Appendix B
Minerals

Historic Mineral Activity and Mineral Potential

Historic Mineral Activity in the Upper Deschutes Planning Area

Locatable Minerals

Locatable minerals are those minerals for which mining claims can be located, such as precious and base metals, and some nonmetallic minerals that possess unique properties (uncommon variety minerals). Exploration for locatable minerals in the Upper Deschutes planning area has been sporadic. Presently, there are 26 mining claims and 7 mill site claims within the planning area and two notices have been filed under the BLM Surface Management Regulations (43 CFR 3809).

Bear Creek Butte

Minor amounts of mercury have been produced from the Clarno Formation in the southeastern part of the planning area. Prospecting began in the late 1920s and by the late 1950s, the US Bureau of Mines had recorded a total of 30 flasks of mercury from the Platner and Oronogo mines, though the actual output was probably larger (Brooks, 1963).

Terrebonne

Diatomite was mined on private land a few miles west of Terrebonne in the 1950s and continued until the reserves were depleted (Orr and others, 1992). There are 20 diatomite claims on adjoining public lands but no notice or plan level operations are occurring.

Leasable Minerals

Leasable minerals are those minerals for which a person must obtain a lease from the Federal government in order to produce the mineral. Generally, leasable minerals include deposits that occur over large areas, such as the energy minerals—oil and gas, coal, and geothermal resources. Lake bed evaporite minerals such as sodium and potassium are also leasable. Owing to the prevalence of volcanic and volcaniclastic sedimentary rocks in the planning area, coal, coal bed methane, oil shale and tar sands and considered to be absent from the planning area and will not be addressed. Currently, no areas within the planning area are leased and no exploration is occurring. This situation could change as technology improves or if energy prices rise dramatically.

Oil and Gas

Minimal oil and gas exploration has occurred historically in the planning area.

Geothermal

There is a geothermal anomaly within the planning area in the vicinity of Powell Buttes that was investigated by Brown and others, (1980). Their work indicates a potential for boiling-temperature fluids at a depth of about 1000 meters. More geophysical exploration and deep drilling are required to prove the existence of an economically viable geothermal system.

Salable Minerals

Salable minerals are common variety minerals such as sand, gravel, rock, and cinders that generally are purchased from the Federal government. Over the past 10 years, nearly

1,000,000 cubic yards of sand, gravel, and rock have been produced from quarries and pits for construction and maintenance of county roads and state highways. Sales of sand and gravel to individuals have averaged about 2,500 cubic yards per year. During the same period of time, cinder production has varied from about 200 to 1,000 cubic yards per year (mostly for use on county roads). Theft of slab lava (a decorative stone) has been a problem in the Cline Buttes area for many years. Over the past 5–8 years, the demand for decorative stone has gone from a few to several hundred tons per a year.

Mineral Potential

Classification

The mineral potential classification system, as described in BLM Manual 3031, Illustration 3, is used to evaluate the potential for locatable, leasable, and salable minerals in the resource area. Potential refers to the potential for occurrence of specific mineral resources rather than their economic viability.

Level of Potential

O. ~ The geologic environment, the inferred geologic processes, and the lack of mineral occurrences do not indicate potential for accumulation of mineral resources.

L. ~ The geologic environment and the inferred geologic processes indicate low potential for accumulation of mineral resources.

M. ~ The geologic environment, the inferred geologic processes, and the reported mineral occurrences or valid geochemical/geophysical anomaly indicate moderate potential for accumulation of mineral resources.

H. ~ The geologic environment, the inferred geologic processes, the reported mineral occurrences and/or valid geochemical/geophysical anomaly, and the known mines or deposits indicate high potential for accumulation of mineral resources. The “known mines and deposits” do not have to be within the area that is being classified but have to be within the same type of geologic environment.

ND. ~ Mineral(s) potential not determined due to lack of useful data. This notation does not require a level-of-certainty qualifier.

Level of Certainty

A. ~ The available data are insufficient and/or cannot be considered as direct or indirect evidence to support or refute the possible existence of mineral resources within the respective area.

B. ~ The available data provide indirect evidence to support or refute the possible existence of mineral resources.

C. ~ The available data provide direct evidence but are quantitatively minimal to support or refute the possible existence of mineral resources.

D. ~ The available data provide abundant direct and indirect evidence to support or refute the possible existence of mineral resources.

Mineral Potential in the Planning Area

No areas of critical mineral potential exist in the planning area. The potential for energy derived from the burning of biomass generated by juniper treatments is covered in the Vegetation sections.

Locatable Minerals

Map S-20[1] displays the areas of varying potential for locatable minerals. The mineral potential areas were developed from known geologic settings, inferred geologic processes, current and historical mining activity, and extrapolation of known mineral deposits or mineralization into areas of similar geologic setting.

Base and Precious Metals

There is a high potential (H-C) for the occurrence mercury in the southeast part of the planning area near Bear Creek Butte based on historical production and the proven existence of cinnabar mineralization (Brooks, 1963). However, the deposits tend to be localized and small and there is no direct evidence to suggest the presence of large scale cinnabar deposits. The northeastern part of the planning area has a moderate potential (M-B) for some base and precious metals due to the occurrence of such materials elsewhere in the John Day and Clarno Formations.

Diatomite is an accumulation of microscopic siliceous skeletons of aquatic plants (diatoms) that proliferate in shallow, silica-rich lake water. In the resource area, diatomite occurs about 5 miles east of Terrebonne in a late Miocene or early Pliocene lake bed (Orr and others, 1992). Based on the known occurrence of diatomite on private lands, a high potential (H-C) for the existence of diatomite is inferred for adjoining BLM administered lands.

Leasable Minerals

Oil and Gas

No oil or gas has been discovered within the planning area and exploration has been minimal. The central and western parts of the planning area have a low potential for oil and gas (L-B) because of the predominantly young volcanic geology (Map S-18, Oil and Gas Potential). The eastern part of the planning area where the John Day and Clarno formations crop out, there is a moderate potential (M-B). Oil and gas have been discovered in or below these formations northeast of the planning area near the John Day River.

Geothermal Energy

The central and western parts of the planning area are considered to have a moderate (M-B) geothermal potential owing to the young volcanic geology and the area's proximity to the Cascade Volcanoes and Newberry Caldera (Map S-13, Geothermal Potential). There is a geothermal anomaly within the planning area in the vicinity of Powell Buttes that was investigated by Brown and others, (1980). Their work indicates a potential for boiling-temperature fluids at a depth of about 1000 meters and more work is required to prove the existence of an economically viable geothermal system. Based on this information, the Powell Buttes area is considered to have a high (H-C) potential for geothermal development.

Salable Minerals

Common variety mineral materials such as sand, gravel, rock, and cinders may be purchased or acquired by free use permits from the BLM. Most of the planning area has

[1] All Maps with an S prefix before a number are support maps available on a CD that includes the ROD/RMP, maps printed with the ROD/RMP, and support maps that document conditions within the planning area during the development of the plan.

a moderate potential for the occurrence of mineral materials (Map S21, Mineral Material Potential). The high potential areas are in and around existing mineral material sites. Most of the high potential areas occur in areas with cinder cones, alluvial deposits of sand and gravel (La Pine area) and volcanic rock outcrops known to have a sufficient quality for utilization in asphalt. The Badlands basalt flow also has a high potential for mineral materials in the form of ropy slab lava. However, the collection of slab lava in the Badlands ACEC/WSA will not be allowed.

Mineral Development Scenarios

Introduction

This appendix describes the reasonable foreseeable development scenarios for development of leasable, locatable, and salable mineral commodities. The purpose of the reasonably foreseeable development scenario is to provide a model that predicts the level and type of future mineral activity in the planning area, and will serve as a basis for cumulative impact analysis. The reasonably foreseeable development first describes the steps involved in developing a mineral deposit, with presentation of hypothetical exploration and mining operations. The current activity levels are discussed in Chapter 2 of this document. Future trends and assumptions affecting mineral activity are discussed here, followed by the prediction and identification of anticipated mineral exploration and development.

Scope

The development scenarios are limited in scope to BLM administered lands within the planning area. The reasonable foreseeable development is based on the known or inferred mineral resource capabilities of the lands involved, and applies the conditions and assumptions discussed under Future Trends and Assumptions. Changes in available geologic data and/or economic conditions would alter the reasonable foreseeable development, and some deviation is to be expected over time.

Leasable Mineral Resources

Reasonably Foreseeable Development of Oil and Gas

Future Trends and Assumptions

Based on the history of past drilling and foreseeable development potential in the planning area, activity over the next 15–20 years would continue to be sporadic. It is anticipated that oil and gas activity would consist of the issuance of a few leases, a few geophysical surveys, and perhaps the drilling of one or two exploratory holes. This could occur almost anywhere in the district, but more likely would occur in the eastern part of the planning area.

Because of the low potential for development of hydrocarbons, (even though the potential for occurrence is moderate in some areas), the discovery of a producible oil and gas field during this planning cycle is not expected. However, to comply with the Supplemental Program Guidance for Fluid Minerals (Manual Section 1624.2), the potential surface impacts associated with the discovery and development of a small oil/gas field are given in the following sections.

Geophysical Exploration

Geophysical exploration is conducted to determine the subsurface structure of an area. Three geophysical survey techniques are generally used to define subsurface characteristics through measurements of the gravitational field, magnetic field, and seismic reflections.

Gravity and magnetic field surveys involve small portable measuring units which are easily transported via light off-road vehicles, such as four-wheel drive pickups and jeeps, or aircraft. Both off-road and on-road travel may be necessary in these two types of surveys. Usually a three man crew transported by one or two vehicles is required. Sometimes small holes (approximately 1 inch by 2 inches by 2 inches) are hand dug for instrument placement at the survey measurement points. These two survey methods can make measurements along defined lines, but it is more common to have a grid of discrete measurement stations.

Seismic reflection surveys are the most common of the geophysical methods, and they produce the most detailed subsurface information. Seismic surveys are conducted by sending shock waves, generated by a small explosion or through mechanically beating the ground surface with a thumping or vibrating platform, through the earth's surface. The thumper and vibrator methods pound or vibrate the ground surface to create a shock wave. Usually four large trucks are used, each equipped with pads about 4-foot square. The pads are lowered to the ground, and the vibrators are electronically triggered from the recording truck. Once information is recorded, the trucks move forward a short distance and the process is repeated. Less than 50 square feet of surface area is required to operate the equipment at each recording site.

The small explosive method requires that charges be detonated on the surface or in a drill hole. Holes for the charges are drilled utilizing truck-mounted or portable air drills to drill small-diameter (2–6 inches) holes to depths of 100–200 feet. Generally 4–12 holes are drilled per mile of line and a 5–50-pound charge of explosives is placed in the hole, covered, and detonated. The resulting shock wave is recorded by geophones placed in a linear fashion on the surface. In rugged terrain, a portable drill carried by helicopter can sometimes be used. A typical drilling seismic operation may utilize 10–15 men operating 5–7 trucks. Under normal conditions, 3–5 miles of line can be surveyed daily using this method. The vehicles used for a drilling program may include heavy truck mounted drill rigs, track-mounted air rigs, water trucks, a computer recording truck, and several light pickups for the surveyors, shot hole crew, geophone crew, permit man, and party chief.

Public and private roads and trails are used where possible. However, off-road cross-country travel is also necessary in some cases. Graders and dozers may be required to provide access to remote areas. Several trips a day are made along a seismograph line, usually resulting in a well defined 2-track trail. Drilling water, when needed, is usually obtained from private landowners.

The surface charge method utilizes 1–5-pound charges attached to wooden laths 3–8 feet above the ground. Placing the charges lower than 6 feet usually results in the destruction of vegetation, while placing the charges higher, or on the surface of deep snow, results in little visible surface disturbance.

It is anticipated that 2 notices of intent involving seismic reflection and gravity/magnetic field surveys will be filed.

Drilling Phase

Once the application for a permit to drill is approved, the operator may begin construction activities in accordance with stipulations and conditions. When a site

is chosen that necessitates the construction of an access road, the length of road may vary, but usually the shortest feasible route is selected to reduce the haul distance and construction costs. Environmental factors or a landowner's wishes may dictate a longer route in some cases. Drilling activity in the planning area is predicted to be done using existing roads and constructing short (approximately 0.25 mile) roads to access drill site locations.

Based on the history of past drilling and the low to moderate potential for oil and gas, exploration will probably continue to be sporadic. During the life of this plan, 1-2 exploratory wells for oil and gas are expected to be drilled in the eastern part of the planning area where the potential is moderate. The success rate of finding oil or gas is predicted to be no greater than 10% based on the average exploratory well success rate in the U.S.

During the first phase of drilling, the operator would move construction equipment over existing maintained roads to the point where the access road begins. No more than 0.25 mile of moderate duty access road with a cinder or gravel surface 18 to 20 feet wide is anticipated to be constructed. The total surface disturbance width would average 40 feet with ditches, cuts, and fill. The second part of the drilling phase is the construction of the drilling pad or platform. The likely duration of well development, testing, and abandonment is predicted to be less than 12 months per drill site. The total disturbance for each exploratory well and any new road constructed to the drill site is expected to be up to 6 acres. Thus, the total surface disturbance caused by exploratory drilling over the life of the plan is expected to be up to12 acres.

Field Development and Production

No field development is expected to occur during the life of the plan. However, the following scenario describes operations and impacts associated with field development and production.

Small deposits of oil or gas discovered in the planning area would probably not be economic to develop. The minimum size that would be economic would be a field containing reserves of 50–60 billion cubic feet (BCF) of gas with a productive lifespan of 10 years. The total area of such a field would be 200 acres with the array of development wells spanning 160 acres. The field would require four development wells in addition to the discovery well. Each development would require 0.25 miles of road. Development well access roads would be cinder or gravel surfaced and would have a width of about 20 feet. The width of the surface disturbance associated with roads would average 40 feet. Produced gas would be carried by pipelines over a distance of 30 to 60 miles. The width of surface disturbance for pipelines would average 30 feet. Any produced oil would be trucked to refineries outside of Oregon.

For development of a single 50-60 BCF field, the total surface disturbance would be 8 acres for well pads, 5 acres for roads, 13 acres for field development and up to 600 acres for pipelines. The total surface disturbance caused by 1-2 exploration wells and the development of one oil/gas field over the life of the plan would be up to 650 acres.

Plugging and Abandonment

Wells that are completed as dry holes are plugged according to a plan designed specifically for the downhole conditions of each well. Plugging is accomplished by the placing of cement plugs at strategic locations downhole and up to the surface. Drilling mud is used as a spacer between plugs to prevent communication between fluid bearing zones. The casing is cut off at least 3 feet below ground level and capped by welding a steel plate on the casing stub. After plugging, all equipment and debris would be removed and the site would be restored as near as reasonably possible to its original

condition. It predicted that the 1-2 exploratory wells drilled would be plugged and abandoned.

Reasonably Foreseeable Exploration and Development of Geothermal Resources

Future Trends and Assumptions

With environmental protection and enhancement being a major consideration in the Pacific Northwest, clean, low-impacting energy sources are becoming more important. The abundant geothermal resources thought to be present in the Northwest are essentially undeveloped. As the demand for environmentally-friendly energy sources increases, the known geothermal resource in the Powell Buttes area would likely attract renewed attention.

Geophysical/Geochemical Exploration

As with oil and gas, geothermal geophysical operations can take place on leased or unleased public land. Depending upon the status of the land (leased/unleased), the status of the applicant (lessee/nonlessee), and the type of geophysical operation proposed, (drilling/nondrilling), several types of authorizations can be used if the proposed exploration exceeds "casual use," as defined in 43 CFR 3200.1. In all cases, the authorizations require compliance with NEPA and approval by the authorized officer. As with oil and gas, the operator is required to comply with all terms and conditions of the permits, regulations, and other requirements, including reclamation, prescribed by the authorized officer. Monitoring for compliance with these requirements would be done during the execution of the operations and upon completion.

In addition to the geophysical methods discussed in the Oil and Gas section, the following exploration techniques are often employed in geothermal prospecting:

Microseismic: Small seismometers are buried at a shallow depth (hand-dug holes) and transmit signals from naturally-occurring, extremely minor seismic activity (micro-earthquakes) to an amplifier on the surface. Stations are located away from roads to avoid traffic "noise." These units are often backpacked into areas inaccessible to vehicles.

Resistivity: Induced polarization techniques are used to measure the resistance of subsurface rocks to the passage of an electric current. A vehicle-mounted transmitter sends pulses of electrical current into the ground through two widely spaced electrodes (usually about two miles apart). The behavior of these electrical pulses as they travel through underlying rocks is recorded by "pots" (potential electrodes), small ceramic devices that receive the current at different locations. The electrodes are either short (2–3 feet) rods driven into the ground, or aluminum foil shallowly buried over an area of several square feet. Two or three small trucks transport the crew of 3–5 people to transmitting and receiving sites.

Telluric: A string of "pots" record the variations in the natural electrical currents in the earth. No transmitter is required. Small trucks are used to transport the crew and equipment.

Radiometric: Radioactive emissions (generally radon gas) associated with geothermal resources are usually measured using a hand-held scintillometer, often at hot spring locations. Another method used involves placing plastic cups containing small detector strips sensitive to alpha radiation either on the surface or in shallow hand-dug holes. If holes are dug, they are covered, and the cups left in place for 3–4 weeks. At the end of the sampling period, the cups are retrieved and all holes are backfilled. These surveys can be conducted on-foot or with the aid of light vehicles.

Geochemical Surveys: Geochemical surveys are usually conducted at hot springs by taking water samples directly from the spring. Sampling for mercury associated with geothermal resources is often done by taking soil samples using hand tools. These surveys can be conducted on-foot or with the aid of light vehicles.

Temperature Gradient Drill Hole Surveys: Temperature gradient holes are used to determine the rate of change of temperature with respect to depth. Temperature gradient holes usually vary in diameter from about 3.5 to 4.5 inches, and from a few hundred feet to about 5,000 feet in depth. They are drilled using rotary or coring methods. Approximately 0.1 to 0.25 acre per drill hole would be disturbed. A typical drill site could contain the drill rig, most likely truck-mounted, water tank(s), fuel tank, supply trailer, and a small trailer for the workers. Drilling mud and fluids would be contained in earthen pits or steel tanks. Water for drilling would be hauled in water trucks, or if suitable water sources are close, could be piped directly to the site. Water consumption could range from about 2,000 to 6,000 gallons per day, with as much as 20,000 gallons per day under extreme lost circulation conditions.

Other equipment that would be utilized includes large flatbed trucks to haul drill rod, casing, and other drilling supplies, and in some cases, special cementing and bulk cement trucks. Two or three small vehicles would be used for transporting workers. In most cases, existing roads would be used. It is estimated that short spur trails (usually less than a few hundred yards long) would be bladed for less than 10 percent of these holes. All holes would be plugged and abandoned to protect both surface and subsurface resources, including aquifers, and reclamation of disturbed areas would be required, unless some benefit to the public could be gained—for example, a water well or camping area. Depending upon the location and proposed depth of the drill hole, detailed plans of operation that cover drilling methods, casing and cementing programs, well control, and plugging and abandonment may be required.

Based the needed exploratory work identified by Brown and others (1980) to determine economic viability in the Powell Buttes area, it is anticipated that notice(s) of intent will be filed to drill up to 20 temperature gradient holes in that area.

Drilling and Testing

Drilling to determine the presence of, test, develop, produce, or inject geothermal resources can be done only on land covered by a geothermal resources lease.

A typical geothermal well drilling operation would require 2–4 acres for a well pad, including reserve pit, and 0.5 mile of moderate duty access road with a surface 18–20 feet wide, totaling up to 40 feet wide with ditches, cuts, and fills. Existing roads would be used whenever possible. Total surface disturbance for each well, and any new road is expected to be no more than 6 acres. In some cases, more than one production well could be drilled from one pad. Well spacing would be determined by the authorized officer after considering topography, reservoir characteristics, optimum number of wells for proposed use, protection of correlative rights, potential for well interference, interference with multiple use of lands, and protection of the surface and subsurface environment. Close coordination with the State would take place. It is anticipated that the duration of well development, testing, and if dry, abandonment, would be 4 months. Prior to abandonment, the operator would be required to plug the hole to prevent contamination of aquifers and any impacts to subsurface and surface resources. Plugging is accomplished by the placing of cement plugs at strategic locations downhole and up to the surface. Depending upon the formations encountered, drilling mud could be used as a spacer between plugs to prevent communication between fluid bearing zones. The casing is cut off at least 6 feet below ground level and capped by welding a steel plate on the casing stub. After plugging, all equipment and debris would be removed, and the site would be restored as near as reasonably possible to its original condition. A dry hole

marker is often placed at the surface to identify the well location. If the surface owner prefers, the marker may be buried. Any new roads not needed for other purposes would be reclaimed.

It is estimated that 4–6 exploratory wells will be drilled.

Geothermal Power Plant Development

Although not expected, a 24-megawatt power plant could be constructed within the Powell Buttes area during the life of this plan. It is anticipated that the developed geothermal resource would be water dominated and that the geothermal power conversion system would be either single or double flash, or binary cycle. Before geothermal development could occur, site-specific baseline studies and environmental analyses, with public involvement, would be done. The scenario below describes the level of disturbance that would likely occur from the development of a 24 megawatt power plant: Five to seven production wells and one or two injection wells would be drilled. It is anticipated that access would be provided by existing roads, and the construction of short (0.5 to 1-mile long) roads with a surface of 18 to 20 feet wide, totaling up to 40 feet wide with ditches, cuts, and fills. Surface disturbance from well pad and road construction would probably range from 2 to 6 acres per well. The power plant facility, including separators, energy converters, turbines, generators, condensers, cooling towers, and switchyard, would involve an estimated 5 to 10 acres. Pipelines and power lines would disturb an additional 3 to 6 acres. If a water cooling system is employed, one to three water wells, requiring about 0.25 acre per well, would be drilled, unless the cooling water was obtained from the geothermal steam condensate. Depending upon location, terrain, geothermal reservoir characteristics, and type of generating facility, total surface disturbance for a 24 megawatt (gross) geothermal power plant, and ancillary structures, would probably range from about 25 to 75 acres, or about 1 to 3 acres per megawatt. After construction, approximately one-third to one-half of the disturbed area would be revegetated. Prior to abandonment, 30–50 years later, the remaining disturbed area would be reclaimed.

Direct Use of Geothermal Energy

Low- and moderate-temperature (50–300 degrees F) geothermal resources have many direct use applications. Direct applications and potential development scenarios include space heating and cooling of residences and businesses, applications in agriculture, aquaculture, and industry, and recreational and therapeutical bathing. Depending upon the type of use and magnitude of the operation, surface disturbance could range from a few acres for a well and greenhouses or food processing facilities to tens of acres for larger agricultural or aquacultural developments. It is anticipated that two wells would be drilled to heat one greenhouse operation or some of the residential areas near Powell Buttes during the life of this plan.

Locatable Mineral Resources

Reasonably Foreseeable Exploration and Development Scenarios

Future Trends and Assumptions

Reclamation science would continue to advance due to experience and research. More detailed design effort would be placed on the reclamation of mined lands in the future. This would result in an overall increase in reclamation costs but those costs would pay dividends in the long-term with increased reclamation success.

The economics of mining in the planning area would be driven by the relationship between production costs and the market price of the commodity. While production

costs can be controlled or anticipated through management and technology, the price of mineral commodities (especially of gold) could vary widely. The overall profitability of an operation (and hence the level of activity at the prospecting, exploration, and mining phases for development of ore bodies) would be closely related to the price of the mineral commodity.

No chemical heap-leaching operations are forecasted during the plan period. If such an operation is proposed during the life of the plan, it would be subjected to environmental review under a plan of operations pursuant to regulations found in 43 CFR 3809.

Casual Use, Notices, Plans of Operations, Use and Occupancy

There are 3 levels of use defined by the 43 CFR 3809 regulations—casual, notice, and plan of operations. Generally, casual use means activities resulting in negligible, if any, disturbance of public lands or resources. Mechanized earth-moving equipment or truck-mounted drills are not allowed under casual use. Notice-level operations involve surface-disturbing exploration operations of 5 acres or less. Casual use and notice-level operations do not involve Federal actions that require compliance with NEPA. A plan of operations is required for all non-exploration mining activity that is not casual use, regardless of the number of acres disturbed. A plan is also required for all exploration activities that disturb over 5 acres, bulk sampling which will remove 1,000 tons or more of presumed ore for testing, or for any surface-disturbing operations greater than casual use in certain SMAs and lands/waters that contain federally-proposed or listed T&E species or their proposed or designated critical habitat. The approval of plans of operation is a Federal action that requires NEPA compliance. Mining claim occupancy associated with notice- or plan-level operations, also requires compliance with NEPA.

Details of plan of operations filing and processing requirements can be found in 43 CFR 3809.400. Generally, plans must include a detailed description of all operations, including a map showing all areas to be disturbed by mining, processing, and access, all equipment that would be used, periods of use, and any necessary buildings or structures. A detailed reclamation plan to meet the standards found in 43 CFR 3809.420, and a monitoring plan to monitor the effect of operations are also required. An interim management plan showing how the project area would be managed during periods of temporary closure to prevent unnecessary and undue degradation must also be submitted. The operator also must submit a reclamation cost estimate. The BLM may require operational and baseline environmental information, and any other information, needed to ensure that operations will not cause unnecessary and undue degradation.

When a plan of operations is received, BLM would review it to make sure that it is complete. Where necessary, the BLM would consult with the State to ensure operations would be consistent with State water quality requirements. In addition, the BLM would conduct any consultation required under the "National Historic Preservation Act" or "Endangered Species Act." Onsite visits would be scheduled when necessary. BLM could require changes to the plan of operations to ensure that the performance standards found in 43 CFR 3809.420 would be met, and that no unnecessary or undue degradation of lands or resources would occur. In addition, site specific mitigating measures would be imposed when necessary. A financial guarantee covering the estimated cost of reclamation, as if BLM were to contract with a third-party, would have to be provided before operations could begin. The financial guarantee would have to be sufficient not only to cover costs of reclamation, but also costs associated with interim stabilization and compliance with Federal, state, and local environmental requirements while third-party contracts would be developed and executed.

BLM approval is necessary to occupy public land for more than 14 calendar days in any 90-day period within a 25-mile radius of the initially occupied site. Details for the submittal and approval of use and occupancy are contained in 43 CFR 3710. As defined

in these regulations, occupancy means full or part-time residence on the public lands. It also means activities that involve residence; the construction, presence, or maintenance of temporary or permanent structures that may be used for such purposes; or the use of a watchman or caretaker for the purpose of monitoring activities. Residence or structures include, but are not limited to, tents, motor homes, trailers, campers, cabins, houses, buildings, and storage of equipment or supplies. Also included are fences, gates, and signs intended to restrict public access.

Permanent structure means a structure fixed to the ground by any of the various types of foundations, slabs, piers, or poles, or other means allowed by building codes. The term also includes a structure placed on the ground that lacks foundations, slabs, piers, or poles, and that can only be moved through disassembly into its component parts or by techniques commonly used in house moving. The term does not apply to tents or lean-tos.

The disposal of sewage and gray-water would be subject to the rules and regulations of the ODEQ. The disposal of garbage and other debris would be subject to all appropriate local, state, and Federal rules and regulations. Likewise, the drilling of any water wells would be subject to all ODWR requirements. Permanent structures would be subject to all state and county permitting. Copies of all required local and state approvals and permits would be filed with the BLM prior to allowing any occupancy.

Background on the Development of a Locatable Minerals Mine

The development of a mine from exploration to production can be divided into four stages. Each stage requires the application of more discriminating (and more expensive) techniques over a successively smaller land area to identify, develop, and produce an economic mineral deposit. A full sequence of developing a mineral project involves reconnaissance, prospecting, exploration, and mine development.

Reconnaissance: Reconnaissance-level activity is the first stage in exploring for a mineral deposit. This activity involves initial literature search of an area of interest, using available references such as publications, reports, maps, aerial photos, etc. The area of study can vary from hundreds to thousands of square miles. Activity that would normally take place includes large scale mapping, regional geochemical and geophysical studies, and remote sensing with aerial photography or satellite imagery. These studies are usually undertaken by academic or government entities, or major corporations. The type of surface-disturbing activity associated with reconnaissance-level mineral inventory is usually no more than occasional stream sediment, soil, and rock sampling. Minor off-road vehicle use could be required.

Prospecting: A prospecting area is identified when reconnaissance reveals anomalous geochemical or geophysical readings, a unique geologic structure or feature, or the occurrence of typical mineral bearing formations. Historical references to mineralization can also lead to the identification of a prospecting area. This area could range from a single square mile to an entire mountain range of several hundred square miles.

Activity that would take place in an effort to locate a mineral prospect includes more detailed mapping, sampling, geochemical and geophysical study programs. Also, this is the time when property acquisition efforts usually begin and most mining claims are located in order to secure ground while trying to make a mineral discovery. Prospecting on an annual basis is considered a minimum requirement under the mining laws to secure a claim.

Types of surface disturbing activity associated with prospecting would involve more intense soil and rock chip sampling using mostly hand tools, frequent off-road vehicle use, and placement and maintenance of mining claim monuments. This activity is

normally considered "casual use" (43 CFR 3809.5) and does not require BLM notification or approval.

Exploration: Upon location of a sufficiently anomalous mineral occurrence, or favorable occurrence indicator, a mineral prospect is established and is subjected to more intense evaluation through exploration techniques. Activities that take place during exploration include those utilized during prospecting but at a more intense level in a smaller area. In addition, activities such as road building, trenching, and drilling are conducted. In later stages of exploration, an exploratory adit or shaft may be driven. If the prospect already has underground workings these may be sampled, drilled, or extended. Exploration activities utilize mechanized earth-moving equipment, drill rigs, etc., and may involve the use of explosives.

Typical exploration projects in the planning area could include: in-stream dredging with portable suction dredges, exploratory drilling which could include construction of new roads, use of explosives to sample rock outcroppings, and excavation of test pits. If the exploration project disturbs 5 acres or less, it is conducted under a notice (43 CFR 3809.301) which requires the operator to notify BLM 15 days before beginning the activity. A copy of each notice received is sent to the Oregon Department of Geology and Mineral Industries (DOGAMI) for their review. If the project disturbs more than 5 acres, it is conducted under a plan of operations (43 CFR 3809.401) and requires NEPA compliance before approval.

Mine Development: If exploration results show that an economically viable mineral deposit is present, activity would intensify to obtain detailed knowledge regarding reserves, possible mining methods, and mineral processing requirements. This would involve applying all the previously utilized exploration tools in a more intense effort. Once enough information is acquired, a feasibility study would be made to decide whether to proceed with mine development and what mining and ore processing methods would be utilized.

Once the decision to develop the property is made, the mine permitting process begins. Upon approval, work begins on development of the mine infrastructure. This includes construction of the mill, offices, and laboratory; driving of development workings if the property is to be underground mined, or prestripping if it is to be open pit mined; and building of access roads or haulage routes, and placement of utility services. During this time additional refinement of ore reserves is made.

Once enough facilities are in place, actual mine production begins. Concurrent with production there often are "satellite" exploration efforts to expand the mine's reserve base and extend the project life. Reclamation of the property is conducted concurrently with, or upon completion of, the mining operation. Often subeconomic resources remain unmined and the property is dormant, waiting for changes in commodity price or production technology that would make these resources economic.

Activities that occur on these lands include: actual mining, ore processing, tailings disposal, waste rock placement, solution processing, metal refining, and placement of support facilities such as repair shops, labs, and offices. Such activities involve the use of heavy earthmoving equipment and explosives for mining and materials handling, exploration equipment for refinement of the ore reserve base, hazardous or dangerous reagents for processing requirements, and general construction activities.

The size of mines varies greatly and not all mines would require all the previously mentioned facilities and equipment. Acreage involved can range from less than 5 acres to several hundred. Any mining that involves greater than casual use, regardless of the number of acres, requires the submittal of a plan of operations, and appropriate NEPA analysis, under 43 CFR 3809.401 and .411.

Diatomite was mined by the open pit method a few miles west of Terrebonne in the 1950s and continued until the reserves were depleted (Orr and others, 1992). Currently, there are 20 mining claims for diatomite on adjoining lands administered by the BLM. No notices or plans of operation have been filed for these claims. If diatomite is produced from adjacent BLM administered lands, up to several hundred acres of ground disturbance could result. However, such large scale developments of diatomite are not expected during the life of this plan. Any development for production would require a plan of operations and compliance with NEPA.

Minor amounts of mercury have been produced from the Clarno Formation in the southeastern part of the planning area. Prospecting began in the late 1920s and by the late 1950s, the US Bureau of Mines had recorded 30 flasks of total mercury production from the Platner and Oronogo mines, though the actual output was probably larger (Brooks, 1963). No claims presently exist for mercury within the planning area. Any development for production would require a plan of operations and compliance with NEPA.

Salable Mineral Resources

Reasonably Foreseeable Exploration and Development Scenarios

Future Trends and Assumptions

It is assumed that the demand for mineral materials will continue to increase in conjunction with the population growth in central Oregon. The mineral material supply from existing private and public sources in the planning area appears to exceed the foreseeable demand over the next 20 years. However, based on the distribution of public and private ownership, ODOT is not able to consistently offer a public mineral material source for its construction projects in order to increase bidder competition (ODOT, 1998). Owing to the existing supply and the distribution of ODOT's prospective mineral material sites across the planning area, it is assumed that 3-4 new mineral material sites will be developed in the next 20 years.

The development and reclamation of mineral material sites would be subject to the Guidelines for Development of Salable Mineral Materials section (in this Appendix).

Rock Quarry, Sand/Gravel/Cinder Pit Development

Existing material sites disturb approximately 15–20 acres of land each. This acreage is necessary for the mine itself, rock crushing operations, truck-turn around areas, access trails for bulldozers and drills, overburden stockpile sites, and aggregate stockpile areas. For access to a new quarry site, approximately 0.5 acre of land would be disturbed by new road construction.

It is expected that the existing mineral materials sites in this area would be utilized intermittently throughout the planning period and that 3-4 new sites would be developed. Any development of a new site or expansion of an existing pit that causes surface disturbance beyond previously inventoried limits would require resource inventories, site-specific NEPA compliance, and development and reclamation plans.

After all useable material is removed from existing and future mineral material sites, reclamation work would be conducted according to an approved interdisciplinary plan. Upon depletion, reclamation work would be conducted on the material sites as well as on all unneeded access roads and trails. Oversized rock would be put back into the quarries or pits and where possible, cutslopes would be graded to conform to the

existing topography. Stockpiled topsoil would be spread over sideslopes and floors, and seeded as directed by BLM. Access roads and trails would be graded for proper drainage, scarified and seeded.

Decorative Stone

It is anticipated that the Prineville District Office would receive 10-20 sale requests per year for decorative stone, such as slab lava and ropy lava. At this time, there are no designated areas for which sales contracts or free use permits are issued for decorative stone; sales contracts and free use permits are only available for cinder and pit run gravel. However, one or more areas may be designated for decorative rock gathering during the life of this plan. Prior to designation and prior to any road or trail construction, appropriate inventories and NEPA compliance would be conducted to prevent unnecessary and undue degradation. Reclamation plans would be developed for any designated collecting areas and their access roads and trails. In most cases, existing roads would provide access to areas where the stone is scattered on the surface. In these areas, the rock would be hand-picked and loaded directly onto pick-ups or flatbed trucks, or onto pallets and then loaded onto trucks. There would be both on and off-road vehicle travel. There is a possibility that temporary road or trail construction could be necessary to gain access in some areas.

Stipulations and Guidelines for Mineral Operations

The following are mineral leasing stipulations, and guidelines for locatable and salable mineral operations. The special stipulations may be used on a site-specific basis.

Leasing Stipulations

Standard Leasing Terms

Standard leasing terms for oil and gas are listed in Section 6 of Offer to Lease and Lease for Oil and Gas Form 3100-11. They are:

> Lessee shall conduct operations in a manner that minimizes adverse impacts to the land, air and water, to cultural, biological, visual and other resources, and to other land uses or users. Lessee shall take reasonable measures deemed necessary by lessor to accomplish the intent of this section. To the extent consistent with lease rights granted, such measures may include, but are not limited to, modification to citing or design of facilities, timing of operations, and specification of interim and final reclamation measures. Lessor reserves the right to continue existing uses and to authorize future uses upon or in the leased lands, including the approval of easements or rights-of-way. Such uses shall be conditioned so as to prevent unnecessary or unreasonable interference with rights of lessee.
>
> Prior to disturbing the surface of the leased lands, lessee shall contact BLM to be apprised of procedures to be followed and modifications or reclamation measures that may be necessary. Areas to be disturbed may require inventories or special studies to determine the extent of impacts to other resources. Lessee may be required to complete minor inventories or short-term special studies under guidelines provided by lessor. If in the conduct of operations, T&E species, objects of historic or scientific interest, or substantial unanticipated environmental effects are observed, lessee shall immediately contact lessor. Lessee shall cease any operations that would result in the destruction of such species or objects until appropriate steps have been taken to protect the site or recover the resources as determined by BLM in consultation with other appropriate agencies.

Standard terms for geothermal leasing can be found on Offer to Lease and Lease for Geothermal Resources (Form 3200-24), Section 6, and are very similar to those described above for oil and gas leasing.

Powersite Stipulation (Form No. 3730-1) is to be used on all lands within powersite reservations.

Special Leasing Stipulations

The following special stipulations are to be utilized on specifically designated tracts of land as described in the Resource Management Plan.

Recreation, Motorized Travel, and Visual Resources

A 30-day public notice period may be required prior to exception, modification, or waiver of recreation, motorized travel, and visual resource stipulations.

Resource – Designated recreation sites including, but not limited to campgrounds, OHV staging areas, and OHV play areas

- *Stipulation:* Surface occupancy and use is prohibited within developed recreation sites.
- *Objective:* To protect developed recreation sites.
- *Exception:* An exception to this stipulation may be granted by the authorized officer if the operator submits a plan demonstrating that impacts from the proposed action are acceptable or can be mitigated adequately.
- *Modification:* The boundaries of the stipulated area may be modified by the authorized officer if the recreation site boundaries are changed.
- *Waiver:* This stipulation may be waived if the authorized officer determines that the entire leasehold no longer contains designated recreation areas.

Resource – Motorized Travel

- *Stipulation:* Access, travel, and drill site construction will be limited in areas where motorized use is restricted. Areas classified as limited to existing roads and trails or designated roads and trails will limit access for mining activities to just those roads that are open under the designation. Access will not be allowed in areas closed to motorized vehicle use.
- *Objective:* To protect important scenic and wildlife resources, and to enhance primitive recreational opportunities.
- *Exception:* An exception to this stipulation may be granted by the authorized officer if the operator submits a plan which demonstrates that impacts from the proposed action are acceptable or can be mitigated adequately.
- *Modification:* The boundaries of the stipulated area may be modified if the authorized officer determines that portions of the area can be occupied without adversely affecting the resource values.
- *Waiver:* This stipulation may be waived if the motorized vehicle closure is lifted. A 30-day public notice period will be required prior to exception, modification, or waiver of this stipulation.

Resource – VRM Class I

- *Stipulation:* Surface occupancy is prohibited in VRM Class I areas.
- *Objective:* To preserve the existing character of the landscape.
- *Exception:* None
- *Modification:* None
- *Waiver:* None. No exceptions, modifications, or waivers may occur because all VRM Class I lands within the planning area are in WSAs, which are already closed to mineral leasing (43 CFR Subparts 3800.0-3 and 3201.11).

Resource – VRM Class II

- *Stipulation:* All surface-disturbing activities, semi-permanent and permanent facilities in VRM Class II areas may require special design including location, painting and camouflage to blend with the natural surroundings and meet the visual quality objectives for the area.
- *Objective:* To control the visual impacts of activities and facilities within acceptable levels.
- *Exception:* None.
- *Modification:* None.
- *Waiver:* This stipulation may be waived if the authorized officer determines that there are no longer VRM Class II areas in the leasehold.

Wildlife

Resource – Raptor nest sites including but not limited to Bald Eagle, Golden Eagle, Northern Goshawk, Coopers Hawk, and Great Grey Owl nests (see Table 1).

- *Stipulation:* Surface occupancy and use is prohibited in the spatial buffers during the dates shown for each raptor species in Table 1.
- *Objective:* To protect raptor nest sites.
- *Exception:* An exception may be granted by the authorized officer if the operator submits a plan which demonstrates that the proposed action will not adversely affect the bird or its nest site.
- *Modification:* The boundaries of the stipulated area may be modified if the authorized officer determines that a portion of the area can be occupied without adversely affecting the species or its nest site.
- *Waiver:* This stipulation may be waived if the authorized officer determines that there is no longer raptor nesting habitat on the leasehold. Consultation with the ODFW will be required prior to exception, modification, or waiver of this stipulation.

Resource – Deer, elk, and pronghorn winter range

- *Stipulation:* Surface use is prohibited during the times listed in Table 1 within deer, elk, and pronghorn winter range. This stipulation does not apply to the operation or maintenance of production facilities.
- *Objective:* To protect deer, elk, and pronghorn winter range from disturbance during the winter use season and to facilitate long-term maintenance of deer/elk/pronghorn populations.
- *Exception:* An exception to this stipulation may be granted by the authorized officer if the operator submits a plan which demonstrates that impacts from the proposed action are acceptable or can be mitigated adequately.
- *Modification:* The boundaries of the stipulated area may be modified if the authorized officer determines that portions of the area no longer contain winter range. This stipulation can be expanded to cover additional portions of the lease if additional habitat areas are identified, or if habitat use areas change. The dates for the timing restriction may be modified if new wildlife use information indicates that the dates in Table 1 are not valid for the leasehold.
- *Waiver:* This stipulation may be waived if the authorized officer determines that the entire leasehold no longer contains winter range. Consultation with the ODFW will be required prior to exception, modification, or waiver of this stipulation.

Resource – Sage grouse lek sites

- *Stipulation:* Surface occupancy and use is prohibited within 0.6 miles of known sage-grouse lek sites.
- *Objective:* To protect sage-grouse lek sites.
- *Exception:* An exception may be granted by the authorized officer if the operator submits a plan which demonstrates that the proposed action will not affect the sage-grouse or its lek site.

- *Modification:* The boundaries of the stipulated area may be modified if the authorized officer determines that a portion of the area can be occupied without adversely affecting the sage grouse or its lek site.
- *Waiver:* This stipulation may be waived if the authorized officer determines that there is no longer a lek site on the leasehold.
- *Note:* There are no standardized closures to surface occupancy and use in sage grouse nesting, brooding/rearing, or winter habitat areas. However, restrictions (including seasonal closures to surface use) could apply and would be determined by site-specific analyses.

Areas of Critical Environmental Concern/Special Management Areas

Resource – ACECs

- *Stipulation:* Surface occupancy is prohibited within all ACECs.
- *Objective:* To protect natural processes and historic, cultural, scenic, fisheries, and wildlife resources.
- *Exception:* An exception to this stipulation may be granted by the authorized officer if the operator submits a plan demonstrating that impacts from the proposed action are acceptable or can be mitigated adequately.
- *Modification:* The boundaries of the stipulated area may be modified if the ACEC boundaries are modified.
- *Waiver:* This stipulation may be waived if the ACEC designation is lifted. A 30-day public notice period will be required prior to exception, modification, or waiver of this stipulation.

Guidelines for Locatable Minerals Surface Management

43 CFR 3809—Standards for Exploration, Mining, and Reclamation

The following operational guidelines for mining activities have been compiled to assist the miner in complying with the 43 CFR 3809 regulations, which apply to all mining operations on BLM administered lands. The manner in which the necessary work is to be done will be site specific and all of the following standards may not apply to each mining operation. It is the mining claimant's and operator's responsibility to avoid "unnecessary or undue degradation" and they must perform all necessary reclamation work. Refer to 43 CFR 3809 regulations for general requirements and performance standards. The BLM will provide site-specific guidelines for some mining proposals.

Operations in WSAs are regulated under 43 CFR 3802 and the wilderness IMP. WSAs are technically open to mineral location, but are severely restricted by the wilderness IMPs "no reclamation" standard.

Construction and Mining

Vegetation removal: Remove only that vegetation which is in the way of mining activities. Merchantable timber must be marked by BLM prior to cutting, and may not be used for firewood. It is recommended that small trees (less than 6 inches diameter at breast height [dbh]) and shrubs are to be lopped and scattered, or shredded for use as mulch. Trees over 12 inches dbh should be bucked and stacked in an accessible location unless they are needed for the mining operation.

Firewood: Firewood may not be cut and sold, or used off of the mining claims.

Topsoil: All excavations should have all productive topsoil (usually the top 6 to 18 inches) first stripped, stockpiled, and protected from erosion for use in future

reclamation. This also includes removal of topsoil before the establishment of mining waste dumps and tailings ponds if the waste material will be left in place during reclamation.

Roads: Existing roads and trails should be used as much as possible. Temporary roads are to be constructed to a minimum width and with minimum cuts and fills. All roads shall be constructed so as not to negatively impact slope stability. Access may be limited in some areas by off-highway vehicle restrictions.

Water quality: When mining will be in or near bodies of water, or sediment will be discharged, contact the ODEQ and U.S. Army Corps of Engineers. It is the operator's responsibility to obtain any needed suction dredging, streambed alteration, or water discharge permits required by Federal or state agencies. Copies of such permits shall be provided to the resource area manager if a notice or plan of operations is filed.

Claim monuments: Due to the history of small wildlife deaths, plastic pipe is no longer allowed for claim staking pursuant to state law. It is recommended that existing plastic pipe monuments have all openings permanently closed. Upon loss or abandonment of the claim, all plastic pipe must be removed from the public lands, and when old markers are replaced during normal claim maintenance, they are to be either wood posts or stone or earth mounds, consistent with state law.

Drill sites: Exploratory drill sites should be located near or adjacent to existing roads when possible without blocking public access. When drill sites must be constructed, the size of the disturbance shall be as small as possible in order to conduct drilling operations.

Dust and erosion control: While in operation, and during periods of temporary shut-down, exposed ground surfaces susceptible to erosion will need to be protected. This can be accomplished with seeding, mulching, installation of water diversions, and routine watering of dust producing surfaces.

Fire safety: All State fire regulations must be followed, including obtaining a campfire permit or blasting permit if needed. All internal combustion engines must be equipped with approved spark arresters.

Safety and public exclusion: The general public may not be excluded from the mining claim. In the interest of safety, the general public can be restricted only from specific dangerous areas (underground mines, open pits, or heavy equipment) by erecting fences, gates and warning signs. It is the operator's responsibility to protect the public from mining hazards. Gates or road blocks may be installed on existing or proposed roads only with the approval of the resource area manager.

Occupancy: All structures/trailers on mining claims must be used for mining purposes (must be reasonably incident to mining) and should be covered by a notice or plan of operation. Use of such a structure for residential purposes not related to mining or for recreation is not authorized.

Suction dredging: Filing either notice or plan of operations is required on all suction dredge operations. The operator must have the applicable ODEQ suction dredge permit prior to starting work, and a copy should be submitted to the resource area manager.

Tailings ponds: Settling ponds must be used to contain fines and any discharge into creeks must meet the ODEQ standards.

Trash and garbage: Trash, garbage, used oil, etc. must be removed from public land and disposed of properly. Do not bury any trash, garbage, or hazardous wastes on public

lands. Accumulations of trash, debris, or inoperable equipment on public lands are viewed as unnecessary degradation and will not be tolerated.

Cultural and paleontological resources: Operators shall not knowingly alter, injure, or destroy any scientifically important paleontological (fossil) remains or any historical or archaeological site, structure, or object on Federal lands. The operator shall immediately bring to the attention of the resource area manager, any paleontological (fossil) remains or any historical or archaeological site, structure, or object that might be altered or destroyed by exploration or mining operations, and shall leave such discovery intact until told to proceed by the resource area manager. The resource area manager shall evaluate the discovery, take action to protect or remove the resource, and allow operations to proceed within 10 working days.

Threatened and endangered species of plants/ animals: Operators shall take such action as may be needed to prevent adverse impacts to T&E species of plants and animals and their habitat which may be affected by operations. Special status species (Federal candidate/Bureau sensitive) of plants and animals, and their habitat, will be identified by the resource area manager, and shall be avoided wherever possible.

Areas of Critical Environmental Concern: Operators are required to prepare and have the BLM approve a plan of operations prior to conducting mining activities within ACECs. The plan of operations would specifically need to address methods to mitigate impacts to those relevant and important resource values for which the ACEC was designated.

Suitable Wild and Scenic Rivers: Areas within 0.25 mile of rivers recommended suitable as a wild river under the "Wild and Scenic Rivers Act," are closed to new mineral location. Mining activity occurring at the time of congressional designation would be allowed to continue, but must be conducted in a manner that minimizes surface disturbance, sedimentation, pollution, and visual impacts. Areas recommended as either scenic or recreational under the "Wild and Scenic Rivers Act" would allow new and existing mineral location to occur, but it must be conducted in a manner that minimizes surface disturbance, sedimentation, pollution, and visual impacts.

Reclamation

Reclamation of all disturbed areas must be performed concurrently with mining, or as soon as possible after mining permanently ceases. Reclamation shall include, but shall not be limited to: (1) saving of topsoil for final application after reshaping of disturbed areas has been completed; (2) measures to control erosion, landslides, and water runoff; (3) measures to isolate, remove, or control toxic materials; (4) reshaping the area disturbed, application of topsoil, and revegetation of disturbed areas, where reasonably practicable; and (5) rehabilitation of fisheries and wildlife habitat. When reclamation of the disturbed area has been completed, except to the extent necessary to preserve evidence of mineralization, the resource area manager must be notified so that inspection of the area can be made.

Equipment and debris: All mining equipment, vehicles, structures, debris, and trash must be removed from the public lands during periods of non-operation and/or at the conclusion of mining, unless authorization from the resource area manager is given to the operator or claimant in writing.

Backfilling & recontouring: The first steps in reclaiming a disturbed site are backfilling excavations and reducing high walls. Coarse rock material should be replaced first, followed by medium sized material, with fine materials to be placed on top. Recontouring means shaping the disturbed area so that it will blend in with the surrounding lands and minimize the possibility of erosion.

Seedbed preparation: Recontouring should include preparation of an adequate seedbed. This is accomplished by ripping or disking compacted soils to a depth of at least 6 inches in rocky areas and at least 12 inches in less rocky areas. This should be done following the contour of the land to limit erosion. All stockpiled settling pond fines, and then topsoil, are spread evenly over the disturbed areas.

Fertilizer: The resource area manager must be contacted to determine if fertilization will be necessary, and if so, the type and rate of application.

Revegetation: A resource area manager-approved revegetation prescription must be used to provide adequate revegetation for erosion control, wildlife habitat, and productive secondary uses of public lands.

Mulch: As directed by the resource area manager, during review of the notice or plan of operations, the disturbed area may require mulching during interim or final reclamation procedures. Depending on site conditions, the mulch may need to be punched, netted, or blown on with a tackifier to hold it in place. In some cases, erosion control blankets may be cost effective for use.

Roads: After mining is completed, all new roads shall be reclaimed, unless otherwise specified by the resource area manager. High wall and cutbanks are to be knocked down or backfilled to blend with the surrounding landscape. Remove all culverts from drainage crossings and cut back the fill to the original channel. The roadbed should be ripped to a minimum depth of 12 inches to reduce compaction and provide a good seedbed. The road must then be fertilized and seeded if necessary. When necessary, waterbars are to be used to block access and provide drainage.

Tailings ponds: The ponds should be allowed to dry out and the fines removed and spread with the topsoil, unless the fines contain toxic materials. If the ponds contain toxic materials, a plan will be developed to identify, dispose, and mitigate effects of the toxic materials. If necessary, a monitoring plan will also be implemented. The ponds should then be backfilled and reclaimed.

Guidelines for Development of Salable Mineral Materials

Proposed Operations

All proposed pits and quarries, and any exploration that involves surface disturbance, are required to have operating and reclamation plans that must be approved by the resource area manager. All proposals will undergo the appropriate level of review and compliance with NEPA.

Operating Procedures

Where practicable, the following requirements should be made a part of every contract or permit providing for the use of mineral material sites in the planning area:

- For additional information, see operating guidelines in the Management Plan.
- Oversized boulders shall not be wasted but shall be broken and utilized concurrently with the excavated material.
- The operator shall comply with local and state safety codes covering quarry operations, warning signs, and traffic control. All necessary permits must be obtained from state and county agencies.
- Use of the site for equipment storage and stockpiling rock material is allowed for

the duration of the contract or permit. Use of the site beyond that time would be authorized under a special use permit.

- All topsoil shall be stockpiled or windrowed, as appropriate, for use in reclamation.
- Prior to abandonment, all material sites will be graded to conform with the surrounding topography. Oversize material that is not usable will be placed in the bottom of the pit and the pit would be filled, graded covered with topsoil. Reseeding, if necessary, will be done as prescribed by the resource area manager. Access roads no longer needed by the BLM will be abandoned and reclaimed as directed by the resource area manager.
- For additional information, see operating guidelines in the proposed Management Plan.

Quarry Design

Where in steep terrain in the operating area, quarry developments will require a series of benches to effectively maximize the amount of mineral materials to be removed in a safe manner. In most cases, bench height should not exceed 40 feet, and if the bench will be used by bulldozers to access other parts of the quarry, the width of the bench should be at least 25 feet. If the bench is not used by equipment, then this width can be reduced to approximately 10 feet.

Clearing of timber and brush should be planned at least 10 feet beyond the edge of the excavation limit. Most often the brush will be piled and burned at the site, or scattered nearby.

If at all possible, all topsoil and overburden should be stockpiled and saved for eventual quarry site reclamation. These piles may need to be stabilized by seeding in order to minimize erosion during the winter months. As a standard procedure, the excavation of the quarry floor should be designed with an outslope of approximately 3 percent in order to provide for adequate drainage of the floor. Compliance with this design should be made a requirement of all operators at the site.