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ENVIRONMENTAL ASSESSMENT

OREGON TRAIL MUSHROOMS
GEOTHERMAL LOAN GUARANTY APPLICATION

MALHEUR COUNTY, OREGON

~~February~~ May 1981

~~Assistant Secretary for Resource Applications~~
Washington, D.C. 20585

GEOTHERMAL LOAN GUARANTY OFFICE
SAN FRANCISCO OPERATIONS OFFICE
DEPARTMENT OF ENERGY

DISCLAIMER

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1. SUMMARY

The action assessed is the guaranty of a loan by the Geothermal Loan Guaranty Office of the U.S. Department of Energy (DOE) to finance the construction and operation of a mushroom-growing facility that will use geothermal (hot) water for process and space heat. The project consists of two separate facilities: a growing facility located just outside of the eastern limit of the city of Vale, Oregon (Malheur County, Oregon) and a composting facility located about 6.4 km (4 miles) southwest of the city limits (also in Malheur County, Oregon).

Five test wells have been drilled into the geothermal resource at the growing site. Either well no. 4 or well no. 5 will serve as a production well. All geothermal fluids will be reinjected into the geothermal aquifer, so either well no. 3 will be used for this purpose, wells nos. 1 and 2 will be deepened, or a new well will be drilled on the site. A cold-water well will be drilled at the growing site, and another will be drilled at the composting site.

The environmental effects of the proposed project are not expected to be significant. Surface land subsidence is expected to be minimal and localized because of the shallow depth of the reservoir and the small amount of water to be extracted. Groundwater depletion is also expected to be minimal and localized because of the small amount of water to be extracted. No withdrawls from or discharges to the surface water system are anticipated as part of this project. Also, the site is located outside of the "100-year" flood hazard boundary as defined by the Federal Insurance Administration.

The air contamination from well drilling and facility operation is not expected to be significant. No analysis of gases from existing geothermal wells in the area is available; however, no odor of hydrogen sulfide is detectable at open wells near the site. More importantly, the geothermal water will be used in a closed system so that any gases present cannot escape during normal operation. Disturbance from noise is not expected to be lengthy or severe.

The project is not likely to have a significant effect on terrestrial or aquatic biota. No rare or endangered plants or animals are known to exist at the sites.

The effects on land use are not expected to be significant. The proposed use is consistent with the county zoning for the area of the growing facility. Although the soil type found at the growing facility is classified as "prime," the likelihood of high return from the use of this site as cropland is not great because the site is isolated from other fields by the Malheur River on three sides and the highway on the fourth side and, also, because the site is probably too small for the operation of large farm machinery. However, the commitment of prime farmland to the project is not irreversible because the land can be reconverted to farmland after the project's lifetime.

The project will have beneficial socioeconomic effects by expanding the county's tax base and producing a new source of employment and income for the local population. Up to approximately 70 jobs will be created by the project.

No archaeological sites, registered or proposed historic sites, or natural landmarks will be affected by the project.

Per GC request add something like: "The amount of solid waste generated by the proposed facility is expected to be small and if not disposed of as a byproduct will be disposed of in a local landfill."

2. DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

2.1 THE PROPOSED ACTION

2.1.1 Purpose and need for the action

Oregon Trail Mushrooms (OTM), a limited partnership in which Geothermal Energy Corporation (GEC) and Oregon Trail Resources Development (OTRD) will be the general partners, has proposed the construction and operation of a commercial mushroom-producing facility that will use geothermal water for process and space heat. To obtain financing, OTM has applied for a loan guaranty from DOE's Geothermal Loan Guaranty Program [authorized by Title 10, *Code of Federal Regulations*, Part 790 (10 CFR 790)]. In compliance with 10 CFR 790 and DOE's Proposed Guidelines for compliance with the National Environmental Policy Act based on current regulations from the Council on Environmental Quality, this document assesses the environmental impacts of the proposed action at the earliest meaningful time in the decision-making process.

2.1.2 Site location

The proposed site of the OTM growing facility is just outside the eastern limit of the city of Vale in Malheur County, Oregon. Vale is the county seat and is located about 607 km (377 miles) southeast of Portland and about 124 km (77 miles) northwest of Boise, Idaho (Fig. 2.1). U.S. Route 20 connects Vale with the nearby commercial center of Ontario, where U.S. I-80 provides access to Boise and other large cities in the Northwest. An additional facility for compost production will be located about 6.4 km (4 miles) southwest of the city limits (Fig. 2.2).

Both the city of Vale and the main project site are situated on the geologic floodplain of the Malheur River at an elevation of about 607 m (2200 ft). However, the site is protected by flood-control dikes on three sides and by dams located upstream. The buildings will be located outside of the "100 year" flood hazard boundary as defined by the Federal Insurance Administration. The flat river plain is abruptly terminated by rocky buttes that dominate the landscape of Vale, rising 200 to 300 m (700 to

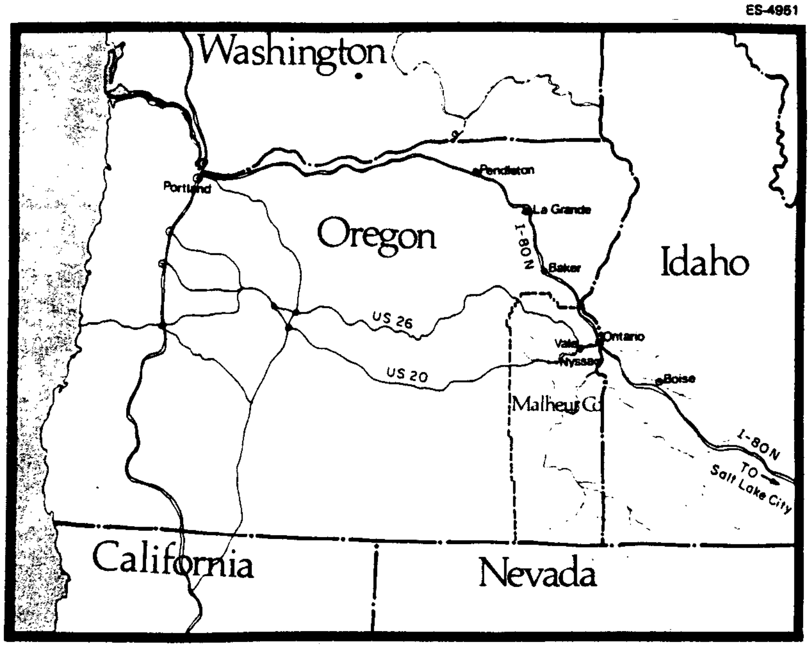

Fig. 2.1. Location of Vale, Oregon, in relation to major northwestern cities.

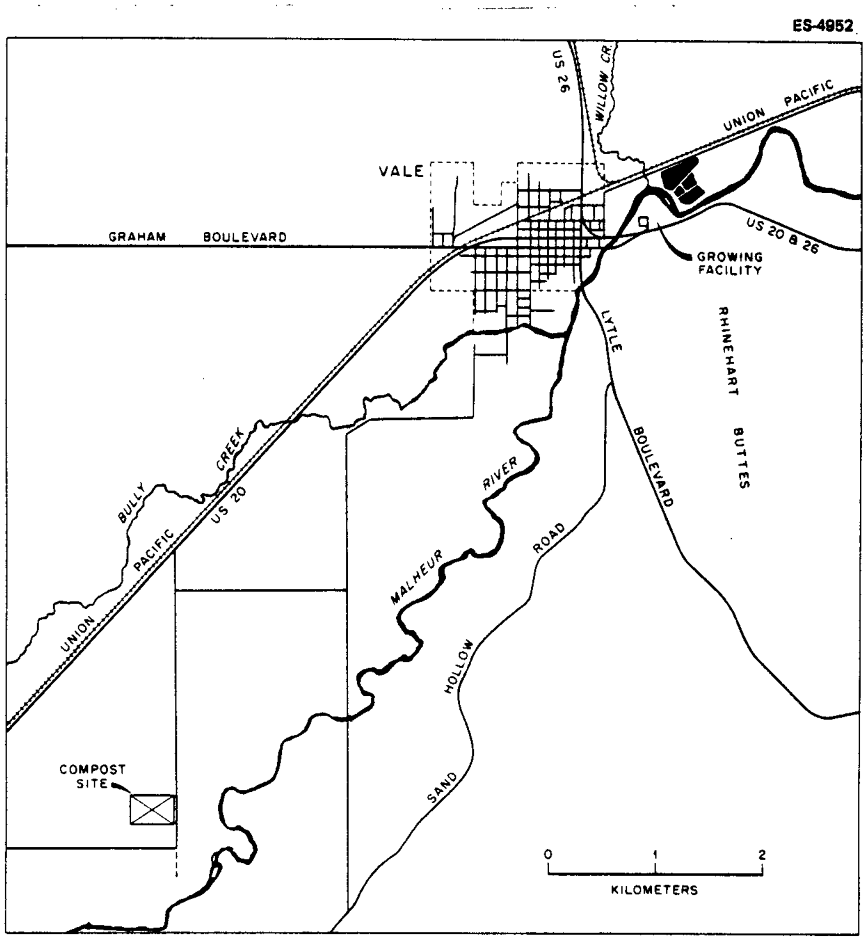

Fig. 2.2. Overall view of the project areas, showing main site and compost site.

900 ft) above the valley floor.[1] The Malheur River is a tributary of the Snake River and flows northeast from Vale to join Snake River near the Oregon-Idaho state line north of Ontario. The Malheur River and its tributaries provide water for irrigation of about 111,000 ha (274,000 acres) of land in the county.[2] Although 94% [2.4 million ha (5.9 million acres)] of the total county land area is nonirrigated rangeland, the economy of Malheur County is heavily agricultural. The Bureau of Land Management controls 73% of the land in Malheur County [about 1.8 million ha (4.5 million acres)].[2]

2.1.3 Project description

OTM proposes to use the most advanced methods currently available to produce mushrooms commercially. The process consists of several distinct steps, beginning with the formation of compost from raw materials. A compost wharf will be located on the western boundary of parcel III, which is 12 ha (30 acres) in size. After the compost is made, it will be transported to the growing site on parcel I [3.6 ha (9 acres)] where it will be pasteurized in the tunnel building. After pasteurization, the mushroom spawn will be applied to the compost and incubated. When the first phase of incubation is completed, the mold-laden compost will be moved to a nearby growing building to be incubated again. At this point, the incubated compost will enter the growing period. During the growing period, the first break, or yield, of mushrooms will be cut, sorted, and packaged. The compost will remain in the growing building after the first cut, and additional breaks of mushrooms will be produced. The compost will then be sent to the compost wharf for sale. In addition to the major buildings, there will be several smaller auxiliary buildings. A compost-shop building will be constructed next to the compost wharf on parcel III. A cooling-storage building and a boiler building will be constructed on parcel V near the growing building. A three-bedroom house on parcel II [0.28 ha (0.7 acre)] and a floral shop in parvel V [0.81 ha (2 acres)] will be redecorated to provide offices, meeting rooms, and a laboratory. Operation of the greenhouse on parcel V will remain unchanged. Other than two wells drilled in 1980 and a pipeline to them, no structures on parcel IV [7.7 ha (19 acres)] are planned for this project. Three other wells were drilled in 1980 on parcel V, and three older test wells are located on parcel I. The configuration of the parcels and location of the wells at the main site are shown in Fig. 2.3. Parcel III is the compost facility site shown in Fig. 2.2.

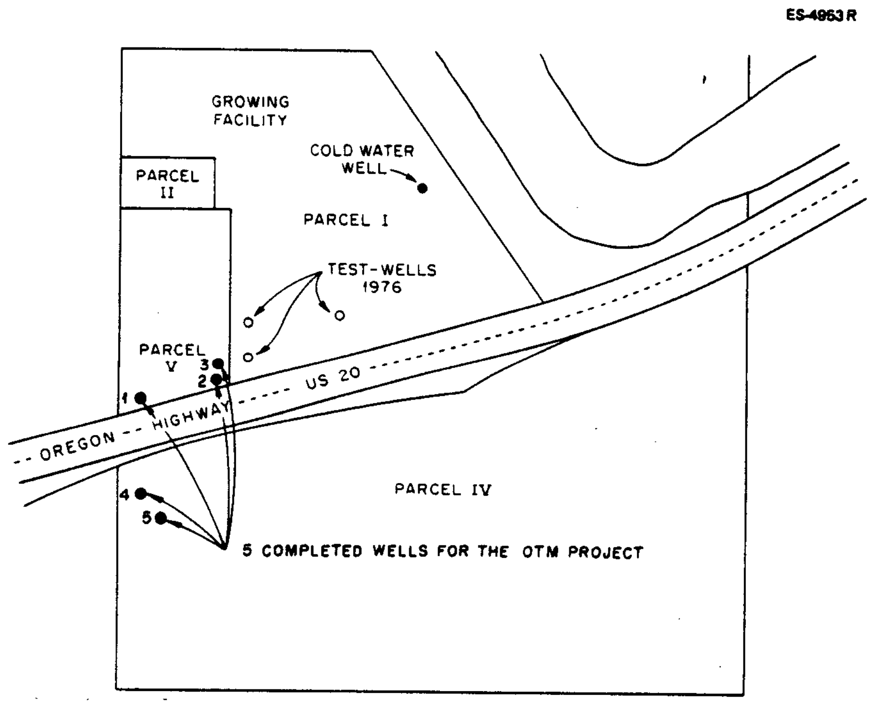

Fig. 2.3. Configuration of the OTM property parcels at the growing site.

2.1.3.1 Water wells

Development of the facility will occur in two continuous phases, partial construction and facility expansion. This will allow OTM to start mushroom production before construction is completed. Three wells were drilled in 1976 and were used for testing. They have not been plugged and are unrelated to the present project. Characteristics of the five wells drilled are given in Table 2.1. Water with a temperature of less than 121°C (250°F) is considered a water resource by Oregon state law, whereas water above that temperature is considered a mineral resource. Because water temperatures in all of the wells were less than

Table 2.1. Characteristics of recently drilled geothermal wells

Well	1	2	3	4	5
Date	3/24/80	6/19/80	3/29/80	4/2/80	6/19/80
Total depth, m	259	183	15	24	76
Cased interval, m	0–42	0–55	0–14	0–9	0–32
Perforated interval, m		12–19	12–14		25–32
Flow rate, liter/min	34	950	950	1140	950
Temperature, °C	99	82	84	102	102

[a]Maximum yield tested.
Source: Oregon Water Resources Department records.

121°C (250°F), casing in the wells was set according to regulations for water wells established by the Oregon Department of Water Resources (DWR) and the Department of Environmental Quality (DEQ). Extensive testing will be conducted to determine the production capability of the recently drilled wells. OTM anticipates that production from either well no. 4 or well no. 5 will suffice for all their needs. However, additional wells will be drilled if necessary. A total flow rate of 1890 lpm (500 gpm) for all geothermal wells will adequately supply OTM's needs for hot water for the completed facility. A flow rate of 950 lpm (250 gpm) will adequately supply OTM's hot water needs for the first phase of the facility.

All geothermal fluids produced will be reinjected into the geothermal aquifer; several options exist for this disposal. Well no. 3 may be used in its existing condition; wells nos. 1 and 2 may be used after they have been deepened, or a new well may be drilled on the site east of the existing wells. The design, installation, and receiving formation of the reinjection well will be approved by the Oregon DWR in accordance with their regulations. OTM will also comply with the state Underground Injection Control (UIC) Program mandated by U.S. EPA once it becomes effective.

In addition to the geothermal production and injection wells, there will be a cold-water well at the growing site and one at the compost site. Both will be drilled and cased according to standard procedures. The well at the growing site will probably be located in the eastern part of parcel I, and an adequately permeable zone is expected to be found at a depth of 15 to 30 m (50 to 100 ft). Demand for cold water at the growing site will not exceed 2650 lpm (700 gpm) for the completed facility. The demand for cold water at the growing site during the first phase of the facility will not exceed 1320 lpm (350 gpm). The freshwater well at the compost site will be located near the northeast corner of the compost wharf. Demand for fresh water at the compost site will not exceed 380 lpm (100 gpm). Drilling should take no more than two days for each well.

2.1.3.2 Construction

Construction will be in two continuous phases, partial construction and facility expansion. This will allow OTM to commence mushroom production before construction is completed. The first phase will involve the construction of the compost wharf; the tunnel building, which consists of several enclosed passages; one growing building; the cooler building; and the boiler building. Existing structures will be used for offices. Expansion will involve construction of a second growing building. The tunnel building may eventually be expanded at a later date.

The compost structure on parcel III will be a roofed, open, free-span structure erected on a concrete pad. The compost wharf will cover an area of about 2323 m^2 (25,000 ft^2). The existing county road will be paved, and a spur from it to the compost wharf will also be paved. The total amount of land cleared for construction and paving will be less than 1.5 ha (3 acres). Conventional construction methods and equipment will be used to build the facility, including a concrete storage pond with an area of 47.6 m^2 (512 ft^2), a depth of 2.4 m (8 ft), and a storage capacity of 114 m^3 (30,000 gal).

At parcels I, II, and IV, less than 2.5 ha (6 acres) will be cleared for paving and construction of the growing facilities shown in Fig. 2.4. The original tunnel building will consist of several tunnels, a work area, and a rest room. The tunnel area may eventually be expanded.

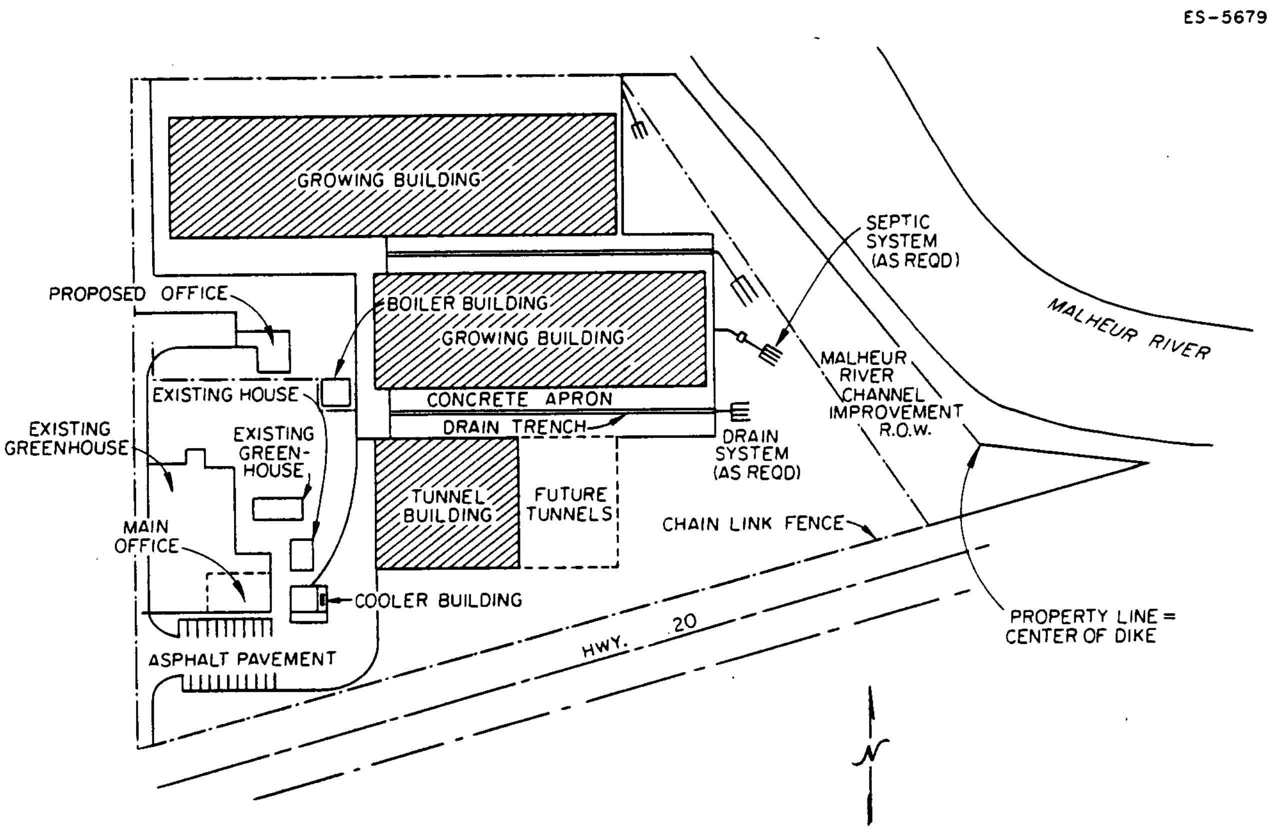

Fig. 2.4. Proposed layout of the growing facilities.

The original growing building will contain growing rooms, a corridor work area, and a rest room. During the expansion phase, an identical growing building will be added; it will be located near the original growing building. A cooler building and a boiler building will house the refrigeration and heating system. Conventional methods, equipment, and materials will be used to build the structures. The buildings will consist of a concrete foundation, steel girder support, and prefabricated walls and ceilings. A hole will be augered underneath Highway 20, and a pipeline will be set that connects the wells on parcel IV with the major facilities on parcel I. These activities will be done so as not to interfere with traffic.

The initial phase of construction is anticipated to take four months. An additional two months of preparation will be necessary before operation begins. The expansion phase will require several additional months.

2.1.3.3 Compost site operations

Compost, the medium in which the mushrooms grow, will be made on the compost wharf. The raw materials required to make compost are straw, poultry manure, and gypsum, all of which will be purchased from local farmers and vendors. The straw will be transported to the site in truck loads once each year during harvest. The poultry manure and gypsum will be stored in concrete bins on the compost wharf adjacent to the storage pond. Poultry manure will be brought to the facility by truck about three times a week; gpysum will be brought to the facility by truck about five times a year.

The straw will be wet by automatic sprinklers and then mixed with the gypsum and poultry manure by diesel-powered equipment. The mixture is watered and aerated by periodic turning by this equipment. After mixing, the compost is loaded into dump trucks by diesel-powered front-end loaders and transported to the mushroom growing site. The compost is made in staggered cycles so that at any time there is straw being wetted and compost mixtures at various stages of readiness. The water not absorbed by the straw or compost mixture will drain into the storage pond and be recirculated into the sprinkler system when needed or automatically when the pond contains 95 m^3 (25,000 gal). Water demand on the freshwater well is not expected to be more than 0.0063 m^3/s (100 gpm) at any time. Power for the sprinkler system will be provided by hookup to the existing onsite transmission line. Effluents from the compost operation will be diesel exhaust, evaporated water, and nontoxic amounts of inorganic gases, which rise from the compost and have an unpleasant odor. Table 2.2 lists the resources consumed and the products and effluents that result.

2.1.3.4 Growing-site operations

Compost will be transported twice a week to the tunnel building at the growing site. This will result in twelve round trips twice each week by truck between the compost site and the growing site. A carefully controlled convective system circulates air and steam up through the compost to maintain the precise climate control necessary to kill all

Table 2.2. Resource inventory for first-phase operation of compost facility

	Solid materials	Fuel	Water
Inputs	Compost Straw: ~35 t[a]/week from local farmers by truck annually Poultry manure: ~35 t/week from regional farmers by truck 3 times/week Gypsum: ~2 t/week from wholesaler by truck bimonthly Sale Spent compost: ~65 t/week from growing facility by trucks returning from fresh compost delivery	Moving equipment Diesel fuel[b] Electric power Hookup to 220-V transmission line onsite	Sprinkler system Groundwater: ⩽100 gpm
Outputs	Products Fresh compost: to growing facility by truck 24 times/week Spent compost: ~65 t/week sold to local farmers or nurseries	Gas (emissions) Compost NH_3, CO_2, H_2O[b] Moving equipment Diesel exhaust[b]	Water Vaporized Recycled Absorbed by compost

[a] t = metric ton.
[b] Quantity undetermined.

undesirable organisms and condition the compost. Steam will be produced by a boiler burning light fuel oil. The exact size of the boiler has not yet been chosen, but it will be no larger than one specified at 293 kW (1,000,000 Btu/hr) and no smaller than one specified at 72.5 kW (250,000 Btu/hr). Therefore, fuel use would range from a maximum of 56 m^3/year (14,892 gal/year) for the smaller boiler to a maximum of 225 m^3/year (59,568 gal/year) for the larger boiler. An intermediate-size boiler might be selected. The fuel will probably be stored in a 38-m^3 (10,000-gal) tank located near the office.

Demand for steam during the pasteurization and conditioning process will not exceed 35 kg/hr (16 lb/hr), and vents will release the air-steam mixture when necessary. After the compost has been conditioned satisfactorily, mushroom spawn purchased from a commercial laboratory is applied as the compost is mechanically withdrawn from the pasteurization tunnel. It is then transported to a growing building where the spawn is incubated, a process that again requires precise climate control. Demand for steam during incubation will not exceed 4.4 kg/s (2 lb/hr).

After incubation a layer of peat is added, and the material is placed onto growing shelves. Peat moss will be shipped to Vale in bags by rail or truck and transported to the growing facility about once every two months.

After the growing period, the first crop of mushrooms is ready. The mushrooms will either be picked by machine or by hand, depending on market response to the produce. After the mushrooms are picked, they will be sorted and packaged for shipment. About 75% of the mushrooms will be picked up by grocery delivery trucks en route to other scheduled pickups and deliveries each day. The remainder will be shipped about every other day to wholesale produce companies no farther than Boise, Idaho. Waste mushrooms will either be dumped at the Vale landfill [about 6.4 km (4 miles) away] or given to local farmers as animal feed.

After the first crop, the compost remains on the shelf and the same procedure is repeated for several more crops, except that the growing time is slightly less. While the mold and mushrooms are growing, they are watered periodically by an automatic sprinkler system. Water not absorbed by the growth medium will be collected by a drainage system that discharges into a drain field in compliance with DEQ regulations and recommendations. After the last crop, the room will be steam-cleaned and the spent compost mechanically removed into a dump truck that has finished unloading fresh compost at the tunnel building. The dump truck will return to the compost facility where the spent compost will either be sold as fertilizer to local farmers or packaged and sold to nurseries and other stores. Traffic generated by compost sales will depend on the bulk in which it is bought by customers.

Geothermal water will be used to preheat cool water before it is put through the boiler to produce steam. When heating is required, the geothermal water will circulate through a pressurized hot water coil system in an air-handling unit. The warmed air will be blown through ducts into the various buildings. The geothermal water will be pressurized at about 340 kPa (50 psi) to prevent corrosion by oxygen. When cooling is required, the geothermal water will be used to vaporize lithium bromide in a refrigerant system. This will chill water from the freshwater well that will then be blown into the ductwork. Precise temperature control will be maintained by a microprocessor unit that automatically mixes the hot and cold air streams.

Once the hot water has been circulated through the appropriate system, it will be injected into the disposal well. Hot and cold water for domestic use will also be provided by the cold-water wells. The geothermal water will heat the cold water for domestic purposes by means of a heat exchanger. Sanitary wastewater will pass through a septic tank before being discharged into a drain field according to Oregon DEQ regulations and recommendations.

Electricity will be provided by a hookup to a transmission line on the site. Table 2.3 lists the resources consumed and the products and effluents that result at the growing site.

2.2 NO ACTION ALTERNATIVE

No DOE action is equivalent to the denial of application for a loan guaranty and would eliminate the impacts associated with the project. Denial of the application would also eliminate the positive economic effects of the project and may slow down the commercialization of geothermal energy applications (an objective of the Geothermal Loan Guaranty Office). The qualifications for a loan guaranty are such that the project would probably not be implemented without the backing of DOE.

2.3 ALTERNATIVE SITES

The nature of the geothermal resource (fault related) requires that the drill sites and the facility be located as described in Sect. 2.1.3.1. Wells must be located on or near the fault. Direct-heat-application uses require that the facility be located close to the production well(s) to minimize heat loss during transport. Alternative sites for the production of compost were not identified. No significant adverse impacts from the project have been identified; therefore, little is to

Table 2.3. Resource inventory for first-phase operation of growing facilities

	Solid materials	Fuel	Water
Inputs	Mushrooms Fresh compost: from compost facility by truck 24 times/week Peat moss: ≤7.5 t/week from wholesaler by rail or truck ≤monthly Mushroom spawn: from commercial laboratory by plane to Boise, by truck to site monthly	Moving equipment Diesel fuel[b] Boiler No. 1 fuel oil: ≤4500 liters/week from distributor by truck ≤bimonthly Electric power Hookup to 220-V transmission line onsite	Geothermal water: ≤ 16 liters/s from ≤3 wells Boiler preheat Climate control 1. Heating system 2. Cooling system Domestic hot water heat exchange system Cold groundwater: ≤16 liters/s from 1 well Boiler feed Climate control Sprinkler system Domestic use 1. Cold water 2. Feed for heat exchange system
Outputs	Mushrooms: to market by grocery trucks backhauling daily, to regional produce wholesalers by truck every other day Mushroom waste: ~195 kg/week to Vale landfill by truck or given to local farmers daily Spent compost: ~65 t/week to compost facility by trucks returning from fresh compost delivery	Gas (emissions) Growing rooms NH_3, CO_2, H_2O[b] Moving equipment Diesel exhaust[b] Boiler ≤38 kg/week total emissions (particulates, SO_x, CO, NO_x)	Geothermal water: ≤16 liters/s injection into 1 disposal well Cold water: ≤16 liters/s into 4 drain fields Climate control and sprinkler system: disposal into drain fields (2) Domestic use: disposal through septic tanks (2) into drain fields (2)

[a] t = metric ton.
[b] Quantity undetermined.

be gained by moving the facility locations within the parcels previously described.

2.4 ALTERNATIVE OPERATIONAL PROCEDURES

OTM considered using down-hole heat exchangers rather than transporting the geothermal fluid to the facilities for direct application and use of the thermal energy. However, OTM has tentatively rejected the use of down-hole heat exchangers because little is known about the quality of the geothermal fluid and problems with sealing or corrosion may exist.

The methods of waste disposal (fluid injection and sale or landfilling of mushroom wastes and compost) do not result in any significant adverse impacts.

REFERENCES FOR SECTION 2

1. U.S. Department of the Interior, Bureau of Land Management, *Technical Examination Report and Environmental Analysis Record for Vale Known Geothermal Resource Area, Vale, Oregon,* U.S. BLM 36-030-4-1, 1974.
2. Malheur County Planning Office, *Comprehensive Plan, Malheur County, Oregon,* draft, 1978.

3. DESCRIPTION OF AFFECTED ENVIRONMENT

3.1 GEOLOGY AND SOILS

The proposed sites lie on the Malheur River floodplain in the Owyhee Uplands, on the Columbia Plateau at the western edge of the Snake River Downwarp. The floodplain consists of Quaternary alluvium. It is surrounded by benchlands and uplands of moderate relief composed primarily of Pliocene river and lake deposits forming tuffaceous sandstones, siltstones, and conglomerates. These strata are known collectively as the Chalk Butte Formation, which generally dips gently to the east and has a thickness of 152 m (500 ft) or more. The formation of the Vale and Rhinehart buttes, which stand in bold relief to the valley and uplands, is currently being debated and studied by geologists. Although the buttes are mapped as part of the Miocene-age Deer Butte Formation, apparently uplifted by faulting,[1] it is more plausible that they are a part of the Chalk Butte Formation that has been silicified along a fault zone and have therefore resisted erosion.[2] The Chalk Butte Formation is underlain by several thousand feet of basalt flows and older river and lake deposits, all of which are Miocene age or younger.

Several faults have been identified in the area, although the displacement along them has been difficult to determine. The faults have not displaced recent deposits; therefore, surface expression of them is minimal and geophysical evidence becomes crucial. Of the greatest significance are the Malheur River Fault trending east-west along the Malheur River,[3] the Willow Creek Fault trending northwest-southeast along Willow Creek, and Vale Fault, a likely continuation of the Willow Creek Fault south of the Malheur River Fault (Fig. 3.1). Some geologists consider the east block of the Willow Creek and Vale faults to be a horst,[4] indicating a northernmost extension of the Basin and Range Province. The Malheur River Fault intersects these faults at the growing site, helping to explain why the geothermal resource is so near the surface.

A moderate seismic risk exists in the area, which is in zone II as defined by Algermissen.[5] An earthquake with an epicenter west of Vale

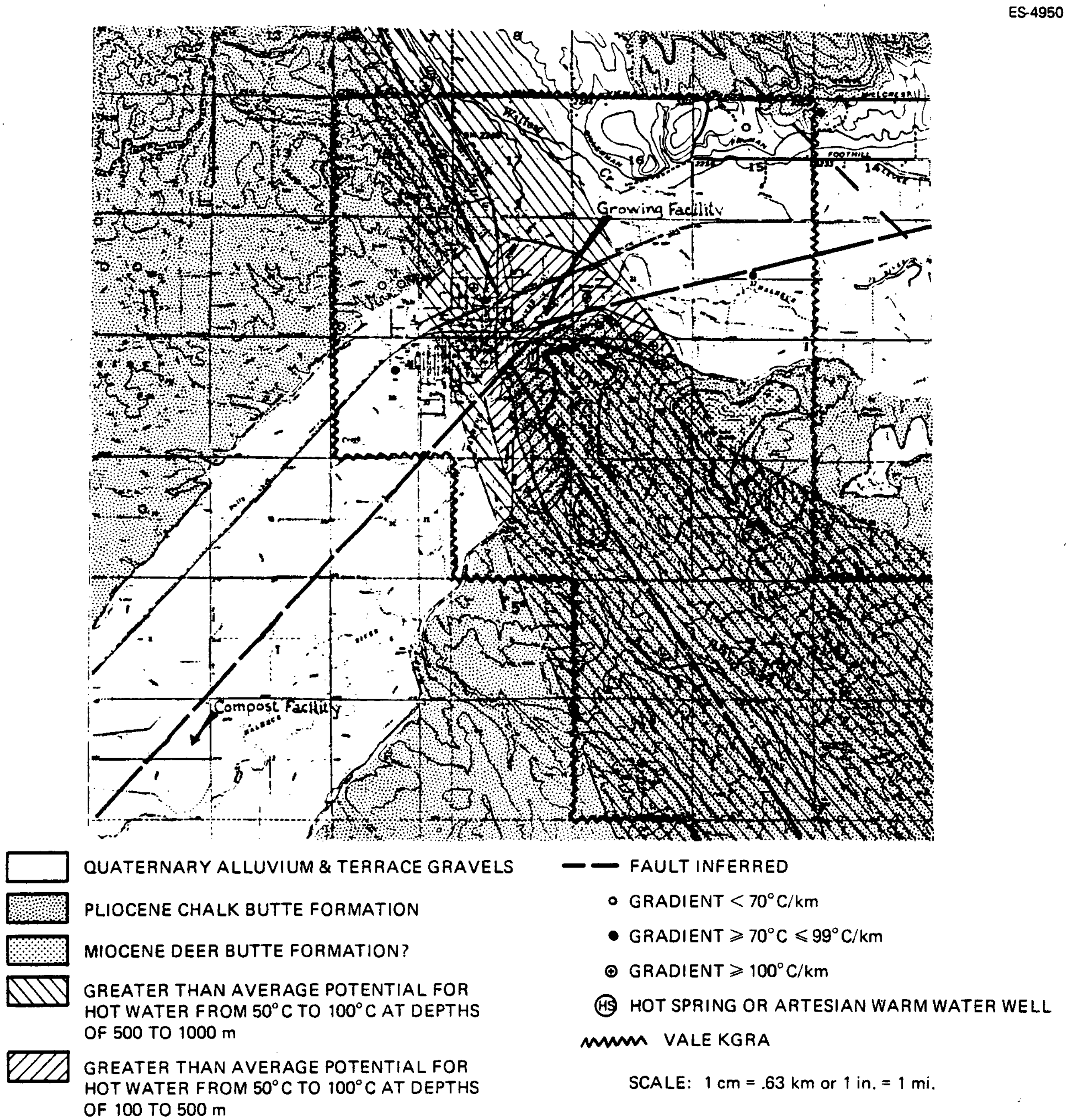

Fig. 3.1. Geologic map of Vale area. Sources: Malheur County Comprehensive Planning Staff, *Comprehensive Planning Program's Background Reports. Vol. IV. Land Capabilities and Natural Resources*, 1977, and Paul Lienau, *Agribusiness Geothermal Energy Utilization Potential of Klamath and Western Snake River Basins, Oregon*, 1978.

and a magnitude of 3.0 to 3.5 on the Richter scale was felt by residents of Vale in 1975. Evidence of mass wasting in the form of rockfalls occurs on the slopes of Rhinehart Butte across the road from the growing site.

Soil on the compost site belongs to either the Stanfield or Umapine series and is coated with alkali on the surface. The Stanfield series consists of a surface horizon of light brownish-gray silt loam underlain by a horizon of hardpan, at a depth of 56 cm (22 in.). The Umapine series consists of a dark brownish-gray silt loam to a depth of 152 cm (60 in.). Both these soils are alkaline. Soil on the growing site belongs to the Powder series, which has a dark brown surface horizon of silt loam underlain by a horizon of very fine sandy loam to a depth of 251 cm (99 in.). The pH of Powder soils ranges from 6.6 to 8.4. All the soils were formed from recent alluvium and have (1) a low shrink-swell potential, (2) slow runoff rates, (3) slight wind and water erosion hazard, (4) wetness as a problem condition, and (5) a 0 to 3% slope. Permeability is moderate in the Powder soil, and it has very good agricultural capability if reclaimed and irrigated. Permeability is moderate to low in the Umapine and Stanfield soils, which have good agricultural capability if irrigated and reclaimed (Sect. 3.6.3).[6]

3.2 HYDROLOGY AND WATER QUALITY

3.2.1 Surface water

The major perennial surface water features of the Vale area are the Malheur River, its tributaries (Willow Creek and Bully Creek), and the Snake River, into which the Malheur flows. Other surface water is found in intermittent streams, creeks, and ponds in winter and spring and in irrigation and drainage ditches. Surface water in the region is used almost exclusively for agriculture and recreation.[7]

Bully Creek, Willow Creek, and the Malheur River have all been greatly altered by and for agricultural use. The creeks have been channelized, straightened, and dammed to create reservoirs for irrigation withdrawal. Diversion of river water to the reservoirs or for irrigation causes low flows and high water temperatures in summer because of solar heating of the diminished supply. Also during summer, the lower Malheur River is largely composed of irrigation wastewater characterized by a high silt load and a high level of nonpoint-source agricultural pollutants.[8] The Malheur River is typically not in compliance with Oregon water quality standards for temperature, turbidity, and suspended solids.[9] Siltation, channelization, agricultural pollution, and irrigation withdrawal have essentially destroyed the fishery value of the lower creeks and river in the Vale vicinity.[8] Fishing for both wild and stocked sport fish occurs primarily in the upper reaches of the creeks and river above the reservoirs.

The site is protected by flood-control dikes on three sides and by dams located upstream. The dike marks the boundary of the "100-y" flood hazard boundary as determined by the Federal Insurance Administration. As indicated in Fig. 2.4, the site property line is located along the center of the dike. Therefore, the project will be located outside the "100-y" flood hazard boundary determined by the Federal Insurance Administration.[10]

3.2.2 Groundwater

The most prevalent source of groundwater in the area is the Quaternary alluvium, which is 15 to 30 m (50 to 100 ft) thick on the floodplain. The water table stays relatively constant at 3.7 m (12 ft) below the surface except during periods of flooding. Pumping rates up to 1320 lpm (350 gpm) are common at depths of 7.6 to 15 m (25 to 50 ft). In some places the water table has risen slightly because of extensive diversion of water into the Malheur River Watershed and intensive irrigation practices. This change has been moderate because most of the valley is now at or near hydrologic equilibrium. Groundwater in the area varies from hard to very hard, and corrosion is a frequent problem to users of groundwater.[7] Table 3.1 gives the chemical analysis of a sample from a shallow cold-water well on the eastern portion of parcel I. Boron exceeds federal agricultural requirements, and iron exceeds federally recommended drinking water criteria.[11] Groundwater is also sporadically

Table 3.1. Partial listing of constituents in sample of cold water from well on parcel I

	Concentration (ppm)
pH	8.3
Nitrate	2.4
Phosphorous	0.07
Potassium	3.00
Calcium	12.1
Magnesium	2.8
Sodium	203.0
Zinc	9.7
Iron	1.3[a]
Manganese	0.024
Copper	0.22
Sulfate	134.00
Boron	1.09[b]

[a] Exceeds Oregon drinking water standards and will require pretreatment to reduce the concentration to the standard of 0.3 mg/liter.

[b] Exceeds federal agricultural requirements and will require pretreatment to reduce the concentration to the standard of 0.75 mg/liter.

Source: Western Laboratories, *Water Test Laboratory 1031,* Parma, Idaho, April 1977.

available in the Chalk Butte Formation below the alluvium. Little is known about its characteristics because it is seldom used. A stratum of sand containing a good flow of warm water occurs several hundred meters northeast of the growing site at a depth of 171 to 175 m (560 to 575 ft).[12]

3.2.3 Geothermal resources

The Vale Hot Springs, immediately east of the growing site, discharge groundwater at approximately 93°C (200°F) at the banks of the Malheur River. The ground around the springs and in the southwest corner of parcel IV is warm enough that plants there remain green all year. Two wells in parcel V, both less than 15 m (50 ft) deep, provide hot water at temperatures of 93°C (200°F) to 104°C (220°F) for the greenhouse. These temperatures contrast with those of the cold-water test well on parcel I and other wells in the vicinity, such as those that supply water to the city of Vale, that have temperatures close to that of the average annual air temperature. Although the causes of the hot water are still not well understood, apparently the intersection of the Malheur River Fault with the Willow Creek-Vale Fault serves as a conduit for the release of heat and possibly water from a much deeper source. The geothermal waters contain high concentrations of boron and arsenic (see Table 3.2), which restrict their use for drinking and agriculture. The exact nature of the geothermal system is still currently unknown.

3.3 ATMOSPHERIC CHARACTERISTICS

3.3.1 Climate

The climate of eastern Oregon is considered temperate because of the predominant influence of Pacific air masses that moderate temperature extremes. The passage of these air masses over the Coastal, Cascade, and Blue Mountain ranges, however, results in the loss of most of their moisture.[13] Hence, the climate of the eastern portion of the state is semiarid with warm, dry summers and cold, dry winters. Average annual precipitation ranges from 22 to 28 cm (9 to 11 in.), 45% of which is snow. There is an average of 156 frost-free days per year for the Vale-Ontario-Nyssa area.[7]

Predominant winds are from the north and west, averaging 8 to 10 km/h (5 to 6 mph), but occasionally reaching about 65 km/h (40 mph), usually during March, April, and May.[7] Devastating weather events such as cloudbursts, tornadoes, or severe hailstorms are relatively rare in Oregon,[13] and even winter snows generally do not make outdoor operations hazardous in Vale.[7] Drought during spring and early summer is the most damaging weather condition for the area. Agricultural crops and practices are planned accordingly, with most cultivated land being irrigated.

Table 3.2. Partial listing of constituents from samples of geothermal water from Vale Hot Springs[a] and geothermal well no. 1[b]

	Concentration (mg/liter) (except as noted)	
	Vale Hot Springs	Geothermal well no. 1
Color, units	50	NR[c]
Turbidity, JTU	62	NR
Solids, total	1160[d]	994
Solids, volatile	89	NR
pH, standard units	8.0	7.75
Alkalinity, total as $CaCO_3$	132	NR
Hardness as $CaCO_3$	78.7	NR
Calcium	32.0	15.6
Magnesium	1.2	3.56
Total iron	0.2	NR
Manganese	0.05	NR
Arsenic	0.15[d]	NR
Conductance, μmho/cm	2000	1040
Chlorides	350[d]	NR
Sodium	315	310
Potassium	11.0	7.9
Fluoride	5.0	5.25
Phosphates, soluble ortho	0.2	NR
Sulfates	111.5	NR
Silicon	78.3	73.5
Aluminum	0.1	NR
Nitrogen, ammonia	0.0	NR
Nitrogen, nitrite	0.0	NR
Nitrogen, nitrate	0.70	NR
Lithium	0.33	0.3
Boron	13.50[d]	9.7

[a]Source: Oregon Department of Environmental Quality, *Laboratory Sample SW 75-102,* Salem, April 1975.

[b]Source: Century Laboratories, *Laboratory Sample No. 7189,* Boise, Idaho, July 1980.

[c]Not reported.

[d]These values exceed certain federal and state standards. For that reason, direct application of the geothermal fluid was not considered for the project.

3.3.2 Air quality and dispersion conditions

Air in the Vale area is generally considered to be of high quality,[9] and, in fact, Malheur County is currently meeting all federal air quality standards. Major sources of pollution are related to agricultural activities. Dust storms may result from exposure of bare soil during harvesting or preparation for planting.[14] Burning of residue on agricultural lands, application of agricultural chemicals, the presence of nearby food processing plants, and the Boise urban area all contribute pollutants to the region's air.[7] Temperature inversions are frequent enough to produce a considerable potential for air quality problems. Figure 3.2 gives isopleths for the number of forecast days of high meteorological potential for air pollution in the United States. Vale is located in one of the higher isopleth regions (40 to 50 days in a five-year period).

3.4 NOISE

The location of the proposed growing facility is on U.S. Highway 20 on the fringes of the municipal area of Vale. The proximity of this location to the road makes it an exception to the otherwise quiet rural background. Traffic is fairly heavy and constant because Highway 20 is the main route through the county for truck traffic between western and central Oregon and U.S. I-80N in Ontario.

The compost facility site is more typical of the general area in terms of background noise. Ambient sound levels would be expected to result from nearby light traffic, operation of farm equipment, and wind; the average level would be about 40 dB(A).

There is no county or municipal ordinance governing noise. Complaints about public-nuisance noise would most likely be handled through the county or municipal court in Vale on a case by case basis.

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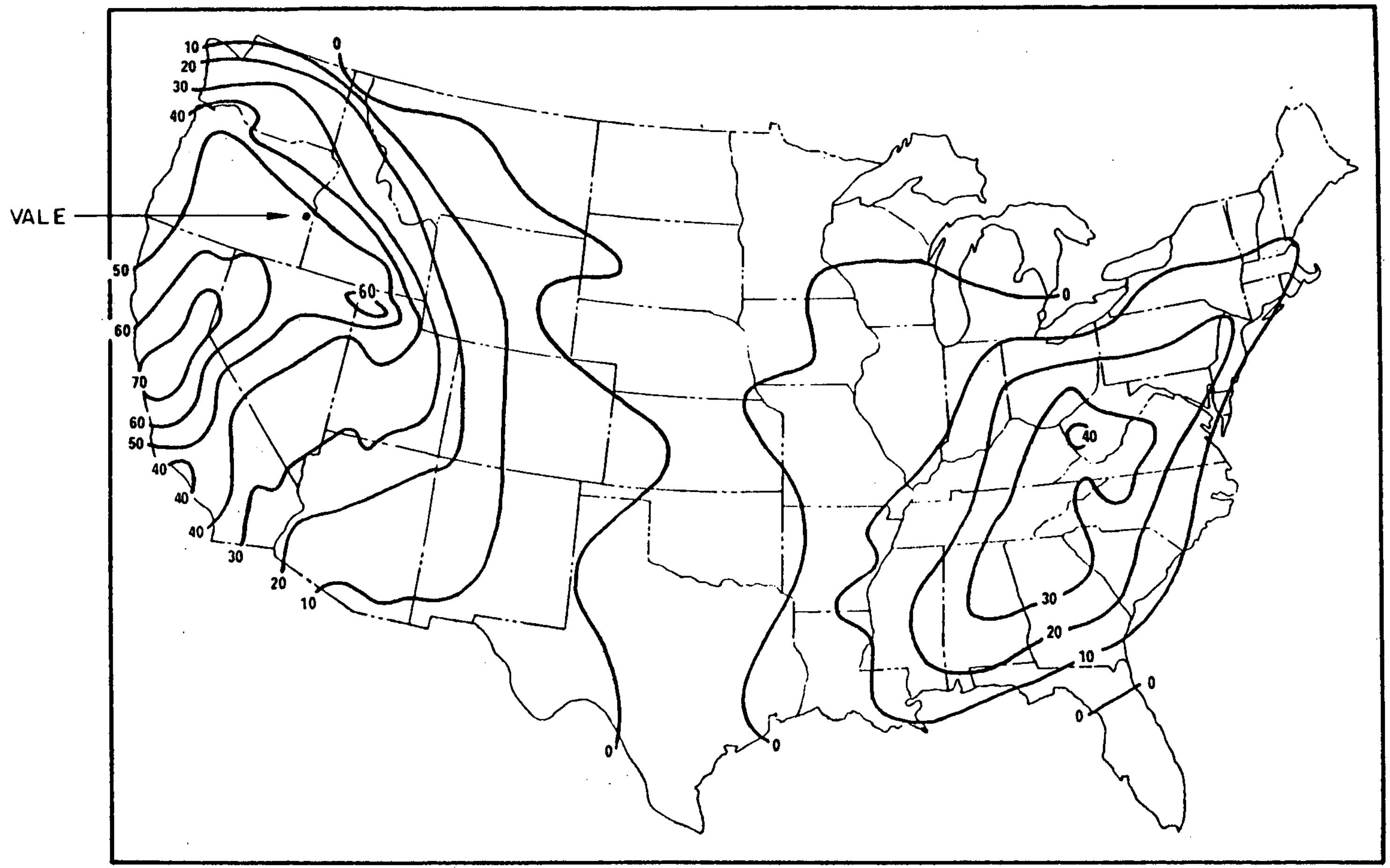

Fig. 3.2. Isopleths of total number of forecast days of high meteorological potential for air pollution in a five-year period. Data are based on forecasts issued since the program began (Aug. 1, 1960, and Oct. 1, 1963, for eastern and western parts of the United States respectively) through April 3, 1970. Source: G. C. Holzworth, *Mixing Heights, Wind Speeds, and Potential for Urban Air Pollution Throughout the Contiguous United States*, Environmental Protection Agency, U.S. Government Printing Office, Washington, D.C., 1972.

3.5 ECOLOGY

3.5.1 Terrestrial ecology

The biota of the Vale area is typical of the Cold Desert Biome.[14] A desert shrub or shrub-steppe plant association forms the native floral assemblage, which consists mainly of perennial bunch grasses, such as bluebunch wheatgrass (*Agropyron spicatum*) and Idaho fescue (*Festuca idahoensis*), and big sagebrush (*Artemisia tridentata*). A century of abusive overgrazing by domestic livestock, however, has converted most of the bunch grass understory to less desirable annual grasses, notably cheatgrass (*Bromus tectorum*). Sagebrush and other shrubs have also increased in abundance on damaged land. A range rehabilitation program begun in 1962 has resulted in reseeding with crested wheatgrass (*A. cristatum*) and brush control in some areas. The native bunch grass, however, is now largely restricted to areas inaccessible to livestock or far from water.[14]

The native fauna of the area includes mule deer and pronghorn antelope, the major big game species; small mammals such as bats, rabbits, and rodents; "fur-bearers" such as beaver, muskrat, otter, raccoon, and mink; carnivores such as coyote, fox, skunk, and bobcat; and numerous species of reptiles, amphibians, and birds. Appendix A is a list of mammals, birds, and reptiles found in the Vale KGRA. Figure 3.3 is a map of use areas for recreational wildlife species.

Riparian habitat, characterized by thick vegetational cover, is found along the stream and river banks. Willows (*Salix* spp.), chokecherry (*Prunus* spp.), and numerous meadow grasses and forbs are representative of this habitat type.[7] Much of it has been converted to agricultural use, however, and such is the case for the site of the mushroom-growing facility. Irrigated farmland does provide habitat for quail (*Lophortyx californica*) and pheasant (*Phasianus colchicus*), which are important game species,[9] and the reservoirs and wetlands along the creeks and rivers provide habitat for migrating and resident waterfowl.

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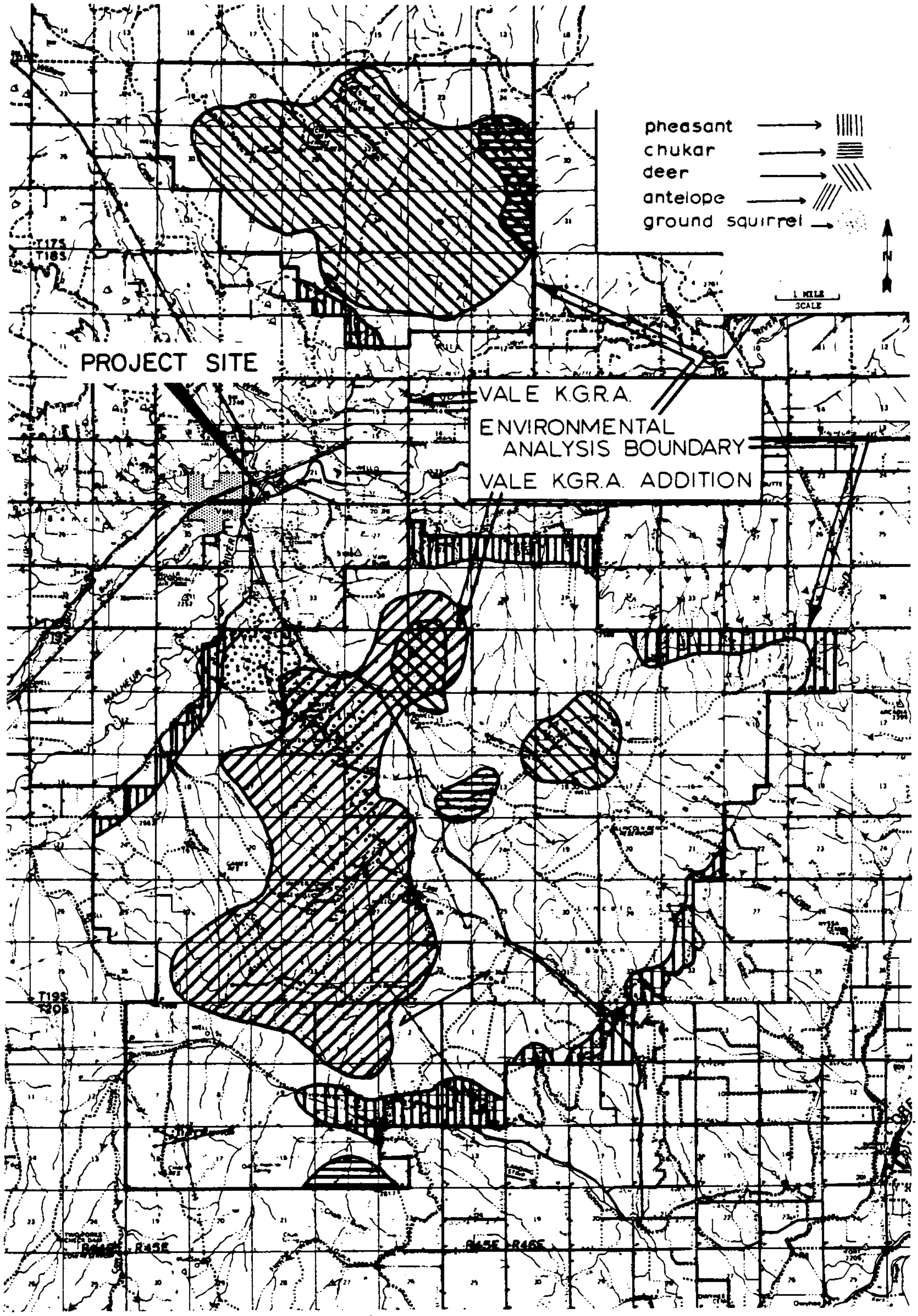

Fig. 3.3. Use areas for common recreational wildlife species. Source: U.S. Bureau of Land Management, Vale, Oregon, District Office, *Environmental Analysis Record of Vale Geothermal Resource Area, Vale, Oregon,* 1974.

3.5.2 Aquatic ecology

No commercial fisheries exist in Malheur County.[8] The reservoirs and upper reaches of the creeks and rivers support productive sport fisheries which are managed by periodic eradication of rough fish and restocking for recreational use. Species present include smallmouth bass (*Micropterus dolomieui*), black crappie (*Pomoxis nigromaculatus*), and rainbow trout (*Salmo gairdneri*).

The lower Malheur River near Vale is a continuous mixing zone of nonpoint irrigation wastewater in summer. Consequently, there is little fishing value in this section. Likewise, the lower portion of Willow Creek is said to be currently devoid of fishery value; most of the fishery production of Bully Creek has also been lost.[8]

3.6 LAND USE

3.6.1 Malheur County

The land area of Malheur County is about 2.6 million ha (6.3 million acres). Of this total, about 2.4 million ha (5.9 million acres), or 94%, is rangeland. Much of this land, about 73% of the county, is controlled by the Bureau of Land Management, which authorizes grazing use for local stockmen. The livestock-related income from the county's rangelands amounted to an estimated $38 million in 1977.[15] In addition, rangeland provides areas for recreation — such as off-road vehicle use, hunting, fishing, and "rockhounding" — and for wildlife habitat.

Only about 111,000 ha (274,000 acres) of the county is cropland. These areas are primarily located in the river valleys, close to sources of water for irrigation. Major crops include potatoes, sugar beets, onions, and corn. Despite the relatively small percentage of county land in the cropland category, production of nonlivestock agricultural commodities generated the largest percentage of income, about $48 million in 1977. Conservation of agricultural land is a major issue in Malheur County since the flat river valley croplands are also the most attractive areas for residential development.[15] About 85% of the county's population resides in and around the cities of Nyssa, Ontario, and Vale; about one-third of the county's irrigated land is also located in and around these three cities.

3.6.2 Project sites

A more detailed picture of land use in and around the city of Vale as of 1976 is presented in Fig. 3.4. The location of OTM's proposed growing facility is on a parcel of land bounded on the west, north, and east by the Malheur River and on the south by Highway 20. Although this area was previously used to grow alfalfa or as pasture, it currently lies fallow; it is zoned C-2 (Commercial or Rural Service Center Zone), which allows farm or commercially oriented agricultural use.[16] Several geothermally heated greenhouses, used for growing flowers and potted plants, are located on OTM-owned property to the west of the proposed growing facility site. There are also several private residences.

The proposed composting site (Fig. 2.2) is located on land previously used to grow crops but which is now pasture. The shift from cropland to pasture occurred because of the buildup of salts from continual irrigation. This area is now extremely alkaline and thus very poor for pasture.

3.6.3 Prime and unique farmland

The site of the mushroom-growing facility is on soil in the Powder series. This soil type is classified as "prime" in Malheur County. Documentation to this effect was provided by the Soil Conservation Service of Ontario, Oregon (Appendix B).

The compost facility is located on soils of the Umapine and Stanfield series. These soil types are not considered prime or unique in Malheur County.

3.7 WATER USE

Use of water in the Vale vicinity is predominantly for agricultural and municipal purposes. Large amounts of water from the Malheur River and its tributaries are diverted for irrigation. Whereas surface water

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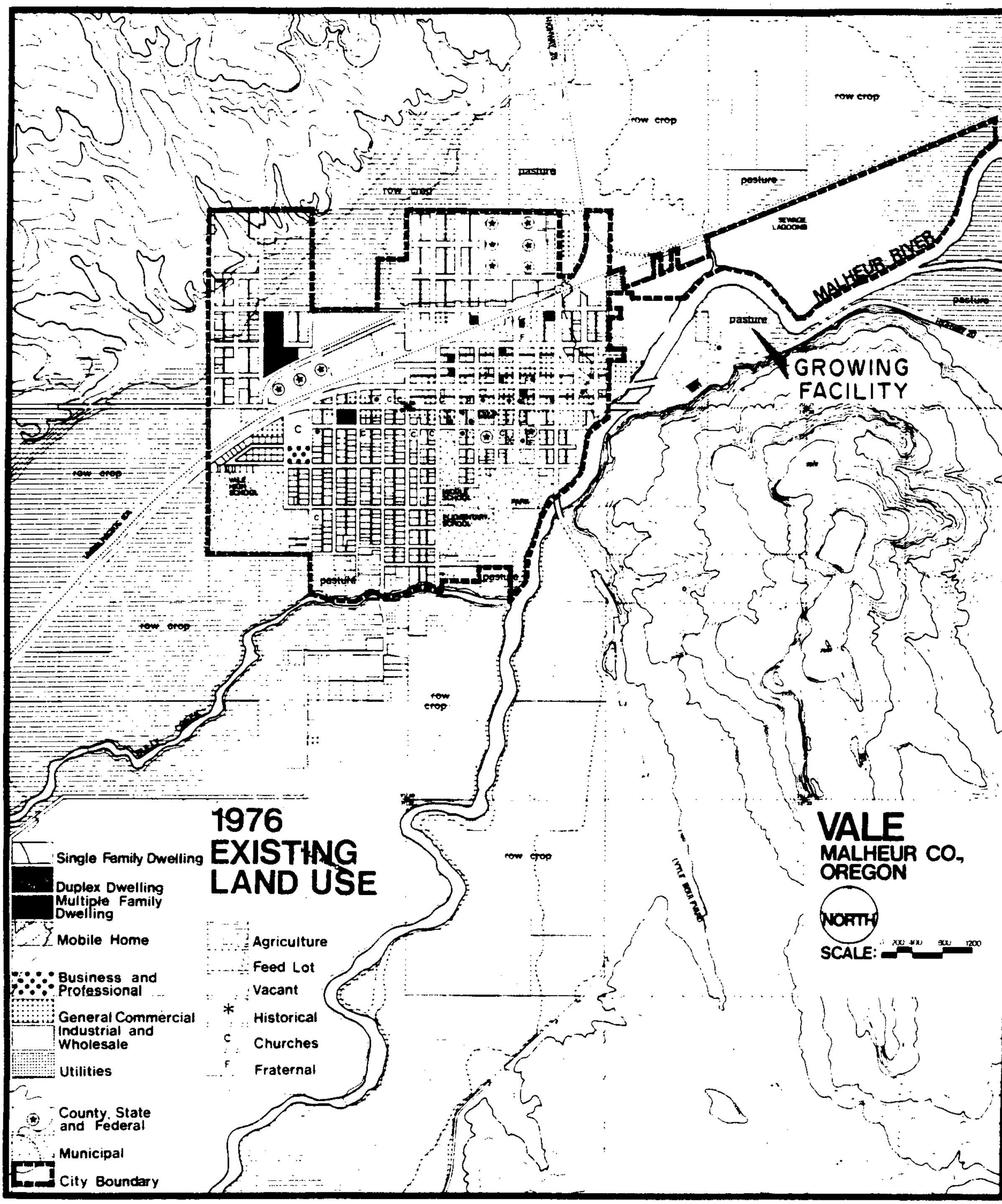

Fig. 3.4. Existing land use in and around the city of Vale, 1976. Source: Malheur County Comprehensive Planning Staff, *Comprehensive Planning Program's Background Reports. Vol. IV. Land Capabilities and Natural Resources*, 1977.

is used almost exclusively for agriculture, municipal and industrial supply comes primarily from groundwater. In 1979, the month of maximum withdrawal by the city of Vale was June [87,500 m^3 (23 million gal)], whereas February was the month of minimum withdrawal [37,800 m^3 (10 million gal)].[12] Municipal use by Vale represents the major withdrawal of groundwater in the area.

3.8 DEMOGRAPHY AND SOCIOECONOMICS

The 1979 population of Vale is about 1900; the estimated total population of Malheur County was about 25,000 in 1977.[15] About 85% of the county's residents live in and around the cities of Vale, Nyssa, and Ontario. The percentage of residents living in rural areas has declined with the modernization of agriculture and an accompanying reduction in farm-related employment. Growth has recently been rapid in Ontario because of its importance as a regional commercial and service center. Population projections suggest further growth there but stable to moderate growth for Vale and Nyssa.[15]

The economic and employment base of Malheur County is narrow and concentrated on agriculture. Crops and livestock are the major sources of livelihood. Industrialization is limited to food processing (e.g., potatoes and sugar beets), which, in turn, is dependent on local agriculture. Although agricultural and food processing employment declined as technology improved, farm income has generally risen in recent years because of increased productivity and favorable market prices.[17] Unemployment is generally low, partly because of heavy out-migration, especially of young, educated adults. Malheur County ranks near the bottom of the state for most measures of income; about 20% of the population is at or below poverty level.

Malheur County exhibits a surprisingly high level of cultural diversity. Three distinct ethnic groups are strongly represented: (1) Basque immigrants were attracted to the area in the 19th century by the sheep-raising industry. Until recently, they retained their own language, culture, and identity; the younger generation is now becoming more Americanized. (2) During World War II, Japanese-Americans were evacuated from U.S. coastal areas to detention camps in Malheur County. About half of them remained after the war.[9] (3) A Mexican-American group representing former migrant laborers has also become established. Many have little or no knowledge of English and remain culturally segregated as a result. This group is thought to be particularly subject to unemployment stemming from agricultural mechanization.[15] In 1970, Spanish-speaking individuals constituted over 10% of the county population.

3.9 CULTURAL RESOURCES

3.9.1 Archaeological and historical sites

The Vale area was of interest to early Indian tribes because of the presence of the river and hot springs. It was a favorite camping ground of Paiute Indians, the major tribe in the region, but was also used by the Snakes and Shoshones. Rhinehart Butte was once an Indian burial ground, but most of the relics at the site have long since been removed.[18] No intensive professional inventory of archaeological and paleontological sites has ever been completed, but there is good probability that numerous sites exist. An archaeological survey of OTM's parcels I, II, III, and V, however, revealed no surface evidence of aboriginal use.[19] The report on this survey is included as Appendix C.

The first white settlers were miners and stockmen who arrived in the mid-nineteenth century. Vale was a stopping point for emigrants on the Oregon Trail who were attracted by the presence of good water and the hot springs. The Stone House Hotel, the first structure built in Vale, was opened as a traveler's rest in 1873 by Louis B. Rhinehart. This structure, located on Main Street in Vale, is listed in the National Register of Historic Places.[20] A second site listed in the National Register is the Oregon Trail Historic District, about 8 km (5 miles) SE of Vale on Lytle Boulevard (Fig. 2.4). Lytle Boulevard closely follows the original trail. Roads, cultivated fields, and the town have obliterated most other evidence of it. Many other unlisted points of historical interest are found in and around Vale. These include the stagecoach station ruins, abandoned townsites, abandoned mine sites, pioneer graves, and homestead ruins. Many sites potentially qualify for the National Register of Historic Places.[20]

3.9.2 Natural landmarks

There are no natural landmarks in Malheur County, Oregon, that are listed in the National Registry of Natural Landmarks.

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4. POTENTIAL ENVIRONMENTAL CONSEQUENCES

4.1 IMPACTS ON GEOLOGY AND SOILS

Normally, subsidence and induced seismicity are the two most significant geologic impacts that might be caused by geothermal development. Subsidence often results when the rate of fluid withdrawal or discharge from an aquifer exceeds the rate of recharge. The groundwater recharge rate for this area is not known; however, the amount of discharge resulting from the project is small [about 31.5 liters/s (500 gpm)]. Also, most of the withdrawn fluids (both hot and cold waters) will be returned to the system. Geothermal fluids will be reinjected, and water used for domestic purposes and the sprinkling systems will recharge the unconfined, shallow groundwater system as seepage from the drain field. Therefore, because of the small fluid withdrawal quantities and the large percentage of fluids to be returned to the groundwater systems, the likelihood of subsidence caused by the project is low. Should subsidence occur, it would most likely be confined to the project site and would be small. The flood protection afforded by a dike 3.7-m (12-ft) high should not be significantly affected.

Induced seismicity may occur when the fluids are injected into rocks at pressures in excess of the existing pore pressure or by activating faults by injecting or withdrawing fluids. Induced seismicity resulting from the injection of fluids into rock above its pore pressure will be prevented by complying with Oregon DWR regulations governing injection procedures. The likelihood of activating existing faults in the area is small because of the small size of the project. Also, the absence of surface displacement along the faults at the growing site indicates that they have probably been inactive for a long period of time.

To reduce the uncertainty of the adverse impacts of subsidence and determine what, if any, mitigatory measures are necessary, a detailed study should be undertaken to determine how the geothermal system operates and what the effects of its development are.

In addition to the impacts that may be caused by the project, existing geological hazards may affect the project. Vale is in seismic risk zone II (Fig. 4.1), in which natural earthquakes can occur and cause moderate damage. There is also a remote possibility that rock fall or slumping on the steep slope in parcel IV could cross the highway and cause damage to the project facilities. Sound engineering and building practices appropriate for a seismic risk zone II will be implemented to reduce or prevent damage resulting from a natural earthquake.

Less than 3.7 ha (9 acres) of the project sites will be paved or built on. Paving and construction will increase surface runoff onto soil adjacent to project facilities and thus increase the likelihood of erosion. Impacts of soil disruption can be reduced by effective engineering design and landscaping.

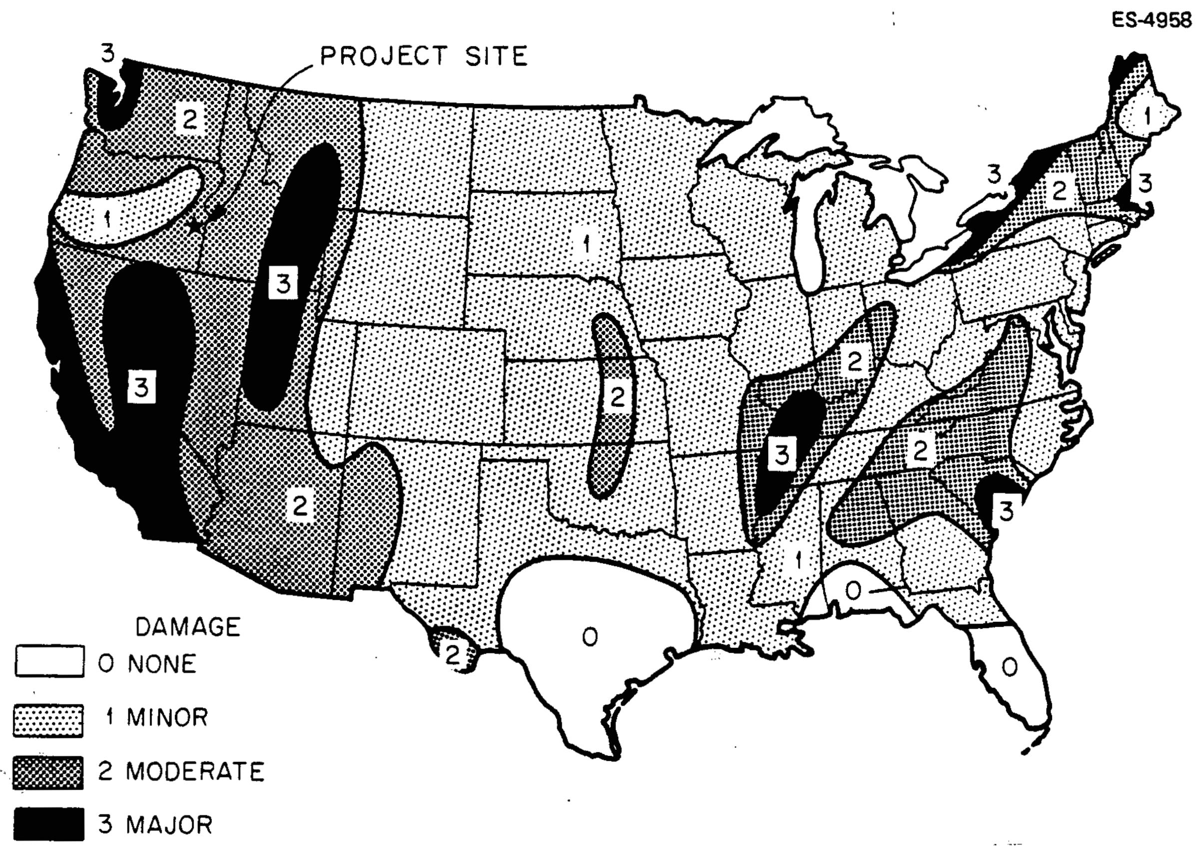


Fig. 4.1. Seismic risk zones for the continental United States. Source: S. T. Algermissen, *United States Earthquakes*, U.S. Government Printing Office, Washington, D.C., 1968.

4.2 IMPACTS ON WATER QUALITY

4.2.1 Surface water

All water used in the mushroom-growing and compost operations will come from groundwater supplies via onsite water wells. This includes both geothermal fluids and cold water for other purposes. No use of surface water from the Malheur River is involved.

Disposal of water used in the OTM facilities is not expected to have an impact on any surface water body. Hot geothermal fluids will be reinjected into the hot-water aquifer. Cold water from the greenhouses will be filtered to remove solids and then discharged into an approved drain field. No leakage of water from the drain field to the Malheur River is anticipated. Sanitary wastewater will be discharged into a septic system. Water for the sprinkling stream at the compost production site will be pumped from an onsite well and stored in a pond to be recirculated. The latter site is about 400 m (1/4 mile) from the river and thus would not have an impact on it.

4.2.2 Groundwater

Potential impacts on groundwater include depletion of groundwater, including the geothermal resource, and deterioration of groundwater quality.

Fluctuations in groundwater levels may occur when water is withdrawn from one unit and injected into a second. Depletion resulting from the proposed project, however, is expected to be minor based on previous experience. Reduced temperatures or flows indicate that the geothermal resource is being used faster than it is being replaced. The greenhouses on parcel V have been in operation for about 20 years, and neither the temperature of the geothermal water nor the water table has changed significantly. The cold-water wells may also deplete groundwater. Much of the cold water at the growing site, however, will be returned to the system through the drain fields, thus reducing the likelihood of the water table being lowered. Further study of the geothermal and normal groundwater systems, their relationship to each other, and their relationship to surficial hydrologic features is necessary to determine impacts more effectively. Potential impacts of the project on Vale Hot Springs and the

Malheur River are considered in Sect. 4-7. The well at the compost site is the only one in several acres; therefore, it has a larger groundwater source from which to draw, even though the water table may experience a minor drop.

Deterioration of groundwater quality can result from improper well drilling or casing, improper injection techniques, or improper septic tank or drain field design or placement. Compliance with appropriate Oregon DEQ and DWR regulations, county ordinances, and the EPA UIC Program (when it becomes effective) will prevent the occurrence of these impacts as a result of normal operation. OTM should have no difficulty complying with regulations of the UIC program. Accidents are discussed in Sect. 4.10.

The Oregon DEQ has recommended that the percolation rate of septic wastes that have passed through an adequate septic tank should not exceed 0.57 m^3/6.97 m^2 per day (150 gal/75 ft^2 per day) through drainage sidewalls in specified soils, of which the Powder soil is one. This rate is calculated so that a safety margin of 100% exists. OTM will comply with this recommendation; therefore, the possibility of adverse impact to the groundwater because of improper drain field design or placement should be very low.

4.3 IMPACTS ON AIR QUALITY

Sources of impact on air quality from the project are minor and include fugitive dust, emissions from burning of diesel and boiler fuel, and odor from the compost.

All regularly used areas of the project sites will be paved. Therefore, any dust problem should be only temporary and confined to the construction stage.

The boiler will be between 250,000 and 1 million Btu/h and will burn light fuel oil. Small commercial boilers (500,000 to 15 million Btu/h) typically produce the following emissions per 1000 liters of fuel: 0.25 kg particulates, 5 kg SO_2, 0.1 kg SO_3, 0.6 kg CO, and 2.8 kg NO_x. The EPA considers that emission sources producing less than 100 lb/h of each pollutant do not constitute a major emission source.[1] The amounts of pollutants produced by OTM's boiler will be substantially less than this level, should be readily dispersed, and should not pose an air quality problem.

Very few of the pieces of equipment used onsite are diesel powered. Those that are include the compost turner, straddle buggy, front-end loaders, and dump trucks. All other equipment is electric. Transportation of materials into and out of the plant sites will involve an increase in truck traffic in the area. This increase, however, will be minimized by the fact that most major purchasers of the finished product have trucks in the area to deliver other produce. These same trucks will pick up mushrooms, thus preventing an empty run to their home distribution centers.

Production of the compost causes some unpleasant odor. The composting operation will therefore be located in an area well removed from the residential district of Vale. Only one permanent residence is near the compost site.

No analysis of gases from the existing geothermal wells is available. Although hydrogen sulfide is often released when geothermal fluids are withdrawn, no odor of hydrogen sulfide is detectable at the open wells used at the greenhouses. The geothermal fluid will also be used in a closed system so that any gases present would not normally be released.

4.4 NOISE IMPACTS

Sources of noise in the project area include well drilling, construction activities, and operation of vehicles and equipment. Drilling for a maximum of six water wells will probably be accomplished in less than two weeks total time. Construction will also be of brief duration. No extensive clearing or excavation of the site will be required, and much of the activity will be devoted to assembling prefabricated materials. Hence, disturbance will not be lengthy or severe.

Operation of trucks, front-end loaders, and other machinery will represent a more permanent increase in noise level. The project sites are outside the residential area, and activity will probably be confined to daylight or business hours; consequently, very few residents will notice the increase. Existing thoroughfares will be used for project-related truck traffic so that little difference from current levels of noise from the highway should be noticeable outside the project area.

4.5 ECOLOGICAL IMPACTS

4.5.1 Terrestrial ecology

The OTM facility is not likely to have a significant impact on the terrestrial biota of the area. No rare or endangered plants or animals are known to exist at the sites. Both sites have been extensively disturbed by agricultural use. The growing site is also close to the continual disturbance of the main highway. Neither site constitutes valuable wildlife habitat.

4.5.2 Aquatic ecology

The OTM facility will not have a significant impact on any aquatic biota in its vicinity. No withdrawal from or disposal of water to the river is planned. Even an accidental release of fluids from the mushroom plant would be unlikely to cause significant damage because the adjacent section of the river is already drastically altered by non-point pollution and irrigation withdrawals.

4.6 IMPACTS ON LAND USE

The construction and operation of OTM's plant will represent only a slight shift in land use. Because the proposed business is a commercial agricultural one, OTM's use is consistent with county zoning for the area of the growing facility. Although the soil type on the main parcel is considered "prime," the likelihood of high return from use of the site as cropland is not great. The area is isolated from other fields by the river on three sides and the highway on the other. It is probably too small for operation of large farm machinery to be efficient. The existing residences and other structures on adjacent parcels also tend to limit its suitability as cropland. Thus, the commitment of a few acres of prime farmland to the project will represent only a minimal conflict with other agricultural use. This commitment is not an irreversible one because the land can be reconverted for farmland after the project's lifetime. The compost facility site is not now usable as cropland because of its alkaline condition. Therefore, no conflict with other uses is likely to arise.

4.7 WATER USE IMPACT

According to the Watermaster of Malheur County, use of water for the project will not significantly limit its use for any other purposes (Appendix D). Oregon governs water use by means of filing appropriative rights. Any conflict regarding water use would be resolved on the basis of these rights. The project has the potential to deplete the flow of Vale Hot Springs, but this depletion would probably not pose a significant impact. The hot springs are not regarded as a cultural or recreational resource by any group. Although appropriative rights for the hot springs have been filed, they have not been used in the last five years and therefore can be subjected to abandonment procedures under Oregon State law.[2] Depletion of Vale Hot Springs would reduce the amount of chemical constituents present in the springs, such as arsenic and boron, entering the Malheur River.

The project is unlikely to have a significant impact on the flow of the Malheur River because of the small size of the project and the fact that most of the geothermal and normal groundwater being withdrawn will be returned to the subsurface by reinjection or infiltration.

4.8 SOCIOECONOMIC IMPACTS

The establishment of the OTM facilities is likely to have a positive impact on the local socioeconomic situation. The business will represent a new source of income and employment for the citizens of nearby towns and for Malheur County.

Construction workers will probably be recruited from the skilled labor force available within about 100 miles of Vale. Construction activities are expected to be complete in less than one year, so this form of employment will be short term. A permanent labor force of about

40 to 50 workers, however, will be employed once the plant is fully operational. Since training in operation of the facility will be given at the plant, workers from the unskilled and semiskilled labor pool in Vale and Ontario can be recruited. Operation will be year-round, thus entailing no seasonal unemployment. If marketing conditions dictate that a hand-picked product is more desirable than a machine-harvested one, about 70 workers will be needed.

County planners consider that diversification of the county's economy is necessary.[3] The proposed OTM facility is therefore regarded as a desirable step toward this goal. Success of the business will expand the county's tax base and produce new revenue. This project also represents the initial development and commercialization of a new natural resource, which is also encouraged by the county.

Because local residents will provide the labor force, only a small daily increase in traffic from commuting personnel is likely, and because Highway 20 is a main route, it should be adequate to handle the increased personnel and truck traffic to and from the plant.

4.9 IMPACTS ON CULTURAL RESOURCES

No negative impacts on cultural resources are anticipated from the OTM project. Parcel I, on which the greatest amount of construction will be performed, was at least partly under water as recently as the 1870s. The river has shifted its path by forming a meander to expose this site since then. All parcels have been extensively disturbed by farming and/or construction (parcels II and V). No surface evidence of aboriginal use was detected during a recent archaeological survey. If site preparation and construction activities should unexpectedly uncover any buried artifacts, the archaeologist who performed the survey or some other qualified professional will be notified and asked to make an evaluation. This stipulation will be a part of the loan agreement.

All the registered or proposed historical sites discussed earlier (Sect. 3.9) are outside the project area and will not be affected. There are no natural landmarks close enough to the project sites to be potentially affected by it.

4.10 ACCIDENTS

Project-related accidents for geothermal facilities usually include well blowouts, deterioration of groundwater quality due to casing failure, and surface spills of geothermal fluids.

The geothermal resource for the OTM project is shallow and normally pressured; therefore, the chance of a blowout is minimal.

Casing failure in the disposal well could contaminate the project's cold-water supply as a worst case. Arsenic and boron are naturally present in Vale Hot Springs at levels exceeding federal water quality standards. These substances are inferred to be present in the geothermal fluids at the site and could degrade the quality of water used for mushroom watering and domestic purposes. Proper drilling and casing procedures, however, minimize the likelihood of a casing failure.

The impact of a surface spill would probably be extremely minor even if it involved hot water. A spill could result in infiltration of the cold groundwater supply and the river by geothermal fluids. The impact on groundwater would be similar to that of a casing failure but less severe because a surface spill is more readily detected. Vale Hot Springs flows naturally into the river just upstream of the project site, and river temperatures are often abnormally high due to low flows. A spill-related infiltration would probably not have a significant additional detrimental influence on the river.

REFERENCES FOR SECTION 4

1. U.S. Environmental Protection Agency, *Compilation of Air Pollutant Emission Factors*, 3rd ed., AP-42, August 1977.
2. Frank Elfering, personal telephone conversation with Paul Intemann, January 26, 1981.
3. Malheur County Planning Commission, *Comprehensive Plan for Malheur County, Oregon*, Draft, 1978.

5. COORDINATION WITH STATE, LOCAL, AND REGIONAL PLANS

There are no known conflicts with state, local, or regional plans. The project has been coordinated by the applicant's requests for permits or opinions from state and county agencies having jurisdiction or interests in the area of the proposed project and by DOE contacts with various federal, state, and local agencies. The agencies contacted include:

Federal

Bureau of Land Management
Soil Conservation Service
Fish and Wildlife Service
Geological Survey

State of Oregon

Water Resources Department
Department of Fish and Wildlife
Department of Environmental Quality
Department of Geology and Mineral Resources

County of Malheur

County Planning Commission
County Watermaster

These agencies have concurred that the proposed facility is compatible with known plans for the area.

6. ORNL CONTRIBUTORS

This environmental analysis was prepared by the Oak Ridge National Laboratory for the Geothermal Loan Guaranty Office, San Francisco Operations Office of the U.S. Department of Energy. The ORNL staff who contributed to this report are: L. J. Mezga (M.S., Geology; Certified Professional Geologist), Project Manager; F. E. Sharples (Ph.D, Zoology; Certified Professional Ecologist), Project Team Leader; and P. R. Intemann (B.S., Geology).

Appendix A

FAUNA THAT OCCUR IN THE VALE KGRA*

*From U.S. Department of the Interior, Bureau of Land Management, *Environmental Assessment Record for Proposed Oil and Gas Leasing in the Vale Area,* U.S. BLM OR-030-6-41, 1977.

MAMMALS

Order	Scientific name	Common name
Insectivora	*Sorex vagrans*	Wandering shrew
Chiroptera	*Myotis lucifugus*	Little brown bat
	Myotis californicus	California bat
	Myotis subulatus	Small-footed bat
	Pipistrellus hesperus	Western pipistrel
Lagomorpha	*Lepus californicus*	Black-tailed jackrabbit
	Sylvilagus nuttalli	Mountain cottontail
Rodentia	*Eutamias minimus*	Least chipmunk
	Spermophilus lateralis	Mantled ground squirrel
	Spermophilus townsendi	Townsend ground squirrel
	Marmota flaviventris	Yellow-bellied marmot
	Neotoma cinerea	Bushy-tailed woodrat
	Neotoma lepida	Desert woodrat
	Onychomys leucogaster	Grasshopper mouse
	Peromyscus maniculatus	Deer mouse
	Reithrodontomys megalotis	Harvest mouse
	Microtus longicaudus	Long-tailed vole
	Ondatra zibethicus	Muskrat
	Castor canadensis	Beaver
	Erethizon dorsatum	Porcupine
	Dipodomys ordi	Ord kangaroo rat
	Thomomys townsendii	Townsend's pocket gopher
Carnivora	*Lynx rufus*	Bobcat
	Canis latrans	Coyote
	Vulpes fulva	Red fox
	Mustela frenata	Long-tailed weasel
	Lutra canadensis	River otter
	Taxidea taxus	Badger
	Mephitis mephitis	Striped skunk
	Procyon lotor	Raccoon
Artiodactyla	*Antilocapra americanus*	Pronghorn antelope
	Odocoileus hemionus	Mule deer

BIRDS

Order	Scientific name	Common name
Pelecaniformes	*Pelcanus erythrorhynchos*	White pelican
Ciconiiformes	*Ardea herodias*	Blue heron
Anseriformes	*Olor columbianus*	Whistling swan
	Branta canadensis	Canada goose
	Branta canadensis leucopareia	Lesser Canada goose
	Anas platyrhynchos	Common mallard
	Anas streperus	Gadwall
	Mareca americana	Baldplate (Widgeon)
	Anas acuta	American pintail
	Anas carolinensis	Green-winged teal
	Anas cyanoptera	Cinnamon teal
	Mergus merganser	American merganser
Falconiformes	*Cathartes aura*	Turkey vulture
	Buteo regalis	Ferruginous hawk
	Aquila chrysaetos	Golden eagle
	Falco sparverius	Sparrow hawk
Galliformes	*Alectoris graeca*	Chukar partridge
	Lophortyx californica	California quail
	Phasianus colchicus	Ring-necked pheasant
Gruiformes	*Fulica americana*	American coot
Charadriiformes	*Charadrius vociferus*	Killdeer
	Capella gallinago	Common snipe
	Recurvirostra americana	Avocet
	Larus californicus	California gull
Columbiformes	*Columba livia*	Rock dove
	Zenaidura macroura	Mourning dove
Strigiformes	*Otus asio*	Screech owl
	Bubo virginianus	Great horned owl
	Speotyto cunicularia	Burrowing owl
Caprimulgiformes	*Chordeiles minor*	Nighthawk
Micropodiformes	*Selasphorus rufus*	Rufous hummingbird
Coraciformes	*Megaceryle alcyon*	Belted kingfisher
Piciformes	*Colaptes cafer*	Red-shafted flicker
Passeriformes	*Tyrannus verticalis*	Western kingbird
	Empidonax wrightii	Gray flycatcher
	Eremophila alpestris	Horned lark
	Tachycineta thalassina	Violet-green swallow
	Hirundo rustica	Barn swallow
	Pica pica	Magpie
	Corvus corax	Raven

BIRDS (continued)

Order	Scientific name	Common name
Passeriformes (continued)	*Corvus brachyrhynchos*	Common crow
	Sitta canadensis	Red-breasted nuthatch
	Catherpes mexicanus	Canon wren
	Salpinctes obsoletus	Rock wren
	Turdus migratorius	Robin
	Lanius ludovicianus	Loggerhead shrike
	Sturnus vulgaiis	Starling
	Vireo solitarius	Solitary vireo
	Denroica petechia	Yellow warbler
	Denroica auduboni	Audubon warbler
	Passer domesticus	English (house) sparrow
	Dolichonyx oryzivorus	Bobolink
	Sturnella neglecta	Western meadowlark
	Agelaius phoeniceus	Red-winged blackbird
	Euphagus cyanocephalus	Brewer blackbird
	Molothrus ater	Brown-headed cowbird
	Piranga ludoviciana	Western tanagers
	Passerina amoena	Lazuli bunting
	Pipilo erythophthalmus	Rufous-sided towhee
	Passerculus sandwichensis	Savannah sparrow
	Chondestes grammacus	Lark sparrow
	Amphispiza belli	Sage sparrow
	Junco oreganus	Oregon junco
	Spizella passerina	Chipping sparrow
	Zonotrichia leucophrys	White-crowned sparrow
	Melospiza melodia	Song sparrow

AMPHIBIANS AND REPTILES

Order	Scientific name	Common name
Bufonidae	*Bufo woodhousei woodhousei*	Woodhouse's toad; Rocky Mountain toad
Hylidae	*Hyla regilla*	Pacific treefrog
Ranidae	*Rana pretiosa*	Spotted frog
	Rana catesbeiana	Bullfrog
Igunidae	*Crotaphytus collaris bicinctores*	Great Basin collared lizard
	Crotaphytus wizlizenii wizlizenii	Long-nosed leopard lizard
	Sceloporus occidentalis biseriatus	Great Basin fence lizard
	Sceloporus graciosus graciosus	Northern sagebrush lizard
	Uta stansburiana stansburiana	Northern side-blotched lizard
	Phrynosoma platyrhinos platyrhinos	Northern Desert horned lizard
Scincidae	*Eumeces skiltonianus*	Western skink
Teiidae	*Cnemidophorus tigris tigris*	Great Basin whiptail lizard
Colubridae	*Coluber constrictor mormon*	Western yellow-bellied racer
	Pituophis melanoleucus deserticola	Great Basin gopher snake
	Thamnophis sirtalis fitchi	Common garter snake; Valley garter snake
Viperidae	*Crotalus viridis lutosus*	Great Basin rattlesnake

Appendix B

SOIL CONSERVATION SERVICE DETERMINATION OF PRESENCE OF PRIME FARMLAND ON THE SITE

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
46 SW 2nd St., Ontario, Oregon 97914

Date: 11-8-79

TO WHOM IT MAY CONCERN:

The soils in the SE 1/4 Sec. 20, T18S, R45E are mapped by the Soil Conservation Service as:

SERIES	CAPABILITY UNIT NON-IRRIGATED	CAPABILITY UNIT IRRIGATED
10A Powder		

This soil is classified as prime land in Malheur county.

Name Robert E. Perry

Title Soil Conservationist

Appendix C

REPORT ON THE SITE ARCHAEOLOGICAL SURVEY

A SURVEY FOR CULTURAL RESOURCES
IN THE VALE, OREGON LOCALITY

report to

OREGON TRAIL MUSHROOMS

written by

DUANE MARTI

Vale, Oregon

November 1979

INTRODUCTION

This is a report of a cultural resource survey conducted for Oregon Trail Mushrooms, which is planning to construct a mushroom growing facility near Vale, Oregon (Map 1). The survey of the lands proposed for development is required by federal law in order to determine whether or not cultural resources may be impacted during the construction and operation of the mushroom growing facility.

The project proposes to use geothermal energy to provide the heat needed by the facility. The survey was required by the U. S. Department of Energy which is considering the possibility of extending loan guarantees to the project. The survey was conducted by Duane Marti. Mr. Paul Rutten, Project Manager, provided preparatory information and maps of the project area.

This survey was begun on the 15th of November with the initial request by Mr. Rutten. The survey included four steps: (1) A literature search, (2) Contact with knowledgeable persons, (3) An on-the-ground survey, and (4) The preparation of this report.

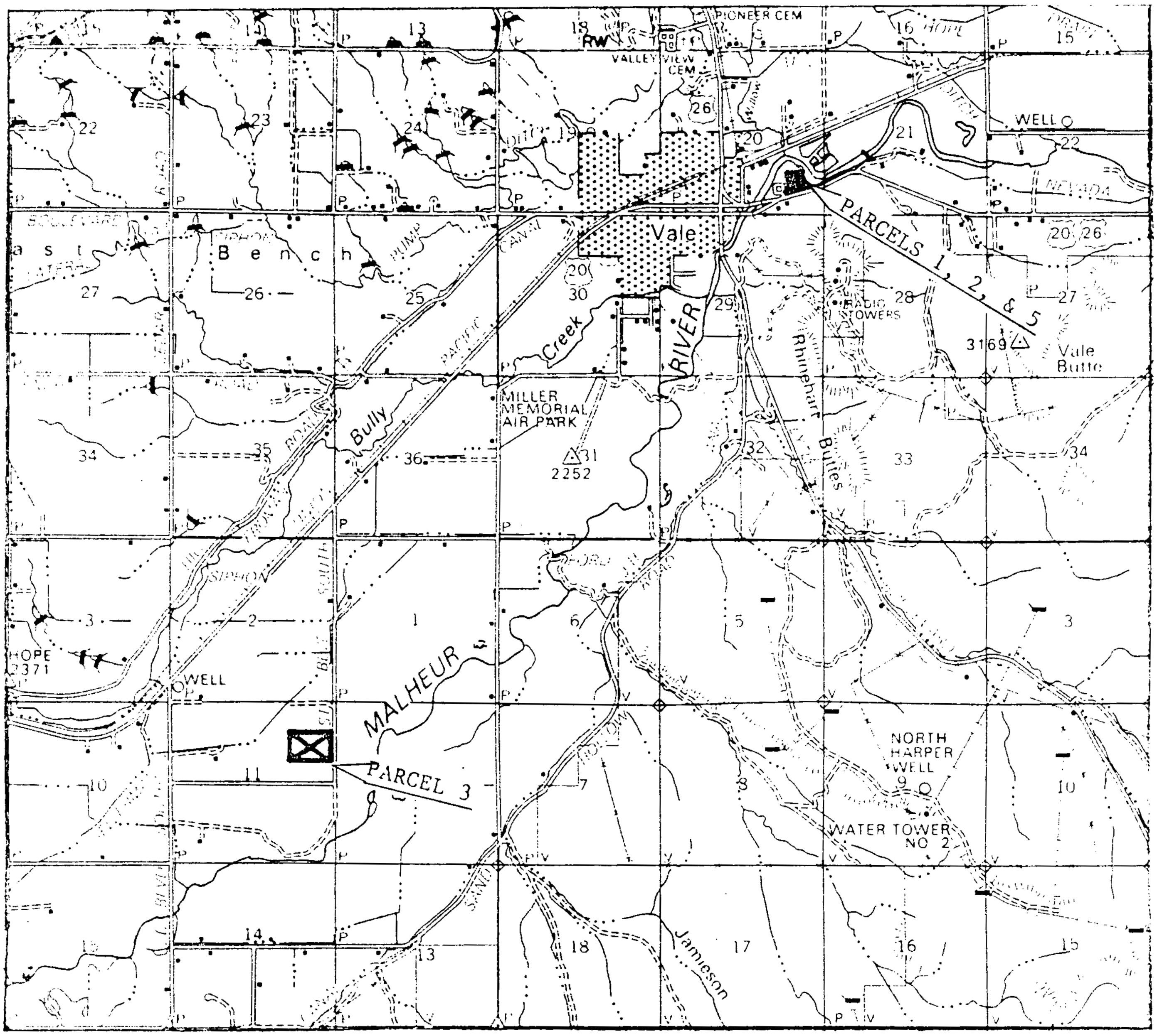
PROCEDURES

The literature search of all pertinent literature was conducted initially. This search indicated that previous cultural resource investigations included: (1) Reservoir surveys (Osborne 1948; Cole 1961; Newman 1964), (2) Surveys for geothermal development (Mack 1975; Ruebelmann 1975; Ames 1976; Hauck 1976, 1977, 1978); (3) Surveys for sewers (McNeill 1977); (4) Excavations (Long 1974; McNeill 1978); (5) Ethnographical research (Steward 1938; Steward and Wheeler-Voegelin 1974; Stewart 1939); (6) Historical research (Gregg 1950; Ogden 1950, 1961, 1971; Haines 1973); and (7) Cultural resource overviews (Gehr, Nelson, and Walke 1978; Boreson, Moody, and Murphey 1979). These sources identified no

R44E R45E

T18S

T19S



Map 1: Overall view of project areas.
(Base map: Mitchell Butte, OR-BLM planimetric)

cultural resources in the project areas. The cultural resource site files maintained by the Vale District, Bureau of Land Management were also consulted, but again with no success in regards to the project areas.

Several persons knowledgeable of local prehistory and history were interviewed, but they were unable to provide any detailed information about the project areas. However, they were able to provide information about the frequency of floods prior to the construction of dams on the Malheur River and Bully Creek.

The on-the-ground survey was conducted on the 18th of November by Duane Marti. As stated above, the work was facilitated by the cooperation of Mr. Paul Rutten.

SETTING

The Vale area lies within the northern portion of the Owyhee Uplands, a north facing basin drained by the Owyhee and Malheur rivers (Franklin and Dyrness 1969). The area is characterized by rolling hills with low relief to steep buttes. Two buttes, Rhinehart and Vale, dominate the landscape with elevations of 2920 and 3169 feet respectively.

The Vale area is considered to be part of the Cold Desert Biome. The floral assemblage, the Agropyron-Festuca Association, is typically composed of bluebunch wheatgrass (Agropyron spicatum), Idahofescue (Festuca idahoensis), Sandberg's bluegrass (Poa secunda), squirreltail (Sitanion hystrix), and big sagebrush (Artemesia tridentata), the latter a principal indicator of over-grazing. The topography of the area provides a wide variety of small vegetative habitats due to different exposures to solar radiation, slope of the land, and other differences.

Among the fauna observed in the area are the following: Pronghorn antelope (Antilocapra americanus), Mule deer (Odocoileus hemionus), Black-tailed jackrabbit (Lepus californicus), Mountain cottontail (Sylvilagus nuttalli), Bobcat (Lynx rufus), Coyote (Canis latrans), and Great Basin Rattlesnake (Crotalus viridis lutosus).

Wetlands along Bully and Willow creeks and the Malheur River provide habitat for dabbling ducks, while short reaches of other streams provide habitat for waterfowl during periods of streamflow. Prior to the settlement of the Malheur River Basin and construction of numerous diversion dams for irrigation in the early 1900s, chinook salmon (Oncorhynchus tshawytscha) and steelhead (Salmo gairdnerii gairdnerii Richardson) were found in most of the river.

SURVEY

Since the project areas consisted of approximately 42 acres, a complete, intensive survey was conducted. The survey was conducted by walking parallel transects spaced 30 meters apart until each area was thoroughly covered. Both areas were level and only partially covered with brush and grass, thus allowing maximum visibility.

CULTURAL RESOURCE SYNTHESIS

In the general area of the project areas a number of cultural resource surveys have been conducted including the following: Alvord Desert (Newman et al 1975, Pettigrew 1975), Camas Creek Drainage Basin (Plew 1976), Dirty Shame Rockshelter (Aikens et al 1977), and High Rock Country (Layton 1966, 1970). These studies indicate the region surrounding the project areas has probably been inhabited by aboriginal peoples for the last 11,000 years or possibly more.

Ethnographically, the researchers disagree as to the identity of the recent inhabitants of the project areas. Stewart (1939:133) identifies them as the Koa'aga'itoka band of the Northern Paiutes, while Steward (1938:172) states they were known as the Yahanduka.

Historically the area around Vale was periodically visited by fur trappers led by Peter Skene Ogden during the years from 1826 to 1829 (Ogden 1950, 1961, 1971). Starting in the early 1840s, the emigrants along the Oregon Trail began to travel through the Vale area. The route of the Oregon Trail which entered the Vale area from the south is roughly approximated by Lytle Boulevard. According to Cross and Gibbs (1940:214) and Haines (1973:332-3), the Malheur River Crossing, which was mile 1527 on the trail, is thought to be located in the vicinity of the present Lytle Boulevard bridge. The trail then continued north of town along Willow Creek. Many of the emigrants described in their journals the hot springs which were located just downstream from the river crossing.

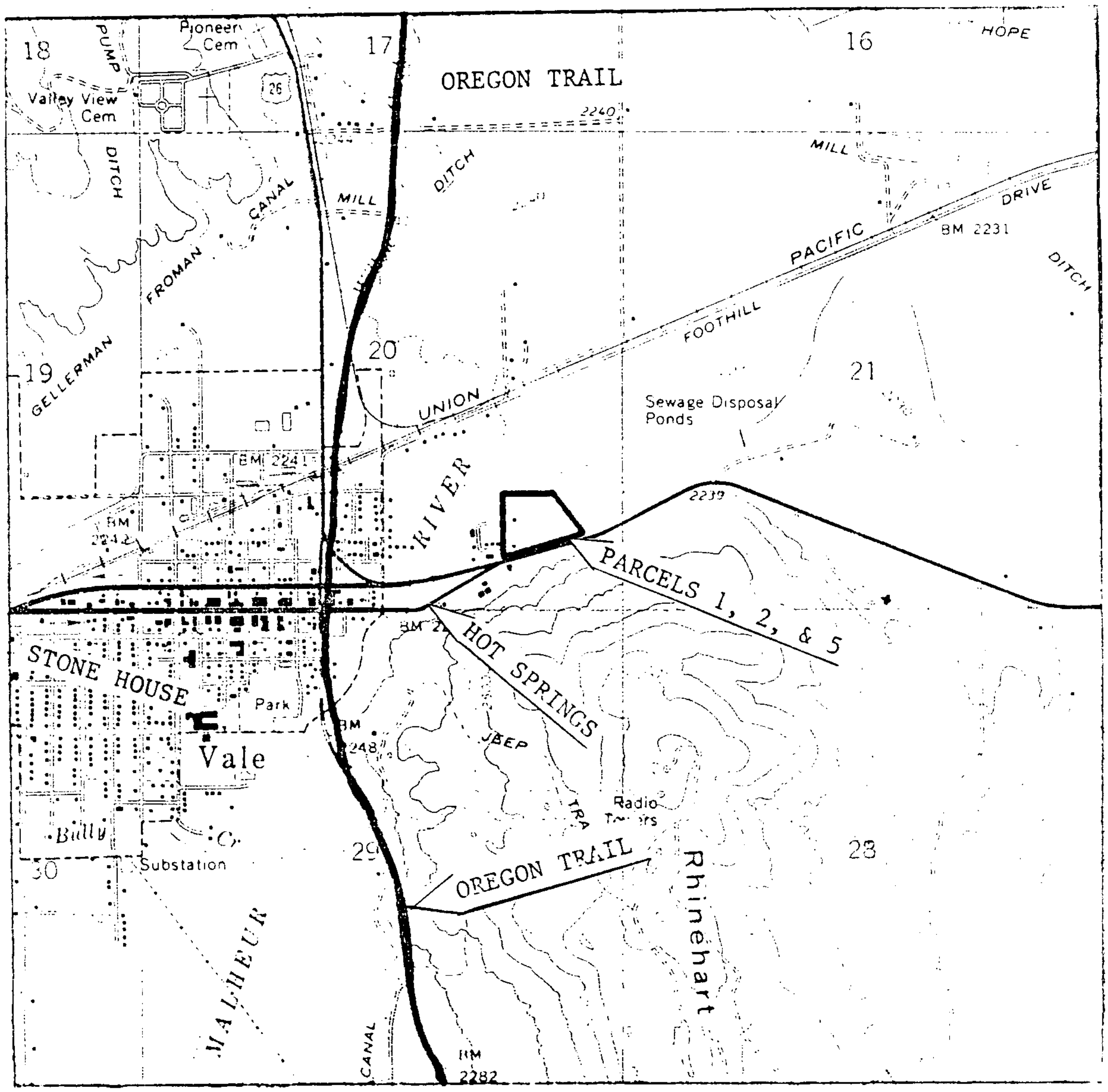
In the fall of 1863, Jonathan Keeney built a small log house on the east bank of the river near the river crossing (Gregg 1950:303). Seven years later, he was bought out by Louis Rinehart who built the historic Stone House on the west side of the river. Completed in 1872, the Stone House became a popular wayside inn, serving the travelers passing over the "emigrant trail" (Gregg 1950:303). The Stone House was entered on the National Register of Historic Places on 19 May 1972.

The town of Vale continued to grow and by 1883 it had evolved into a recognizable entity. The town has always been located west of the Malheur River and north of Bully Creek. In 1906, the Union Pacific railroad, which is located just north of the main project area, was built from Ontario to Vale.

RESULT OF INVESTIGATIONS

Parcels 1, 2, and 5 (SE¼SE¼, Sec. 20, T18S, R45E, W. M.) (Map 2)

Overall these parcels constitutes a small (approximately 12 acres), but level area adjacent to the Malheur River. Located in the active floodplain, the area



Map 2: Overall view of Parcels 1, 2, and 5.
(Base map: Vale East, OR quad)

contains an alluvial deposit that has been redistributed by the periodic flooding. Prior to the completion of the dams on the Malheur River (Warm Springs in 1919 and Beulah in 1935) and Bully Creek (Bully Creek in 1965), the Malheur River valley has been subjected to seasonal flooding. In recent times there have been two major floods; one in 1925 and the other in 1957 (McNeill 1977:2-3).

According to a 1873 map prepared by J. D. Crawford, a Government Land Office surveyor, the Malheur River flowed through the southern portion of Parcel 1. Since that survey, the river has changed its course as it presently borders Parcels 1, 2, and 5 on three sides. In addition to this natural redistribution, the parcels have been disturbed by construction and farming activities.

In 1958 the U. S. Army Corps of Engineers conducted an extensive channelization project on both the Malheur River and Bully Creek and also built dikes along both streams. Presently there is a dike on three sides of these parcels. According to local residents Parcel 1 has been extensively farmed for a number of years. There are buildings located on both Parcels 2 and 5.

No evidence of any aboriginal utilization of this project area was uncovered during the on-the-ground survey. However, a broken white, porcelain, electrical insulator and a base of a broken, clear, square-shaped bottle were found. The insulator is of a type used by local farmers in constructing electrical fences. The bottle had no embossing on it, but both the patina on the bottle and the thickness of the glass indicated that it was an older bottle. However, it was located at the base of the dike bordering the east side of Parcel 1 and it was impossible to determine if it was in situ or had been introduced during the construction of the dike.

Parcel 1 will contain the main growing building and the tunnel building. The building located on Parcel 2 will be converted into the office, while those of Parcel 5 will be left intact. Thus only Parcel 1 will be subjected to any ground disturbing activities.

Parcel 3 ($S\frac{1}{2}S\frac{1}{2}NE\frac{1}{4}NE\frac{1}{4}$, $N\frac{1}{2}SE\frac{1}{4}NE\frac{1}{4}$, Sec. 11, T19S, R44E, W. M.)

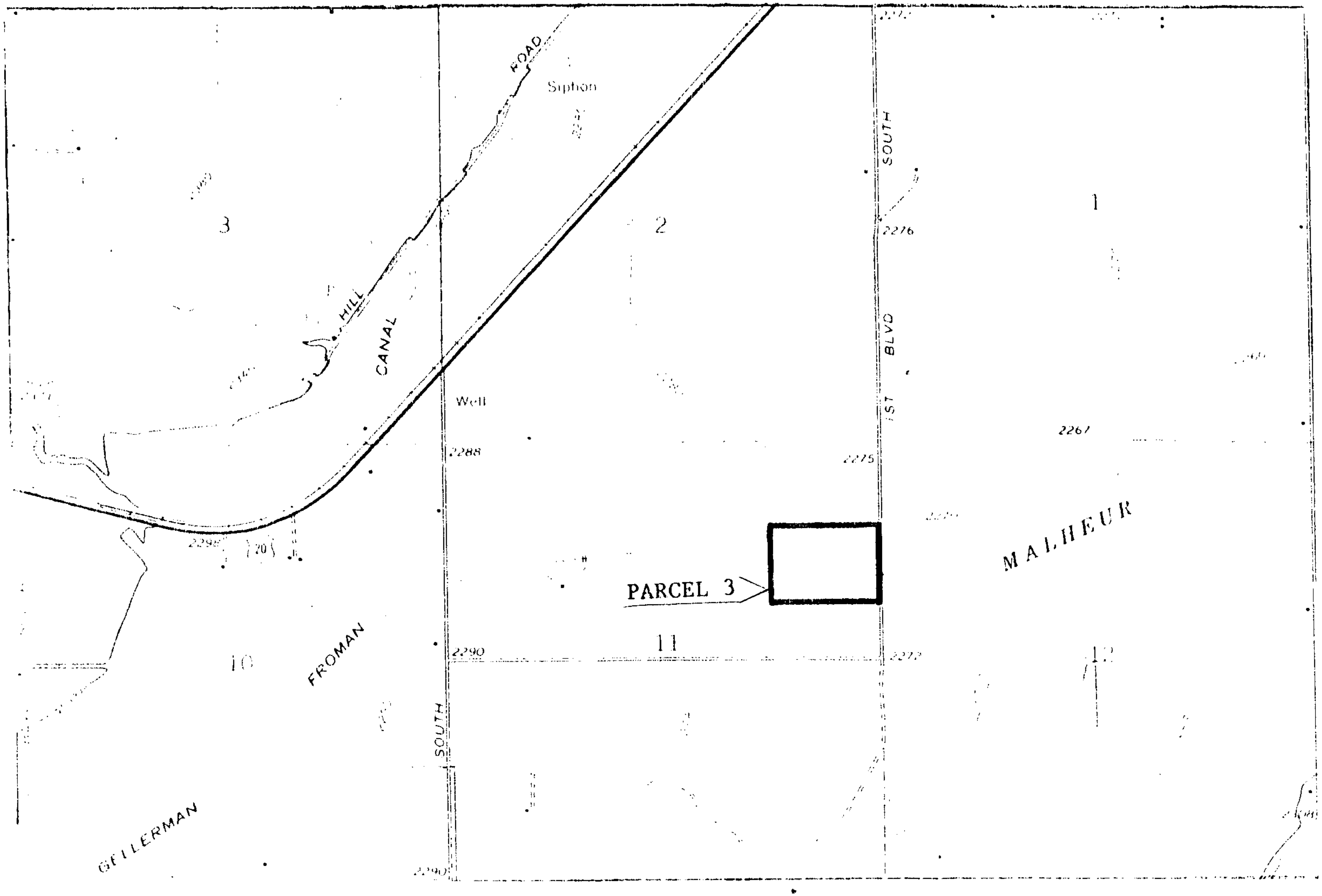
Parcel 3 (Map 3) is a level area located approximately 400 meters west of the Malheur River. The parcel consists of approximately 30 acres in total. The parcel is covered with grass and some brush and has been used recently as a pasture. A new building will be built on this parcel and it will contain the composting area for the project.

No evidence of any aboriginal utilization was found during the survey of the parcel. Only three, broken, white, porcelain insulators similiar to those discussed above were found. The backdirt of numerous rodent burrows were inspected but with negative results.

DISCUSSION AND RECOMMENDATIONS

As the result of this survey, no cultural resources were located which will be impacted by the proposed project. However, regional ethnographical research (Steward 1938, Steward and Wheeler-Voegelin 1974, Stewart 1939), areal surveys (Newman 1964, Mack 1975, Ruebelmann 1975, McNeill 1977), and areal excavations (Long 1974, McNeill 1978) have clearly demonstrated that the Vale area was extensively utilized aboriginally. The discrepancy between the results of this survey and the others could be possibly explained by the small amount of land involved in the project. Nevertheless, it is likely that cultural resources could be located during the construction phase of the project. If any cultural resources are discovered, this researcher or another professional archaeologist should be immediately notified so an evaluation of the resources can be conducted.

All of the historical sites discussed above (i.e. Oregon Trail, Malheur River Crossing, Vale Hot Springs, or Stone House) are outside of the project areas and will not be impacted by the project. None of the local residents who were interviewed were able to identify any other historical sites within the project



Map 3: Overall view of Parcel 3
(Base map: Vale West, OR quad)

areas.

Since this survey failed to locate any cultural resources, I recommend that it be allow to proceed. However, I wish to iterate that the Vale area is a potentially significant, but largely unknown area of aboriginal utilization and that caution should be exercised during the construction phase to avoid inadvertently disturbing any cultural resources.

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Appendix D

LETTER FROM MALHEUR COUNTY WATERMASTER EVALUTING THE IMPACT OF GROUNDWATER WITHDRAWALS ON WATER USE

WATER RESOURCES DEPARTMENT

MALHEUR COUNTY COURTHOUSE • VALE, OR • 97918 • Phone 473-3930

November 14, 1979

To Whom It May Concern:

Use of groundwater by Oregon Trail Mushrooms at rates less than 500gpm does not significantly restrict its use for other purposes. Groundwater underlying the city of Vale and its vicinity is adequate for all present and planned needs; no competition for it is foreseen.

Respectfully,

Frank Elfering
Watermaster, Malheur County

lkb