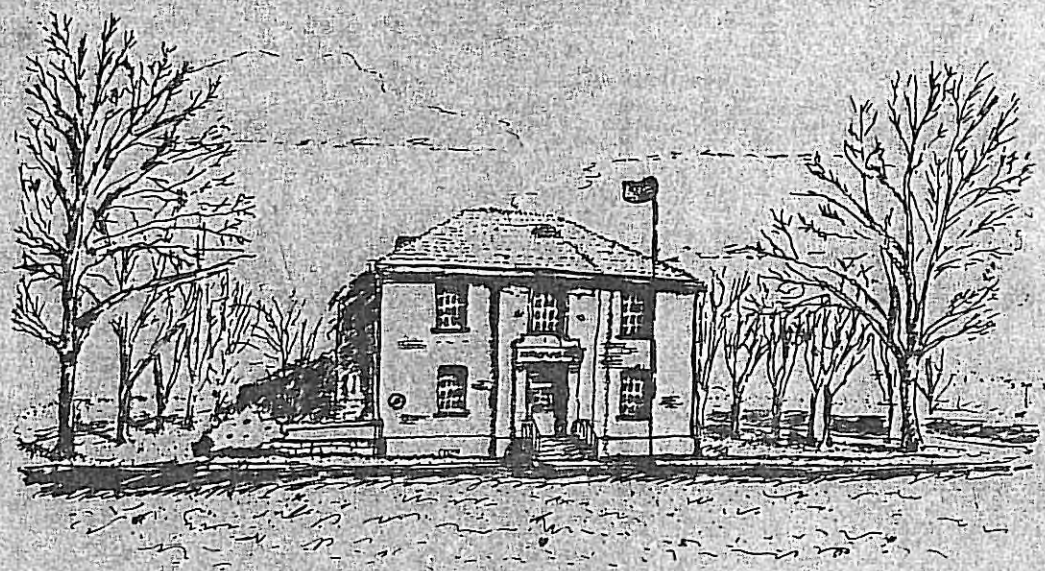


Diane Seeger

UMATILLA

ARMY DEPOT

Technical Report



Prepared for:

Umatilla Depot Task Force

&

Oregon Economic Development Department

775 Summer Street NE

Salem, Oregon 97310

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INTRODUCTION

The following report is a supplementary document to the Final Comprehensive Plan Report for the Umatilla Army Depot. This report documents the conditions on the Depot relative to the natural characteristics of the site and the improvements and conditions that have been made to the site in the last fifty years.

The regulations that must be abided as the site is considered for civilian use are also described. There are three primary types of regulations that will influence the process and timing for conversion of the site from military use to civilian use. These include:

Morrow and Umatilla County Land Use Regulations

Oregon Department of Water Resources

State and Federal environmental clean up programs currently being programmed and implemented.

In considering a plan for future civilian use the social and economic characteristics were considered. These facts about the surrounding cities and counties established the framework for understanding the community resources that are available to fulfill the expectations for Depot reuse described in the plan.

Finally, an in-depth market assessment was conducted. The assessment was divided into two parts. The first is a general market assessment of the opportunity for traditional urban uses such as residential, commercial and industrial. The second is a thorough analysis of the Depot's resources and facilities and the potential for agricultural use.

An Appendix provides additional research relative to the water use, quality, law and rights impacting the Depot. Also included are the references for several of the sections included in this report and summarized in the Final Comprehensive Plan Report.

I. REGIONAL SETTING

The Depot is located in northeast Oregon in the southern part of the Columbia Basin in a predominately agricultural setting. Centered between Umatilla and Morrow Counties, the Depot is within two miles of the Columbia River along its northern border, and about the same distance from the Umatilla River along its eastern border. The region is characterized by a sparse, but growing, population residing on the large irrigated farms which are the dominant industry of the area. The major commodities of the region are agricultural, and the major imports into the region are petroleum products and fertilizer. See Exhibit I-1.

The small towns surrounding the Depot include Hermiston to the East, Boardman and Boardman Junction to the west, Irrigon to the north, and Umatilla to the northeast. The closest towns of larger size are Pendleton, Oregon, and the Tri-cities of Washington State. Other areas in the immediate proximity to the Depot are the Umatilla National Wildlife Refuge just west of Irrigon, and the McNary Dam, at Umatilla along the Columbia River. Further from the Depot, but of significant importance in the region, is the Umatilla Indian Reservation east of Pendleton. Most of the land immediately surrounding the Depot is in large-scale, irrigated agricultural production.

A strong transportation system links the Depot and the region to major urban centers throughout the northwest. Interstate I-84 which runs just south of the southern property line of the Depot links Portland to Boise, and points in the East. Just outside the southeast corner of Depot, I-84 interchanges with I-82, which runs north to the Tri-cities.

Along the south property line of the Depot is a major line of the Union Pacific Railroad. To the north, on the Columbia River, the Ports of Umatilla and Morrow serve as shallow draft ports providing access for barges between the Columbia River ports and Portland, as well as other West Coast port cities.

II. EXISTING CONDITIONS

A. NATURAL CHARACTERISTICS

1. *Climate*

The Umatilla Basin region is temperate and mild to semiarid; average annual precipitation ranges from 7 (near Umatilla) to 35 inches (in the Blue Mountains near the southeastern margin of the Basin); in Hermiston (less than 10 miles northeast of the Depot) precipitation averages slightly more than 8 inches per year. Temperature ranges vary from an average low of 26°F in January to an average high of 89°F in July; the annual average temperature is approximately 53°F. Average annual pan evaporation in the Hermiston area is approximately 45 inches, the equivalent of approximately 32 inches of field evaporation.

During the period from 1961 to 1990, Hermiston experienced an average of 106 days per year for which the low temperature was 32°F or less. On average, there are 16.2 days per year in which the maximum daily temperature is less than 32°F; the variability of this statistic, however, is demonstrated by the 62 days during 1985 in which the daily maximum temperature was 32°F or below in Hermiston.

This information was obtained from George Taylor of the Oregon State University Atmospheric Sciences Department.

2. *Topography*

a. Regional

The Umatilla Basin is an area of approximately 2,700 square miles which lies in a physiographic province known as the Columbia Plateau. Hogenson (1964) further subdivides the Basin and the Depot site lies in the portion he termed the Umatilla lowlands. The gently-rolling lowlands generally slope down to the north-northwest (toward the Columbia River). Elevations range from approximately 200 feet near the Columbia River to approximately 2,100 feet in the Horse Heaven Hills.

b. Site

The Depot area consists of two terraces, each of which is an area of gently rolling terrain. The terraces are separated along the Coyote

Coulee; the Coulee is the principal geographic feature on the Depot. The Coulee is a north-northeast to south-southwest-trending feature comprised of a steep slope at the edge of the upper terrace and an adjacent depression to the northwest. Relief of approximately 50 feet separates the upper and lower terraces.

Elevations across the Depot range from approximately +420 feet above mean sea level (MSL) in the northwestern corner to approximately +670 feet MSL on the upper side of the Coyote Coulee in the northeastern quadrant of the Depot.

There are no well-developed surface drainage features on the site.

3. *Geology*

a. Regional

The Columbia Plateau is characterized by a westward-plunging synclorium (a regional system of basin-like folds), the axis of which is indistinct but roughly parallels the Columbia River. This structure is bounded on the south-southeast by the Blue Mountains anticline. The Umatilla Basin contains several larger structures (Horse Heaven, Rieth, and Service anticlines; Agency syncline) whose axes lie at angles ranging from 30 to 90 degrees from the general east-west axial trend of the synclorium.

Structural deformation in the area is believed to have reached its maximum during the Pleistocene epoch (i.e., between 7 and 2 million years before present). The area appears to have been tectonically quiescent after that time.

The oldest rocks in the region are found in the Blue Mountains, where bedrock is comprised of pre-Tertiary era (more than 65 million years before present) amphibolite-grade metamorphic rocks intruded by numerous small granitic bodies. This complex is overlain by volcanic and terrestrial sedimentary rocks of the Eocene-age Clarno formation. Surface expression of the Blue Mountains complex and Clarno formation is limited to the southernmost portion of the Basin.

Basalts of the Columbia River Basalt Group (CRB) are between about 20 and 10 million years in age (Miocene epoch) and overly the Clarno formation. CRB underlies most portions of the basin. Maximum thickness of the CRB is not known, but is at least 2,500 feet.

Variable thicknesses of younger Pliocene to Recent period alluvial materials of the Alkali Canyon formation and Spokane Flood deposits cover most of the CRB bedrock. These materials were deposited in stream, lake bed, and wind-transported environments. The sedimentary materials vary in thickness from 0 feet (in areas of CRB outcrop) to more than 200 feet.

b. Site

Surface materials within the Depot consist of eolian sands and loess (wind-deposited silts and sands) of Pliocene to recent age. These materials form a thin (0 to 10 feet thick) veneer over sedimentary rocks of the Alkali Canyon formation and Spokane Flood glaciofluvial gravels.

The Alkali Canyon formation was formed from material deposited in glacial lakes. Spokane Flood gravels were deposited by catastrophic floods during the Pliocene epoch. Dames & Moore interpreted Coyote Coulee as a standing wave deposit formed during the Spokane floods. The sedimentary units are between 105 and 190 feet thick.

Columbia River Basalt of Miocene age lies beneath the sedimentary materials at depths ranging from approximately 115 to 190 feet below ground surface (bgs). Total thickness of the basalts is not known but exceeds 1,500 feet.

Exhibit II-1 presents a geologic cross-section of the site.

4. Vegetation and Wildlife Resources

Resources in this category include both the native and naturalized plants and animals within the Depot study area. For discussion purposes, they are divided into vegetation, wildlife, and threatened and endangered species. The following descriptions are based on field visits to the Depot in January and April 1993, secondary sources of information for the area, data from the Soil Conservation Service, Oregon State Department of Fish and Wildlife, and U.S. Army Corps of Engineers reports and maps.

a. Vegetation

The Depot site is three miles south of the Columbia River and is considered part of the Columbia Plateau. The Depot exists in a

semiarid region, characterized as one of the driest areas of the Pacific Northwest, with only about ten inches of precipitation per year. The site occupies over 30 square miles of land on a thick sequence of igneous flood basalts. The plateau rises gently from the Columbia River toward the site where elevations range from 370 in the northwest corner of the Depot lands to 672 along the northern rim of Coyote Coulee, a canyon carved into the site, showing evidence of early floods of glacial melt water. This Coulee, which dissects the eastern portion of the site, is the one unique physical feature on the Depot site, in an otherwise mostly contiguous rolling landscape.

The site includes an administration, housing and facilities maintenance area at the southern border which consists of approximately 200 acres, a relatively small portion of the site. Landscape and ornamental species dominate the administrative and residential area, requiring constant upkeep and maintenance. Most of the landscape in that area consists of open lawn areas and tree-lined streets. Grassy areas are currently well-maintained and mowed often. All of the maintained landscape area has some type of irrigation system, most of which is fully automatic. Much of the landscape was installed in the early 1940s when the Depot was originally built, and is now reaching maturity. Some of the trees have been removed and replaced, but the overall landscape character in this area remains in good quality and a valuable resource.

The administration area consists of approximately 26 acres on which diverse species have been planted in the improved areas of the base. Frequent tree plantings include black and moraine honey locusts along the main entrance and axis, scotch pine along 5th Avenue, and additional groupings of sycamore, maple, birch, blue ash, cottonwood and ponderosa pines in lesser amounts throughout this portion of the site. (See Table II - 1) Grassy areas are common in the residential and community recreation areas.

The remaining lands, which make up the major portion of the site, are referred to as the controlled area and are utilized for ammunition and chemical storage, test firing, warehousing and landfills. Landscape in this controlled area has been at least partially altered in the past with the construction of patrol roads, railroads and bunkers, but the vegetation remains largely the same as it was previous to the installation of the Depot.

Exhibit II-1
Geologic Cross Section

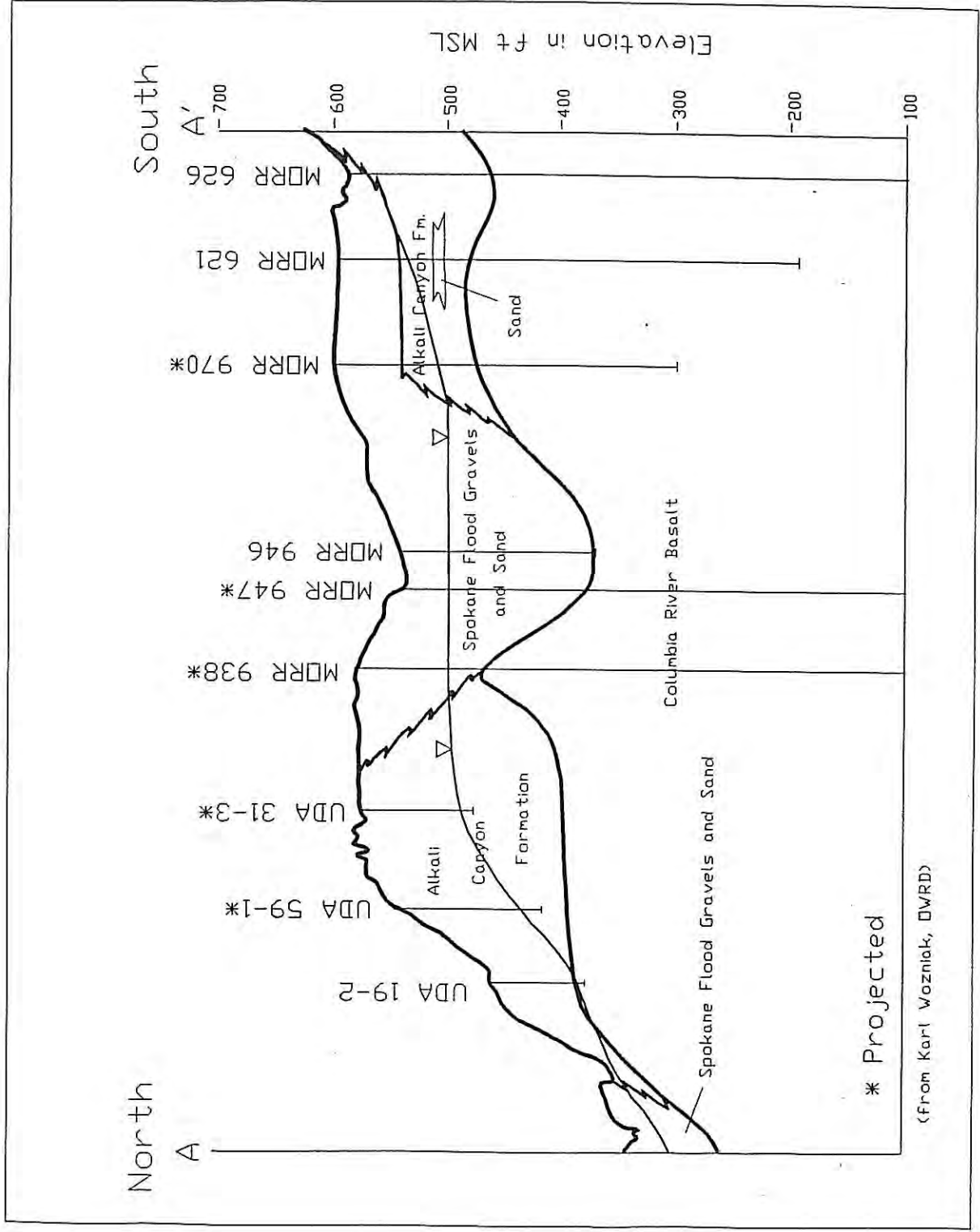


Table II - 1
Common Vegetation in the Administrative/Housing Area

Species	Common Name
Trees	
<i>Acer platanoides</i>	Norway Maple
<i>Betula pendula</i>	White Birch
<i>Catalpa speciosa</i>	Western Catalpa
<i>Elaeagnus angustifolia</i>	Russian Olive
<i>Fraxinus pennsylvanica</i>	Green Ash
<i>Fraxinus quadrangulata</i>	Blue Ash
<i>Gleditsia triacanthos inermis</i> 'Moraine'	Moraine Honey Locust
<i>Koelreuteria paniculata</i>	Golden Rain
<i>Picea pugnans</i>	Colorado Spruce
<i>Pinus banksiana</i>	Jack Pine
<i>Pinus nigra</i>	Austrian Pine
<i>Pinus ponderosa</i>	Ponderosa Pine
<i>Pinus sylvestris</i>	Scotch Pine
<i>Platanus occidentalis</i>	American Sycamore
<i>Populus nigra</i> 'Italica'	Lombardy Poplar
<i>Populus nigra thevestina</i>	Lombardy Poplar
<i>Robina pseudoacacia</i>	Black Locust
<i>Salix babylonica</i>	Weeping Willow
<i>Sorbus aucuparia</i>	Mountain Ash
<i>Syringa vulgaris</i>	Common Lilac

Table II - 2
Native Vegetation of the Umatilla Army Depot

Species	Common Name
Shrubs	
<i>Artemisia tridentata</i>	Big sagebrush
<i>Chrysothamnus nauseosus</i>	Grey rabbitbrush
<i>Chrysothamnus viscidiflorus</i>	Green rabbitbrush
<i>Purshia tridentata</i>	Antelope bitterbrush
<i>Sarcobatus vermiculatus</i>	Greasewood
Forbs	
<i>Oenothera pallida</i>	Evening primrose
<i>Phlox</i> spp.	Phlox
<i>Salsola kali</i> *	Russian thistle
Grasses	
<i>Agropyron dasytachyum</i>	Thickspike wheatgrass
<i>Agropyron spicatum</i>	Bluebunch wheatgrass
<i>Bromus tectorum</i> *	Cheatgrass
<i>Oryzopsis hymenoides</i>	Indian ricegrass
<i>Poa secunda</i>	Sandberg's bluegrass
<i>Stipa comata</i>	Needle and thread grass

*Introduced species, prevalent in the region.

The Federal candidate 2 species Laurence's milk-vetch (*Astragalus collinus' laurentii*') is found in the vicinity, but has not been documented for the Depot site.

Predominant vegetation in the study area is made up of large contiguous areas of drought-adapted steppe and shrub-steppe types, of mainly sagebrush and bunchgrass communities of the Upper Sonoran Biotic Zone. (See Table II - 2). Land in this area consists of deep excessively drained soils with rapid permeability, slow runoff characteristics and low hazard of water erosion. The native plant community on the western half of the site includes needle and thread grass, Sandberg bluegrass, antelope bitterbrush, big sagebrush and other perennial forbs and grasses.

There are six distinct stands of Bitterbrush (*Purshia tridentata*) on the Depot. This species is of significant interest because it has all but disappeared from the semi-arid region in which the Depot is located, due to the intensive agricultural use of the surrounding land.

Maintaining these unusual stands of Bitterbrush serves several values: bitterbrush is one of the native wildlife food and cover species in the region; it is also used as foraging material for the Depot's introduced antelope. Most importantly, preserving these areas maintains existing plant diversity in an ecosystem, which by its nature, can support only a limited variety of species.

Russian thistle and cheatgrass are introduced species which are found in smaller numbers on the site. On the eastern portion of the site, many of the same native plant communities are found consisting mainly of needle and thread grass, antelope bitterbrush, sagebrush, and Sandberg bluegrass. Bluebunch wheatgrass, grey rabbitbrush and Indian ricegrass are found in smaller numbers.

The sagebrush-bluebunch wheatgrass association contributes to a large portion of the site, and is commonly encountered in areas adjacent to the Columbia River and its tributaries, generally up to an elevation of 750 feet. Three layers are found within this association, including a shrub layer composed of sagebrush with lesser amounts of smaller shrubs such as rabbit brush; a layer of perennial grasses including needle and thread grass and bluebunch wheatgrass; and a thin layer of Sandberg bluegrass close to the soil surface. These shrubs remain active in dryer months by tapping permanent moisture in the subsoil. Sagebrush in some areas has been burned as a method of vegetation control, where overgrowth has encroached across roads.

Coyote Coulee, the unique feature on the site, stretches from the Umatilla River, near the town of Umatilla, southwest through the

Table II - 3
Confirmed and Possible Mammal, Reptile and Amphibian Species

Species	Occurrence
Mammals	
Badger	Common
Black-tailed hare (jackrabbit)	Common
White-tailed hare (jackrabbit)	Common
Rocky Mountain cottontail	Common
Townsend pocket gopher	Common
Washington ground squirrel*	Common
Deer mouse	Common
Coyote	Common
Pronghorn Antelope	Confined herd
Reptiles	
Leopard lizard	Possibly present
Desert horned lizard*	Likely to be present
Western skunk	Possibly present
Western yellow-bellied racer	Confirmed
Great basin gopher snake	Common
Common valley garter snake	Possibly present
Wandering western garden snake	Likely to be present
Night snake	Possibly present
Sagebrush lizard	Possibly present
Side-blotched lizard	Likely to be present
Amphibians	
Pacific treefrog	Likely to be present
Spotted frog*	Possibly present
Northern leopard frog	Possibly present

*ODFW Sensitive Species

Oregon Department of Fish and Wildlife, 1991

Table II - 4
Birds Observed at the Umatilla Army Depot

Common	Occurence
Killdeer	Common
Black-billed Magpie	Common
Red-tailed Hawk	Common
American Kestrel	Common
California Gull	Common
Rock Dove	Abundant
Western Kingbird	Common
Horned Lark	Abundant
Barn Swallow	Common
Black-billed Magpie	Abundant
Common Crow	Common
American Robin	Common
Starling	Common
House Sparrow	Common
Western Meadowlark	Abundant
Brewer's Blackbird	Common
Lark Sparrow	Occasional
Brewer's Sparrow	Occasional
White-crowned Sparrow	Abundant

Oregon Department of Fish and Wildlife, 1991

corner of Depot lands, down the eastern half of the site to the Union Pacific Railroad leased land at the southern border, west of the administration area. Land in this small canyon consists of 30-60 percent slopes, with well-drained soils. Permeability of soil in this area is moderate, runoff is rapid and potential for water erosion is high. The area is essentially native rangeland and wildlife habitat. Grasses dominate and include needle and thread grass, bluebunch wheatgrass and Sandberg bluegrass.

b. Wildlife Resources

Wildlife occurring at the Depot includes numerous species associated with grasslands and shrub-steppe environments. This habitat supports a range of species including several that are considered threatened, endangered or sensitive by state and federal governments. A variety of mammals, reptiles and amphibians inhabit the base (Table II -3). Pronghorn antelope which were introduced to the confines of the Depot in 1969, are often seen roaming the site. They are managed by the Oregon Department of Fish and Wildlife and are excluded from the administration area and the firing range, in the northwest corner, by means of a chainlink fence. The 17 antelope originally delivered to the site over twenty years ago, achieved steady growth throughout the years, especially during periods when coyote populations were controlled. The herd had finally grown to about 400 in 1986. Subsequently, the site carrying capacity for antelope was determined to be a population of approximately 200; as a result, a number of antelope were transferred off the property in 1988, to bring the population under control. Additional antelope above this maximum have been used a number of times for stocking other suitable areas in eastern Oregon. The current number has remained relatively constant, under a plan developed by U.S. Fish and Wildlife Service and is believed to range between 200 and 225. However, due to the complex nature of predator-prey-disease relationships it is difficult to predict future populations.

Other mammals which are common to the region include the badger, black-tailed jackrabbit, coyote, Washington ground squirrel, pocket gopher, and several species of small rodents. A representative portion of these are found at the Depot. Much of the site is dominated by grasses with little or no surface water available. The arid region limits food sources in the area; therefore, most wildlife habitat choose to frequent streamside thickets, steep canyons and hilly sagebrush regions. Antelope prefer the open sagebrush habitat and

Table II - 5
Endangered or Threatened Species at the Umatilla Army Depot

Species	Designation
Burrowing owl	Oregon sensitive species
Long-billed curlew	Federal Candidate species, Oregon sensitive species
Bald eagle	Federally threatened, State threatened
Ferruginous hawk	Federal Candidate species
Loggerhead shrike	Federally sensitive species
Swainson's hawk	Oregon sensitive species

Oregon Department of Fish and Wildlife, 1991

do well there. Many of the animals in the region have been reduced in number over the past years, due to the conversion of many parcels in the area to agricultural land.

The site also includes a representative portion of those bird species found in the region (Table II - 4). Many make use of the base as year-round residents and others as spring and summer residents and migratory visitors. Because of the lack of surface water on the site (there are no lakes or streams) no water birds are found. Aquatic environments do exist nearby, however, at the Umatilla River, Columbia River and Cold Springs Reservoir.

c. Threatened and Endangered Species

There are no threatened or endangered plant species currently recorded as being on or near the Depot. The Federal candidate 2 species Laurence's milk-vetch (*astragalus collinus 'laurentii'*) is found in the vicinity, but has not been documented for the Depot site.

Species known to occur at the site include the burrowing owl, bald and golden eagles, long-billed curlew and ferruginous hawks and peregrine falcons. (Qualitative Bird Study, Oregon Fish and Wildlife, 1991). Long-billed curlew have been counted by the Oregon Fish and Game Department and have numbered between 41 and 82 over the last five years. Many nesting pairs of curlew are said to use the northern portion of the site, as well as the nearby Umatilla River. Ferruginous hawks have been sighted only occasionally on the site and do not have any known nesting areas at the Depot. They enjoy the habitat in the Columbia basin where jack-rabbits and other small mammals live in juniper, sagebrush and other small shrubs. The eagles utilize a portion of the site for hunting, where they find a variety of mammals on the site, primarily jack-rabbits and other small rodents. Burrowing owls have been witnessed nesting on the site. A few sightings of Loggerhead shrikes have been seen at the Depot in the past. Peregrine falcons have occasionally been seen in the vicinity, but probably do not have significant habitat on the Depot lands.

There are two wildlife species on the site which are of current concern to Oregon State Fish and Wildlife. The Washington ground squirrel and the Western burrowing owl have both been highly reduced in numbers over the past years because of the conversion of native grasses to agricultural land. The Western burrowing owl is an Oregon sensitive species that is known to frequent the site (Table II -

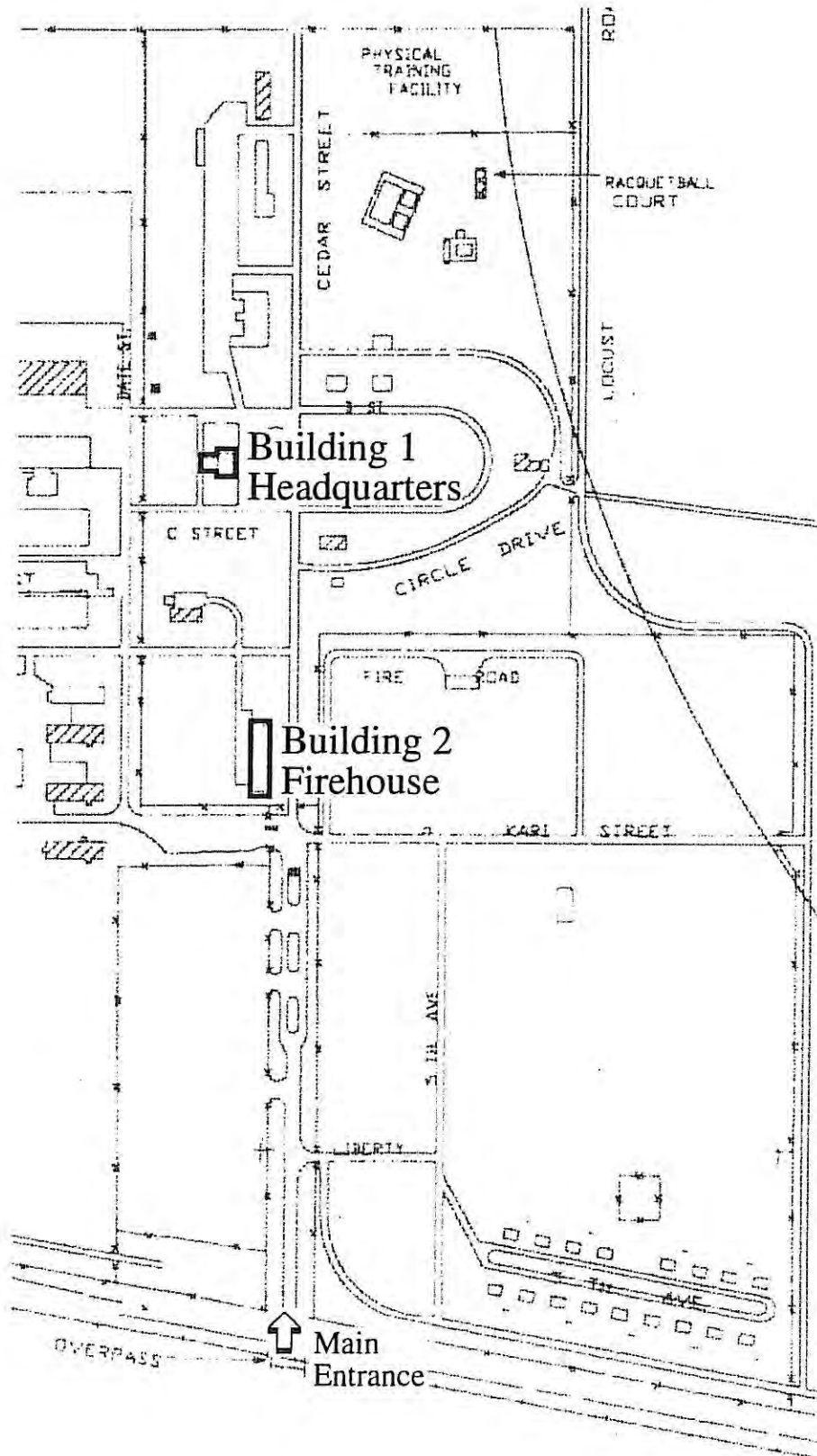
5). Additionally, the long-billed curlew is a Federal category 2 candidate species and an Oregon sensitive species. In recent years, the curlew has experienced a reduction in nesting habitat in the region, due to the conversion of sagebrush and cheatgrass type rangelands into irrigated circles for the production of wheat, potatoes, sugar beets and alfalfa. The bald eagle, is a regular winter resident at the Depot and is a species listed as Federally threatened and threatened in Oregon. The ferruginous hawk, a Federal candidate 2 species, has been observed at the Depot in the past but does not use the site for nesting. Loggerhead Shrike, a Federally sensitive species, has been observed nesting in the past in the Bunker block B area. Peregrine falcons, which are only occasionally sighted, are listed as endangered in Oregon. Swainson's hawk, an Oregon sensitive species has utilized the Depot lands seasonally for hunting.

5. Cultural Resources

Cultural resources consist of prehistoric and historic sites, structures, districts, artifacts, or any other physical evidence of human activity considered important to a culture or community. Much of the region's historical and archaeological significance dates back to various Indian tribes that resided in the area, and to the early passage of settlers along the Oregon Trail. During the early 1800s, the first recorded history of the area (documented by Lewis and Clark), notes that the land was being used by Cayuse and Umatilla Indians. Much of the county is within the original territory of the Umatilla Indians. Historically, Indian use of the site was characterized by fishing, hunting and foraging for food. Hunting for deer, elk and other game took place throughout the region. Salmon fishing occurred on all major rivers and streams in the area.

There are 16 recognized historic sites within Umatilla and Morrow Counties, mostly concentrated in Pendleton, which are listed on the National Register of Historic Places and protected by law. The Oregon Trail, which was used primarily between 1843-1857, crosses Morrow and Umatilla Counties and passes about seven miles south of the Depot. The whole Oregon Trail in Oregon is listed on the National Register even though it is only preserved in sections. The Wells Springs segment, about 15 miles southeast of the site, has been preserved. This Oregon Trail was the major access route into the area for settlers from the east who were beginning to outnumber the local Indian populations. Permanent settlements were established in the canyons of such creeks as Butler and Willow Creek in the late 1860s. During this time, immigrants and gold miners streamed into the Umatilla River Valley

Exhibit II-2
Category III Minor Importance Properties



as they set up camps in search of gold in the Blue Mountains. Local Indians in the area were confined to reservations outside of Morrow County after their last uprising in 1878.

No known archaeological or historic sites have been found on the Depot. None of the listed Historic Places for either county is within the confines of the Depot; however, there is one within proximity to the site. This site, in the Columbia Basin region, shows evidence discovered of prehistoric people which lived along the river for an extensive time period. A major permanent village existed at the confluence of the Umatilla and Columbia Rivers in the area where Umatilla was later established in 1862. The site, on both sides of the mouth of the river, was inhabited for over 3,000 years and is believed to have numbered over 500 people. Prehistoric flaked stone tools have been found at the village site as well as on the Depot, along the rim of Coyote Coulee. A subsistence area of the Warm Springs Indians has also been identified west of Irrigon.

In 1984, a historic American Building Survey of the Depot was conducted and no highly significant or significant buildings were identified. At that time, two minimally significant buildings were identified which included the headquarters building (building 1) and the firehouse (building 2), both of which are along Cedar Street past the main entrance. (See Exhibit II - 2). The State Historic Preservation Office, after a review of the Depot site, declared these two buildings eligible for inclusion on the National Register of Historic Places in 1988.

It is the policy of both Counties to cooperate with state agencies and other historical organizations to preserve historic buildings, sites, cultural areas and archaeological sites and artifacts. It is also their policy to protect significant historical and cultural sites from land use activities which diminish their value as historical resources. The Confederated Tribes of the Umatilla Indian Reservation control 8 percent of the Umatilla County land area, mostly to the east of Pendleton. They have concerns for the protection and conservation of Indian and non-Indian cultural resources located within the region of the Depot, because of the historic uses of their ancestry in communities along the Umatilla and Columbia Rivers.

Implementation of any reuse of the Depot would have no impact on known archaeological or historic sites. In the event that any sites were found on the Depot, care would need to be taken to avoid inadvertent disturbance of archaeological resources, and further studies may need to be conducted.

- Native American Concerns

The Depot falls in the historic lands of the Umatilla Indians. The Cayuse Indians held territory to the east of the site as well, and both tribes made trips through the site for hunting and gathering.

No known traditional Indian places or village sites are located at the Depot. Nevertheless, the Confederated Tribes of the Umatilla Indian Reservation are very interested in any reuse of the site. They are concerned with the protection and conservation of Indian and non-Indian cultural resources which may be located within the area and would like to be updated on the process. A primary concern is protection of traditional use values and resources such as fishing areas, hunting areas, root digging areas, berry picking areas, campgrounds and other resource use areas.

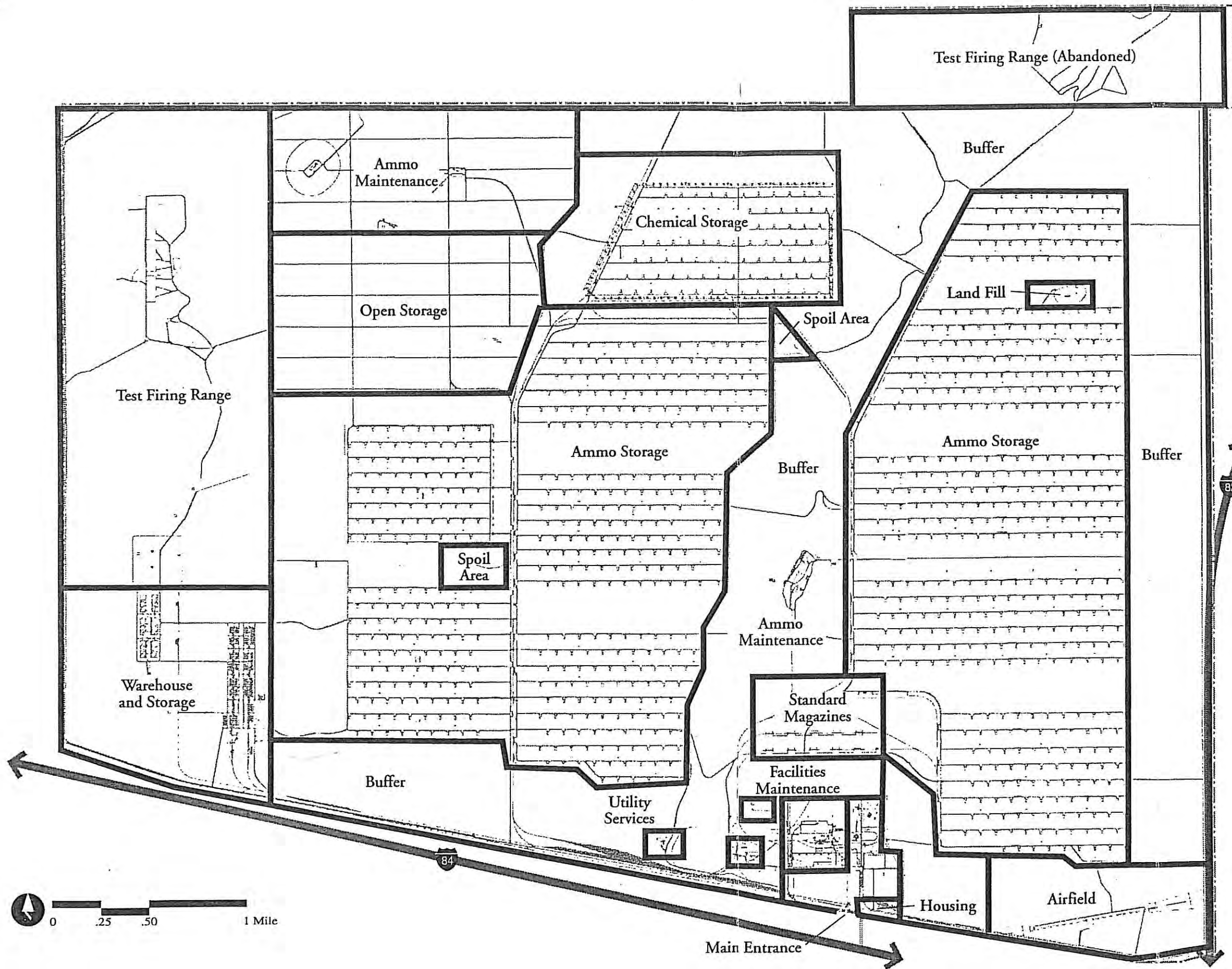
B. IMPROVEMENTS AND CONDITIONS

1. Land Use

The Depot breaks down into easily defined land use areas which precisely reflect the mission of the Depot. Defined in civilian terms, that mission is largely the storage and minor maintenance of ordnance, along with the shipping and receiving these supplies entail. Security is provided for the supplies and some demolition of ordnance occurs. In addition, the tasks themselves must be administered, the structures and machinery maintained, and the staff comfortably housed. (See Exhibit II-3)

Following these priorities, the largest acreage of land-use, 7,568 acres, is given over to storage of ordnance by type. Buffer zones, which supply security and safety from the explosive nature of the ordnance, follow at 7,525 acres. Together, these two land uses account for over three-quarters of the 19,729 acres which, including leased easements, constitute the Depot.

The following table further subdivides the existing land-use categories by acreage. A description of the use of each area follows the table.



Exhibit

II-3

Existing Land Use

**Table II - 6
Depot Land Use Characteristics**

Land Use	Acreage
Ammunition Storage	5,933
Open Space Buffer	4,851
Ammunition Demolition	1,716
Chemical Storage	852
Ammunitions Maintenance	815
Open Storage	783
Warehouse and Storage	646
Former Firing Range	621
Airfield	293
Standard Magazines	140
Administrative	136
Facilities Maintenance	40
Spoil Areas	32
Abandoned Landfills	20
Housing	15
Landfill	15
Utilities Service Area	7
UP Railroad (Lease)	140
Restricted Easement	2,674
TOTAL ACREAGE (including leased land)	19,729

a. Ammunition Storage

At 5,933 acres, this is the largest land use category on site. Two separate areas make up the Ammunition Storage Area. Munitions are stored in bunker structures accessed by gravel roads and rail. This category excludes chemical storage. (See Exhibit II - 4)

b. Buffers

These open space areas are designated for nonuse in order to provide safety distances from the ammunition storage. Stocked antelope and wildlife graze here.

c. Ammunition Demolition

This area of 1,716 acres is used for open storage, open burning, and for demolition of explosives.

d. Chemical Storage

This storage site of 852 acres is under high security for reasons of safety. Chemicals are held in bunker structures accessed by gravel roads and by rail.

e. Ammunitions Maintenance

There are two separate sites which make up this category of 815 acres. Both locations are considered inconvenient by the army; one is not served by rail, and access roads are in poor condition.

f. Open Storage Areas

The 783 acres of open storage in this area receive little use, but are available for storage, if needed. The northern portion of this area is restricted for safety reasons due to its proximity to ammunition storage.

g. Warehouse and Storage Area

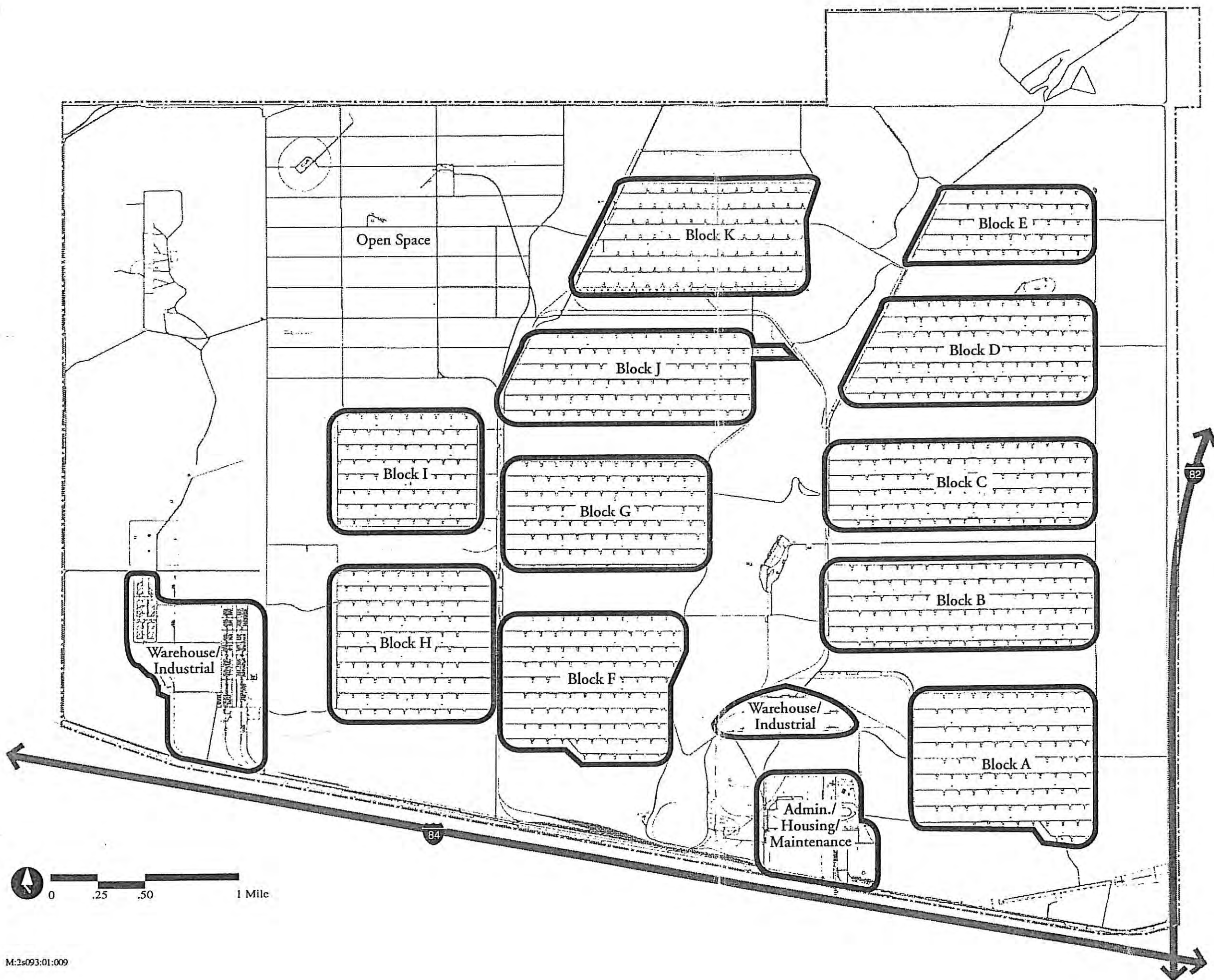
This area, served by road and rail, comprises 646 acres and includes warehouses, open storage areas, and parking. Most of the 36 warehouse structures contained within this area are vacant, however.

h. Firing Ranges

There are two firing range sites. The former firing range of 621 acres has been abandoned and is presently restricted due to "undiscovered, unexploded ordnance." The new firing range is used for security police qualification firing.

i. Airfield

The airfield accounts for 293 acres, most of which are buffer easements for air traffic. The site, presently inactive, contains a runway and fuel storage facilities.



Exhibit

II-4

Bunker Designations

j. Standard Magazines

An above-ground explosive storage area with buffer areas of 140 acres served by road and rail.

k. Administrative

The headquarters and administrative support function on this 136 acres, from which roads lead to all other land-use areas on site. (See Exhibit II - 5)

l. Facilities Maintenance

Maintenance facilities on this 40 acres include a watertank, machine and carpenter shops, maintenance areas for auto and rail, and fuel and oil storage.

m. Spoil Areas

The spoil area of 32 acres holds excess and unsuitable soil materials after gravel excavation.

n. Abandoned Landfills

Twenty acres west of the facilities maintenance area.

o. Housing

There are 24 structures within this 15 acre site allocated for housing.

p. Landfill

The landfill is 15 acres dedicated to nonhazardous solid waste disposal.

q. Utilities Service Area

Sewage treatment facilities are located on these 7 acres.

r. UP Railroad Lease

Owned by Union Pacific for railcar storage, these 140 acres are leased by the army to serve the Depot as a railroad classification yard parallel to the UP main line.

s. Restricted Easements

The Army has acquired easement rights to 2,674 acres to the North/Northeast and Southeast of the Depot and restricted it for the purpose of providing safety distances from depot activity. No residences are allowed within this "nonuse" area; however, the land is irrigated for agriculture by owners.

2. *Transportation*

a. Freeway

The site is bounded on the east by I-82; no access is provided from this facility.

The site is bounded on the South by I-84. A diamond interchange provides the only freeway access to the Depot property.

b. Railway

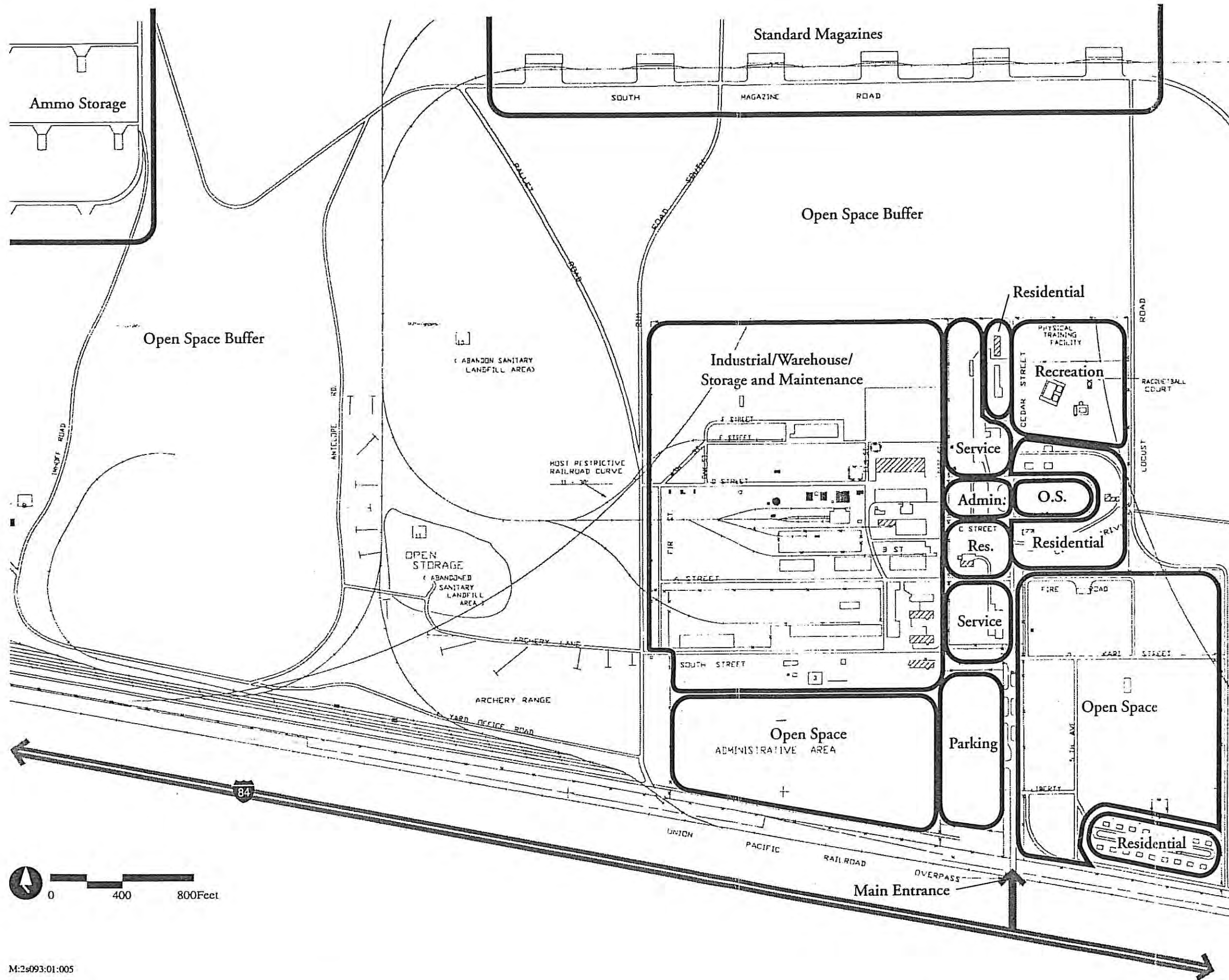
A spur line from Union Pacific Railway serves the entire south boundary of the Depot; a rail car classification and storage yard also exists in this boundary.

c. Air

A small airstrip exists in the southeast corner of the Depot. The bituminous runway is 3,000 ft. long by 50 ft. wide and in fair to poor condition. The airstrip is VFR (visual flight rules) only and has no navigational aids. The significant limitation in the airfield is the poor profile of the runway: it was constructed as a hump, or vertical curve, along its length. Hence, it is considered unsafe.

d. Additional Access Points

Connections to local roads exist, at the northwest and southeast corners of the Depot, but they are presently locked and unused. The southeast access connects to Westland and Walker Roads and could provide a one-way route to the Depot from I-82. The northwest access connects to Summitt Road and Highway 730.



UMATILLA
ARMY DEPOT
Technical Report
Exhibit II-5
Administration Area
Existing Land Use

e. Internal Roadways

The Depot contains approximately 190 miles of internal roadway. These roads include a "patrol road" on the perimeter, roads providing circulation routes within the Depot, access roads within the Administrative and Warehouse areas, and access roads serving the bunkers and munitions storage blocks. Approximately 160 miles of the internal roads are surfaced, mostly with bituminous paving classified by the Army as either "light" or "medium."

There are approximately 5 miles of local access service roads within the Administrative area, including the residential areas east of the main entrance road (Cedar Street). These roads are generally 22 to 24 ft. wide and are classified as medium bituminous; all are classified as being in good or excellent condition. Access to existing buildings appears adequate.

A 20 ft. wide, medium bituminous, primary access road connects the warehouse area with the Administrative area. Within the Warehouse area, there are approximately 7 miles of service roads, generally 22 to 24 ft. wide. These roads are classified as medium bituminous and are in fair to good condition. Access to existing buildings and the concrete aprons to the west appear adequate.

Utilizing approximately 24 miles of existing internal roads, it appears that three major circulation loops are available to access the majority of the remaining portion of the site, excluding bunker K and some of the perimeter area. The following conditions have been noted:

West loop: The majority of this loop consists of 16 to 20 ft. wide medium bituminous roads in excellent condition. However, to keep bunker K isolated from this loop, approximately 8,800 ft. of a 16 ft. wide gravel road classified in poor condition would have to be utilized.

Central loop: The roads along this loop are 16 to 20 ft. wide medium bituminous in excellent condition. However, to complete this loop a connection along the west portion between Ironwood Road and Juniper Road, the east portion of the west loop would have to be made or approximately 2,300 ft. of new road to connect Ironwood Road to the southern primary access road would have to be constructed.

East loop: The north-south roads along this loop are 16 to 20 ft. wide, medium bituminous and in good to excellent condition. However, to complete this loop, bunker service roads — medium bituminous, in good condition, but only 10 ft. wide — would have to be utilized in the east-west direction at both the north and south end of the loop.

Other observations: The perimeter “patrol” roads are 20 ft. wide gravel in fair condition along the west portion of the site and 20 ft. wide medium bituminous in good to excellent condition along the remainder of the perimeter.

The service roads for the bunker areas are 10 ft. wide, medium bituminous, in good condition.

The service roads for the active area in the Northwest portion of the site, presently designated as the ammunition demolition area, are generally 16 ft. wide gravel road in either poor or good condition. There are two 16 ft. wide medium bituminous service roads in good to excellent condition in this area.

By visual inspection, the surfaces of paved roads appear to be in good to excellent condition. However, inspection of the occasional pothole indicated that the roads have a very thin structural section.

The road system appears to be suitable for the present level of traffic carried. However, the pavement widths and apparent structural section, in general, would not be suitable for the traffic volumes and weights normally experienced on public roads outside the Depot. (See Exhibit II - 6)

f. Internal Rail

From the boundary spur line, the Depot is served by a looped rail system essentially adjacent to all munitions storage blocks. A dead-end rail line serves the warehouse area in the southwest corner of the Depot. In total, the Depot has about 50 miles of track; most of the track is 75-pound rail, the main-line and loop are 100-pound rail. Generally, the tracks are in good condition.

The boundary spur line, approximately 3 miles long, contains approximately 8 miles of railroad car classification/storage areas. The dead-end spur lines to the Warehouse area consists of approximately

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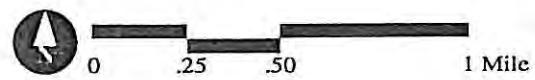
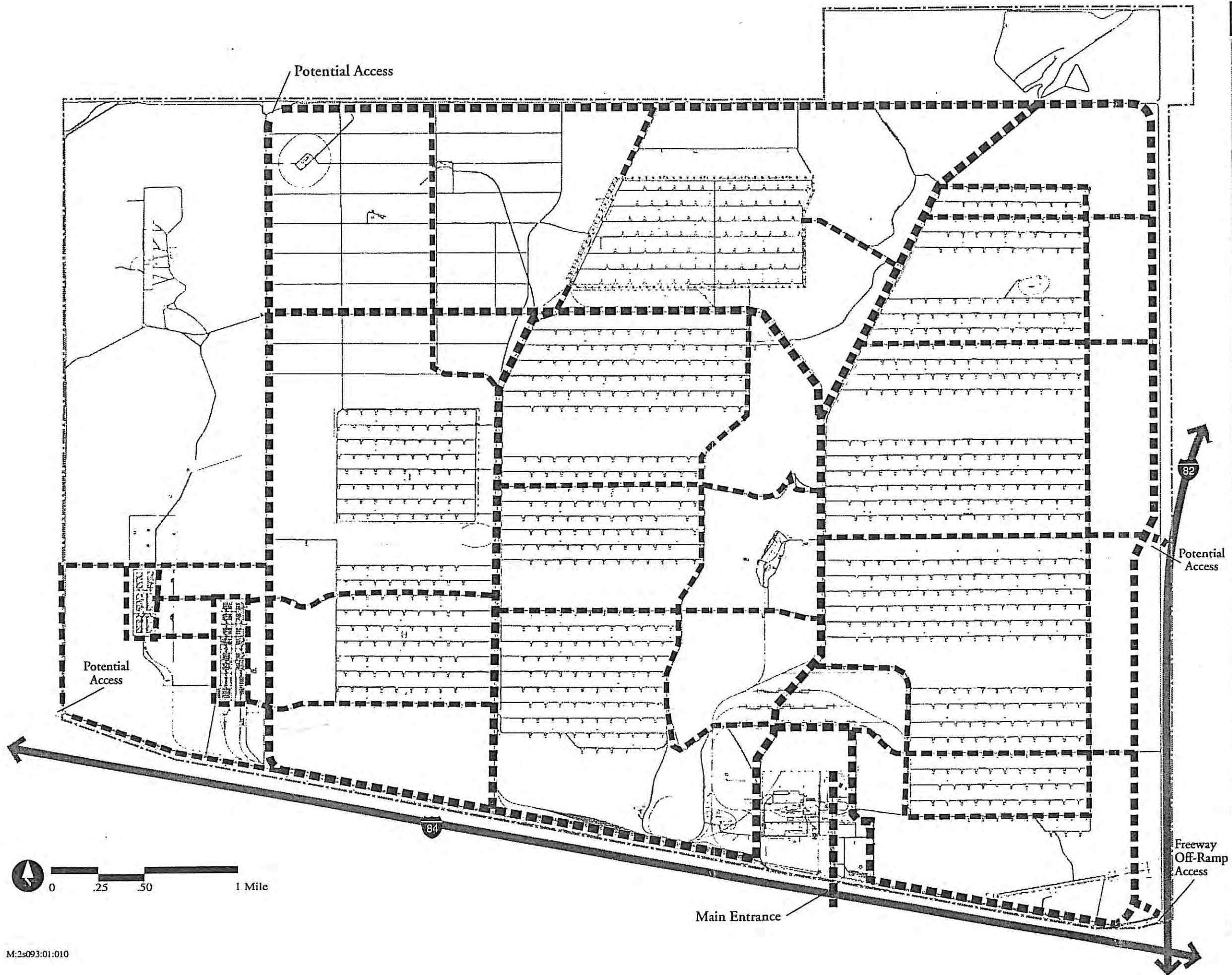
Major Roads

Minor Roads

Exhibit

II-6

Roadway Plan



10.5 miles of track. The main internal loop consists of approximately 8 miles of track. Also, there is a second loop consisting of approximately 8 miles of track, encircling bunker K. The remainder of the rail system consists of dead-end spur lines serving the Administrative area, the industrial waste lagoon, bunkers D and E, and isolated open storage areas. (See Exhibit II - 7)

g. Ability of the Transportation System to Support Reuse

In general, the transportation system would be able to support reuse of the Depot, at an intensity of the future use which is similar to the existing use by the Army. The freeway, county road, and rail access points to the Depot have the greatest ability to support a more intense use. The internal rail system may need further evaluation compared to the specific reuse proposals to determine adequacy.

Depending upon the redevelopment concepts, and the volumes and weights of vehicles, portions of the internal road system could require widening or reconstruction of the structural sections. The airstrip should be considered unusable without reconstruction.

3. Buildings

a. General Assessment

- Background

Nearly all buildings within the Depot were constructed during the early years of the Second World War. A variety of materials and types of construction were utilized depending on the intended use of the structures. Provision of utilities such as electricity, water, sewer, telephone, heating, etc., also depended on usage. Buildings are categorized by usage and location. General categories are as follows:

- Headquarters area
- Warehouse and storage
- Ammunition supply and storage

A discussion of each of these building categories is presented below.

- Maintenance

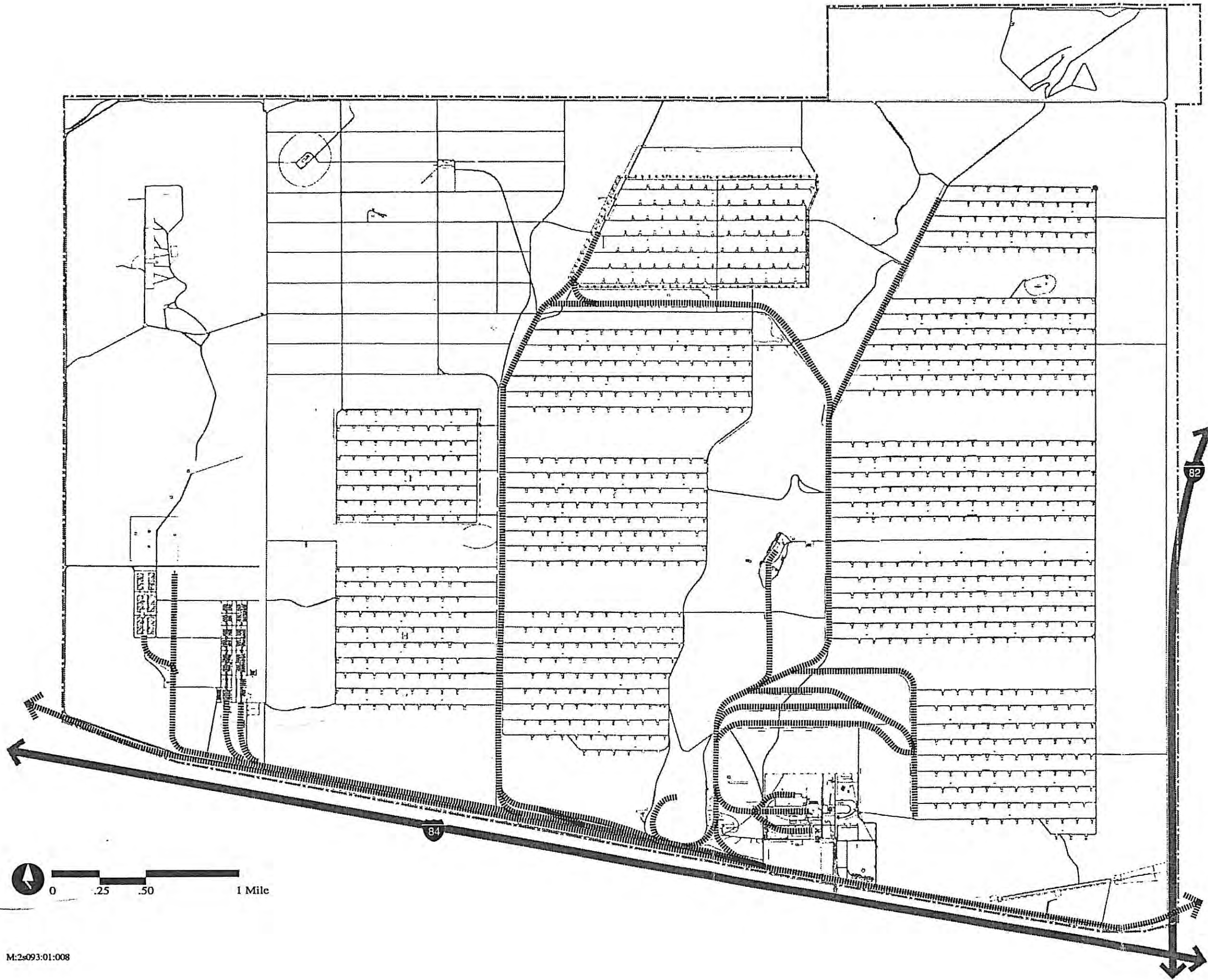
Most buildings appear to be adequately maintained. A full time maintenance staff is stationed at the Depot. Remedial work is now done on an "as needed" basis. The relatively dry climate of Eastern Oregon has prolonged the useful life of structures. Buildings that are actively used seem to be better maintained than less active buildings. Deterioration of siding and roofing is evident on some of the lesser used buildings in the warehouse and storage area. It appeared that nearly any major structure could be refurbished to a satisfactory condition with reasonable expenditure. (However, this comment does not apply to asbestos abatement - see subsection e.)

- Building Code

Buildings constructed fifty years ago did not, of course, follow the provisions of current building codes such as the Uniform Building Code. Nevertheless, these structures have performed well throughout their lifetime and, based on information available to us, have not been significantly damaged by operational live loadings, winds or seismic events.

Unlike Western Oregon, which was recently upgraded to Seismic Zone 3, Eastern Oregon remains within Seismic Zone 2b. Zone 3 involves higher lateral forces and more stringent structural design parameters than Zone 2. Furthermore, many of the Depot buildings, with the possible exception of ammunition storage "bunkers", are single story structures of relatively light construction. Such buildings are normally "controlled" by wind forces rather than seismic forces. Thus, changes/upgrading of the seismic provisions of the Uniform Building Code may not affect most buildings at the Depot.

The Uniform Building Code allows additions, alterations or repairs to be made to any building or structure without requiring the existing building or structure to comply with all the requirements of the Code. However, the addition, alteration or repair itself must conform to Code requirements for a new building, and such action must not cause the existing structure to violate the Code or become unsafe. As mentioned in the opening paragraph of this subsection, most of the existing buildings at the Depot



Exhibit

II-7

Rail Network

have apparently stood the "test of time", and appear suitable for future reuse.

- Electrical Code

The buildings or facilities that would change from government to private ownership should be brought up to electrical standards as required by the Uniform Building Code, and in particular to the National Electrical Code. The applicable code requirements would be determined by the local inspection authority. Modifying an existing building or facility would require an inspection to determine if the electrical service, wiring and devices meet the latest building code requirements. Electrical distribution equipment and lighting systems that do meet the current code requirements would have to be inspected and analyzed for their length of time in service, amperage/voltage capacity, and determine if they meet today's standards for energy efficiency. Depending on the planned or intended modifications and/or past maintenance, all or part of the electrical distribution equipment, wiring/conduit systems, grounding, and lighting systems may have to be replaced.

- Asbestos Abatement

An Asbestos Assessment Survey was conducted by Dames & Moore at the Depot. Their report, dated August 1992, indicates that a total of 1,154 samples were collected from 285 buildings. Ammunition storage bunkers were excluded from the survey. Testing of the samples disclosed that 42 percent of all buildings surveyed contained at least one friable asbestos containing material (ACM).

Estimated cost for abatement of asbestos for the entire base, including buildings and utility systems, ranges from \$11,500,000 to \$22,750,000.

Typically, ACM was found in roofing shingles, cement board panels and siding, caulking, and architectural finishes such as tiles, drywall, sheet vinyl, etc. Asbestos insulation for buildings and utilities was also detected.

Asbestos abatement must be considered in the reuse of buildings. Presumably, such abatement will be performed by the govern-

ment before the Depot is closed and turned over to others. If not, abatement of specific structures will affect the cost of reuse of existing buildings.

b. Review by Use and Location

1) Headquarters Area

- Overview

The Depot operating, maintenance and security personnel are based at the Headquarters area. This complex of buildings is adjacent to the south boundary of the site and has direct access to Highway I-84 via a diamond interchange. Some buildings are leased to and used by the Oregon National Guard.

Approximately 47 buildings are located within this area. Usages include offices, security stations, maintenance shops, vehicle storage, warehouses, community center, heating plant, and related occupancies. The buildings have assigned numbers of under 100, and range in size up to 30,660 square feet. A breakdown of areas is as follows:

—	Over 10,000 S.F.:	6 buildings
—	5,000 to 9,999 S.F.:	6 buildings
—	Under 5,000 S.F.:	35 buildings

Most structures are single story with a few two-story buildings being used chiefly for offices/personnel activities. Several of the office and building shops have brick siding. Electrical, water, sewer, and HVAC is furnished to most of these structures. Based on our visual observations, most structures are adequately maintained.

- Reuse

These structures should be reusable for similar activities in the future provided they continue to be adequately maintained. Because the buildings represent architectural practices of the early 1940s regarding space utilization, lighting, circulation, etc., they may have to be modified to suit needs of future users. Such

modifications would comply with Building Code requirements and would be subject to asbestos abatement as described in subsection e.

2) Warehouse and Storage

- Overview

Located on the Southwest corner of the property, the warehouse and storage complex of buildings is well-served by both rail spurs and roads. Buildings with numbers in the 100 series are located on the east side of the complex; series 200 buildings are to the west.

There are thirty (30) series 100 buildings, with an aggregate area of 455,210 square feet. Breakdown of individual areas, excluding very small buildings and minor structures, is as follows:

—	30,700-30,000 S.F.:	4 buildings
—	18,120 S.F.:	3 buildings
—	14,400 S.F.:	1 building
—	12,350-12,000 S.F.:	22 buildings

Two distinct types of structure are found in this area. Three buildings, each 18,120 square feet, are now designated "maintenance/ammunition". One of these, used by the Oregon National Guard, is very well-maintained; the other two buildings need extensive refurbishment. These three structures have concrete floor slabs, steel building frames, corrugated steel siding and roofing (steeply sloped roofs), and longitudinal crane rails for overhead traveling cranes located within an upper gallery. There are single large doors on either end of these buildings, and large doors are spaced along the longitudinal walls on both sides. No raised loading docks are provided along the sides of these buildings.

The remainder of the buildings are single story warehouse type, two of which appear to have been recently refurbished and are used by the U.S. Postal Service. Rail spurs run along one side of each warehouse, and raised loading docks and large doors are

provided on both sides to allow transfer of material. Typically, these buildings feature concrete floor slabs, timber columns, wall girts and roof purlins, timber roof trusses spanning from wall to wall, and shingle roofing and siding. Some of the buildings have reinforced concrete walls. Electrical, water, and dry-pipe fire protection is provided to all series 100 buildings, and some have telephone, heating and sewers as well.

There are six (6) series 200 buildings with a total aggregate area of 518,400 square feet. The area of each building is 44,110-44,290 square feet. These single story structures have concrete floor slabs, timber columns and wall girts, three-span timber roof trusses (two rows of interior columns), metal siding, and slightly sloping tar and gravel roofs. Electrical, water, dry pipe fire protection, and heating services are provided. Fire walls subdivide these large buildings, and large sliding doors are provided in exterior walls. A disadvantage is that door sills are at ground level; there are no elevated loading docks.

- Reuse

Future reuse appears feasible for these warehouse and storage buildings. For the three series 100 steel frame buildings with overhead craneways, possibilities include light manufacturing, vehicle repair, metal fabrication, small foundry, boat building and similar activities. Other 100 and 200 series buildings are suitable for light manufacturing, warehousing, long-term storage, etc. Actual reuse, of course, will be governed by demand, marketing effort and financing.

3) Ammunition Supply and Storage

- Overview

This activity occupies most of the interior of the site. There are three basic building types: "Standard Magazines", "Bunkers", and "Miscellaneous Buildings and Structures".

a) Standard Magazines

The 14 Standard Magazine buildings, situated immediately behind the Headquarters complex, have an aggregate area of 157,178 square feet (11,227 square feet each). The buildings appear to be solidly constructed and have raised concrete floor slabs, concrete block or tile walls and corrugated metal roofing. Four large doors and an elevated loading dock are provided on one side of each building. A rail spur/paved area exist adjacent to the dock. The Depot maintenance staff indicated that timber trusses support the roof. Only electrical service is furnished to each building.

b) Bunkers

There are 1,000 bunker ammunition storage "buildings". Each is located a safe distance from its neighbors. Floor area per bunker is approximately 2,147 square feet; therefore, aggregate area is 2,147,000 square feet! Electricity is reported to be furnished to only 90 bunkers. Typical construction is reinforced concrete floor slab end and side walls and arch roof. A single heavy door is provided at one end, and the roof is covered with about two feet of earth. Access to bunkers is by paved road only.

c) Miscellaneous Buildings and Structures

There are about twenty miscellaneous buildings within the Ammunition Supply and Storage area. These range from very small up to two buildings of 18,400 square feet and 16,500 square feet respectively. These two buildings were/are employed for decommissioning of ammunition.

- Reuse

Although relatively small, Standard Magazines may be suitable for warehousing or long-term storage. The bunkers are very specialized structures not easily converted to other purposes. Miscellaneous structures might be utilized in support of nearby activities and/or development.

c. Urban Design/Visual Quality

From an urban design/visual quality standpoint, the Depot can be divided into four areas: Administration, Facilities Maintenance, Southwest Warehouse, and Ordinance Storage. These are discussed separately below.

- Headquarters Area

The main entrance onto the Depot is via the security checkpoint at the southern end of Cedar Street. All administrative functions, office, residential and housing units, are located in the heart of this complex (136 acres). The majority of buildings were constructed in 1941 and 1942. The area is bounded by a buffer zone to the north, east, and west, and the Union Pacific rail corridor to the south. Vehicular and pedestrian circulation generally provides functional connections to logically grouped buildings and facilities. The Administrative area is unified through a "grid" type of layout, whereby the centrally located Headquarters and parade ground form the core and all other buildings extend out from that point. Landscape plantings help to unify the area, providing a sense of individuality and place, while affording visual relief and shade in the summer months.

The majority of office functions occur in Buildings 1, 2, 18, 31, and 32, and to a lesser degree in several of the other larger warehouse and maintenance sheds. Building 1 is the Headquarters building, was built in the early 1940s, and is still in good condition. It is a two-story brick building with red tile roofs and serves as the focal point for the area. Building 2, the Firehouse, similar in style and materials as Building 1, is currently being used additionally for security and as a general storehouse. Both buildings were listed eligible in 1988 by the State Historic Preservation Office for inclusion on the list of Historic Places, and therefore have historical architectural significance. Buildings 18 and 31 along Dale Street are of the same design and in good condition, currently being utilized for supplies, instruction and administrative general purposes. Building 32, along Cedar Street, is of newer wood frame construction and contains the community center, auditorium, post exchange and instructional rooms.

There are 24 single family detached housing units on the base, 17 of which are located in a separate area in the southeast section of the Administration area along 5th Avenue. The street is lined with mature locust and birch trees. All of the 17 units are currently vacant except one, and the units are in poor to fair condition. The remaining

housing units are located in the center of the Administrative area along Cedar Street and Circle Drive, and are in good to excellent condition. Architecture in this area follows two distinct styles, but they blend together well, probably because of the unity of the landscape features. The first is that of the older 2-story brick buildings with red tile roofs which were built in the 1940s when the Depot was first constructed. The other is that of the one-story ranch style buildings which were built much more recently. The houses facing onto the parade ground along Circle Drive are constructed of brick, with tile roofs and are architecturally interesting, matching the Headquarters Building in style. Other housing units along Cedar Street are of newer wood construction, with lap siding painted yellow in color and asphalt shingle roofs. Street trees and open lawn areas are assembled in such a way as to form a good sense of overall unity.

Building 34 contains 13 small units with shared bathrooms used as enlisted barracks, and one apartment located at the north end of Cedar Street. The style of this building is of the newer construction, as are Buildings 32 and 33 which are adjacent at the north end of Cedar Street. These units are in good condition and currently house Navy personnel assigned to the Boardman Bombing Range.

In the northeast corner of the Administration area, east of the community center are the recreation facilities. Existing uses available for personnel include the children's playground, tennis court, multi-court, outdoor swimming pool, bathhouse, softball area, and picnicking area with barbecue pit. The recreation area is located adjacent to and north of homes on Circle Drive. The landscape in this area is fairly limited and consists of some sparse plantings of pine trees with grassy areas among the facilities.

The ceremonial center of the administration area is the Headquarters Building (Bldg. #1), and the parade ground. Circle Drive frames several housing units and the parade ground, enclosing the central core in a well-defined, recognizable space. The core is linked to the rest of the administration area via Cedar Street, which serves as the main axis through the site, and several key east/west streets A, D, and South.

Cedar Street was planted with Locust trees on either side in the 1940s. These now create a pleasant and inviting street from the main entrance to the parade grounds. In addition, several large lawn areas have been created in the Administrative core area that enhance visual

appeal and allow for pedestrian use. The condition of the landscaped areas is generally good and it is apparent that some attention was given to the overall theme of the landscape program on the base. Overall, the landscape provides an excellent framework on which a future landscape design can be based.

- Facilities Maintenance

The facilities maintenance area is located north of and adjacent to the administrative area and contains an additional 40 acres. Services such as automotive, rail, machine, carpenter shops and other general maintenance functions are housed in this area. The majority of buildings were constructed in 1941 and 1942.

The area bounded by South Street, F Street, Fir Street, and Date Street comprises the majority of buildings within this category, which are mostly in good condition. The area is also served by rail access to the train maintenance shed (Building 10), which then connects south to the Union Pacific switchyard. Several of the buildings have the capability to provide overhead crane operations, and other areas contain fuel and oil storage, a water tank, and other storage warehouses. Some of the facilities in this area follow the general character of the older buildings in the administrative area with their brown brick style. The facilities maintenance area contains little to no landscaping. For the most part areas between buildings are covered in asphalt and serve as parking and storage areas for outdoor equipment. The land east of Fir Street is unmaintained and consists of native bunchgrasses.

Visual quality, urban design and building layout in this area serves much more of a functional purpose than an aesthetic one. Five different lengths of rail connect into this area, and are utilized for central receiving purposes. Buildings 10, 11, 17, 18, 19, 30 and 39, all have immediate access to the rail system. Most of the buildings in this area are of brown brick and were constructed in the early forties. A fully utilized railroad engine shop/roundhouse serves as the central focus for the rail network within the facilities maintenance area. Other buildings in the area consist of aluminum and steel warehouses with relatively low visual aesthetic quality, but high functionality. Uses in the area include vehicle and engine maintenance, receiving and supply center, medical supply storage and inflammable materials storehouses.

- Southwest Warehouse Area

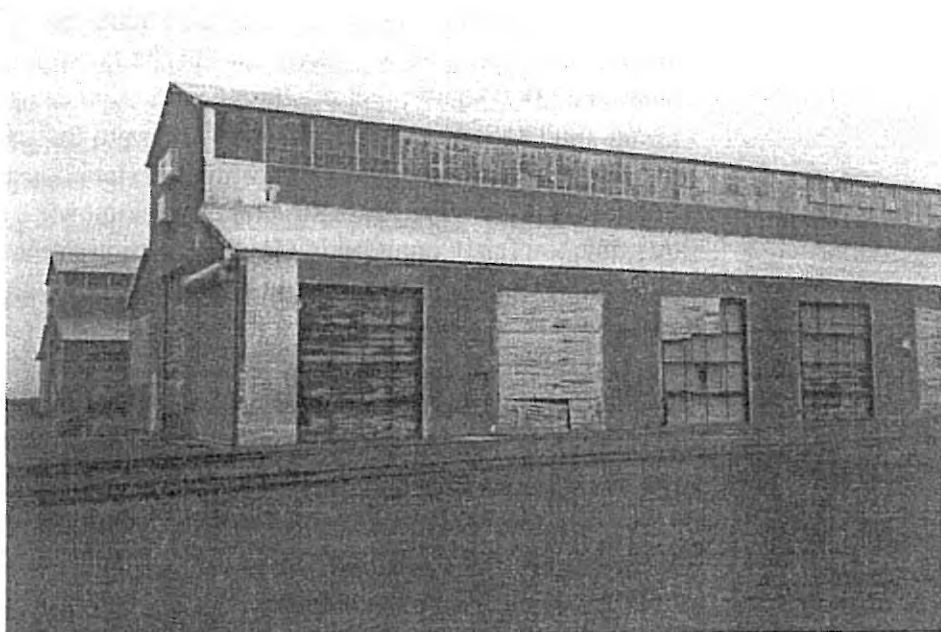
This warehouse area, roughly three miles west of the Administrative and Facilities Maintenance area contains 640 acres. The area contains one grouping of six warehouses to the far west, which each contain 84,000 square feet of storage space, but are predominantly vacant, and have immediate adjacent access to the rail system. These buildings appear to be made of corrugated steel construction and are in fair condition. These six structures are somewhat rundown, and at this time are fairly unattractive looking, although they do have a more interesting visual character than the other pod of warehouses to the east.

The other grouping of 24 buildings are readily accessible to a number of rail lines leading to the switchyard. These buildings are identical in style following a one-story, industrial design with roll-up doors on each side, allowing delivery and removal of equipment and supplies via the rail access. This pod of buildings is deteriorating and therefore visual quality in this area is relatively low due to the blandness in architectural design and lack of landscaping in the area. This portion of the site could be utilized for warehousing or manufacturing by other business which could take advantage of and utilize the benefits of a rail system.

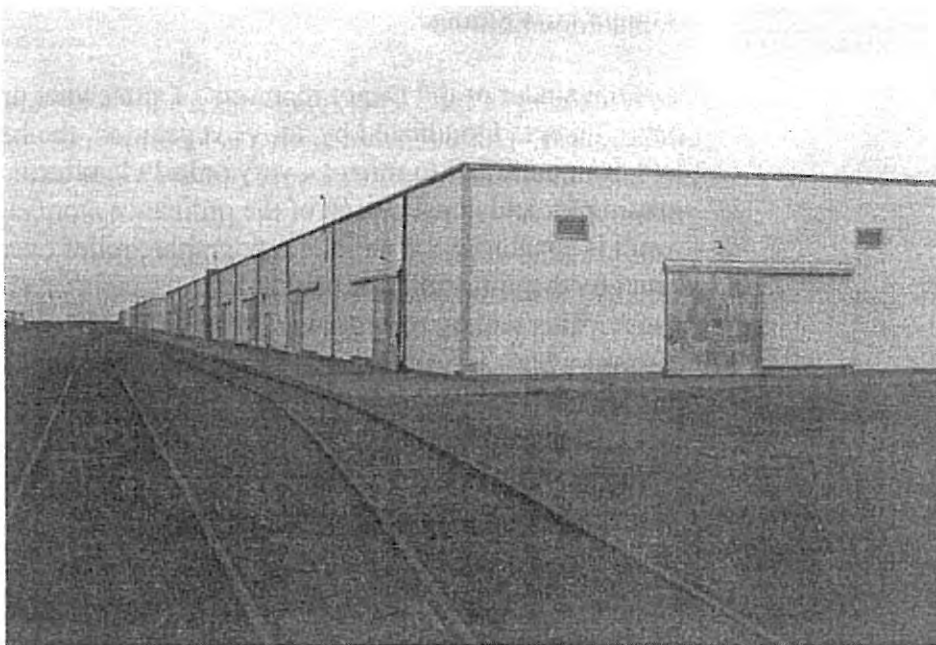
- Ammunition Storage

The remainder of the Depot represents a somewhat unique visual environment. Dominated by native vegetation, the land has nonetheless been modified to reflect a very orderly landform pattern through grading for and construction of the ordinance storage bunkers. The result is a landscape with little topographic relief overall, but dominated by the uniformity of bunker layout spacing and visual prominence. This feeling of order is reinforced by the road/railroad systems which serve the storage complex. The only exceptions to this are (1) the Coulee which traverses the site, and (2) the buffer areas between the ordinance storage complex and the property boundary. These latter areas represent a predominantly undisturbed shrub-steppe Columbia Plateau environment.

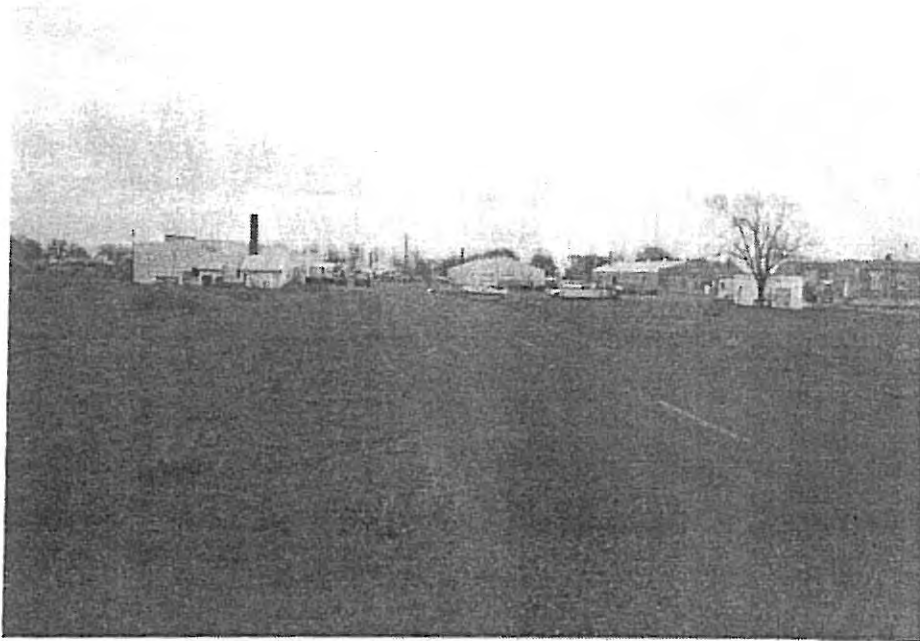
Representative photographs describe the visual quality of the Depot on the following six pages.



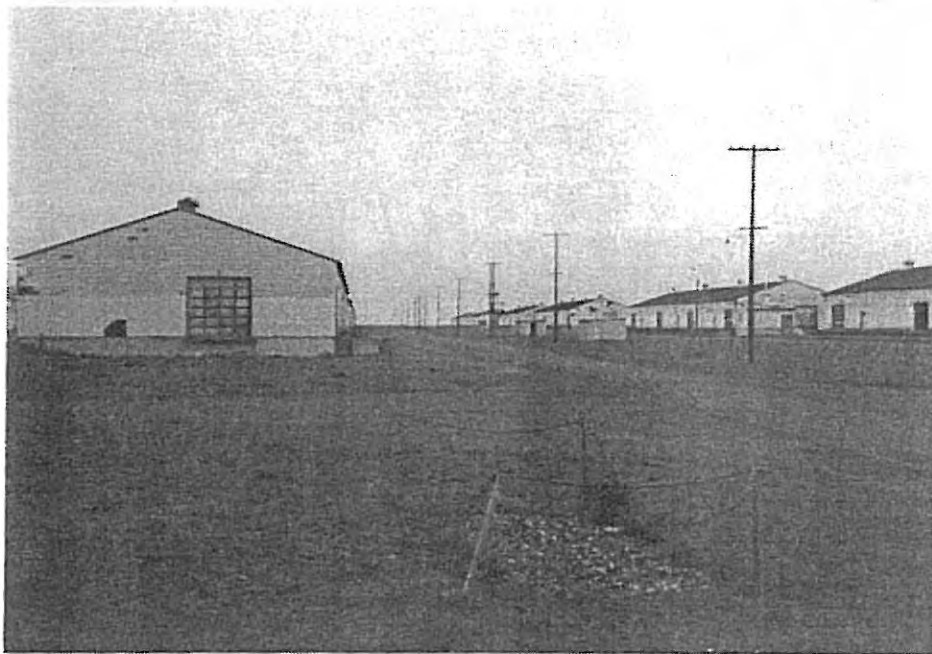
Set of 24 warehouses on southwest corner of the site.



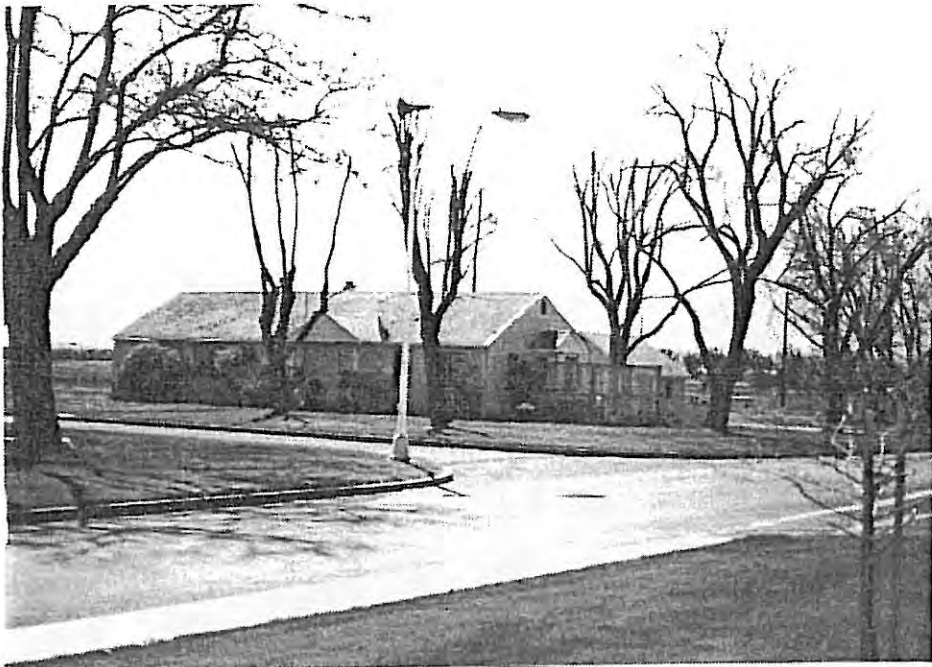
View of corner of warehouse, part of 6-bldg. pod with access to rail network



Looking east down E Street toward Facilities Maintenance area



Set of 24 warehouses in the southern portion of the site



Newer residential unit on corner of Cedar and D Street (Bldg. 55)



Original brick residences along Circle Drive (Bldgs. 15, 16, 70)



Headquarters building eligible for listing on the National Register of Historic Places



View in front of Building 32, looking south down Cedar Street



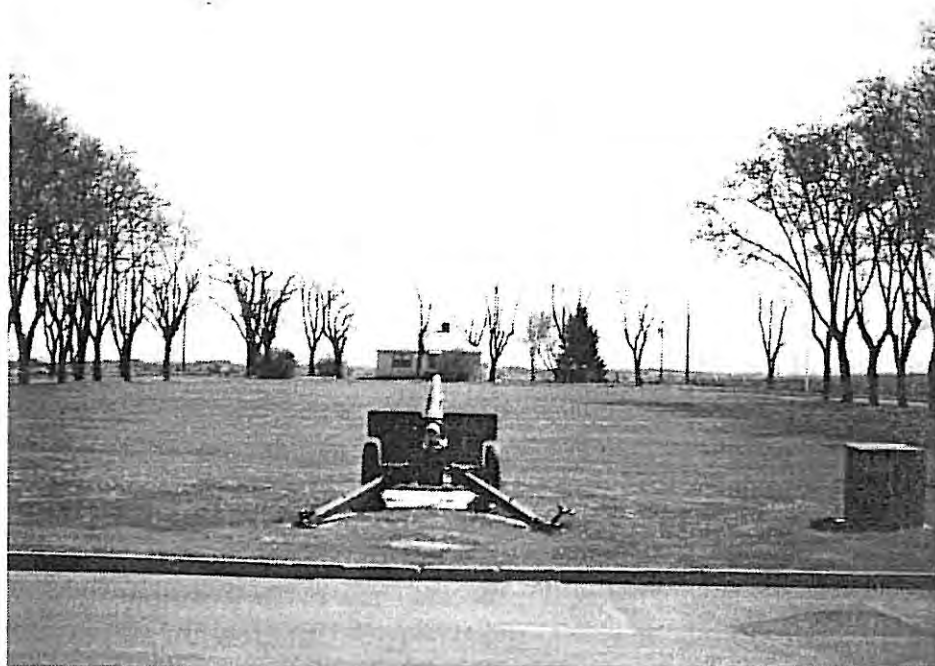
Newer residential unit (Bldg. 51) fronting on A Street



View west from corner of Dale and A Streets, with Buildings 17 and 18 shown on the right.



Main access along Cedar Street, lined with mature locust street trees



Parade field looking east toward Building 35

4. Utilities

a. Sewer and Waste Water

Only the Administrative area is served with a piped sanitary sewer system leading to a treatment facility. The entire system was installed in the early 1940s. Concrete pipes 6- to 10-inches in diameter collect sewage from this area and convey it to a treatment site approximately 5,000 ft. west. The treatment facility consists of two Imhoff tanks that discharge to a percolation drainfield. Only one of the Imhoff tanks is presently in service (reported to be 43,000 gpd capacity). The second tank (545,000 gpd capacity) is out of service, and its ability to be used is unknown.

The Administrative area collection system is divided into four subsystems. Subsystem A consists of approximately 5,700 ft. of 10" concrete pipe running from the Imhoff tank to MH A18 on the main entrance road. From that point, 8" concrete pipe runs approximately 5,450 ft. north, serving buildings along Cedar Street and an isolated building south of the southwest corner of bunker B.

Subsystem B consists of approximately 2,200 ft. of 8" concrete and at least 2,900 ft. of 6" s/s and serves the majority of the Administrative area west of Cedar Street.

Subsystem C consists of approximately 1,300 ft. of 8" concrete serving the northeast portion of the Administrative area.

Subsystem D consists of approximately 1,250 ft. of 8" concrete serving the housing area at the southeast corner of the Administrative area.

The condition of the collection system (including all subsystems) is unknown, but due to the age of the system, it may be suspect.

Individual septic tanks and drainfields provide for treatment of domestic sewage at locations other than the Administrative area. In some cases, such as the Warehouse area, several buildings are connected to one septic tank. Present-day records show two active septic tanks with a total capacity of 11,000 gpd serving the south half of the Warehouse area. The north half of the Warehouse area appears to have no sanitary sewer service at present. The concrete apron area west of the Warehouse area is served by a 5,000 gpd septic tank.

The septic tank systems for the majority of the isolated buildings have a total known capacity of 31,450 gpd. The condition of these isolated systems is unknown; however, several of the buildings they serve are presently inactive.

b. Water

The Depot water system consists of wells, pipelines, and storage reservoirs. Chlorination at the well head is the only treatment required in the system. The system is in reality two systems: one serving the northwest and north-central portion of the Depot and the second serving the southwest (Warehouse) area and the Administrative area. The bunker block areas are not served by the water system.

North system: The north system includes three wells providing 2,030 gpm and 120,000 gallons of elevated storage. A 12" AC (asbestos-cement) transmission main approximately 5,400 ft. long runs west then southwest from the storage tank to an isolated building in the northwest corner of the ammunition demolition area.

The building is served by four hydrants. A 3" AC line continues approximately 1,800 ft. southwest then approximately 3,200 ft. south to a small building on West Patrol Road at the access road to the present demolition pits. No hydrants serve this building.

Also, a 10" AC transmission line runs approximately 1,800 ft. south of the storage tank to a second isolated building in the north-central portion of the ammunition demolition area. This building is served by a looped 8" distribution line including four hydrants. A 6" PVC (polyvinyl chloride) line runs approximately 4,100 ft. southeast to a pump house at the southwest corner of bunker K. From there, three distribution lines, 1" - 3" PVC and 2 - 4" PVC, serve isolated points in bunkers K and J. There are no fire hydrants in this area.

Except for the 12" and 10" AC transmission lines and perhaps the 6" booster pump system, the north system would not meet present-day standards. The 3" lines may be adequate to provide a sufficient flow of drinking water or process water but they are inadequate for fire flows.

South system: The Administrative/Warehouse system includes three wells providing 2,120 gpm and 250,000 gallons of elevated storage. This system also includes a well that is not used due to high nitrate

concentrations and a 1 million gallon ground reservoir that is not used due to lack of demand. A 12" PVC transmission line approximately 16,000 ft. long connects the storage tank in the Administrative area with the 1 million gallon storage tank in the Warehouse area.

Most of the distribution piping within the Administrative area and Warehouse area is cast iron pipe (with lead joints), and there are some lengths of AC and PVC. The pipes are sized sufficiently to deliver fire flows, and with exception of an occasional leaking joint, no maintenance problems have been encountered. The Administrative area and the Warehouse area are well-served with fire hydrants.

A 10" AC transmission line runs approximately 6,500 ft. north from the Administrative area storage tank to the inactive industrial waste lagoon, which is served by a 6" distribution line including three hydrants. An 8" AC transmission line continues approximately 2,850 ft. north to serve one hydrant and two services west of bunker C.

In general, the south system appears satisfactory.

c. Surface Water/Storm Sewer

Most of the Depot surface water is simply allowed to run off hard surfaces to nearby ground, where it evaporates or percolates into the ground. In the Administrative area, a storm sewer collection system of catch basins and approximately 3,100 ft. of 8" and 10" concrete pipe collect surface water and convey it to the southwest corner of the area. From there a 10" concrete transmission line conveys it approximately 5,600 ft. west where it is discharged onto the ground and allowed to percolate or evaporate. In addition, there is a small (800 ft. of 8" concrete) system east of Cedar St. that drains to a percolation tank east of the Administrative area.

d. Electrical

Electrical power is supplied to the Depot on overhead lines by Umatilla Electric Cooperative Association (UECA). The service is provided at 12,470 volts, three phase, four wire, 60 hertz. The Depot substation is located east of the main entrance. From this substation, the site electrical system is fed on overhead lines on wooden poles located along roadways similar to a rural electric distribution system. The poles' lines have existed since the original construction and the poles are in poor condition. Presently, a run along the southwest side is being replaced with new poles and copper wire.

Typically, buildings and railcar loading docks, outside of the administration area, are serviced by overhead pole lines and pole mounted transformers. The transformers are sized per each building's load requirements and supply power to the buildings by an underground or overhead service entrance. The transformers on the Depot have been checked for PCBs and have been scheduled to be removed or changed out to comply with EPA requirements.

The administration area is primarily served by underground conduits from pad mounted transformers. The conduit system and transformers are in good condition. Power in this area has been transformed down to 2300 volts open delta and then reduced to 277/480 volts, three phase, 120/208 volt, three phase or 120/240 volt single phase, depending on each building's requirements.

Storage buildings and loading docks in the outlying areas have old incandescent lighting in poor condition and should be replaced with a more efficient lighting system. The power wiring, circuit breaker panels and devices should be replaced and brought up to Code.

In general, the electrical system has been well-maintained in the high use areas, but upgrades have been on an as-needed basis. All electrical equipment is owned and maintained by the Depot. At this time, buildings that are rented are maintained inside by the renter and the Depot maintains the system up to the building's service entrance.

In a 1987 Master Plan Report, the total transformer load for the Depot was approximately 6,000 kVA. The Umatilla Electric Cooperative Association (UECA) has stated the feeder is capable of supplying 10,000 kW with 5,000 kW of power going to the Depot. UECA is willing to increase the supply if a greater demand should develop in the future.

e. Telephone

The telephone service from Pacific Northwest Bell Telephone Co. enters the Depot on the southeast corner of the property.

Services are a combination of overhead and underground lines going to all areas of the site. Most of the system is underground serving the administration and main outlying buildings. Remote areas have special mine-type units mounted on posts, or provisions for portable telephones.

Condition and capacity of the telephone system is unknown at this time and needs to be reviewed further.

f. Lighting

General site lighting conditions depend on the area and the frequency of use. The administration area street lighting is in good condition, well-maintained, and the poles are spaced to provide good illumination of the area.

The street lighting around the outlying buildings has been shut off because of its age and type of system. The building perimeters and part of the streets are now illuminated by outdoor fixtures mounted on the building outside walls.

The administration area interior office and shop lighting is in good condition; however, it is not energy efficient and should be changed if the opportunity presents itself.

The outlying buildings' incandescent fixtures are in poor condition and should be replaced to boost light output and decrease energy cost.

III. REGULATORY CONDITIONS

A. COUNTY LAND USE REGULATION

The Depot, due to its Federal ownership, has not been zoned by Morrow and Umatilla Counties. The surrounding land use of both counties, however, is overwhelmingly agricultural, and is zoned to meet the Land Conservation Development Commission's (LCDC) guidelines for preservation of agricultural development within the state. The land-use designations have varying restrictions, as follows:

1. *Umatilla County*

a. North & South County Agricultural Plan Designation

Within Umatilla County, land to the north, northeast, and south of the Depot falls within this category of the Umatilla County Comprehensive Plan.

The extensive commercial farming operations within this area form the backbone of the Umatilla County agricultural economy and are protected with an Exclusive Farm Use (EFU) zoning. This zoning, intended to protect the area from nonfarm conflicts, sets up a minimum parcel size of 160 acres and considers any nonfarm activities to be secondary and conditional use of land. Conditional land use applications must pass a matrix review system based on such issues as: compatibility to surrounding farms, size and nonproductive soil types, and service of community need. Commercial agricultural production processes, as well as the sale of agricultural produce and agricultural research, all fall within an expanded definition of agricultural farming and are considered primary uses.

b. West County Irrigation District

Land directly to the east of the Depot falls into this district which is characterized by land parcels of 45 to 90 acres producing highly cost-effective specialty crops, such as mint and asparagus, mixed with the larger farm parcels typical of the region as a whole. Much of the farming done in this district is defined as part-time. Zoning regulations here specify a minimum of parcel size of 40 acres to "preserve the existing agricultural parcelization and enterprises." In addition to the minimum lot size, a nonfarm use review is also in effect.

c. Industrial Plan Designation

Outside the southeast corner of the Depot, between I-84, I-82, and Westlund Road, is a wedge of land falling within the Industrial Plan Designation. Besides the major thoroughfares, the Union Pacific Railroad's Hinkle Rail Classification Yard is an asset to promoting industry within this area.

2. *Morrow County*

a. Exclusive Farm Use (EFU)

Almost without exception, land adjacent to the Depot within Morrow County, falls into this category, zoned to conserve the extensive commercial farming operations which characterize land use in this area. As in Umatilla County, the EFU zone sets a minimum parcel size of 160 acres and considers any nonfarm activities as secondary and conditional land uses. Within its primary agricultural land use, however, the EFU Zone permits the exploration of geothermal resources and the disposal of solid wastes. Conditional uses include such land use as exploration, mining and processing of geothermal or mineral resources, as well as community services such as schools, parks, golf courses, etc.

b. Rural Residential (RR I)

As the urban boundary of Irrigon, northwest of the Depot, descends toward the West Division Canal, a very small area zoned Rural Residential meets the Depot property line. This zone designation allows for single family residences within a minimum lot size of one acre. Farming is allowed, with restrictions on livestock and animal husbandry. There is no maximum acreage restriction, and many residents within this zone hold 5-10 acres, or more, which they farm. Public building and recreational facilities intended to serve the residents of the area (with a few exceptions, such as golf courses) are also considered primary uses in this zone.

c. Farm Residential (FR II)

The only other exception to the predominantly EFU land use which surrounds the Depot in Morrow County occurs south of the Union Pacific Line along the southern boundary of the Depot and North of I-84. This area is zoned Farm Residential and is similar in restric-

tions to Rural Residential, but has a minimum acreage designation of 2 acres.

B. WATER RESOURCES

Water sources may be classified as either “**Groundwater**” or “**Surface Water.**” Groundwater refers to water from wells and surface water refers to water from rivers or streams. Most of the groundwater in the vicinity of the Depot occurs in either deep basaltic formations or in shallow alluvium that may or may not be hydraulically connected to nearby streams or rivers. Surface water sources include the Columbia River and its tributary, the Umatilla River.

For the purpose of this study, water sources within approximately six (6) miles of the eastern boundary of the Depot and 10 miles of the southern and western boundaries were investigated. The northern boundary is the Columbia River. The ease and expense of obtaining pipeline rights-of-way and the lengths of the required water supply lines were considered in setting these parameters.







Water sources in Oregon are controlled and managed by the Oregon Water Resources Department. According to existing state law, permits to use water can be obtained either of two ways. The first is to procure water from existing sources that have valid, transferable water rights. The second is to obtain a new water right and develop a new source.

1. *Groundwater*

The potential for developing new groundwater sources in the area is limited. Almost all of the lands in the vicinity of the Depot lie within the boundaries of existing “Critical Groundwater Areas” as defined by the Oregon Water Resources Department (See Exhibit III-1). When an area is so designated, new wells cannot be developed and existing wells cannot be expanded. Existing water rights within a “Critical Groundwater Area” may be curtailed in order of their dates of priority, with the later wells being curtailed first.

The three major aquifers in the vicinity of the Depot have all been designated as “**Critical Groundwater Areas.**” They include the **Stage Gulch Critical Groundwater Area** that extends south and east of the Depot, the **Butter Creek Critical Groundwater Area** that extends to the south, southwest and east of the Depot, and the **Ordinance Critical Groundwater Area** that includes the Depot and extends in all direction from it. Both the Stage Gulch and Butter Creek areas include deep basaltic aquifers that, while characteris-

Legend:

-  Stage Gulch Area
-  Butter Creek Area
-  Ella Butte Area (classified use)
-  Ordnance Basalt Area
-  Ordnance Gravel Area
-  Boundary

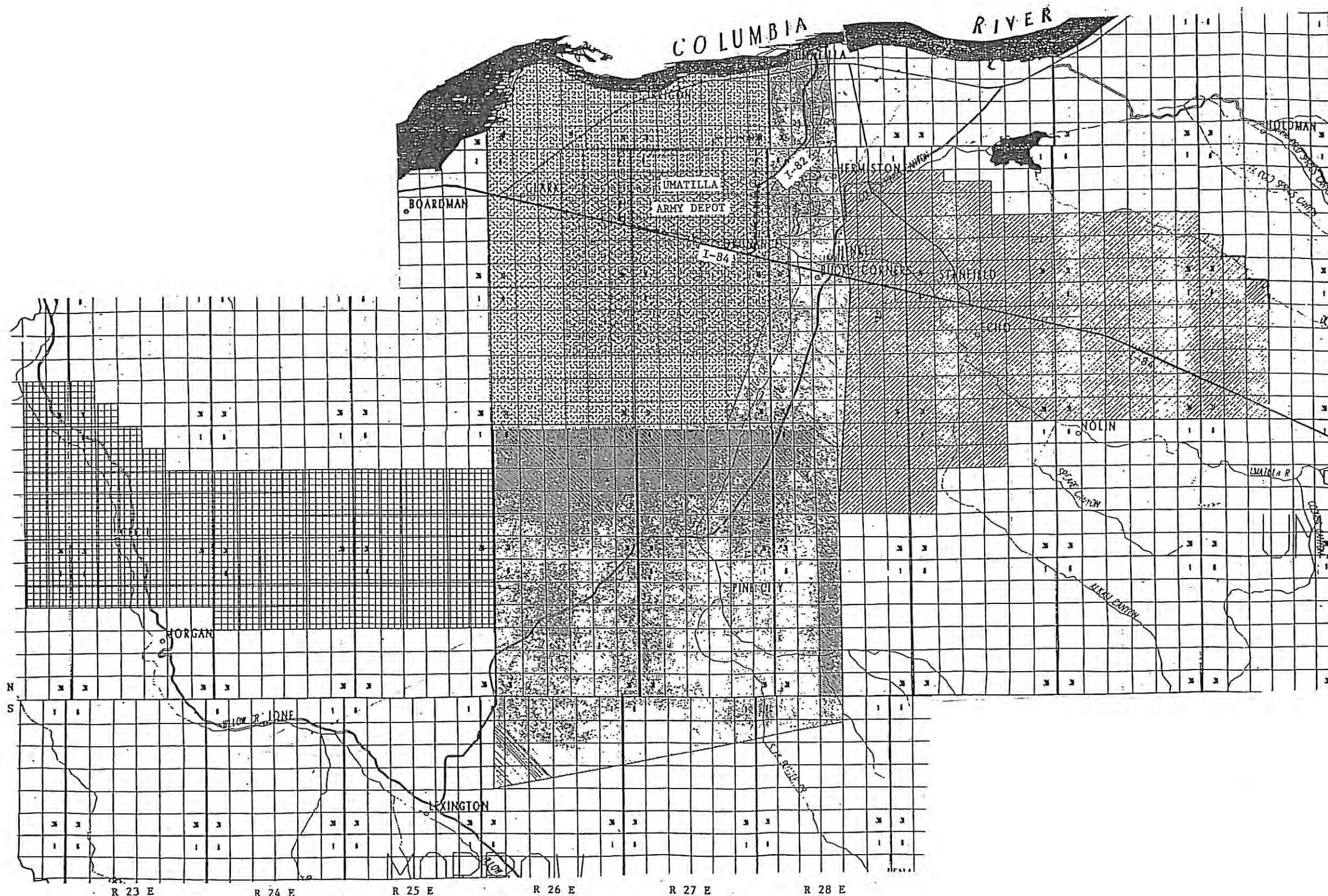


Exhibit III-1

Critical

Groundwater Areas

tically are high yielding sources with excellent water quality, have been declining for decades. The Ordnance Critical Groundwater Area includes both a shallow alluvium and the underlying deep basalts. The restrictions on the shallow alluvium do not extend north of the Depot boundary, but restrictions on the deep basaltic aquifer extend to the Columbia River.

There are areas overlying alluvial aquifers north of Hermiston and east of the Umatilla River and a larger area north and west of the Depot that are not included in Critical Groundwater Areas. These areas are probably hydraulically connected to the Columbia River and can be susceptible to fluctuations pool levels in the John Day Pool (Lake Umatilla) above the John Day Dam and/or the McNary Pool above McNary Dam. If mitigation of endangered anadromous fish requires lowering the John Day Pool to its minimum operating pool level, major disruptions of the yield of the adjacent alluvial aquifers will occur. As a result, they have limited potential as new sources of groundwater.

In summarizing the potential of existing groundwater sources, any single source which provided less than two (2) cfs was disregarded.

2. Surface Water

The two potential surface water sources in the area are the Columbia River and the Umatilla River.

Concerns relating to minimum flows required for fish protection in the Columbia River have caused the Oregon Water Resources Department to suspend the issuance of new permits for withdrawal above Bonneville Dam. As a result, it is unlikely that a new water permit will be issued from the Columbia River in the near future. There are, however, several existing permits that might be of use. Included are those held by the Port of Umatilla, the city of Boardman, the Hermiston Development Corporation (pending), the Port of Morrow (pending), and several large corporate farms.

The Umatilla River is used for irrigation by the Hermiston Irrigation District, the Westland Irrigation District, the Stanfield Irrigation District, and the West Extension Irrigation District. In addition, several smaller ditch companies and individual users rely on its waters. The Umatilla River has been over-allocated for many years. In order to provide in-stream users (principally the Confederated Tribes of the Umatilla) an amount of water in the river that will allow restoration of traditional anadromous fish runs, the Bureau of Reclamation recently completed a project that would replace one of the irrigation districts' withdrawals from the Umatilla River with Colum-

bia River water. A second phase is presently under construction that will replace an additional segment of irrigation withdrawals with Columbia River water. Since the Umatilla River is presently over-allocated and an effort is being made to restore fish runs in the river, it is not considered likely that any additional withdrawals will be allowed.

If surface water is to be used for potable water, it must be treated to a higher level than groundwater. Columbia River water is of moderately high quality. Umatilla River water can be turbid and contains elevated levels of agricultural chemicals and other pollutants. However, there are many users that do not require a potable water source. Examples are most food processing industries and power generation stations.

3. *Water Requirements*

The total volume of water required by potential users of the Depot site has not been projected as of this writing. However, considering the possible uses of the area, the following assumptions can be made:

- **Agricultural Users.** The requirement during the peak use period for a balanced agricultural crop rotation is approximately 6.5 gallons per minute (gpm) per acre. Assuming that a maximum of 10,000 acres of the Depot lands is irrigable, the peak demand for irrigation is estimated to be 65,000 gpm (145 cfs).

The quality of the water required for agriculture is not high. Either surface water from the Columbia or Umatilla Rivers or groundwater from any of the surrounding aquifers can be used with no additional treatment.

- **Industrial Users.** The range in the volumes and quality of water required for industrial purposes is great. As examples, a modern potato processing plant may require as much as 1,000 gallons per minute, but the quality of the water need not be potable. A manufacturer of electronic equipment, on the other hand, may employ the same number of people, but only require 100 gallons per minute or less. However, it may require potable water, or perhaps an even higher level of treatment. The effluent from most industrial users is suitable for agriculture. Thus, if five (5) food processors used a total of 5,000 gallons per minute during the peak use period, approximately 800 acres could be irrigated with the effluent.

- **Municipal Users.** It is assumed that any municipal users of waters within the Depot complex would be in the vicinity of the existing housing units. Examples of enterprises that might need municipal water are colleges and universities, prisons, and large office complexes. The volume required is approximately 100 gallons per day per capita. Thus, if a 10,000 person university were located at the site, approximately 700 gallons per minute would be required. The water would obviously have to be of potable water quality.

4. *Water Sources*

- **Groundwater.** Possible groundwater sources within the “critical” areas include transfer of the existing water rights held by several irrigated farms, the cities of Umatilla and Irrigon and the Depot. The city of Umatilla is operating at near its permitted level. The city of Irrigon does not have permits for a significant amount of water beyond its own needs. Almost all the existing water rights held by farms in the area are being utilized. However, it might be possible (and desirable) to use an existing agricultural right for industrial purposes and then utilize the effluent from the industrial use for agricultural purposes. It might also be possible to buy an existing water right, change its use from agricultural to industrial, and retire the land upon which it was utilized. This might be good for the community in the short term, but, by retiring the land from production, it could erode the economic base of the area. The Depot has about 10 cubic feet per second (4,500 gallons per minute) in groundwater permits. Industrial use of this water would require a new permit to allow a change in the type of use.

Groundwater users in “noncritical” areas include several irrigated farms, the Port of Morrow and the Irrigon and Umatilla Fish Hatcheries. The fish hatcheries are searching for additional sources for their own uses, so can be eliminated from consideration. According to Port of Morrow officials, its water is reserved for potential users in the vicinity of the Port’s industrial properties.

- **Surface Water.** Possible surface water sources include the Umatilla and Columbia Rivers.

On the Umatilla River, possible sources include four irrigation districts and several ditch companies and individual farms. However, the Umatilla River water is over-allocated. As part of the Umatilla Basin Project, the West Extension Irrigation District’s Umatilla River

water right will be pumped from the Columbia River in an exchange in order to make more water available in the Umatilla River for fish enhancement. A long-term goal of the Confederated Tribes of the Umatilla is to return native stock runs of salmon and steelhead to the Umatilla River. This will require water in the river year-round. Any attempt to change the type of use of existing water rights in the Umatilla River will almost certainly be contested and stands little likelihood of success.

The Columbia River appears to be the only available source of surface water in the region. Among present permit holders, the Port of Umatilla has an existing permit for municipal and industrial water use which has not yet been fully allocated. The city of Boardman has water rights in excess of current demands. There are over 465,000 gallons per minute (1,000 cfs) of existing water rights held by irrigated farms in the area. In addition, the Port of Morrow, Hermiston Development Corporation and the U.S. Army have applications pending for Columbia River water upon which the Oregon Water Resources Department has not acted.

Because of environmental concerns, any further appropriation of waters from the Columbia River are unlikely in the near future. No further permits will be considered by the Oregon Water Resources Department until the amount of instream flow needed for endangered species is determined.

5. *Conclusions*

Summaries of the existing and pending water permits for groundwater and surface waters are presented as Exhibit Nos. 2 and 3.

- The only new source of significant volumes of groundwater that may be developed is in the Columbia River alluviums along the shore of the John Day Pool. Since this source is thought to be hydraulically connected to the John Day Pool and is highly dependent upon the pool operating levels, there is a high probability that a reliable water source cannot be developed from this aquifer.
- There is almost no potential for developing a new source of groundwater in any of the basaltic aquifers surrounding the site, from the Ordinance alluvial aquifers, or from the Umatilla River.

Exhibit III - 2

Potential Surface Water Sources

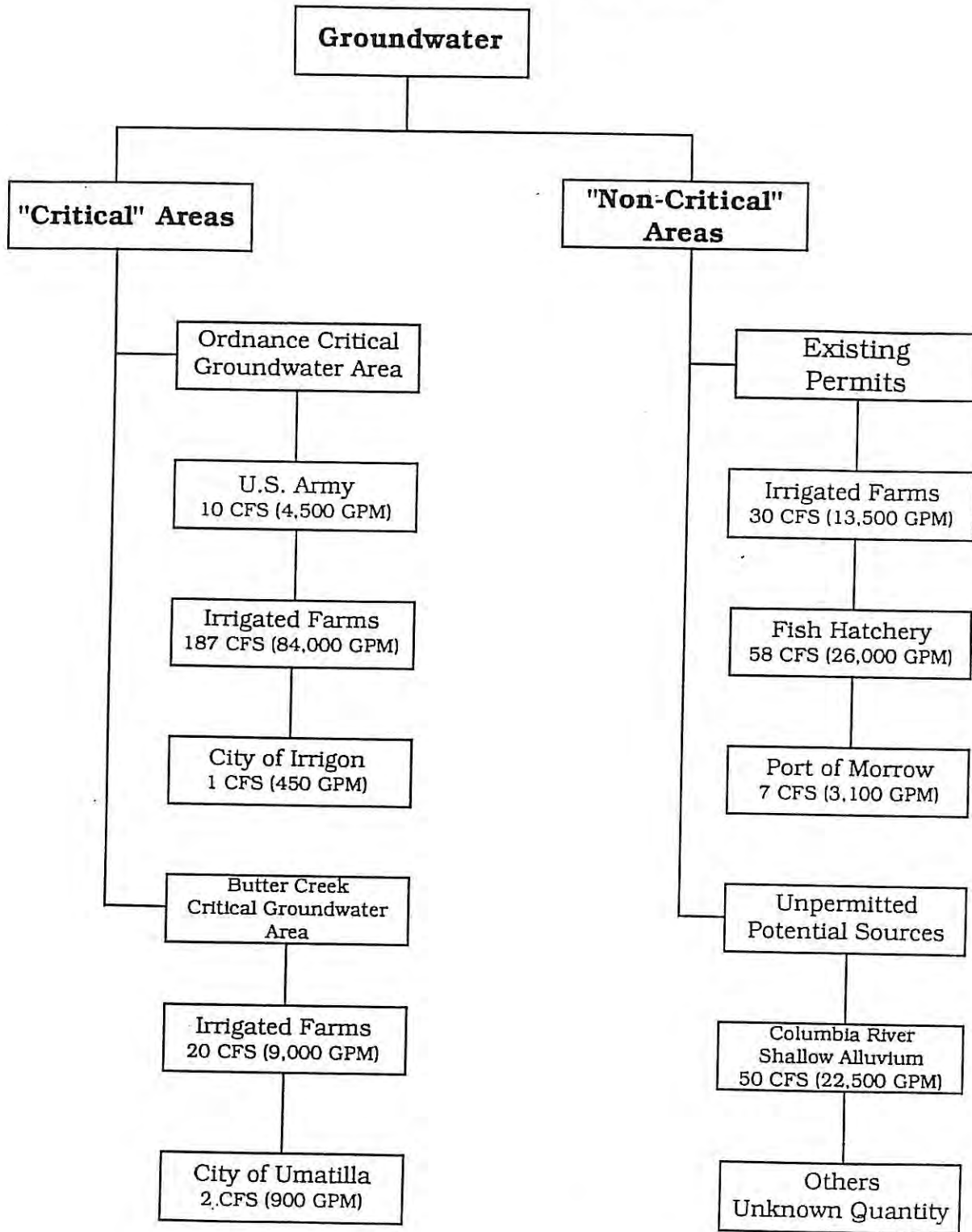
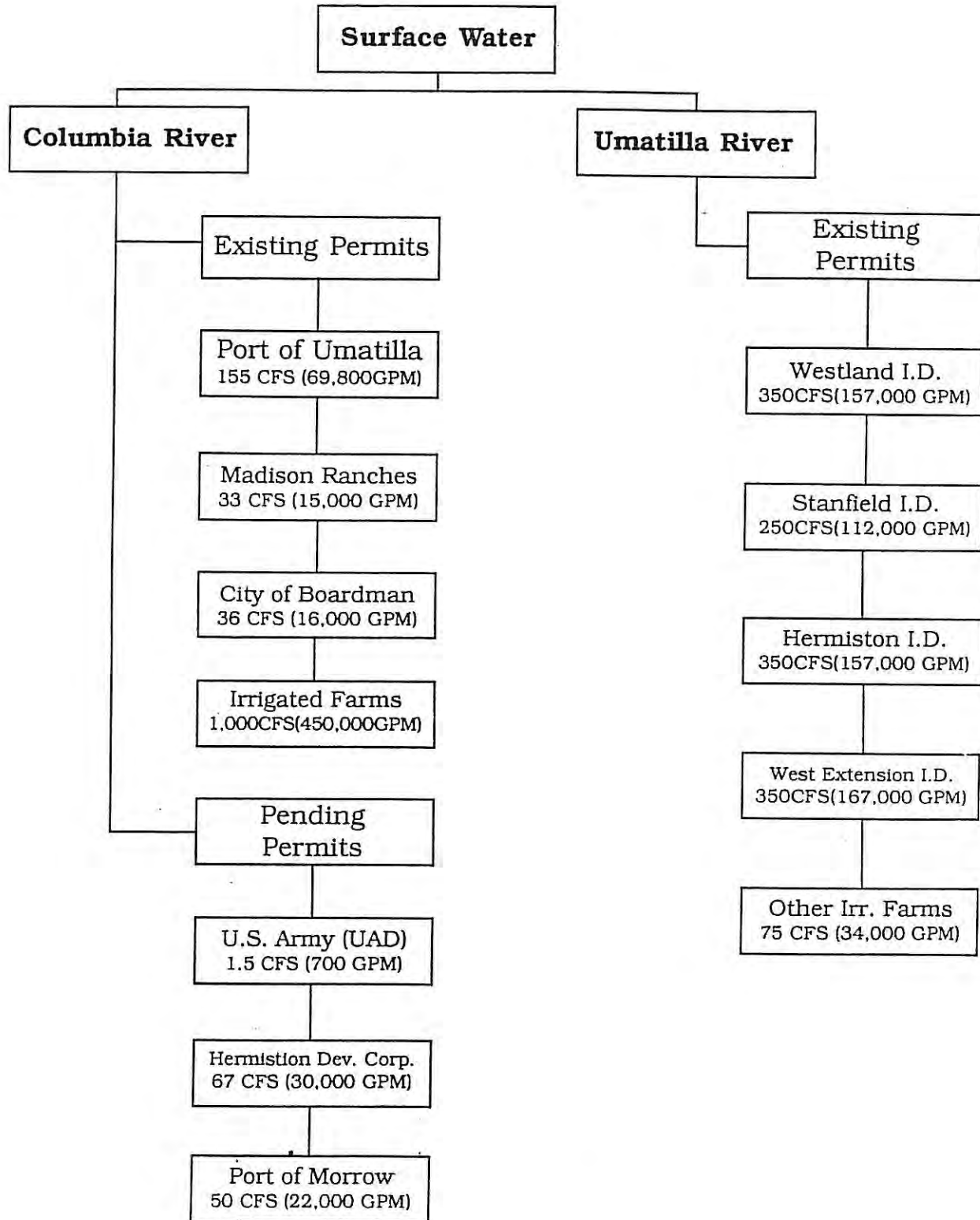


Exhibit III - 3

Potential Groundwater Sources



- For the large volumes of water required for most agricultural uses (including food processing) the only source remaining is the Columbia River. The most likely sources would be the permit applications pending from the Hermiston Development Corporation and/or the Port of Morrow. The Port of Morrow is located about 8 1/2 miles away, and has indicated that it has other users identified for its permit, should it be issued.
- For smaller volumes of water, the most likely source is the Ordnance basaltic aquifer. The Depot has permits for about 4,500 gallons per minute (10 cubic feet per second). If it can be proven that the water is not contaminated by activities (past or present) of the Depot, and that the aquifer will sustain the required level of pumpage, this is obviously the best source for volumes up to the maximum sustainable capacity of the existing wells, presuming that a change in type of use will be allowed by the Oregon Water Resources Department.
- If the existing Depot permits cannot be transferred, if the aquifer will not sustain the required pumpage, or if the aquifer proves to be unsuitable for use because of pollution, waters from the Regional Water Supply System proposed by the Port of Umatilla appear to be the best alternative. This permit excludes agricultural uses of the water. It is not probable that it can be modified to include them.

6. *Preliminary Recommendations*

- Determine the water quality, the maximum sustainable yield, and the possibility of obtaining permits for a change in type of use for the existing Depot wells.
- Determine the possibility of obtaining municipal and industrial water from the proposed Port of Umatilla Regional Water Supply system.
- Investigate the utilization of existing groundwater permits in the area by a change in type of use and a transfer of place use and point of appropriation. If it can be proven that the new place of use is in the same aquifer as the existing one and that the total amount of withdrawal from the aquifer is not increased, it is likely that the Oregon Water Resources Department will allow the transfer.
- Consider the Columbia River as the only source of large volumes of water for either agricultural or industrial users. The most likely

provider is the Hermiston Development Corporation (pending permit approval).

C. ENVIRONMENTAL HAZARDS AND CLEAN-UP PROGRAMS

At present, there are a number of programs under way to identify environmental hazards and the actions needed, if any, to clean up the site. This section presents an overview of the work that is under way.

1. *Disposal of Chemical Agents and Munitions*

A Draft Environmental Impact Statement (DEIS) for disposal of chemical agents and munitions at the Depot was issued in October 1991. The DEIS was specific to the Depot and was based upon implementing incineration technology being given verification tests at the Johnson Atoll Island facility in the Pacific Ocean. Preliminary plans for incinerator construction have been prepared and application has been made for a RCRA permit to construct and operate the incinerator.

If the incinerator is constructed at the Depot, bunker block K and about 60 acres adjoining it on the southeast will be unavailable for any redevelopment until the disposal is complete. This may last until the year 2002 or later. Opportunities to redevelop nearby lands will be affected by security controls to be in place at the disposal facility. "Marketability" of nearby redevelopment may be affected by perceptions of risk.

2. *Depot RI/FS*

- In 1987, the U.S. Environmental Protection Agency (EPA) placed the Depot in its National Priorities List (i.e., "Superfund" List), because of contamination at the former explosives washout lagoons. As a result, EPA and the Oregon Department of Environmental Quality (DEQ) are currently overseeing the completion of an RI/FS by the Army, under a three-party Interagency Agreement. Originally, 10 "operable units" or discrete study areas were identified. This number was later reduced to eight. Currently, Records of Decision (RODs) have been signed for three units and others are expected to be signed shortly. The RODs formally document the cleanup decisions agreed to by the parties. Compared to the size of the Depot, or one of the bunker blocks, most of the potentially contaminated sites within the operable units are relatively small in size—a few hundred square feet to a few acres. The notable exception is the Ammunitions Demolition area, approximately 1,750 acres along the west side of the Depot.

Redevelopment or use of these specific sites would not be possible until they were determined to be clean or until cleanup is complete. Reuse of nearby properties, however, would be possible when the base closure is implemented. For sites being cleaned, the standard is to restore areas to allow for unrestricted future use.

- Remedial Action: Explosive Washout Lagoons

In approximately the center of the Depot is the site of a former explosive washout facility. Two former lagoons (27 ft. by 80 ft., and 39 ft. by 80 ft.) were found to be contaminated with organic explosives and related compounds. In 1992, the Depot proposed cleaning up soil contamination by using on-site composting. Design of this remediation work is presently underway. The composting is estimated to require two years, after which the remediation objective would be met.

It is likely that some sort of long-term groundwater pump and treat system will be required for contaminated groundwater. The implication of a long-term pump and treat system, from a land use perspective, is that some sort of use restrictions will be applied in the immediate area of the treatment. If nothing else, there will be extraction wells, injection wells, monitoring wells, and some sort of above-ground water treatment system to be operated and maintained. Current estimates are that such a system would have to operate for a period of about 10 to 30 years, depending upon the specific cleanup level required and the technology used.

- Remedial Action: Deactivation Furnace

ROD has been signed for the former Deactivation Furnace Operable Unit located in the southwest portion of the site. This project is currently in remedial design. Remediation is expected to proceed more quickly than for the lagoon soils and should be completed within one year of commencement.

- Remedial Action: Ammunitions Demolition Area




For the 1,750 acre parcel along the Depot west boundary, actual remediation is not likely to be feasible. Within this area there is a possibility that unexploded munitions exist at unknown depths beneath the surface. The probable "remediation" of this area will be removal of any obvious debris from surface and then long-term land

use limitations to prohibit any use that involves excavations. Continued long-term use for military training is a most likely result.

3. *BRAC Studies*

In addition to cleanup initiated by hazardous waste sites around the depot, the BRAC (Base Realignment and Closure) program requires additional studies. Investigations have been made to survey for asbestos, radon, PCB-filled devices, and lead-based paints. Addressing these issues will be a part of base closure. They should not affect the future redevelopment potential of property. However, removal of an existing facility on the property may be a cost-effective means to address a problem. (See Exhibit III - 4)

Legend:

-  Areas of Contamination
-  Major Hazards
-  Minor Hazards



IV. SOCIO-ECONOMIC CHARACTERISTICS

A. POPULATION

Table IV - 1 shows the total population in Morrow County, Umatilla County, and Oregon in 1970, 1980, and 1990. Both Morrow County and Umatilla County experienced dramatic population growth, 68.4 percent and 31 percent respectively, between 1970 and 1980. Over the same decade, the total population of the state increased 2.9 percent, a substantially smaller percentage. During the 1980s the reverse situation occurred, the population of the state grew by 7.9 percent, while the population increased by 1.4 percent in Morrow County and .7 percent in Umatilla County.

Table IV - 1 also shows the age distribution of the population in 1970, 1980, and 1990. In the 1970s, a large portion of the population growth in Morrow County and Umatilla County occurred in three age groups: 0-4, 18-24, and 25-44. This growth reduced the median age of the two counties. In the following decade, while the 25-44 age group (the Baby Boomers) continued to increase, the population 24 years and younger decreased. By 1990, the median age of the population in both counties stabilized and was close to the median age of the population of the state, 34.5.

B. EMPLOYMENT

Table IV - 2 shows the distribution of total employment by industry in Morrow County and Umatilla County, compared with the state, for the years 1970, 1980, and 1990.

Employment in Morrow County is centered around agriculture. Over a span of twenty years, farms have continued to supply the county with the largest number of jobs. In 1990, despite a 5.6 percent decrease in farm employment between 1980 and 1990, one third of the county's total number of jobs were farm jobs. In that same year, farm jobs in the state of Oregon as a whole only accounted for 3.9 percent of total employment. In addition, the manufacturing industry in Morrow County, which consists mostly of food processing companies that use the area's agricultural products, has expanded over the years. In 1970, the manufacturing industry provided 11.5 percent of the total number of nonfarm jobs in the county, and by 1990 it had grown to be 31 percent of nonfarm employment.

Table IV-1
**Morrow County, Umatilla County, and Oregon,
 Population by Age Group, 1970, 1980, 1990**

Morrow County									
Age Group	1970	% of total	1980	% of total	1990	% of total	% Change 1970-1980	% Change 1980-1990	% Change 1970-1990
0-4	325	7.3%	677	9.0%	597	7.8%	108.3%	-11.8%	83.7%
5-17	1,242	27.8%	1,744	23.2%	1,715	22.5%	40.4%	-1.7%	38.1%
18-24	314	7.0%	828	11.0%	577	7.6%	163.7%	-30.3%	83.8%
25-44	972	21.8%	2,139	28.4%	2,283	29.9%	120.1%	6.7%	134.9%
45-54	503	11.3%	786	10.5%	805	10.6%	56.3%	2.4%	60.0%
55-64	539	12.1%	644	8.6%	753	9.9%	19.5%	16.9%	39.7%
65-74	329	7.4%	464	6.2%	502	6.6%	41.0%	8.2%	52.6%
75+	241	5.4%	237	3.2%	393	5.2%	-1.7%	65.8%	63.1%
Total	4,465	100.0%	7,519	100.0%	7,625	100.0%	68.4%	1.4%	70.8%
Median Age	32.7		28.9		33.6				
Umatilla County									
Age Group	1970	% of total	1980	% of total	1990	% of total	% Change 1970-1980	% Change 1980-1990	% Change 1970-1990
0-4	3,420	7.6%	5,105	8.7%	4,470	7.5%	49.3%	-12.4%	30.7%
5-17	11,695	26.0%	12,425	21.1%	12,036	20.3%	6.2%	-3.1%	2.9%
18-24	4,436	9.9%	6,984	11.9%	5,618	9.5%	57.4%	-19.6%	26.6%
25-44	9,830	21.9%	16,337	27.8%	18,046	30.5%	66.2%	10.5%	83.6%
45-54	5,601	12.5%	5,729	9.7%	5,904	10.0%	2.3%	3.1%	5.4%
55-64	4,801	10.7%	5,586	9.5%	4,964	8.4%	16.4%	-11.1%	3.4%
65-74	3,114	6.9%	4,125	7.0%	4,723	8.0%	32.5%	14.5%	51.7%
75+	2,026	4.5%	2,570	4.4%	3,488	5.9%	26.9%	35.7%	72.2%
Total	44,923	100.0%	58,861	100.0%	59,249	100.0%	31.0%	0.7%	31.9%
Median Age	30.9		29.6		33.2				
Oregon									
Age Group	1970	% of total	1980	% of total	1990	% of total	% Change 1970-1980	% Change 1980-1990	% Change 1970-1990
0-4	197,269	7.7%	198,046	7.5%	201,421	7.1%	0.4%	1.7%	2.1%
5-17	636,163	24.9%	525,011	19.9%	522,709	18.4%	-17.5%	-0.4%	-17.8%
18-24	304,064	11.9%	330,549	12.6%	267,528	9.4%	8.7%	-19.1%	-12.0%
25-44	585,523	22.9%	784,949	29.8%	926,395	32.6%	34.1%	18.0%	58.2%
45-54	282,306	11.0%	243,605	9.3%	296,595	10.4%	-13.7%	21.8%	5.1%
55-64	254,148	9.9%	247,609	9.4%	236,349	8.3%	-2.6%	-4.5%	-7.0%
65-74	182,761	7.1%	184,554	7.0%	224,438	7.9%	1.0%	21.6%	22.8%
75+	116,995	4.6%	118,782	4.5%	166,886	5.9%	1.5%	40.5%	42.6%
Total	2,559,229	100.0%	2,633,105	100.0%	2,842,321	100.0%	2.9%	7.9%	11.1%
Median Age	29		30.2		34.5				

Source: U.S. Census, 1970, 1980, 1990, and Economics Research Associates.

Table IV-2
Morrow County and Umatilla County
Distribution of Total Employment by Industry

Morrow County Industry	1970	% of		1980	% of		1990	% of		% Change 1970-1980	% Change 1980-1990	% Change 1970-1990
		total	Nonfarm		total	Nonfarm		total	Nonfarm			
Farm	966	41.3%		1,531	28.7%		1,446	33.2%		58.5%	-5.6%	49.7%
Nonfarm ²	1,371	58.7%		3,800	71.3%		2,912	66.8%		177.2%	-23.4%	112.4%
Agric./Forestry/Fishing and Other ³	40		2.9%	75		2.0%	119		4.1%	87.5%	58.7%	197.5%
Mining	0		0.0%	0		0.0%	0		0.0%	n/a	n/a	n/a
Construction	38		2.8%	890		23.4%	76		0.0%	2242.1%	-91.5%	100.0%
Manufacturing	158		11.5%	1,019		26.8%	902		31.0%	544.9%	-11.5%	470.9%
Trans./Public Utilities	(d)		0.0%	(d)		0.0%	228		7.8%	n/a	n/a	n/a
Wholesale Trade	(d)		0.0%	(d)		0.0%	77		2.6%	n/a	n/a	n/a
Retail Trade	293		21.4%	418		11.0%	309		10.6%	n/a	n/a	n/a
FIRE ⁴	73		5.3%	137		3.6%	122		4.2%	42.7%	-26.1%	5.5%
Services	207		15.1%	291		7.7%	303		10.4%	87.7%	-10.9%	67.1%
Gov. and Gov. Enterprises										40.6%	4.1%	46.4%
Federal, Civilian	39		2.8%	61		1.6%	94		3.2%	56.4%	54.1%	141.0%
Military	67		4.9%	66		1.7%	55		1.9%	-1.5%	-16.7%	-17.9%
State and Local	339		24.7%	478		12.6%	627		21.5%	41.0%	31.2%	85.0%
Total	2,337	100.0%		5,331	100.0%		4,358	100.0%		128.1%	-18.3%	86.5%

Umatilla County Industry	1970	% of		1980	% of		1990	% of		% Change 1970-1980	% Change 1980-1990	% Change 1970-1990
		total	Nonfarm		total	Nonfarm		total	Nonfarm			
Farm	3,107	15.6%		3,237	11.5%		3,217	10.8%		4.2%	-0.6%	3.5%
Nonfarm ²	16,857	84.4%		24,796	88.5%		26,665	89.2%		47.1%	7.5%	58.2%
Agric./Forestry/Fishing and Other ³	201		1.2%	368		1.5%	665		2.5%	83.1%	80.7%	230.8%
Mining	16		0.1%	36		0.1%	30		0.1%	125.0%	-16.7%	87.5%
Construction	665		3.9%	1,117		4.5%	1,113		4.2%	68.0%	-0.4%	67.4%
Manufacturing	2,973		17.6%	4,548		18.3%	6,862		25.7%	53.0%	50.9%	130.8%
Trans./Public Utilities	1,247		7.4%	1,672		6.7%	1,533		5.7%	34.1%	-8.3%	22.9%
Wholesale Trade	605		3.6%	1,303		5.3%	1,290		4.8%	115.4%	-1.0%	113.2%
Retail Trade	3,097		18.4%	4,844		19.5%	4,974		18.7%	56.4%	2.7%	60.6%
FIRE ⁴	734		4.4%	1,506		6.1%	1,206		4.5%	105.2%	-19.9%	64.3%
Services	3,021		17.9%	4,664		18.8%	5,782		21.7%	54.4%	24.0%	91.4%
Gov. and Gov. Enterprises												
Federal, Civilian	1,089		6.5%	891		3.6%	873		3.3%	-18.2%	-2.0%	-19.8%
Military	267		1.6%	260		1.0%	232		0.9%	-2.6%	-10.8%	-13.1%
State and Local	2942		17.5%	3787		15.3%	4105		15.4%	28.7%	8.4%	39.5%
Total	19,964	100.0%		28,033	100.0%		29,882	100.0%		40.4%	6.6%	49.7%

Oregon Industry	1970	% of		1980	% of		1990	% of		% Change 1970-1980	% Change 1980-1990	% Change 1970-1990
		total	Nonfarm		total	Nonfarm		total	Nonfarm			
Farm	51,576	5.7%		61,417	4.6%		62,921	3.9%		19.1%	2.4%	22.0%
Nonfarm ²	855,448	94.3%		1,271,420	95.4%		1,542,525	96.1%		48.6%	21.3%	80.3%
Agric./Forestry/Fishing and Other ³	8,527		1.0%	18,904		1.5%	29,389		1.9%	121.7%	55.5%	244.7%
Mining	1,687		0.2%	2,982		0.2%	2,120		0.1%	76.8%	-28.9%	25.7%
Construction	41,108		4.8%	67,632		5.3%	80,795		5.2%	64.5%	19.5%	96.5%
Manufacturing	178,862		20.9%	225,565		17.7%	234,100		15.2%	26.1%	3.8%	30.9%
Trans./Public Utilities	53,252		6.2%	67,345		5.3%	75,627		4.9%	26.5%	12.3%	42.0%
Wholesale Trade	46,002		5.4%	71,274		5.6%	82,450		5.3%	54.9%	15.7%	79.2%
Retail Trade	145,467		17.0%	227,553		17.9%	278,378		18.0%	56.4%	22.3%	91.4%
FIRE ⁴	54,088		6.3%	100,997		7.9%	112,063		7.3%	86.7%	11.0%	107.2%
Services	163,778		19.1%	274,154		21.6%	414,275		26.9%	67.4%	51.1%	152.9%
Gov. and Gov. Enterprises												
Federal, Civilian	25,515		3.0%	30,527		2.4%	34,192		2.2%	19.6%	12.0%	34.0%
Military	15,252		1.8%	13,929		1.1%	12,384		0.8%	-8.7%	-11.1%	-18.8%
State and Local	121,910		14.3%	170,558		13.4%	186,752		12.1%	39.9%	9.5%	53.2%
Total	907,024	100.0%		1,332,837	100.0%		1,605,446	100.0%		46.9%	20.5%	77.0%

Notes: 1 Includes full-time and part-time employees.
 2 Includes full time and part time jobs not included in individual totals due to disclosure issues.
 3 "Other" consists of the number of jobs held by U.S. residents employed by international organizations and foreign embassies and consulates in the U.S..
 4 Finance, Insurance, and Real Estate.
 (d) Not shown to avoid disclosure of confidential information
 Source: Bureau of Economic Analysis, U.S. Dept. of Commerce.

Total employment in Morrow County increased by over 128 percent between 1970 and 1980, and then decreased by 18.3 percent the following decade. A significant portion of this growth and reduction can be attributed to the coal fire electric generating plant, which was constructed in Morrow County, southeast of the city of Boardman, in the late 1970s and early 1980s. The county experienced an exceptionally large increase in construction jobs, which increased from 38 in 1970, to 890 in 1980. In 1990, long after the project had been completed, employment in the construction industry leveled out at 76 jobs. The county's net growth in employment between 1970 and 1990 can also be attributed to net growth in all industries except the military.

Umatilla County's distribution of employment resembles that of the state. In 1990, as a percentage of nonfarm employment, the four largest categories in both Umatilla County and Oregon were manufacturing, services, retail and state and local government. However, the manufacturing industry in Umatilla County was stronger than it was on the state level. In 1990, the manufacturing industry comprised 27.3 percent of nonfarm jobs in Umatilla County and 15.2 percent in Oregon.

Between 1970 and 1990, both Umatilla County and the state experienced a decade of substantial growth in total employment followed by a decade of smaller growth. The net result of the growth, was a 49.7 percent increase in total employment in Umatilla County between 1970 and 1990, and a 77 percent increase in the state over the same period. In Umatilla County, the nonfarm industries that experienced the most growth over the two decades were agriculture/ forestry/fishing and other (230.8%), manufacturing (130.8%), and wholesale trade (113.2%). During the same period, the nonfarm industries that experienced the most growth in the state of Oregon as a whole were agriculture/forestry/fishing/other (244.7%), services (152.9%), finance, insurance, and real estate (107.2%), and construction (96.5%).

Table IV - 3 illustrates labor force statistics for Morrow County, Umatilla County, and Oregon. Throughout the early and mid 1980s, with the exception of some small deviations, the labor force in the two counties remained significantly larger than employment. Consequently, the unemployment rate in the two counties combined grew rapidly, from 7.2 percent in 1980 to 12.1 percent in 1986. The completion of the coal electric generating plant construction project and the subsequent loss of construction jobs has been cited as one cause of the high unemployment rates in the 1980s. During the same period, the unemployment rate in the state peaked at 11.6 percent in 1982 and then decreased to 8.4 percent in 1990.

Table IV-3
Labor Force Statistics

	1980	1982	1984	1986	1988	1990	1992	% Change 80-82	% Change 82-84	% Change 84-86	% Change 86-88	% Change 88-90	% Change 90-92
Morrow County	5,790	5,200	4,380	4,050	3,590	3,500	3,260	-10.2%	-15.8%	-7.5%	-11.4%	-2.5%	-6.9%
Umatilla County	28,020	29,220	29,570	30,850	29,910	30,050	30,600	4.3%	1.2%	4.3%	-3.0%	0.5%	1.8%
Morrow-Umatilla Combined	33,810	34,420	33,950	34,900	33,500	33,550	33,860	1.8%	-1.4%	2.8%	-4.0%	0.1%	0.9%
Oregon	1,295,000	1,324,000	1,335,000	1,360,000	1,426,000	1,491,000	1,534,000	2.2%	0.8%	1.9%	4.9%	4.6%	2.9%

	1980	1982	1984	1986	1988	1990	1992	% Change 80-82	% Change 82-84	% Change 84-86	% Change 86-88	% Change 88-90	% Change 90-92
Morrow County	5,460	4,660	3,880	3,500	3,180	3,190	2,880	-14.7%	-16.7%	-9.8%	-9.1%	0.3%	-9.7%
Umatilla County	25,900	25,780	26,140	27,170	27,300	27,540	27,750	-0.5%	1.4%	3.9%	0.5%	0.9%	0.8%
Morrow-Umatilla Combined	31,360	30,440	30,020	30,670	30,480	30,730	30,630	-2.9%	-1.4%	2.2%	-0.6%	0.8%	-0.3%
Oregon	1,188,000	1,171,000	1,210,000	1,245,000	1,343,000	1,409,000	1,422,800	-1.4%	3.3%	2.9%	7.9%	4.9%	1.0%

Unemployment Rate

	1980	1982	1984	1986	1988	1990	1992	Change 80-82	Change 82-84	Change 84-86	Change 86-88	Change 88-90	Change 90-92
Morrow County	5.7%	10.4%	11.4%	13.6%	11.4%	8.9%	11.7%	4.7%	1.0%	2.2%	-2.2%	-2.5%	2.8%
Umatilla County	7.6%	11.8%	11.6%	11.9%	8.7%	8.4%	9.3%	4.2%	-0.2%	0.3%	-3.2%	-0.3%	0.9%
Morrow-Umatilla Combined	7.2%	11.6%	11.6%	12.1%	9.0%	8.4%	9.5%	4.4%	0.0%	0.5%	-3.1%	-0.6%	1.1%
Oregon	8.3%	11.6%	9.4%	8.5%	5.8%	5.5%	7.3%	3.3%	-2.2%	-0.9%	-2.7%	-0.3%	1.8%

Source: Oregon Department of Human Resources, Employment Division.

V. GENERAL MARKET ASSESSMENT FOR REUSE

Reuse of the Depot offers challenges from a number of perspectives. Communities which are closing military bases throughout the country are experiencing problems and pressures as this transition occurs. Ultimately, the plan in Umatilla must be tied to:

- market-driven demand;
- unique opportunities that are identified and pursued;
- cost constraints, particularly the cost of retrofit vis-a-vis potential income;
- existing legislation that controls transfer of surplus military land;
- local objectives;
- capacity of the surrounding community to market the land; and
- available financial incentives.

The process is complex. Our team's report will also highlight an issue which may be unique to Umatilla — the availability of water for agriculture or processing. As we conducted our research, we were told many times that given the uncertainty of a water supply for the base, we would ultimately need to define our reuse strategy under three scenarios: 1) water made available for whatever could be proposed; 2) limited water, perhaps through a revitalized well system; and 3) no additional water. It is our belief that the "no water" scenario will virtually close the door to future reuse of the Depot.

As we developed our socio-economic and community analysis, we took a liberal attitude toward reuse opportunities. A broad array of potential activities have been identified. Most could have market potential, assuming that other implementation elements are in place — as noted above.

A. LEADERSHIP INTERVIEWS

Community and business leaders in Umatilla and Morrow Counties were very interested in having input into charting the final use of the Depot. However, some felt the planning effort could be a little premature. Our response has been to point out two factors: first, since the 1988 list of closures was announced, few bases have completed the Record of Decision

concerning the transfer of property — it is a slow, bureaucratic process; and second we believe there are opportunities for interim joint land uses on the base, assuming some logistic/legal elements can be resolved.

We conducted interviews in the community and at the state level for a week, as well as follow-ups with a number of others: data sources, area businesses, and economic development entities. Our staff sought to get a thorough understanding of the issues which will be faced in the transfer/conversion process. Our questions were open ended, allowing for considerable discussion. They included:

1. What are the issues concerning the transfer of the Depot to civilian or other use?
2. What are the assets of the area to facilitate a new use?
3. What liabilities/constraints exist which will impact an alternative use?
4. What needs to be done?
5. How should the long-term management scenario look?

We also discussed some of their ideas about reuse. We received the following input.

B. ISSUES

From our interviews, we learned the following. The Depot has gone through an economic base transition, largely during the 1970s and 1980s decades. As the Columbia River was tapped for circle type irrigation, the area which before was largely a desert became fertile for certain types of crops. Assuming a relatively stable water supply, the future of the area will continue to be linked to the agricultural niche it has successfully carved out, combined with agricultural processing. The tumultuous economy during the 80s has created some longer-term growth challenges for the region. Many believe that there lingers past perceptions of the two-county area as a boom-bust type economy, which is not close to the truth today. However, the economy and thus the reuse opportunities will depend (somewhat) on diffusing these perceptions. In the meantime, leaders see the area as continuing to exist in the shadow of the Tri-cities, which have captured much of the retail and office base for the region.

In the immediate term, the base closure has been tainted with the plans to incinerate waste products from the base. Some of the Hermiston residents have concern about whether this is environmentally safe. Technicians indicate there is no real threat, and clearly this military residue must be disposed of before serious reuse activity can begin.

Many we interviewed saw potential conflicts in allocating the base resources - particularly as the land falls into two counties. For this reason, the consultants' team was directed to look at the "big picture", that is a plan that looks at how the reused base would function under a total planned concept. This concern is based on the fear that early "cherry picking" will take the better real estate assets and limit long-term options.

Finally, the importance of water was reiterated throughout the interviews. Without its availability, the potential to capture opportunities at the base was seen as essentially nonexistent. The on-base wells have limited supply, in addition to the fact that extensive nitrate pollution has been found in them during recent tests. If this issue is not resolved, many people are concerned that the reuse potential of the base will be a lost opportunity.

C. AREA ASSETS

Any major redevelopment project must account for the strengths and weaknesses of the local economic base and community. Always on projects of this type, we ask local leaders to identify what assets we can build from. The input we received in the two-county area was surprisingly realistic. Respondents identified not only some of the assets on the base itself, but also such factors as location and the growth of local business.

The existing reusable resources on the base included:

- Industrial buildings;
- On-site rail facilities that include an overhead crane;
- A small landing field which is still viewed as usable; and
- A highway/road providing direct access to the port docks.

Interestingly, the Army's administrative area with related building was not viewed as a major asset.

The Depot location was also viewed as a key positive factor in evaluating reuse potential. Given the fact that it is at the intersection of two interstates, many believe this provides the property with excellent access to the Northwest region of the county. In addition, the rail lines make other areas of the county and broader region accessible, as does the port which has a water link to major markets. As the base evolves to another use, the availability and low cost of electricity are expected to be a business promotion tool, linked in part to the planned co-generation plant.

Finally, some of the more generic characteristics of the area are viewed as favorable to reuse. For example, the successful agricultural businesses have been leveraged into growing food processing operations. This latter element, the value added aspect of agriculture, contributes to the health of the regional economy. In addition, smaller, but solid, machine shop businesses also seem to reflect a potential for future growth and expansion.

With the conceptualization of the program and celebration of the anniversary of the Oregon Trail, many expect tourism to grow. The Umatilla Indian economic development programs have begun to implement strategies to capitalize on this — hotels/resort, golf, gaming and interpretive activities. By combining this with Eastern Oregon's moderate climate, many of those interviewed see tourism as a having growth potential for the area. In contrast, however, there was not a good deal of potential for the Depot. Overall, most of the leaders in the two-county area view it as being well-positioned to capture new growth in the upcoming years. The Depot is one element which can be used to leverage and capture that growth.

D. AREA CONSTRAINTS

There are a number of factors both on and off the base which will constrain or inhibit its reuse. Here, in contrast, most of the problems identified were those specific to the physical characteristics of the base itself.

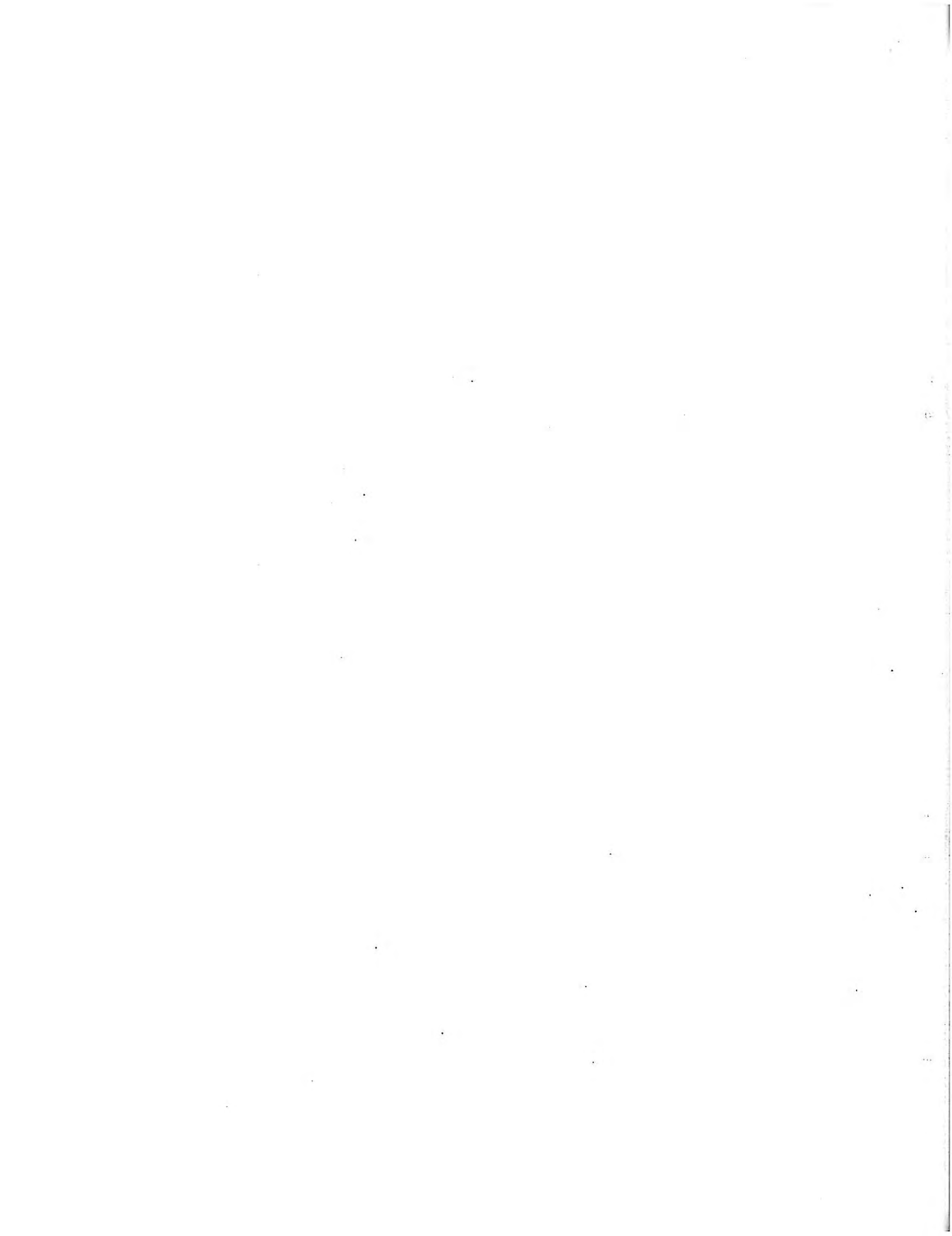
Perhaps the issue of most concern is the left-over war munitions that are believed to be on the Depot. The problem with (half-formula) nerve gas is known. There is concern that other unexploded ordinance exists in addition to these chemicals. While these contaminants exist, some people pointed out that the base soils are of poor quality. There was an inference that agricultural use might be questionable.

Much of the base structure and infrastructure are 40 to 50 years old. This brings issues of maintenance and adequacy for current day activities. The buildings, which have asbestos will require updating. Additionally, the

infrastructure is known to have problems with sanitary sewer, roads, and electrical systems. A main concern is whether the cost of rehabilitation will be justified by the price the market will pay for the space — or will a subsidy be needed?

In the mid-term, there are likely to be options for joint private-military use. However, current military leases are negotiated with a 30-day termination clause in case of national security need. Thus, there will be a real challenge in trying to find a stable, long-term tenant which would be willing to sign under these circumstances.

Finally, most of our interviewees are well aware that the reuse of such a large piece of land will take many years to bring about. In fact, it is entirely possible that the base may never be used in its entirety. For this reason there is concern about the cost of maintaining the property, especially if this burden falls on the state or local governments. Once the Army has left, there may be little in reusable condition until the clean up is complete. The question that people asked is: “Do we really have an asset with the Depot?”



VI. AGRICULTURAL ASSESSMENT FOR REUSE

The Depot is located in a predominately agricultural setting. The regional economy in this portion of Morrow and Umatilla counties depends heavily upon irrigated crop production and processing. Residents of these two counties combined rely upon the direct agricultural production and processing for roughly 22 percent of total covered employment, 21 percent of total covered payroll, and 13 percent of total earnings from all sources, excluding the indirect and induced impacts of this direct economic impact on other business activity in the region. (Oregon Employment Division; Bureau of Economic Analysis). This compares to a Oregon statewide dependence on agriculture of 3 to 4 percent for employment and total payroll. The dependence is most dramatic in Morrow county, where direct agricultural production and processing activities account for 38 percent of total employment, and 51 percent of private sector employment.

The expansion of irrigated crop production along the Columbia River in Eastern Oregon and Washington during the past twenty-five years has developed an otherwise arid, rangeland environment into an important agribusiness center of the region that includes production, processing, and supporting services. At present irrigated crop farms surround the Depot on all sides, and large scale food processing plants are located in adjacent communities. The pivotal high-value crop in the immediate area is potatoes, grown primarily for processing in local plants, and secondarily for fresh pack sales. Agronomic considerations are such that potatoes are grown in "rotations" with legumes (alfalfa), grains, and other crops in order to sustain product yields and quality over time. Recent diversification of production beyond traditional potato/alfalfa/grain rotations has expanded growing and processing opportunities in other high value vegetables such as green peas, sweet corn, onions, and carrots, as well as alternative field crops such as popcorn and grass seed.

Given the importance of agriculture and related business activity in this area, it is logical to consider agricultural uses of the Depot as candidates for future development of the Depot. There are several complicating features, however, that question future agricultural uses of the Depot. Paramount in this regard is the real or imagined threat of contamination, health risk, and incompatible facilities tied to the unique role of the base as a military chemical and ammunition Depot. Ultimate uses of the land or facilities will depend upon as yet undetermined conditions of the base if and when the Depot is demilitarized. Simplifying assumptions are necessary to assess even the most basic development alternative. Second, the continued success and

growth of the agricultural economy in the immediate area is tied directly to the availability of water for irrigation and/or processing. Depleted natural groundwater aquifers and competing demands for surface water place limits on irrigation-based agricultural development. Third, agricultural development represent only one of many use possibilities. Expansion of agricultural production or processing is dependent upon market conditions and firm level competitiveness of prospective business ventures. Technical feasibility does not guarantee economic success. Regulation, planning objectives, and economic conditions will exert varying influences on ultimate base development activity from among the alternatives possible.

A. ASSESSMENT OF DEPOT RESOURCES AND FACILITIES

From the perspective of agricultural development, this assessment of resources is organized into three main categories; land, water, and facilities. Information and statistics concerning these variables were obtained from documents submitted by base officials (Real Property Utilization Survey, April 1992; Master Plan), and personal interview with Mr. Michael Sweet, Depot Civilian Executive Assistant. This assessment is geared towards development potentials that cover basic crop and livestock production, processing or manufacturing of agricultural products, and related agricultural services.

1. Land Resources

The Depot covers 19,729 contiguous acres, 17,055 acres owned by the Army, and 2,674 acres of restrictive easements on farmland immediately bordering the base along the northern and portions of the eastern perimeter.¹ The restrictive easements are privately owned lands with easements acquired to accommodate safety zones designated by the Army where such safety zones extend beyond the base property lines. Landowners cannot reside on these designated properties as terms of the easement restrictions, although it appears that some farming activities may be taking place on the restricted easements. For purposes of this assessment, it is presumed that the restrictive easement acreage would revert to uses determined by the private owners in the event of demilitarization. Base records do not indicate the presence of any contamination or hazardous materials that might otherwise limit future development potential by private owners on the restrictive easements.

The 17,058 acres owned by the Army is separated into 18 land use areas as designated by the Army to carry out the Depot mission [Real Property Survey, p.17-20]. For purposes of assessing agricultural use potential, these land use areas can be segregated into five general categories: 1) ammunition

storage; 2) ammunition maintenance and open storage; 3) administration; 4) buffer zones; and 5) warehouse and storage.

The first and largest category includes 6,925 acres designated as ammunition and chemical storage areas characterized by the "bunker" or magazine structures. The ammunition and chemical storage areas comprise 41 percent of the Depot land area. Natural soil structures in the bunker storage areas appear to have been modified in the construction of these facilities. Also, the irregular surface topography presented by the bunkers themselves may preclude conventional sprinkler irrigation and cultivation practices, or require extensive modification of existing landforms.

The second land use category consists of 3,935 acres (23 percent of total base property), of generally open areas including uncovered storage areas, ammunition maintenance areas, demolition areas, and test firing areas. These lands are less developed, but contain numerous mission-specific facilities such as demolition pits, firing ranges, grid road networks and various buildings, as well as numerous contamination areas.

The third general category includes the small acreage containing administrative, maintenance, service, landfills, and other miscellaneous activities. Combined, these areas comprise 698 acres of developed property (4 percent of total base property).

Of specific interest to the agricultural use potential are those acres that might be readily converted to irrigated crop production. The three land use categories described above account for 11,558 acres, (67 percent of the total Depot area), and contain a variety of facilities and uses that appear contradictory to simple conversion to agricultural use, especially crop production. Such concerns include the existence of specialized buildings (magazines and bunkers), possible contamination sites, intensive road grids, and military administrative facilities.

In the case of these first three general land use categories, there are apparent obstacles that stand in the way of ready conversion to land use for conventional farm practices or food production. This need not exclude all other uses, particularly innovative or nontraditional applications such as waste disposal, wildlife habitat, grazing, or the production of nonfood alternative crops. Such possibilities will be explored later in this analysis. Two other land use categories exist on the Depot that appear more conducive to conventional agricultural use. These are the "buffer" zones surrounding the ammunition storage areas, and the warehouse and storage areas in the southwest corner of the Depot.

The buffer zones are intended to provide safety distances around designated ammunition storage sites, and are treated as largely undeveloped open spaces, according to base records. Four general tracts serve as buffer zones: 1) approximately 1,000 acres in a strip along the length of the eastern base boundary (inside the restricted easement); 2) approximately 650 acres in a strip along the northeast corner of the base (inside the restricted easement); 3) approximately 800 acres along the southern boundary just west of the administrative area; and 4) approximately 700 acres in diagonal strip following Coyote Coulee that separates the two main ammunition storage areas. These four buffer zones, so identified with acreage estimated from the Depot map, sum to roughly 3,150 acres. Base records report aggregate buffer zone area to be 4,851 acres. The apparent discrepancy between the buffer zones identified on the Depot map, versus the reported acreage, may arise from the classification of additional buffer zones within the ammunition storage areas. That is, significant open areas exist around the bunker/magazine grids within the ammunition storage areas.

The three buffer zone areas around the perimeter of the Depot comprising approximately 2,500 acres appear to have potential for cropland development. The 700 acre buffer zone along Coyote Coulee is less promising, due to the steeper slopes (5 to 20%), although some portion of this 700 acres may be suitable for intensive crop production.

In addition to the buffer zones, some of the undeveloped acreage in the ammunition maintenance and open storage areas may prove suitable for irrigated crop production. At present, the road grids, structures, and listed contamination sites appear as potential obstacles to immediate agricultural use within these areas, but such concerns may be resolved if and when the base is demilitarized. Combined, these two management use areas contain approximately 1,600 acres. Allowing for existing structures and contamination sites, perhaps 1,500 acres may be suitable for intensive crop production from these two areas. Doubtless there are numerous other small acreage tracts throughout the Depot in addition to these recognizable open areas that may offer agricultural production potential.

The last general land use category considered here is the warehouse supply and storage tract located on the southwest corner of the Depot. This acreage is of interest primarily because of the potential for agricultural processing, services, storage, or transshipment. In this regard, the facilities and improvements discussed later will provide a more thorough assessment of available resources. Apart from the warehouse facilities, an approximate 100 acre tract in southwestern most corner of this tract is largely undeveloped, and may offer crop production potential.

The foregoing inventory of land resources indicates that although the majority of the Depot lands are utilized in mission-specific roles, some of which preclude ready conversion to agricultural use due to possible contamination or existing facilities. There are, however, significant tracts of undeveloped, apparently uncontaminated acreage that may be suitable for crop production, assuming production practices, irrigation, and access can be readily extended from adjacent farmland. Approximately 2,500 acres of buffer zones in tracts around the perimeter of the Depot represent the most likely areas for conversion to irrigated agricultural crop production. In addition, another 1,500 acres in the ammunition maintenance and open storage areas may be adapted to crop production with minor modifications. Other designated buffer zones, as well as smaller, undeveloped tracts within ammunition storage areas, or administrative areas offer perhaps another 1,000 to 2,000 of potential, but less certain adaptation to intensive cultivation.

Apart from crop production potential, land resources on the Depot may also be considered for less intensive livestock grazing, or the production of nontraditional crops. While livestock grazing may take advantage of tracts infeasible for crop production, such as areas with steep slopes, or the ammunition storage areas, concerns over contamination, or animal safety bear further analysis. At a minimum, those acres feasible for crop production would provide grazing opportunities, although the productivity of such land is very limited in terms of forage production potential in natural state. To the extent immediate hazards to livestock such as cattle are resolved as a part of demilitarization, virtually all of the undeveloped base acreage provides grazing potential. Nontraditional crop production, such as cottonwood trees for woodpulp, represent another class of agricultural land use activities that may be capable of employing acreage otherwise unsuitable for intensively cultivated crops such as potatoes. Acreage of questionable use in irrigated crop production may also be suitable for other agricultural land use potentials, such as feedlots, bulk storage, or settling ponds for agricultural processing waste water.

According to Depot records, there are no past or present agricultural outleases on base property. This is due to incompatibility of commercial agricultural uses with the mission and safety considerations of the Depot, rather than any inherent natural barriers to agricultural use. Some limited evidence of agrarian, nonmilitary use of particular land tracts exists on the base. There is developed ornamental horticulture in the landscaping around the Depot administrative facilities, and a herd of introduced pronghorn antelope lives in the buffer zones within the base's perimeter fences. Beyond this minor activity, the acreage contained within the Depot boundaries

is conspicuously void of agricultural activity, particularly in comparison to farmland immediately adjacent to the base on all sides.

Soil forms on the Depot are primarily glacial flood-deposits reworked extensively by wind action. Soil structures are loamy fine sands, sands, and gravel. The terrain is gently rolling hills dissected by low terraces, sand dunes, and blowouts caused by wind erosion. A natural coulee bisects a portion of the property from south to north behind the administrative headquarters to the northeast corner of the base.

2. *Water Resources*

The development of high value agricultural commodities in the Morrow/Umatilla County area surrounding the Depot has been dependent upon ample supplies of water. This region is relatively arid, receiving less than ten inches of rainfall naturally in a year. The production of important crops such as potatoes requires as much as 30 inches of water (2.5 acre feet) during the critical May - September growing season. Thus, successful cultivation of these crops relies upon irrigation water supplied either from wells or diversion of surface water.

Available water resources on the Depot include natural rainfall and associated runoff (reported annual precipitation is 8.11 inches), and 7 deep basalt wells located on the property. Three elevated tanks provide a combined 370,000 gallons of storage capacity, in addition to a 1 million gallon ground level reservoir.

Depot records indicate that the combined rated capacity of the seven wells currently functioning on the base is 4,500 gpm; tested capacity is 3,525 gpm. Based on actual use reported during the summer of 1980, these wells operate significantly below capacity. Moreover, a falling water table, and well construction problems may impair the capability of the Depot wells to sustain output at rated or tested capacities. A preliminary review of water rights filed on these wells with the Oregon Water Resources Department (OWRD) indicates that at least six of the seven wells have perfected rights, although the volume of the transferable right will likely require an interpretation of past beneficial use on the Depot. For example, fire protection use may transfer at a different rate than crop irrigation use [Ladd].

Based on this information, it appears that a maximum of perhaps 4,500 gpm from existing Depot wells may be available for beneficial use on the Depot. Assuming that all of this were available for transfer to subsequent users, these wells would be capable of irrigating a maximum of roughly 450 to 675

acres of cropland in a potato/alfalfa/grain rotation. This estimate assumes a limit of 16 hours per day, seven day per week pump operation for the lower range, and 24-hr/day operation for the higher range. In either case, irrigation requirements are assumed to be 2.5 acre feet (814,625 gallons) per acre over a representative 90 day growing season. To the extent the Depot wells were dedicated to other higher value uses, or the perfected transferable right reduced, the irrigable acreage potential would be reduced, accordingly. For example, based on representative processing plant water requirements of around 800 gpm per plant, if Depot wells were used to supply 2 plants (1,600 gpm required), only 300 to 450 acres could be irrigated from remaining capacity of the Depot wells.

Beyond the Depot boundaries, water appears to be available through transfers from other sites in the area, although long-term water availability and usage are a highly controversial and uncertain issue in this region. The groundwater aquifer system in this area has been designated as a critical water area by the state of Oregon, resulting in a moratorium against future drilling of any new wells. Moreover, diversion of additional surface waters from the Columbia River has undergone severe restrictions pending the recovery plan mandated by listing certain Columbia River salmon stocks under the Federal Endangered Species Act.

Despite ominous predictions of future restrictions on water availability, neighboring municipalities, Port districts, and private interests have water rights that appear transferable to the Depot site. Interviews with various organizations indicate that water is available for development purposes, and that water is not an absolutely binding consideration for viable economic development alternatives on the Depot [Burns; Grow; Niel].

3. Buildings and Facilities

The structures and utilities listed in the Depot Real Property Utilization Survey document the existence of many different facilities, many of which have mission-specific roles on the base. Of the roughly 1,900 buildings inventoried on Depot records, the most prevalent features on the Depot—the 1,001 ammunition storage bunkers—are designed for a singular military purpose, the nature of which has no immediate counterpart in agriculture. Similarly, the 100 air raid shelters spread throughout the bunker storage area were designed for a unique purpose that may require imaginative application or reconfiguration in order to adapt to a productive agricultural use. As an example, controlled environment storage analogous to chemical or ammunition storage on the Depot is also important in many agricultural applications, but on a scale much different than that represented by the representative

bunker. Agricultural crop storage and production typically capitalize on economies of scale that encourage a few large facilities, whereas the ammunition storage bunkers represent many small facilities. Adopting agricultural production or processing purely to utilize the specialized bunker structures on the Depot may lead to cost inefficiencies, compared to commercial alternatives available elsewhere.

In contrast, the 50 to 60 warehouse and storage facilities located around the administrative area and the southwestern corner of the Depot represent more generic use possibilities across a range of production, processing, and agribusiness activities. While the large warehouse buildings offer many general possibilities, these facilities likely do not have many of the attributes that would be required for specialized food processing, such as waste water treatment or refrigeration.

Approximately 60 additional buildings are listed as shops, repair facilities, and utility facilities spread throughout the Depot. These structures are likely to be compatible with agricultural production or processing operations, or may support certain specialized uses, such as construction or repair in the agricultural service industries. An additional 30 to 40 buildings may be categorized as administrative facilities such as living quarters and office space. Thirteen buildings on the Depot are proposed for demolition, none of which appear to represent significant agricultural use potential.

There is an extensive road system on the Depot, comprised of approximately 192 miles within the boundaries. Approximately 165 miles consist of hard-surfaced paved roads, and approximately 27 miles of gravel surfaced roads. Much of the road system is in grids providing access to the bunker storage areas, and to a lesser extent, the open storage area. These roads pose obvious obstacles to intensive cropland development, as do the bunker structures themselves. Given the mission and security concerns of the Depot, access is currently restricted to the main entry on the southern end of the base off of Interstate Highway 84. More convenient access to other sections of the Depot may be necessary to facilitate efficient agricultural development, and may require the construction of entrance roads through adjacent farmland.

B. AGRICULTURAL USE POTENTIALS

1. Irrigated Crop Production

The resource inventory and assessment indicates that significant acreage may be available upon demilitarization for conversion to agricultural production. Pending a reassessment if and when the base is demilitarized, from 2,450 up

to possibly 6,000 acres of the Depot has potential for crop production.² Given the cautions and uncertainties noted in the assessment of land suitability, it seems prudent to focus on the more conservative estimate (approximately 2,500 acres) of cropland acreage that might be readily available for irrigated crop production.

The most likely areas for conversion to agricultural production are the buffer zones along the perimeters of the Depot. Along the eastern and northern boundaries, crop production may be expanded relatively easily into the buffer zones from existing cultivated acreage, thus reducing the need for supporting infrastructure. The buffer zone on the southern border between the Depot and Interstate 84 maybe have less convenient access for area farmers. Water transfer for irrigation to the perimeter buffer acreage may also be extended from adjacent farms.

Based on established cropping practices in this area, production potential favors high valued commodities such as potatoes, and accompanying rotation crops such as alfalfa hay, and grains (wheat and corn), as well as other vegetables (green peas, carrots, and onions) and specialty crops such as popcorn, melons, and grass seed.

Enterprise budgets developed by the Oregon State University Extension Service indicate that the high valued potato and vegetable crops generate the greatest net return, while rotation crops such as alfalfa and grains may fail to cover total costs [OSU Extension Service]. Although financially less attractive, rotation crops are necessary to consistently produce high quality, high valued potatoes. A representative farm operation might allocate 60 percent of the acreage to alfalfa (a three year crop), 20 percent to potatoes (an annual crop), and 20 percent to grains (an annual crop). This results in a 5 year rotation as a given tract shifts from potatoes in year one, to grains in year two, then to alfalfa for three years, and then back to potatoes. Astute farm managers adjust this rotation in response to alternative crop possibilities, market conditions, production potentials, and other considerations.

Given the above assumptions, costs and revenues weighted for all three crops in the rotation (potatoes, alfalfa, and wheat) amount to approximately \$102 per acre net return in current dollars over all costs, including establishment costs and returns to fixed assets and management. Returns to land in this case are calculated at a fair market land lease charge of \$150/acre. The net return reflects profits of \$868 per acre on potatoes, balanced with losses of \$103/acre on alfalfa, and \$30/acre on wheat. The estimated net return of \$100 annually per acre in a 5 year crop rotation represents a benchmark

opportunity cost for other potential agricultural and nonagricultural uses of this acreage.

As a further inducement to irrigated potato production on suitable Depot acreage, past experience in this region has demonstrated that superior potato yields and quality are possible from soils that have not been farmed previously. Any such incentives or premiums would enhance net returns to the grower in the short term over the \$102/acre 5-year rotation average estimate as derived above. Applying the \$102/acre return reference as an arithmetic, rather than proven market or agronomic potential, developing the all 2,500 Depot acres tentatively identified as possible crop land would generate \$2.2 million in annual gross revenues, and just over \$250,000 annually in producer profits.

The potential irrigated crop acreage in the buffer zones (2,500 acres) is significantly greater than the estimated maximum available water resources developed on the Depot. Allocating the full capacity output from all seven of the Depot wells would irrigate only 450 to 675 acres under ideal conditions, leaving no water available during the irrigation season for alternative demands. This need not limit irrigated crop production on the base if irrigation demand is sufficient to divert water from other uses in the area. Water may be transferred from place of use, but not point of diversion. Thus, growers or other interested parties with ground or surface water rights and the means of delivering the water to the Depot may develop crop acreage beyond that sustainable by base irrigation capacity. Such transfers would imply that the value of the water transferred to the Depot would result in a higher return than the water's next best alternative use. If irrigable crop land is the limiting factor, water likely will be transferred to the Depot to produce additional commodities. Alternatively, if water is the limiting resource, then the inherent productivity of the Depot lands compared to other acreage in the area will determine water transfers.

Market conditions for the affected agricultural commodities will also influence the magnitude and mix of future crop production on the Depot. Total annual potato acreage in the Morrow/Umatilla two country area is approximately 28,000 acres. Assuming a rotation that establishes 20 percent of additional irrigated crop acreage in long-term potato production, developing 2,500 acres would add 500 acres to local production; an increase of less than 2 percent. Such an increase likely to be absorbed without much market impact over the long term. However, if the entire 2,500 acres were to be devoted to potato production in the initial year, without any compensating reduction in other potato acreage in the area, the market impacts would likely be significant, leading to as much as a 30 percent decline in grower prices,

based on the long-term price-quantity relationship for potatoes.³ Potato growers throughout the Pacific Northwest are aware of the sensitivity of price and market demand to the annual production in this region. Established producers are unlikely to undertake large, speculative increases in production that might otherwise reduce prices and revenues. Thus, large scale expansion of potato acreage on the Depot will likely come at the substitution of production elsewhere.

The growth in the vegetable processing sector in the Morrow/Umatilla county region in recent years has expanded the cropping alternatives for producers in this area, and such alternatives also apply to production potential on the Depot. Aggressive recruitment of processing firms, combined with favorable agronomic conditions in this area has resulted in increased production of crops such as green peas, sweet corn, carrots and onions, as well as relatively new commodities including popcorn and tall fescue grass seed. Economic analyses of these commodities conducted by the OSU Extension Service indicates that grower returns for these alternatives are often higher than for traditional alfalfa and grains, and in some cases approach the returns possible from potato production. While these newer alternatives hold promise, they are limited in acreage due to localized processing markets, and are typically grown under contract. Further expansion of crop acreage in these commodities will likely require growth in processing activity, and market success, as well.

Higher valued irrigated crops typically have higher production costs, and may require specialized growing skills on the part of farm managers. Total production costs for potatoes approach \$1,500/acre, and \$1,300/acre for carrots, compared to \$480/acre for irrigated wheat. As a result, growers are less inclined to take risks on higher valued specialty crops, and often demand formal purchase agreement contracts with processor/buyers on at least some portion of their crop. The implication is that any development of agricultural lands on the Depot will have to pass a litmus test of market feasibility in the eyes of the investor. Even if carrots or potatoes could be grown on selected tracts, such activity will only take place if market prices and perceived risk justify the cost or investment compared to alternatives elsewhere. Throughout the irrigated regions of Northeastern Oregon, several large scale agricultural developments have failed in recent years. Economic feasibility in the agricultural industry cannot be guaranteed in a cookbook process if for no other reason than inherent production and market risks.

2. *Dryland Crops*

As the terms implies, dryland crops are grown utilizing natural rainfall without supplementary irrigation. Depending upon weather and growing conditions, dryland crops may be produced every other year, allowing the soil to lay "fallow" a year in between crops in order to acquire additional moisture. The arid conditions on the localized Depot likely preclude typical dryland crops such as wheat, barley, or other field crops prevalent along the Columbia Plateau to the South, East, and West of the Depot. Moreover, the soils on the base are primarily sand and gravel, very well-drained, and therefore unable to accumulate reserve moisture in the root zone through fallow practices. Nearly all cultivated agricultural crops require more than the 8.1 inches of annual rainfall that falls on the Depot.

Beyond traditional cereal grains, there may be some potential to increase the productivity of dryland forage crops on the Depot, such as native grasses, in order to boost livestock forage, or a single annual cutting of hay. Such development is more likely to be in the spirit of maintaining or improving rangeland conditions, rather than cultivating or producing significant cash crops. In the unirrigated state, the Umatilla base property is unproductive in terms of standards applied to commercial crop agriculture.

3. *Livestock Grazing*

The low crop productivity potential of the Depot in an unirrigated condition does not rule out low intensity agricultural uses such as livestock grazing by cattle, horses, or sheep. Grazing in arid or semiarid regions of Eastern Oregon and Washington is widespread, albeit an extensive use of the land resources. In these arid regions, a single cow may require 30 to 50 or more acres for adequate forage production to sustain the animal over a year. The extensive use of land as grazing or rangeland relaxes requirements concerning the irrigation potential of the land, such that more acreage is suitable for grazing than would be available for intensive cultivation.

Based on the assessment and inventory of land resources, livestock grazing may be a potential for the demilitarized ammunition storage areas, so long as stock is not impeded by the bunker structures. Grazing may also be feasible on the open storage and ammunition maintenance areas, as well as all of the buffer zones including Coyote Coulee. Those areas with contamination or hazardous materials are not suitable for grazing, due to the risk implied for livestock or subsequent consumers. In addition, areas of routine human activity such as buildings, roadways, or farmland may require barriers to exclude grazing livestock. While the total acreage representing explicit

contamination or hazard may be relatively small compared to the total base acreage available for grazing, extensive use of fences or other containment devices would be necessary, and may prove infeasible on a piecemeal basis given the low carrying capacity of the land. Rather, large grazing blocks might be identified, utilizing existing fences where available, and supplemented with new fences where necessary to form efficient grazing management operations.

As a planning point, assuming that perhaps 75 percent of the Depot land area may lend itself to livestock grazing in a decontaminated, demilitarized state, roughly 12,750 acres would be available. Further assuming a carrying capacity of 30 to 50 acres annually per animal unit (an animal unit is a cow with calf at her side), the base would support a herd of from 250 to 425 cows. This is a modest beef cow operation by commercial standards, and one that would still require supplemental feeding during the winter months, as well as fencing and stock water improvements. The net return potential from a livestock grazing operation such as outlined above would be directly governed by the cost at which the rangeland or grazing rights are acquired. As an extensive use of relatively low productivity land, the net return and imputed land value is significantly lower than that possible through intensive use such as irrigated crop production.

4. Confined Livestock Operations

Another alternative linked to livestock production would be the development of confined livestock operations such as a feedlot. There are beef cattle feedlot operations in the immediate area, and the old base housing tract located on the South side of Interstate 84 was at one time developed as a swine production facility by private interests. Certain landforms and facilities may be adopted to confined livestock operations, but the economic potential for feeding operations is strongly influenced by other factors, as well.

The economics of confined livestock operations rely upon adequate supplies of livestock, feed inputs, proximity to slaughtering or processing facilities, and competitive market prices. The land availability on the Depot is therefore a lesser consideration in the establishment of a successful feeding operation. There are significant economies of scale in livestock feeding, such that small scale enterprises typically incur higher per unit costs, and are vulnerable to the frequent revenue fluctuations in this sector. Livestock feeding and processing are much more concentrated industries than the production operations.

Although cattle and calf production is Oregon's single largest farm commodity group, competitive market forces over time have led most of the feeder cattle to be shipped out of state for finishing and processing. Large scale development on the Depot of a beef feedlot would have to resolve competitive issues outside the parameters of Depot-specific concerns. Smaller specialized confinement operations catering to niche markets (i.e., lean beef, export demand, or custom feeding) may prove more successful. Development of related small scale activities such as livestock boarding, recreational facilities, or certain veterinary facilities are other Depot use possibilities.

5. Nontraditional Crop Production

The productive potential of irrigable lands surrounding the Depot covers a wide array of crop and livestock possibilities ranging from traditional commodities such as wheat and cattle to innovative newcomers such as popcorn and canola (rape seed). More recently, forest products companies have expressed interest in large scale production of hybrid cottonwood or poplar trees for pulpwood using farmland in this area.

Based on limited information available concerning pulpwood production in the Morrow/Umatilla County area, it appears that the hybrid cottonwood trees are produced in a six or seven year period under drip irrigation with water requirements similar to potatoes (2.5 acre feet annually). The land is not intensively cultivated after stand establishment. Trees are planted at 500 to 600 per acre, grow an average of 10 feet annually, and are mechanically harvested when they reach 60 to 70 feet in height. The harvested trees are chipped at a central facility and then shipped in bulk to existing paper/pulp mill facilities in the region. The growing conditions in this otherwise arid area, particularly the heat units available during the growing season, evidently are sufficient to overcome the costs added by irrigation. Timber products companies are investigating plantation cottonwood production on these and other sites as an alternative fiber source given decreased availability of softwoods on public forest lands, and higher prices for available supplies.

Boise Cascade, a major lumber and wood products corporation in the Northwest, presently has about 1,500 acres of cottonwood trees planted near Boardman, Oregon, west of the Depot, and another 2,500 acres scheduled for planting in 1993. Boise Cascade's announced plan is to raise 6,000 acres on the Boardman site, and a total of 20,000 acres in the area by 1997. Boise Cascade operates a pulp mill in Wallula, Washington. In addition, Potlatch Corporation has recently acquired 10,000 acres of Boardman farmland west of the Depot, and an option on another 12,000 adjacent acres. Potlatch will

make its first planting in 1994 with the objective of supplying the Potlatch Corporation paper mill in Lewiston, Idaho.

Typically, new or alternative crops in agriculture are spawned by provisions of Federal farm policy, irrigation potential, or depressed prices for traditional crops. In the case of pulpwood fiber production from cottonwoods, it is somewhat unusual to have crop production patterns altered by the interests of nonfood sectors, such as the wood products industry. Moreover, the scale of proposed cottonwood production—potentially 40 thousand irrigated acres within five or ten years—represents a significant conversion of agricultural land from food to fiber production. It should be emphasized that the proposed cottonwood production schemes are still in developmental stages, in that the 6 or 7-year production cycles have yet to be completed on these sites that would provide information of ultimate economic feasibility.

Assuming that fiber pulpwood production proves economically feasible in this area, the potential for establishing plantations on the Depot seems intriguing. Although concerns over contamination and associated health hazards apply to any agricultural development of base properties, the use conflicts imposed by facilities such as the storage bunkers may be less constraining on tree production in comparison to intensive irrigated crop farming. Any lingering doubts over the potential to contaminate human food supplies through crop production on some acreage might also be resolved by shifting to fiber production, instead. Given the expansive acreage scale of cottonwood production introduced to date, the large contiguous block of acreage available on the Depot would appear to lend themselves to such an application.

Still unresolved in such consideration of available acreage is the issue of water availability. Given the maximum irrigation potential of perhaps 600 acres using Depot wells, larger scale production of cottonwood trees will entail the procurement of additional water supplies. Water law allows for the transfer water rights among users within established guidelines, such that rudiments of supply and demand define a primitive water "market." Nonetheless, water rights are not freely traded according to demand prices. Agricultural producers bordering the Depot may be less inclined to transfer water to six-year fiber crops than for annual crops such as potatoes or wheat. Development interests such as the Ports or neighboring communities are another possibility for water transfers, although public entities may be wary of the influence tree production has on the economic development of the area, compared to other business possibilities.

The possible choice between traditional crop production or alternative tree production is not a polarized selection. Guided by economic incentives, the highest and best use of acreage and facilities on the base would be expected to produce a variety of agricultural uses. Presumably, ideally situated crop land such as the buffer strips will be developed as such, at least initially. Less desirable but still extensive tracts such as the storage and maintenance areas might lend themselves to trees, lower value crops, grazing, or even to lay idle.

6. Agricultural Processing

In aggregate, agricultural processing and food manufacturing contribute nearly as much to the output of the agricultural economy as does basic crop and livestock production. Representing concentrated job opportunities and "value added" potential to locally grown crops, agricultural processing offers the potential to further economic development of an area even after the crop production potential has been achieved. Such is the case with the two-county Morrow/Umatilla region surrounding the Depot.

Several potato processing facilities are located in this area, operated primarily by large food manufacturing firms. In addition, vegetable processing has expanded locally, representing both smaller specialized operations as well as large regional and national concerns. Other value added activity ranging from livestock feeding to grain milling occur on a widespread, but smaller scale throughout the area.

While the economic development benefits of this sector are well-recognized by area development planners, the complexity and intense competition involved in attracting and locating processing firms place limits on the degree to which the agricultural processing sector can expand. That is, the value-added concept is well-accepted, but that alone is insufficient to create or attract a successful processing firm and/or investor. Given the documented capability of American agriculture to overproduce for both domestic and international markets, economic success is governed more by cost and quality competitiveness, or managerial skill than purely production potential. Paramount considerations by processors in this regard are basic issues such as cost, quality, stability and volume of local raw product supplies; shipping and transportation costs; skills and availability of a local work force; environmental and regulatory compliance costs; utility or power rates; and fixed plant and equipment costs. During the 1980's many west coast food processors moved to the midwest not because of a lack of west coast agricultural commodities, but because of the lower transportation costs from the midwest to access east coast population centers.

Given this perspective, potential for developing agricultural processing activity on the Depot must be evaluated carefully. The availability of existing base facilities or property is unlikely to be a convincing argument to attract a major food processor who have the flexibility to locate in different areas. State and local development agencies in competing regions routinely can offer processors newly constructed, subsidized facilities and infrastructure support superior to that available on the Depot. A more plausible advantage is to target processors interested in the specific crops grown in this area, who would otherwise incur high transportation costs in shipping the raw product to another location.

This location advantage, combined with the transportation network and access, competitive power rates, effluence disposal, and lack of urban growth restrictions will likely work to the advantage of the Depot site. The highway, rail, and potentially barge transportation options available from the Depot appear particularly advantageous to processors or shippers dependent upon an efficient distribution network. This applies to operations where shipment or transshipment costs are an important competitive factor, such as a repacking facility, or intermediate processing and assembly operations. Power rates based on cheap hydroelectric generation were once a significant benefit for electricity-intensive manufacturing in the northwest. Local utility costs are less of an advantage in the regional energy markets of the present. Rates are nonetheless competitive with other areas, especially those that rely solely upon coal-fired generation. Moreover, companion utility considerations including effluence or waste water disposal, environmental regulation, and local planning restrictions are much less problematic in this location. The rural, noncongested lifestyle, recreation opportunities, and growth potential may further appeal to processors currently hemmed in by suburban land use in metropolitan locations.

Some possible problems confronting processing development on the Depot are labor supply, location, water availability, facilities, capacity utilization, and concern over contamination. By national standards, the labor pool and skill level in the surrounding communities is relatively small, particularly for processors who depend upon a large work force for seasonal employment only. The development of year-around employment opportunities will likely draw required work force from the surrounding area, but short-term employment competing with other processors for limited seasonal workers may be problematic for such processors in this location. Similarly, the Depot is 150 miles from Portland, Oregon, the nearest metropolitan market. There are limited local markets to serve in the adjacent counties.

The water issues discussed previously apply to processors, as well. This concern may not be overly restrictive in the longer term, to the extent processing demand for water will draw needed supplies from lower valued uses, but at present there are not long-term water sources immediately available on the Depot, aside from the limited well capacity.

The buildings presently available on the Depot are either mission specific military facilities, or more generic warehouse/shop/administrative space. Specialized food processing requirements, such as climate control, sanitation, or food manufacturing equipment would likely have to be added for many intensive food manufacturing activities. The cost of remodeling or modifying the old Depot structures might well exceed the cost of new construction. Less specialized processing activities, such as grading, cleaning, or packing, appear more readily adaptable to existing Depot facilities.

Capacity utilization is a common concern among food processors. Specialized facilities constructed and utilized to process a commodity during harvest for a few short weeks or months of the year often proves uneconomical. By either lengthening the harvest season or storing the raw product for later processing, the plant can extend its operating season, and thereby enhance plant capacity utilization. Also, processors search for complimentary products that might be combined or utilized to extend the operating season of a plant.

The final concern—possible contamination from the former military mission—is a difficult perceptual issue. In such cases, the perception can be as compelling as scientific fact. In an era when the mere mention of “agricultural chemicals” stirs uneasiness in consumers’ minds over food safety, concerns over chemical weapons once stored on the Depot may be a public relations issue some processors would sooner avoid. In such cases, less intensive processing applications or processing that only partially utilizes Depot facilities may prove less controversial.

The foregoing evaluation paints a cautious picture of processing potentials on the Depot. Some opportunities do exist, but the potential is limited for large scale food manufacturing to rival the potato processing industry that has evolved in this area over the past 20 years. Additional food processing activity will likely develop in the area, but the Depot itself offers limited unique advantages.

7. Related Agricultural Uses and Activities

Managers and investors representing various agricultural activities have viewed the Depot for some time with an eye towards eventual demilitarization that would allow civilian access to the resources and facilities located on the base. The agricultural production and processing possibilities have been examined above. Directly and indirectly tied to the basic production and food manufacturing activities are a wide array of related services that may find productive uses of the Depot and its resources upon demilitarization. Fundamental services such as equipment repair and maintenance, input supply, transportation and storage, as well as related functions such as finance, management, merchandizing, and retail trade are an important part of the agricultural economy, and visible businesses in neighboring communities.

In the process of evaluating agricultural use opportunities on the Depot, local agribusiness interests exhibited routine familiarity with the base and its resources, likely the result of long association and communications undertaken by the Depot military command. Local business planners frequently cited the potential of the base for logistical shipping/transportation services, light industrial use, and waste disposal.

Apart from the organized planning and development agencies in this area, the unique facilities and natural resources located on the Depot create an allure for entrepreneurial spirits that may well be fueled by the perception that these building and improvements will one day be available at greatly reduced "government surplus" prices. This logic reasons that a structure that may have cost the military \$500,000 to construct surely has some profitable use if it can be obtained for \$5,000? Thus motivated investors are able to imagine all sorts of money-making development schemes. That limited civilian economy use of the existing Depot facilities has taken place, despite continual inquiries, suggests that what may prove feasible at ten cents on the dollar is impractical at fair market value.

One of the drawbacks to discounted or subsidized access to the government surplus such as the Depot facilities (should this occur upon demilitarization) is that it shocks the local capital market, by creating a suddenly lower-cost alternative. Imagine the local impact of the abrupt availability of twice the wholesale storage space upon local businesses. As average costs and prices are lowered, some "decapitalization" of the industry may occur and competitive advantages shift to those who captured the windfall gain of the government surplus. This can be destabilizing if no new economic activity is created, if all that has occurred is a redistribution of income.

The inventory of facilities and natural resources available on the Depot suggests that agricultural services featuring storage, inspection, handling, minor service or manufacturing, disposal, management, temporary housing, and transportation may find attractive development opportunities on the base. Nearly all of these potential uses are already available in nearby communities, but the space or expansion potential offered on the base may be conducive to business growth. For example, the eastern edge of the Depot adjacent to Interstate highway 82 represents a potential site for expansion of the local community's agribusiness sector.

It is understandable that local economic planning agencies are interested in seeing the Depot put into a complimentary or growth industry that will supplement, rather than merely compete with the existing business economy. That is, the development theme should not necessarily focus on what can be done cheaper on the Depot; rather, what new enterprise can be undertaken because of the productive assets that become available. Local planners in Morrow County on the west side of the Depot have suggested an "early access" option. This suggestion would make unused warehouse facilities on the southwest corner of the base more accessible to civilian economic interests through the development of a west side access road. Such access might phase in economic development at fair market rates, and allow for a gradual conversion of military facilities to meet local business opportunities.

C. SUMMARY OF AGRICULTURAL DEVELOPMENT POTENTIALS

There are a wide range of potential opportunities for agricultural development on the Depot, as surveyed above. Assuming that demilitarization does occur in the near future, and that this process does not radically alter the basic land resources or structural facilities, there are certain agricultural uses that appear more likely or promising than others. Specific uses and acreage are suggested here as guideline references based on the resource inventory. This listing does not imply that all individual uses could occur simultaneously. These are intended as realistic potentials; not a set of prescriptive recommendations.

Potential agricultural uses are as follows:

1. 2,500 acres of irrigated high value crop production in traditional crop rotation with potatoes, primarily in the buffer strips along the north, east, and south perimeter of the base. Additional irrigation water for at least 2,000 of these acres would be required, transferable to the Depot site from other locations.

2. 1,500 - 3,500 acres of additional irrigated crop production, contingent upon nonhazardous access to the ammunition maintenance and open storage areas. Off-depot irrigation water would be required for all of these acres. This acreage may also be suitable for livestock grazing.
3. Up to 10,000 acres of irrigated fiber (cottonwood) production, contingent upon nonhazardous access to the ammunition storage areas, and compatibility of tree production with the existing facilities (bunkers). Off-Depot irrigation water would be required for all of these acres. This acreage might also be suitable for certain waste water treatment, or livestock grazing.
4. Use of selected warehouse/storage facilities on the southwest corner of the base for agricultural storage, sorting, packing, or light processing.
5. Use of selected shop, storage, and utility buildings along the southern portion of the Depot for agricultural service industries.
6. Modification or reconstruction of selected large storage facility for agricultural processing activity.

These possibilities do not exhaust the range of activities that are likely to be uncovered by innovative entrepreneurs and business interests in the area. Actual investment decisions, timing, and enterprise choices are best left to individual managers, rather than centralized planning agents.

1. Reported acreage vary slightly across different Army documents, possibly due to different methods of land area categorization. For purposes here, the acreage reported in the April 1992 Real Property Utilization Survey are used.
2. The assessment of land conditions may change significantly between the present and the time of eventual/potential civilian development, depending upon actions taken during demilitarization. For example, major contamination areas may be cleaned up, or facilities modified that would allow for greater agricultural production potential. Similarly, thorough environmental assessment or actions during demilitarization may render certain tracts unsuitable for farming.
3. The farm level price elasticity of demand for potatoes has been estimated to be approximately -0.3, meaning that a ten percent increase in price is associated with a 3 percent decrease in quantity

demand. That is, the demand is relatively insensitive to price changes. By inference, a ten percent increase in quantity (such as created by 2,500 new acres from the depot) would result in a 33 percent decline in grower prices. The market would require a significantly lower price in order to absorb the increased output.

APPENDIX

A. HYDROGEOLOGY

General. The project area lies within an area defined by the Oregon Department of Environmental Quality (ODEQ) as the Lower Umatilla Basin (LUB). The ODEQ generally divides the aquifers within the LUB into two systems. These consist of an upper alluvial system and lower confined CRB aquifers. The ODEQ states that it may be possible to divide the upper alluvial system into an upper unconfined and lower semiconfined aquifer, but that the two aquifers appear to behave as a single unit.

The Lower Umatilla Basin is a semi-arid area. As a result, streams within the drainage area may alternate between a gaining and losing condition (i.e., they receive water from shallow aquifers during periods of high groundwater and contribute water to those same aquifers during low groundwater periods). This results in local, seasonal groundwater flow direction reversal.



The Oregon Water Resources Department (OWRD) has designated three critical groundwater areas in the basin (Ordinance, Butter Creek, and Stage Gulch). The OWRD created these areas due to the continuing water level declines in both the basalt and alluvial aquifers. The declines have occurred because water has been removed from the aquifers faster than natural recharge can occur.

Alluvial Aquifer. The alluvial aquifer is developed within the Spokane Flood deposits. These consist of coarse-grained, uncemented materials and typically are excellent aquifers due to their natural porosity and permeability. These aquifers receive natural seasonal recharge from both precipitation and stream contributions.

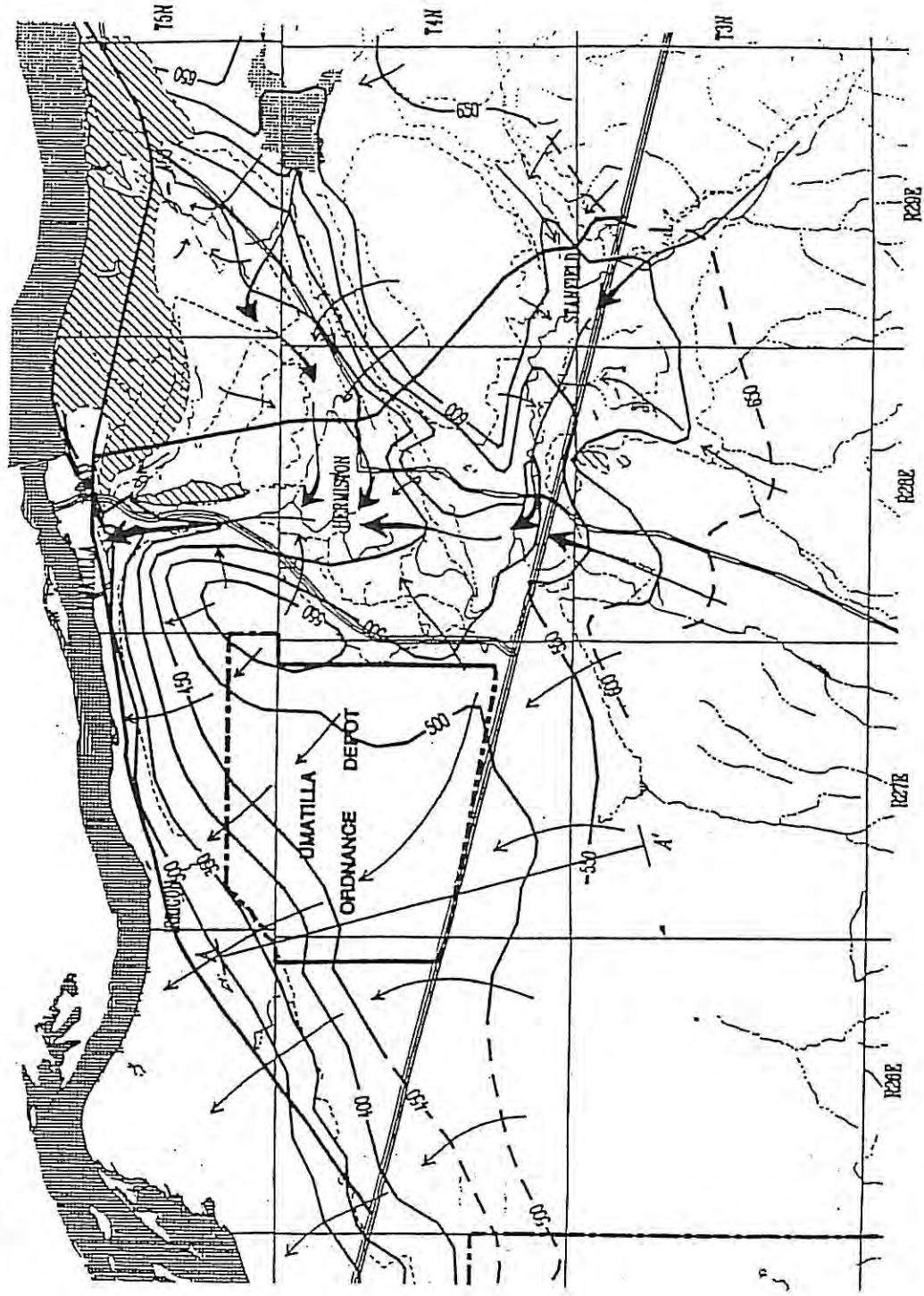
Saturated aquifer thickness (i.e., the depth from the water table to bedrock) ranges from approximately 25 to 75 feet in the Subarea. Specific capacities within the alluvium range from 25 to 100 gallons per minute (gpm) per foot of drawdown. Total well yields range from 400 to 3,000 gpm, averaging 1,800 gpm. The lower values are generally observed in the southern portion of the Subarea. Pump tests generally produce little or no effect upon nearby wells, giving testimony to the high transmissivity and storage coefficient of this aquifer.

The OWRD, using data from the ODEQ's Lower Umatilla Basin Study (LUBS), has generated a preliminary potentiometric surface map for the shallow alluvial aquifer in the region (Exhibit A-1). This map clearly illustrates the division of the regional groundwater system into two regimes. The partition occurs along a line which approximately follows the eastern border

Exhibit A-1

-  Undifferentiated Alluvial Deposits
-  Columbia River Basalt

Arrows show inferred flow lines
 February 1991 Data Set
 Contour Interval = 50 feet



of the Depot. West of this divide the groundwater flow direction is generally northward; east of the divide the flow pattern is more complex.

At least a portion of the groundwater issues as springs along the Umatilla River. Groundwater may flow to the northwest in portions of the Subarea (McCall, 1975), but this is not firmly established. In T. 5 N., R. 26 E., the alluvial aquifer is reportedly in hydraulic connection with the Columbia River.

According to McCall (1975), the saturated alluvium thins to the north, south, and west of the Subarea. The Umatilla River apparently forms the eastern boundary.

Water level declines within the alluvial aquifer ranged from 12 to 29 feet from 1966 to 1976. The rate of decline averaged 1.6 feet per year prior to initiation of the artificial recharge project. Wells near the Columbia River, however, generally showed no such decline.

Columbia River Basalt Aquifers. Most of the "basalt" aquifers actually exist in interflow zones. The interflow zones consist of varying thicknesses of alluvial or residual material developed at the surface of the basalt bedrock. The interflow zones can be excellent aquifers. These zones are developed to a greater or lesser extent at each of several flow boundaries. The intervening basalt flows have very low permeability and normally serve as vertical barriers between the interflow aquifers. Permeability within the basalt is constrained to rubble zones, fractures, or cooling joints. According to Karl Wozniak, OWRD, aquifers within the CRB are generally tabular and are confined laterally as well as horizontally. Lateral barriers may be structural or stratigraphic in nature.

The amount of recharge received by the basalt aquifers is problematic. Shallow basalt wells have shown a lower rate of water level decline than deeper wells (1.6 to 2.0 feet per year, compared to 5 to 7 feet per year), indicating limited recharge to the shallower basalt aquifers. Deep-well current meter tests performed at the Depot in 1964 showed no measurable water movement (Sceva, 1966). Water from the deeper basalt aquifers yields C^{14} dates ranging from 6,700 to 27,000 years. Nitrogen contaminants in water from the basalt aquifers could indicate that there is at least a minor amount of comparatively recent recharge to the basalt; however, there is also evidence of commingling between the basalt aquifers and the alluvial aquifer in a number of wells. Alluvial aquifer water inadvertently introduced to a basalt well by leakage through the casing annulus may be the true source of the nitrate contaminants.

Karl Wozniak of OWRD states that one interflow zone, the Selah Member, may subcrop beneath the alluvial aquifer south of the Depot. If this is the case, water from the alluvial aquifer may serve as a partial natural recharge source for this individual interflow zone.

Regardless of the actual amount of recharge to the basalt, steep water level declines (5 to 7 feet per year prior to 1976) in the deeper basalt aquifers indicate that "water mining" is taking place; that is, the pumping rate vastly exceeds the recharge rate and the resource is being more or less permanently depleted.

There are no clearly defined potentiometric surfaces within the basalt aquifers. Many wells completed in the CRB draw from more than one aquifer. Karl Wozniak (OWRD) states that the commingling of these aquifers results in an observed head which is lower than the natural head of the uppermost aquifer and higher than the natural head of the lowermost aquifer drained by the well.

Well yields within the basalt aquifers are highly variable. These wells can have excellent yields (exceeding 1,000 gpm); however, drawdown is quite steep due to the low storage coefficients. As stated within the CGWA Order, "...transmissivity of the basalt is estimated to range from 10,000 feet² to 50,000 feet² per day... the hydraulic effects from the pumping of wells can extend over great distances within individual aquifers."

Site. Existing wells at the Depot are completed in basalt aquifers. Well depths range from -115 to -157 feet bgs, and from +380 to +470 feet MSL. Groundwater flow direction is generally interpreted as southeast to northwest.

As noted above, there are no well-developed surface drainage features at the Depot; Brian Mayer, Well Inspector for Eastern Oregon, stated that water infiltrates into the area surface soils almost immediately. Precipitation, human use (spray irrigation, leaky irrigation canals, sewer), and the County Line Water Improvement District (CLWID) Artificial Recharge Project are the local sources of shallow groundwater recharge.

Groundwater Recharge Program. The CGWA order of 1976 limited pumpage from the Subarea to 9,000 acre-feet per year; previous pumpage rates had been as high as 15,000 acre-feet per year. To respond to this reduction, the CLWID initiated a groundwater recharge program in 1977.

The recharge procedure consists of pumping water during the winter months from the Umatilla River via the High Line Canal to a "leaky canal". The canal is about three miles long and is located along the east and north sides of Section 34, T. 4 N., R. 27 E. (approximately two miles south of the Depot). Water pumped to the canal percolates into the shallow alluvial aquifer.

Since its inception, the recharge program has reversed the previous decline trend (1 foot per year) and by 1984 the water table had recovered approximately 12 feet of its head loss, half of which was attributable to the recharge project. The volume of water artificially recharged to the aquifer is added to the allowable pumpage for the Subarea, subject to sustained water levels at selected observation wells. Artificial recharge totaled approximately 6,280 acre-feet in 1984. Montgomery (1990) estimates the total potential recharge capacity for this project at 10,600 acre-feet/year.

B. CURRENT WATER USAGE

Alluvial Aquifer. About 39 wells tap the alluvial aquifer in the Subarea of the Ordnance CGWA. Predominant usage is irrigation; these well permits were issued for irrigation of approximately 7,000 acres of land.

No new permits have been issued since December 6, 1971.

Basalt Aquifer . A total of 30 groundwater certificates were issued for industrial, irrigation, and municipal use. Total irrigated acreage under permits and certificates of water right for the deep basalt aquifer is 2,336.7 acres. Total irrigated acreage for the shallow basalt aquifer is 915.5 acres. At the time the OWRC declared the Ordnance CGWA, eight wells within the Ordnance basalt area produced water for agriculture from the deep basalt aquifers.

The Depot has a total of eight certificates of water rights: three deep and three shallow basalt wells for fire protection use, and one deep and one shallow basalt well for domestic purposes. Authorizations are as follows:

<u>Category</u>	<u>Shallow Basalt</u>	<u>Deep Basalt</u>
Fire protection	2.02 ft ³ /sec	6.19 ft ³ /sec
Domestic	0.78 ft ³ /sec	0.5 ft ³ /sec
Irrigation	0.34 ft ³ /sec	

No new deep basalt permits have been issued within the CGWA since June 3, 1966. No new shallow basalt permits have been issued since April 26, 1971.

C. WATER QUALITY

Regional. Regional groundwater quality has been generally degraded due to the presence of elevated concentrations of nitrates, primarily within the shallow alluvial aquifer. The ODEQ has declared the Hermiston-Boardman area a groundwater management area due to these elevated contaminant levels. Exhibit A-2 displays general nitrate concentrations within the basin for both aquifer systems. All water quality data referenced herein were obtained from ODEQ's LUBS.

Alluvial Aquifer. Elevated nitrogen concentrations are observed within the alluvial aquifer in the LUB. Background levels of nitrogen, chlorides, and TDS in groundwater are generally low or even below detection limits at points in the southern portion of the basin. Concentrations of these constituents generally increase as one moves down-gradient. Several factors (feed-lots, numerous food processing plants, septic systems, fertilizer manufacture, and normal agricultural practices) contribute to this decline in water quality.

Basalt Aquifer. As previously discussed, low levels of nitrogen are observed within the basalt aquifers at scattered locations within the basin. A summary of chemical analyses for selected basalt wells is presented as Appendix B. This may indicate that the aquifer is receiving a limited amount of recharge. There is uncertainty regarding the actual aquifer source of the nitrates; many wells in the area show evidence of poor construction and probably allow communication of water from the alluvial aquifer to the Basalt Aquifer (Jerry Grondin, DEQ; Brian Mayer, OWRD; Karl Wozniak, OWRD). Also see comments regarding the Selah Member subcrop in the Hydrogeology section. Since the water from the alluvial aquifer has elevated nitrate concentrations, nitrates ascribed to basalt aquifers may actually be introduced from the alluvial aquifer.

Site

Exhibit A-3 maps the groundwater nitrate concentrations observed at the Depot.

Alluvial Aquifer.

As in most of the rest of the LUB, the Depot area exhibits elevated groundwater nitrate concentrations. These concentrations generally increase in a down-gradient direction. Due to its hydrologic position (down-gradient relative to the regional groundwater gradient), groundwater at the Depot has

Exhibit A-2

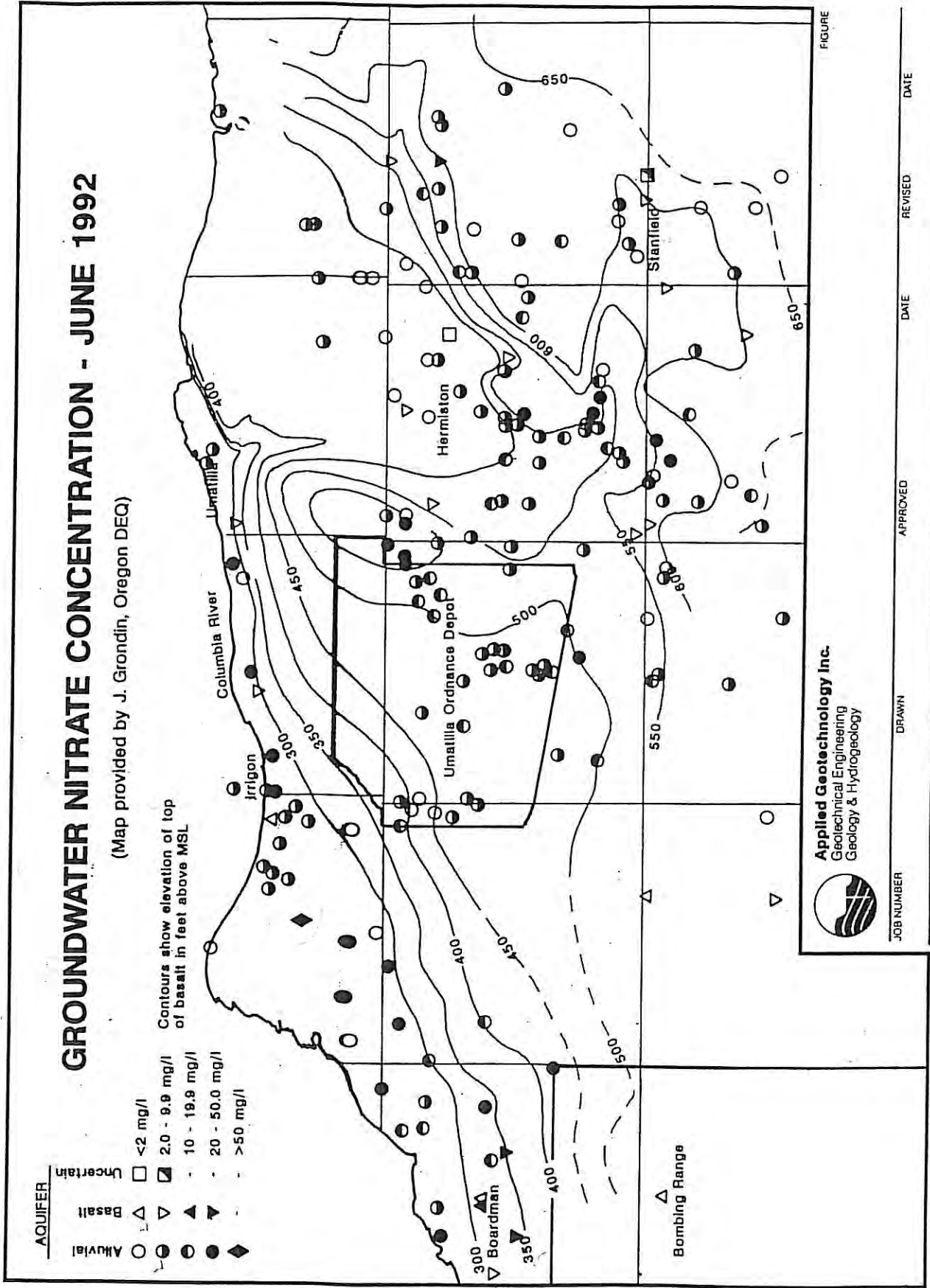
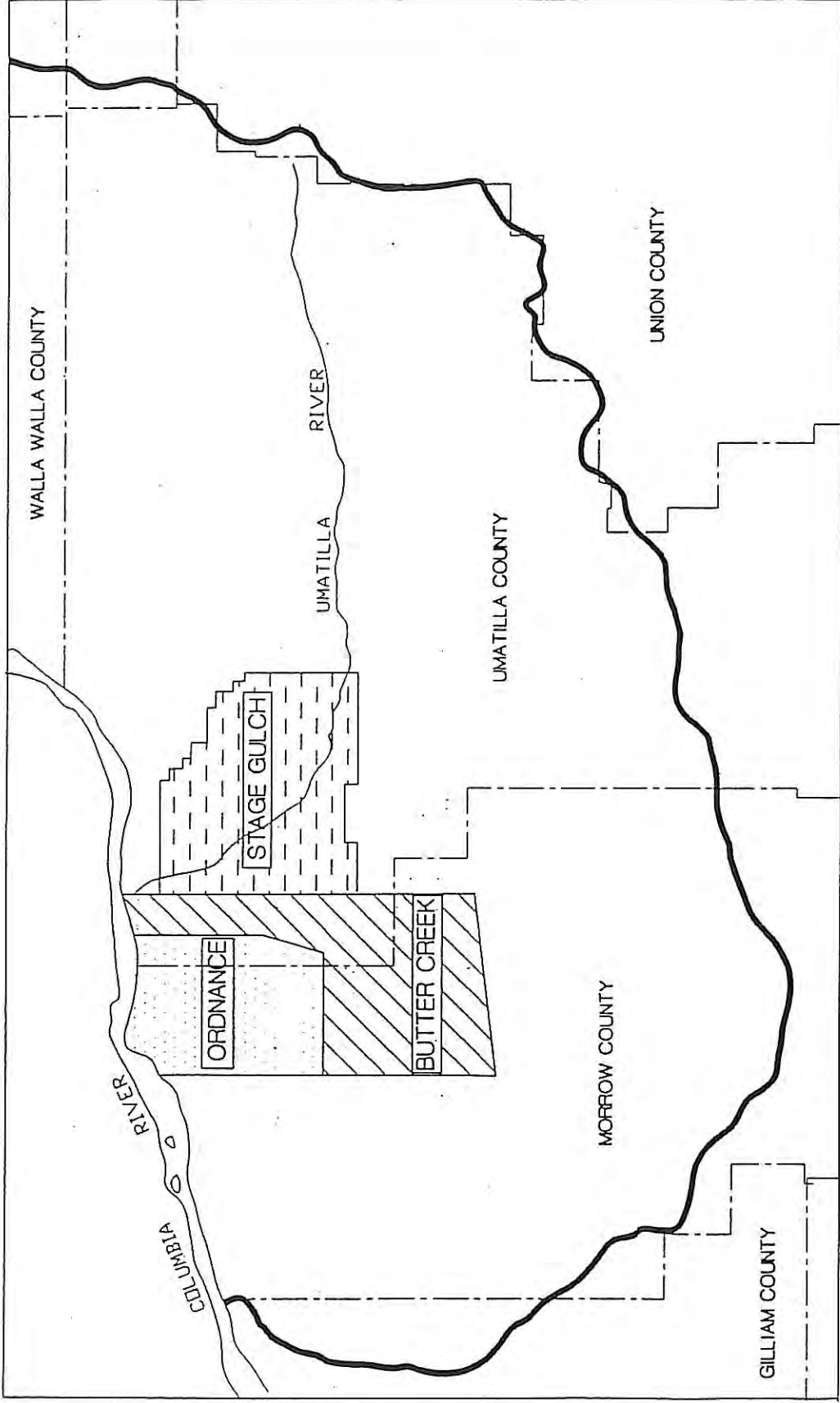


Exhibit A-3



received nitrates from more sources. Nitrate levels in the alluvial aquifer at the Depot are therefore generally higher than elsewhere in the LUB.

According to the Dames & Moore remedial investigation, "...it is possible that on-post sources are solely responsible for nitrate/nitrate contamination in the vicinity of Site 4 and at well 005" (i.e., the washout lagoons and Stratigraphic factors may influence the introduction of nitrates into the basalt aquifers in and around the project area).

D. PERTINENT WATER LAW

Critical Groundwater Area Designation

The Depot lies within the Ordnance CGWA as decreed by the Oregon Water Resources Commission (OWRC) on April 2, 1976, under the authority of the Oregon Groundwater Act of 1955 (ORS 537.505 - ORS 537.795; specifically, ORS 537.730 through 537.742). This decree was issued due to the water level decline in both the shallow alluvial aquifer and the basalt aquifers. Two groundwater areas are defined within the order:

The Ordnance basalt groundwater area (all of T. 3 N., R. 26 E.; all of T. 3 N., R. 27 E. except that part draining directly into Butter Creek; all of T. 4 N., R. 26 E., and T. 4 N., R. 27 E.; and that part of T. 5 N., R. 26 E. and T. 5 N., R. 27 E. lying south of the Columbia River), and

The Ordnance gravel groundwater area (Sections 1, 2, 3, 10, 11, 12, 13, 14, and 15, T. 3 N., R. 26 E.; Sections 10, 11, 12, 13, 14, 15, 22, 23, 24, 25, 26, 27, 34, 35, and 36 of T. 4 N., R. 26 E.; the north one-half of T. 3 N., R. 27 E.; all but Sections 1 through 6 of T. 4 N., R. 27 E.; Sections 6, 7, and 18 of T. 3 N., R. 28 E.; and Sections 7, 18, 31, and those areas of Sections 8, 19, 16, 17, 19, 20, and 30 of T. 4 N., R. 28 E., lying west of the Umatilla River).

The OWRC has the option of exercising several provisions under these laws. No new water rights may be granted within a Critical Groundwater Area. The OWRC also determines the total permissible groundwater withdrawal for the area. (Maximum pumpage from the Subarea is limited to 9,000 acre-feet per year.) The water allocation from any given well can be increasingly restricted as the groundwater supply declines; OWRC has the authority to decrease these allotments if the groundwater situation continues to deteriorate, either due to groundwater potential levels or temperature changes. Critical groundwater status is reviewed no less than once every 10 years.

Perfected Water Rights - Limitations

Allocations can be transferred to uses other than those initially specified. Brian Mayer (Eastern Region WRD) stated that, due to questionable casing jobs on the existing wells, any transfer of usage will be contingent upon recompletion of the wells.

Reallocation of perfected water rights is also limited by the amount of water actually taken from the point of diversion within the previous five years. Any portion of a perfected water right not utilized for five years is subject to forfeiture.

E. AVAILABLE WATER RIGHTS

Applicable Regulations

The primary limitation on water rights is the region's designation as a CGWA. No new water rights may be granted within this area and the appropriate governing bodies will carefully scrutinize any usage transfer.

Depot Water Rights

The Depot has seven wells on site. Table A - 1 (following text) summarizes perfected water rights and related information for the wells. Table A - 2 lists water usage from the Depot wells during 1990 (the last year for which tabulated data are available).

Exemptions from Filing . Certain wells are exempt from filing for water rights. These are:

“...for stockwatering purposes, for watering any lawn or noncommercial garden not exceeding one-half acre in area, for single or group domestic purposes in an amount not exceeding 15,000 gallons a day or *for any single industrial or commercial purpose in an amount not exceeding 5,000 gallons a day* .” [emphasis added]

Light industrial uses which use limited quantities of water are highly prospective for the Depot area.

Table A-1
Perfected Water Rights

Well No.	Perfected Water Right (cfs)	Permit No.	Priority Date	Water Level Elev.,ft. (MSL)	Total 1991 Production (K gal)	Designated Usage	
1*	2.34	G2826	1/5/65	482	1991	0 Industrial, Public Supply	
2	0.78	G2825	1/5/65	483	1991	15545 Industrial	
3	0.23	G2830	1/5/65	424	1991	1059 Fire Protection	
4	1.11	G2827	1/5/65	295	1991	41696 Fire Protection	
5	1.11	G2827	1/5/65	292	1991	29872 Fire Protection	
6	2.26	U-522	12/19/52	278	1991	10346 Fire, Dom., Maint.	
7	0.50	G1017	1/27/58	290	1991	6742 Domestic	
?	1.72	G2829	1/5/65			Fire Protection	
	10.05	Total perfected water rights					

* Shut in due to high nitrate concentration

Table A-2
Historic Depot Water Usage

Well Number	Consumption							
	K gal							
	<u>1991</u>	<u>1990</u>	<u>1989</u>	<u>1988</u>	<u>1987</u>	<u>1986</u>	<u>1985</u>	<u>1984</u>
1	0*	0*	0*	283	47,304	32,595	66,530	38,309
2	15,545	15,653	11,425	12,393	1,550	9,556	4,334	14,255
3	1,059	1,814	2,102	1,549	1,485	1,307	817	964
4	41,969	51,708	27,980	5,992	38,633	15,587	6,513	11,368
5	29,872	17,477	33,059	83,886	43,791	37,695	9,660	1,793
6	10,346	4,303	5,083	3,668	3,913	3,022	3,618	2,138
7	6,742	3,980	1,396	37	1,774	238	278	735
Total	107,251	96,925	83,034	109,796	140,437	101,986	93,735	71,546

* Shut in due to high nitrate concentration

Data provided by Umatilla Army Depot.

Potential New Sources of Water. No new water rights are granted within a critical ground water area. Nevertheless, a few opportunities exist for the acquisition of additional water supplies.

Point of Diversion Changes. While no new water rights will be granted within the critical groundwater area, it may be possible to acquire additional water for the Depot by transferring water allotments via point-of-diversion changes. In other words, water allocated at another location can instead be taken at the Depot. This would necessitate negotiation with municipalities, ports, or individuals to obtain the water required. Currently the city of Irrigon has a 1-cfs allocation; the city of Umatilla has a 2-cfs allocation; the Port of Morrow has a 7-cfs allocation; irrigated farm rights total approximately 200 cfs; and the Corps of Engineers fish hatchery at the John Day Pool has rights totaling 50 cfs.

Surface Water Permits. Currently the Hermiston Development Commission (HDC; application S-71309), the U.S. Bureau of Reclamation (S-71293), and the Port of Morrow (S-71110) have permits pending for acquisition of water from the Columbia River. On February 13, 1991, the HDC applied for 267 cubic feet per second (cfs) of water to be diverted from the Columbia.

The Port of Umatilla holds a Columbia River water right in the amount of 155 cfs; usage is limited to municipal and industrial. The Port is working in conjunction with the HDC to support approval of the HDC application, which will complement the more limited Port permit.

Status of these permits is currently pending due to concerns regarding threatened and endangered salmon runs. The U.S. Bureau of Reclamation has applied for a permit intended to assure an adequate river level for migration of these species.

It is not unreasonable to consider the possibility of allocation from one of these sources.

Groundwater Recharge Programs. Montgomery (1990) investigated several potential recharge projects. In addition to increasing the recharge from the CLWID project, Montgomery evaluated the potential for new recharge projects for two gravel pits, to be supplied by the Westland A-Line Canal, and construction of a new recharge canal to be supplied by the B-Line Canal. Montgomery estimated the potential recharge volume from these potential projects at 16,000 acre-feet/year.

The primary purpose of these projects would be to increase Umatilla River flow rates for anadromous fish migration. These projects have potential, however, to increase the allowable pumpage from the alluvial aquifer in the area.

F. APPLIED GEOTECHNOLOGY, INC. REFERENCES

Brown, Steve, Manager, Water Rights Section, Oregon Water Resources Dept., personal communication.

Grondin, Gerald H., Hydrogeologist, ODEQ Groundwater Section, personal communications.

Hogenson, G. M., Geology and Groundwater of the Umatilla River Basin, Oregon, 1964, U.S. Geol. Survey Water-Supply Paper 1620, 162 p.

James M. Montgomery Consulting Engineers, Inc., Lower Umatilla River Basin Shallow Groundwater Artificial Recharge Study, 1990, Report prepared for the U.S. Bureau of Reclamation.

Mayer, Brian, Well Inspector, Eastern Oregon Region, Oregon Water Resources Department, personal communications.

McCall, William B., Ground-Water Conditions and Declining Water Levels in the Ordnance Area, Morrow and Umatilla Counties, Oregon, 1975, Oregon Water Resources Department.

Miller, Donn, An Evaluation of Artificial Recharge to the Alluvial Ground-water Reservoir near Ordinance, Oregon, for the period 1977-1984; Oregon Water Resources Department, 1985.

ODEQ, 1988 Oregon Statewide Assessment of Nonpoint Sources of Water Pollution, August 1988.

ODEQ, Oregon's 1992 Water Quality Assessment Report - 305(b) Report, April 1992.

Oregon Water Resources Division, various well logs, various dates.

Robison, James H., Hydrology of basalt aquifers in the Hermiston-Ordnance area, Umatilla and Morrow Counties, Oregon, U.S. Geol. Survey Hydrologic Investigations Atlas HA-387, 2 sheets, 1971.

Sceva, Jack E., A Brief Description of the Ground-Water Conditions in the Ordinance Area, Morrow and Umatilla Counties, Oregon: State Engineer Groundwater Report No. 11, 1966.

Sexson, James E., On the Question of a Determination of a Critical Ground-water Area in the Ordinance Area, Morrow and Umatilla Counties, Oregon: Findings, Conclusions, and Order, 1976, Oregon Water Resources Department.

Taylor, George, Oregon State University Atmospheric Sciences Department; personal communication, January 1993.

USDA Soil Conservation Service, Soil Survey of Morrow County Area, Oregon.

USDA Soil Conservation Service, Soil Survey of Umatilla County Area, Oregon, November 1988.

Wozniak, Karl, Hydrogeologist, Oregon Water Resources Department, personal communications.

G. REGIONAL WATER SOURCE LITERATURE REVIEW

The development of a regional water source has been a concern in the area for many years. A recent review of the literature and discussions with personnel who have worked on the problem resulted in the compilation of the following documents. A brief review of the information contained in the document is included. The documents are not centrally located, but many are in the archives of the city of Hermiston, the Port of Umatilla, and/or PACAM Engineering, Inc. of Hermiston, Oregon. There is no particular order to the way the documents are presented.

1. *Published or Bound Documents*

- a. Barnes - Stubbs, Financial Analysis and Well Report for the City of Hermiston, Oregon (prepared and financed by Campbell Development Co., Inc.), no date.

A plan to address the city of Hermiston's short-term water requirements by providing a regional water system using a Campbell Development Co., Inc. owned well (the static level of which declined 77' from April, 1969 to December, 1975) and a 200,000 gallon storage

tank. Also addresses financing of the water system by means of (but not limited to) a tax increment system.

- b. Bartholomew, William S., Groundwater Conditions and Declining Water Levels in the Butter Creek Area, Morrow and Umatilla Counties, Oregon Groundwater Report No. 24, October, 1975. State of Oregon Water Resources Department.

Report of groundwater conditions in 1975 in the Butter Creek Critical Groundwater Area, with a listing of groundwater rights and well data for the area.

- c. Cornell, Howland, Hayes, and Merryfield, A Report on an Engineering Investigation of the Municipal Water System, City of Hermiston, Oregon, June, 1963.

The stated purpose of this document is an investigation to prepare a comprehensive master plan for the city of Hermiston's water development; a guide for expansion and improvement, for analysis of operating costs of the existing system, for estimates of future costs, for preparing a plan to finance water supply improvements, analysis of existing water rates and recommendations for changes. Included is an in-depth discussion of the city's wells to the date of the study, a prediction for a 1998 "saturation" population of 9,250 in Hermiston.

- d. Davies-Smith, E.L. Bolke, and C.A. Collins, Geohydrology and Digital Simulation of the Ground-Water Flow System in the Umatilla Plateau and Horse Heaven Hills Area, Oregon and Washington, no date, U.S. Department of Interior.

A description of the alluvial and basalt aquifers in the Umatilla Basin and their dynamics, including flow systems, pumpage and recharge.

- e. Draft Remedial Investigation/Feasibility Study of the Umatilla Depot Activity, Prepared for: U.S. Army Toxic and Hazardous Materials Agency by Dames & Moore.

Part A: RI/FS Work Plan, January, 1990. This document is part of a technical report which provides preliminary identification of requirements for Umatilla Depot Activity and outlines the various RI/FS tasks and the manner in which the project will be managed.

Part D: Health and Safety Plan, December, 1989. The purpose of this portion of the document is to assign chains of command for responsibility, establish personnel protection standards, safety practices and procedures and outline responses to events that may occur during clean-up work at the site.

- f. Foster, Jess G., Greater Hermiston Regional Water Facility Project - grant pre-application, December 4, 1975.

A grant pre-application for federal assistance. This document was developed under guidelines issued by the Northwest Federal Regional Council and addressed to the same agency. This proposed water project was based on long range projections of industrial and municipal demands in the Hermiston, Umatilla, Echo and Stanfield area, and included Umatilla Army Depot water use in its projections. The proposed project consisted of development of water source, large storage reservoir and transmission lines to the several entities.

- g. Futrell-Redford-Saxton Environmental Consulting Engineers, Regional Water System Feasibility Study for the Hermiston Area, no date.

The region of study includes, Hermiston, Stanfield, Echo, Umatilla, McNary, Umatilla Army Depot and Lamb-Weston plus 25,000 acres of agricultural land. This detailed study of groundwater conditions and costs of a regional water system has many supporting figures and tables, and includes an extensive bibliography. Two points of current interest: 1) A Ranney System for water withdrawal was recommended, and 2) Conclusion No. 17 that artificial recharge of groundwater aquifers in the study area is not economically feasible.

- h. Futrell-Redford-Saxton and Wallulis & Assoc., Inc., Regional Water System Feasibility Study for Hermiston-Boardman, Oregon, December, 1974.

This report includes the Futrell-Redford Saxton study plus environmental assessment statement and a Regional water system feasibility study for North Morrow County.

- i. IRZ Consulting & PACAM Engineering, Inc., Feasibility of Irrigation Canal along the Columbia River in Oregon, November, 1992.

Outlines three possible responses for irrigators to the proposed lowering of the John Day pool for salmon recovery. One response the feasibility and potential routes of canals with one or two river pump stations to replace individual irrigator's pump stations is examined at length. Probable costs for each canal scenario are included. Estimates costs for each of the three responses (i.e., canal to serve irrigators, river dredging at each pump station or extending intake pipes farther into the river).

- j. Jones Associates, Inc., Greater Hermiston Regional Water Facility, 1975.

As justification of a request for a \$12,000,000 grant to help finance water supply, storage and transmission lines, this communication, as implied by its title, delineates regional water problems. The region is defined as the cities of Hermiston, Umatilla, Stanfield, Echo, Port of Umatilla, Umatilla Army Depot, and various industrial organizations - unnamed with the exception of Lamb-Weston. The water source proposed is the Columbia River water collected from the shallow alluvial aquifer by Ranney System.

- k. McCall, William B., Groundwater Conditions and Declining Water Levels in the Ordnance Area, Morrow and Umatilla Counties, Oregon Groundwater Report No. 23, October, 1975. State of Oregon Water Resources Department.

Report of groundwater conditions in 1975 in the Ordnance Critical Groundwater area, with a listing of locations of groundwater rights and well data for alluvial and basaltic aquifers.

- l. Norton, Marc A. and Bartholomew, William S., Update of Groundwater Conditions and Declining Water Levels in the Butter Creek Area, Morrow and Umatilla Counties, Oregon Groundwater Report No. 30, October, 1984. State of Oregon, Water Resources Department.

An update of the 1975 report for the Butter Creek area with the records of wells revised and additional water right information, including a list of cancelled water rights.

- m. PACAM Engineering, Inc., Regional Water Supply System, Feasibility and Pre-Engineering Report, January, 1991.

This report assumes the use of Columbia River water and outlines various combinations of municipal, irrigation and industrial uses with estimates of probable costs for each scenario. Includes discussion of a possible entity that would own, operate and maintain the proposed regional system.

- n. RZA AGRA, Inc., John Day (Lake Umatilla) Project, Geotechnical Evaluation of Minimum Pool Mitigation Measures for Wells in the Lake Umatilla Area Oregon and Washington, July 30, 1992.

A report done for the Corps of Engineers on the sensitivity of water wells within the Lake Umatilla area to changes of lake level. Five well "types" were identified based on construction, aquifer and use. Cost estimates are given for mitigation measures for each well type. An estimate of number of wells needing mitigation measures is given for each well type. The wells examined are within a three mile radius of the lake margins.

- o. State of Oregon, Water Resources Dept., Umatilla Basin Report, August, 1988.

This is a support document for planning in the Umatilla Basin - a region defined generally by the John Day and Grande Ronde River Basins on the west, south and east and the Columbia River on the north. Water supply and quality, interstate cooperation on water management, instream needs, out-of-stream use, watershed management with management and policy options for each topic are discussed. A section detailing water systems and problems of each municipality in the region is included. References, tables, appendices, and maps contribute to the document.

- p. Stubbs & Associates, Population & Economic Opportunity Analysis, City of Hermiston. Umatilla River Basin, no date.

This study projects population growth in Oregon and the Umatilla River Basin to the year 2050. Explanations of the assumptions for the figures and their reliability are given. A range of from 17,000 to 56,000 people is projected for the year 2050 in the market area of Hermiston. The internal evidence suggests 1977 as the date this report was prepared.

- q. Sweet-Edwards/EMCON, Inc. (For Wallulis & Assoc., Inc.), City of Hermiston Basalt Aquifer, Groundwater Recharge Project Hydrogeologic Feasibility Report, July, 1989.

Examines hydrogeologic feasibility of injecting water from a shallow aquifer into a deep basalt aquifer for temporary storage, and concludes that the injection of water into the basalt aquifer is feasible from both hydrogeologic and water quality viewpoints and predicts a long-term slowing of decline in water levels through recharge. Includes bibliography.

- r. U.S. Army Corps of Engineers, Walla Walla District, McNary Master Plan, 1982.

The most recent evaluation of the McNary project's resources and needs. This document is the official guide for management decisions on the Corps' McNary lands.

- s. U.S. Army Corps of Engineers, Bonneville Power Administration & Bureau of Reclamation, Columbia River Salmon Flow Measures Options Analysis/EIS, September, 1991.

The purpose of this EIS is to identify and present effects of options for changing in-stream flow levels in the effort to increase salmon populations in the lower Columbia and Snake rivers.

- t. U.S. Army Corps of Engineers, Bonneville Power Administration, National Marine Fisheries Services & Bureau of Reclamation, Interim Columbia and Snake Rivers Flow Improvement Measures for Salmon, Draft Supplemental Environmental Impact Statement, October, 1992.

This document was written because the Council on Environmental Quality guidelines directed Federal agencies to prepare supplements to final environmental statements if 1) there are substantial changes in the project relevant to environmental concerns; 2) there is significant new information relevant to environmental concerns; or 3) the agency determines that the purposes of the National Environmental Policy Act will be furthered by doing so. The authors believe that all three factors apply. This document identifies a preferred plan of action for water management to enhance salmon migration. (Fearing that serving as a cooperating agency might conflict with their ESA responsibilities, the National Marine Fisheries Services withdrew in

February, 1993 from participation in the development of conclusions relative to effects of the proposed actions.)

- u. United States Department of Interior, Bureau of Reclamation, Umatilla Basin Project, Oregon, Planning Report-Final Environmental Statement, Filing date: February 12, 1988.

This report discusses the recommended plan for the proposed Umatilla Basin Project which would provide Columbia River water to some irrigation districts in exchange for their rights to Umatilla River water thus leaving flows for fish restoration in the Umatilla River. This final report includes comments from agency and public review of the Planning Report/Draft Environmental Statement, published July, 1986.

- v. Wallulis & Associates, Inc., Water Study for the City of Hermiston, Oregon, January, 1982.

Focuses on the city of Hermiston's water needs for the next 20 years. This study addresses water sources, distribution and storage, and includes a computer analysis of water pressure on city systems. A 4% annual growth rate was used to predict 30,000 population in year 2010 and 17,000 by 1990. The proposal recommends artificially recharging the underground basalt reservoir as a way to defer going to the Columbia River for water until after the city had expanded its water revenue base and when the city did acquire Columbia River water, provide storage of treated Columbia River water.

- w. Wallulis & Associates, Inc., Engineering Investigation of Regional and Local Water Resources for the City of Hermiston, Oregon, Sept., 1976.

The goal of this study was to analyze potential water sources for short and long-term needs of Hermiston and the Hermiston region. Estimates of costs of development from several sources for Hermiston only, and for the Hermiston region with and without grant assistance are included.

- x. Zwart, Michael J., Groundwater Conditions in the Stage Gulch Area Umatilla County, Oregon, December, 1990. State of Oregon Water Resources Department

Report of existing groundwater conditions in the Stage Gulch Critical Groundwater area, with a listing of groundwater rights and well data for the area.

2. *Miscellaneous Documents*

- a. Letter from Sjtanley G. Wallulis, P.E. to City Manager, Hermiston, Oregon.

Date: 02-16-89

Subject: Interim Project Report on the artificial recharge demonstration project and the related applications for water right permits.

- b. Public Facilities Plan, City of Hermiston, Oregon

Date: 1990

Subject: Inventory and general assessment of city streets, water, wastewater and storm water.

- c. Water System Flow Test 9/7/89

With View Drive Booster Station Flow Demand On System

By: J. R. Woodward

Subject: Well statistics plus monthly totals of water pumped for years 1984 - 1989.

- d. Unpublished information from the Port of Umatilla, 1992.

Subject: Technical specifications for test holes and well logs for the test holes. Includes specifications and a well log for the pumping well. Also, includes part of the groundwater supply feasibility study done in conjunction with the Port of Umatilla's development of its 155 cfs groundwater permit from Oregon Department of Water Resources.

e. PACAM Engineering, Inc., June/July, 1992

This document was prepared at the request of the Port of Umatilla. It estimates the probable costs for a proposed potable water system that would provide water to Lamb-Weston, Simplot and the cities of Hermiston, Stanfield and Echo. There are two estimates given depending on the water source (i.e., the Columbia River or four shallow wells).

H. PROFESSOR JAMES CORNELIUS REFERENCES

Burns, Joe, Hermiston Development Corp. March 30, 1993. Telephone Interview.

Grow, Byron, Port of Umatilla. March 23, 1993. Personal Interview.

Ladd, Michael, Oregon Water Resources Department. March 22, 1993. Personal interview.

Neil, Gary, Port of Morrow. March 26, 1993. Telephone Interview.

Oregon Employment Division. 1992. 1991 Oregon Covered Employment and Payrolls by Industry & County. State of Oregon, Salem.

Oregon State University Extension Service. 1991. Enterprise Budget: Alfalfa, North Central Region. EM 8451, Oregon State University, Corvallis.

Oregon State University Extension Service. 1991. Enterprise Budget: Carrots, North Central Region. EM 8549, Oregon State University, Corvallis.

Oregon State University Extension Service. 1991. Enterprise Budget: Corn, Irrigated, North Central Region. EM 8458, Oregon State University, Corvallis.

Oregon State University Extension Service. 1991. Enterprise Budget: Cow-Calf, North Central Region. EM 8471, Oregon State University, Corvallis.

Oregon State University Extension Service. 1991. Enterprise Budget: Peas, Green, Irrigated, North Central Region. EM 8455, Oregon State University, Corvallis.

- Oregon State University Extension Service. 1991. Enterprise Budget: Popcorn, Irrigated, North Central Region. EM 8457, Oregon State University, Corvallis.
- Oregon State University Extension Service. 1991. Enterprise Budget: Potatoes, North Central Region. EM 8460, Oregon State University, Corvallis.
- Oregon State University Extension Service. 1991. Enterprise Budget: Tall Fescue Seed, North Central Region. EM 8453, Oregon State University, Corvallis.
- Oregon State University Extension Service. 1991. Enterprise Budget: Wheat, Irrigated, North Central Region. EM 8456, Oregon State University, Corvallis.
- Oregon State University Extension Service. 1993. 1992 Oregon County and State Agricultural Estimates. Special Report 790. Oregon State University, Corvallis.
- Sweet, Michael, Civilian Executive Assistant, Umatilla Army Depot. March 22, 1993, Personal Interview.
- U. S. Department of Commerce, Bureau of Economic Analysis. 1993. Personal Income by Major Source and Earnings by Industry for Counties and Metropolitan Areas; Oregon, 1985 - 1990. Regional Economic Information System.
- United States Army. 1992. Real Property Utilization Survey: Umatilla Depot Activity. Facilities Engineering Division, Tooele Army Depot, Tooele, Utah.

I. PLANNING AND ENVIRONMENTAL REFERENCES

- Soil Survey of Morrow County Area, Oregon. United States Department of Agriculture. Soil Conservation Service, December, 1983.
- Soil Survey of Umatilla County Area, Oregon. United States Department of Agriculture. Soil Conservation Service, January 1989.
- Natural Resources Management Plan for the Umatilla Army Depot Activity, Hermiston, Oregon. Prepared by Morrow SWCD, March 1988.

Range Inventory for Umatilla Army Depot. USDA, Soil Conservation Service. November, 1991

Qualitative Bird Survey. Oregon Department of Fish and Wildlife. May 1991.

Final EIS: Base Alignment and Closure, 4 Bases Compared - Arizona, Nevada, Utah, Oregon. Umatilla Depot Activity. U.S. Army Corps of Engineers, August 1991.

Real Property Utilization Survey. Tooele Army Depot, Umatilla Army Depot Activity. Facilities Engineering Division, Engineering Branch, Tooele, Utah, April 1992.

Master Plan Report, Umatilla Depot Activity, Oregon. Prepared for Tooele Army Depot. U.S. Army Corps of Engineers, Walla Walla District, Engineering Division, September 1987.

Draft ES, Interstate 82/182, Prosser, WA to Int. 80N in Oregon. Oregon State Highway Division, 1972.

Morrow County Comprehensive Plan.

Umatilla County Comprehensive Plan.