PREASSESSMENT SCREEN
For The
SOUTHEAST IDAHO PHOSPHATE MINE SITE, IDAHO

Prepared By The:
Southeast Idaho Phosphate Mine Site Trustee Council

June 15, 2015
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<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anaconda</td>
<td>Anaconda Copper Mining Company</td>
</tr>
<tr>
<td>AOC</td>
<td>Administrative Order on Consent</td>
</tr>
<tr>
<td>ASAOC</td>
<td>Administrative Settlement Agreement/Order on Consent</td>
</tr>
<tr>
<td>APC</td>
<td>Agricultural Products Corporation</td>
</tr>
<tr>
<td>Becker</td>
<td>Becker Industries, Inc.</td>
</tr>
<tr>
<td>BIA</td>
<td>Bureau of Indian Affairs</td>
</tr>
<tr>
<td>BLM</td>
<td>Bureau of Land Management</td>
</tr>
<tr>
<td>CERCLA</td>
<td>Comprehensive Environmental Response, Compensation, and Liability Act</td>
</tr>
<tr>
<td>COPC</td>
<td>Contaminant of Potential Concern</td>
</tr>
<tr>
<td>CVF</td>
<td>Cross Valley Fill</td>
</tr>
<tr>
<td>CWA</td>
<td>Clean Water Act</td>
</tr>
<tr>
<td>DOI</td>
<td>Department of Interior</td>
</tr>
<tr>
<td>dw</td>
<td>Dry Weight</td>
</tr>
<tr>
<td>ECOPC</td>
<td>Ecological Contaminant of Potential Concern</td>
</tr>
<tr>
<td>Eco-SSL</td>
<td>Ecological soil screening level</td>
</tr>
<tr>
<td>EE/CA</td>
<td>Engineering Evaluation/Cost Analysis</td>
</tr>
<tr>
<td>EMF</td>
<td>Eastern Michaud Flats Superfund Site</td>
</tr>
<tr>
<td>EPA</td>
<td>Environmental Protection Agency</td>
</tr>
<tr>
<td>FMC</td>
<td>Food Machinery and Chemical Corporation</td>
</tr>
<tr>
<td>Forest Service</td>
<td>United States Forest Service</td>
</tr>
<tr>
<td>FWS</td>
<td>Fish and Wildlife Service</td>
</tr>
<tr>
<td>IDEQ</td>
<td>Idaho Department of Environmental Quality</td>
</tr>
<tr>
<td>IDHW</td>
<td>Idaho Department of Health and Welfare</td>
</tr>
<tr>
<td>IDL</td>
<td>Idaho Department of Lands</td>
</tr>
<tr>
<td>MCY</td>
<td>Million Cubic Yards</td>
</tr>
<tr>
<td>Media</td>
<td>Environmental receptors potentially exposed to hazardous substances (e.g., water, sediment, soil, vegetation, animal tissue)</td>
</tr>
<tr>
<td>mg/kg</td>
<td>Milligrams per kilogram (also referred to as parts per million)</td>
</tr>
<tr>
<td>mg/L</td>
<td>Milligrams per liter (also referred to as parts per million)</td>
</tr>
<tr>
<td>Mine Site</td>
<td>Southeast Idaho Phosphate Mine Site</td>
</tr>
<tr>
<td>NOV</td>
<td>Notice of Violation</td>
</tr>
<tr>
<td>NRDA</td>
<td>Natural Resource Damage Assessment</td>
</tr>
<tr>
<td>NuWest</td>
<td>Agrium/NuWest Industries, Inc./NuWest Mining Inc.</td>
</tr>
<tr>
<td>ODA</td>
<td>Overburden Disposal Area</td>
</tr>
<tr>
<td>OU</td>
<td>Operable Unit</td>
</tr>
<tr>
<td>P₄/Monsanto</td>
<td>P₄ Production LLC; a wholly-owned subsidiary of Monsanto Company</td>
</tr>
<tr>
<td>PAS</td>
<td>Preassessment Screen</td>
</tr>
<tr>
<td>PPM</td>
<td>Parts Per Million</td>
</tr>
<tr>
<td>PRP</td>
<td>Potentially Responsible Party</td>
</tr>
<tr>
<td>RCRA</td>
<td>Resource Conservation and Recovery Act</td>
</tr>
<tr>
<td>Rhodia</td>
<td>Rhodia, Inc.</td>
</tr>
<tr>
<td>RI/FS</td>
<td>Remedial Investigation/Feasibility Study</td>
</tr>
<tr>
<td>ROD</td>
<td>Record of Decision</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Full Form</td>
</tr>
<tr>
<td>--------------</td>
<td>-----------</td>
</tr>
<tr>
<td>Se</td>
<td>Selenium</td>
</tr>
<tr>
<td>SI</td>
<td>Site Investigation</td>
</tr>
<tr>
<td>Simplot</td>
<td>J.R. Simplot Company</td>
</tr>
<tr>
<td>State</td>
<td>Idaho State</td>
</tr>
<tr>
<td>TP1</td>
<td>Tailings Pond 1</td>
</tr>
<tr>
<td>TP2</td>
<td>Tailings Pond 2</td>
</tr>
<tr>
<td>Tribes</td>
<td>Shoshone-Bannock Tribes</td>
</tr>
<tr>
<td>UAO</td>
<td>Unilateral Administrative Order</td>
</tr>
<tr>
<td>USDA</td>
<td>United States Department of Agriculture</td>
</tr>
<tr>
<td>USGS</td>
<td>United States Geological Survey</td>
</tr>
<tr>
<td>WFA</td>
<td>Western Fertilizer Association</td>
</tr>
<tr>
<td>WMA</td>
<td>Waste Management Act</td>
</tr>
<tr>
<td>ww</td>
<td>Wet Weight</td>
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</table>
I. INTRODUCTION, SCOPE, AND AUTHORITY

This document is the preassessment screen (PAS) prepared pursuant to 43 CFR Part 11 for the Southeast Idaho Phosphate Mine Site (Mine Site). Phosphate exploration and mining in southeast Idaho was first conducted in the early 1900s, with mining activities continuing to the present day. Large-scale phosphate mines in the region consist of open pit or contour strip operations that were developed near surface exposures of the Phosphoria Formation. According to the U.S. Geological Survey (USGS), phosphate operations in southeast Idaho account for about 30 percent of total U.S. reserves, and represent one of only two commercially-viable phosphate reserves in the nation (the other located in Florida). The phosphate ore is transported by truck, rail, or slurry pipeline to local processing facilities in Soda Springs or Pocatello, Idaho.

Historic phosphate mining operations involved removal of soils and rock to access the phosphate ore. As ore was excavated, overburden rock and waste shales containing selenium were excavated. This overburden and waste shale were placed adjacent to mine pits, or backfilled into pits. Historic reclamation practices changed throughout the mining period from little to no reclamation requirements to today’s more stringent standards. The historic mines under investigation had varying degrees of reclamation requirements, including regrading of slopes and various revegetation seed mixes. Some of the vegetation planted during reclamation is now known to accumulate selenium at levels that harm or kill livestock. The resultant combination of non-selective waste material placement, in addition to minimal to non-existent reclamation, allowed for infiltration of water into the dumps/pits and oxidation of mine waste (Figure 1).

Selenium is a naturally occurring element in the environment, and an essential micronutrient for humans, plants, and wildlife. However, at too high of concentrations, selenium can be toxic. Mining processes resulting in oxidation of the selenium bearing mine waste results in a selenium oxidation state that makes it highly water soluble, mobile, and toxic. Past mining and reclamation practices have resulted in the interaction of water with selenium-bearing material, leading to selenium contamination of surface and groundwater. Toxic levels of selenium have been detected in water, sediment, and biota collected from phosphate mines in southeast Idaho.

In 1996, isolated livestock losses associated with selenium uptake prompted concerns about potential ecological and human health impacts from past mining operations (Montgomery Watson 1999). Subsequent investigations have indicated elevated levels of selenium and other mining-related metals as a result of mining activities throughout the Mine Site (IDEQ 2002).

The Mine Site encompasses an approximately 17,000 acre area within portions of Bannock, Bear Lake, Bingham, and Caribou Counties, Idaho and contains 17 major open pit phosphate mines (Table 1). The Food Machinery and Chemical Corporation (FMC), J.R. Simplot Company (Simplot), Agrium/NuWest Industries, Inc/NuWest Mining Inc (NuWest), Solvay/Rhodia (Rhodia) and P₄ Production LLC (P₄/Monsanto; a wholly-owned subsidiary of Monsanto Company) are potentially responsible parties.

The purpose of the PAS is to provide a review of readily available information on hazardous substance releases and potential impacts of those releases on natural resources under the trusteeship of Federal, State, or Tribal authorities. Once drafted, the PAS is used to evaluate the
need to conduct a formal natural resource damage assessment (NRDA) as authorized under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), 42 U.S.C. § 9601 et seq., as amended; and the Clean Water Act (CWA), 33 U.S.C. § 1251 et seq. Listed below are the criteria that must be met to proceed past the preassessment phase to the full assessment phase of the NRDA process.

1) A discharge of oil or release of hazardous substance has occurred.
2) Natural resources for which a State or Federal agency or Indian Tribe may assert trusteeship under CERCLA have been or are likely to have been adversely affected by the discharge or release.
3) The quantity and concentration of the discharged oil or released hazardous substances is sufficient to potentially cause injury to those natural resources.
4) Data sufficient to pursue an assessment are readily available or likely to be obtained at reasonable cost.
5) Response actions, if any, carried out or planned do not or will not sufficiently remedy the injury to natural resources without further action.

This document has been prepared pursuant to title 43 CFR § 11.23(e) for the US Department of the Interior (DOI, as represented by the Fish and Wildlife Service (FWS), Bureau of Indian Affairs (BIA), and Bureau of Land Management (BLM)); the US Department of Agriculture (USDA, as represented by the U.S. Forest Service (Forest Service)); and the Shoshone-Bannock Tribes (Tribes), federally recognized Tribes with a Reservation established by Executive Order. Pursuant to § 107 (f) of CERCLA and § 300.600 of the National Contingency Plan, these sovereigns are trustees for all the natural resources that may potentially be injured by contaminant releases into the Mine Site, and are herein collectively referred to as the Trustees.

Figure 1. Schematic of the phosphate mining process and potential for selenium release into the environment (adapted from GAO 2012).
Table 1. Phosphate Mine Status and Associated Selenium Contamination in Southeast Idaho (adapted from GAO 2012).

<table>
<thead>
<tr>
<th>MINE NAME</th>
<th>ACTIVE</th>
<th>INACTIVE</th>
<th>ACRES DISTURBED</th>
<th>SELENIUM CONTAMINATION DETECTED</th>
<th>LIVESTOCK DEATHS HAVE OCCURRED</th>
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<tbody>
<tr>
<td>Ballard</td>
<td>•</td>
<td></td>
<td>635</td>
<td></td>
<td></td>
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<tr>
<td>Blackfoot</td>
<td></td>
<td>•</td>
<td>NA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bridge¹</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Champ</td>
<td>•</td>
<td></td>
<td>392</td>
<td></td>
<td></td>
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<tr>
<td>Conda/Woodall</td>
<td>•</td>
<td></td>
<td>1,506</td>
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<tr>
<td>Diamond Gulch</td>
<td>•</td>
<td></td>
<td>32</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dry Valley</td>
<td>•</td>
<td></td>
<td>888</td>
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<td></td>
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<tr>
<td>Enoch Valley</td>
<td>•</td>
<td></td>
<td>581</td>
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<tr>
<td>Gay²</td>
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<td>4,736</td>
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<td>Georgetown</td>
<td></td>
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<td>251</td>
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<td>Canyon</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Henry</td>
<td>•</td>
<td></td>
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<td></td>
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<td>Lanes Creek</td>
<td>•</td>
<td></td>
<td>29</td>
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<td>Mountain Fuel</td>
<td>•</td>
<td></td>
<td>716</td>
<td></td>
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</tr>
<tr>
<td>North Maybe</td>
<td>•</td>
<td></td>
<td>1,228³</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rasmussen</td>
<td>•</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ridge</td>
<td>•</td>
<td></td>
<td>756</td>
<td></td>
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</tr>
<tr>
<td>Smoky Canyon</td>
<td>•</td>
<td></td>
<td>2,506</td>
<td></td>
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</tr>
<tr>
<td>South Maybe</td>
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<td>South</td>
<td>•</td>
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<td></td>
</tr>
<tr>
<td>Rasmussen</td>
<td>•</td>
<td></td>
<td>389</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wooley Valley</td>
<td>•</td>
<td></td>
<td>808</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>4</td>
<td>14</td>
<td>16,527</td>
<td>17</td>
<td>6</td>
</tr>
</tbody>
</table>

¹ The Blackfoot Bridge Mine is a newly permitted mine (Record of Decision signed in 2011), and as such will not be included in the NRDA.
² Gay Mine occurs on Shoshone-Bannock Tribal lands. For purposes of this PAS, Trustees, at this time, are not considering Gay Mine. Such consideration may be made at a later date.
³ Acres of disturbance provided include disturbance for North Maybe Mine and South Maybe Canyon Mine combined.

II. SITE BACKGROUND INFORMATION

The Mine Site is located entirely in southeast Idaho, with most individual mines occurring near the city of Soda Springs, Idaho. Mining impacts have occurred over an approximate 17,000 acre area, with proposed mining in the future expected to impact an additional several thousand acres. These large-scale mines are open pit or contour strip mines, developed near the surface exposures of the Phosphoria Formation. The majority of the mines occur within the Blackfoot River Subbasin; one additional mine also drains to the Portneuf River Subbasin in addition to the Blackfoot; and one mine drains to the Salt River Subbasin. All three subbasins ultimately drain to the Snake River. Additionally, Diamond Gulch Mine, Georgetown Canyon Mine, and a portion of Conda Mine drain to the Bear River Subbasin, tributary to the Great Salt Lake. Figure
Climate near the Mine Site is heavily influenced by topography. The north-to-south-trending mountain ranges west of the Mine Site create a natural barrier for water-bearing Pacific air masses creating a rain shadow effect that results in a dry climate. The southeastern part of the Mine Site is wetter and cooler than the other parts because of the increasing elevation (Montgomery Watson 1999). In the cooler months, precipitation is generally from snow, while in the springtime, cool marine air from the south brings precipitation. In the summer, precipitation is associated with localized, orographic thunderstorms (Montgomery Watson 1999). Average precipitation increases in an easterly direction, with approximately 12 inches in the west and 25 to 35 inches in the central and eastern portions of the Mine Site (IDEQ 2002).

Geology at the Mine Site is generally composed of deformed Paleozoic and Mesozoic sedimentary rocks, including thick marine clastic units, cherts, and limestones, and is situated within the northern region of the Basin and Range Physiographic province (Montgomery Watson 1999). The valleys are largely filled with Quaternary alluvium and colluvium that overlay Pleistocene basalt flows. Thick rhyolite flows of the Snake River Plain region, and rhyolite domes, located south of the Blackfoot Reservoir, make up the remaining volcanic sequences in the area (IDEQ 2002). The Phosphoria Formation was deposited during Permian time, forming the western phosphate field, part of which is located in the Mine Site.

Vegetation types in the Mine Site are transitional between the Great Basin vegetation to the south and the Rocky Mountain vegetation to the north, and are a result of elevation, moisture, temperature, soil type, slope, and aspect. Based on previous investigations, the Mine Site contains or supports about 75 species of mammals, 272 species of birds, 16 species of reptiles, 16 species of fish, and seven species of amphibians (USGS and Forest Service 1977; Forest Service 1985, 1997; and Idaho Conservation Center Database 1999, all as cited in Montgomery Watson 1999). Some of these species permanently reside within the area while others use the area seasonally. Many of these species rely on the wide range of habitat types within the Mine Site for completion of key life-cycle requirements, such as feeding, nesting, rearing offspring, wintering, and migration. There are many large resident mammals that depend on these habitats for wintering and rearing, such as mule deer (*Odocoileus hemionus*), moose (*Alces alces*), and elk (*Cervus canadensis*). Other mammals depend on a variety of habitats, including riparian and wetland habitats, for foraging and rearing such as mink (*Mustela vison*) and muskrat (*Ondatra zibethicus*). A variety of birds use the Mine Site including raptors, passerines, waterbirds, and shorebirds. Raptors, such as bald eagles (*Haliaeetus leucocephalus*) and osprey (*Pandion haliaetus*) use riparian habitats for nesting, foraging, and rearing of young. Passerines utilize numerous habitats types within the area to nest and rear young, including species of jays, sparrows, flycatchers, swallows, and chickadees. The Mine Site is located within the Pacific Flyway and provides waterfowl with stopover habitat to forage and replenish nutritional reserves during migration. Additionally, the Mine Site aquatic habitats offer waterfowl an area for nesting and brood rearing. Many types of waterbirds depend on the Mine Site, such as Canada goose (*Branta canadensis*), canvasback (*Aythya valisineria*), mallard (*Anas platyrhynchos*), northern pintail (*Anas acuta*) redhead (*Aythya americana*), lesser scap (*Aythya affinis*) and various other aquatic-dependent birds, including belted kingfisher (*Megaceryle alcyon*) and great
blue heron (*Ardea herodias*). Amphibians and reptiles also depend on aquatic habitats found within the Mine Site.

Several threatened, endangered, or candidate species may occur at the Mine Site, including the threatened Canada lynx (*Lynx Canadensis*) and Ute ladies’-tresses orchid (*Spiranthese diluvialis*); wolverine (*Gulo gulo*) and yellow-billed cuckoo (*Coccyzus americanus*), both recently proposed for listing; and the candidate greater sage-grouse (*Centrocercus urophasianus*) and whitebark pine (*Pinus albicaulis*). Several species classified as sensitive by federal and state agencies also potentially occur at the Mine Site including: northern goshawk (*Accipiter gentilis*), Columbian sharp-tailed grouse (*Tympanuchus phasianellus columbianus*), trumpeter swan (*Cygnus buccinator*), Harlequin duck (*Histrionicus histrionicus*), great gray owl (*Strix nebulosa*), flammulated owl (*Otus flammeolus*), boreal owl (*Aegolius funereus*), three-toed woodpecker (*Picoides triadactylus*), western big-eared bat (*Corynorhinus townsendii pallescens*), spotted bat (*Euderma maculatum*), Columbia spotted frog (*Rana luteiventris*), Yellowstone cutthroat trout (*Oncorhynchus clarkii bouvieri*), Bonneville cutthroat trout (*Oncorhynchus clarkii utah*), starveling milkvetch (*Astragalus jejunus var. jejunus*), Payson’s bladderpod (*Lesquerella paysonii*), and Cache beardtongue (*Penstemon compactus*).

Members of the Tribes have a history that is tied to a tradition with the land and their way of life. The Tribes have not relinquished any on- or off-Reservation hunting, fishing, and gathering rights. In order to be able to subsist on these natural resources reserved for the Tribe through federal agreements and Executive Orders (e.g., Fort Bridger Treaty of 1868), the Tribe believes that the resources must be essentially clean and free of contaminants. The Tribes have developed a Waste Management Act for lands within the boundary of Fort Hall Reservation (Shoshone-Bannock Tribes 2009) for the purpose of, among others, preventing degradation of the environment. Pursuant to the Waste Management Act (WMA), the Tribe’s Environmental Waste Management Program has promulgated regulations establishing the degree of cleanup required at contaminated sites (December 2010 Soil Cleanup Standards). The Soil Cleanup Standards are intended to protect the “traditional, religious, and cultural uses of Reservation lands and water” in order to protect and maintain “the way of life and traditional activities of the Tribes” (WMA § 101(B)(6)). These standards will be considered in any NRDA undertaken.

The culture of the Tribes is inextricably tied to the streams/rivers within the Mine Site, and the plants and animals living along and in those streams/rivers. Fishing, hunting, plant gathering, swimming and traditional ceremonies have been, and continue to be, significant parts of Tribal life. The presence of contamination may decrease and degrade traditional foods and may preclude the use of the streams/rivers in the Mine Site for fishing, swimming and other recreational uses. These limitations on the use of the streams/river and its resources also have a negative impact on the cultural and spiritual well-being of the Tribes and their members.

The areas adjacent to the Mine Site also support many recreational uses, including, but not limited to, fishing, hunting, hiking, boating, camping, swimming, and wildlife viewing. These visitors contribute to the local economies through the purchase of fuel, food, services, lodging, fishing/hunting gear, and other supplies.
Figure 2. Diagram of surface water flow (generalize to 25% increments) from phosphate mines to drains, creeks, and rivers in southeastern Idaho (Adapted from Hamilton and Buhl 2003).
A. Sources of Contaminant Releases and Current and Past Uses

Phosphate Mines

1. Ballard Mine – P₄/Monsanto
   Ballard Mine is located approximately 13 miles northeast of Soda Springs, Idaho. Exploration and stripping at Ballard started in June 1951, with mining occurring from 1952-1969. Ballard Mine consisted of several side-hill and open-pit excavations. During the 17 years of mining, 10.4 million dry net tons of phosphate rock were mined and hauled to Monsanto’s elemental phosphorous plant in Soda Springs, Idaho (Lee 2001). Approximately 20 million cubic yards (MCY) of waste rock were stripped; of that amount, two MCY were used to backfill the pits, with the remaining 18 MCY hauled to the waste rock dumps (Lee 2001). The mining operations at the Ballard Mine predated the Idaho Surface Mining Act of 1971, as well as several federal mining-related regulations. Monsanto relinquished the mineral leases at Ballard Mine to the BLM in April 1984, and BLM accepted relinquishment in July 1984 (Lee 2001).

   Major drainages at Ballard Mine are Wooley Valley Creek on the east side of the Mine and Ballard Creek on the west. Both creeks are tributaries to the Blackfoot River.

   At present, Ballard Mine has six distinct open mine pits and six distinct waste rock dumps, over an approximately 524 acre area (MWH 2011). Currently, the only ancillary facilities remaining at Ballard are remnants of a partially paved haul road, various unimproved soft surface two-track roads, and the Ballard Shop Area consisting of a garage/shop building, an unused office building, various small storage sheds and buildings, and a stockpile of slag from Monsanto’s elemental phosphorous plant (MWH 2011).

2. Henry Mine – P₄/Monsanto
   The Henry Mine, located approximately 16 miles northeast of Soda Springs, Idaho, operated from 1969-1989, with approximately five miles of phosphate outcrop ultimately developed and mined, and hauled to P₄/Monsanto’s elemental phosphorous plant (Lee 2001). Approximately 99.6 MCY of waste rock were moved at Henry Mine, with an estimated volume of 32.3 MCY in the external waste rock dumps and 67.3 MCY in the pits as backfill (MWH 2011). The BLM accepted relinquishment of the Henry Mine lease in December 1993, following reclamation (Lee 2001).

   Surface water drainages at Henry Mine consist of Lone Pine Creek which flows into the Little Blackfoot River, tributary to the Blackfoot Reservoir. Additionally, there is an unnamed creek draining from the southern portion of Henry Mine that flows into Long Valley Creek, which also flows into the Little Blackfoot River. The Little Blackfoot River itself flows directly through the north and central portions of Henry Mine, then directly into the Blackfoot Reservoir.
The Henry Mine lease area is approximately five miles long and one-half-mile wide and includes 689 acres owned by P4/Monsanto, 40 acres owned by BLM, and 1,080 acres owned by the Idaho Department of Lands (IDL). Approximately 1,000 acres of the mine lease area was disturbed during mining operations, with approximately 680 of those acres reclaimed (MWH 2011). Most of the mine pits at Henry have been backfilled, except for pits on the northern and southern ends of the mine, and portions of the mine highwalls remain exposed in a number of pit areas (MWH 2011). With the exception of a three-mile long former haul road, which is mostly paved, and minor two-track dirt roads, no significant ancillary facilities remain at Henry Mine (MWH 2011).

3. Enoch Valley Mine – P4/Monsanto
The mine lease area at Enoch Valley Mine is approximately three and a half miles long by half a mile wide, and is located approximately 19 miles northeast of Soda Springs, Idaho. Enoch Valley Mine began operation in 1989 and continued until 2003. The mine leases at Enoch Valley consist of 55 acres owned by P4/Monsanto, 838 acres administered by IDL, and 582 acres of Forest Service land. The mineral leases at Enoch Valley Mine have not been relinquished back to BLM.

Enoch Valley Mine is drained to the south by Rasmussen Creek, which flows into Angus Creek. Angus Creek is a perennial stream that flows directly into the Blackfoot River. The northern portion of Enoch Valley Mine is drained by W. Rasmussen Ridge Creek which flows toward Lone Pine Creek; though low water levels may preclude an actual surface water connection to Lone Pine Creek.

Records indicate approximately 51.5 MCY of waste rock was moved at Enoch Valley Mine, with an estimated 22.2 MCY contained in the two external waste rock dumps and 29.3 MCY of waste rock as backfill in the mine pit (MWH 2011). Active facilities remain at Enoch Valley Mine to support mining at P4/Monsanto’s South Rasmussen Mine, primarily at a nine acre ore loading facility. Other facilities present at Enoch Valley Mine include: office buildings, shops/sheds, two blasting magazines and ammonium nitrate storage, and fuel/propane tanks.

4. South Rasmussen Mine – P4/Monsanto
The South Rasmussen Mine, located 17 miles northeast of Soda Springs, Idaho includes 640 acres of State of Idaho and 160 acres of Federal lands. Operations at the South Rasmussen Mine were initiated in 2001 including excavation of the pit and construction of the East Overburden Dump known as the Horseshoe overburden disposal area (ODA), and a second external dump located between the east and west limb pits.

The Horseshoe ODA is located at the headwaters of an unnamed tributary to Sheep Creek, with a wetland located at its base. The unnamed tributary originates within, and flows out of that wetland until it joins Sheep Creek less than one mile downstream.
Ore reserves at South Rasmussen Mine were depleted in May 2013. Reclamation at the mine is ongoing and is expected to continue through 2014.

5. Conda/Woodall Mountain Mine – Simplot
Conda/Woodall Mountain Mine is located approximately 8 miles northeast of Soda Springs, Idaho. Mining operations at Conda/Woodall Mountain occurred from 1906 through 1984, and consisted initially of underground operations with strip mining in the latter years (Newfields 2008). Underground mining operations occurred until 1956 and resulted in the production of 3,000,000 tons of ore, with the transition to open pit (surface) mining beginning in 1952 (Schwarze 1967).

Major drainages at Conda/Woodall Mountain Mine include State Land Creek, Pedro Creek, and Camp G Creek. All three creeks are intermittent streams; State Land Creek flows directly to the Blackfoot River, and Pedro and Camp G Creeks flow into Trail Creek, which is tributary to the Blackfoot River. Additionally, on the southern portion of Conda Woodall Mountain Mine, Margarette Creek flows into Trail Canyon Creek, which is tributary to the Bear River.

Records indicate approximately 21 million tons of ore were mined at Conda/Woodall Mountain Mine, with approximately 78.7 MCY of waste rock removed (Newfields 2008). Processing of ore from Conda/Woodall Mountain Mine occurred at mill and calciner facilities constructed on-site. Associated with the mill/calciner facilities are two tailings ponds. The Old Tailings Pond operated from 1969-1979 and was approximately 125 acres in size. Currently the Old Tailings Pond is drained and sparsely vegetated with grasses and shrubs. The 138 acre New Tailings Pond was constructed in 1979 to replace the Old Tailings Pond. This pond is currently utilized as a reservoir for water used in the slurry line pump station for Smoky Canyon Mine (see #6 Smoky Canyon Mine below).

At one time, a small community was constructed about a half-mile from Conda/Woodall Mountain Mine. The community consisted of 82 homes, offices, a boarding house, a community store, a post office, a grade school, and a recreation hall (Lee 2001). Only one building remains from the former townsite, and the former mill facilities were demolished in 2004. Other mining-related features that remain on-site include approximately 460 acres of open mine panes (pits) and approximately 660 acres of external and backfilled-pit ODA (Newfields 2008).

6. Smoky Canyon Mine – Simplot
Smoky Canyon Mine is located on National Forest System lands, 24 miles east of Soda Springs, Idaho. Though exploration activities by USGS first occurred in 1914, Simplot did not start mining at Smoky Canyon until 1983. The Smoky Canyon Mine complex consists of an open-pit mine, an ore benefication plant, an 80-mile long phosphate concentrate slurry line (from Smoky Canyon Mine to Simplot’s Don Plant in Pocatello, Idaho), a tailings pipeline system, and a tailings impoundment (Lee 2001).
Multiple major drainages occur within the influence of Smoky Canyon Mine. Tygee Creek drains to Stump Creek and includes Smoky Creek, Roberts Creek, East Tygee Creek, and Tygee Creek. Sage Creek drains south to Crow Creek and includes Pole Canyon Creek, the north fork of Sage Creek, Sage Creek, and South Fork Sage Creek. Flows from both the Tygee and Sage Creek ultimately flow into the Salt River Subbasin, at the confluence of Stump Creek and the Salt River.

Past mining at Smoky Canyon Mine was divided into Panels A through E, with current mining operations in Panel F, and ultimately Panel G. Panels A through E, including the ODAs, encompass an area approximately 1875 acres in size, of which approximately 202 MCY of overburden (waste) backfill were placed in the panel pits. (Newfields 2005, 2011). Smoky Canyon Mine also contains the Pole Canyon ODA. This ODA is a cross-valley fill (CVF), roughly 130 acres in size and containing between 26-50 MCY of overburden material. Pole Canyon was filled from above by end-dumping overburden materials from dump trucks into the canyon. Natural sorting of the overburden materials by gravity resulted in very coarse materials filling the canyon bottom first and creation of a “french drain” through which Pole Canyon Creek continues to flow (Newfields 2005).

Reclamation has been completed at Panels A through E. The Record of Decision (ROD) for mining in Panels F and G, which lie to the south of the reclaimed Panels, was signed in 2008. It is anticipated that Panels F and G will include an approximately 1,449 acre disturbance area (including road construction, mine pits, and work areas), and have a mine life of 16 years.

Two tailings impoundments, Tailings Pond 1 (TP1) and Tailings Pond 2 (TP2) have historically been, and will continue to be used as part of the operations at Smoky Canyon Mine. Both ponds occur on Simplot-owned lands. TP1 was used for tailings deposition from 1983-1991, and is currently being used as a reservoir for storing mill water (MFG 2004). TP2 has been in use since 1991 and is the current location of active tailings deposition.

7. Lanes Creek Mine –NuWest

Lanes Creek Mine is a small open-pit mine, located approximately 15 miles northeast of Soda Springs, Idaho. Mining operations at Lane Creek began in 1978 and continued until 1989 (Lee 2001). The Lanes Creek Mine lease covers 336 acres, but historic mining operations were confined to 32 acres consisting of six mine pits, an ODA, a reclaimed ODA, a topsoil stockpile, a sediment catch pond, an ore stockpile, and a mine drainage channel (TechLaw, Inc. 2008A). Simplot formally owned the mineral rights at Lanes Creek, but never mined the site. NuWest acquired the mineral rights from Simplot and currently has an Idaho Department of Lands approved Mine and Reclamation Plan. NuWest intends to mine, remediate, and reclaim the Lanes Creek Mine site.

Surface water drainage from Lanes Creek Mine includes flow from North Creek, South Creek, and the Mine Drainage Channel. South Creek flows into North Creek,
which flows into Lanes Creek. The Mine Drainage Channel also flows into Lanes Creek. Lanes Creek then flows into the Blackfoot River, forming its headwaters.

North Maybe Mine is located approximately 17 miles northeast of Soda Springs, Idaho, and lies mostly on National Forest System land, with a small portion on private and state land. North Maybe Mine operated from 1965 through 1967, was idle from 1968 to 1971, operated from 1972 to 1984, then sat idle again until the final ore was removed in 1993 (AECOM 2009). During the life of the Mine, approximately 15 million tons of ore and 52 MCY of waste were mined.

Major drainages from North Maybe Mine include East Mill Creek and Kendall Creek. East Mill Creek flows into Spring Creek, which ultimately flows to the Blackfoot River. Kendall Creek flows east to Diamond Creek, which joins with Lanes Creek to form the Blackfoot River. Two additional small drainages at the Mine include an ephemeral stream that flows out of the base of Big Draw Dump and a small spring at the south end of the Mine that flows into Maybe Creek.

The Mine pit, which is approximately 2.5 miles long, is surrounded by 12 external waste rock dumps, with approximately 612 acres of disturbance as a result of mining activities (AECOM 2009). No ore milling or processing occurred on site, ore was transported via rail car to NuWest’s fertilizer plant near Soda Springs, Idaho. Most of the facilities at North Maybe Mine have been removed, including office buildings, employee quarters, and conveyors; however, a boxcar used for equipment storage and a concrete pad from the equipment shop are still present.

9. South Maybe Canyon Mine – NuWest
South Maybe Canyon Mine is located approximately 17 miles northeast of Soda Springs, Idaho, on both private and National Forest land. Phosphate ore was extracted from the Mine between 1976 and 1984. Waste rock material from the Mine was placed in a CVF dump in Maybe Canyon. The South Maybe Canyon Mine CVF is approximately 1.0 miles long, 0.3 miles wide, and 425 feet deep, with a total surface area of approximately 120 acres. It is estimated to contain approximately 29 MCY of waste material. During construction of the CVF a French drain was constructed to transport stream flow under the CVF to Maybe Creek (TRC 2006).

The major drainage from South Maybe Canyon Mine isMaybe Creek which flows to Dry Valley Creek, a tributary to the Blackfoot River.

10. Champ Mine –NuWest
Champ Mine was an open-pit mine located approximately 16 miles northeast of Soda Springs, Idaho on two low hills on the valley floor. Mining at Champ was initiated by the Conda Partnership (who later sold their interests to NuWest) in 1982 (Lee 2001), with mining ceasing at the Champ Mine Extension in 1985. During the active mining of Champ Mine and the Champ Mine Extension, approximately 30 MCY of
waste rock were generated (CH2MHILL 2012A). Mining at Champ resulted in three
dumps, two mine pits, and a stock pile area.

The two main drainages within the Champ Mine boundary include Goodheart Creek
and Dry Canyon Creek, both creeks flow on, or adjacent to the Mine, in a westerly
direction. Both creeks are intermittent and tributary to Slug Creek, which is tributary
to the Blackfoot River.

11. Mountain Fuel Mine – NuWest
Mountain Fuel Mine is located approximately 16 miles northeast of Soda Springs,
Idaho, and extends over three miles in length. Mining operations began in late 1966,
with the stripping of approximately one-million tons of overburden from the ore zone
(Lee 2001). However, prior to any phosphate ore being mined or removed,
operations were suspended. Ore production at Mountain Fuel Mine began again in
late 1985 and continued until May 1986 until it was temporarily shut down until the
summer of 1987 (Lee 2001). Additional leases were acquired over the years, which
brought the total acreage of the Mountain Fuel lease to 1,130 acres. Operation at
Mountain Fuel Mine continued into 1993 at an annual production rate of
approximately 1.6 – 1.7 million tons of phosphate ore, until operations were shut
down in November 1993 (Lee 2001). Mining activities at Mountain Fuel resulted in
four mine pits, six waste dumps, a sediment pond, haul roads, a maintenance/shop
building, and a railroad spur with a tipple (CH2MHILL 2012B).

Mountain Fuel Mine is located at the head of the Dry Canyon Creek watershed and
includes several minor unnamed drainages. The unnamed drainages appear to be
limited to the Mine site. Dry Canyon Creek is a tributary to Slug Creek which in turn
flows into the Blackfoot River. Dry Canyon Creek is an intermittent stream that
flows from the southern to the mid-point portion of the mine and continues north
away from the Mountain Fuel Mine, eventually flowing into Slug Creek. Dry Basin
Creek is located west of the Mine’s Saddle Dump near the northeastern portion of the
Mine lease. It appears to be an intermittent stream that flows into Slug Creek
(CH2MHILL 2012B).

12. North, South, and Central Rasmussen Ridge Mine – NuWest and Solvay/Rhodia
Rasmussen Ridge Mine is located approximately 19 miles northeast of Soda Springs,
Idaho. Mining began at Rasmussen Ridge Mine in January 1991 and portions of it
are currently active. The Mine consists of two mine pits, two external waste rock
dumps, two growth media storage areas, and a mine office and shop (SAIC 2002).
Initially, Rhone-Poulenc Basic Chemicals Company held the leases at Rasmussen
Ridge, but assigned those leases to Rhodia in 1998, and designated NuWest as the
operator at the Mine. Later that year, Rhodia assigned the leases to Nuwest, who
continued with the mining activities.

The Rasmussen Ridge Mine is located on the drainage divide between the Angus
Creek and Sheep Creek watersheds. Surface water from the eastern portion of the
Mine drains to No Name Creek, which flows west across the Mine to join Angus
Creek, which is tributary to the Blackfoot River. The western portion of the Mine drains to the West Fork of Sheep Creek, which flows into Sheep Creek before flowing to Lanes Creek, a tributary to the Blackfoot River (SAIC 2002).

Georgetown Canyon Mine and the Industrial Plant are located approximately 19 miles southeast of Soda Springs, Idaho, and occupy approximately 87 acres on patented ground. Mining and production of ore at Georgetown Canyon began on sixteen claims between 1909 and 1928, with additional underground and open pit mining occurring between 1955 and 1963 (Ecology and Environment, Inc. 2008). The size of the open pit extends approximately 10,000 feet long, 250 feet wide, and 100 feet deep.

The major drainage at Georgetown Canyon Mine is Georgetown Creek, which flows directly across the Mine Site from north to south. Phosphoria Gulch also flows through the Mine and Industrial Plant area, eventually connecting to Georgetown Creek from the east. Several minor tributaries and the Right Fork of Georgetown Creek also occur at the Mine, and flow into Georgetown Creek, which flows approximately 11 miles to its confluence with the Bear River.

Ore from Georgetown Canyon Mine was processed at the on-site Industrial Plant located in the bottom of the canyon. This Plant was built on top of Georgetown Creek and consisted of an electric furnace and kiln fertilizer plant. Both a conveyor belt and railroad spur was used to move ore from the open pit of the Mine to the Industrial Plant (Ecology and Environment, Inc. 2008). Many of the structures at the Mine and the Plant were demolished, removed, or capped beginning in the early 2000s (Ecology and Environment, Inc. 2008). The remediation of the Industrial Plant was completed in 2011 by NuWest under a RCRA Consent Judgment with the State of Idaho.

14. Dry Valley Mine – NuWest and FMC
Both NuWest and FMC have mined portions of Dry Valley, with the FMC leases lying on the north portion of the valley. The Dry Valley Mine is located on public and private land, approximately 17 miles northeast of Soda Springs, Idaho.

The major drainage at Dry Valley Mine is Dry Valley Creek, which flows through and around the Mine, and is tributary to the Blackfoot River. Tributaries to Dry Valley Creek receiving flow from the Mine include Young Ranch Creek, North and South Stewart Creeks, Maybe Creek, and Chicken Creek.

Mining operations at Dry Valley Mine were initiated in 1992. The lease for the Mine extends over six miles in length, with actual mining disturbance extending...
approximately 3.5 miles. Approximately 2.3 million tons of ore were produced annually (TechLaw, Inc. 2008B). Mined phosphate ore was transported via rail line to NuWest’s Conda fertilizer plant, near Soda Springs, Idaho. Existing facilities at NuWest’s portion of Dry Valley Mine include an office/shop, rail spur, ore stockpile, and tipple/loadout.

In total, four pits were mined (Pits A and B were mined by FMC, Pits C and D were mined by NuWest), along with seven overburden dumps totaling approximately 380 acres in size, including those in the South Extension Project (BLM 2000).

15. Wooley Valley Mine – Solvay/Rhodia

Wooley Valley Mine is located approximately 16 miles northeast of Soda Springs, Idaho, on a combination of Forest Service, BLM, and private land. The Mine was broken into three Units (1, 3, and 4). Unit 1 was mined from 1955 – 1956, then again from 1967 – 1969. Unit 3 was mined from 1976 – 1989, and resulted in approximately 20 acres of surface disturbance. Mining operations at Unit 4 began in 1969 and by 1974 all economically recoverable phosphate ore had been recovered (Ecology and Environment 2000). Mining at Unit 4 occurred in three phases, and resulted in the creation of two pits, six waste dumps, and the development of approximately 2.5 miles of haul and service roads. Former surface structures on Unit 4 included two metal buildings, one office building, two trailers, and a repair facility (Ecology and Environment 2000).

In late 1971, a mine operator at Wooley Valley placed about 80,000 cubic yards of waste rock, ice, snow, frozen ore, and frozen mud on the crest of a dump constructed at the ridge line above Unit 4, raising the elevation of the dump by about 15 feet. This material was later pushed over the side of the dump. During the late spring thaw in 1972, the slope failed, and the material flowed down the face of the dump, generally toward the east, into a wooded area below. Silt associated with this slope failure overfilled onsite retention ponds, and silt-laden water spilled out of the ponds and flowed into the Blackfoot River upgradient of the Blackfoot Narrows. The mudflow from the dump was approximately 600 feet long, 70 feet wide, and 3 feet deep. An attempt was made to stabilize the remaining portions of the dump by removing about 20 feet from the top of the dump and all of the loose material on the dump face. Additionally, benches were cut into the face. Reshaping and reseeding of the dump were completed by 1973. No further failures have been noted for this dump (Ecology and Environment 2000).

The major surface water drainage at Wooley Valley Mine is Angus Creek, which flows along the Wooley Valley haul road before joining with the Blackfoot River. Several unnamed intermittent streams also flow through the Mine toward the Blackfoot River.


Diamond Gulch Mine sits approximately 9 miles southeast of Soda Springs, Idaho. Mining began at Diamond Gulch in 1960 and was the first mine to be opened and
operated on the Caribou National Forest (Lee 2001). Mining occurred in 1960, and resulted in a total of 32 acres of disturbance and about 84,000 tons of phosphate ore recovered from the Mine. Due to economic and geologic considerations, the mine was closed in 1961 and reclamation completed in 1962 (Lee 2001). An unnamed intermittent stream channel runs below the Diamond Gulch Mine, flowing 3.5 miles to the west where it enters the Bear River (IDEQ 2007A).

Ore Processing Facilities

1. P4/Monsanto Soda Springs Facility (EPA 1997)
   The Monsanto Soda Springs Plant is located approximately one mile north of the City of Soda Springs and processes locally mined phosphate ore to produce elemental phosphorus. In 1952, Monsanto purchased the Plant site, built the Plant, and started operations. The Plant consists of more than a dozen administrative and processing buildings plus ore piles, slag piles, by-product materials, surface impoundments, and a solid waste landfill. Approximately 1 million tons of phosphate ore are processed through the Plant each year using an electric arc furnace process.

   In 1984, Golder Associates was commissioned to evaluate groundwater and surface water impacts resulting from current and past activity. Thirty-one new monitoring wells were installed to supplement seven existing wells (additional wells have been added subsequently). This investigation showed groundwater under the Plant to be contaminated with fluoride, cadmium, selenium, vanadium, and other inorganic compounds. The sources of the contamination were hypothesized to be the underflow solids pond, the northwest pond, and the hydroclarifier. A separate plume showing contamination with chloride, sulfate, and vanadium exists in the southeast portion of the Site.

   EPA proposed the Monsanto Site for the National Priorities List (NPL) in May, 1989. The Plant was made final on the NPL on August 30, 1990 (55 Fed. Reg. 35502). EPA and Monsanto negotiated an Administrative Order on Consent (AOC), pursuant to which Monsanto agreed to perform a RI/FS for the Soda Springs Site. The AOC was issued by EPA on March 19, 1991.

2. Agrium/NuWest Conda Phosphate Operations Plant (BCI 2001)
   Agrium/NuWest operates the Conda Phosphate Operations phosphate mining processing plant near Conda, Idaho, approximately five miles north of Soda Springs, Idaho. Phosphate ore is shipped to the processing plant from NuWest mines active in the Mine Site. As part of the approximately 300,000 tons of phosphoric acid produced at the plant annually, roughly 1.5 million tons of calcium sulfate (phosphogypsum) are produced. This phosphogypsum, or gypsum, is stored in four ponds west of the plant. Gypsum contains impurities such as silica, usually as quartz,

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2 The Simplot Don Plant and FMC’s historic phosphate ore processing facility in Pocatello are included in the 2,530 acre Eastern Michaud Flats (EMF) Superfund Site. The EMF Superfund Site partially occurs on Shoshone-Bannock Reservation Lands, in the Portneuf River Subbasin. For purposes of this PAS, Trustees are not considering impacts from the EMF site. The EMF site will be addressed at a later date.
as well as radium and uranium and smaller amounts of toxic metals and elements such as arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver. Environmental concerns exist because of the presence of the trace toxic metals/elements and radionuclides in the gypsum, and what impacts may be occurring to groundwater. Additionally, the ponds containing gypsum process water often contain surface water at pH values below 2.

B. Potentially Responsible Parties

The Potentially Responsible Parties (PRPs) identified at this Site include, but are not limited to, the following companies whose site activities are described in more detail below. Other smaller PRPs have been identified and also are referenced in the following site activities discussion. (Adapted from Lee 2001):

1. FMC, which refers to all past and current owners/operators of mining operations at Gay Mine (located on Tribal lands and not considered in this PAS) and Dry Valley Mines. Though some of FMC’s leases have been acquired from other companies (i.e, P4/Monsanto and Kerr-McGee Oil Industries, Inc.), many of FMC’s leases were initially acquired outright.

2. Simplot, which refers to all past and current owners/operators of mining operations at Smoky Canyon, Conda/Woodall Mountain, Lanes Creek, and Gay Mine (located on Tribal lands and not considered in this PAS).

Between the years 1946 to 1952, the Simplot Company was undergoing a series of internal changes. The original Simplot Fertilizer Company, Inc. merged into the Simplot Investment Company, which in turn, merged into the present J. R. Simplot Company.

The Ruby Company was assigned Federal phosphate leases in the early 1960s and initiated exploratory drilling on some phosphate leases. In 1966, the Ruby Company changed their name to Simplot Industries, Inc., who then assigned their leases to Bannock Chemical Corporation. In the late 1960s, John D. Archer was issued Federal phosphate leases, and assigned those leases to Alumet Company, a formalization of a three-way partnership between Earth Science, Inc., National Steel Corp., and Southwire Company. In the early 1980s, the Bannock Chemical Corporation leases were assigned to the J.R. Simplot Company, followed by the acquisition by Simplot of Alumet’s leases in the mid-1990s.

Other leases currently held by Simplot include those originally held by the Anaconda Copper Mining Company (Anaconda), who purchased their mining claims from the Southern California Orange Grove Fertilizer Company. In 1959, Anaconda and Simplot formed a joint venture which operated until 1961 when Anaconda began selling all their facilities and leases to Simplot.

Mining contractors at the Simplot mines consisted of, but may not be limited to: HK Contractor’s Company, Washington Construction, and Morrison Knudsen Company.
3. NuWest, which refers to all past and current owners/operators of mining operations at North Maybe, South Maybe Canyon, Champ, Mountain Fuel, Georgetown Canyon, Rasmussen Ridge, Lanes Creek and Dry Valley Mines.

Western Fertilizer Association (WFA) initially held leases and mined sites currently owned/operated by NuWest. WFA assigned some of the mining leases to Central Farmers Fertilizer Company who then sold leases to El Paso Natural Gas Products Company. In 1966 El Paso Natural Gas Products Company changed their name to El Paso Products Company, while continuing to conduct mining activities at some of the mine sites. Mine leases were then assigned to El Paso Products Service Company (though a series of mergers, Huntsman Advanced Materials is the successor to El Paso) before selling the leases to Agricultural Products Corporation (APC); a wholly owned subsidiary of Beker Industries Inc. (Beker). In 1975, APC was dissolved and all of their property holdings were assigned to Beker. In 1979, Beker assigned portions of their leases to Western Cooperative Fertilizer, Inc. and combined to form the Conda Partnership. All of their phosphate properties were transferred to the Conda Partnership. In 1987, Beker filed for Chapter 11 bankruptcy. NuWest Industries, Inc. replaced Beker in the Conda Partnership. In 1992, NuWest Industries, Inc. bought out Western Cooperative Fertilizer, Inc, and formed a wholly owned subsidiary named NuWest Mining, Inc. to replace the co-op in the Conda Partnership. In 1995, the Conda Partnership was dissolved and all of the mine properties were assigned to NuWest. In October of 1995, Agrium, Inc., a Canadian firm based in Calgary, Alberta, acquired NuWest. Typically, active mining operations are managed by Agrium, Inc. while the remediation of historic mine sites are managed by NuWest.

Actual mining operations and ore hauling for the current NuWest sites were contracted out to, but may not be limited to: Wells Cargo, Inc. and the predecessors of Washington Group International (Washington Construction Company).

4. Solvay/Rhodia, which refers to all past and current owners/operators of mining operations at Wooley Valley, Diamond Gulch, and Rasmussen Ridge Mines.

Leases currently held by Solvay/Rhodia, were initially acquired from the San Francisco Chemical Company before they reorganized in 1969 and changed their name to Stauffer Chemical Company. Stauffer was then acquired by Imperial Chemicals Industries, Ltd. who immediately sold what had been Stauffer to the Rhone-Poulenc Basic Chemicals Company, which reorganized in 1998 and formed a subsidiary company entitled Rhodia, Inc. In 2011, Solvay launched a takeover bid of Rhodia.

Mining contractors for mines with leases held by Rhodia include, but may not be limited to: Cherf Brothers, Inc. and Sankey Contractors, Inc.

5. P₄/Monsanto, which refers to all past and current owners/operators of mining operations at Ballard, Henry, Enoch Valley, and South Rasmussen Mines.
The original mining leases held by the present day P₄/Monsanto were originally assigned to the Monsanto Chemical Company. However, in 1997, Monsanto spun off some of its business to form Solutia, and then formed a joint venture between Solutia and Monsanto called P₄ Production L.L.C. P₄ Production owns Monsanto’s processing plant in Soda Springs, Idaho, as well as all other mineral rights formerly held by Monsanto. Additionally, several of P₄/Monsanto’s mining leases were originally assigned to them from Simplot and FMC.

Actual mining operations and ore hauling for the current P₄/Monsanto sites were contracted to, but may not be limited to: Morrison Knudsen Company, Wells Cargo, Inc., and Dravo-Soda Springs (a joint venture between the Dravo Corporation and N. A. Degerstrom, Inc.).

C. Damages Excluded from Liability under CERCLA

Certain damages are excluded from liability under CERCLA as stated in title 43 CFR § 11.24 (b). Those damages include those resulting from federally-permitted discharges or activities as defined in Section 101 (10) of CERCLA (including activities permitted under the CWA, Clean Air Act, Solid Waste Disposal Act, etc.); discharges resulting in damage that were specifically identified as an irreversible and irretrievable commitment of natural resources in an environmental impact statement or other comparable environmental analysis; and damages resulting from release of a hazardous substance that occurred wholly before the enactment of CERCLA. Historic and ongoing mining activities have resulted in a considerable amount of contamination at the Mine Site since CERCLA was enacted in 1980. Hazardous substances continue to be present from releases from the Mine Site, therefore, potentially causing injury to natural resources. Given the history of mining activity at the Mine Site, the Trustees will further investigate federal permits and approvals issued for the Mine Site as well as environmental impact statements and other environmental analyses performed for the Mine Site to determine whether any damages are excluded from liability under CERCLA pursuant to 43 CFR § 11.24 (b).

D. Response Actions Taken or Planned

The EPA, IDEQ, and Forest Service are currently leading efforts to conduct CERCLA Remedial Investigation/Feasibility Studies (RI/FS) at several individual mines within the Mine Site3 (Table 2). The RI/FSs are currently being conducted by the mining companies, with oversight provided by the EPA, Forest Service, or IDEQ as the lead agency (depending on majority land ownership for each individual mine). There are currently a number of agreements, including but not limited to, AOCs, Administrative Settlement Agreement/Order on Consent (ASAOC) or Unilateral Administrative Orders in effect for CERCLA RI/FS work and other CERCLA response actions at 10 mines4. Briefly, the purpose of the RI/FS is to evaluate the nature and extent of contamination at each mine, develop a baseline risk

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3 Gay Mine and the now defunct FMC ore processing facility are located on Shoshone-Bannock Tribal lands. For purposes of this PAS, Trustees are not considering those two sites. Such consideration will be made at a later date, at which time a PAS will be completed for those sites
4 The 10 mines include: Smoky Canyon, Conda/Woodall Mountain, North Maybe, South Maybe Canyon, Champ, Mountain Fuel, Georgetown Canyon, Ballard, Henry, and Enoch Valley Mines
assessment for ecological and human health, and to develop and evaluate appropriate remedial actions to reduce contamination at the mine.

For those mines in the Mine Site with the majority of their land ownership occurring on private or State land, the EPA or IDEQ has the lead for the RI/FS activities. For those mines with the majority of their land ownership occurring on National Forest System lands, the Forest Service has the lead. Because the nature and extent of contamination, and the risks to human health and the environment have not yet been fully defined, it is unknown what final remedial actions will be proposed by EPA and the Forest Service across the Mine Site. Several removal actions at individual mines within the Mine Site have been completed, or are proposed as discussed further below. However, these actions will not sufficiently remedy potential injury to trust resources.

1. Smoky Canyon Mine
   In 2002 an AOC was entered into voluntarily by the Forest Service, EPA, IDEQ, and Simplot to perform a Site Investigation (SI) and Engineering Evaluation/Cost Analysis (EE/CA) at Smoky Canyon Mine. The AOC divided the Mine into two areas. The Forest Service was designated as the lead agency for Area A, occurring on Federal lands, with EPA, FWS, BLM, the Tribes, BIA, and IDEQ as support agencies. While IDEQ was designated the lead for Area B, the portion of the Mine occurring on private land, with EPA, FWS, IDL and Idaho Department of Water Resources designated as support agencies.

   Based on data presented in the final SI report, overburden waste in the Pole Canyon CVF was identified as the primary source of selenium in surface and groundwater emanating from the Pole Canyon CVF (Newfields 2005). As such, in October 2006, an AOC was signed to conduct a non-time-critical removal action at the Pole Canyon CVF. The intent of the removal action was to isolate the Pole Canyon CVF from Pole Canyon Creek and divert run-on from adjacent slopes away from the CVF. Construction activities associated with this removal action were completed in November 2008.

   Given the large-scale of Smoky Canyon Mine, and the nature and extent of contamination at the Mine, it was determined that a RI/FS would be a better mechanism to address remediation at the Mine because contaminant issues were more complex and widespread than originally suspected and would likely require long-term water treatment (typically cleanups under the EE/CA process mitigate short-term threats while cleanups under the RI/FS process are implemented for longer-term cleanup actions). Therefore, in August 2009, an AOC to conduct a RI/FS at Smoky Canyon Mine was signed, which superseded the portion of the 2003 AOC associated with Area A. The 2003 AOC remains in full force and effect for Area B. The RI/FS work plan has been finalized as of May 2011. The RI for all media except groundwater, was finalized in 2014.

   As a follow-up to the 2008 removal action, a second early action has been initiated at the Pole Canyon CVF. The 2008 removal action focused on reducing water inflow to
the ODA from Pole Canyon Creek and run-on from the adjacent hillside, but did not address infiltration into the ODA from direct precipitation and snowmelt, or risks due to the potential for ingestion of ODA surface materials or associated vegetation containing elevated contaminant concentrations. The objectives of the early action under construction in 2015 are to: reduce or eliminate water infiltrating into the ODA due to direct precipitation; reduce or eliminate the potential for ecological risk and risk to human receptors due to ingestion of vegetation on the ODA; and elimination of release of contaminants of potential concern (COPCs) from the ODA through sediment transport.

Additionally, a treatability study was started in 2014 to pilot a treatment technology to reduce selenium concentrations emanating from Hoopes Springs. Simplot completed construction of the facility in February 2015.

2. North Maybe Mine
In 2004, an AOC was entered into voluntarily by the Forest Service, EPA, IDEQ and NuWest to perform a SI and EE/CA at North Maybe Mine. The majority of North Maybe Mine lies on National Forest System lands; therefore the Forest Service was designated as the lead agency, with EPA, FWS, the Tribe, and IDEQ as support agencies.

In August 2008, the Forest Service issued an Action Memorandum approving the time-critical removal action at the East Mill dump. The purpose of the removal action was to contain, consolidate and isolate sediments which contain elevated concentrations of selenium. These sediments have accumulated since 1983 when, during construction of the dump, a severe rainstorm caused the dump to fail and waste material to wash down into East Mill Creek. Construction activities associated with the removal action were completed in November 2008.

In 2007, the Forest Service decided to address contamination at the North Maybe Mine under the CERCLA remedial process instead of the CERCLA removal process. The Forest Service initiated negotiations with the PRPs to conduct a RI/FS instead of the SI and EE/CA specified in the 2004 AOC. Negotiations on that transition between the Forest Service and PRPs stalled in August 2009, at which point the Forest Service dropped the requirement for NuWest to complete the SI and EE/CA they agreed to undertake under the 2004 EE/CA AOC. The Forest Service initiated a RI/FS for the North Maybe Mine in 2010. However, NuWest does have continuing obligations under the 2004 AOC, including the performance and maintenance of work on East Mill Creek related to the August 2008 Action Memorandum.

In June 2010, North Maybe Mine was divided into two Operable Units, the West Ridge Operable Unit and the East Mill Operable Unit. A Unilateral Administrative Order (UAO) was issued by the Forest Service for the West Ridge Operable Unit in June 2010. This UAO requires Hunstman Advanced Materials, LLC and Wells Cargo, Inc. to conduct a RI/FS on the West Ridge Operable Unit including the portion of the Mine that lies to the west of the North Maybe Mine pit and includes the West
Mill Dump, Dump 5 North and South, Dump F, the El Paso Dump, Big Draw Dump, and Dumps 6 – 8 (Formation 2011A). In October 2012, an ASAOC was signed by the Forest Service, IDEQ, the Tribes, and Nu-West to finish the RI/FS for the East Mill Operable Unit. The IDEQ, FWS and the Tribes are designated as support agencies under that 2012 ASAOC.

In 2014, the Forest Service signed a Removal Action Memorandum to provide alternative water and feed for horses pastured downstream of the East Mill dump to prevent exposure to contaminated water and forage until a permanent cleanup is implemented. This time-critical removal action was implemented in 2014 by NuWest.

Table 2. Summary of CERCLA activities at the Southeast Idaho Phosphate Mines (adapted from GAO 2012 with updated dates provided, if available, since the release of GAO 2012).

<table>
<thead>
<tr>
<th>Mine Name</th>
<th>Pre-CERCLA Activities</th>
<th>Removal Action Process</th>
<th>Remedial Action Process</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CERCLA Preliminary</td>
<td>Final Site</td>
<td>Final Engineering</td>
</tr>
<tr>
<td>Diamond Gulch</td>
<td>2007/2008</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Dry Valley</td>
<td>2008</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Georgetown Canyon</td>
<td>2008</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Lanes Creek</td>
<td>2008</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Rasmussen Ridge</td>
<td>2002</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>South Rasmussen</td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Wooley Valley</td>
<td>2000</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

1. Dates in parenthesis represent estimates for future milestones.
3. Lanes Creek is currently planned to be mined by Agrium/NuWest and it is anticipated to also be concurrently remediated and reclaimed under agreement with the State of Idaho.
4. The Preliminary Assessment for South Maybe Canyon Mine was focused on the CVF.
3. Conda/Woodall Mountain Mine
In January 2008, an AOC was entered into voluntarily by IDEQ, EPA, BLM, and Simplot to perform a RI/FS at the Conda/Woodall Mountain Mine. IDEQ was designated as the lead agency for this site, with EPA implementing CERCLA at this site under the AOC. The BLM, FWS, and Tribe elected to participate as support agencies, with BLM retaining its CERCLA authority on lands at the site that are subject to BLM’s jurisdiction, custody or control.

On November 1, 2010, IDEQ and EPA approved Simplot’s EE/CA to conduct an early non time-critical removal action at the Pedro Creek ODA. The purpose of this early action is to stabilize the ODA from an erosion and seismic standpoint, and to reduce the release, migration, and risk of selenium and other COPCs from the ODA. The AOC to conduct this early action was signed by all parties in October 2012. Construction of the removal action will be completed in 2014.

4. Ballard, Henry, and Enoch Valley Mines
In 2003 an AOC was entered into voluntarily by the IDEQ, EPA, Forest Service and P4/Monsanto to perform a SI and EE/CA at Ballard, Henry and Enoch Valley Mines. IDEQ was designated as the lead agency for this site, with EPA implementing CERCLA at this site under the AOC. The BLM, Forest Service, FWS, BIA, and Tribe elected to participate as support agencies.

Given the complexity and widespread nature of contamination at the three P4/Monsanto Mines, it was determined by the agencies and P4/Monsanto that a RI/FS would be a better mechanism to address remediation at the Mine. Therefore, in November 2009, an AOC to conduct a RI/FS at Ballard, Henry, and Enoch Valley Mines was signed, which superseded the 2003 AOC. The RI/FS work plan has been finalized, as of May 2011. No interim or early actions have been completed at any of the P4/Monsanto Mines.

5. South Maybe Canyon Mine
In September 1998, the Forest Service entered into a voluntary AOC with NuWest for completion of a SI and EE/CA at South Maybe Canyon Mine. No other agencies were designated as support agencies in the AOC. NuWest conducted the SI and EE/CA under Forest Service oversight until 2009. However, Nu-West and the Forest Service reached an impasse over deficiencies in the EE/CA to address the cross-valley fill. The Forest Service notified Nu-West in December 2009 that it would complete the EE/CA.

In January 2012, an Action Memorandum was signed by the Forest Service for approval of a removal action at South Maybe Canyon Mine. Subsequently, an ASAOC to conduct the non-time-critical removal action was signed in August 2012. The purpose of the removal action is to reduce infiltration into, and isolate surface runoff from, contaminated fill material in the South Maybe Canyon Mine CVF, in order to reduce selenium loading into Maybe Creek (Forest Service 2012). The PRP
began the design for the removal action in 2013. The design was approved in early 2015 and Nuwest began construction of the remedy in June 2015, with completion of the action expected in one to two years. No other CERCLA removal or remedial actions have occurred at the Mine, to date. However, in March 2013 the Forest Service and NuWest entered into an ASAOC for performance of a RI/FS at South Maybe Canyon Mine.

6. Champ Mine
   Effective August 16, 2012, an ASAOC was entered into voluntarily by the Forest Service, IDEQ, the Tribe, and NuWest for performance of a RI/FS at Champ Mine. The Forest Service has been designated as the lead agency, while the FWS and Tribe have elected to participate as support agencies. RI/FS activities at Champ Mine are in the early stages, with field investigations initiated in 2013. As such, no interim or early removal actions have been completed at Champ Mine.

7. Mountain Fuel Mine
   Effective August 16, 2012, an ASAOC was entered into voluntarily by the Forest Service, IDEQ, the Tribe, and NuWest for performance of a RI/FS at Champ Mine. The Forest Service has been designated as the lead agency, while the FWS and Tribe have elected to participate as support agencies. RI/FS activities at Champ Mine are in the early stages, with field investigations initiated in 2013. As such, no interim or early removal actions have been completed at Champ Mine.

8. Georgetown Canyon Mine
   Effective May 9, 2014, a CO/ASAOC was entered in voluntarily by IDEQ, Forest Service, the Tribe, NuWest and CF Industries, Inc. for performance of a RI/FS at Georgetown Canyon Phosphate Mine. The IDEQ has been designated as the lead agency, while the Forest Service will implement CERCLA under this CO/ASAOC for the portion of the Site located on National Forest System land. The FWS and Tribe have elected to participate as support agencies. RI/FS activities at Georgetown Canyon Mine are in the very early stages, with field investigations implemented in spring 2014. As such, no interim or early removal actions have been completed at Georgetown Canyon Mine.

In addition to CERCLA RI/FS work, the IDEQ has entered into Consent Orders at several Mines not undergoing, or otherwise scheduled for RI/FS work, pursuant to the Idaho Environmental Protection and Health Act and the Idaho Hazardous Waste Management Act.

1. Georgetown Canyon Mine-Industrial Site
   IDEQ entered into a Consent Order with NuWest to address historic releases of hazardous waste from the Industrial Site at Georgetown Canyon Mine. To address Site contamination, NuWest agreed to conduct a Site Investigation, including field sampling, and to implement a Remedial Action Plan. Remedial actions were performed at the Industrial Site during 2009 and 2010. These activities were designed to prevent the migration of potentially hazardous materials from the Site and reduce potential exposure routes from hazardous materials to humans and/or
environmental receptors on-site. Major components of the remedial actions included: capping of the slurry pit and the arc furnace and clarifier, removing the remaining phosphate ore from Phosphoria Gulch, and day lighting Georgetown Creek. Additional tasks were implemented to de-water saturated soils near the slurry pit, re-channel the creek in Phosphoria Gulch to prevent over-land flow onto the Site and make improvements to the settling pond. Institutional controls are currently in place on the Site to restrict land use and the site is maintained and monitored under an Operations and Maintenance Plan.

2. South and Central Rasmussen Ridge Mine
The EPA issued two Notice of Violations (NOV) to NuWest in 2005 and 2006 for discharge of selenium-contaminated pond water to the South Fork of Sheep Creek and No Name Creek, respectively. Actions taken thus far to remedy the NOVs include pumping the pond water to the Mine pit to eliminate the surface water pathway. Additionally, NuWest submitted a revised Mine and Reclamation Plan that calls for a portion of an external overburden pile, that is a source of contamination, to be capped with a liner in order to reduce infiltration of water into the pile.

Additionally, IDEQ and NuWest have entered into a Consent Order to address impacts of contaminants to groundwater, including groundwater that is interconnected to surface water. As part of the Consent Order, NuWest developed a Plan to delineate the contaminant plume and determine and investigate source areas. NuWest will also develop a Remedial Action Plan to evaluate alternatives for groundwater to meet applicable groundwater quality standards. Work towards remediating the South and Central Rasmussen Ridge Mine is ongoing.

3. South Rasmussen Mine
In 2007, EPA issued a NOV for P4/Monsanto’s South Rasmussen Mine due to the discharge of pollutants from a seep at the toe of the Horseshoe Dump to the West Fork of Sheep Creek. Selenium concentrations in the discharge were up to 150 times the State’s chronic water quality criterion. In a settlement between EPA and P4/Monsanto, the company agreed to a $1.4 million penalty, along with the implementation of measures to prevent waters containing pollutants from draining into the groundwater, wetlands, and the West Fork of Sheep Creek.

In 2012, IDEQ entered into a Consent Order with P4/Monsanto to implement P4’s responsibilities under the Idaho Ground Water Quality Rule; document the recent steps taken by P4/Monsanto to address ground water quality violations originating at the Horseshoe Dump; and establish procedures to be implemented by P4/Monsanto to remedy any violations of and assure future compliance with the Idaho Ground Water Quality Rule. The Consent Order also required P4/Monsanto to submit a Point of Compliance Application for the South Rasmussen Mine which was issued by IDEQ in 2014. Remedial actions, as outlined in a Remedial Action Plan developed as part of the Consent Order, are ongoing.
Additionally, IDEQ and IDL have exercised statutory authority for mining currently conducted on State Land. Remedial actions will be conducted at the following Mine under agreement with the State of Idaho:

1. Lanes Creek Mine
   In 2014, IDL issued an approved mine plan to Agrium/NuWest to reopen the Lanes Creek Mine. It is the intent of the IDL approved Mine and Reclamation Plan and the pending IDEQ issued groundwater Points of Compliance to have Agrium/NuWest mine, remediate, and reclaim the Lanes Creek Mine site in one activity. This includes the remediation of the impacts created from the 1978-89 mining activity. Mining is anticipated to begin in 2015.

III. PRELIMINARY IDENTIFICATION OF RESOURCES AT RISK

Elevated concentrations from multiple heavy metals and inorganic compounds have been identified at the individual mine sites. Contaminants of potential ecological concern at the individual mine sites include: aluminum, antimony, arsenic, barium, beryllium, boron, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, molybdenum, nickel, selenium, silver, thalium, uranium, vanadium, and zinc. However, selenium is the most significant contaminant (in concentration, extent, and potential toxicity) at the Mine Site.

Across the approximately 17,000 acre area where the individual mine sites occur, there exist four major subbasins that receive surface and ground water flow from the individual mine sites (Figure 3). These include:

1. **Blackfoot River Subbasin**, emanating from its headwaters of Lanes Creek and Diamond Creek, in southeast Idaho, where it flows northwest into the Blackfoot Reservoir, ultimately discharging into the Snake River at the Fort Hall Reservation. Most of the individual mines within the Mine Site occur in the Blackfoot River Subbasin, and consequently drain to the Blackfoot River. One mine, Conda/Woodall Mountain, straddles the ridge between the Blackfoot River Subbasin and the Bear River Subbasin. The east slope of this mine drains into State Land Creek and Pedro Creek prior to their discharging into the Blackfoot River. Abundant data collection (referenced in Section C of this document) has occurred in the last two decades across the Blackfoot River Subbasin by USGS, IDEQ, and in association with ongoing remedial actions at individual mines.

2. **Salt River Subbasin**, flowing west out of the mountains in Wyoming, then north along the Idaho/Wyoming border, continuing its northward meander until its confluence with the Snake River at Palisades Reservoir in Idaho. Smoky Canyon Mine drains into several streams, including Stump Creek and Crow Creek, which are tributaries to the Salt River. Abundant data have been collected in the last decade to characterize the nature and extent of contamination on various media within and downstream of Smoky Canyon Mine.

3. **Bear River Subbasin**, emanating from the Uinta Mountains in northeast Utah, meandering in a northerly direction between Wyoming and Utah, before it turns to the northwest in Idaho, running in a northwest direction until Alexander Reservoir, just outside the town...
of Soda Springs, Idaho, before making a sharp southerly turn where it flows back into Utah until its terminus in the Great Salt Lake. Several mines drain into the Bear River before it crosses into Utah, including Conda/Woodall Mountain, Diamond Gulch, and Georgetown Canyon Mines. Additionally, both the P4/Monsanto Soda Springs Facility and the Agrium/NuWest Conda Phosphate Operations Plant areas drain to the Bear River Subbasin. While data have been collected in conjunction with remedial activities at the Processing Plants and Conda/Woodall Mountain Mine, data gaps exist for Diamond Gulch and Georgetown Canyon mines.

4. Portneuf River Subbasin, emanates in Caribou County, Idaho approximately 25 miles east of Pocatello, Idaho along the eastern side of the Portneuf Range. It initially flows south, passing westward around the southern end of the range, and then turns north to flow between the Portneuf Range to the east and the Bannock Range to the west. It flows northwest through downtown Pocatello and enters the Snake River at the southeast corner of American Falls Reservoir, approximately 10 miles northwest of Pocatello. The Portneuf River is a 124-mile long tributary of the Snake River that begins and ends on the Fort Hall Reservation in southeast Idaho. Limited data collection has occurred in the Portneuf River Subbasin, and data gaps exist related to the impacts of the release of hazardous substances. While the Portneuf River Subbasin is described in the PAS as a major subbasin because of its proximity to the other Subbasins, at this time the geographic scope of the PAS is limited to the Blackfoot River, Salt River, and Bear River Subbasins.

Ultimately, drainage from the Blackfoot River, Salt River, and Portneuf River Subbasins flow into the Snake River. The Snake River is formed in northwest Wyoming, bending to the northwest and entering eastern Idaho at Palisades Reservoir. The Snake River then flows northwest, meeting up with the Henrys Fork of the Snake River, where it makes a turn, flowing slightly southwest, rounding the Fort Hall Indian Reservation, and into American Falls Reservoir before continuing its flow west through southern Idaho.
Figure 3. Individual phosphate mines, major Subbasins, and streams within the Southeast Idaho Phosphate Mine Site
A. Affected Media

Elevated concentrations of selenium have been identified in surface water, ground water, soils, sediments, vegetation, and animal tissue across the extent of the Mine Site (IDEQ 2002; IDEQ 2004). The fate and transport of selenium throughout the Mine Site is influenced by physical, geochemical, and biological processes, and that movement may be most influenced by local hydrologic conditions. Furthermore, biological resources that move throughout the Mine Site distribute contaminants via physiologic mechanisms and trophic-level transfer. Contaminants in biological tissues bioaccumulate through food web (i.e., trophic-level) transfer as organisms higher in the food web consume organisms occupying niches lower in the food web. As a result, aquatic and wetland habitats (and any associated organisms), including those areas seasonally or intermittently inundated, are contaminated as a result of selenium releases, subsequent transport, or remobilization. In addition, upland areas including soil, vegetation, and terrestrial organisms are also contaminated as a result of historic reclamation practices.

B. Preliminary Identification of Pathways of Exposure

Numerous natural resources, including surface water, ground water, sediments, vegetation, and animal tissues, have accumulated elevated selenium concentrations as a result of releases from identified upstream mines and ore processing facilities, and these releases have occurred through various pathways. Upstream sources have discharged in the past, and in most cases, continue to discharge selenium into the Blackfoot, Salt, Bear, and Portneuf River Subbasins. Infiltration of water through waste rock dumps and pits has resulted in mobilization of selenium into the surface and ground water, as well as accumulation in sediments and vegetation both on-site and in downstream locations that are influenced by the surface and ground water flowing through the individual mine sites. Erosion from waste rock dumps to surface soils also contributes to the transport of selenium.

Due to the open spaces and accompanying air currents, wind erosion and subsequent deposition also serves as a mechanism of chemical transport at the Mine Site (IDEQ 2002). Wind erosion of surface soils may transport and deposit selenium contaminated soils some distance from its source, dependent on wind speed and other factors. These wind deposited soils may be directly taken up by vegetation, may be deposited in aquatic or riparian systems, and/or may be incidentally ingested by wildlife feeding in the depositional areas.

Precipitation can infiltrate through waste rock dumps or mine pits and carry contaminants into groundwater, or directly to surface water through seeps, springs, or French drains in the waste rock dumps. Infiltration is one of the major transport mechanisms at the Mine Site (IDEQ 2002). Runoff from spring snowmelt and storm events is also a significant transport mechanism for selenium contamination. This surface flow has the potential to move contaminated material from the waste rock dumps into local streams and ponds or onto adjacent terrestrial areas. Contaminated materials (from both soils and water) that enter local streams or surface waters are transported downstream. Terrestrial and aquatic wildlife are subsequently exposed to these contaminants through direct contact, feeding, and breeding.

Similarly, uptake of selenium in soil placed as caps on waste rock dumps, and vegetation growing in that soil, also provides an exposure pathway to wildlife. Grazing animals
foraging on that vegetation, as well as small animals and birds feeding or living on those waste rock dumps may be exposed either through direct or incidental ingestion when foraging.

Aquatic organisms at the Mine Sites depend on habitats within rivers and creeks where surface water and sediment are contaminated with selenium. Macroinvertebrates and some species of fish (particularly at early life-stages) are closely associated with sediments, and depend on interstitial spaces within sediments for feeding, spawning, and cover from predators. Organisms that depend on the water-sediment interface may be exposed to contaminants, and accumulate contaminants in tissues through dermal and/or dietary exposure. Dermal exposure from water and sediment is facilitated through diffusion, active transport pumps at the gill, or through adsorption. Dietary exposure occurs from intentional consumption of water and contaminated prey, and from incidental ingestion of sediment while foraging (Rand and Petrocelli 1985). Macroinvertebrates further provide dietary exposure to higher trophic-level organisms, as they provide a food resource for many species of fish and aquatic-dependent wildlife (e.g., insectivorous birds). Fish also provide a food resource for piscivorous wildlife and humans. Piscivorous birds and mammals (e.g., osprey and mink) feed on resident fish species, and other species (e.g., bald eagles) may scavenge carcasses of fish. As a result, piscivorous birds and mammals may be exposed to contaminants from the consumption of aquatic prey (i.e., macroinvertebrates and fish).

C. Documentation of Exposed Resources and Potential Adverse Effects

This section describes the natural resources at the Mine Site for which currently available data demonstrate that exposure to hazardous substances has occurred, or is likely occurring. This section is not intended to be a complete inventory of potential exposures or injuries occurring in the system.

Hazardous substances, most notably selenium, have been documented in surface water, ground water, soils, sediment, vegetation, and animal tissues within the Mine Site over the past decade, and continue to be documented in current studies (Montgomery Watson 1999; Ratti et al. 2002; Skorupa et al. 2002; Kuck 2003; Vasterling 2003; Hamilton and Buhl 2004; Presser 2004; Hamilton and Buhl 2005; Van Kirk and Hill 2007).

Exposures and potential adverse impacts to natural resources include, but are not limited to:

- Exceedances of State criteria for the protection of aquatic life.
- Fish consumption advisory based on selenium concentrations (IDHW 2006).
- Elk liver consumption advisory based on selenium concentrations (IDHW 2006).
- Impacts to fish from aqueous and dietary exposures.
- Effects to wildlife that depend on aquatic prey or forage within the Mine Site boundary.

Further information on contaminant concentrations and exposures with potential effects to trust resources are presented below by specific media. Data are not available for all media at all individual mine sites. Therefore, the data presented will be focused on those sites where CERCLA investigations are ongoing, as those sites are more likely to have recent data that has been validated.
**Surface Water**

Elevated selenium concentrations in surface water have resulted in the listing of the Blackfoot River Subbasin from its headwaters, downstream to the Blackfoot Reservoir, on the Idaho 2010 Integrated Report (formerly the CWA 303(d) list) as water quality impaired due to selenium (IDEQ 2011). This listing indicates that portions of the Blackfoot River do not meet applicable water quality standards for one or more beneficial uses due to selenium. Tributary streams to the Blackfoot River also listed include: State Land Creek, Goodheart Creek, Dry Valley Creek, Chicken Creek, Maybe Creek, Mill Creek, Spring Creek, upper, middle, and lower Sheep Creek, and Rasmussen Creek. Four tributary streams to the Salt River are included in the 2010 Integrated Report due to selenium concentrations. These streams include: Pole Canyon Creek, North Fork Sage Creek, South Fork Sage Creek, and the confluence of Sage Creek with North Fork Sage Creek to its mouth.

Idaho’s surface water criteria for the protection of aquatic life are 0.005 mg/L (chronic) and 0.02 mg/L (acute; IDAPA 58.01.02). Sampling conducted by IDEQ in 2007 indicated selenium concentrations from multiple sampling locations on the Blackfoot River ranging from 0.005 to 0.007 mg/L during May sampling events (IDEQ 2007B). A comparison of selenium concentrations between 2004 and 2007 indicated a slight trend in increased selenium concentrations at those same Blackfoot River sampling locations (Figure 4; IDEQ 2007B). As part of the CERCLA site investigation at P4/Monsanto’s mine sites, additional sampling of the Blackfoot River was conducted between May 2004 and September 2009. Concentrations varied at all sampling locations between years but ranged between >0.001 mg/L to 0.009 mg/L selenium (MWH 2011).

Both the acute and chronic Idaho surface water criteria have been exceeded at multiple tributary streams to the Blackfoot River, across the subbasin. For example, selenium surface water concentrations in E. Mill Creek were over 800 times above (i.e., 4.07 mg/L) the chronic criterion during sampling in 2005 (HWS 2008), and surface water downstream of the South Maybe Canyon CVF in Maybe Creek increased during 10 years of monitoring from 0.71 mg/L selenium in 1997 to 3.14 mg/L in 2008 (Forest Service 2012). Selenium concentrations in E. Mill Creek and Maybe Creek are the two biggest contributors to surface water selenium loading in the Blackfoot River. Data from other phosphate mine-influenced tributary drainages also indicate selenium concentrations above Idaho surface water criteria, but to a lesser extent than E. Mill and Maybe Creeks. Sampling by USGS in 2000 also indicated elevated selenium concentrations in water at eight locations along the Blackfoot River (Hamilton and Buhl 2004). That same study reported a hazard assessment of selenium in the aquatic environment to be moderate at Trail Creek, upper and lower Slug Creek, and lower Blackfoot River, and a high hazard at Angus Creek, upper and lower East Mill Creek, and Dry Valley Creek, with selenium concentrations sufficiently elevated in several ecosystem components to cause adverse effects to aquatic resources in the Blackfoot River Subbasin (Hamilton and Buhl 2004). Table 3 below summarizes data available for selenium concentrations for the Blackfoot River Subbasin, including its tributary streams, where exceedences of Idaho’s surface water criteria for the protection of aquatic life have been documented.
The surface expression of ground water at seep locations also contribute to selenium loading into the subbasin, representing high concentration and low flow conditions. For example, selenium concentrations as high as 25 mg/L (i.e., 5000 times the Idaho surface water chronic criterion) have been reported in seeps emanating from overburden disposal areas at Smoky Canyon Mine (Newfields 2009).

Elevated selenium concentrations in surface water have resulted in livestock mortality or poisoning events across the Mine Site. For example, in 1996, six horses pastured 1.5 miles downstream of the South Maybe Canyon CVF developed selenosis from chronic exposure to contaminated water in Maybe Creek; five of those horses were euthanized because it was unlikely the horses would recover from the exposure (USDA 2012).

**Ground Water**
Idaho has established a drinking water maximum contaminant level for selenium of 0.05 mg/L (IDAPA 58.01.11). Idaho’s ground water regulation allows temporary on-site ground water impacts during the period of active mineral extraction, but requires compliance upon completion of mining operations. The regulations also contain an antidegradation policy which calls for the protection of existing and designated uses of surface waters (IDEQ 2004).

In the Southeast Idaho Phosphate region, groundwater is generally classified into three flow systems (local, intermediate, and regional; Ralston et al., 1977). In the local systems, the groundwater recharge areas are often adjacent to the discharge area. Because the shallow groundwater system often directly underlies the external waste dumps, the underlying alluvial system is most likely to be impacted by seepage from the waste rock dumps, and may provide the most direct link to potential receptors when the groundwater emerges as surface water. Exposure to ecological receptors could be through spring flow, discharge to nearby creeks, water supply wells, or potential vegetative uptake. On a regional scale, the Idaho Department of Health and Welfare (IDHW) conducted limited testing of private wells within the Mine Site (7 wells) for selenium contamination. Results from the sampling effort led the IDHW to conclude that there is no apparent public health hazard from drinking or using ground water from the Mine Site (IDHW 2006). However, localized ground water studies to characterize and delineate conditions near individual mine sites were deferred to the site-specific selenium investigations. Elevated concentrations of selenium have exceeded Idaho’s groundwater criteria at some individual mine sites where mining operations have ceased (Table 4).
Figure 4. Selenium concentrations documented in surface water (SW) samples collected across the Mine Site, 2003 - 2007 (Adapted from IDEQ 2007B).
Table 3. Examples of Southeast Idaho Phosphate surface water selenium concentrations exceeding the Idaho selenium surface water chronic criterion for the protection of aquatic life. Concentrations presented represent those sampling locations where selenium concentrations were the most elevated.

<table>
<thead>
<tr>
<th>Sampling Location</th>
<th>Associated Mine Site</th>
<th>Se Concentration (mg/L)²</th>
<th>Sampling Date</th>
<th>Reference</th>
</tr>
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<tbody>
<tr>
<td>Blackfoot River¹</td>
<td>NA</td>
<td>0.005 - 0.007</td>
<td>May 2007</td>
<td>IDEQ 2011</td>
</tr>
<tr>
<td>Blackfoot River (MST 027)</td>
<td>NA</td>
<td>0.009</td>
<td>May 2007</td>
<td>MWH 2011</td>
</tr>
<tr>
<td>Blackfoot River (USGS Henry Gauge)</td>
<td>NA</td>
<td>0.0114</td>
<td>May 2009</td>
<td><a href="http://nwis.waterdata.usgs.gov/nwis">http://nwis.waterdata.usgs.gov/nwis</a></td>
</tr>
<tr>
<td>East Mill Creek (upper sediment control pond)</td>
<td>North Maybe</td>
<td>4.07</td>
<td>April 2005</td>
<td>HWS 2008</td>
</tr>
<tr>
<td>Maybe Creek (CVF toe)</td>
<td>South Maybe Canyon</td>
<td>3.14</td>
<td>May 2008</td>
<td>Forest Service 2012</td>
</tr>
<tr>
<td>Ballard Creek (MST 067)</td>
<td>Ballard</td>
<td>0.867</td>
<td>May 2009</td>
<td>MWH 2011</td>
</tr>
<tr>
<td>Henry Creek Tributary (MST 280)³</td>
<td>Henry</td>
<td>0.29</td>
<td>May 2008</td>
<td>MWH 2011</td>
</tr>
<tr>
<td>Rasmussen Creek Tributary (MST 144)</td>
<td>Enoch Valley</td>
<td>0.21</td>
<td>May 2008</td>
<td>MWH 2011</td>
</tr>
<tr>
<td>Pedro Creek (NES 5)</td>
<td>Conda</td>
<td>6.89</td>
<td>May 2009</td>
<td>Formation 2010</td>
</tr>
<tr>
<td>South Rasmussen (SRDSS-6)</td>
<td>Rasmussen Ridge</td>
<td>3.66</td>
<td>April 2010</td>
<td>TRC 2010</td>
</tr>
<tr>
<td>Sheep Creek (E8)</td>
<td>South Rasmussen</td>
<td>0.75</td>
<td>May 2005</td>
<td>EPA 2007</td>
</tr>
<tr>
<td>GHC-01</td>
<td>Champ</td>
<td>1.59</td>
<td>May 2009</td>
<td>CH2MHILL 2012A</td>
</tr>
<tr>
<td>MFPD-19</td>
<td>Mountain Fuel</td>
<td>1.46</td>
<td>May 2009</td>
<td>CH2MHILL 2012B</td>
</tr>
<tr>
<td>LCM-4</td>
<td>Lanes Creek</td>
<td>0.204</td>
<td>May 2003</td>
<td>TechLaw, Inc. 2008A</td>
</tr>
<tr>
<td>Unit 4 (U4-WR5-05-P)</td>
<td>Wooley Valley</td>
<td>0.62</td>
<td>April 2012</td>
<td>CH2MHILL 2013</td>
</tr>
<tr>
<td>Drainage/Side Tributary (DRN-3)</td>
<td>Georgetown Canyon</td>
<td>0.16</td>
<td>May 2012</td>
<td>Williams 2013</td>
</tr>
</tbody>
</table>

¹ Sampling conducted at multiple locations between Blackfoot River headwaters and Blackfoot Reservoir.
² Idaho’s surface water criterion for the protection of aquatic life is 0.005 mg/L (chronic) and 0.02 mg/L (acute).
³ Henry Creek is tributary to the Little Blackfoot River, which flows directly into the Blackfoot Reservoir.
Table 4. Examples of Southeast Idaho Phosphate ground water selenium concentrations exceeding Idaho’s selenium criterion for the protection of ground water. Concentrations presented represent those sampling locations where selenium concentrations were the most elevated.

<table>
<thead>
<tr>
<th>Well Identification</th>
<th>Associated Mine Site</th>
<th>Se Concentration (mg/L)</th>
<th>Sampling Date</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monitoring Well MW16A</td>
<td>Ballard</td>
<td>1.81</td>
<td>June 2009</td>
<td>MWH 2011</td>
</tr>
<tr>
<td>Monitoring Well MW010</td>
<td>Henry</td>
<td>0.1</td>
<td>May 2008</td>
<td>MWH 2011</td>
</tr>
<tr>
<td>Monitoring Well MMW035</td>
<td>Enoch Valley</td>
<td>0.772</td>
<td>NA²</td>
<td>MWH 2011</td>
</tr>
<tr>
<td>GW-16 (Pole Canyon)</td>
<td>Smoky Canyon</td>
<td>0.845</td>
<td>Sept 2011</td>
<td>Formation 2013</td>
</tr>
<tr>
<td>GW-22 (Shield and Jouglard Canyons Sub-Basin)</td>
<td>Conda</td>
<td>12</td>
<td>May 2009</td>
<td>Formation 2010</td>
</tr>
<tr>
<td>MW-103C</td>
<td>North Maybe E. Mill OU</td>
<td>3.4</td>
<td>Sept 2012</td>
<td>Ecology and Environment 2013</td>
</tr>
<tr>
<td>MW-601-C</td>
<td>North Maybe W. Ridge OU</td>
<td>0.896</td>
<td>June 2011</td>
<td>Formation 2012B</td>
</tr>
<tr>
<td>Shallow Well (GW-8s)</td>
<td>Dry Valley</td>
<td>0.144</td>
<td>May 2006</td>
<td>TechLaw 2008B</td>
</tr>
<tr>
<td>MC-1</td>
<td>South Maybe Canyon</td>
<td>2.56</td>
<td>2006</td>
<td>Forest Service 2012</td>
</tr>
<tr>
<td>PZ-2</td>
<td>Rasmussen Ridge</td>
<td>1.55</td>
<td>May 2010</td>
<td>TRC 2010</td>
</tr>
<tr>
<td>South Fence Line Well (TW-39)</td>
<td>P₄/Monsanto Processing Facility</td>
<td>0.489</td>
<td>May 2011</td>
<td>Golder Associates 2012</td>
</tr>
</tbody>
</table>

¹ Idaho’s criteria for protection of ground water quality is 0.05 mg/L.
² Sampling date not available.

Sediment
Discharges of selenium from individual mine sites have contributed to sediment contamination across the Mine Site. The discharge of selenium to sediments has resulted from surface water transport of selenium, as well as deposition of dissolved or selenium-contaminated suspended particulates into the sediment from upland soils (due to erosion or mine dump failures).

EPA has established a screening benchmark value for selenium concentrations in sediments of 2.0 mg/kg dry weight (dw). This benchmark is used to determine whether selenium concentrations in sediment are considered ecological contaminants of potential concern (ECOPCs), warranting further assessment. If sediment selenium concentrations exceed 2.0 mg/kg, further analysis is needed to determine the hazards posed by selenium.

EPA’s screening benchmark was developed in part from research by Lemly (2002) whereby an assessment of selenium in aquatic ecosystems was conducted. In addition to EPA
screening guidance, reviews of other studies conducted on biological effects of exposure to selenium-contaminated sediments concluded that selenium is a reliable predictor of adverse biological effects and that a preliminary toxic threshold exists at 2.5 mg/kg. This review also reported that adverse effects were always observed at selenium concentrations greater than 4.0 mg/kg in sediments (Van Derveer and Canton 1997, cited in NIWQP 1998).

Additionally, IDEQ has established removal action levels for selenium in sediments. In regulated areas (sediments supporting aquatic life), IDEQ established a removal action level of 2.6 mg/kg, dw (IDEQ 2004). These levels were established based on published benchmarks for aquatic life effects or maximum background concentrations reported from an Area-Wide investigation of the southeast Idaho phosphate mining area. In non-regulated areas (those areas not supporting aquatic life), the IDEQ removal action level is 7.5 mg/kg, dw. This level was established for the protection of terrestrial receptors and is based on subpopulation risks in impacted areas from avian/terrestrial incidental ingestion.

In work conducted across the Mine Site, Hamilton and Buhl (2004) reported selenium sediment concentrations from multiple locations in the Blackfoot River Subbasin (including Slug Creek, Sheep Creek, Trail Creek, Angus Creek, and the lower Blackfoot River) ranging from 1.0 to 1.8 mg/kg. These values are between 2 and almost 4 times higher than the value (0.5 mg/kg) Moore et al. (1990) and Presser et al. (1994) used to represent the threshold between uncontaminated (background) concentrations and impacted sediments with elevated selenium concentrations.

Additionally, several of the ongoing CERCLA remedial investigations at the individual mine sites have reported elevated selenium concentrations ranging from 2.6 to 1300 mg/kg dw in sediments throughout the Mine Site (Table 5). In general, sediment selenium concentrations are higher in the upper reaches of the Mine Site (i.e., closer to the sources) and decrease downstream. For aquatic invertebrates and vertebrates, the primary selenium exposure pathway includes direct contact with, and incidental ingestion of, sediment.

Additionally, samples collected from E. Mill Creek contained selenium concentrations of 39 mg/kg dw; concentrations that are almost 20 times EPA’s screening benchmark for selenium in sediments, and 15 times above IDEQ’s sediment removal action level. Hamilton and Buhl (2004) also identified a significant correlation of Blackfoot River drainage selenium concentrations in sediment and water, sediment and aquatic plants, and sediment and macroinvertebrates suggesting that selenium moves among aquatic ecosystem component and accumulates in the food web.
Table 5. Measured total recoverable selenium sediment concentrations (mg/kg dw) at individual phosphate mine sites in Southeast Idaho. Concentrations presented represent those sampling locations where selenium concentrations were the most elevated.

<table>
<thead>
<tr>
<th>Sample Location</th>
<th>Associated Mine Site</th>
<th>Se Concentration (mg/kg)</th>
<th>Sampling Date</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Camp G Creek Sub-Basin</td>
<td>Conda</td>
<td>739</td>
<td>May 2009</td>
<td>Formation 2010</td>
</tr>
<tr>
<td>Dump Seep (MDS032)</td>
<td>Ballard</td>
<td>1300</td>
<td>May 2004</td>
<td>MWH 2011</td>
</tr>
<tr>
<td>Dump Seep (MDS026)</td>
<td>Enoch Valley</td>
<td>550</td>
<td>May 2004</td>
<td>MWH 2011</td>
</tr>
<tr>
<td>Pond (MSP055)</td>
<td>Henry</td>
<td>148</td>
<td>May 2004</td>
<td>MWH 2011</td>
</tr>
<tr>
<td>Pole Canyon (Downgradient of DP-7)</td>
<td>Smoky Canyon</td>
<td>65.9</td>
<td>November 2011</td>
<td>Formation 2012A</td>
</tr>
<tr>
<td>Stock Pond (West Ridge)</td>
<td>North Maybe</td>
<td>477</td>
<td>September 2011</td>
<td>Formation 2012B</td>
</tr>
<tr>
<td>Lower Pond</td>
<td>South Maybe Canyon</td>
<td>829</td>
<td>Sept 1998</td>
<td>TRC 1999</td>
</tr>
<tr>
<td>Slug Creek - Below Goodheart Creek</td>
<td>Champ and Mountain Fuel</td>
<td>2.6</td>
<td>Sept 1998</td>
<td>Montgomery Watson 1999</td>
</tr>
</tbody>
</table>

1. Idaho’s removal action level for selenium in sediments supporting aquatic life is 2.6 mg/kg, dw. EPA’s selenium sediment screening benchmark for ECOPC’s is 2.0 mg/kg.

**Upland Soils and Vegetation**

Soil and vegetation types across the Mine Site vary depending on topography. Soil depths can range from less than three inches in the mountains to greater than ten feet in the valleys. Vegetation communities across the Mine Site are mainly comprised of sagebrush/steppe, grass/forb, and aspen/Douglas fir communities.

Mean background concentrations of selenium in soils of the western United States are 0.05 mg/kg with a range in concentrations reported to be 0.006 – 80 mg/kg (Schacklette and Boerngen 1984, Hem 1989). While there are no promulgated standards for selenium concentrations in soils, EPA identified an ecological soil screening level (Eco-SSL) of 0.52 mg/kg selenium in soils (EPA 2005). The Eco-SSL is representative of concentrations of selenium in soil that is protective of ecological receptors that commonly come into contact with soil or ingest biota that live in or on soil. The intent of Eco-SSLs is to screen soil selenium concentrations to determine if additional ecological risk assessment evaluation is warranted. Table 6 shows data from 10 sites where selenium sediment concentrations have exceeded EPA Eco-SSLs by as much as 600-fold.

Additionally, IDEQ has established removal action levels for selenium in soils and vegetation (IDEQ 2004). This soil removal action level of 5.2 mg/kg, dw is based on incidental ingestion by sensitive species in riparian zones and wetland areas, because they are considered the most productive ecological habitat in the Mine Site, and have the highest potential for exposure to sensitive receptors. The IDEQ selenium removal action level for soil was developed based on published soil benchmarks or maximum background concentrations reported from an Area-Wide investigation of the southeast Idaho phosphate mining area. The IDEQ also developed a vegetation removal action level of 5.0 mg/kg, dw,
based on a reclamation goal for unrestricted grazing use upon completion of mining activities (IDEQ 2004). The vegetation removal action level is based on subpopulation risks to avian and terrestrial receptors based on ingestion of forage or maximum background concentrations reported from an Area-Wide investigation of the southeast Idaho phosphate mining area.

Selenium is, in general, less toxic to plants than it is to wildlife, and as a primary producer, vegetation is the foundation for most food chains supporting fish and wildlife populations. However, vegetation is known to accumulate selenium, occasionally in highly elevated concentrations, which may pose a risk to wildlife that forage on that vegetation. Data compiled by BLM estimate that in the last 16 years, over 1200 head of livestock have died from selenium poisoning across the Mine Site. These mortality events have been associated with cattle, sheep, and horses grazing on vegetation with elevated selenium concentrations. Vegetation types that tend to accumulate selenium in the highest concentrations are referred to as selenium “hyperaccumulators”; plants that absorb selenium in greater concentrations than that in the soil in which it is growing. Most of the livestock mortality events across the Mine Site have been caused by the consumption of plants in the genus Aster. Aster sp. have been documented to accumulate up to 10,000 ppm dw selenium (Davis et al. 2012). Concentrations greater than 400 ppm have been associated with acute selenosis poisoning in livestock, while concentrations of between 5 - 150 ppm in the diet for several weeks or months may result in sub-chronic (i.e., an exposure period longer than acute but less than a life-long exposure) poisoning. For perspective, plants containing selenium in concentrations of 3000 ppm may be lethally toxic to cattle if consumed in amounts of less than 0.5 kg (Davis et al. 2012).

Since 1996, livestock mortality events have been documented at the South Maybe, Conda/Woodall Mountain, Wooley Valley, Georgetown Canyon, Lanes Creek, and Henry mine sites. The most recent event occurred in October 2012, when sheep were grazed on P4/Monsanto’s South Henry Mine without authorization from the company. Ninety-five sheep died over an approximately 48-hour period after consuming western aster (Symphyotrichum ascendens) that was growing in the pit of the South Henry Mine. Following tissue analysis by the USDA Poisonous Plant Research Lab, it was confirmed that the 2012 sheep mortality event resulted from acute selenium poisoning. Vegetation samples were collected from the location where the sheep were grazing, and analyzed for selenium. Concentrations varied depending on the vegetation type, but averaged 263 mg/kg dw, with one Aster sp. sample containing 2454 mg/kg dw selenium (P4 Production, LLC 2013).

Alfalfa (Medicago sativa) is also a hyperaccumulator and may be exposed as a result of its deep-rooted nature. While the minimum root depth is approximately two feet, it is not uncommon for the roots to extend as deep as 15 feet. When alfalfa grows over reclaimed overburden or waste rock piles that have been capped with soil, its roots may penetrate the cap, allowing for uptake of selenium that has leached from the waste rock. Other individual mines across the Mine Site have reported elevated selenium concentrations in vegetation samples collected. Table 7 shows data from seven sites where selenium concentrations in vegetation samples exceed the State of Idaho Removal Action Level (5.0 mg/kg), in some cases by a factor of 200.
Table 6. Measured selenium surface soil concentrations (mg/kg dw) at individual phosphate mine sites in Southeast Idaho. Concentrations presented represent those sampling locations where selenium concentrations were the most elevated.

<table>
<thead>
<tr>
<th>Sample Location</th>
<th>Associated Mine Site</th>
<th>Se Concentration (mg/kg)¹</th>
<th>Sampling Date</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCO-17 (Pedro Creek Sub-Basin)</td>
<td>Conda</td>
<td>120</td>
<td>Aug 2009</td>
<td>Formation 2010</td>
</tr>
<tr>
<td>MWD080 (Waste Rock Dump)</td>
<td>Ballard</td>
<td>209</td>
<td>June 2009</td>
<td>MWH 2011</td>
</tr>
<tr>
<td>MWD091N (Waste Rock Dump)</td>
<td>Enoch Valley</td>
<td>128</td>
<td>June 2009</td>
<td>MWH 2011</td>
</tr>
<tr>
<td>MWD 090 (Waste Rock Dump)</td>
<td>Henry</td>
<td>318</td>
<td>June 2009</td>
<td>MWH 2011</td>
</tr>
<tr>
<td>LPSV-01 (Seep Area)</td>
<td>Smoky Canyon</td>
<td>53</td>
<td>Aug 2011</td>
<td>Formation 2012A</td>
</tr>
<tr>
<td>IA-6 ODA (West Ridge)</td>
<td>North Maybe</td>
<td>201</td>
<td>2011</td>
<td>Formation 2012B</td>
</tr>
<tr>
<td>TR7-3</td>
<td>South Maybe Canyon</td>
<td>279</td>
<td>Sept 1998</td>
<td>TRC 1999</td>
</tr>
<tr>
<td>SLVG-05</td>
<td>Lanes Creek</td>
<td>38.1</td>
<td>Sept 2003</td>
<td>TechLaw, Inc. 2008A</td>
</tr>
<tr>
<td>DGBLM-020</td>
<td>Diamond Gulch</td>
<td>57.4</td>
<td>June 2000</td>
<td>IDEQ 2007A</td>
</tr>
</tbody>
</table>

¹ Idaho’s removal action level for selenium in soils and vegetation is 5.2 mg/kg, dw. EPA’s selenium Eco-SSL is 0.52 mg/kg.
² Sample taken using XRF.

Table 7. Measured selenium vegetation concentrations (mg/kg dw) at individual phosphate mine sites in Southeast Idaho. Concentrations presented represent those sampling locations where selenium concentrations were the most elevated.

<table>
<thead>
<tr>
<th>Sample Location</th>
<th>Associated Mine Site</th>
<th>Se Concentration (mg/kg)¹-Veg Type</th>
<th>Sampling Date</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>ST10-05 (Shield/Jouglard Canyon Sub-Basins)</td>
<td>Conda</td>
<td>170 – Not Defined</td>
<td>Aug 2009</td>
<td>Formation 2010</td>
</tr>
<tr>
<td>MMP035 (Mine Pit)</td>
<td>Ballard</td>
<td>1010 - Forbes</td>
<td>Aug 2009</td>
<td>MWH 2011</td>
</tr>
<tr>
<td>MWD087 (Mine Pit)</td>
<td>Henry</td>
<td>146 – Grasses and Forbes</td>
<td>June 2009</td>
<td>MWH 2011</td>
</tr>
<tr>
<td>LPSV-01 (Seep Area)</td>
<td>Smoky Canyon</td>
<td>164 – Forbes</td>
<td>Aug 2011</td>
<td>Formation 2012B</td>
</tr>
<tr>
<td>IA-6 ODA (West Ridge)</td>
<td>North Maybe</td>
<td>286 – Broadleafs 18.7 – Woody Species</td>
<td>2011</td>
<td>Formation 2012B</td>
</tr>
<tr>
<td>TR3-3</td>
<td>South Maybe Canyon</td>
<td>185 – Forbes 160 – Grass</td>
<td>Sept 1998</td>
<td>TRC 1999</td>
</tr>
</tbody>
</table>

¹ Idaho’s selenium removal action level in impacted and reclaimed vegetation is 5.0 mg/kg.
Aquatic Wildlife

Fish and Macroinvertebrates

The fishery resource within the Mine Site provides recreational, ecological, and cultural services. Fish are among the most sensitive group of organisms to chronic selenium exposure (Coyle et al. 1993). Across the Mine Site, elevated selenium has been measured in resident fish tissue for nearly the last 15 years. Fish within the Mine Site have been exposed to and have accumulated selenium above threshold effects levels documented in the literature (Goettl and Davies 1978, Hilton et al. 1980, NIWQP 1998, Lemly 1996).

Macroinvertebrates comprise a large portion of an aquatic ecosystem’s biomass and form trophic links within the food web. They also play a significant role in nutrient cycling and transfer within aquatic media. Macroinvertebrates depend on uncontaminated sediments for completion of key life-cycle requirements. Macroinvertebrates have typically only been considered dietary sources of selenium to higher trophic levels (Janz et al. 2010); however, exposure to contaminated sediments may impact the invertebrate communities and limit growth, biomass, habitat range, reproduction, and disrupt ecological function. A reduction in biomass from contaminated water and sediments may result in an inadequate prey base for other organisms (e.g., fish) that depend on them as a food resource. Macroinvertebrates also may accumulate contaminants from sediments and may transfer contaminants to higher organisms through a dietary pathway. This pathway is the primary mechanism by which selenium contaminates both the aquatic and terrestrial food webs. Furthermore, macroinvertebrate taxa display a wide range of sensitivities to disturbances (i.e. contaminants), making them a useful class of organisms to quantify impacts through community structural indices.

USGS conducted sampling in September 2000 at nine locations in the Blackfoot River Subbasin. Geometric mean selenium concentrations in fish ranged from 2.7 mg/kg dw in speckled dace (*Rhinichthys osculus*) sampled from Sheep Creek to 52.3 mg/kg dw in cutthroat trout (*Oncorhynchus clarkii bouvieri*) sampled from East Mill Creek (Hamilton and Buhl 2004). Results from historical sampling along the Blackfoot River indicate a trend of increased selenium concentrations in both salmonids and forage fish between the years 1999 to 2004, with selenium concentrations in salmonids measured at up to 9.7 mg/kg dw, and selenium concentrations in forage fish as high as 15 mg/kg dw (MWH 2011). These studies, as well as others (Piper et al. 2000; Hamilton et al. 2002), suggest that selenium concentrations in fish collected from the Blackfoot River Subbasin may be sufficient to cause adverse effects in sensitive fish species.

In addition to the USGS sampling described above, sampling of fish and macroinvertebrates has been conducted at several individual mines across the Mine Site in association with ongoing CERCLA activities. In 1998, a Regional Investigation was conducted to evaluate selenium concentrations on multiple receptors. Reported fish tissue selenium concentrations ranged as high as 7.9 mg/kg wet weight (ww) in fish collected from East Mill Creek (Montgomery Watson 1999). Limited macroinvertebrate sampling (four samples) also was conducted, with a maximum selenium concentration of 10.6 mg/kg reported (Ecology and
Environment 2011). Additionally, Hamilton and Buhl (2004) reported macroinvertebrate concentrations in lower Blackfoot River and Angus Creek (6.7 – 7.7 mg/kg dw), Dry Valley Creek (12.8 mg/kg dw) and East Mill Creek (27 – 75 mg/kg dw).

Sampling conducted in 2009 at Conda/Woodall Mountain Mine revealed elevated selenium concentrations in fish tissue (Formation Environmental 2010). Reported concentrations in speckled dace collected from the Camp G Creek drainage at Conda/Woodall Mountain ranged up to 10.4 mg/kg dw in whole-body samples, with aquatic invertebrate tissue from the same location containing 65.2 mg/kg dw. Aquatic invertebrate tissue from the French drain area of Conda contained up to 429 mg/kg dw selenium; however, no fish were collected from that area. The Pedro Creek drainage consistently has the most elevated selenium concentrations in media sampled across the Conda/Woodall Mountain Mine. Selenium concentrations in speckled dace whole-body tissue samples from Pedro Creek ranged between 20.3 – 36.4 mg/kg dw, with selenium concentrations in co-located aquatic invertebrates measured at 36.1 mg/kg dw. Fish tissue selenium concentrations from fish collected from State Land Creek were similarly elevated, with whole-body concentrations in redside shiner, speckled dace, and Utah sucker ranging between 11.8 – 33.5 mg/kg dw.

At the P4/Monsanto mines, fish and macroinvertebrate sampling was conducted at the Ballard and Henry Mines in 2004. While no fish were sampled at Ballard Mine, macroinvertebrates that were sampled from 10 sampling stations had selenium concentrations ranging from 17 – 313 mg/kg dw (MWH 2011). Whereas macroinvertebrates sampled at Henry Mine had selenium concentrations much lower, ranging from 2.9 – 6.2 mg/kg dw. Additionally, though no salmonids were sampled at Henry Mine, forage fish that were sampled had whole-body selenium concentrations ranging from 2.4 – 6.1 mg/kg dw (MWH 2011). Sampling of fish and macroinvertebrates at Enoch Valley Mine occurred in 1999, 2000, and 2004. Forage fish and salmonids were sampled at six sampling stations, with reported whole body selenium concentrations ranging from 3.4 – 15 mg/kg dw and 1.2 – 6.7 mg/kg dw, respectively (MWH 2011). Macroinvertebrates were sampled at 13 sampling stations, with reported selenium concentrations ranging from 3.4 – 18 mg/kg dw (MWH 2011).

In 2004 aquatic biota sampling was conducted at streams and springs influenced by Smoky Canyon Mine. Whole body fish tissue and macroinvertebrate samples were analyzed and reported on a ww basis. Future fish and macroinvertebrate tissue sample results at Smoky Canyon Mine were reported on a dw basis. For simplicity, the 2004 data are presented here on a ww basis, with the calculated dw following (assuming 75 % moisture content). Selenium concentrations from brown trout and sculpin collected in 2004 from Hoopes Springs and Sage Creek were the most elevated compared to other sampling locations with concentrations ranging from 3.4 – 7.4 mg/kg ww (13.6 – 29.6 mg/kg dw) and 3.7 – 5.8 mg/kg, ww (14.8 – 23.2 mg/kg dw), respectively. Similarly, macroinvertebrates collected from Hoopes Springs and Sage Creek also had the highest selenium concentrations compared to other sampling locations with concentrations as high as 4.51 mg/kg, ww (18.04 mg/kg dw) and 3.66 mg/kg, ww (14.64 mg/kg dw), respectively (Newfields 2005). Selenium concentrations in sculpin and trout collected in 2004 from South Fork Sage Creek were
comparatively lower with concentrations up to 1.7 mg/kg ww (6.8 mg/kg dw; Newfields 2005).

However, during sampling conducted in 2009 and 2010 from South Fork Sage Creek, whole body fish tissue selenium concentrations were as high as 17.9 mg/kg dw in sculpin and 17.5 mg/kg dw in brown trout (Formation 2011B). Selenium concentrations of whole body fish samples collected in 2009 and 2010 from Sage Creek were similar to the concentrations reported in 2004, with concentrations in sculpin as high as 28 mg/kg dw, and maximum concentrations in brown and Yellowstone cutthroat trout of 28.3 mg/kg dw and 20.38 mg/kg dw, respectively (Formation 2011B). Although Crow Creek was not sampled during the 2004 effort, it was included in the 2009 and 2010 sampling effort. Maximum selenium concentrations in sculpin and brown trout were 16.2 mg/kg dw and 16.8 mg/kg dw, respectively (Formation 2011B). Additionally, marcroinvertebrate selenium concentrations in samples collected in 2010 were almost double the concentrations reported from the 2004 sampling effort, with maximum concentrations reported at 24.10 mg/kg dw (Formation 2011B).

Studies indicate that selenium in fish tissue largely results from uptake through diet rather than through ingestion or absorption of selenium in water (Lemly 1982, Hamilton et al. 1990, Coyle et al. 1993). For rainbow trout (Onchorhynchus mykiss), concentrations in the diet of 9 – 13 mg/kg dw caused mortality (Goettl and Davies 1978, Hilton et al. 1980). Furthermore Hilton et al. (1980) suggests that fish diets (e.g., macroinvertebrates) containing greater than 3 mg/kg selenium may be toxic to rainbow trout. This is consistent with the Lemly (1996) recommendation of 3 mg/kg as the toxic threshold for selenium in aquatic food-chain organisms consumed by fish and wildlife.

Research indicates that salmonids, including trout species, are highly sensitive to selenium contamination (Lemly 1996). While there is some variation in selenium concentrations that are lethal to fish, in laboratory studies, mortality occurred to rainbow trout exposed to waterborne selenium (as sodium selenite) when whole-body concentrations exceeded 1 mg/kg dw (Hunn et al. 1987). Whereas Hilton et al. (1980) exposed rainbow trout to waterborne and dietary sodium selenite and reported significant changes in blood chemistry occurring at whole-body concentrations reaching 2 mg/kg dw, and survival was reduced at whole-body selenium concentrations exceeding 5 mg/kg dw. Other effects, such as teratogenesis have been reported at whole-body fish tissue selenium concentrations between 10 – 20 mg/kg dw (NIWQP 1998). Given the concentrations of selenium reported in fish tissue across the Mine Site, it is evident that fish are accumulating selenium above the toxic effects threshold (4 mg/kg dw; Lemly 1996).

Persistent selenium concentrations in fish tissues resulted in a fish consumption advisory issued by the IDHW for two species (Yellowstone cutthroat trout and rainbow trout) of fish in the E. Mill Creek drainage (IDHW 2006). Fish tissue selenium concentrations had exceeded levels that would be protective of sensitive groups (i.e., children). A follow-up Health Consultation by the IDHW (2013) recommended removal of that advisory due to the lack of catchable fish in the stream, and provided a recommendation that fisherman and local residents targeting the Blackfoot and Salt rivers and its tributaries to follow the Idaho Fish
Consumption Advisory Project suggestions for fish consumption in Idaho (8 oz. per week for adults and 4.5 oz. per week for children). Elevated contaminant concentrations resulting in advisories typically result in a loss of fisheries resources in terms of use and consumption.

**Salamanders**

In June 1999, a substantial die-off of at least 152 tiger salamanders (*Ambystoma tigrinum*) was observed at Gay Mine (Skorupa et al. 2002). Three dead and one moribund (but still alive) larval salamanders were collected and sent to the FWS’s contract lab for analysis. Subsequently, the Tribe collected an additional 19 dead salamanders in July and September 1999 and submitted those samples to the USGS National Wildlife Health Center (NWHC) in Madison, Wisconsin, for diagnostic evaluation. In 2000, there also were an unknown number of salamanders found dead at the Smoky Canyon Mine tailings ponds. Two larval salamanders from that event were also sent to the USGS NWHC.

In both of the die-off events at Gay Mine and the Smoky Canyon Mine tailings ponds, the USGS NWHC’s general diagnoses were that there was confirmed selenosis (selenium poisoning) in one of the salamander samples submitted, and suspected selenosis in the remaining samples (USGS 2001A; USGS 2001B). USGS NWHC reported selenium concentrations in the confirmed cases to be 86 mg/kg dw (assuming 63% moisture content) for the Gay Mine sample, and 46 mg/kg dw for the Smoky Canyon Mine sample (both of which were salamander tail samples). Additionally, results from Gay Mine samples submitted to the FWS’s contract lab ranged from 40 mg/kg – 68 mg/kg dw, in the tails, resulting in estimated whole body concentrations of 62 mg/kg – 105 mg/kg, respectively. A composite liver sample also was analyzed with a reported selenium concentration of 150 mg/kg dw.

**Wildlife**

**Big Game**

Since 1996, there have been livestock mortality events associated with selenium toxicosis, at seven of the southeast Idaho phosphate mines. These incidents have created concerns that big game species whose home ranges encompass the phosphate mines, and that are utilizing the same forage, may be similarly impacted (Kuck 2003). However, mortality events of big game species (including deer, elk and moose) have not been observed. Selenium poisoning of livestock across the Mine Site has been attributed to livestock foraging patterns. That is, livestock are typically confined to a small forage area that can contain plant species known to absorb selenium in greater concentrations than exists in soils (e.g., hyper-accumulators of the genus *Aster* and *Astragalus*). The transient nature and large home range of big game species likely reduces the potential for acute exposure to vegetation containing elevated selenium concentrations. As such, there are no documented cases of widespread selenium poisoning in free-ranging wild mammals (Skorupa 1998, USDI 1998).

However, during the 1999 big game hunting seasons the Idaho Department of Fish and Game conducted an investigation of selenium concentrations in elk tissue. Liver and muscle tissue
samples were collected from 229 elk harvested in two Game Management Units that occur within the Mine Site (Montgomery Watson 2000). Results suggest that elk may consume seleniferous forage within the Mine Site, as approximately 50% of the sampled elk harvested within two miles of historic mining areas had elevated levels of selenium in both liver and muscle tissues (IDEQ 2004). Liver selenium concentrations were reported as high as approximately 38 mg/kg dw, which approaches the large mammal toxic threshold liver concentrations of 45-60 mg/kg dw (USDI 1998). Additionally, a single elk was observed with deformed hooves, a classic sign of selenium exposure. Subsequently, the IDHW reviewed the elk tissue data and recommended that a person with a body weight of 165 lbs should not eat more than 10 ounces per month of elk liver from the Mine Site (IDHW 2006). Selenium tissue concentrations have not been investigated for either mule deer or moose within the Mine Site.

**Birds**

The following paragraphs summarize both documented and suspected toxic levels of selenium from exposure to birds within the Mine Site.

The Mine Site supports a wide diversity of bird species that forage on aquatic and terrestrial prey items. Birds may be exposed to contaminants from the consumption of aquatic and terrestrial prey (i.e. macroinvertebrates, fish, and small mammals), vegetation, and incidental consumption of sediments and soils. Injury to these wildlife resources could result in economic losses in wildlife-based recreation, alterations to ecological functions, and subsistence and cultural losses to tribal members. When evaluating effects of selenium on avian species, it is the selenium concentration in the egg that causes developmental abnormalities and death of embryos. Therefore, selenium in the egg gives the most sensitive measure for evaluating exposure hazards to birds (Skorupa and Ohlendorf 1991).

Available data collected from the Mine Site indicate that birds inhabiting the Mine Site are exposed and potentially injured as a result of selenium exposure. In 1999, the FWS conducted a one-season, reconnaissance survey of selenium in water and avian eggs at selected sites within the Mine Site (Skorupa et al. 2002). The FWS’s survey efforts were targeted towards surface impoundments and wetlands that were most likely to have elevated concentrations of selenium (those deemed as ‘high-risk’ sites). Results of the survey effort revealed embryonic abnormalities in some eggs sampled, and avian eggs in multiple species demonstrated elevated selenium concentrations, ranging as high as 80 mg/kg dw in American coot (*Fulica Americana*) eggs. Additionally, 57 of the 74 eggs sampled (77%) contained ≥ 10 mg/kg selenium, an adverse effects threshold identified in mallard studies. Using the data collected from the Skorupa et al. (2002) study, as well as data from four other avian taxa (Ohledorf et al. 1986, Skorupa 1998, Skorupa et al. unpublished data) Skorupa et al. (2002) conducted a risk assessment that estimated the probability of teratogenesis for every egg collected in that study. The conclusion of the risk assessment was that for the 74 eggs collected in that Mine Site study, there was a predicted risk for teratogenesis of 8.04% for eggs collected from the ‘high risk’ sites within the Mine Site. As the study authors point out, this level of risk exceeds the risk documented from Kesterson Reservoir, California (Ohlendorf 1989).
In 2012, the FWS conducted another, limited, avian egg reconnaissance survey effort. Ten American white pelican eggs (*Pelecanus erythrorhynchos*) were collected from a nesting colony at the Blackfoot Reservoir near the Mine Site and 10 pelican eggs were collected from a nesting colony at Minidoka National Wildlife Refuge, approximately 93 air miles to the west (unpublished data). Selenium concentrations in the eggs collected from Minidoka ranged from 1.34 – 2.72 mg/kg dw, which is below background concentrations reported in the literature (3 mg/kg; Skorupa and Ohlendorf 1991, Ohlendorf and Heinz 2011). Selenium concentrations in one egg collected from the Blackfoot Reservoir exceeded literature-reported background (4.43 mg/kg) with concentrations ranging from 1.68 mg/kg to 4.43 mg/kg.

Other avian studies conducted across the Mine Site also reported elevated selenium concentrations. Ratti et al. (2002) reporting on a study commissioned by the Idaho Mining Association documented an increase in selenium concentrations from mostly songbird eggs collected from the mining sites. Fifty-seven percent of eggs collected had selenium concentrations below 5 mg/kg dw, 30% had concentrations between 10 – 16 mg/kg dw, and 5% had concentrations above 16 mg/kg dw. Those species included: yellow-headed blackbird (*Xanthocephalus xanthocephalus*); common snipe (*Gallinago gallinago*); European starling (*Sturnus vulgaris*); mountain bluebird (*Sialia currucoides*); red-winged blackbird (*Agelaius phoeniceus*); American kestrel (*Falco sparverius*); and song sparrow (*Melospiza melodia*).

Due to the extensive foraging range and migration patterns of some birds, selenium concentrations in eggs collected on or adjacent-to individual mine sites may not be solely attributed to that individual mine. However, the data would still be applicable for evaluation of impacts to birds across the entire Mine Site.

Effects to birds reported in the literature indicate that potential injury to birds at the Mine Site is likely based on concentrations of selenium reported, and presented above. Reproductive impairment (reduced egg hatchability and clutch viability) has been documented in several studies at concentrations between 12 – 14 mg/kg dw (Ohlendorf 2003, Lam et al. 2005). Additionally, concentrations between 13-24 mg/kg dw measured in eggs is the threshold for teratogenic effects at a population level, with the range of sensitivity varying by species (Skorupa and Ohlendorf 1991).

**Livestock**

Livestock poisoning or mortality events have occurred at several mines across the Mine Site. In the fall of 1996, six horses pastured on private land downstream from the South Maybe Canyon Mine CVF were diagnosed with selenosis, which prompted a site investigation study to identify the cause of the selenosis (TRC 2006). In 2009, 18 cattle died while grazing near Lanes Creek Mine; liver samples indicated high selenium concentrations.

Historic records indicate that beginning in the early 1990s, livestock grazing mortalities have occurred at Conda/Woodall Mountain Mine that may have been attributed to selenium poisoning (Newfields 2008). Between the early 1990s and 2004, there have been nine incidents of sheep and horse mortalities in which the diagnoses indicated that livestock were
exhibiting signs of chronic selenosis, or where tissue samples indicated elevated (toxic) concentrations of selenium (Newfields 2008).

In October 2012, 95 sheep in a herd of 1200 died after grazing within the south pit of Henry Mine. Results following a USDA Poisonous Plant Research Laboratory investigation indicated the cause to be the sheep’s consumption of western aster (Symphyotrichum ascendens), a plant considered a hyper-accumulator. Selenium concentrations in vegetation samples collected following the mortality event were reported to be as high as 2454 mg/kg dry weight in western aster samples, almost 500 times the State’s removal action level of 5 mg/kg for reclaimed or impacted vegetation.

**Human Use**

The Fort Bridger Treaty of 1868 affirmed the Fort Hall Indian Reservation as a “permanent home” for the Shoshone and Bannock people for their “absolute and undeterred use and occupation.” The Treaty also reserved off-reservation rights including hunting, fishing, and gathering to tribal members on “unoccupied lands of the United States.” People in Tribal communities, as well as other local communities and visitors, may have experienced lost uses, and loss of cultural and spiritual experiences, due to the presence of contaminants across the Mine Site. Elevated selenium concentrations resulting in fish and elk liver consumption advisories has likely resulted in a loss of both fisheries and big game resources in terms of use and consumption. Similarly, elevated selenium in surface water has likely resulted in a loss of drinking water use and consumption (e.g., during camping trips) and livestock watering. Elevated selenium in vegetation also has likely resulted in lost opportunities for typical subsistence practices, including the collection of various plants for both consumption and spiritual use.

**D. Potentially Affected Resources**

The DOI, Forest Service, and Tribe collectively have trusteeship over natural resources that have been exposed to, and potentially impacted by, hazardous substance releases across the Mine Site. The natural resources include, but are not limited to:

- Surface water;
- Ground water;
- Sediments;
- Soils;
- Aquatic and terrestrial vegetation;
- Federally listed threatened and endangered species;
- Migratory birds including raptors, passerines, waterfowl, and piscivorous birds;
- Resident fish species;
- Aquatic-dependent wildlife;
- Terrestrial wildlife;
- Reptiles and amphibians;
- Aquatic and terrestrial invertebrates; and
- Riparian, wetland, and riverine habitats

The resources listed above provide services that may have been lost due to contamination. These services include, but are not limited to, the following:
• Tribal subsistence;
• Cultural and spiritual use;
• Habitat which provides essential functions to support fish and wildlife populations;
• Consumptive water uses (drinking, livestock watering, irrigation or other activities that consume water);
• Options for providing enhancement and conservation of threatened and endangered species;
• Wildlife viewing;
• Hunting and fishing; and
• Outdoor recreation

IV. PREASSESSMENT SCREEN CRITERIA
As discussed in the introduction to this document, Title 43 CFR Part 11.23(e) identifies five criteria that must be met in order for the Trustees to proceed with a NRDA. The criteria and the Trustees’ preliminary assessment of those criteria, based on this preassessment screen, are as follows.

1) A discharge of oil or release of hazardous substance has occurred.
Numerous studies identified in this PAS have documented substantial releases of hazardous substances, particularly selenium, into the Bear, Blackfoot, and Salt River Subbasins. These releases originated from open-pit phosphate mining operations, and their processing facilities, located in Southeast Idaho, and have occurred over an extensive period of time.

2) Natural resources for which a State or Federal agency or Indian Tribe may assert trusteeship under CERCLA have been or are likely to have been adversely affected by the discharge or release.
Natural resources for which State or Federal agencies or Indian Tribes may assert trusteeship have likely been adversely impacted in the past and are likely to continue to be adversely impacted by hazardous substances. Studies conducted across the Mine Site have documented elevated concentrations of hazardous substances, particularly selenium, in water, sediment, soil, vegetation, and biological tissues, which have been attributed to releases from upstream sources (i.e., individual mines). Further, it is likely that contaminated natural resources could adversely impact other natural resources through various pathways of exposure (e.g., direct contact or dietary exposure).

3) The quantity and concentration of the discharged oil or released hazardous substance is sufficient to potentially cause injury to those natural resources.
Water, sediment, soil, vegetation, and biological tissue samples collected from the Mine Site over decades of research contain hazardous substances at concentrations that:
   a. Exceed criteria or guidelines established for the protection of aquatic life;
   b. Equal or exceed effect levels shown to cause injury to fish, birds and mammals; and
   c. Warrant consumption advisories for human populations.
The following summarizes general study findings highlighted in the PAS that can be associated with potential injury of water, sediment, fish, birds, mammals, and potentially other natural resources.

**Water and sediment**
- Exceedences of State acute and chronic selenium criteria in surface waters as a result from discharges from individual mines throughout the Mine Site;
- Exceedences of State criteria for protection of groundwater quality; and
- Exceedence of EPA’s selenium sediment screening benchmark for ECOPC’s and toxic threshold values established in the literature.

**Aquatic Biota**
- Elevated selenium concentrations in fish tissue sufficient to warrant a consumption advisory;
- Selenium concentrations in macroinvertebrates exceeding the toxic threshold in aquatic food-chain organisms consumed by fish and wildlife; and
- Selenium concentrations in fish tissue at or above concentrations shown to impair growth, reproduction, and survival of fish, and above thresholds for protection of piscivorous birds and mammals.

**Birds and Mammals**
- Elevated selenium concentrations in organ tissue of big game sufficient to warrant a consumption advisory for elk liver;
- Elevated selenium concentrations in vegetation that has resulted in multiple livestock mortality events;
- Selenium concentrations in bird egg tissue exceeding toxicity thresholds for reproductive impairment; and
- Selenium concentrations in bird egg tissue at or exceeding levels known to cause teratogenic effects.

4) **Data sufficient to pursue an assessment are readily available or likely to be obtained at reasonable cost.**

Data for the Mine Site are numerous and will be useful to conduct an Injury Assessment in a more cost effective manner. Additionally, data will continue to be collected as part of the ongoing CERCLA remedial action investigations at the Mine Site. Those data will also be utilized in the Injury Assessment. Additional studies will be needed to address data gaps, confirm pathways of exposure and quantify injury and service losses. It is expected that these additional data may be obtained at reasonable costs.

5) **Response actions from Superfund remedial activities carried out or planned do not or will not sufficiently remedy the injury to natural resources without further action.**

The EPA, IDEQ, and Forest Service may identify and complete remedial actions which will likely reduce contaminant exposure within the Mine Site. At this time it is not known what remedial actions will occur, and therefore is not possible to evaluate the expected natural resource benefit from the remedies. However, given the geographic
extent of the Mine Site, it is unlikely that the remedial actions will sufficiently remedy injury to trust resources (including past injury from historic mining activities), and it is expected that additional restoration actions will be required.

Furthermore, injury has likely occurred to-date as a result of existing contamination, and will continue to occur until a fully protective remedy is implemented. Future remedial actions will not address service losses incurred from past and on-going injuries; therefore, additional restoration will be necessary.
V. REFERENCES


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IDEQ. 2007B. Water Quality Sampling for Metals - Blackfoot River and Tributaries (HUC 17040207), Selected Bear River Tributaries (HUC 16010201), and Selected Salt River Tributaries (HUC 17040105). Pocatello, Idaho. December.


