reclamation success are outlined in Section 2.4.7.1, Reclamation Success Criteria.

Mitigation

Mitigation measures described for the Proposed Action also would be applicable to this alternative.

Residual Impacts

The identified mitigation measures would help to reduce impacts to soil resources to less than significant; therefore, residual impacts would not be anticipated.

4.11.4 Irreversible and Irretrievable Impacts

An irretrievable commitment of a resource is 1 in which the resource or its use is lost for a period of time. An irretrievable loss of soil productivity and quality would be lost for the life of the Project on approximately 633 acres (Proposed Action) or 317 acres (RPA) associated with production and

monitoring wells, header houses, ponds, pump stations, and Project roads. No irreversible impacts would be anticipated.

4.11.5 Relationship between Local Short-term Uses and Long-term Productivity

Implementation of the Project would result in accelerated erosion and soil loss during construction and loss of productivity of vegetative cover and forage at production and monitoring wells, header houses, pump stations, ponds, and access roads for the life of the Project. However, implementation of reclamation measures would restore the long-term productivity of affected soils after the Project was reclaimed, assuming regular monitoring for effectiveness demonstrates successful reclamation.

4.12 Transportation

Primary access roads in the GHPA are mostly county- and BLM-maintained roads. State routes, U.S. Highways, and an Interstate Highway also would be utilized by Project-related activities. The greatest impact to transportation resources would be through increased traffic trips generated during construction and operation.

Transportation issues associated with the Project were identified by the BLM through internal scoping, consultation with cooperating agencies, and through comments provided during the scoping process, and include:

- Increased traffic on Wyoming State Route 136 and Gas Hills Road (CR 212), as well as on other Project area regional roads in the area around the Project; and
- Increased risk of accidents on GHPA and regional roads due to increased traffic and truck transportation.

Analysis of impacts to transportation was completed by comparing assumed existing traffic patterns to projected increases in Project-related traffic. Existing traffic data on county and rural roads within and near the GHPA was not available. Existing traffic is assumed to be light on the rural road network within and near the GHPA due to the remote nature of the area. Impacts from transportation specific to air quality, wild horses, and wildlife can be found in Section 4.1, Air Quality; Section 4.16; Wild Horses; and Section 4.17, Wildlife and Fisheries.

Assumptions used to analyze impacts to transportation include:

- Construction and processing materials primarily would be transported to the GHPA via Wyoming State Route 136 and Gas Hills Road (CR 212);
- Over the road vehicles would comply with WYDOT rules and regulations; for example, all contractors hauling loads that exceed WYDOT's oversize and/or overweight standards would acquire the requisite permits and comply with WYDOT safety regulations;
- Cameco does not anticipate overweight loads would be transported to the GHPA;
- All use and modification of Fremont and Natrona county roads would be conducted in accordance with county regulations; and
- All roads within the GHPA would be constructed to design specifications contained in the BLM Gold Book (BLM 2007) and BLM Manual 9113 (1985).

4.12.1 No Action Alternative

Under the No Action Alternative, in-situ mining activities would not take place within the GHPA, and there would be no change to currently authorized transportation activities. Approximately 3 miles of roads within the GHPA would be reclaimed. Reclamation of these roads would reduce access within the GHPA.

4.12.2 Proposed Action Alternative

Under the Proposed Action, up to 6 miles of new primary road, designed for transportation of employees and materials to and from the Project, would be constructed within the GHPA. This new road would supplement the 8 miles of existing primary roads within the GHPA. In addition, approximately 16 miles of secondary roads would be constructed to supplement, and in some cases, replace, approximately 28 miles of existing secondary roads within the GHPA. Approximately 2 miles of existing secondary roads would be within proposed mine unit boundaries, and would be removed during mine unit

construction. Impacts associated with construction of new roads would be resource-specific, and are discussed throughout this document.

Transportation resources would be impacted through additional vehicle trips. These impacts would be greatest during the construction phase of the Project and could consist of increased road maintenance, elevated traffic levels outstripping the existing capacity of roads, and a heightened potential for accidents. The projected maximum daily trips per day for the Proposed Action Alternative during mine unit construction would be 22 heavy truck trips and 7.4 light truck trips a day (Cameco Transportation Plan, **Appendix G**). Drilling would occur 16 days a month; however, this analysis averaged vehicle trips and miles over 365 days to develop comparable numbers. The number of vehicles would be higher during drilling days. During 2013, construction of mining infrastructure, process buildings, and evaporation ponds would begin and would last 1 year. Construction of additional infrastructure also would take place in 2018, lasting 1 year. During both these years an additional 0.8 heavy truck trips and 3.3 light truck trips would occur each day. Construction in 2013 and 2018 would occur 300 days a year; however, the analysis averaged vehicle trips and miles over 365 days to develop comparable numbers.

Cameco estimates that during operation, an average of 1.2 heavy truck trips a day and 46 light truck trips a day would occur (**Appendix G**), for Project operations. Heavy truck trips would include required deliveries to support resin operation, commercial delivery service, waste transportation, and resin transportation. Of the anticipated 1.2 heavy truck trips a day, approximately 0.9 trips daily, or 325 annually, would result from resin transport to the Smith Ranch-Highland facility. An additional estimated 3.0 heavy truck trips per day (1,085 annually) would transport chemicals used for uranium recovery to and from the GHPA (**Table 4.8-1** and **4.8-2**). Light truck trips would consist of transporting operations personnel. Of the daily personnel transportation trips, 80 percent would be anticipated to come from Riverton and 20 percent from Casper. Project personnel would utilize Wyoming State Route 136 from Riverton or Gas Hills Road from Waltman.

Transporting resin to the Smith Ranch-Highland facility would take place on 37 miles of unpaved roads and 105 miles of paved roads (**Figure 2.3-2**) would utilize the roads detailed in Cameco's Transportation Plan (**Appendix G**). Capacity for 7 days of resin would be housed at the Carol Shop facility for storage in the event roads become impassible due to inclement weather. Snow removal on state routes, U.S. highways, and interstates currently is, and would continue to be, provided by the State of Wyoming. Furthermore, Cameco also would utilize its own snow removal equipment as detailed in the Transportation Plan (**Appendix G**). Road maintenance crews would be contracted to assist in the event of a road closure lasting more than 7 days.

The greatest impact to transportation would be increased traffic in and near the GHPA and the use of new and existing roads during construction. Existing traffic data was not available for the Gas Hills Road connecting to U.S. 20/26, but based on the assumption that 80 percent of construction traffic would come from Riverton (Transportation Plan, **Appendix G**) and utilize Wyoming State Route 136, traffic would increase approximately 11 percent on Wyoming State Route 136 from existing levels. Traffic data for Wyoming State Route 136 was collected by the WYDOT. As detailed in Section 3.12, Transportation, 2010 current traffic levels on Wyoming State Route 136 are very light, approximately 208 vehicles daily. An increase in traffic of 11 percent would not be anticipated to exceed the capacity of Wyoming State Route 136. With the exception of resin or chemical transportation, it is anticipated that the majority of operations traffic would come from Riverton (**Appendix G**), and would cause an increase of 23 percent in vehicle traffic from existing levels on Wyoming State Route 136. This increase in traffic also would not be anticipated to exceed the capacity of Wyoming State Route 136. The addition of approximately 1 heavy truck trip daily to the Smith Ranch-Highland facility and 3 heavy truck trips daily to transport chemicals also would not exceed the capacity of the existing road network. Therefore, impacts of the Project to the existing capacity of transportation resources would be minimal.

New roads and existing roads within the GHPA would be maintained to a level able to accommodate anticipated project traffic. Increased traffic on existing roads may incrementally increase maintenance

costs. Cameco's Transportation Plan (**Appendix G**) details emergency transportation plans and includes a more in-depth description of construction and operation traffic. Potential accident rates for all sections of roadway utilized by the Project, where data are available, are presented in Section 4.8, Public Health and Safety.

Mitigation

Because anticipated impacts would not be significant, no additional mitigation measures to avoid, minimize, or mitigate impacts would be required.

Residual Impacts

No significant impacts would be anticipated due to transportation associated with the Project, and therefore, residual impacts also would not be anticipated.

4.12.3 Resource Protection Alternative

The RPA would be similar to the Proposed Action, except that uranium bonded to resin would be processed to slurry at the Gas Hills facility before being transported to the Smith Ranch-Highland facility. Under this alternative, heavy truck trips for Project operation would decline from an average of 1.2 daily trips to 0.7 daily trips. Light truck trips would remain the same as the Proposed Action. Heavy truck trips would be reduced to 122 annual trips to the Smith Ranch-Highland facility as opposed to 325 annual trips under the Proposed Action. Forty-eight more annual trips than the Proposed Action would occur as a result of chemical deliveries to support the additional processing; however, there would be 155 fewer trips, under the RPA than the Proposed Action. Fewer vehicle trips would produce less traffic in and near the GHPA, resulting in less impact than the Proposed Action.

Mitigation

No additional mitigation measures would be required.

Residual Impacts

No residual impacts would be anticipated.

4.12.4 Irreversible and Irretrievable Commitment of Resources

Project-related traffic increases and subsequent impacts to transportation would be irretrievable for the life of the Project. However, these impacts would not be irreversible as they would cease at Project closure. Project-related impacts due to the development of new roads within the GHPA would be reversible, with reclamation of roads constructed for the Project. No irretrievable impacts would be anticipated from either of the action alternatives.

4.12.5 Relationship between Local Short-Term Uses and Long-Term Productivity

Over the 25-year life of the Project, a maintained road network would be in place for enhanced recreational access and other uses within the GHPA. Over the long-term, access roads would be reclaimed, resulting in a reduction of the transportation network in the GHPA and reduced access to the area.

4.13 Vegetation

This section describes potential impacts to vegetation resources that could occur from activities associated with the Project and alternatives. The GHPA was the area evaluated for impacts for vegetation resources.

The primary issues associated with vegetation resources were identified by the BLM through internal scoping, consultation with cooperating agencies, and through comments provided during the scoping process, and include direct and/or indirect impacts to special status plant species; riparian/wetland habitats; forage production rates in rangeland areas; and impacts associated with the introduction and/or spread of noxious weeds and invasive species. See specific resource sub-sections for further discussion on special status species, and noxious weeds and invasive species. See Section 4.5, Livestock Grazing, for further discussion on impacts to range resources.

Impacts to vegetation and wetland resources were identified based on the locations of these resources in relation to the proposed surface disturbance areas.

The following assumptions were used in the analysis of impacts to vegetation resources:

- Areas of recently disturbed bare ground would be more susceptible to erosion and invasion by non-native species.
- Erosion from disturbed areas would be minimal once vegetation or other surface stabilization was established. Successful establishment of herbaceous vegetation generally takes a minimum of 3 to 5 years, depending on soil and precipitation, and requires monitoring until the BLM determines the reclamation to be successful.
- Reclamation on areas with soil reclamation constraints (as defined in Section 4.11, Soils), especially with saline and/or alkaline soils would be difficult, and successful reclamation could require additional mitigation measures.
- Extensive networks of pipelines, access roads, drilling infrastructure, and other utility corridors could lead to fragmentation of native landscapes, which can decrease species diversity, lead to decrease in the number and populations of native and special status species, and provide corridors for invasion of non-native species.
- Surface disturbance activities would result in the conversion of woody vegetation cover types to grass/forb-dominated vegetation in the short term.
- Applicant-committed environmental protection measures listed in Section 2.3.8, Existing Monitoring Plans, the Revised PoO (PRI 2011a) and the WDEQ Mine Permit Application (PRI 2009) were taken into account in determining impacts.

4.13.1 No Action Alternative

Under the No Action Alternative, the Project would not be approved. Current land use and surface-disturbing activities would continue as currently authorized. Under this alternative the Carol Shop, portions of the AML road, and previously disturbed lands would be reclaimed, resulting in the reclamation of approximately 40 acres. Exploratory drilling would continue at the rate of approximately 5 acres a year. Reclamation of these sites would be anticipated to occur within the same calendar year as the disturbance. Mining-related exploration activities on BLM-managed lands may not result in over 5 acres of unreclaimed surface disturbance at any time during the life of the NOI filed for each action.

4.13.2 Proposed Action Alternative

Under the Proposed Action Alternative, surface infrastructure (processing facilities, waste water disposal facilities, roads, header houses, and power lines) and subsurface infrastructure (wells, pipelines,

electrical lines, and communication cables) would be constructed in the GHPA. Mine unit development would occur in phases with each mine unit taking several years to be developed. Each mine unit would be projected to operate over a period of 13 to 17 years, with interim reclamation taking place concurrently with development activities, and final reclamation and decommissioning occurring at the end of the Project. Cameco would implement construction and operations using environmental protection measures as described in Section 2.3.9, Applicant-Committed Environmental Protection Measures, the Revised PoO (PRI 2011a), the SWPPP and the WDEQ Mine Permit Application Reclamation Plan (PRI 2009). Construction and operations also would be consistent with the BLM recommended BMPs, and the Lander and Casper RMP objectives and stipulations.

4.13.2.1 Vegetation

Under the Proposed Action Alternative, the Project would directly remove or impact a total of 1,315 acres of vegetation. **Table 4.13-1** identifies acreage of Project-related disturbance by vegetation community type for construction and operation activities associated with mine components and related infrastructure. The entire surface within each mine unit would be disturbed from construction activities. The majority of the Project-related disturbance would occur in the mixed sagebrush-grassland and the rough breaks (East) vegetation community type. In addition, vegetation along existing access roads would be affected by increased dust deposition (e.g., reductions in growth rates). Impacts are described below as either short-term or long-term. Short-term impacts are defined as occurring within 3 to 5 years following surface disturbance, while long-term impacts are defined as those lasting longer than 5 years.

Short-term direct impacts from Project-related activities would include the trampling of herbaceous vegetation, clearing/blading of surface cover, and removal of vegetation during construction. Long-term direct and indirect impacts would include the long-term loss of vegetation for facilities during the life of the Project and the permanent conversion of native vegetation communities resulting from the spread of noxious and invasive species, fragmentation of native vegetative communities, and conversion of shrub-dominated vegetation cover type to a grass/forb-dominated vegetation cover type. See Section 4.13.2.2, Noxious Weeds and Invasive Species, for discussion of the impacts related to noxious and invasive weed species. Fugitive dust accumulation on plants has been shown to adversely affect a variety of plant functions and high dust accumulations can lead to partial defoliation, increased plant mortality, and decreases in growth rates and vigor (BLM 2007a; USEPA 2008b; USFWS 2008). Fragmentation of vegetative communities would result from the development of a network of access roads, utilities, and well pads, which can impact native vegetative communities and native plant species. Impacts from fragmentation could include the loss of suitable habitat, more exposure to disturbances, and increased competition (BLM 2007a). Vegetative communities also could be affected by damage to biological soil crusts, as described in Section 4.11, Soils.

Project-related activities in sagebrush shrubland areas (including bottomland sagebrush and mixed sagebrush grassland) would result in the conversion of a shrub-dominated vegetation cover type to a grass/forb-dominated vegetation cover type in the short term. Over the long term, shrubs would become re-established and increase in abundance within the majority of disturbed areas as a result of reclamation and natural re-colonization. The loss of 743 acres of shrub-dominated vegetation would represent a long-term impact as it would take up to 20 years following reclamation for mature shrub species to re-establish (USDA 2004, BLM 2007a).

In Mine Unit 4, approximately 15 acres of wetlands along WWC would be potentially disturbed by construction activities related to development of the Mine Unit, and the access road and pipeline construction ROWs. As described in the PoO (PRI 2011a) and the Mine Permit Application Operations Plan (PRI 2009), wetlands within the limits of the GHPA generally would be avoided. Following completion of delineation drilling, injection and recovery wells would be located outside

Table 4.13-1 Acreages of Affected Vegetation Communities under the Proposed Action Alternative

Mine Component			Vegetation Communities							
			Bottomland Sagebrush (acres)	Disturbed Land (acres)	Mixed Sagebrush-grassland (acres)	Reclaimed Areas (acres)	Rough Breaks East (acres)	Rough Breaks West (acres)	Upland Grassland (acres)	Wetlands (acres)
Mine Units, Including Monitoring Well Rings	Mine Unit 1	Construction	18	-	98	-	<1	25	25	<1
		Operation	9	-	49	-	<1	12	13	<1
	Mine Unit 2	Construction	6	-	168	43	142	-	16	-
		Operation	3	-	85	21	72	-	8	-
	Mine Unit 3	Construction	-	48	31	5	-	15	-	-
		Operation	-	24	16	3	-	8	-	-
	Mine Unit 4	Construction	18	<1	177	4	50	-	-	15
		Operation	9	<1	89	2	25	-	-	7
	Mine Unit 5	Construction	13	2	46	50	7	-	-	-
		Operation	6	1	23	25	3	-	-	-
Project Infrastructure	Roads with Utility Corridors	Construction	28	25	111	15	4	19	6	<1
		Operation	5	4	20	3	<1	3	1	<1
	Disposal Wells	Construction	--	--	2	2	--	2	--	--
		Operation	--	--	1	1	--	1	--	--
	Satellite Building Central	Construction	1	-	4	-	-	-	-	-
		Operation	1	-	4	-	-	-	-	-
	Satellite Building West	Construction	-	-	5	-	-	-	-	-
		Operation	-	-	5	-	-	-	-	-
	Water Management	Construction	8	27	8	20	-	-	-	-
		Operation	8	27	8	20	-	-	-	-
	Topsoil Piles	Construction	<1	<1	2	<1	<1	<1	<1	-
		Operation	<1	<1	2	<1	<1	<1	<1	-
Total		Construction	93	102	651	136	204	60	47	15
		Operation	42	57	301	73	101	25	22	8

the boundary of the wetlands; however, access roads and pipe lines may require crossing of wetland areas (Appendix D-11, PRI 2009). Potential short-term and long-term impacts to wetlands would be dependent on the placement of delineation wells, access roads, and overhead power lines within the mine unit. Short-term impacts could include, but would not be limited to; clearing of all hydrophytic vegetation, temporary erosion and sedimentation of stream channels, and the introduction of contaminants into flows and/or existing channel sediments. Long-term impacts could include loss of wetlands resulting from overhead power lines and access road placement during the life of the Project, and long-term changes in surface and groundwater flows.

As described in the PoO and the Mine Permit Application Operations Plan (PRI 2011a, 2009), jurisdiction of wetlands impacted by development on Mine Unit 4 would be determined in consultation with the USACE. If required, the applicant would develop a mitigation plan for impacts to jurisdictional wetlands that would be approved by the WDEQ-LQD, BLM, and USACE. Prior to mine unit development, the final locations of wells would be identified and submitted for approval by the WYDEQ-LQD. At that time specific impacts to wetlands would be determined, and any required state and federal permits and mitigation plans developed and submitted for approval. As actual surface disturbance locations and their relation to wetlands in the mine units is unknown, it is assumed for the impact analysis that the Project has the potential to impact wetlands in Mine Unit 4.

Where access roads and pipelines cross perennial and intermittent drainages, BMPs as detailed in the Mine Permit Application Operation Plan (PRI 2009) would be implemented to prevent erosion and sedimentation of those drainages. BMPs implemented could include the construction of ditches and berms, riprap, sediment basins, and silt fences to prevent sedimentation and erosion. Any spills or discharge of pollutants into Waters of the State via storm water runoff would be managed using the BMPs described in the SWPPP. See Section 2.3.8, Existing Monitoring Plans, for the BMPs listed in the SWPP. To minimize fugitive dust and collisions with wildlife and livestock, access roads in the wellfield areas would have reduced speed limits, and would consist of either unconstructed light use 2-track roads or constructed narrow access roads. In addition, disturbed areas would be reclaimed as described below.

The total amount of surface disturbance at a given time would be minimized through the phased development of each mine unit. After completion of mine unit construction, and after operations start, approximately 95 percent of the mine unit would undergo interim reclamation to stabilize the disturbed soils. However, an estimated 45 percent of the mine unit would be impacted by cross-country mechanized travel to well heads, for a total of 50 percent disturbance of a mine unit during operation. Interim reclamation would occur concurrently with operations. Interim reclamation is described in Section 2.3.2.5, Interim Reclamation, and would focus on disturbed surfaces not used during mine unit operation. Disturbed surfaces would be scarified and contoured, if necessary, followed by topsoil placement and seeding with a BLM-approved seed mix (**Table 4.13-2**). Topsoil stockpiles that would be stored for more than a year would be seeded with just the grasses from the approved reclamation seed mix. Where conditions prevent seeding for a period of time longer than 3 months, disturbed areas would be temporarily treated until interim reclamation could occur. Temporary treatments could include scarification, mulching with straw mulch, or seeding with a temporary cover crop (e.g., barley, winter wheat, millet, or rye) at 30 pounds/acre. In addition, disturbed areas with slopes greater than 25 percent would immediately be mulched with straw mulch or seeded with a temporary cover crop. Erosion controls would be installed as appropriate to prevent erosion and sedimentation.

Final reclamation would occur after mining was complete and groundwater restoration had been deemed successful in a mine unit (Section 2.3.5, Mine Unit Restoration and Reclamation). A detailed description of final reclamation activities is included in the Mine Permit Application (PRI 2009). During final reclamation, facilities would be removed, wells would be plugged and abandoned, and access roads would be reclaimed. All disturbed surfaces would be scarified, ripped, and/or disked as appropriate, and graded and contoured to approximate original contours to blend with the surrounding topography. Salvaged

Table 4.13-2 Interim and Final Reclamation Seed Mix for the Proposed Action[a]

Common Name	Scientific Name	Variety	lbs PLS[b]/ac
Westem Wheatgrass[c]	*Agropyron smithii*	Rosana	3.00
Thickspike Wheatgrass[c]	*Agropyron dasystacum*	Critana	3.00
Slender Wheatgrass[c]	*Agropyron trachycaulum*	Pryor	3.00
Ricegrass	*Oryzopsis hymenoides*	Nespar	2.00
Green Needlegrass	*Stipa viridula*	Lodorm	2.00
Sheep Fescue[d]	*Festuca ovina*		2.00
Gardner Saltbush	*Atriplex gardneri*		0.75
Cicer Milkvetch	*Astragalus cicer*	Lutana	0.50
Shadscale Saltbush	*Atriplex confertifolia*		0.50
Big Sage	*Artemisia tridentate*		0.50
Antelope Bitterbrush[e]	*Purshia tridentate*		0.50
Total lbs. PLS/Acres			17.75

[a] If any of the above seed or approved substitutes become unavailable or cost prohibitive, reasonable substitutions could be made with prior approval of WDEQ-LQD and BLM. If more locally adapted varieties of certified seed become available, they could be substituted with prior approval of WDEQ-LQD and BLM. For temporary seeding of topsoil stockpiles, only the grasses listed in the seed mix would be used.

[b] The stated seeding rates are for Pure Live Seed (PLS). Percent PLS is the total of multiplying germination plus dormant or hard seeds by the percent purity.

[c] Streambank Wheatgrass (*Elymus lanceolatus*) or Bluebunch Wheatgrass (*Agropyron spicatum*) could be added to or substituted for any of the listed wheatgrass species as long as the total wheatgrass mix does not exceed 10 lbs. PLS per acre.

[d] Idaho Fescue (*Festuca idahoensis*) could be substituted for Sheep Fescue at 2 lbs. PLS per acre.

[e] Winterfat (*Krascheninnikovia lanata*) could be substituted for Antelope Bitterbrush at 0.5 lbs. PLS per acres.

topsoil would be re-applied. Seeding would be conducted using the pitting and seeding method; drill or broadcast seeding would be used during fall and spring seeding windows in limited areas. To cover newly seeded areas, these areas would be raked or dragged. Final reclaimed areas would be fenced for a period of at least 2 years or until the vegetation was capable of renewing itself with properly managed grazing and without supplemental irrigation or fertilization. The fencing would not be removed until the WDEQ-LQD and BLM agree that the revegetated areas were able to support livestock grazing.

Vegetation cover types could recover at varying rates. Herbaceous-dominated plant communities (including the reclaimed areas and upland grasslands) would typically take 3 to 5 years to establish adequate ground cover to prevent erosion and provide forage for wildlife species and grazing operations. Woody-dominated plant communities (including bottomland sagebrush and mixed sagebrush grassland) would require up to 20 years for shrubs of similar stature to recolonize the area (BLM 2007a). Reclamation efforts could take longer in areas with soil reclamation restraints (see Section 4.11, Soils for further discussion).

As referenced in the Mine Permit Application, the goal of final reclamation would be to restore the land to a condition that would sustain the current land use of livestock grazing and wildlife habitat in accordance with WDEQ guidelines. These guidelines outline specific vegetation parameters that would be used to compare reclaimed areas against a COMA that were identified during baseline vegetation surveys. Two

COMAs that are representative of the various vegetation types in the GHPA were established during additional vegetation sampling conducted in 2007. The COMAs and vegetation surveys are described in further detail in Addendum D8 of the Mine Permit Application (PRI 2009). Successful revegetation at the end of the bonding period is defined as when:

1. The vegetation species of the reclaimed land are self-renewing under natural conditions prevailing at the site;
2. The total vegetation cover of perennial species (excluding noxious weed species) and any species in the approved seed mix is at least equal to the total vegetation cover of perennial species (excluding noxious weed species) on the area before mining;
3. The species composition and diversity are suitable for the approved post-mining land use; and
4. The above are achieved during a single growing season, no sooner than the fifth full growing season on the reclaimed lands.

Mitigation

The following mitigation measures are proposed to further avoid, minimize, or mitigate Project-related impacts to vegetation resources.

VEG-1: Project disturbances would avoid wetlands as identified in the Mine Permit Application and the vegetation surveys conducted by HWA (HWA 2011a). Surface disturbance would not occur within the wetlands along WWC. Erosion and sediment BMPs as described in the SWPPP (PRI 2009), would be implemented within 500 feet of wetlands located within the vicinity of surface disturbance associated with the Project.

VEG-2: In areas of LRP due to saline and/or alkaline soils, the saline and alkaline tolerant seed mix in **Table 4.13-3** would be used.

Implementation of mitigation measure VEG-1 would reduce impacts to wetlands by avoiding surface disturbances in mapped wetlands and implementing erosion and sedimentation controls within 500 feet of wetlands. The implementation of erosion and sedimentation controls within the 500 feet of wetlands would ensure that wetlands would not be impacted by overland surface flow, and sedimentation resulting from surface disturbance associated with the Project. Implementation of VEG-2 would assist in reclamation efforts in areas with LRP due to saline and/or alkaline soils within the GHPA.

Residual Impacts

Vegetation recovery to similar cover and species composition after implementation of a reclamation program would be expected to occur over the long term (longer than 5 years). Herbaceous-dominated plant communities would require an estimated minimum of 3 to 5 years to establish adequate ground cover to prevent erosion and provide forage for wildlife species and grazing operations. Woody-dominated plant communities would require up to 20 years for shrubs of similar stature to recolonize the area. Fragmentation and the conversion of vegetation communities could occur over the long term, depending on the success of reclamation.

Residual impacts due to the loss of sagebrush habitat are discussed in Section 4.17, Wildlife and Fisheries. Implementation of mitigation measures would result in no residual impacts to wetland resources.

4.13.2.2 Noxious Weeds and Invasive Species

Under the Proposed Action Alternative, a total of approximately 1,315 acres of vegetation would be removed or disturbed (**Table 4.13-1**). Following surface disturbance activities, noxious weeds and invasive species could colonize areas that typically lack or have minimal vegetation cover. Surface

Table 4.13-3 Proposed Interim and Final Saline/Alkaline Reclamation Seed Mix, Mitigation Measure VEG-2[a]

Common Name	Scientific Name	Variety	Pounds Pure Live Seed/Acre
Westem Wheatgrass	*Agropyron smithii*	Rosana	3.00
Thickspike Wheatgrass	*Agropyron dasystacum*	Critana	3.00
Slender Wheatgrass	*Agropyron trachycaulum*	Pryor	3.00
Ricegrass	*Oryzopsis hymenoides*	Nespar	2.00
Idaho Fescue	*Festuca idahoensis*		2.00
Cicer Milkvetch	*Astragalus cicer*	Lutana	0.50
Yarrow	*Achillea spp.*		0.25
Gardner Saltbush	*Atriplex gardneri*		0.75
Shadscale Saltbush	*Atriplex confertifolia*		0.75
Bud Sage	*Artemisia spinescens*		0.50
Winterfat	*Krascheninnikovia lanata*		1.00
Total Pounds Pure Live Seed/Acre			**16.75**

[a] If any of the above seeds or approved substitutes become unavailable or cost prohibitive, reasonable substitutions could be made with prior approval of the WDEQ-LQD and BLM. If more locally adapted varieties of certified seed becomes available, they could be substituted with prior approval of the WDEQ-LQD and BLM.

[b] The stated seeding rates are for Pure Live Seed (PLS). Percent PLS is the total of multiplying germination plus dormant or hard seeds by the percent purity.

disturbance and increased vehicle travel along new routes could spread noxious weeds and invasive plant species and colonize areas with minimal vegetation cover or recently disturbed areas (BLM 2007a). Noxious weed species can degrade and modify native communities, reduce structural and species diversity, and out-compete native species (BLM 2007a). Cheatgrass, already present in the GHPA, is a concern as it can alter the local fire regime and fire-recurrence interval, often resulting in alteration of species composition of native communities.

Implementation of the applicant-committed environmental protection measures and the Reclamation Plan would reduce the potential for noxious weeds and invasive species spread and establishment in the GHPA. The Mine Permit Application Operations Plan (PRI 2009) states that during operations and following surface reclamation, noxious weeds would be controlled by annual spraying on an as-needed basis, until final bond release was obtained. Final bond release would be contingent on revegetation success as defined in Section 4.13.2.1, Vegetation. Noxious weed control would be performed only by individuals with appropriate state and BLM pesticide certifications. Even after successful reclamation, populations of weedy annual species (e.g., halogeton) could remain established in localized areas.

All surface disturbance would be reclaimed either concurrently during the shift from construction to operations or once mining was complete. Noxious weed management would continue during the post-mining reclamation period and the post-closure monitoring period.

Mitigation

The following mitigation measures are proposed to further avoid, minimize, or mitigate Project-related impacts related to noxious weeds and invasive species.

NOX–1: Development of a noxious weed management plan that includes pre-construction surveys, education of construction and operation personnel during construction and operation activities, the washing of vehicles and equipment before entering and leaving the GHPA, herbicide spraying, and annual monitoring. Survey information collected during pre-construction surveys would include species name, GPS location of weed infestations, percent cover, and approximate size of weed infestations. Control of noxious and invasive species would be consistent with the Vegetation Treatments on Public Lands Administered by the BLM in the Western U.S. (BLM 2007b), and could include chemical, mechanical, and biological methods. Herbicide treatment methods also would be consistent with BLM (2007c) guidance. It is recommended that the Fremont County Weed and Pest be consulted in the development of the noxious weed management plan.

NOX-2: Cheatgrass control methods on BLM-administered lands would be determined in consultation with the BLM and would focus on preventing the further spread of cheatgrass into areas disturbed by the Project.

Implementation of mitigation measure NOX-1 would provide more detail on existing noxious weeds of concern in the GHPA, and would provide specific methods for management of noxious weeds. In addition, it would provide a more accurate method of measuring success of weed treatments and would allow for flexibility in control methods. The focus of the weed management plan would be to address general weed prevention and control methods to be implemented pre-, during, and post-construction. Implementation of NOX-2 would assist in preventing the spread of cheatgrass into areas disturbed by the Project.

Residual Impacts

Implementation of the additional mitigation measure would reduce residual impacts from noxious weeds and invasive species. However, noxious weed and invasive species could persist over the long term regardless of the implementation of control programs.

4.13.2.3 Special Status Plant Species

The following impact assessments focus on special status plant species, which include those species federally listed as threatened, endangered, proposed, or candidate species, as well as BLM-sensitive species with the potential to occur within the GHPA. These species are identified in Section 3.13.3, Special Status Plant Species. Field surveys for the special status plant species were conducted in mid- to late June 2010, in the GHPA in areas of modeled habitat for each species (HWA 2011a) and in July 2011, within 0.25 mile of the Gas Hills Road upgrade ROW.

Persistent Sepal Yellowcress

Potential habitat for persistent sepal yellowcress was modeled as occurring north of Mine Unit 3, but still within the GHPA. During field surveys conducted in 2010 and 2011, in the modeled habitat areas in the GHPA, no populations of this species were observed (HWA 2011a,b). However, during field surveys conducted in 2011 along the Gas Hills Road upgrade ROW, suitable habitat for the persistent sepal yellowcress was observed (HWA 2011b). The majority of direct impacts to the suitable habitat for this species would be avoided because the location of the habitat is outside areas that would be impacted by surface-disturbing activities associated with the development of mine units under the Proposed Action. Direct impacts to suitable habitat could occur during the upgrade of the Gas Hills Road. Indirect impacts to the suitable habitat could include the spread of noxious and invasive weed species, fugitive dust, and potential changes in surface flow related to construction and operation activities. These indirect impacts

would be mitigated through the implementation of applicant-committed environmental protection measures (Section 2.3.9, Applicant-committed Environmental Protection Measures).

Cedar Rim Thistle

Potential habitat (587 acres) for the species was modeled as occurring in Mine Units 1 through 4. (HWA 2011a). No populations of Cedar Rim thistle were observed during field surveys in the modeled habitat; however, suitable habitat was observed among the clay slopes and fans within stands of Wyoming big sagebrush and grasslands in the vicinity of the Beaver Rim (HWA 2011a,b). A known location of Cedar Rim thistle occurs 2 miles southwest of the GHPA. Development of Mine Units 1 through 4 could potentially result in direct impacts to the suitable habitat for this species. Indirect impacts to the suitable habitat could include the spread of noxious and invasive weed species and fugitive dust. Indirect impacts would be mitigated through the implementation of applicant-committed environmental protection measures (Section 2.3.9, Applicant-committed Environmental Protection Measures).

Beaver Rim Phlox

No populations of Beaver Rim phlox were observed during field surveys; however, suitable habitat for the species was observed along the slopes and top of the Beaver Rim in gaps among the Wyoming sagebrush (HWA 2011a,b). This identified habitat occurs in the GHPA in areas of moderate to steep slopes. As the suitable habitat is located outside areas where surface-disturbing activities associated with the Proposed Action would occur, direct impacts to the suitable habitat would be avoided. Indirect impacts to the suitable habitat could include the spread of noxious and invasive weed species and fugitive dust. These impacts would be mitigated through the implementation of applicant-committed environmental protection measures (Section 2.3.9, Applicant-committed Environmental Protection Measures).

Rocky Mountain Twinpod

Potential habitat (2,592 acres) for the species was modeled as occurring within all mine units. No populations of Rocky Mountain twinpod were observed during field surveys; however, suitable habitat was observed along the north slope of the Beaver Rim (HWA 2011a,b). Direct impacts to the observed locations of suitable habitat for this species would be avoided because the location of the habitat is outside areas that would be impacted by surface-disturbing activities associated with the Proposed Action. Indirect impacts to the observed locations of suitable habitat could include the spread of noxious and invasive weed species and fugitive dust. These impacts would be mitigated through the implementation of applicant-committed environmental protection measures (Section 2.3.9, Applicant-committed Environmental Protection Measures).

Limber Pine

Within the GHPA, limber pine was observed in small stands in the higher elevations atop the Beaver Rim and east towards the Rattlesnake Hills (HWAa,b). Direct impacts to the suitable habitat for this species would be avoided as the location of the habitat is outside areas that would be impacted by surface-disturbing activities associated with the Proposed Action. Indirect impacts to the suitable habitat could include the spread of noxious and invasive weed species, fugitive dust, and fragmentation of species habitat. These indirect impacts would be mitigated through the implementation of applicant-committed environmental protection measures (Section 2.3.9, Applicant-committed Environmental Protection Measures).

Mitigation

The following mitigation measures are proposed to further avoid, minimize, or mitigate Project-related impacts to special status plant species.

SSP-1: Perform pre-construction surveys for persistent sepal yellowcress, Cedar Rim thistle, and Rocky Mountain twinpod in identified habitat (HWA 2011a,b) 1 year prior to development of

each mine unit and associated access roads within the modeled habitat boundary. Locations of any populations or individuals of Persistent sepal yellowcress, Cedar Rim thistle or Rocky Mountain twinpod identified during pre-construction surveys would temporarily be flagged during construction. Surface disturbance would not occur within 100 feet of any identified individuals or populations.

Implementation of mitigation measure SSP-1 would minimize or avoid direct impacts to any populations of persistent sepal yellowcress, Cedar Rim thistle, and Rocky Mountain twinpod that potentially may occur in the GHPA. Implementation of mitigation measures, VEG-1, VEG-2, and NOX-1 would minimize indirect impacts to any populations of persistent sepal yellowcress, Cedar Rim thistle, and Rocky Mountain twinpod.

Residual Impacts

Implementation of the additional mitigation measures would minimize impacts on special status plant species populations and suitable habitat.

4.13.3 Resource Protection Alternative

Under the RPA, construction of the Project would directly impact or remove a total of 818 acres of vegetation. **Table 4.13-4** identifies acreage of Project-related disturbance by vegetation community type for construction and operation activities associated with mine components and related infrastructure. Under this alternative surface disturbance would be reduced, as only half of each mine unit surface area would be disturbed from construction activities. Surface disturbance also would be reduced through the use of the closed loop drilling system, the reduced number of evaporation ponds, and by annual development planning. The closed loop drilling system eliminates the excavation of drilling mud pits, while annual development planning would identify procedures to constrain surface disturbance to identified areas. The amount of surface disturbed at one time would be reduced by the addition of construction timing constraints which would not allow construction of Mine Units 3 through 5 until successful reclamation was demonstrated on the mine unit developed 2 prior (e.g., Mine Unit 3 would not be developed until interim reclamation of Mine Unit 1 has been shown to make significant progress toward meeting reclamation success criteria).

4.13.3.1 Vegetation

Impacts from the RPA would be the same as described for the Proposed Action, except there would be a decrease in the acreage of shrub-dominated vegetation and wetlands impacted by the construction and operation activities. Construction and operation activities under the RPA would result in the long-term loss of 458 acres of shrub-dominated vegetation and 8 acres of wetlands.

Interim and final reclamation would occur as described under the Proposed Action. Final reclamation goals under this alternative would be evaluated using the reclamation criteria established in the Draft Lander RMP (BLM 2011b), which are based on the USDA-NRCS ESDs for each mapped ecological site (USDA-NRCS 2011). The criteria for reclamation success are outlined in Section 2.4.7.1, Reclamation Success Criteria.

Mitigation

Mitigation measures VEG-1 and VEG-2 would be implemented for the RPA as described under the Proposed Action Alternative.

Residual Impacts

Residual impacts to vegetation resources would be the same for the RPA as described under the Proposed Action Alternative.

Table 4.13-4 Acreages of Affected Vegetation Communities under the RPA

Mine Component			Vegetation Communities							
			Bottomland Sagebrush (acres)	Disturbed Land (acres)	Mixed Sagebrush-grassland (acres)	Reclaimed Areas (acres)	Rough Breaks East (acres)	Rough Breaks West (acres)	Upland Grassland (acres)	Wetlands (acres)
Mine Units, Including Monitoring Well Rings	Mine Unit 1	Construction	10	-	52	-	<1	13	13	<1
		Operation	4	-	21	-	<1	5	5	<1
	Mine Unit 2	Construction	3	-	87	22	73	-	8	-
		Operation	1	-	34	9	29	-	3	-
	Mine Unit 3	Construction	-	25	17	3	-	10	-	-
		Operation	-	10	7	1	-	4	-	-
	Mine Unit 4	Construction	9	<1	91	2	27	-	-	8
		Operation	4	<1	36	<1	10	-	-	3
	Mine Unit 5	Construction	7	1	24	27	3	-	-	-
		Operation	3	<1	10	11	1	-	-	-
Project Infrastructure	Roads with Utility Corridors	Construction	28	25	111	15	4	19	6	<1
		Operation	5	4	20	3	<1	3	1	<1
	Disposal Wells	Construction	-	-	2	2	--	2	-	-
		Operation	-	-	1	1	--	1	-	-
	Satellite Building Central	Construction	-	-	-	-	-	-	-	-
		Operation	-	-	-	-	-	-	-	-
	Satellite Building West	Construction	-	-	-	-	-	-	-	-
		Operation	-	-	-	-	-	-	-	-
	Water Management	Construction	8	27	8	20	-	-	-	-
		Operation	8	27	8	20	-	-	-	-
	Topsoil Piles	Construction	<1	<1	2	<1	<1	<1	<1	-
		Operation	<1	<1	2	<1	<1	<1	<1	-
Total		**Construction**	**65**	**78**	**393**	**90**	**107**	**43**	**27**	**8**
		Operation	**24**	**42**	**137**	**45**	**41**	**13**	**10**	**3**

4.13.3.2 Noxious Weeds and Invasive Species

Under the RPA, direct and/or indirect surface disturbance-related impacts to noxious weeds and invasive species would be approximately 818 acres. Anticipated impacts and recovery timeframes would be the same as described for the Proposed Action Alternative. As part of this alternative, Cameco would be required to submit and comply with the requirements of a noxious weed plan as described in Section 2.4.7.1, Reclamation Success Criteria.

Mitigation

Because Cameco would submit and comply with the requirements of a noxious weed plan under the RPA, only mitigation measure NOX-2 would be proposed by the BLM for this alternative.

Residual Impacts

Residual impacts to noxious weeds would be the same for the RPA as described under the Proposed Action Alternative.

4.13.3.3 Special Status Plant Species

Under the RPA, direct and/or indirect surface disturbance-related impacts to special status species would be approximately 818 acres. Anticipated impacts and recovery timeframes would be the same as described for the Proposed Action Alternative. The potential for impacts to occur would be reduced proportionately due to the reduction in surface disturbance compared to the Proposed Action.

Mitigation

Mitigation measures for special status plant species would be the same for the RPA as described under the Proposed Action Alternative.

Residual Impacts

Residual impacts to special status plant species would be the same for the RPA as described under the Proposed Action Alternative.

4.13.4 Irreversible and Irretrievable Commitment of Resources

If interim and final reclamation is successful, no irreversible commitment of resources would be anticipated for native vegetation communities. The loss of vegetation during construction and prior to reclamation would be irretrievable.

In areas with soil reclamation constraints, where interim reclamation might not be successful, there would be an irretrievable loss of native vegetation communities due to construction activities. If successful reclamation was not achieved, disturbed areas no longer would support native vegetation communities and potentially could be dominated by noxious and invasive weed species, especially halogeton and cheatgrass species. This would represent an irreversible and irretrievable commitment of this resource.

4.13.5 Relationship between Local Short-Term Uses and Long-Term Productivity

For all alternatives, long-term impacts that could affect long-term productivity include the disturbance of herbaceous and shrub-dominated vegetation cover types that would require up to 20 years to recover, and the potential that populations of weedy annual species (e.g., halogeton) could become established in localized areas for extended periods of time. Under all alternatives, the disturbance of herbaceous and woody-dominated vegetation community types would occur.

The decrease in vegetation cover types either through direct impacts (i.e., removal of vegetation) or indirect impacts (i.e., the spread of noxious and invasive species) could impact ecological function, livestock and wildlife grazing, and recreation activities in the GHPA.

4.14 Visual Resources

This section describes potential visual impacts associated with the Project and alternatives. The area evaluated for visual effects encompasses the viewshed of the Project, the area from which project features would be visible, most of which is within approximately 5 miles of the GHPA (**Figure 4.14-1**). As illustrated in **Figure 4.14-1**, visibility of Project features would be greatest within the GHPA and nearby to the northwest. Terrain, particularly the Beaver Divide, limits visibility of the GHPA from the east and south. Issues associated with visual resources that were identified by the BLM through internal scoping, consultation with cooperating agencies, and through comments provided during the scoping process included potential impacts to recreational users. No issues related to visual resources were identified from public comments submitted during the scoping process.

Impacts to visual resources were analyzed using the procedures outlined in the BLM Visual Contrast Rating Handbook H-8431-1 (BLM 2007d). Visual impacts were determined by comparing visual contrast ratings for the Project facilities with the VRM class objectives for the GHPA, which is designated VRM Class IV (see **Table 3.14-1**). The process involves comparing the degree of visual contrast from the proposed facilities and activities with the existing landscape character both during active recovery and after completion of reclamation. The contrast rating process used one Key Observation Point (KOP) as the viewpoint for conducting the impact analysis.

The KOP used in this analysis is located on Dry Creek Road approximately 0.3 mile west of the east section line of Section 18, T33N, R89W (**Figure 4.14-1**). The visual contrast rating worksheet for this location is included as **Appendix G**. Dry Creek Road is the nexus of the 3 main access roads to the Project vicinity: Wyoming State Route 136 from Riverton; Gas Hills Road (CR 212) from U.S. 20/26 at Waltman; and the Ore Road (CR 5) from U.S. 287 at Jeffrey City. While none of these roads is heavily traveled, the confluence of the 3 onto Dry Creek Road suggests it is a location from which the most viewers are likely to see the GHPA. The particular location of the KOP affords a relatively unobstructed view up the WCC valley toward Mine Unit 2 on the north slope of Beaver Divide. Traffic in the area is rural in nature, and generally is generated by local mineral development or ranching activity; however, some traffic may be generated by recreational activities including hunting, OHV use, or, on rare occasions, hiking.

Potential impacts to visual resources were identified using the assumption that vegetation monitoring would be conducted as described in Section 2.3.7, Temporary Closures. This should be sufficient to assure successful reclamation of disturbed areas.

4.14.1 No Action Alternative

Under the No Action Alternative, in-situ uranium mining activities and the associated new facilities would not be developed within the GHPA. Currently authorized activities would continue and impacts to visual resources would be minimal.

4.14.2 Proposed Action Alternative

Development of the Proposed Action would result in a generally regular pattern of injection and production well heads interspersed with a number of medium-sized header houses in each mine unit. There would be a network of gravel surface and 2-track native surface roads, buried pipelines, pump stations, aboveground power lines, and ancillary facilities in each mine unit. The perspective from the selected KOP looks across Mine Unit 2 and part of Mine Unit 4 at a distance of approximately 2 to 3 miles. The visual effect of the Proposed Action would appear primarily as a textural change with the relatively small well head features spread across the landscape and the header houses and pump stations showing as larger, rectangular structural elements dispersed among the well heads. The pattern of well heads would show as a medium to coarse texture at the 2- to -3 mile viewing distance, providing a moderate contrast with the relatively fine texture of the existing landscape.

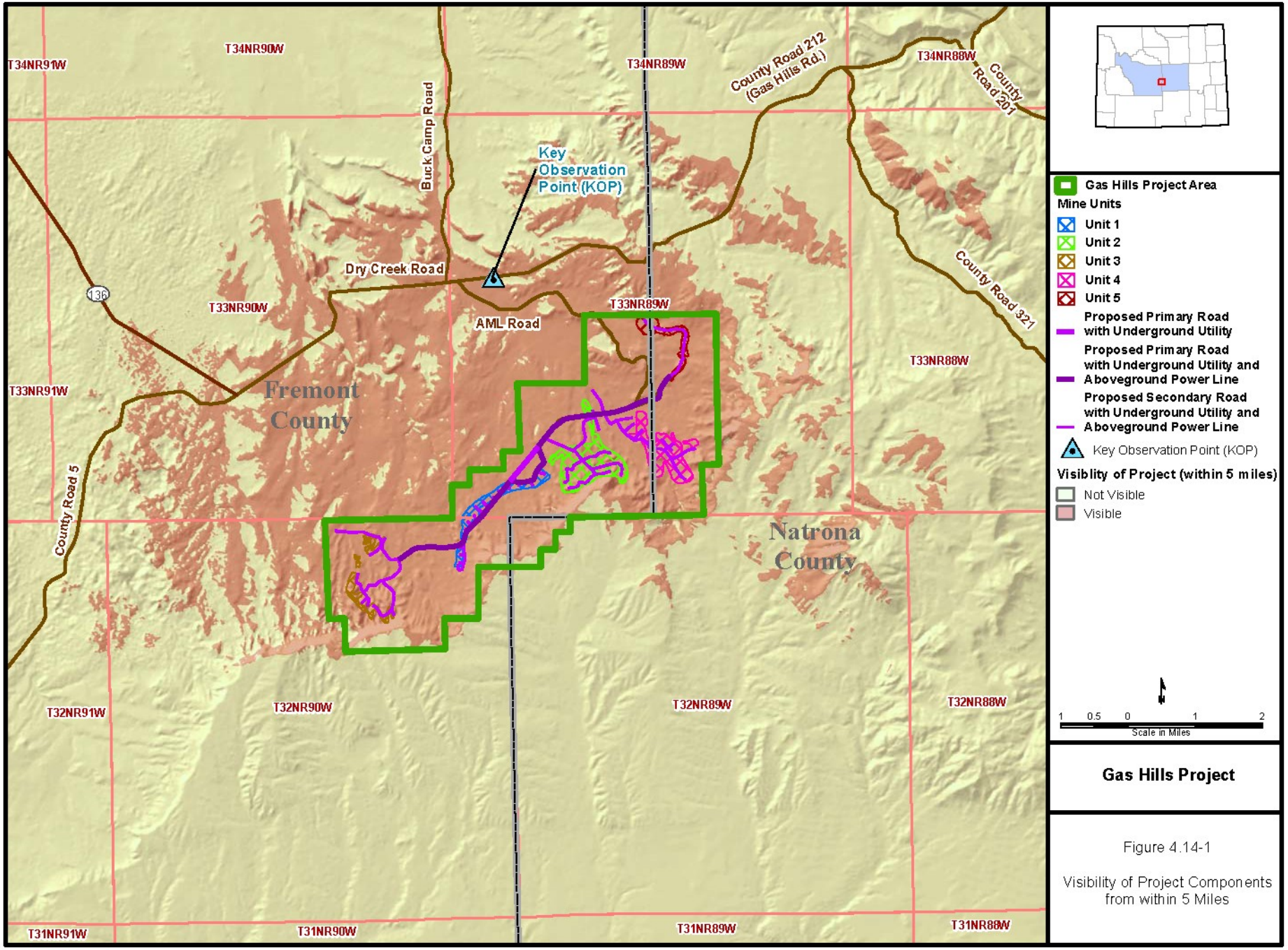


Figure 4.14-1

Visibility of Project Components from within 5 Miles

Access roads and pipelines would introduce horizontal lines on the native ground surface; power lines would be most apparent for their strong vertical pole elements and sometime reflective conductors. The new surface linear features would be similar to existing roads, but the network would be noticeably more dense than the existing condition, providing a weak to moderate quantitative, rather than qualitative, visual contrast. The power lines would be strung on wooden single-pole structures, which would introduce moderate line contrast because of their vertical nature, although most would be at a sufficient distance from the KOP and other public viewpoints that they would not be visually prominent.

The greatest visual contrast from the Proposed Action would occur during construction, and again during decommissioning, when the greatest amount of surface disturbance would occur. Essentially the entire surface of each mine unit would be progressively disturbed over a period of 2 to 3 years during construction. There would be no discernible change to the existing land form from the project. During the construction and decommissioning, natural vegetation would be removed in patterns likely to be more geometric in form than the natural vegetative patterns. Exposure of the lighter colored soils would result in weak color contrast with the existing soil and vegetation colors during most seasons of the year with possible moderate color contrast during the spring and early summer when the green hues of the existing landscape are most prominent. These would be relatively short-term impacts that would recede as interim reclamation replaced disturbances with vegetation comparable to the native plant materials within approximately 3 to 5 years of the disturbance. The relatively flat terrain closest to the KOP would help minimize the visual effect to the KOP because of the low viewing angle while any disturbance on the slopes rising to the Beaver Divide would provide a more noticeable, direct viewing angle that would be partially mitigated by the greater distance from viewers.

After successful completion of interim reclamation activities, there would be minor vegetative form and color contrast effects. Linear features, which would represent most of the unreclaimed disturbance area, would introduce moderately stronger visual contrast. The textural change from the evenly spaced Project facilities would be the most apparent visual effects to viewers during most of the projected 25-year life of the Project, although it would be considered moderate because the facilities would employ colors compatible with the natural landscape, would be relatively small in scale, and would not dominate the view, particularly as seen from the KOP.

The significance of the visual impacts as seen from the KOP would be considered low. Project features would attract the attention of the casual observer, but would not dominate the view and would conform to the VRM Class IV management guidelines for the area.

Mitigation

The following additional measures to avoid, minimize, or mitigate impacts to visual resources are proposed.

VRM-1: Pursuant to the VRM Class IV management objective indicating that visual effects should be minimized to the extent possible, aboveground facilities would be painted with low-reflectivity paints in colors that would blend with the natural environment. The BLM color chart provides a tool for use in selecting an appropriate paint color or colors.

Implementation of mitigation measure VRM-1 would minimize impacts to the degree possible, in compliance with the requirements of VRM Class IV management objectives.

Residual Impacts

Adverse visual effects from the Proposed Action would be minimized by application of the mitigation measure discussed above and by successful reclamation of surface disturbance to the point that casual observers would be unlikely to recognize that there had been activity related to the Project.

4.14.3 Resource Protection Alternative

The RPA would reduce the amount of surface disturbance, compared to the Proposed Action, both during construction and, subsequently, during decommissioning when some underground facilities would be left in place to avoid re-disturbing those areas. It also would result in enhanced reclamation with the objective of returning the disturbed area to enhanced vegetative conditions relative to existing conditions. Approximately 21 miles of new power lines needed to service the ISR mining activities would be placed underground rather than overhead. This would greatly reduce or eliminate the vertical line contrast from power poles in the mine GHPA.

The RPA would result in a reduction in visual contrast compared with the Proposed Action. Under this alternative, the visual effects would be considered low and somewhat lower in intensity than under the Proposed Action. The degree of visual change would conform to the VRM Class IV management guidelines for the area. From a visual resources perspective, the RPA would be more consistent with the directive that “every attempt should be made to minimize the (visual) impact …” in VRM Class IV areas.

Mitigation

Mitigation measures for the RPA would be the same as for the Proposed Action.

Residual Impacts

Residual impacts would be the same as for the Proposed Action.

4.14.4 Irreversible and Irretrievable Commitment of Resources

Previously described impacts to visual resources would be reversible through reclamation efforts; reestablishment of plant communities would require a minimum of 3 to 5 years and is further discussed in Section 4.13, Vegetation.

4.14.5 Relationship between Local Short-Term Uses and Long-Term Productivity

Project components, such as structures, piping, evaporation ponds, power lines and access roads, would be removed at the end of their life spans and the land would be reclaimed to pre-existing or enhanced conditions. These actions would minimize impacts to the long-term productivity and sustainability of public land resources.

4.15 Water Resources

This section evaluates potential impacts to water resources from the Gas Hills Project. The following subsections separately present a discussion of impacts to surface water (Section 4.15.1, Surface Water Resources), groundwater (Section 4.15.2, Groundwater Resources), and water use (Section 4.15.3, Water Use).

4.15.1 Surface Water Resources

The analysis area used for assessing potential impacts to surface water resources is defined as all 6th order, 12-digit HUC-12 Subwatersheds (USDA-NRCS et al. 2010) that have a portion of the GHPA included within their boundary (**Table 3.15-1** and **Figure 3.15-1**) and have surface disturbance proposed by the Project. A total of 4 subwatersheds have a portion of the GHPA within them; however, only the 2 within the Big Horn Basin have Project-related surface disturbance proposed within them and are assessed in the surface water resources analysis. The surface water resources analysis area encompasses over 61,000 acres or approximately 96 square miles.

Primary issues associated with surface water resources were identified by the BLM through internal scoping, consultation with cooperating agencies, and through comments provided during the scoping process. These include potential impacts to surface water quality and quantity such as increased erosion, increased sediment loads or turbidity, increased salinity, increased use of water, and contamination from produced water or other hazardous substance spills.

Impacts to surface water quality were analyzed by determining proposed surface disturbance within each watershed and evaluating the potential for erosion and sedimentation issues. This evaluation included quantification of the number, location, and type of existing and proposed roads crossing waterways. The potential for contamination of surface water from hazardous substance spills and from accidental release of process water also is discussed.

For the purposes of analyzing the number of stream crossings, it was assumed that the National Hydrography Dataset accurately defines the location of waterways that would require a culvert crossing. Any identified issues with consumptive use of water would be resolved through W.S. 41 (WSEO) policies and procedures.

4.15.1.1 No Action Alternative

Current management in the Analysis Area would be maintained under the No Action Alternative. Under this alternative, no project construction or operation would occur. The Carol Shop facility, 1 road, and previously disturbed land would be reclaimed, resulting in the reclamation of approximately 40 acres; reclamation would restore surface contours to approximate original drainage patterns. Continued exploration activities would continue within the GHPA under existing management at a rate of 5 acres or less each year, and reclamation of these sites would be anticipated to occur within the same calendar year as the disturbance. There would be no potential for a hazardous material spill.

4.15.1.2 Proposed Action Alternative

Under the Proposed Action Alternative, Cameco would construct wells, roads, pipelines, evaporation ponds, and surface facilities on approximately 1,315 acres throughout the GHPA. During construction and operation, potential impacts could include increased runoff and erosion from disturbed lands, increased stream channel instability from road crossings, and potential degradation of surface and groundwater quality due to spills of hazardous materials from construction equipment. Surface disturbance during construction of the Project components would have the potential to impact surface water sources by increasing runoff, erosion, and downstream sedimentation.

Mine Units 2, 4, and 5, and the proposed evaporation ponds would be located within the Upper Canyon Creek-Deer Creek Subwatershed, where the major stream is WCC (**Figure 4.15-1**). Mine Unit 3 would be within the Fraser Draw Subwatershed, and Mine Unit 1 would be located within both the Upper Canyon Creek-Deer Creek and the Fraser Draw subwatersheds.

Surface disturbance from Project construction within Upper Canyon Creek-Deer Creek and Fraser Draw subwatersheds would represent 4.8 and 0.6 percent of the total subwatershed areas, respectively. Operational disturbances in the affected sub-watersheds are 0.9 and 0.1 percent of the Upper Canyon Creek-Deer Creek and Fraser Draw subwatersheds, respectively. This disturbance is detailed in **Table 4.15-1** and depicted in **Figure 4.15-1**. Construction activities would remove vegetation cover from disturbed areas, resulting in an increase in runoff. Soil disturbance by mechanized equipment along with the removal of vegetation would result in an increase in soil erosion from disturbed areas. Both of these impacts collectively would result in the potential for sedimentation within ephemeral and perennial (WCC) drainages within and downstream of disturbed areas.

The Project potentially would impact 15 acres of wetlands along WCC in Mine Unit 4, including the perennial reaches of the creek. Impacts to wetlands are discussed in more detail in the vegetation impact analysis in Section 4.13, Vegetation. All disturbance associated with construction within streams or wetlands would require that jurisdiction of wetlands impacted by development on Mine Unit 4 would be determined in consultation with the USACE as described in Section 4.13.2.1, Vegetation. In addition, the applicant would develop a mitigation plan for impacts to the wetlands that would be approved by the WDEQ-LQD, BLM, and USACE. As jurisdictional status of the wetlands and the mitigation to be developed with the USACE is unknown, it is assumed, for the impact analysis, that the Project has the potential to impact wetlands in Mine Unit 4.

The portion of disturbance within the Canyon Creek-Deer Creek and Fraser Draw subwatersheds that would be associated with the evaporation ponds, drainage diversion, and runoff control berm was designed to isolate process water within the ponds and to divert storm runoff from disturbed areas (diversions and berms). The evaporation ponds would be hydrologically isolated using below-grade, synthetically lined, bermed impoundments with a secondary liner and leak detection system. The ponds would be constructed in pairs, and each in the pair would be designed to contain the combined maximum operating capacity of both of the paired ponds to allow for drain-down of 1 pond for any necessary maintenance. A minimum freeboard of 2 feet also would be incorporated, allowing for wind and wave action as well as storage in the event of high intensity precipitation.

Under this alternative, 16 culverts would be installed in roads at waterway crossings, all within the Upper Canyon Creek-Deer Creek subwatershed. There are 10 locations where proposed roads would cross ephemeral streams and 6 locations where a perennial stream (WCC) would be crossed. These crossings could alter the existing channel geometry which could potentially increase water velocities and decrease bank stability. In addition, channel stability could be further decreased by removing bed and bank vegetation, and by culvert installation which could result in changes to channel roughness and gradient. The GHPA experiences high levels of variability in channel processes (i.e., headcutting, bank failure, sedimentation) under natural and existing conditions, and that variability could be further exacerbated by Project development. The majority of these channels generally are dry (ephemeral/intermittent) except during the most intense precipitation periods (e.g., 10-year precipitation events or greater).

Localized channel processes during high flows and in response to changes in channel geometry and upland/riparian vegetation normally include head-cutting, bank failure, channel sedimentation, and channel scour. Construction disturbance near or across drainage channels and streams likely would exacerbate these processes, especially in areas with highly erodible soil types (see Section 4.11, Soils, for discussion of potential impacts to highly erodible soils), by decreasing the vegetative cover and damaging the soil structure that limits erosion under existing conditions.

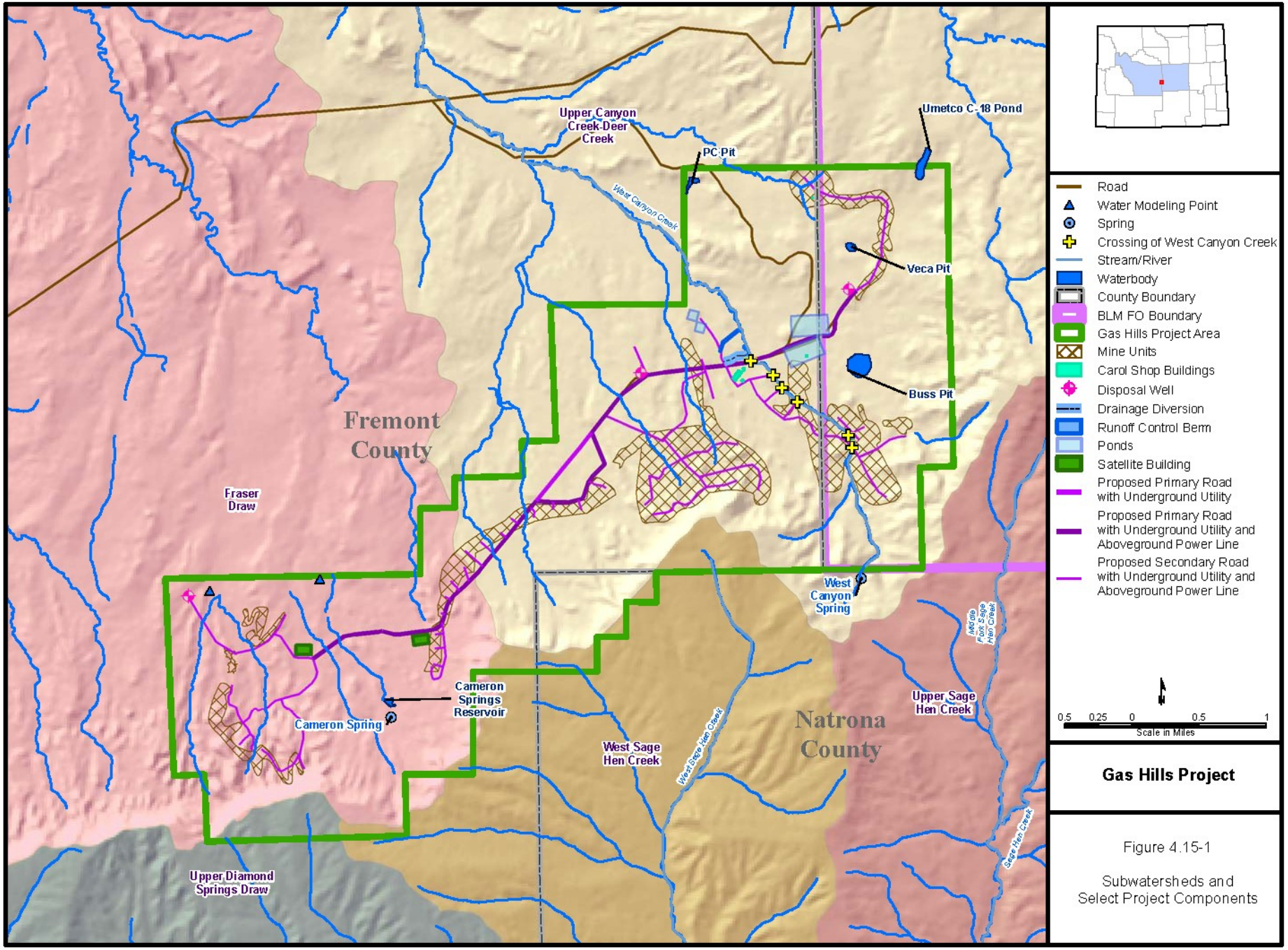


Figure 4.15-1

Subwatersheds and Select Project Components

Table 4.15-1 Surface Disturbance under the Proposed Action Alternative by Subwatershed

Project Facility	Upper Canyon Creek-Deer Creek Subwatershed				Fraser Draw Subwatershed			
	Construction		Operation		Construction		Operation	
	(acres)	(percent)[a]	(acres)	(percent)[a]	(acres)	(percent)[a]	(acres)	(percent)[a]
Mine Unit 1	96	0.4%	48	0.2%	60	0.2%	30	0.1%
Mine Unit 1 Monitoring Well Ring	6	<0.1%	6	<0.1%	5	<0.1%	3	<0.1%
Mine Unit 2	365	1.7%	183	0.8%	0		0	
Mine Unit 2 Monitoring Well Ring	10	0.0%	10	0.0%	0		0	
Mine Unit 3	0		0		90	0.2%	45	0.1%
Mine Unit 3 Monitoring Well Ring	0		0		10	<0.1%	5	<0.1%
Mine Unit 4	255	1.2%	128	0.6%	0		0	
Mine Unit 4 Monitoring Well Ring	9	<0.1%	9	<0.1%	0		0	
Mine Unit 5	111	0.5%	56	0.3%	0		0	
Mine Unit 5 Monitoring Well Ring	8	<0.1%	8	<0.1%	0		0	
Ponds, Drainage Diversion, Runoff Control Berm	62	0.3%	62	<0.1%	0		0	
Process Water Pipeline	8	<0.1%	0		0		0	
Road ROW[b]	120	0.6%	23	<0.1%	80	0.2%	40	0.1%
Satellite Building Central	0		0		5	<0.1%	3	<0.1%
Satellite Building West	0		0		5	<0.1%	3	<0.1%
Topsoil Piles	1	<0.1%	1	<0.1%	2	<0.1%	1	<0.1%
Total	**1,051**	**4.8%**	**533**	**2.4%**	**256**	**0.6%**	**129**	**0.3%**

[a] Reported as percent of total subwatershed area (from **Table 3.15-1**, the total area of Upper Canyon Creek-Deer Creek is 21,810 acres and Fraser Draw is 39,558 acres).

[b] Includes utility construction disturbance.

Note: Differences in totals are due to rounding.

Implementation of applicant-committed measures (ACMs) and BMPs would minimize the impacts of surface disturbance to water resources. Within the state-required SWPPP (SWPPP, Addendum OP-4 to the mine permit application [PRI 2009]), the applicant has committed to minimizing erosion impacts through the use of erosion control and channel stabilizing measures (e.g., ditches and berms, conveyance channels, rock/rip rap, outlet protection, sediment traps or basins, straw bale barriers, silt fence, check dams).

Storm water management would be implemented as defined in the SWPPP, which includes monitoring and maintenance of all control devices and structures during active construction on 1 of 2 schedules; at least once every 14 days, and within 24 hours of a precipitation event greater than 0.5 inches. After active construction is finished but before complete reclamation has occurred, these structures and devices would be inspected a minimum of once per month with the exception of extended periods of frozen ground conditions over the entire site. If unacceptable erosion impacts are discovered during inspections, additional BMPs would be employed to mitigate the impacts.

Impacts from disturbance in upland locations would be minimized through the use of erosion control devices (e.g., silt fences, straw bales, berms, mulches, soil binders, erosion control blankets). See Section 2.3.9, Existing Monitoring Plans, for applicant-committed erosion measures for specific erosion control devices.

Potential spills of hazardous materials from construction or operation equipment would be addressed in the Project's SPCCP, which would be developed prior to Project initiation. This plan includes measures such as secondary containment at all on-site hazardous materials and waste storage facilities, including fuel. The SPCCP also defines procedures to be followed in the case of an accidental spill from a vehicle or equipment. No degradation to water quality would be anticipated.

Potential spills of mine unit fluid would be minimized through proper construction and operational procedures, proper training of personnel, and leak detection devices and alarms. The procedures to be followed in the case of a spill of this type would be similar to those for the Smith Ranch-Highland facility, addressed in the SHEQ Management System Emergency Procedures Volume VIII of the SRH Uranium Project (PRI 2011a), because the Project would be operated as a satellite to the SRH Project. The potential for impacts to water quality remain; however, adequate leak detection devices and alarms could minimize these impacts.

There also is a potential spill hazard during transport of resin that could affect water quality at river crossing locations along the transportation route to Smith Ranch-Highland facility. The main crossings of concern are the North Platte River in Casper and near Douglas. According to analyses contained in Section 4.8, Public Health and Safety, the risk of accidents at these 2 North Platte River crossings (assuming a conservative 1-mile crossing at each) during product shipment would have a probability of occurring 0.006 times in the projected 25-year life of the Project (see Section 4.8, Public Health and Safety, for additional information on risk of traffic incidents).

Mitigation

The following mitigation measures would be applied to further avoid, minimize, or mitigate Project-related impacts to surface water.

SWR-1: Cameco would submit details of the proposed types and locations of the mine unit fluid spill detection devices and alarms to the BLM for review and approval.

Implementation of SWR-1 would allow the most current technology to be used to limit the potential for surface leaks of lixiviant or pregnant solution from ISR well heads within the mine units. Implementation of VEG-1 (Section 4.13.2.1, Vegetation) would eliminate disturbance within wetlands along WCC and would ensure implementation of erosion and sediment BMPs described in the SWPPP (PRI 2011a) within 500 feet of wetlands. Mitigation measure VEG-1, by eliminating road crossings and culvert

installation within wetlands along WCC would reduce the potential of the Project to exacerbate in-channel processes such as headcutting, bank failure, and sedimentation. This mitigation measure would eliminate 3 of the 6 proposed road crossings of WCC within Mine Unit 4. Access to portions of Mine Unit 4 located north and east of WCC could be maintained via the remaining 3 crossings.

Properly implemented BMPs, ACMs, and mitigation measures, used during construction and operation, would minimize impacts of surface disturbance on water quality and quantity; therefore, significant impacts would not be anticipated.

Residual Impacts

No significant impacts would be anticipated to water resources from the Project, and therefore, residual impacts also would not be anticipated.

4.15.1.3 Resource Protection Alternative

The types of impacts to surface water resources under the RPA would be similar to those under the Proposed Action, with the following exceptions. Disturbance for mine unit construction would be reduced, and travel patterns used during operation would be planned to avoid sensitive areas with greater potential to contribute to runoff and sedimentation. Disturbance would be distributed within the same watersheds as described for the Proposed Action (**Figure 4.15-1**) but would be reduced as detailed in **Table 4.15-2**. These changes would reduce potential impacts to drainage patterns, as well as to surface water resources. With proper implementation of ACMs and BMPs during construction and operation, significant impacts would not be anticipated.

The reduction of heavy truck trips used to transport uranium slurry to the Smith Ranch-Highland facility to 122 annual trips under the RPA from 325 annual trips under the Proposed Action would decrease the potential for spills of that material, and would reduce the potential of a release at highway river crossings to approximately 0.002 times in the projected 25-year life of the Project (see Section 4.8, Public Health and Safety, for additional information on risk of traffic incidents).

Mitigation

No additional mitigation measures would be required.

Residual Impacts

No residual impacts would be anticipated.

4.15.1.4 Irreversible and Irretrievable Commitment of Resources

Irreversible impacts to surface water are not anticipated since properly implemented ACMs and BMPs, including reclamation, would reduce effects on water quantity and quality over time. Temporary reductions in water quality from erosion, sedimentation, and spills of hazardous materials would be irretrievable during construction and until reclamation occurred.

4.15.1.5 Relationship between Local Short-term Uses and Long-term Productivity

Increases in erosion and decreases in bank vegetation could potentially impact channel stability during the life of the Project. However, properly implemented ACMs and BMPs would reduce the impacts to channel stability, and long-term effects would be minimized.

Table 4.15-2 Surface Disturbance under the RPA by Subwatershed

Project Facility	Upper Canyon Creek-Deer Creek Subwatershed				Fraser Draw Subwatershed			
	Construction		Operation		Construction		Operation	
	(acres)	(percent)[a]	(acres)	(percent)[a]	(acres)	(percent)[a]	(acres)	(percent)[a]
Mine Unit 1	48	0.2%	19	0.1%	30	0.1%	12	<0.1%
Mine Unit 1 Monitoring Well Ring	6	<0.1%	6	<0.1%	3	<0.1%	1	<0.1%
Mine Unit 2	183	0.8%	73	0.3%	0		0	
Mine Unit 2 Monitoring Well Ring	10	<0.1%	10	<0.1%	0		0	
Mine Unit 3	0		0		45	<0.1%	18	<0.1%
Mine Unit 3 Monitoring Well Ring	0		0		5	<0.1%	2	<0.1%
Mine Unit 4	128	0.6%	51	0.2%	0		0	
Mine Unit 4 Monitoring Well Ring	9	<0.1%	9	<0.1%	0		0	
Mine Unit 5	56	0.3%	22	0.1%	0		0	
Mine Unit 5 Monitoring Well Ring	8	<0.1%	8	<0.1%	0		0	
Ponds, Drainage Diversion, Runoff Control Berm	62	0.3%	62	0.3%	30	<0.1%	12	<0.1%
Process Water Pipeline	8	<0.1%	0	<0.1%	0		0	
Road ROW[b]	120	0.6%	23	0.1%	40	<0.1%	16	<0.1%
Satellite Building Central	0		0		3	<0.1%	1	<0.1%
Satellite Building West	0		0		3	<0.1%	1	<0.1%
Topsoil Piles	1	<0.1%	1	<0.1%	1	<0.1%	0	<0.1%
Total	**638**	**2.9%**	**284**	**1.3%**	**159**	**<0.1%**	**63**	**<0.1%**

[a] Reported as percent of total subwatershed area (from **Table 3.15-1**, the total area of Upper Canyon Creek-Deer Creek is 21,810 acres and Fraser Draw is 39,558 acres).

[b] Includes utility construction disturbance.

Note: Differences in totals are due to rounding.

4.15.2 Groundwater Resources

This section describes potential impacts to groundwater quality and quantity that could result from the Project. The groundwater impact analysis area during construction, operation, and reclamation is the GHPA, which corresponds to the maximum WDEQ-LQD permit boundary. The groundwater impact analysis area during groundwater restoration is the GHPA, plus the area within 10 miles of the GHPA boundary within which potential drawdown impacts could occur during groundwater sweep. Groundwater resources within the GHPA were identified by reviewing existing data sources, including available geology and hydrogeology data from state and federal agencies as well as from Cameco (PRI 2009). Available information was used to identify the extent to which the Project could impact groundwater, and also to identify crossover or conflicts with applicable land use plans and/or regulations.

Potential issues associated with groundwater resources were identified by the BLM through internal scoping, consultation with cooperating agencies, or through comments provided during the scoping process. These issues include:

- Impacts to water quantity and groundwater quality from the Project;
- Potential issues with restoring groundwater quality in the GHPA to pre-mining baseline water quality;
- The potential impact of approximately 12,000 abandoned exploration holes or wells currently existing within the GHPA, some of which may not have been properly plugged and abandoned;
- The potential impact on groundwater flow and quality due to faults, historic mine workings, and complexities in the stratigraphy of the Gas Hills District; and
- The potential for impacts to groundwater quality and quantity from deep disposal of wastewater.

Permitting and oversight of groundwater impacts for ISR mining is under the jurisdiction of the WDEQ-LQD. The following analysis of potential impacts of the Project and alternatives assumes that ISR activities would be conducted in accordance with the WDEQ-LQD mine permit.

4.15.2.1 No Action Alternative

Under the No Action Alternative, ISR mining of uranium in the GHPA would not take place. No change to current groundwater flow patterns and groundwater quality, discussed in Section 3.15.2, Groundwater Resources, would occur, and there would be no impacts to groundwater quantity or quality from the Project beyond those currently existing from past mining activity (see discussion of past mining impacts (Section 3.15.2.4, Hydrology of the Mine Units, Irreversible and Irretrievable Commitment of Resources).

4.15.2.2 Proposed Action Alternative

Under the Proposed Action, in-situ recovery of uranium would occur within 5 mine units within the GHPA, as described in Section 2.3, Proposed Action. The ISR process involves the introduction of a chemical solution, or lixiviant, into groundwater to remove uranium from the subsurface ore deposit. The process also involves injection and pumping wells which redirect groundwater flow to contain and remove the lixiviant. Collectively, these activities could impact groundwater as follows:

- Groundwater quality within mine units would be impacted by the injection of lixiviant to remove uranium from the ore deposit. This intentional impact would be reversed by the implementation of groundwater restoration following the extraction of uranium from the target ore zones.
- Groundwater quality outside of mine units could be impacted by excursions of lixiviant beyond the monitoring well ring around each mine unit. Initial testing results presented in Section 3.15.2, Groundwater Resources, indicate that faults within several of the mine units provide pathways for leakage of groundwater from target ore zones; that hydraulic communication with overlying confining zones is observed; and that interfingering of target ore zones results in hydraulic

communication between zones. These complexities in the subsurface hydrogeologic conditions suggest the potential for migration of lixiviant outside on mine units. Further hydrologic testing would be conducted (see Section 2.3.2.2, Hydrologic Testing) under WDEQ-LQD and U.S. NRC oversight to demonstrate containment of injected fluids.

- Migration of groundwater contaminated by past mining and milling activities may be affected during post mining groundwater restoration. In particular, Mine Unit 4 is located in close proximity to the Buss Pit (see **Figure 1-1**) which contains water impacted with high TDS from past mining activities. Mine Unit 5 is located next to several historic mine pits (including Veca, C-13, C-18, A-8 and Tee pits as shown in **Figure 3.15-4**) and in close proximity to the Gas Hills East Tailings Cap (also see **Figure 3.15-4**) to be managed under the DOE LM program. During groundwater restoration, wells within the mine units would be pumped without simultaneously injecting lixiviant in order to draw in native groundwater from outside of the mine unit. In the case of Mine Unit 4 and Mine Unit 5 this process could draw in or displace contaminated groundwater from past mining and milling activities.
- Groundwater quantity could be impacted by the removal of bleed water during ISR operations. Bleed water is removed from the ISR circulation process so that slightly more (about 1 percent) water is pumped than injected from a wellfield creating inward flow to a mine unit during operations. This would result in a general lowering of groundwater levels within a mine unit through removal of groundwater from aquifer storage and a reduction in available groundwater quantity until restoration of groundwater levels.
- Groundwater quantity temporarily could be impacted by drawdown during groundwater sweep activities associated with groundwater restoration.

These impacts to groundwater would be addressed through the WDEQ-LQD permitting and oversight process which requires monitoring and hydrologic testing of groundwater prior to implementing the ISR process and restoration of groundwater quality to pre-mining baseline water quality conditions. In the event that pre-mining baseline water quality could not be met for 1 or more specific constituents in a mine unit, continued restoration of the groundwater would be required until pre-mining Wyoming Class of Use for the groundwater had been met. The current Class of Use is Class III for livestock use.

ISR mining is regulated by the U.S. NRC because of the radioactive nature of the uranium ore and associated daughter products, and groundwater related to mining operations is regulated by the WDEQ-LQD within the State of Wyoming. The U.S. NRC (2002) established guidelines for the regulation of uranium ISR, and the WDEQ-LQD (2005a,b, 2000) adopted these guidelines as regulations to be followed in conducting ISR activities in Wyoming.

As described in Section 3.16.2, the proposed mine units for the Project would be located in areas with historic underground and open pit mines, faults, areas of elevated TDS water from historic mining, and areas of contaminated groundwater (metals, uranium, and radium) associated with past uranium milling activities. In addition, as described in Section 2.1, Existing Infrastructure and Disturbance in the Gas Hills Project Area, there are areas of abandoned drill holes, some of which may not have been properly plugged. These issues would be addressed for each mining unit through the hydrologic testing and reporting process that would be completed for each mining unit and submitted to the WDEQ-LQD for review prior to initiating ISR activities.

Monitoring and Determination of Impacts to Groundwater Quality

The main guidelines for ISR mining are found in the WDEQ-LQD Rules and Regulations, Chapter 11 (2005b), WDEQ-LQD Guideline Number 8 (2005a), and WDEQ-LQD Guideline Number 4 (2000). There are 5 main aspects to ISR addressed in the regulatory guidelines that WDEQ-LQD would use to determine impacts to groundwater quality:

1. Pre-mining water quality determination would be performed for the GHPA. This water quality data would be compared to data collected from monitoring wells during mine operation to determine if an excursion of lixiviant (defined as an exceedence of at least 2 key constituents at a monitoring well) has occurred. It also would be used during groundwater restoration to determine whether groundwater restoration had achieved pre-mining water quality.
2. Aquifer testing would be performed to establish the directional hydraulic properties of the production zone, hydrologic boundary conditions, possible vertical hydraulic connections with overlying or underlying aquifers, the potential effects of faults, abandoned mine workings, and improperly abandoned drill holes on the migration of the lixiviant. These characterizations would be used to determine the potential of the ISR process to affect water quality outside the mine unit. The characterizations also would be used to determine the potential for adjacent water bodies of adverse water quality to affect ISR mining or groundwater restoration.
3. Production unit water quality determination would compare pre-mining water quality in the mine unit production zone to groundwater collected from monitoring wells in the production zone both during mine operation and groundwater restoration as described in 1) above, but would be applied to the specific target aquifer associated with each mine unit.
4. Monitor well design would be specified for mining units to adequately reflect the directional transmissivity of the production zone, as well as monitor for any excursions into overlying and underlying aquifers that bound the production zone. The location, spacing, and design of monitor wells is covered in WDEQ-LQD Rules and Regulations, Chapter 11 (WDEQ-LQD 2005b), and would be specified by WDEQ-LQD after receipt and review of the hydrologic testing report for each mine unit.
5. WDEQ-LQD guidelines determine the post-mining restoration goals that would apply to each mine unit. For mine closure, groundwater quality would be required to meet 1 of the following conditions:
    a. Pre-mining baseline water quality;
    b. Pre-mining Class of Use; and
    c. WDEQ-LQD specified target levels for specific constituents.

WDEQ-LQD guidelines specify that the primary goal for groundwater restoration would be pre-mining baseline water quality. If pre-mining baseline water quality could not be met for 1 or more constituents (e.g., metals, TDS, radionuclides), the WDEQ-LQD could allow groundwater restoration to pre-mining Class of Use. If pre-mining Class of Use could not be met for 1 or more constituents, the WDEQ-LQD would determine what restoration activities would be required to meet specified target levels for those constituents.

During groundwater restoration, certain groundwater constituents could be more difficult than others to return to restoration target levels. If specific parameters do not achieve pre-mining baseline water quality concentrations, the WDEQ-LQD could approve the use of pre-mining Class of Use as the restoration target levels provided BPT has been applied. WDEQ-LQD Guideline Number 4 (2000) defines BPT for ISR groundwater restoration. The WDEQ-LQD would decide if BPT has been applied to a mine unit for the specific parameters not meeting the restoration target levels. In any case, if any constituent remains above the pre-mining Class of Use, restoration would be deemed unsuccessful and the WDEQ-LQD would determine further restoration using technologies specific to the remaining parameters not meeting the restoration target level. The WDEQ-LQD would have the final determination for groundwater restoration in a mine unit. As noted in **Figure 2-3**, production of Mine Unit 4 would not commence until groundwater restoration for Mine Unit 1 was shown to be successful. The WDEQ-LQD would review and approve the proposed schedule of mining and groundwater restoration for each mine unit prior to commencement of ISR mining.

Process for Determining Containment of ISR Fluids

Geological layers can be discontinuous as a result of shifts from faulting, variable layer thickness, differences in permeability of layers, or physical disruptions from activities such as open-pit mining or wells. These discontinuities can provide avenues for groundwater movement between geological layers, and can provide challenges to containment for ISR. Groundwater monitoring would be used to detect migration of the lixiviant outside mine units due to the presence of geologic discontinuities, or to detect migration of the historically contaminated groundwater toward a wellfield. Operational engineering procedures to avoid uncontrolled migration of lixiviant or existing groundwater contamination (PRI 2009) could include:

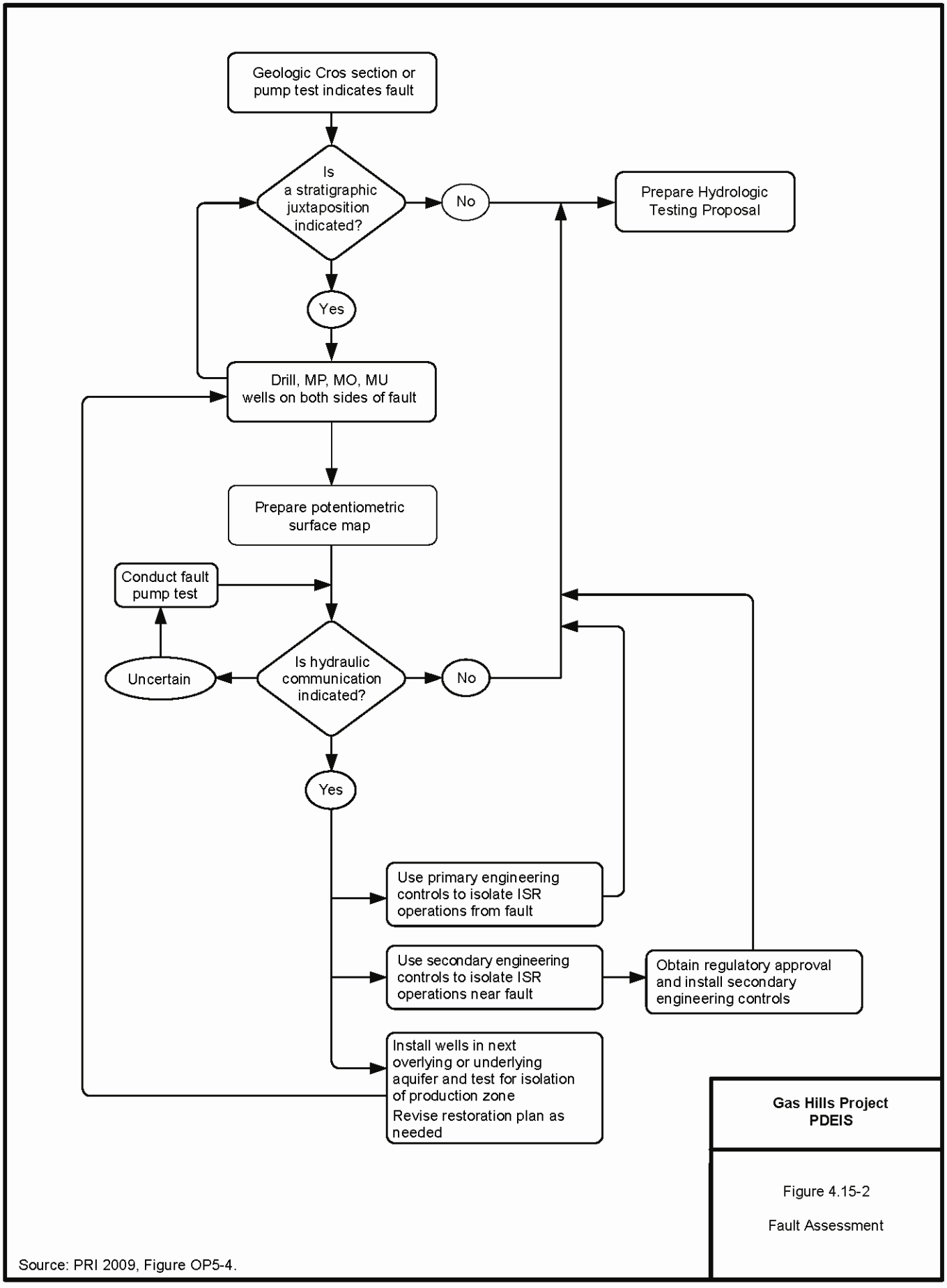
- Production area pattern balancing – increasing or decreasing the ratio of ISR injection wells to recovery wells to better control groundwater flow patterns;
- Pump scheduling – varying the timing and rate of water pumped into ISR injection wells and water removed from ISR production wells to control groundwater flow patterns;
- Wellfield set backs – distancing wellfields from a potential geological problem area;
- Monitoring well design – adjust monitoring well design to provide earlier detection of lixiviant excursions; and
- Water fences – a line of water injection wells used to produce a hydrologic barrier, or fence.

The decision tree shown in **Figure 4.15-2** illustrates the procedure to be followed to address concerns associated with groundwater interaction with faults within a mine unit. The primary procedure would be to determine if there was hydraulic communication between the fault and the production zone of the mine unit or communication with the overlying and underlying aquifers. If hydraulic communication or significant interaction between a fault and mine unit is indicated, engineering controls would be implemented to hydrologically isolate the ISR operation within the fault. The WDEQ-LQD would approve any engineering controls used to isolate a fault in a mine unit.

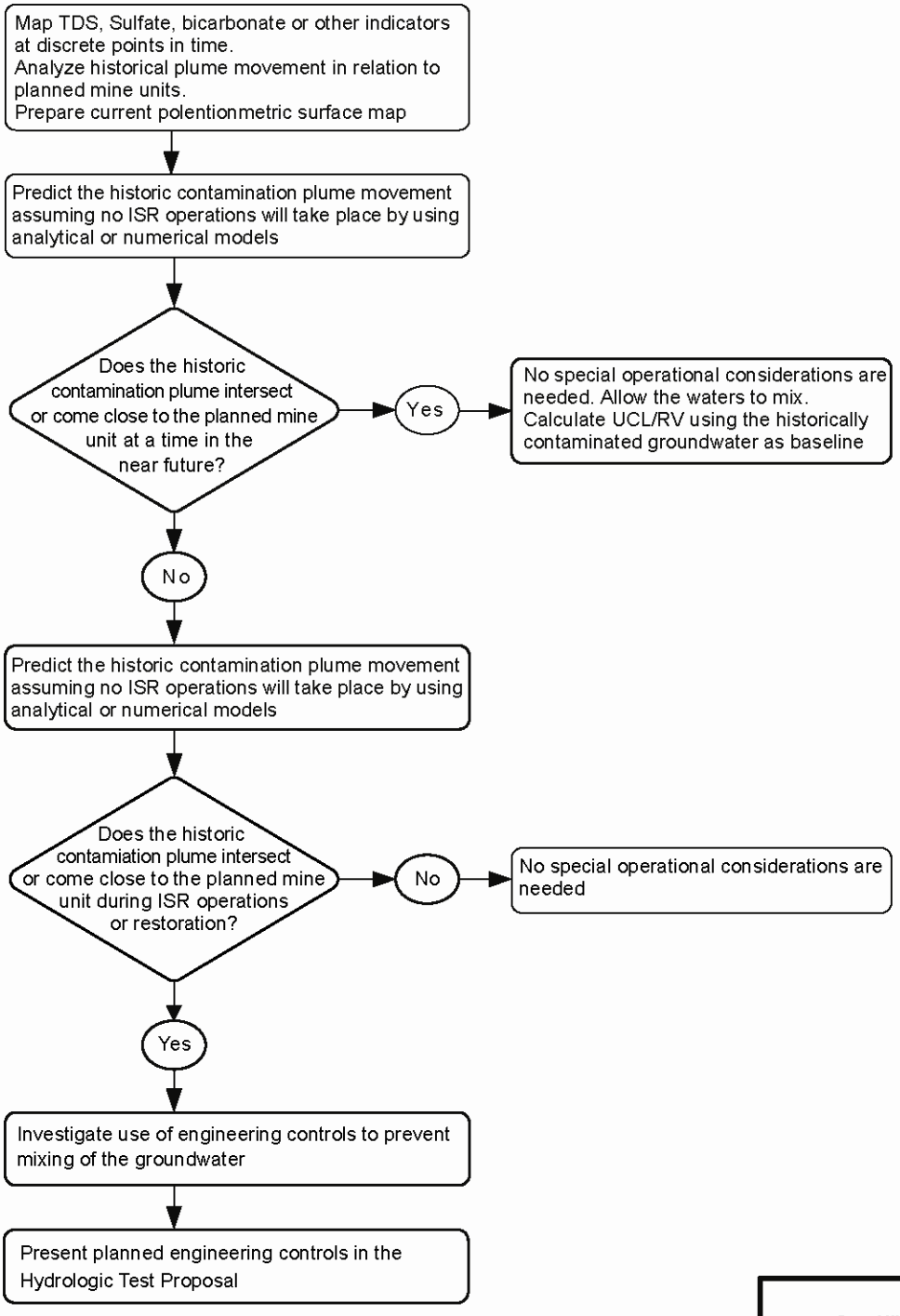
The decision tree shown in **Figure 4.15-3** would be followed to address concerns regarding historic groundwater contamination. Predicted movement of historic groundwater contamination would be used to determine potential interaction with the production wellfield. As with faults, engineering controls approved by the WDEQ-LQD would be used as needed to either control the movement of the historic contamination or prevent the migration of the contaminated water into the production zone. These same procedures would be used during groundwater restoration to keep the historic groundwater contamination out of the production zone. Because Cameco would be required to follow all applicable WDEQ-LQD and U.S. NRC guidelines that apply to both ISR mining of uranium and restoration of groundwater quality, no impacts to groundwater quantity or quality would be expected beyond the GHPA boundary. In addition, the WDEQ-LQD requirement to restore groundwater flow patterns (groundwater quantity) and groundwater quality to pre-mining conditions suggests that there would be no long-term impacts to groundwater from ISR injection and production activities.

Drawdown Impacts During Groundwater Sweep

During the groundwater sweep phase of groundwater restoration, water would be pumped from the wellfield to the processing plant through all production and injection wells without reinjection. This activity would pull relatively unaffected groundwater into each mine unit from surrounding areas, and could potentially increase the depth to groundwater (drawdown) beyond the GHPA as a result of pumping during the groundwater sweep. Conservative analysis using a simplified one-layer Theis solution to represent the production zone of the Wind River Aquifer in the GHPA showed that during a simulated groundwater sweep with each of the 5 mine units pumping at 27 gpm for 3 years with no offsetting reinjection of water, drawdown greater than 2 feet would not extend beyond the boundaries of the GHPA, as shown in **Figure 4.15-4.** The production zone was modeled as a homogenous layer with an average thickness of 100 feet and an average horizontal hydraulic conductivity of 2 feet per day based



Source: PRI 2009, Figure OP5-4.



Gas Hills Project

Figure 4.15-3

Historically Contaminated Groundwater Movement Assessment

Source: Cameco 2009, Figure OP5-5.

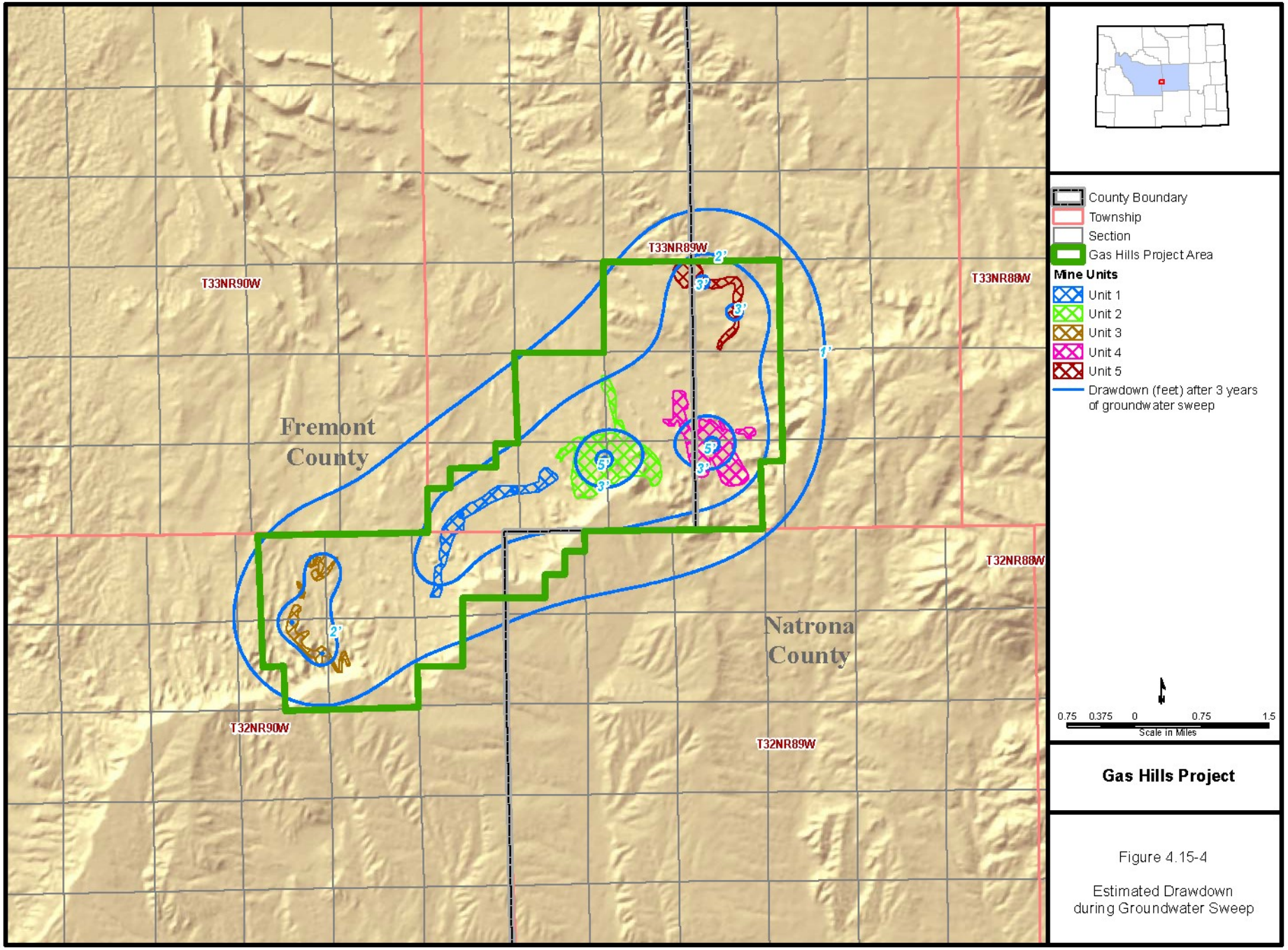


Figure 4.15-4

Estimated Drawdown during Groundwater Sweep

on pumping test results. A specific storage of 5 x 10^{-6} per foot was selected as representative of porous media under confined conditions (Fetter 1980). Initial water levels were established to roughly match the observed water levels presented in **Figure 3.15-3** and **Figure 3.15-4**. Uniform recharge of 0.125 inches per year was applied to simulate recharge from precipitation and runoff. The pumping rate of 27 gpm was based on reported rates for the Irigaray Mine (NRC 2008) and the 3-year pumping rate was based on Cameco's Smith Ranch-Highland Uranium Project in Wyoming (NRC 2008).

While this simplistic analysis indicates that drawdown impacts are not likely to extend beyond the permit boundary and minimal impacts are anticipated beyond mine units, actual drawdown impacts may differ (either more or less than predicted due to uncertainties in the conservative analysis). Prior to initiating operations, Cameco would be required by the WDEQ-LQD to conduct additional hydrologic testing and analysis (see Section 2.3.2.2) which would provide more insight into potential drawdown impacts. Cameco also would be required to submit a site-specific monitoring plan for aquifer restoration activities for approval by the WDEQ-LQD. Cameco's current plans indicate that water levels would be measured in all monitoring wells at least twice a month during operations (see Section 2.3.3.2).

Impacts from Deep Disposal of Wastewater

The Proposed Action also would involve the deep disposal of waste water as part of the Project's water management activities. Cameco is currently investigating the feasibility of deep disposal into the Cloverly, Morrison, Nugget, Phosphoria, Tensleep, Madison, or Flathead formations through the placement of up to 3 test wells in the GHPA. Test well drilling started in 2011, and test results are anticipated in 2012, but are not currently available. Deep well disposal of waste water would be conducted in accordance with the requirements of an approved Underground Injection Control (UIC) Program permit from the WDEQ-WQD for a Class I disposal well.

Permit requirements would be established to protect Underground Sources of Drinking Water (USDW) defined as groundwater with TDS concentrations less than 10,000 mg/L) in the vicinity of the disposal well. This is accomplished by the requirement that the well inject into a formation located below the lowermost USDW in the vicinity of the well and that the geological conditions, including an overlying confining zone, are sufficient to prevent migration of injected fluid into a USDW. Other permit requirements include issuing public notice, providing for public comment on draft permits, as well as holding public hearings upon request. The permit also requires monitoring of groundwater conditions to establish baseline data and to ensure the collection of information on the migration and behavior of injected fluids. In the event that a formation containing groundwater with TDS concentrations greater than 10,000 mg/l is not present beneath the GHPA, Cameco may apply for an aquifer exemption from the USEPA through the WDEQ-WQD UIC program. An aquifer exemption would be approved if Cameco can demonstrate that the aquifer cannot feasibly be developed as a source of drinking water. Assuming compliance with the UIC regulatory program requirements, impacts to groundwater from deep disposal of wastewater would not be anticipated for the Proposed Action other than a local increase in groundwater storage and formation water pressure within the formation used for disposal.

Mitigation

The following mitigation measures would be applied to further avoid, minimize, or mitigate Project-related impacts to groundwater:

GWR-1: The BLM would require Cameco to develop a drawdown level as part of their site-specific monitoring plans to be approved by the WDEQ-LQD below which additional monitoring would be conducted at increasing distances from mine units in order to determine whether drawdown impacts extend to existing water rights holders outside of the GHPA. In the event that drawdown impacts impair the ability of water rights holders to produce water, Cameco would mitigate any impact by lowering the pump in the well, deepening the well, installing a new well to a deep aquifer, modifying ISR operations, or terminating groundwater sweep activities.

Mitigation measure GWR-1 is designed to reduce or eliminate impacts to groundwater levels in the region surrounding the GHPA. Therefore, significant impacts from groundwater drawdown would not be anticipated.

Residual Impacts

Because groundwater levels would be expected to rebound after cessation of groundwater pumping during groundwater restoration, impacts would not be anticipated.

4.15.2.3 Resource Protection Alternative

Under this alternative ISR activities would be implemented within the 5 mine units in the GHPA using the same processes and water volumes to remove uranium from the same target ore zones as the Proposed Action. Therefore, impacts to groundwater quantity and quality would be the same as those discussed under the Proposed Action.

Mitigation

No additional mitigation measures would be required

Residual Impacts

No additional residual impacts would be anticipated.

4.15.2.4 Irreversible and Irretrievable Commitment of Resources

Under the Proposed Action, groundwater would be removed from the Wind River Formation in the Gas Hills District. Most of this water would be recycled as part of the ISR process. However, during the life of the Project there would be an irretrievable loss of groundwater as wastewater that would be disposed of either in evaporation ponds or through disposal of wastewater by injection to deep formations. This water loss was estimated by Cameco (PRI 2009) to be approximately 1 percent of the total amount of water pumped and recycled during the life of the Project. This would amount to approximately 6,000 acre-feet of water over the life of the Project. However, this loss would not be irreversible; lowered groundwater level as a result of mining eventually would rebound through natural recharge to the Wind River Aquifer. Additionally, the WDEQ-LQD guidelines for groundwater restoration require that pre-mining groundwater flow patterns be restored prior to mine closure.

4.15.2.5 Relationship between Local Short-term Uses and Long-term Productivity

Because the WDEQ guidelines require restoration of groundwater flow patterns (groundwater quantity) and groundwater quality to pre-mining conditions, there would be no long-term impact to groundwater productivity in the area of the Gas Hills District affected by the Project. During mining, groundwater in the mine units would not be available for domestic or agricultural use.

4.15.3 Water Use

This section describes potential impacts to current water use in the GHPA that could result from the Project. Potential issues associated with groundwater resources were identified through consultation with the BLM and cooperating agencies, or through comments provided during the scoping process, and include impacts to water supply and groundwater quality from the proposed ISR mining.

Potential impacts to water use within the GHPA were identified by reviewing locations of existing water rights (WSEO 2012), reviewing available geology and hydrogeology from state and federal agencies and Cameco (PRI 2009), and determining potential impacts to holders of water rights other than Cameco.

4.15.3.1 No Action Alternative

Under the No Action Alternative, in-situ uranium mining activities would not take place within the GHPA, and there would be no change to currently authorized water use within the GHPA.

4.15.3.2 Proposed Action Alternative

Current water rights within or immediately adjacent to the GHPA that are not held by the proponent include the Veca Pond Reservoir, Beaver Rim #2 well, C-18 Pit well, and the Cameron Springs #1 (**Table 3.15-6**). The Veca Pond Reservoir is likely not used for its use of permitted stock water, but rather is used only for WSEO acknowledgement of the waterbody left over from past mining. The Beaver Rim #2 well is located approximately 0.5 mile from the nearest mine unit (Mine Unit 5). This distance would be outside the influence of mining operations, and groundwater monitoring during Project operation would evaluate any migration of contaminated groundwater outside the mine unit area. The C-18 Pit well is a dewatering well, and because there is no consumptive use associated with this well, no impacts would occur from the Project. The Cameron Springs #1 is a reservoir supplied by Cameron Springs, which is a perched aquifer upgradient of the Project in the Wagon Bed Formation, and would not be affected by the Project.

Current water rights outside the GHPA, but within the area of potential groundwater impacts are shown in **Figure 3.15-5** and summarized in **Table 3.15-6**. There would be no impact to water quality in any of these wells during mine operations or during post-mining groundwater restoration. Potential short-term impacts to water quantity from drawdown during groundwater restoration are addressed in Section 4.15.2.2.

Mitigation

Because anticipated impacts to water use within the GHPA would not be significant, no additional mitigation measures to avoid, minimize, or mitigate impacts would be required. Potential impacts to water quantity in the area surrounding the GHPA would not be significant by implementation of mitigation measure GWR-1.

Residual Impacts

No significant long-term impacts would be anticipated to water availability or use due to the Project, and therefore, residual impacts also would not be anticipated.

4.15.3.3 Resource Protection Alternative

Potential impacts to water use associated with the RPA would be the same as for the Proposed Action Alternative.

Mitigation

No additional mitigation measures would be required.

Residual Impacts

No residual impacts would be anticipated.

4.15.3.4 Irreversible and Irretrievable Commitment of Resources

Irreversible impacts to water use are not anticipated since properly implemented ACMs and BMPs, including reclamation, would reduce effects on water quantity and quality over time. Under the Proposed Action, consumptive use of groundwater from the Project's proposed in-situ mining process is estimated to be approximately 6,000 acre-feet of water (PRI 2009) over the life of the Project. This would represent irretrievable commitment of water; however, this loss would not be irreversible as this groundwater would eventually be replaced by recharge to the Wind River Formation

4.15.3.5 Relationship between Local Short-term Uses and Long-term Productivity

Properly implemented monitoring and groundwater restoration would reduce or eliminate potential impacts to water rights holders not held by the proponent; therefore, no impacts to long-term productivity would be anticipated.

4.16 Wild Horses

The primary issues associated with wild horses and wild horse HMAs were identified by the BLM through internal scoping, consultation with cooperating agencies, and through comments provided during the scoping process. Issues include direct and indirect impacts that reduce forage, negatively impact water sources and rangeland improvements, and impairment of the wild and free roaming characteristics of wild horse behavior within HMAs. The methodology for assessing impacts to wild horses and HMAs is based on impact parameters that are used as indicators for quantifying impacts between alternatives. The overlap of surface disturbances and HMAs was used to determine loss of acreage and appropriate management levels.

The following assumptions were used in the analysis of impacts to wild horses and HMAs:

- Current HMA appropriate management levels reflect the desired population for the present and foreseeable future of the affected HMAs; and
- An increase vehicular traffic would contribute to difficulties in management of wild horses and HMAs.

4.16.1 No Action Alternative

Under the No Action Alternative, the Project would not be approved. Current land use and surface-disturbing activities would continue as currently authorized. Under this alternative the Carol Shop facility, 1 road, and previously disturbed land would be reclaimed, resulting in the reclamation of approximately 40 acres, resulting in an increase in forage. Exploratory drilling would continue at the rate of approximately 5 acres per year.

4.16.2 Proposed Action Alternative

Under the Proposed Action there would be no direct impacts to wild horses or HMAs. As described in Section 3.17.1, Terrestrial Wildlife, the Muskrat Basin lies 5 miles to the southwest of the GHPA and the Conant Creek, Rock Creek, and Dishpan Butte HMAs are west of Muskrat Basin; therefore, the GHPA does not intersect this group of HMAs, known collectively as the North Lander Complex of HMAs. There would be potential for construction and maintenance vehicles to encounter wild horses outside of the GHPA on CR 5 between Jeffrey City and the GHPA, and indirect impacts would consist of infrequent animal/vehicle collisions involving wild horses that wander the unfenced CR 5 within the Muskrat Basin HMA.

Mitigation

WHS-1: Signage would be posted in the GHPA to notify Project personnel that wild horses may be encountered along the road.

Implementation of WHS-1 would mitigate impacts to wild horses due to vehicle collisions.

Residual Impacts

No significant impacts would be anticipated to wild horses from the Project, and therefore, residual impacts also would not be anticipated.

4.16.3 Resource Protection Alternative

Under the RPA, modifications would be implemented to reduce the environmental impacts of the Project. Modifications include closed-loop drilling and slurry transportation, which are described in detail in Section 2.4, Resource Protection Alternative. Impacts to wild horses under the RPA would be the same

as described above for the Proposed Action Alternative. No additional direct or indirect impacts would be anticipated.

Mitigation

No additional mitigation measures would be required.

Residual Impacts

No residual impacts would be anticipated.

4.16.4 Irreversible and Irretrievable Commitment of Resources

There would be no irreversible or irretrievable commitment of resources during the lifetime of the Project for all Action Alternatives due to a lack of overlap between the GHPA and the North Lander Complex of HMAs. There would be no loss of forage and no reduction in appropriate management levels would be required.

4.16.5 Relationship between Local Short-term Uses and Long-term Productivity

Short-term uses associated with the Project would not affect the long-term productivity of the HMAs and their resident herds.

4.17 Wildlife and Fisheries

The impact assessment analysis area for wildlife and fisheries resources includes all wildlife habitats located within the GHPA. This includes construction and operation of all 5 mine units, associated access roads, power lines, water management components, and other mine-related ancillary facilities.

Wildlife- and fisheries-related issues addressed by this impact assessment were determined by the BLM through internal scoping, consultation with cooperating agencies and the USFWS, and through comments provided during the scoping process. Relevant scoping issues related to wildlife, fisheries, and special status wildlife species include loss or alteration of native and reclaimed habitats, increased habitat fragmentation, animal displacement, direct loss of wildlife, introduction and expansion of noxious and invasive weed species, and impacts associated with wildlife exposure to waste water (i.e., evaporation ponds).

Potential impacts to wildlife and fisheries resources within the GHPA were identified by reviewing existing data sources and literature, quantifying the extent to which the Project could impact habitat, individuals, or populations, and identifying any conflicts with applicable land use plans and/or regulations.

As discussed in Section 3.17, Wildlife and Fisheries, fisheries do not exist within the GHPA, and are not further discussed in this section. The analysis for wildlife resources assumed the following:

- The BLM would continue to manage wildlife and fish habitats in coordination with the WGFD;
- The USFWS would have jurisdiction over the management of any affected federally listed threatened, endangered, or proposed wildlife species, as well as migratory birds; and
- The BLM manages the habitat in consideration of the species listed in BLM Wyoming State Director's Sensitive Species List in accordance with BLM Manual 6840.

4.17.1 No Action Alternative

Under the No Action Alternative, the Project would not be approved and management of the GHPA would continue under current authorizations and land uses.

Under this alternative the Carol Shop facility, 1 road, and previously disturbed land would be reclaimed, resulting in the reclamation of approximately 40 acres. New disturbance to wildlife habitat associated with continued exploration activities would continue within the GHPA at a rate of 5 acres or less each year. This disturbance would occur primarily in mixed sagebrush-grassland and rough breaks habitat types. Reclamation of these sites to wildlife habitat would be anticipated to occur within the same calendar year as the disturbance, and vegetation would require a minimum of 3 to 5 years to be fully reestablished. These activities would have little impact on wildlife populations within the GHPA. Reseeding sites disturbed for reclamation likely would occur within 12 months of the disturbance activity. If reclamation practices are successful, wildlife likely would return to the site after a period of 3 to 5 years (short-term impacts) but depending on the target vegetation community of the disturbance site (e.g., sagebrush) it may take more than 20 years to return to pre-disturbance conditions (long-term impacts).

4.17.2 Proposed Action Alternative

Impacts to wildlife resources under the Proposed Action would include surface disturbance or alteration of native and reclaimed habitats, increased habitat fragmentation, animal displacement, changes in plant species composition, and direct loss of wildlife. The severity of these impacts on terrestrial wildlife species would depend on factors such as the sensitivity of the species, current population trends, seasonal use patterns, type and timing of Project activity, and physical parameters (e.g., topography, cover, forage, climate).

Habitat loss can be defined as short-term and long-term impacts. Short-term impacts would arise from habitat removal and disturbance during construction. The timeframe for short-term impacts is usually 1 to 5 years. Long-term impacts consist of changes to habitats and the wildlife populations that depend on those habitats, irrespective of reclamation success. The timeframe for long-term impacts is usually greater than 5 years. Activities associated with operation would be long-term, and would cease upon mine unit completion and successful reclamation. Disturbance to wildlife during the critical breeding and birthing periods that result in the loss or abandonment of eggs or young can have both short-term and long-term impacts to the species population.

Habitat impacts can be categorized as direct and indirect. Direct habitat impacts result when habitat is destroyed or converted to a form that is unsuitable for the resident species. The primary potential indirect impact would be wildlife avoidance (displacement) of otherwise suitable habitat in and around the GHPA.

4.17.2.1 Terrestrial Wildlife

Big Game Species

Potential direct impacts to big game species (e.g., mule deer, pronghorn, and elk) from development activities on undisturbed lands (**Table 4.13-1**) include 1,206 acres of short-term and 572 acres of long-term surface disturbance to habitat within the GHPA. This would account for approximately 15 percent and 7 percent of the existing habitat within the GHPA. As stated in Section 3.17, Wildlife and Fisheries, no designated big game crucial winter range occurs within the GHPA. A variety of other types of big game habitat (i.e., spring/summer/fall, yearlong, winter/yearlong) are present within the GHPA. However, these habitat types are not considered limiting in Wyoming by the WGFD.

Pronghorn are the most abundant big game species within the GHPA; therefore, direct impacts to pronghorn would be more pronounced than direct impacts to mule deer and elk. The loss of available woody/shrubby vegetation from any disturbance in that vegetation community would be long-term (up to 20 years). However, herbaceous species could become established within 3 to 5 years, depending on reclamation success and weather conditions (i.e., precipitation). In most instances, suitable habitat adjacent to the GHPA would be available for big game species until grasses and woody vegetation were re-established within the disturbance areas.

Additional impacts to big game species would result from increases in noise levels and human presence during construction and operation. Displacement of big game as a result of direct habitat loss and indirect reduction in habitat quality has been widely documented (Irwin and Peek 1983; Lyon 1983, 1979; Rost and Bailey 1979; Ward 1976). Studies have shown that big game species tend to move away from areas of human activity and roads, thereby reducing habitat utilization near disturbance areas (Cole et al. 1997; Sawyer et al. 2006; Ward 1976). Mule deer and pronghorn appear to be more tolerant of human activity than elk. For mule deer, displacement distances ranged from 330 feet to 0.6 mile, depending on the presence of vegetative cover (Ward 1976). For evaluation purposes, 660 feet was the most common displacement distance used for mule deer, especially in areas with minimal vegetative cover. For analysis of the Project, this distance also would apply to pronghorn. Mule deer and pronghorn have been observed to habituate to vehicles, and displacement distances decreased when traffic was predictable, moving at constant speeds, and was not associated with out-of-vehicle activities (Ward 1976). However, traffic within the GHPA would be characterized by slow moving traffic, vehicles that stop, and out of vehicle activity; thus, acclimation by big game would not be anticipated. The potential for big game mortalities from Project-related vehicles along the access roads would be reduced by Project-regulated speed limits on access roads to and within the GHPA.

Impacts to black bears and mountain lions would be low, as these species occur at low densities in this region of Wyoming and no important habitat occurs in or around the GHPA.

Based on the amount of suitable habitat surrounding the GHPA, and the lack of crucial winter range (considered to be the limiting factor for big game populations by WGFD) within or immediately adjacent

to the GHPA, impacts to big game species would be minor and localized to the GHPA and would be limited primarily to displacement from areas of human activity and habitat alteration.

Small Game Species

Direct and indirect impacts to small game would include: wildlife mortalities or displacement related to construction and operation; habitat loss, alteration and fragmentation; exposure to potentially toxic waste water; and increased levels of noise, activity, and human presence. Project construction and operation on undisturbed lands (**Table 4.13-1**) would result in the short-term loss of 1,206 acres and long-term loss of 572 acres of potential habitat, until completion of reclamation and re-establishment of vegetation. This would account for approximately 15 percent and 7 percent of the existing habitat within the GHPA. However, in most instances, suitable habitat adjacent to the GHPA would be available for small game species until grasses and woody vegetation were re-established within the disturbance areas. Fragmentation impacts on some small game species have been shown to negatively impact populations. Small game, especially upland game birds, could experience increased mortality rates due to increased access as a result of new and improved roads (Holbrook and Vaughan 1985). Vehicular traffic could injure or kill individuals, and local populations could experience higher levels of hunting and poaching pressure due to improved access (Holbrook and Vaughan 1985). These temporary losses would reduce productivity during each breeding season affected. The greater sage-grouse is classified as a federal candidate species as well as a BLM sensitive species and, therefore, is discussed further in Section 4.17.2.4, Special Status Wildlife Species.

Specific impacts to waterfowl would include the short-term loss of 15 acres and long-term loss of 8 acres of wetland habitat within the surface disturbance areas (i.e., Mine Unit 4). This would account for approximately 17 percent and 9 percent of the existing waterfowl habitat within the GHPA. In addition to habitat loss, waterfowl also could be impacted by exposure to waste water in the evaporation ponds. If exposure to wastewater in the evaporation ponds results in waterfowl mortalities due to toxicity, impacts could be significant. Given the small amount of suitable waterfowl habitat within the GHPA (approximately 86 acres) and surrounding region, impacts to waterfowl as a result of the Project may be more pronounced than for other small game species.

Nongame Species

Direct and indirect impacts to nongame species would include: wildlife mortalities or displacement related to construction and operation; habitat loss, alteration, and fragmentation; exposure to potentially toxic waste water in evaporation ponds; and increased levels of noise, activity and human presence. Project construction and operation on previously undisturbed lands (**Table 4.13-1**) would result in the short-term loss of 1,206 acres and long-term loss of 572 acres of potential habitat, until reclamation was completed and vegetation re-established. This would account for approximately 15 percent and 7 percent of the existing habitat within the GHPA. Construction activities could result in mortalities of less mobile or burrowing nongame species (e.g., small mammals and reptiles) within ROWs or mine units, as a result of crushing from construction vehicles and drilling equipment. Impacts also could include temporary displacement of more mobile species (medium sized mammals and adult birds) from areas with surface disturbance, due to the short-term and long-term loss of vegetation. The temporary displacement of some species would continue until herbaceous vegetation was returned to pre-construction conditions (approximately 3 to 5 years). For those species dependent on the sagebrush-steppe habitat, displacement would occur until sagebrush shrubs become re-established (up to 20 years).

4.17.2.2 Raptors and Other Migratory Birds

A number of raptor species (e.g., golden eagle, ferruginous hawk, prairie falcon, red-tailed hawk, Swainson's hawk, and great-horned owl) seasonally occupy habitats found within the GHPA. Potential direct impacts to raptors would result from the short-term and long-term disturbance of approximately 1,206 acres and 572 acres of potential habitat, respectively. This would account for approximately 15 percent and 7 percent of the existing habitat within the GHPA. Impacts to raptor species can result from the loss or alteration in habitat, reduction in prey base, and increased human disturbance. The loss

of native habitat to human development has resulted in declines of hawks and eagles throughout the West (Boeker and Ray 1971; Schmutz 1984). In some cases, habitat changes have not reduced numbers of raptors but have resulted in shifts in species composition, such as a reduction in nesting ferruginous hawks and Swainson's hawks and an increase in nesting golden eagles and red-tailed hawks (Harlow and Bloom 1987). Impacts to small mammal populations due to habitat loss and fragmentation can result in a reduced prey base for raptors, resulting in lower raptor densities. Thompson et al. (1982) and Woffinden and Murphy (1989) found that golden eagles and ferruginous hawks had lowered nesting success where native vegetation had been lost and was unable to support jackrabbit (prey) populations. Furthermore, raptors have a high potential of being disturbed from nests and roosts, thereby leading to displacement and reduced nesting success (Holmes et al. 1993; Postovit and Postovit 1987; Stalmaster and Newman 1978).

Breeding raptors in or adjacent to the GHPA could abandon breeding territories, nest sites, or lose eggs or young as a result of Project construction and operation activities that occur during the raptor breeding season (February 1 to July 31). Loss of an active nest site, incubating adults, eggs, or young would violate the MBTA and, in the case of the golden eagle, would violate the Bald and Golden Eagle Protection Act. Loss of active nest sites could potentially impact populations of raptors that occur within the GHPA. Given the number of raptor nests present within the GHPA (40 documented from surveys in 2009, 2010, and 2011), it is likely that a reduction in habitat suitability and overall carrying capacity for raptors would occur if surface disturbance activities occurred within 0.5 mile of an active raptor nest (0.75 mile for ferruginous hawks). Furthermore, future nest sites and foraging habitat would be influenced by surface disturbance activities and increased human presence within the GHPA.

Other avian species that could be impacted by construction and operation activities include nesting passerines or songbirds that use the various habitats within the GHPA. Direct and indirect impacts to these avian species would include: mortalities or displacement related to construction and operation; habitat loss, alteration and fragmentation; exposure to potentially toxic waste water in evaporation ponds; and increased levels of noise, activity, and human presence. Project construction and operation would result in the short-term loss of 1,206 acres and long-term loss of 572 acres of potential habitat. This would account for approximately 15 percent and 7 percent of the existing habitat within the GHPA. Impacts to breeding migratory birds could result in the abandonment of a nest site or territory, or the loss of eggs or young if Project activities were to occur during the breeding season (May 15 to June 30). Similar to raptor species, loss of an active nest site, incubating adults, eggs, or young would violate the MBTA and could potentially impact populations of important migratory birds that occur within the GHPA. In addition, loss of an active nest would not be in compliance with BLM EO 13186.

In addition to the impacts described above, reductions in bird population densities in both open grasslands and woodlands also could be attributed to a reduction in habitat quality produced by elevated noise levels (Reijnen et al. 1997, 1995). Although visual stimuli in open landscapes may add to density effects at relatively short distances, the effects of noise appear to be the most critical factor since breeding birds of open grasslands (threshold noise range of 43 to 60 dB[a]) and woodlands (threshold noise range of 36 to 58 dB(A)) respond very similarly to disturbance by traffic volume (Reijnen et al. 1997). Reijnen et al. (1996) determined a threshold effect for bird species to be 47 dB(a), while a New Mexico study in a pinyon-juniper community found that impacts of gas well compressor noise on bird populations were strongest in areas where noise levels were greater than 50 dB(a). However, moderate noise levels (40 to 50 dB[a]) also showed some effect on bird densities in this study (LaGory et al. 2001). Based on these studies for migratory birds and those described above for raptors, increased noise levels and human activity as a result of the Project could preclude otherwise acceptable migratory bird and raptor habitat from use by species found within the Project region.

As described in Section 2.3.1.5, Power Lines, approximately 21 miles of new 69-kilovolts (kV) aboveground power lines would be constructed to supply power to the header houses in each of the mine units. Surface disturbance from the power line poles would be within the road ROWs, so disturbance would not increase within wildlife habitat. Power lines would incrementally increase the

collision potential for migrating and foraging bird species. However, collision potential typically is dependent on variables such as the location in relation to high-use habitat areas (e.g., nesting, foraging, and roosting), line orientation to flight patterns and movement corridors, species composition, visibility, and line design (APLIC 2006). To minimize potential electrocution and collision impacts to migrating and foraging migratory bird species, Cameco has committed to following APLIC (2006) guidelines (i.e., Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006) as discussed in Section 2.3.8, Applicant-committed Environmental Protection Measures. Measures outlined in this document would be effective in reducing impacts to migrating and foraging migratory bird species by requiring design features (e.g., line spacing, etc.) that limit the potential for electrocution, primarily to raptor species.

To prevent wildlife exposure to potentially toxic waste water in the evaporation ponds, Cameco has committed to installing fences around the evaporation ponds to prevent access, which would reduce the risk of exposure to terrestrial wildlife species (e.g., big game, small game, and reptiles). However, fencing may not be sufficient to reduce the risk of impacts to burrowing wildlife species and bird and bat species. Impacts to bird and bat species could occur as a result of exposure to potentially toxic waste water in the evaporation ponds. If waste water in the evaporation ponds maintains toxic levels and exposure results in bird and/or bat mortalities, impacts could be significant.

4.17.2.3 Reptiles and Amphibians

Similar to the other nongame species discussed above, impacts to reptiles and amphibians as a result of the Project would include mortalities or displacement related to construction and operation and habitat loss, alteration, and fragmentation. Construction activities could result in direct mortalities as a result of crushing of burrows from vehicles and equipment. However, due to suitable habitat adjacent to the GHPA and interim reclamation being completed concurrent with operations, impacts to reptiles and amphibians would be limited primarily to disturbed areas. Implementation of VEG-1 would eliminate any impacts to amphibians that could occur as a result of water contamination in wetlands or riparian areas.

4.17.2.4 Special Status Wildlife Species

The following impact assessments focus on special status wildlife species, which include those species federally listed as threatened, endangered, proposed, or candidate species, as well as BLM sensitive species with the potential to occur within the GHPA. These species are identified in Section 3.17.3, Special Status Wildlife Species.

White-tailed Prairie Dog (BLM Sensitive)

Impacts to prairie dog species could include direct mortalities of individuals, as a result of crushing from construction activities, vehicles, and equipment. Additional impacts could result from increased habitat fragmentation and human presence and noise. Based on the results of the 2009, 2010, and 2011 field surveys (HWA 2011a,b, 2009), a total of 9 white-tailed prairie dog colonies occur within the GHPA. Approximately 5.6 acres of active white-tailed prairie dog colonies would be disturbed by construction activities, and approximately 0.05 acre would be impacted during Project operation (HWA 2011a,b). This would account for approximately 37 percent of the total active white-tailed prairie dog colonies within the GHPA.

Construction activities would not be anticipated to permanently alter white-tailed prairie dog colonies within the GHPA. Habitat disturbance could actually encourage future colonization in the short-term, based on the availability of soft, permeable soils that would occur within the disturbed areas subsequent to the Project construction.

Pygmy Rabbit (BLM Sensitive)

Impacts to the pygmy rabbit could include direct mortalities of individuals as a result of crushing from construction activities, vehicles, and equipment. Additional impacts could result from increased habitat

fragmentation, human presence, and noise. Project construction and operation would result in the short-term loss of 93 acres and long-term loss of 42 acres of potentially suitable sagebrush habitat for this species until reclamation was completed and the mature sagebrush communities re-established. This would account for approximately 9 percent and 4 percent of existing sagebrush habitat within the GHPA. Given the extent of suitable sagebrush habitat in the surrounding region, the geographic location of the GHPA (i.e., on the periphery of the pygmy rabbit's known range), and the lack of documented occurrences during species-specific surveys (HWA 2011a,b), activities associated with the Project would not be anticipated to adversely affect the local population of this species. Therefore, impacts to the pygmy rabbit would be minor.

Bat Species (BLM Sensitive)

Two BLM sensitive bat species, the Townsend's big-eared bat and spotted bat, could be impacted by Project construction. No impacts to communal roosts (e.g., hibernacula, nursery colonies, bachelor roosts) would be anticipated from Project construction, based on review of bat literature for Wyoming and the results of surveys conducted in 2010 (HWA 2011a). Project construction and operation would result in the short-term loss of 1,206 acres and long-term loss 572 acres of potentially suitable foraging habitat for these bat species until reclamation has been completed and the plant communities have been re-established. This would account for approximately 15 percent and 7 percent of the existing habitat within the GHPA. Given the extent of suitable foraging and roosting habitat in the surrounding region and the lack of documented occurrences within the GHPA (HWA 2011a), activities associated with the Project would not be anticipated to adversely affect the local population of these species. Therefore, impacts to BLM sensitive bat species would be minor.

Ferruginous Hawk (BLM Sensitive)

Impacts to ferruginous hawks generally would be the same as described for raptors in Section 4.17.2.1, Terrestrial Wildlife. Impacts specific to ferruginous hawks, if present, would result in the short-term loss of 1,206 acres and long-term loss of 572 acres of potentially suitable upland habitats. This would account for approximately 15 percent and 7 percent of the existing habitat within the GHPA. Additional impacts such as displacement and avoidance also would result from increased noise and human presence associated with construction activities. Based on the results of the 2009, 2010, and 2011 breeding raptor surveys, one active nest is located northwest of the GHPA but its protection buffer does not overlap with the GHPA. Therefore, impacts to ferruginous hawks would be limited primarily to foraging habitat.

Burrowing Owl (BLM Sensitive)

Impacts to burrowing owls generally would be the same as described for raptors in Section 4.17.2.1, Terrestrial Wildlife. Impacts specific to burrowing owls, if present, would result from the short-term loss of 834 acres and 396 acres of long-term loss of potential habitat within the GHPA. This would account for approximately 17 percent and 8 percent of the existing habitat within the GHPA. Additional impacts such as displacement and avoidance also would result from increased noise and human presence associated with construction and operation activities. However, due to the lack of occurrences of this species within the GHPA in recent years, impacts would be low.

Greater Sage-grouse (Federal Candidate, BLM Sensitive)

Impacts to greater sage-grouse would result in the short- to long-term (depending on the ecological site characteristics) loss of potentially suitable breeding, brood rearing, and nesting habitats (**Table 4.17-1**). Impacts to greater sage-grouse would include increased habitat fragmentation as a result of increased noise levels and human presence, dispersal of noxious and invasive weed species, and dust effects from unpaved road traffic. An increase in noxious and invasive weeds reduces habitat quality by eliminating important native species of plants that provide both cover and food for greater sage-grouse. Project-related impacts also could lead to increased vehicle collision potential as well as increased predation by raptors, corvids, and coyotes as a result of decreased sagebrush vegetation cover associated with surface disturbing activities.

Table 4.17-1 Greater Sage-grouse Habitat Potentially Impacted by the Project under the Proposed Action

BLM FO	Lek Buffer/Habitat Type[a]	Existing Habitat (acres)	Estimated Surface Disturbance (acres)[b]	
			Short-term	Long-term
Lander	0.6 Mile No Surface Occupancy (NSO) (Core Area[c])	0	0	0
	0.25 Mile NSO (Non-core Area)	0	0	0
	Nesting Habitat (Core Area[c])	12	0	0
	Nesting Habitat (Non-core Area – 2 mile-buffer of an occupied lek)	2,119	421.6 (20 percent)	37.9 (2 percent)
Casper	0.6 Mile NSO (Core Area[c])	0	0	0
	0.25 Mile NSO (Non-core Area)	0	0	0
	Nesting Habitat (Core Area[c])	0	0	0
	Nesting Habitat (Non-core Area – 2-mile buffer of an occupied lek)	0	0	0
Total		**2,119**	**421.6 (20 percent)**	**37.9 (2 percent)**

[a] Lek buffers based on (BLM IM 2010-012), Wyoming EO 2011-5, and BLM (2007).

[b] Includes disturbance associated with the mine units and Project infrastructure.

[c] Core areas are designated by the WGFD and are managed according to Wyoming EO 2011-5.

As presented in **Table 4.17-1**, no Project-related surface disturbance would occur within areas with greater sage-grouse lek NSO restrictions. In addition, no impacts to the Greater South Pass Core Area would occur as the 12 acres of core area within the GHPA is located in the extreme southern portion of the GHPA. Impacts to greater sage-grouse nesting habitat would occur entirely within the BLM Lander FO and consist of the disturbance of the short-term loss of 421.6 acres (20 percent) and the long-term loss of 37.9 acres (2 percent) of potentially suitable habitat.

Recent studies on greater sage-grouse have shown that energy development can negatively impact populations as a result of increased noise and increased human disturbance (Holloran 2005; Walker et al. 2007). Greater sage-grouse have been observed to abandon lek sites in areas with increased road development (Holloran 2005; Braun 1986; Walker et al. 2007). Brooding female greater sage-grouse in Canada were shown to avoid areas with increased density of visible oil wells. Chick survival decreased as oil well densities within 0.6 mile (1 km) of brooding locations increased (Aldridge 2005). In western Wyoming, brooding female greater sage-grouse avoided producing gas wells during the early brood-rearing period (Holloran 2005).Compared to hens near undisturbed leks, greater sage-grouse hens that used leks within approximately 2 miles of oil and gas development moved further away from leks to nesting areas and had lower nest initiation rates (Lyon and Anderson 2003). Connelly et al. (2000) recommend that energy-related facilities be located more than 2 miles (3.2 km) from active lek sites under ideal habitat conditions, 3 miles (5 km) when habitat conditions are not ideal, and 11 miles (18 km) when sage-grouse populations are migratory. Furthermore, greater sage-grouse hens

that utilized nesting habitats further from roads had greater brood survivorship than those hens utilizing habitat near roads (Lyon and Anderson 2003).

Recent research in Wyoming has shown that greater sage-grouse also may be negatively influenced within or near winter habitats by coal-bed natural gas (CBNG) development. Doherty et al. (2008) found that hens avoided wintering areas with CBNG development, and were 30 percent less likely to use an area with CBNG development even if it contained suitable habitat. Research also has shown that, as a result of increased food sources associated within oil and gas developments (e.g., road kill, litter, etc.), population levels of predators, especially corvids, generally increases over time unless deterrents are used on energy field-related structures (Andren 1992; Avery and Genchi 2004). Wildlife surveys conducted within the GHPA over the past 3 years have documented greater sage-grouse during the spring and summer, including hens with their broods. Therefore, impacts from the Project to greater sage-grouse may occur and would be more pronounced if disturbance occurs during the breeding season (March 1 to July 15). In addition to increased habitat disturbance and fragmentation impacts, the new power lines constructed within the GHPA to each mine unit would increase the potential for collisions and also would provide additional perches for predators (i.e., raptors and corvids). Approximately 7.2 miles of 69-kV power lines would be constructed within 2 miles of the WCC lek.

West Nile virus (WNv) also may be a concern for the Project due to the presence of drilling mud pits during construction and evaporation ponds during operation, with the possibility of increased mosquito populations in the GHPA. WNv is a mosquito-borne disease that can cause a brain infection, encephalitis, that leads to mortality in greater sage-grouse. Mosquitoes spread this virus after they feed on infected birds and then bite non-infected birds. Since its discovery in 1999 in New York, WNv has become firmly established and spread across the U.S. Birds are the natural vector host and serve not only to amplify the virus, but to spread it. Although less than 1 percent of mosquitoes are infected with WNv, they still are very effective in transmitting the virus to greater sage-grouse in areas with high mosquito populations. Although most of the attention has been focused on human health issues, WNv has had an impact on vertebrate wildlife populations, including greater sage-grouse. The Wyoming State Vet Lab determined 22 greater sage-grouse in 1 study project (90 percent of the study birds), succumbed to WNv in the Powder River Basin (PRB) in 2003. While birds infected with WNv have many of the same symptoms as infected humans, they appear to be more sensitive to the virus. Mosquitoes can potentially breed in any standing water that lasts more than 4 days. In the GHPA, the Project generally would result in increased surface water availability associated with Project development. This increase in potential mosquito breeding habitat provides opportunities for mosquito populations to increase. Preliminary research conducted in the PRB of Wyoming indicates WNv mosquito vectors were notably more abundant on a developed CBNG site than 2 similar undeveloped sites (Walker 2008). Reducing the population of mosquitoes, especially species that are apparently involved with bird-to-bird transmission of WNv, such as *Culex tarsalis*, can help to reduce or eliminate the presence of the virus (Animal and Plant Health Inspection Service [APHIS] 2012) in the GHPA and immediate vicinity.

Due to the historic mining disturbance and partially reclaimed wildlife habitat, the GHPA contains a limited amount of tall, mature sagebrush on south- and east-facing slopes that typically is required for greater sage-grouse winter habitat (Section 3.17.2.2, Birds). In addition, no greater sage-grouse winter concentration areas have been identified within the GHPA. Although greater sage-grouse may use portions of the GHPA during the winter months, it is likely that higher quality winter habitat south and west of the GHPA supports the majority of wintering greater sage-grouse in the Project region; therefore, impacts to wintering greater sage-grouse from the Project would be minor.

Brewer's Sparrow, Loggerhead Shrike, Sage Sparrow, and Sage Thrasher (BLM Sensitive)

Impacts to Brewer's sparrow, loggerhead shrike, sage sparrow, and sage thrasher generally would be the same as described for migratory birds in Section 4.17.2.1, Terrestrial Wildlife. Impacts specific to these 4 species, if present, would occur as a result of the short-term loss of 1,206 acres and the long-term loss of 572 acres of potentially suitable upland habitats within the GHPA. This would account for approximately 15 percent and 7 percent of the existing habitat within the GHPA. Additional impacts

such as displacement and avoidance also would result from increased noise and human presence associated with construction and operation activities. However, due to the amount of suitable habitat in the Project vicinity, impacts would be minor.

Mountain Plover (BLM Sensitive)

Due to the documented presence of this species within the GHPA in 2009 and 2010, impacts to mountain plovers would occur as a result of the short-term loss of 1.3 acres (<1 percent) and long-term loss of 0.1 acres (<1 percent) of potentially suitable nesting habitat. In addition, seed from reclaimed areas adjacent to the mountain plover habitat may disperse onto suitable mountain plover habitat which would increase vegetation cover and reduce habitat quality.

Additional impacts such as displacement and avoidance also would result from increased noise and human presence associated with construction and operation activities. If construction and operation activities occur during the mountain plover breeding season (April 10 to July 10) and surface-disturbance activities resulted in the loss of an active nest, impacts to the mountain plover could be significant.

Northern Leopard Frog and Great Basin Spadefoot (BLM Sensitive)

Potential impacts to special status aquatic species, including the northern leopard frog and Great Basin spadefoot, could include direct mortalities of individuals from construction activities, ground compaction, and vehicle traffic within suitable habitat. Impacts also could result from the short-term loss of 15 acres and 8 acres of long-term loss of potentially suitable habitat until reclamation was completed and vegetation re-established. This would account for approximately 21 percent and 11 percent of the existing habitat within the GHPA. Implementation of VEG-1 would eliminate any impacts to these 2 species that may occur as a result of water contamination in wetlands or riparian areas. Therefore, the Project could impact individuals but would not likely cause a trend towards federal listing or loss of viability.

Mitigation

The following mitigation measures would be applied to further avoid, minimize, or mitigate Project-related impacts to wildlife and special status wildlife species.

WFM-1: To protect breeding migratory bird species and greater sage-grouse, surface disturbing activities would be restricted on currently undisturbed lands within the GHPA between May 15 and June 30 for nesting migratory birds and between March 1 and July 15 within 2 miles of an occupied lek for lekking, nesting, and brooding greater sage-grouse. Should removal of habitat be required between these dates, Cameco would coordinate with the BLM and USFWS to conduct breeding migratory bird and greater sage-grouse surveys and implement appropriate mitigation, such as buffer zones around occupied nests, as needed.

WFM-2: To protect breeding raptor species, Cameco would avoid all existing raptor nest sites and surface disturbing activities during the breeding season (February 1 to July 31) within applicable nest protection buffers (i.e., 0.75 mile, unless site-specific, species-specific distances are determined and approved by the BLM). If construction were to extend into the raptor breeding season, Cameco would conduct aerial and/or pedestrian nesting raptor surveys, as applicable, through areas of suitable habitat to identify active nest sites within the GHPA, prior to construction. Since a number of variables (e.g., nest location, species' sensitivity, breeding, phenology, topographical shielding) would determine the level of impact to a breeding pair, appropriate protection measures, such as seasonal constraints and establishment of buffer areas, would be implemented at active nest sites on a species-specific and site-specific basis, in coordination with the jurisdictional agencies (e.g., BLM or USFWS).

WFM-3: To protect bat species and migratory bird species, including raptors and waterfowl, Cameco would install bird exclusion netting over evaporation ponds containing waste water in order to eliminate migratory bird and bat exposure to potentially toxic waste water.

WFM-4: To reduce potential collision impacts to migratory bird species, power lines in areas identified as having high bird use (e.g., wetlands) would be fitted with high visibility markers. In addition, to prevent electrocution to raptor species, power lines in high raptor use areas (e.g., within 0.75 of a nest site and within 0.25 mile of a white-tailed prairie dog colony) would be fitted with anti-perching devices.

SSS-1: To protect breeding burrowing owls, surveys for burrowing owl nests would be conducted during the breeding season (April 15 to September 15) prior to surface disturbing activities in areas of potentially suitable habitat (i.e., white-tailed prairie dog colonies). If a nest is located, a 0.25 mile protection buffer would be implemented around the active nest until the birds fledge from the nest.

SSS-2: To limit raptor and corvid predation on greater sage-grouse, new power lines within 2 miles of occupied greater sage-grouse leks (e.g., West Canyon lek) would be fitted with anti-perching devices (e.g., spikes, triangles, inverted “Y’s”, etc.).

SSS-3: To protect nesting mountain plovers, nest surveys would be conducted if construction were to occur during the breeding season (April 10 to July 10). If a nest is located, a 0.25 mile protection buffer would be implemented around the active nest until the birds fledge from the nest.

Mitigation measure WFM-1 is designed to minimize impacts to bird species protected under the MBTA and greater sage-grouse by avoiding construction during the breeding season. According to the Wyoming PIF Bird Conservation Plan (Nicholoff 2003), the primary dates for most breeding grassland/shrubland bird species in Wyoming are May 15 to June 30. For greater sage-grouse, the primary breeding dates are March 1 to July 15, which includes lekking, nesting, and early-brood rearing. Therefore, reducing ground disturbance during these dates would minimize impacts to nesting birds. Additionally, mitigation measure WFM-3 would eliminate migratory bird and bat exposure to potentially toxic disposed waste water in evaporation ponds. As a result, this mitigation measure would reduce mortalities to migratory bird and bat species as a result of the Project. Mitigation measure WFM-4 would help minimize the potential for increased collisions and electrocutions of migratory bird species by increasing the visibility of power lines and limiting raptor perching locations. While new power lines fitted with anti-perching devices do not necessarily eliminate perching entirely, they are designed to discourage use of the power line as a hunting perch which could in turn decrease the potential for electrocution.

Mitigation measures WFM-2, SSS-1, and SSS-3 would require Cameco to avoid raptor and mountain plover nest sites identified within the areas of disturbance to prevent their removal, and to restrict activity during seasonal timing restrictions (April 15 to September 15 for burrowing owls, February 1 to July 31 for all other raptors, April 10 to July 10 for mountain plovers) within applicable protection buffers (i.e., 0.75 mile for ferruginous hawks, 0.25 mile for burrowing owl and mountain plover, 0.5 mile for all other raptors). As a result of this mitigation measure, Project-related impacts to raptor species and mountain plovers would be low and no take would be expected as a result of the Project.

Mitigation measure SSS-2 would help minimize the potential for increased predation on greater sage-grouse by limiting raptor and corvid perching locations. While new power lines fitted with anti-perching devices do not necessarily eliminate perching entirely, they are designed to discourage use of the power line as a hunting perch which could in turn decrease the potential for predation by raptors and corvids on greater sage-grouse.

Residual Impacts

Adverse impacts to wildlife from the Proposed Action would be minimized by application of the mitigation measures discussed above and by successful reclamation of surface disturbance to meet criteria reclaimed to the final reclamation standards presented in Section 2.3.9, Applicant-committed Environmental Protection Measures.

4.17.3 Resource Protection Alternative

Impacts to wildlife resources under the RPA generally would be the same as described for the Proposed Action, except that surface disturbance associated with each mine unit would be reduced. This would decrease the amount of wildlife habitat disturbed compared to the Proposed Action by 50 percent. Under the RPA, the potential for successful reclamation also would be improved, a closed loop drilling system would be implemented, the number of evaporation ponds would be reduced, enhanced reclamation goals and criteria would be established, and all new power lines would be buried. In addition, the RPA would reduce the number of shipments of material to 122 annual trips to the Smith Ranch-Highland facility as opposed to 325 annual trips, thereby reducing the potential for wildlife-vehicle collisions and indirect impacts from human presence and noise. Further details regarding the impacts of the various components of the RPA are discussed below in detail for each species group.

Under the RPA not all of the surface area within the mine units would be disturbed by construction activity as would occur under the Proposed Action. As shown in **Table 2.4-1**, the estimated construction disturbance would be approximately 50 percent of the area of each mine unit. During operations approximately 30 percent of the area within a mine unit would undergo interim reclamation and the remaining 20 percent would remain disturbed during operation.

4.17.3.1 Terrestrial Wildlife

Big Game Species

Potential direct impacts to big game species under the RPA would be same as described for the Proposed Action except there would be a reduction in the amount of habitat disturbed. Under the RPA 733 acres of short-term and 273 acres of long-term surface disturbance to potential habitat within the GHPA would occur. This would account for approximately 9 percent and 3 percent of the existing big game habitat within the GHPA as opposed to 15 percent and 7 percent under the Proposed Action. Additionally, given the enhanced reclamation goals and criteria established by the BLM, the likelihood of successful reclamation would increase. This would allow for big game use of reclaimed habitats within the GHPA sooner than under the Proposed Action.

Similar to the Proposed Action, based on the amount of suitable habitat surrounding the GHPA, and the lack of crucial winter range within or immediately adjacent to the GHPA, impacts to big game species would be low, limited primarily to displacement from areas of human activity and habitat alteration.

Small Game Species

Potential direct impacts to small game species under the RPA would be the same as described for the Proposed Action except there would be a reduction in the amount of potential habitat disturbed. Under the RPA, 733 acres of short-term and 273 acres of long-term surface disturbance to potential habitat within the GHPA would occur. This would account for approximately 9 percent and 3 percent of the existing habitat within the GHPA as opposed to 15 percent and 7 percent under the Proposed Action. Similar to big game habitat, given the enhanced reclamation goals and criteria established by the BLM, the likelihood of successful reclamation of small game habitat would increase. Specific impacts to waterfowl under the RPA would be the same as described for the Proposed Action except that a reduction in the number of evaporation ponds would reduce the potential for exposure to potentially toxic waste water within the evaporation ponds. Burying power lines also would eliminate any collision potential for small game birds within the GHPA.

Nongame Species

Potential direct impacts to small game species under the RPA would be the same as described for the Proposed Action except there would be a reduction in the amount of potential habitat disturbed. Under the RPA, 733 acres of short-term and 273 acres of long-term surface disturbance to potential habitat within the GHPA would occur. This would account for approximately 9 percent and 3 percent of the existing habitat within the GHPA as opposed to 15 percent and 7 percent under the Proposed Action.

4.17.3.2 Raptors and Other Migratory Birds

Similar to the Proposed Action, a number of raptor species (e.g., golden eagle, ferruginous hawk, prairie falcon, red-tailed hawk, Swainson's hawk, and great-horned owl) seasonally occupy the habitats found within the GHPA. Potential direct impacts to raptor species under the RPA would be the same as described for the Proposed Action except there would be a reduction in the amount of potential habitat disturbed. Under the RPA, 733 acres of short-term and 273 acres of long-term surface disturbance to potential habitat within the GHPA would occur. This would account for approximately 9 percent and 3 percent of the existing habitat within the GHPA as opposed to15 percent and 7 percent under the Proposed Action. Similar to big game and small game habitat, the likelihood of successful reclamation of raptor habitat would increase, given the enhanced reclamation goals and criteria established by the BLM.

If present in or adjacent to the GHPA, breeding raptors could abandon breeding territories, nest sites, or lose eggs or young as a result of Project construction and operation activities that occur during the raptor breeding season (February 1 to July 31). Loss of an active nest site, incubating adults, eggs, or young would violate the MBTA and, in the case of the golden eagle, would violate the Bald and Golden Eagle Protection Act. Loss of active nest sites could potentially impact populations of raptors that occur within the GHPA. Given the number of raptor nests present within the GHPA (40 documented from surveys in 2009, 2010, and 2011), it is likely that a reduction in habitat suitability and overall carrying capacity for raptors would occur if surface disturbance activities occurred within 0.75 mile of an active raptor nest. Furthermore, future nest sites and foraging habitat would be influenced by surface disturbance activities and increased human presence within the GHPA.

Potential direct impacts to other migratory bird species under the RPA would be the same as described for the Proposed Action except there would be a reduction in the amount of potential habitat disturbed. Under the RPA, 733 acres of short-term and 273 acres of long-term surface disturbance to potential habitat within the GHPA would occur. This would account for approximately 9 percent and 3 percent of the existing habitat within the GHPA as opposed to 15 percent and 7 percent under the Proposed Action. Similar to big game and small game habitat, the likelihood of successful reclamation of migratory bird habitat would increase, given the enhanced reclamation goals and criteria establish by the BLM. Impacts to breeding migratory birds could result in the abandonment of a nest site or territory, or the loss of eggs or young if Project activities were to occur during the breeding season (May 15 to June 30). Similar to raptor species, loss of an active nest site, incubating adults, eggs, or young would violate the MBTA and could potentially impact populations of important migratory birds that occur within the GHPA. In addition, loss of an active nest would not be in compliance with BLM EO 13186.

As described in Section 2.4.8, Burial of New Power Lines, all new power lines under the RPA would be buried; therefore, no impacts to migrating or foraging raptor or migratory bird species would occur as a result of collision and electrocution.

Similar to the Proposed Action, to prevent livestock and wildlife exposure to potentially toxic waste water in the evaporation pond, Cameco has committed to installing fences around evaporation ponds to prevent access by wildlife and livestock, which would reduce the risk of exposure to terrestrial wildlife species (e.g., big game, small mammals, and reptiles). However, fencing would not reduce the risk of exposure to bird and bat species and impacts could occur as a result of exposure to potentially toxic waste water in the evaporation ponds. Additionally, under the RPA, a closed loop drilling system would

be implemented. The number of evaporation ponds would be reduced and the overall potential for bird and bat exposure to potentially toxic waste water would be reduced. Nonetheless, if waste water in the evaporation pond maintains toxic levels and exposure results in bird and/or bat mortalities, impacts may be significant.

4.17.3.3 Reptile and Amphibians

Potential direct impacts to reptile and amphibian species under the RPA would be the same as described for the Proposed Action except there would be a reduction in the amount of potential habitat disturbed. Under the RPA, 733 acres of short-term and 273 acres of long-term surface disturbance to potential habitat within the GHPA would occur. This would account for approximately 9 percent and 3 percent of the existing habitat within the GHPA as opposed to 15 percent and 7 percent under the Proposed Action. Similar to big game and small game habitat, the likelihood of successful reclamation of reptile and amphibian habitat would increase given the enhanced reclamation goals and criteria established by the BLM. Similar to the Proposed Action, implementation of VEG-1 would eliminate any impacts to amphibians that may occur as a result of water contamination in wetlands or riparian areas.

4.17.3.4 Special Status Wildlife Species

The following impact assessments focus on special status wildlife species, which include those species federally listed as threatened, endangered, proposed, or candidate species, as well as BLM sensitive species with the potential to occur within the GHPA. These species are identified in Section 3.17.2, Special Status Wildlife Species.

White-tailed Prairie Dog (BLM Sensitive)

Potential direct impacts to the white-tailed prairie dog under the RPA would be the same as described for the Proposed Action except there would be a reduction in the amount of potential habitat disturbed. Approximately 3 acres of disturbance to active white-tailed prairie dog colonies would occur during construction under the RPA as opposed to 5.6 acres under the Proposed Action. This would account for approximately 20 percent of the total active white-tailed prairie dog colonies within the GHPA. Approximately 0.05 acre of disturbance to active white-tailed prairie dog colonies would occur during Project operation.

Construction activities under the RPA would not be likely to permanently alter white-tailed prairie dog colonies within the GHPA. Habitat disturbance may actually encourage future colonization in the short-term, based on the availability of soft, permeable soils that would occur within the disturbed areas subsequent to the Project construction. Therefore, impacts to white-tailed prairie dogs would be low.

Pygmy Rabbit (BLM Sensitive)

Potential direct impacts to the pygmy rabbit under the RPA would be same as described for the Proposed Action except there would be a reduction in the amount of potential habitat disturbed. Under the RPA, 32 acres of short-term and 13 acres of long-term surface disturbance to potential habitat within the GHPA would occur. This would account for approximately 3 percent and 1 percent of the existing habitat within the GHPA as opposed to 9 percent and 4 percent under the Proposed Action. Similar to the Proposed Action, given the extent of suitable sagebrush habitat in the surrounding region, the geographic location of the GHPA (i.e., on the periphery of the pygmy rabbit's known range), and the lack of documented occurrences during species-specific surveys, activities associated with the Project would not be anticipated to adversely affect the local population of this species. In addition, the likelihood of successful reclamation of sagebrush habitat would increase, given the enhanced reclamation goals and criteria established by the BLM. Therefore, impacts to the pygmy rabbit would be low.

Bat Species (BLM Sensitive)

Potential direct impacts to bat species under the RPA would be the same as described for the Proposed Action, except there would be a reduction in the amount of potential habitat disturbed. Under the RPA,

733 acres of short-term and 273 acres of long-term surface disturbance to potential habitat within the GHPA would occur. This would account for approximately 9 percent and 3 percent of the existing habitat within the GHPA as opposed to 15 percent and 7 percent under the Proposed Action. Similar to the Proposed Action, given the extent of suitable foraging and roosting habitat in the surrounding region and the lack of documented occurrences within the GHPA (HWA 2011b), activities associated with the Project would not be anticipated to adversely affect local populations of these species. In addition, the likelihood of successful reclamation of bat habitat would increase given the enhanced reclamation goals and criteria established by the BLM. Additionally, under the RPA, a closed loop drilling system would be implemented. The number of evaporation ponds also would be reduced and the overall potential for bat exposure to potentially toxic waste water would be reduced. Nonetheless, if waste water in the evaporation pond maintains toxic levels and exposure results in mortalities to BLM sensitive bat species, impacts may be significant.

Ferruginous Hawk (BLM Sensitive)

Potential direct impacts to ferruginous hawks under the RPA would be the same as described for the Proposed Action except there would be a reduction in the amount of potential habitat disturbed. Under the RPA, 733 acres of short-term and 273 acres of long-term surface disturbance to potential habitat within the GHPA would occur. This would account for approximately 9 percent and 3 percent of the existing habitat within the GHPA as opposed to 15 percent and 7 percent under the Proposed Action. In addition, the likelihood of successful reclamation of ferruginous hawk habitat would increase, given the enhanced reclamation goals and criteria established by the BLM. Under the RPA, all new power lines would be buried, therefore eliminating the potential for collision and electrocution. Impacts to the ferruginous hawk would be considered low under the RPA.

Burrowing Owl (BLM Sensitive)

Potential direct impacts to burrowing owls under the RPA would be the same as described for the Proposed Action except there would be a reduction in the amount of potential habitat disturbed. Under the RPA, 378 acres of short-term and 148 acres of long-term surface disturbance to potential habitat within the GHPA would occur. This would account for approximately 8 percent and 3 percent of the existing habitat within the GHPA as opposed to 17 percent and 8 percent under the Proposed Action. Similar to the Proposed Action, due to the lack of occurrences of this species within the GHPA in recent years, impacts would be low.

Greater Sage-grouse (Federal Candidate, BLM Sensitive)

Potential direct impacts to greater sage-grouse under the RPA would be same as described for the Proposed Action except there would be a reduction in the amount of habitat disturbed (**Table 4.17-2**). In addition, the likelihood of successful reclamation of sagebrush habitat would increase given the enhanced reclamation goals and criteria established by the BLM. Burying all new power lines under the RPA would eliminate any collision potential for greater sage-grouse as well as eliminate new available perches for raptors and corvids. This would greatly reduce potential predation on greater sage-grouse as a result of the Project.

Wildlife surveys conducted within the GHPA over the past 3 years have documented greater sage-grouse during the spring and summer, including hens with their broods. Therefore, given the Project-related surface disturbance under the RPA, impacts to greater sage-grouse may occur and would be more pronounced if disturbance occurs within suitable habitat during the breeding season (March 1 to July 15).

WNv would continue to be a concern for the Project under the RPA due to the possibility of increased mosquito populations in the GHPA from the presence of evaporation ponds during operation. However, under the RPA, drilling mud pits would be eliminated and the number of evaporation ponds would be reduced relative to the Proposed Action. These changes would decrease the amount of available

Table 4.17-2 Greater Sage-grouse Habitat Potentially Impacted by the Project under the RPA

BLM FO	Lek Buffer/Habitat Type[a]	Existing Habitat (acres)	Estimated Surface Disturbance (acres)[b]	
			Short-term	Long-term
Lander	0.6 Mile NSO (Core Area[c])	0	0	0
	0.25 Mile NSO (Non-core Area)	0	0	0
	Nesting Habitat (Core Area[c])	0	0	0
	Nesting Habitat (Non-core Area – 2-mile buffer of an occupied lek)	2,119	260.3 (12 percent)	28.5 (1 percent)
Casper	0.6 Mile NSO (Core Area[c])	0	0	0
	0.25 Mile NSO (Non-core Area)	0	0	0
	Nesting Habitat (Core Area[c])	0	0	0
	Nesting Habitat (Non-core Area – 2-mile buffer of an occupied lek)	0	0	0
Total		**2,119**	**260.3 (12 percent)**	**28.5 (1 percent)**

[a] Lek buffers based on BLM IM 2010-012, Wyoming EO 2011-5, and BLM (2007).

[b] Includes disturbance associated with the mine units and Project infrastructure.

[c] Core areas are designated by the WGFD and are managed according to Wyoming EOr 2011-5.

mosquito habitat within the GHPA from the Project. Reducing the habitat and, therefore, the population of mosquitoes in the GHPA, especially species involved with bird-to-bird transmission of WNv, such as *Culex tarsalis*, would help to reduce the presence of the virus (APHIS 2012) in the GHPA and immediate vicinity relative to the Proposed Action.

Similar to the Proposed Action, historic mining disturbance has created a mosaic of partially reclaimed wildlife habitat within the GHPA. Therefore, the GHPA contains a limited amount of tall, mature sagebrush on south- and east-facing slopes that typically is required for greater sage-grouse winter habitat. In addition, no greater sage-grouse winter concentration areas have been identified within the GHPA. Although greater sage-grouse may use portions of the GHPA during the winter months, it is likely that higher quality winter habitat south and west of the GHPA supports the majority of wintering greater sage-grouse in the Project region and therefore impacts to wintering greater sage-grouse under the RPA would be low.

Brewer's Sparrow, Loggerhead Shrike, Sage Sparrow, Sage Thrasher (BLM Sensitive)

Potential direct impacts to these BLM sensitive bird species under the RPA would be same as described for the Proposed Action, except there would be a reduction in the amount of potential habitat disturbed. Under the RPA, 733 acres of short-term and 273 acres of long-term surface disturbance to potential habitat within the GHPA would occur. This would account for approximately 9 percent and 3 percent of the existing habitat within the GHPA as opposed to 15 percent and 7 percent under the Proposed Action. In addition, the likelihood of successful reclamation of migratory bird habitat would increase given the enhanced reclamation goals and criteria established by the BLM. Additionally, under the RPA, a closed loop drilling system would be implemented. The number of evaporation ponds also would be reduced

and the overall potential for bird exposure to potentially toxic waste water would be reduced. Nonetheless, if waste water in the evaporation pond maintains toxic levels and exposure results in mortalities to these species, impacts may be significant.

Mountain Plover (BLM Sensitive)

Potential direct impacts to mountain plovers under the RPA would be the same as described for the Proposed Action except there would be a reduction in the amount of potential habitat disturbed. Under the RPA, 0.8 acre of short-term and 0.1 acre of long-term surface disturbance to potential habitat within the GHPA would occur as opposed to 1.3 acres and 0.1 acre under the Proposed Action. Similar to the Proposed Action, seed from reclaimed areas adjacent to the mountain plover habitat may disperse onto suitable mountain plover habitat, which would increase vegetation cover and reduce habitat quality.

Due to the documented presence of mountain plovers within the GHPA, additional impacts such as displacement and avoidance also would result from increased noise and human presence associated with construction and operation activities. If construction and operation activities occur during the mountain plover breeding season (April 10 to July 10) and surface-disturbance activities resulted in the loss of an active nest/s, impacts to the mountain plover could be significant.

Northern Leopard Frog and Great Basin Spadefoot (BLM Sensitive)

Potential direct impacts to the northern leopard frog and Great Basin spadefoot under the RPA would be the same as described for the Proposed Action except there would be a reduction in the amount of potential habitat disturbed. Under the RPA, 8 acres of short-term and 3 acres of long-term surface disturbance to potential habitat within the GHPA would occur, as opposed to 21 acres and 11 acres under the Proposed Action. Implementation of VEG-1 would eliminate any impacts to these 2 species that may occur as a result of water contamination in wetlands or riparian areas. Therefore, the Project under the RPA could impact individuals but would not likely cause a trend towards federal listing or loss of viability.

Mitigation

Mitigation measures under the RPA to further avoid, minimize, or mitigate Project-related impacts to wildlife and special status wildlife species, and their effectiveness would be the same as discussed under the Proposed Action with the exception of WFM-4 and SSS-2. These 2 mitigation measures are not needed to reduce collision and electrocution potential for small game birds, raptors, migratory birds, and special status bird species due to the lack of aboveground power lines under the RPA.

Residual Impacts

Adverse impacts to wildlife from the RPA would be minimized by application of the mitigation measures discussed for the Proposed Action and by successful reclamation of surface disturbance to meet reclamation criteria established in the Draft Lander RMP (BLM 2011b). The basis for these criteria is the NRCS ESD for each mapped ecological site found in the GHPA (USDA-NRCS 2011), as described in Section 2.4.7.1, Reclamation Success Criteria.

4.17.4 Irreversible and Irretrievable Commitment of Resources

No irreversible commitments would be anticipated for Wildlife and Fisheries Resources. A total of 1,206 acres of wildlife habitat (excluding developed areas) for the Proposed Action and 733 acres for the RPA would be incrementally lost during construction and operation, an irretrievable commitment of this resource. This would account for approximately 15 percent and 9 percent of the existing wildlife habitat within the GHPA. However, the majority of this habitat would be subsequently revegetated during operation (reestablishment of plant communities would require a minimum of 3 to 5 years and is further discussed in Section 4.13, Vegetation) until completion of final reclamation.

4.17.5 Relationship between Local Short-term Uses and Long-term Productivity

Long-term impacts could reduce use of the GHPA by wildlife and special status wildlife species. Additionally, short-term impacts associated with increased human presence and noise within the GHPA could displace animals from suitable cover, foraging, and breeding sites. However, due to the reclamation schedule and suitable habitat within and immediately adjacent to the GHPA, wildlife populations will continue to persist and utilize habitat within the GHPA.