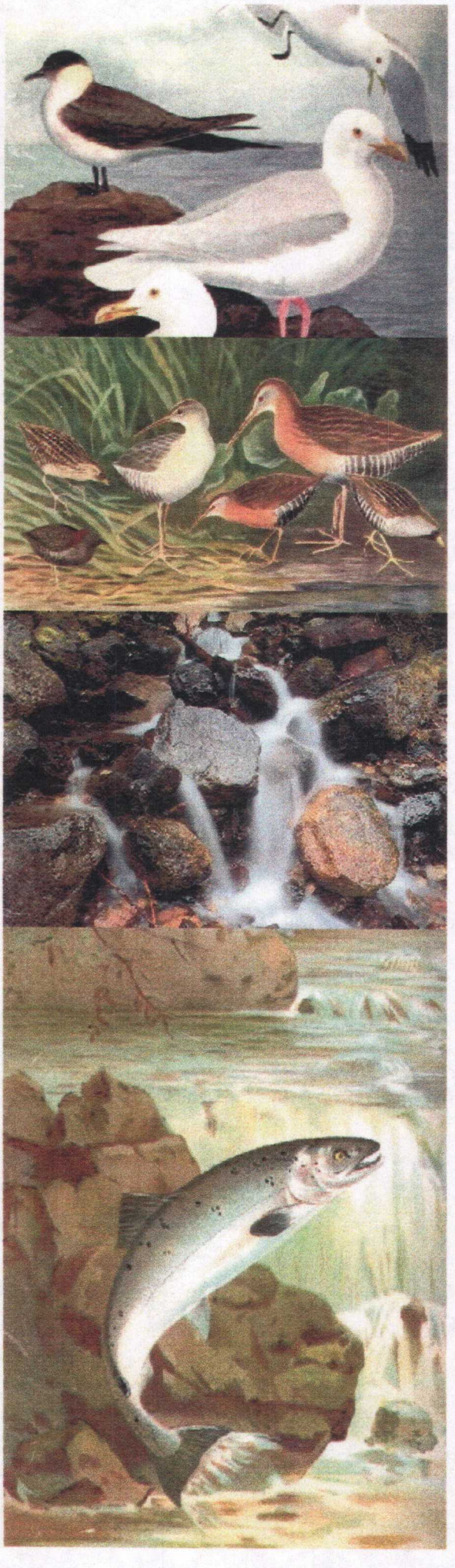

Harney-Malheur Lakes Sub-Basin Assessment

Harney County Watershed Council
450 N. Buena Vista
Burns, OR 97720
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June 2001

This project was funded in part by the
Oregon Watershed Enhancement Board

Produced by
David Vickstrom and
Lynn A. Sirrine

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SECTION ONE

INTRODUCTION

The purpose of this document is to provide a basis for future watershed management plans. The Harney-Malheur Lakes Sub-basin Assessment will serve as a planning tool for the Harney Watershed Council (HCWC) and others.

This assessment was developed as an agreed upon action with the Oregon Watershed Enhancement Board (OWEB) as outlined in a grant to the HCWC.

The Council enjoys the active involvement of the following entities: private landowners, Oregon Water Resources Department, Harney County Court, USDI Bureau of Land Management, Burns Paiute Tribe, OWEB, USDA Forest Service, Izaak Walton League, Malheur National Wildlife Refuge, Oregon Department of Environmental Quality, U.S. Fish and Wildlife Service, USDA Farm Service Agency, Oregon Department of Fish and Wildlife, Harney Soil and Water Conservation District, Oregon State University, USDA Natural Resources Conservation Service, USDA Agriculture Research Service and the Malheur Lake Basin Working Group.

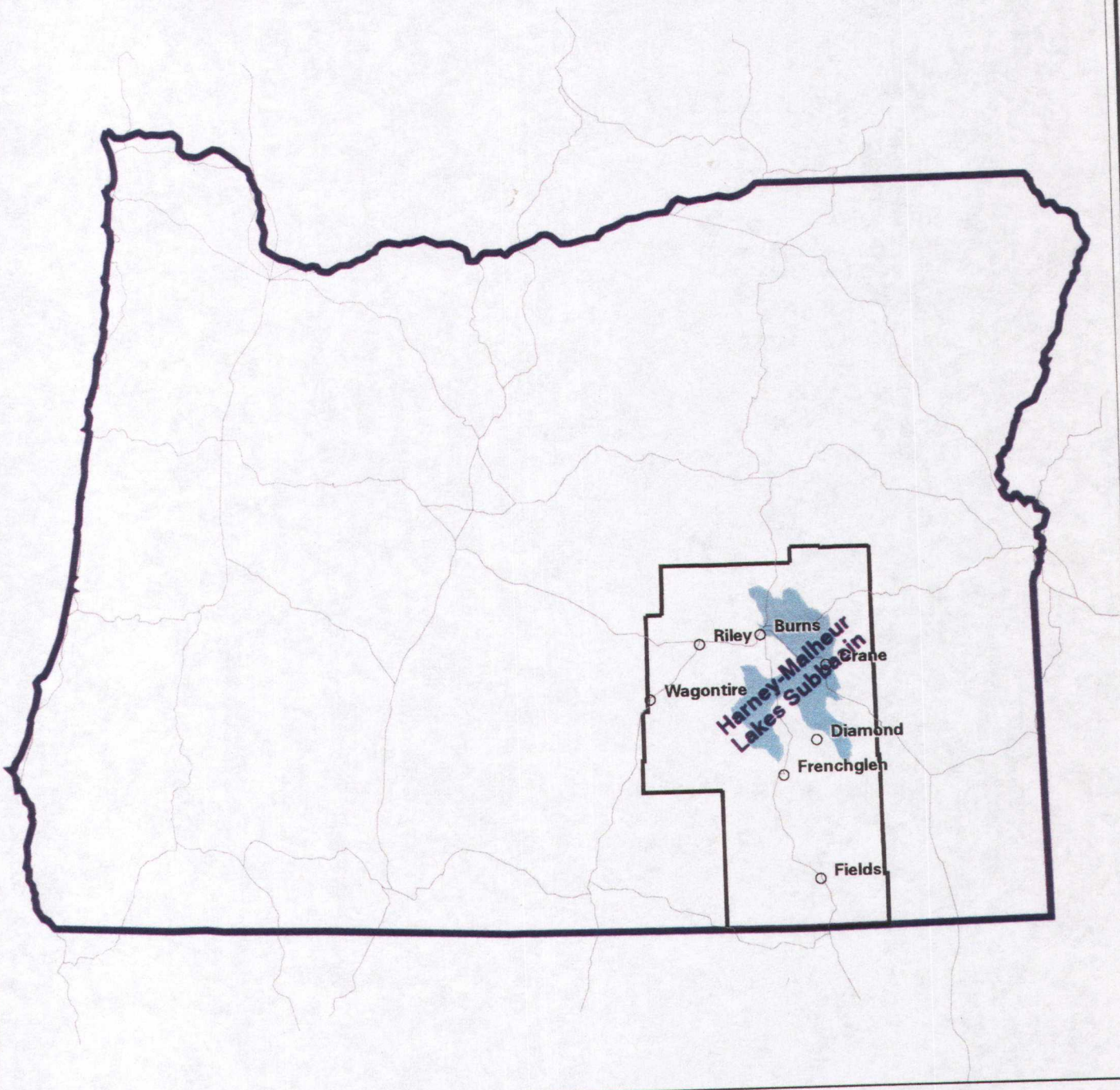
The purpose of the Harney County Watershed Council is to address issues and concerns about watershed health in Harney County and to promote existing good and beneficial conditions. The Council will provide a framework for education, coordination, and cooperation among all interested parties for the development and implementation of watershed action plans beneficial to the people and the environment.

The Council recognizes that local economic and ecological prosperity is dependant upon the current and future availability and quality of water; therefore, the Harney County Watershed Council is committed to this three-part goal:

1. Determine the health of individual watersheds or watershed segments.
2. Retain the health of high quality watersheds.
3. Restore and enhance those watersheds, or portions thereof, that can be improved.

SUB-BASIN DESCRIPTION

The Harney-Malheur Lakes Sub-basin is located in north central Harney County, Oregon (Map 1). The sub-basin is 894,061 acres in size and stretches to approximately 65 miles long and 40 miles across at the widest portion in the Harney-Malheur Lakes area. Harney-Malheur Lakes Sub-basin (4^{th} field USGS Hydrologic Unit Code) is contained in the Malheur Lake Basin (3^{rd} field HUC) and is designated by (HUC) #17120001. This sub-basin is comprised of 12 watersheds (5^{th} field HUC) as #1712000101 -- #1712000112. (Bureau of Land Management Ecological Site Index), Map 2.



MAP #1
HARNEY-MALHEUR LAKES SUBBASIN
VICINITY MAP

HARNEY COUNTY GIS
In cooperation with
The Bureau of Land Management
Burns District Office; Burns, Oregon

Scale: 1 inch = 56.8 miles

Date: 20-MAR-2001, Pam Keller, vicinity11x8.aml/harmalvic.ps

MAP #2 - HARNEY-MALHEUR LAKES SUBBASIN - HYDROLOGIC UNITS LEVEL FIVE

Harney-Malheur Lakes Subbasin (HUC 4): 17120001

Watersheds (HUC 5): 01,02,03,04,05,06 07,08,09,10,11,12

0 1 2 3 4 5 6 MILES

Scale: 1 inch = 5.6 miles

Note: No warranty is made by Harney County or the Bureau of Land Management as to the accuracy, reliability or completeness of these data for individual or aggregate use with other data. Original data was compiled from various sources. This information may not meet National Map Accuracy Standards. This product was developed through digital means and may be updated without notification.

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Date: 21-MAR-2001, Pam Keller, subbasin11x17.aml/harmalhuc5.ps

OWNERSHIP (Map #3)	ACRES	% OF TOTAL ACREAGE
Private Lands	364,496	40.8%
Public Lands Managed by:		
U.S. Bureau of Land Management	357,987	40.0%
U.S. Fish and Wildlife Service	101,555	11.4%
USDA Forest Service	47,429	5.3%
State of Oregon	11,961	1.3%
Indian Lands	10,633	1.2%

MAP #3 - HARNEY-MALHEUR LAKES SUBBASIN - BASE MAP

HARNEY-MALHEUR LAKES

Burns
Hines
Buchanan
Drewse
Lawen
Crane
New Princeton
Voltage
Diamond
Frenchglen

Private Lands - 364,496 acres
BLM Lands - 357,987 acres
State Lands - 11,961 acres
Indian Lands - 10,633 acres
USFS Lands - 47,429 acres
USFWS Lands - 101,555 acres

Total Subbasin Acres: 894,061

Subbasin Boundary
Major Roads
Perennial Streams
Intermittent Streams

Total Stream Miles in Subbasin: 1162.8
Total Perennial Miles: 177.5

0 1 2 3 4 5 6 MILES
Scale: 1 inch = 5.6 miles

Note: No warranty is made by Harney County or the Bureau of Land Management as to the accuracy, reliability or completeness of these data for individual or aggregate use with other data. Original data was compiled from various sources. This information may not meet National Map Accuracy Standards. This product was developed through digital means and may be updated without notification.

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Date: 21-MAR-2001, Pam Keller, subbasin11x17.aml/harmalbase.ps

SECTION TWO

HISTORY OF THE HARNEY-MALHEUR LAKES SUB-BASIN

The Harney-Malheur Lakes Sub-basin was originally home to the Northern Paiute Indian Tribe. Their homeland encompassed portions of southeastern Oregon, northern Nevada, southwestern Idaho and northeastern California. (USDA and USDI, 1997.) The Paiute people moved through and lived in areas on a seasonal basis, hunting and gathering. It is generally believed they occupied this area from approximately 10,000 years ago until approximately 1872. At that time, they were placed on the Malheur Indian Reservation, which was 1.8 million acres in size. In 1878 the Malheur Indian Reservation was terminated. The land was made public domain and the Northern Paiutes were sent to Fort Simcoe, Washington and then to a reservation in Yakima, Washington. In 1972 the United States Government transferred 762 acres approximately 2 miles northwest of Burns to the Paiute tribe, which is now the Burns Paiute Indian Reservation. (Maupin, 2000.)

The first Europeans with whom the Paiutes had contact were trappers who explored the area looking for beaver in the 1820's, 30's and 40's. Settlers first moved into what is now Harney County as early as 1862. As people settled in eastern Oregon, the U. S. Army opened a number of military camps to provide protection from Indian attacks. Camp Harney, often called Fort Harney, was established in 1866 on Rattlesnake Creek in the foothills on the northern edge of the valley. The site was first called Camp Steele, but was renamed for General William S. Harney in 1867. Later the valley and future county would also be known as "Harney."

Many small communities were established and thrived throughout Harney County from the 1870's and 1880's to the 1920's after World War I. Most were established to accommodate homesteaders and farmer growing alfalfa, malting barley, wheat and other produce. Many of the settlers were dry-land farmers and when periods of drought came and crops failed, most left after enduring years of hardship.

Crane is the only town within the assessment area. It was at its peak from 1916-1924 when it served as the railhead for the Union Pacific Railroad where cattle and sheep were loaded and shipped to market. Crane is noted as having the only public union boarding high school in the nation. Children of ranch families living in the various areas of large Harney County are boarded and taught during the week and go home on weekends.

Other small settlements with little or no evidence of existing as once thriving communities are Harney City, Lawen, Harriman, Buchanan, Princeton, Diamond, Voltage and the Narrows. Harney or Harney City was once established where Rattlesnake Creek entered Harney Valley and had a population between 200-300 people in 1909. Diamond, established in the early 1870's was once a center for ranchers and sheepmen to purchase merchandise and outfit their operations each year. Now there is only the Diamond Hotel (a bed and breakfast and Post Office), a couple residences and an elementary school.

SECTION TWO

By the 1880's, the cattle industry had expanded rapidly throughout large areas of Southeastern Oregon. However, a succession of severe winters decimated the herds. Later, sheepherders, many of them Irish or Basque, drove huge flocks of sheep over the range lands, at times in conflict with the cattlemen. (Hatten, 1988.)

On August 18, 1908, by order of President Theodore Roosevelt, all lands within the meander lines of Malheur, Harney and Mud Lakes became a designated federal bird refuge: The Lake Malheur Reservation. Naturalists studying and photographing the wildlife of the area drew attention to the importance of Malheur Lake as a breeding and resting ground for migratory waterfowl and other birds.

In 1935 the Eastern Oregon Livestock Company sold its holdings of 63,000 acres in Blitzen Valley to the U.S. Government to be added to the Malheur National Wildlife Refuge. The refuge headquarters was built near Sod House Springs with labor provided by the Civilian Conservation Corps (CCC).

For over a quarter of a century following the creation of the reservation in 1918, little was accomplished other than attempts to protect the wildlife from hunters killing birds for their feathers or food. During that period, there were proposals by local farmers to drain Malheur Lake into Harney Lake and/or the South Fork of the Malheur River.

As it turned out, nature took care of the drainage of the Harney Basin lakes. The dry period began in 1908, when diminished snow pack in the mountains resulted in shrinking volume of waters in the Harney Basin lakes. Old-timers recalled the year 1889, when Malheur Lake went dry except for water from a spring near the Sod House Ranch. There have been several indications that the lake bed has been dry previously. At that time, sagebrush stumps were visible all over the dry lake bed. Drilling of the lake bed in September 1934 brought up a section of a willow tree from 50 feet, evidence that the lake bed was once at a level well below that of 1934. (Hatten, 1988.)

In the spring of 1934, with the lake dry, farmers seeded several thousand acres of the lake bed with grain. In order to protect their crops from thousands of roaming cattle, farmers fenced and patrolled 4,500 acres of grain.

Once again, nature rendered a verdict as to the lake's ownership. Heavy rains in June of 1934 caused a rapid inflow of water from the Blitzen River into Malheur Lake and threatened grain stacks. In late August 1935, heavy rains caused waters to flow in large amounts into Malheur Lake once again, and within weeks birds were returning to the refuge.

Beginning in 1981, the climate changed again. In the next three years, precipitation increased as considerable snows accumulated in the mountains. Spring runoff down the Silvies River and Silver Creek brought snowmelt waters southward from the Blue Mountains. The Blitzen River, flowing northward from Steens Mountain, did likewise. With an enclosed basin and low summer evaporation rates, the water levels of the Harney County lakes steadily rose each spring.

By 1985, Malheur Lake had expanded to 89,000 acres. Normally dry Harney Lake to the west had 20 feet of water in its lake basin. Tiny Mud Lake, sandwiched between the two big lakes just west of what is called The Narrows, contained four feet of water. Altogether, the three lakes covered 170,000 acres—265 square miles, perhaps the largest extent in 150 years.

The impact of the flood on individual ranches and on the Harney County economy was devastating. Ranchers first diked against the rising waters in the hope that the flood would peak before damaging their homes. One by one the ranches yielded to the inevitable. By 1985, 30 ranchers had been flooded out, their livelihoods, their lands, and in many instances, their homes gone.

In sum, the Harney Basin lakes have advanced and receded and, in the case of Harney and Mud Lakes, temporarily disappeared entirely.

CLIMATE

Harney Valley has a semiarid winter-rainfall type of climate with generally mild summers, cold winters and an annual total average precipitation of around 10.5 inches . Daily minimum temperatures are about 35 degrees less than daily maximums in July and August and 20 degrees less than daily maximums during the winter. Summer rainfall during the growing season is very minimal at the time of lowest humidity. These climatic factors combine to produce a cold, desert, plant community (Upper Sonoran) in the non-irrigated portions of the uplands and contribute to the problems of alkalinity and salt deposits in the marshlands during the summer high-evaporation period.

Most of the precipitation occurs in the form of winter snowfall while summer thunderstorms, sometimes accompanied by strong winds and hail, provide most of the remainder. The average annual precipitation recorded at Burns Airport is 11.02 inches with an average annual snowfall of 35.5 inches. The average annual precipitation recorded at Refuge headquarters is 10.04 inches with an average annual snowfall of 25.00 inches.

There are two climatological stations in the sub-basin, one at Burns Airport at an elevation of 4,140 feet and the other at Malheur Refuge headquarters at an elevation of 4,110 feet (See Tables 1 and 2 on pages 10 and 11). The average maximum monthly temperatures range from 34.3° F in December to 84.4° F in July at the airport and 37.6° F in December and 84.7° F in July at the refuge headquarters. The average minimum temperatures range from 13.4° F in December and 46.8° F in July at the airport and 17.7° F in December and 49.2° F in July at the Refuge Headquarters .

The highest temperature recorded at Burns airport was 102° F in August, 1990 and the lowest -28° F in February, 1992. The highest temperature recorded at Refuge Headquarters was 104° F in August, 1961, and the lowest was -33° F in January, 1992. The date for the last killing frost in spring can range from May 29 to June 14 and the first

in autumn may occur from about August 26 to September 17 to provide a frost-free growing season of 72-100 days, depending on elevation. Regardless, below-freezing temperatures and frost have been recorded each month of the year. Harney Valley is a high risk farming area due to these conditions. Crops that can be grown are limited to hay and hardy cereals.

Table #1, Burns, OR Monthly Climate and Precipitation Averages

BURNS WSO AP, OREGON (351175)

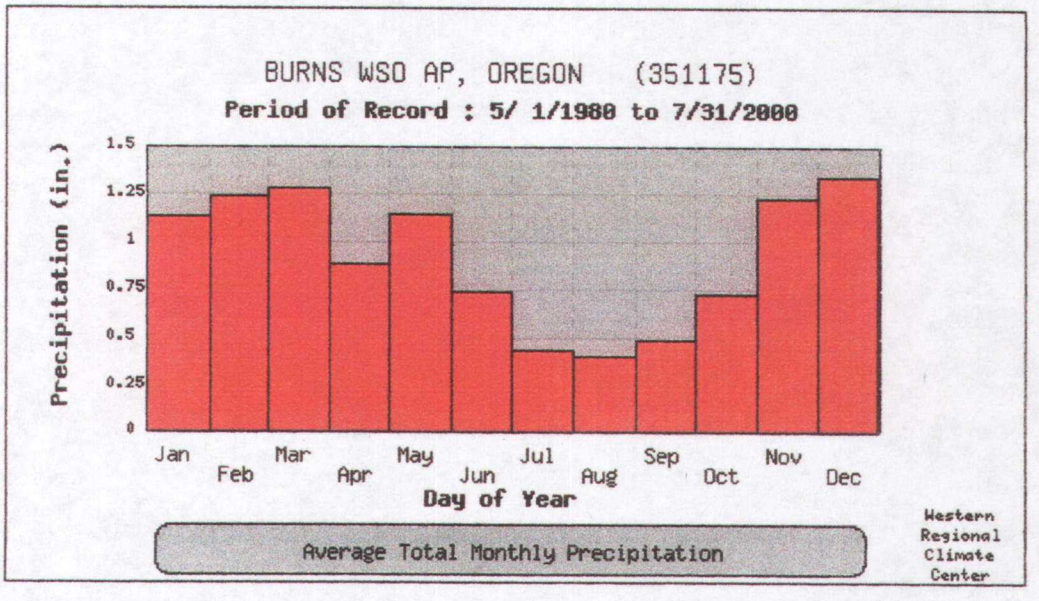
Period of Record Monthly Climate Summary
Period of Record : 5/ 1/1980 to 7/31/2000

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	35.1	39.5	49.3	57.2	65.5	74.1	84.4	84.1	74.8	61.6	44.6	34.3	58.7
Average Min. Temperature (F)	14.7	18.5	25.6	29.7	36.6	41.6	46.8	44.7	36.5	27.3	21.8	13.9	29.8
Average Total Precipitation (in.)	1.13	1.21	1.27	0.87	1.18	0.77	0.40	0.40	0.48	0.72	1.23	1.35	11.02
Average Total SnowFall (in.)	7.0	6.7	3.8	0.7	0.2	0.0	0.0	0.0	0.0	0.7	6.1	10.2	35.5
Average Snow Depth (in.)	4	4	1	0	0	0	0	0	0	0	0	2	1

Percent of possible observations for period of record. Max. Temp.: 96.5% Min. Temp.: 96.4% Precipitation: 96.5% Snowfall: 73.3% Snow Depth: 81.8%

Western Regional Climate Center, wrcc@dri.edu

BURNS WSO AP, OREGON
POR - Monthly Average Total Precipitation



- Average precipitation recorded for the month.

Table #2, Voltage, OR Monthly Climate and Precipitation Averages

VOLTAGE 2 NW, OREGON (355162)

Period of Record Monthly Climate Summary

Period of Record : 4/ 1/1959 to 7/31/2000

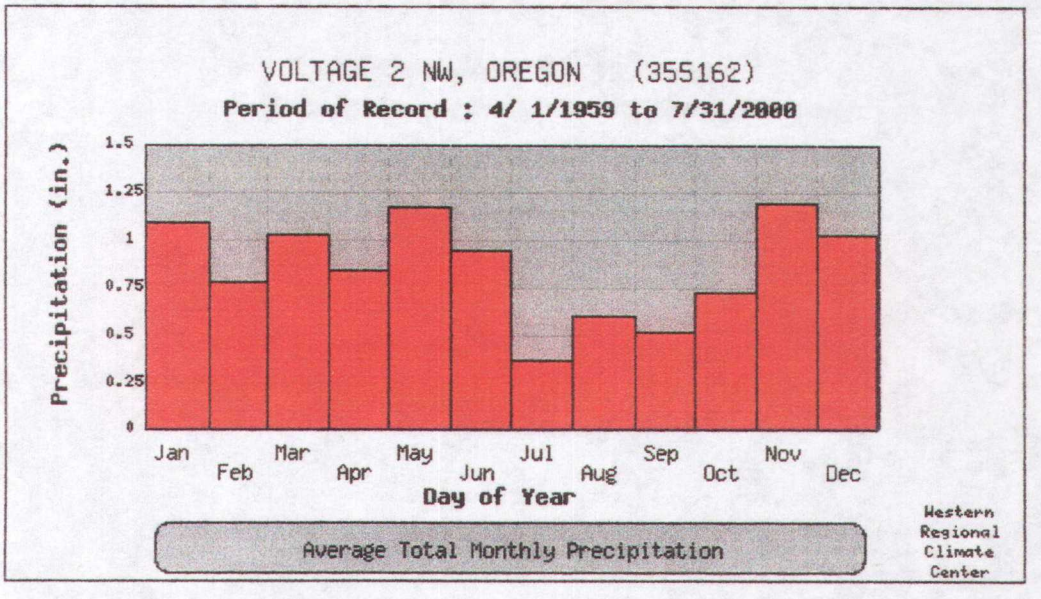
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	37.9	44.2	50.6	58.7	67.4	75.2	84.7	83.1	74.9	63.1	47.2	37.6	60.4
Average Min. Temperature (F)	18.2	22.8	26.0	30.3	37.8	44.5	49.2	47.0	38.8	30.1	24.4	17.7	32.2
Average Total Precipitation (in.)	1.06	0.70	0.99	0.80	1.15	0.90	0.38	0.60	0.51	0.72	1.17	1.04	10.04
Average Total SnowFall (in.)	6.7	3.6	2.8	1.2	0.3	0.0	0.0	0.0	0.0	0.1	2.7	7.6	25.0
Average Snow Depth (in.)	2	1	0	0	0	0	0	0	0	0	0	1	0

Percent of possible observations for period of record. Max. Temp.: 90.9% Min. Temp.: 90.6% Precipitation: 94.8% Snowfall: 94.7% Snow Depth: 92.6%

Western Regional Climate Center, wrcc@dri.edu

VOLTAGE 2 NW, OREGON

POR - Monthly Average Total Precipitation



- Average precipitation recorded for the month.

SECTION TWO

GEOLOGY

Harney Valley is both a structural and erosional valley and lies within the High Lava Plains Physiographic Province (Orr, Orr and Baldwin, 1992). The eastern edge, along most of its margin, is marked by a north-trending fault that uplifted the Crow Camp Hills. Faulting is also responsible for offsetting the east valley wall about three miles south of Buchanan. The uplands just north of the valley have few faults but consist of a broad rock strata dipping gently southward.

Erosion has produced a distinct topographic break between the valley floor and Wright's Point, Dog Mountain and the adjoining upland area. Wright's Point is an excellent example of inverted topography; a lava-filled valley with a creek bed left behind as a linear ridge, then the unprotected softer rocks were eroded away from each side of the former valley. The unconsolidated valley has been filled to a maximum thickness of 250 feet, predominately clay of lacustrine or lake origin, containing lenticular (double convex) beds of sand and gravel varying greatly in thickness. These are located mainly along the alluvial fans and the valley extensions of stream courses flowing into the valley from the north. The deeper gravel layers and permeable zones in the underlying volcanic and sedimentary rock produce a confined aquifer system containing several water-bearing layers separated by non-water-bearing interbeds of clay and tuff.

Tertiary rocks classified as volcanic and volcanic-derived sedimentary rock form the hills around the valley and extend beneath it. The oldest rocks exposed in Harney Valley are the sequence of rhyodacite, andesite, and basalt flows that form the western part of Crow Camp Hills and are the eastern valley wall. Volcanic, pyroclastic, and sedimentary rock form the bedrock hills north, northwest, and west of the valley and extend beneath the unconsolidated valley fill.

Three distinct welded-tuff units laid down during the Pliocene (5-10 million years ago) are interbedded with pyroclastic and volcanic-derived sedimentary rock. These rocks have the capacity to transmit large volumes of water and much of the recharge for the main aquifers beneath the valley originates in the hills to the north and moves through them. The lowest of the three is exposed along Devine Canyon and the Silvies River a few miles north of Harney Valley, and dips southward beneath overlying sedimentary rock. The two younger welded-tuffs cap canyon walls and uplands along the north side of the valley.

The local source vents that produced ash flow tuffs are located in the vicinity of Harney and Malheur Lakes, and Burns. Evacuation of the ash flow magma caused the magma chamber to collapse and form low areas with Harney Valley becoming a southward dipping bowl.

Harney Valley is a circular, sub-volcanic sink with deep, curved, ring-fracture systems located around the perimeter of the valley. This ring-fracture system has been buried by alluvium over time. These faults are stair-stepped, being near the surface at the valley perimeter and at continuing, deeper levels toward the center of the valley. Volcanic action near the valley, as well as long distances from area, have contributed to

deposits of wind-carried ash which landed on the surface of ancient lakes and formed layers within the lake bed sediments. This lacustrine overlay of ash deposits locally covers older, cinder deposits.

HYDROLOGY

The Harney-Malheur Lakes Sub-basin covers an area of approximately 1,400 square miles. The ground water system receives recharge from the adjacent uplands where the bedrock is faulted and broken, and also from seepage of streams draining adjacent uplands. Although Silver Creek, the Silvies River and the Donner und Blitzen River do not originate within the sub-basin, all eventually discharge into Harney or Malheur Lakes.

During prehistoric times the basin was drained by the Malheur River and exited the valley through an outlet near Princeton. This outlet was blocked by a Pleistocene lava flow. The last time water flowed from Malheur Lake through Virginia Valley occurred 32,000 to 38,000 years ago (Malheur Lake Flood Damage Reduction Study, U. S. Army Corp. of Engineers, 1987). An ancient lake once filled Harney and Blitzen Valleys over 200 feet above the current levels, as can be seen by the multi-leveled wave cut terraces and various geomorphic features.

As is characteristic of closed basins, the level of Malheur Lake can widely fluctuate with climatic conditions. Tree rings of stumps found at the bottom of Malheur Lake show climatic conditions varied widely, with the years 1790-1792, 1802-1835 and 1907-1913 being exceptionally wet. In the periods 1842-1849 and 1918-1934, Malheur and Harney Lakes were almost dry.

The peak water level fluctuated within a band of four feet from 1903 to 1982, but beginning in 1982 the lake level started to rise and expanded to include Mud Lake and Harney Lake. The year before (1981) the Burns weather station had recorded 16.77 inches of precipitation (154 percent of normal) and Malheur Lake started to rise.

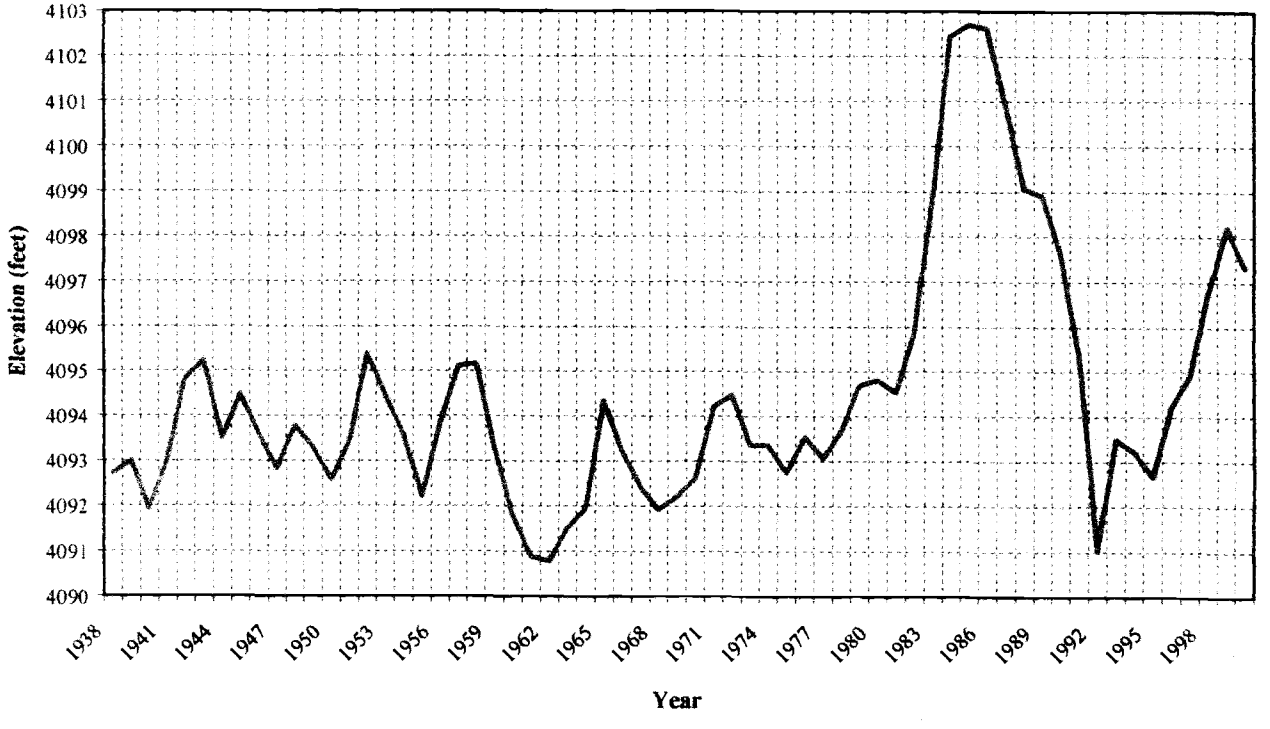
SECTION TWO

This is the Larry Dunn Ranch at Mud Lake on October 17, 1983. The water has receded about 12 inches from the high level reached in July, 1983. The Dunn Ranch headquarters since the early 1900's is located just east of The Sand Reef which separates Harney Lake from Mud Lake area west of The Narrows and Malheur Lake. Photo by Pauline Braymen.

The lake level reached 4,102.68 feet by 1985, a deviation of approximately 7.5 feet above the normal range *(see Graph #1 and Table #3)*. At this level, and since Malheur Lake is so shallow, each one-foot rise in water level equals between 8,000-9,000 additional water-covered surface acres *(see Table #4)*. The high water level almost reached the surface level elevation of 4,115, the point at which the lake would start draining through the prehistoric outlet near Princeton. Map 4 shows the extreme difference between the surface areas of Harney, Mud and Malheur Lakes in a dry, low water year (1962) and a wet, high water year (1985). *Note that the computer-generated map using elevation points has created a distortion of the outermost maximum 1985 waterline and the lakes' surface areas were not quite as large as shown.*

GRAPH #1

Malheur Lake
Peak Annual Elevation
1938-2000



MAP #4 - HARNEY-MALHEUR LAKES SUBBASIN- LAKE LEVELS

HARNEY-MALHEUR LAKES

Maximum Level, 4103 feet, 1985.
Contour from 10 meter DEM.

Level 4097 feet.
Contour from USGS topo map and Bill Beal.

(Minimum level, 4091 feet, 1962 not shown.)

Subbasin Boundary
Major Roads
Perennial Streams
Intermittent Streams

0 1 2 3 4 5 6 MILES

Scale: 1 inch = 5.6 miles

Note: No warranty is made by Harney County or the Bureau of Land Management as to the accuracy, reliability or completeness of these data for individual or aggregate use with other data. Original data was compiled from various sources. This information may not meet National Map Accuracy Standards. This product was developed through digital means and may be updated without notification.

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The Bureau of Land Management
Burns District Office; Burns, Oregon

Date: 30-APR-2001, Pam Keller, subbasin11x17.aml/harmalelev.ps

Table #3: Malheur Lake Peak Annual Elevations. Surface acreages are interpolated estimates from a U.S. Fish & Wildlife Service report, NEC-86/20 dated September, 1986.

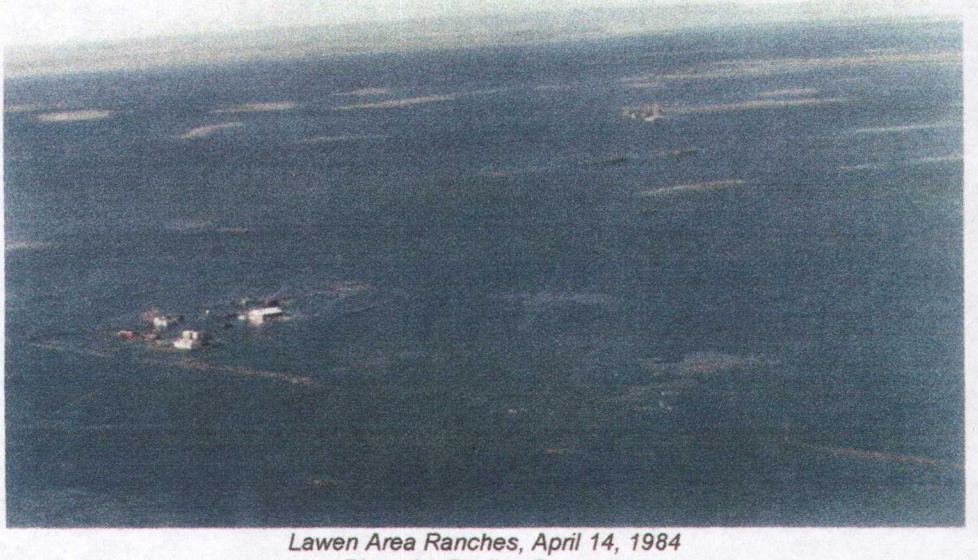
Year	Peak Elevation	Surface Acreage
1938	4092.70	31,780
1939	4093.00	34,600
1940	4091.92	24,304
1941	4093.02	34,788
1942	4094.81	51,695
1943	4095.24	55,756
1944	4093.50	39,300
1945	4094.48	48,560
1946	4093.60	40,240
1947	4092.80	32,720
1948	4093.77	41,838
1949	4093.30	37,420
1950	4092.56	30,464
1951	4093.42	38,548
1952	4095.39	57,166
1953	4094.44	48,180
1954	4093.57	39,958
1955	4092.20	27,080
1956	4093.84	42,496
1957	4095.12	54,628
1958	4095.16	55,004
1959	4093.30	37,420
1960	4091.82	23,184
1961	4090.88	12,800
1962	4090.78	11,800
1963	4091.50	19,600
1964	4091.92	24,304
1965	4094.34	47,230
1966	4093.20	36,480
1967	4092.40	28,960
1968	4091.90	24,080
1969	4092.20	27,080
1970	4092.60	30,840
1971	4094.20	45,900
1972	4094.47	48,465
1973	4093.34	37,796
1974	4093.36	37,984
1975	4092.73	32,062
1976	4093.54	39,676
1977	4093.06	35,164
1978	4093.68	40,992
1979	4094.68	50,460
1980	4094.80	51,600
1981	4094.52	48,940
1982	4095.85	61,490
1983	4098.80	88,860

1984	4102.42	122,360
1985	4102.68	124,440
1986	4102.60	123,800
1987	4100.94	109,400
1988	4099.06	91,352
1989	4098.90	89.830
1990	4097.60	77,660
1991	4095.38	57,072
1992	4091.00	14,000
1993	4093.50	39,300
1994	4093.20	36,480
1995	4092.65	31,310
1996	4094.20	45,900
1997	4094.90	52,550
1998	4096.75	70,100
1999	4098.22	83,234
2000	4097.32	75,252

Table #4: Elevation/Volume/Surface Area Table for Malheur Lake and Harney-Mud Lakes.

Elevation	Malheur Lake		Harney-Mud Lakes	
(Ft. msl)	Volume (Acre-Ft)	Surface Area Acres	Volume (Acre-Ft)	Surface Area (Acres)
4,080	0	0	0	0
4,085	0	0	17,700	16,000
4,088	0	0	55,147	19,900
4,089	6,238	2,000	72,184	21,600
4,090	12,500	4,000	91,523	22,200
4,091	43,700	14,000	113,113	23,000
4,092	78,600	25,200	136,954	25,000
4,093	108,376	34,600	163,096	27,300
4,094	147,582	44,000	191,538	29,600
4,095	196,255	53,500	222,281	31,900
4,096	254,391	62,900	255,324	34,200
4,097	322,035	72,500	290,668	36,500
4,098	398,794	81,100	328,361	38,900
4,099	484,699	90,800	368,406	41,200
4,100	580,062	100,000	410,751	43,500
4,101	685,022	110,000	455,396	45,800
4,102	799,493	119,000	502,341	48,100
4,103	922,471	127,000	551,338	49,900
4,104	1,053,451	135,000	601,937	51,300
4,105	1,191,936	142,000	653,985	52,800
4,110	1,990,867	178,000	935,977	60,000
4,115	2,975,805	216,000	1,257,218	68,500
4,119	3,900,262	247,000	1,544,811	75,300

The combined three lakes covered approximately 172,000 acres (279 square miles) as compared to 67,000 at the 4,093 foot elevation during this high water period, probably the largest surface area attained in the last 150 years.



Lawen Area Ranches, April 14, 1984
Photo by Pauline Braymen

Many roads, agricultural operations and utilities were damaged and disrupted. Sections of State Highway 205 south of Burns to Frenchglen, and State Highway 78 between Burns and Crane, were under water (Hatton, 1988). State Highway 205 had to be raised twice to be above the high water and the damaging wave action. Power poles were sheared off by the movement of ice during spring break-up.

Prior to a study conducted by the U. S. Geological Survey in 1975, investigations suggested that the Silvies River contributed most of the inflow to Malheur Lake, however the 1975 study showed that the Donner und Blitzen River is also a major contributor. Because of the amount of water diverted for irrigation from the Silvies, only about 32 percent of the long-term average annual flow reached the lake over a 36-year period (1939-1974).

The snowmelt on Steens Mountain provides water for the Donner und Blitzen River, the major source of water for Malheur Lake. Water is diverted for irrigation and habitat maintenance of Malheur Refuge. During the same 36-year period (1939-1974), about 45 percent of the long-term average annual flow reached the lake.

The remainder of the average inflow into Malheur Lake can be contributed to rainfall (16 percent) and springs, mainly Sod House Spring (six percent).

The other streams flowing into the sub-basin are noted by the following specific areas for clarity in reference to aquifers:

Northern Valley Front (Harney Valley):
The streams flowing south off the Malheur Forest go underground and disappear around mid-June due to irrigation of meadows and natural stream processes. The streams along the valley front are reduced to minimum flow by August 20. They typically disappear from the surface anywhere from two and one-half miles to four miles (Rattlesnake and Cow Creeks) below the Forest Service boundary. Rock Creek flows to Corcoran Reservoir and is at minimal flow from that point during summer irrigation.

The streams (Poison, Devine, Prater, Soldier, Mill, Coffeepot, Rattlesnake, Cow and Rock Creeks) flowing out of the canyons into the valley contribute water to buried channels of ancient alluvium to form linear aquifers. These linear aquifers do not form a straight line, but are serpentine as they wind downward toward the lower valley elevation. The aquifers are buried channels of sand and gravel covered by mud and silt. Rapid deposition of sediments took place during the geologic time of the late Pleistocene. High flooding brings down more water-bearing alluvium and a layering effect is created with the coarse sediment forming channels covered by broad over-bank layers of mud and silt.

The aquifers are difficult to find when drilling for water. The channels do not necessarily repeat in the same location over subsequent depositional periods. There is very little stacking of the water-bearing sand and gravels on top of each other because of the active, serpentine conformation of the aquifers.

Stinkingwater Front:
This area's stream hydrology is the same as the North Valley Front. The intermittent streams (Mahon and Crow Camp Creeks) finger through distributaries to the lower elevations of Malheur Lake.

Riddle Creek:
The streams (Riddle, Smyth, Paul Creeks) in this portion of the sub-basin do not flow past Dry and Barton Lakes. From these lakes back toward the southeast, most wells are producing in volcanic sands and fractured, competent volcanics. Competent volcanics tend to break without deforming to maintain open fractures. The area north of the Round Barn/Dry Lake area contains local cinder beds which form high quality aquifers.

Jackass Mountain:
Intermittent Jackass Creek and its tributaries provide surface water for the aquifers which are confined to fractured systems in volcanic rock and are hard to locate for drilling wells.

Harney Lake:
The sediments around Sand Gap and southward have limited aquifer potential. The better water-bearing zones of volcanic cinder beds and porous lava flows are located from Sand Gap northward. Silver and Hughet Creeks provide surface water for the aquifers in this area.

GROUND WATER

The shallow aquifers in Harney Valley are unconfined and only partly filled so that the water table is at atmospheric pressure. The deeper alluvial aquifers and those in the underlying tertiary volcanic and sedimentary rocks are usually confined. The water is under pressure greater or lesser than the atmosphere, as it is enclosed above by beds of low permeability. Some of the aquifers in the area are confined under sufficient pressure to create flowing or artesian wells at land surface.

Harney Valley and the surrounding water-delivering uplands are, for practical considerations, a closed hydrologic system. Inflow is from precipitation and outflow is from evapotranspiration. In such a system, the deeper confined aquifers remain filled at a relatively constant volume. Over time, the shallower, unconfined aquifers remain filled at average water table levels related to the Silvies River and recharge must equal discharge. Water moves through the shallow, unconfined aquifers in recharge areas and the confined aquifers lose water upward through the unconfined aquifers in the discharge areas. The uplands also tend to be areas of recharge, the lowlands areas of discharge.

The chemical character of the water changes as it moves southward from calcium bicarbonate with low mineral content to sodium bicarbonate with moderate to high mineral content. The water is generally of excellent quality near the western, northern and eastern edges of the valley. As water moves out into the valley it contains trace levels of boron, sodium, and dissolved salts. Excessive concentrations build up in and near Malheur Lake making the water unsuitable for most uses.

There are also various locations of thermal water from flowing wells and natural hot spring sources. Any water warmer than 65° F. (18° C.) in this area is considered to be thermal. Locations of some hot water sources are: near Hines and about 5 miles south (temperatures of 70-80° F., 21-27° C.), the northeastern part of Sunset Valley (temperature of 105° F., 41° C.), hot springs around the perimeter of Harney Lake, and Crane Hot Springs (temperature of about 175° F., 80° C.). The common aquifer is probably the cinder zones in the younger volcanic rocks at the edge of valley foothills.

SURFACE WATER

Soils are covered over large areas with an alkali crust in some parts of the valley. Water drainage over these areas dissolves and carries off part of the alkali. The brown-colored, alkali-laden water moves only short distances because most of it flows into ditches and nearby fields, where it evaporates and infiltrates into the soil. However, this

is not the case in the South Harney Valley where the alkali water moves into Malheur Lake from nearby alkali flats.

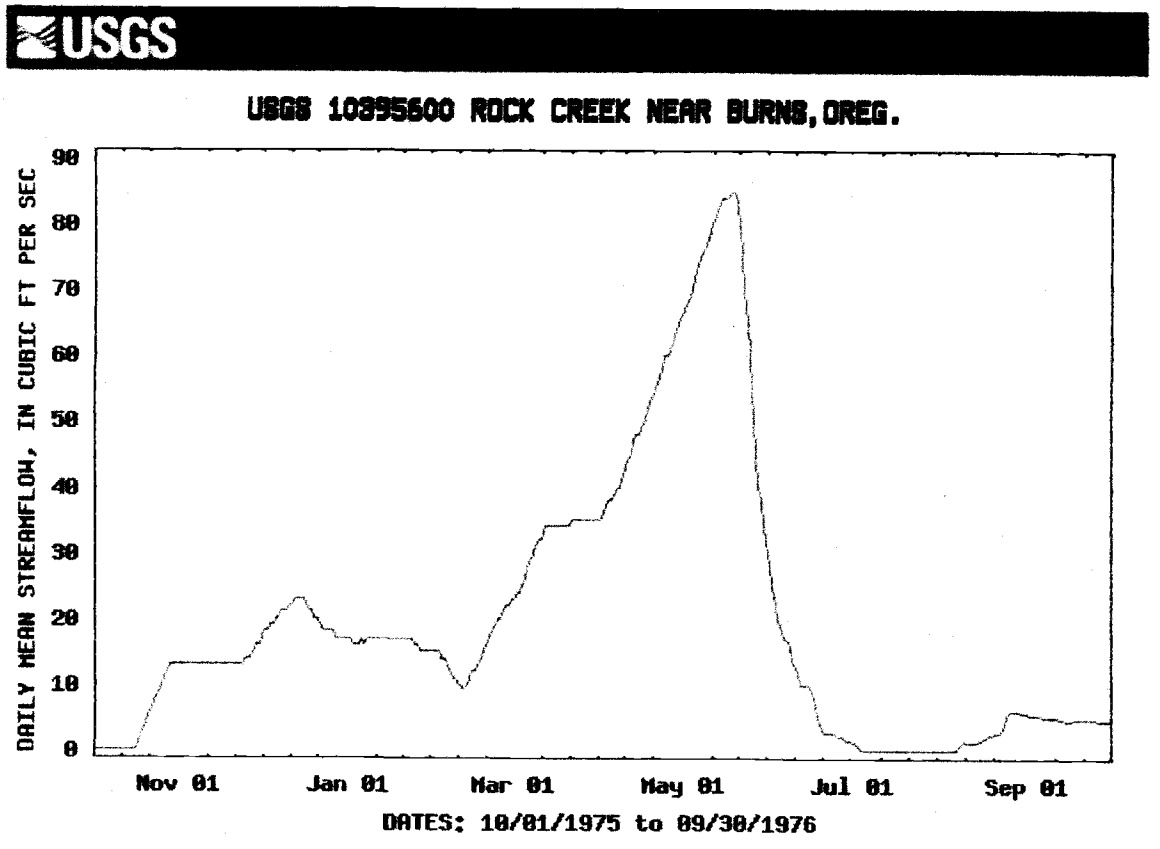
WATER SUPPLY

The Silvies River, Silver Creek and the Donner und Blitzen River contribute to, but are not part of, this sub-basin. The average discharge for the river near Burns is 128,000 acre-feet per year or 177 cubic feet per second (cfs). The maximum discharge was 4,960 cfs on April 6, 1952 and the minimum discharge was no flow in July-September, 1934. Other small streams also contribute to the water supply. The Silvies River drains approximately 1,200 square miles and represents one-fourth of Harney Basin. See graphs numbered 2, 3 and 4 of available data for minimum and maximum flows.

Silver Creek originates in the northwest corner of the county and drains approximately 900 square miles flowing through Warm Springs Valley to Harney Lake.

The Donner und Blitzen River (often called the Blitzen River) originates on the Steens Mountain and flows northward for 50 miles to discharge into Malheur Lake. This river system drains approximately 1,000 square miles. The average discharge for the river near Frenchglen is 91,290 acre-feet per year or 126 cfs. The maximum discharge was 4,270 cfs on April 26, 1978 and the minimum was 4.2 cfs on December 9, 1972.

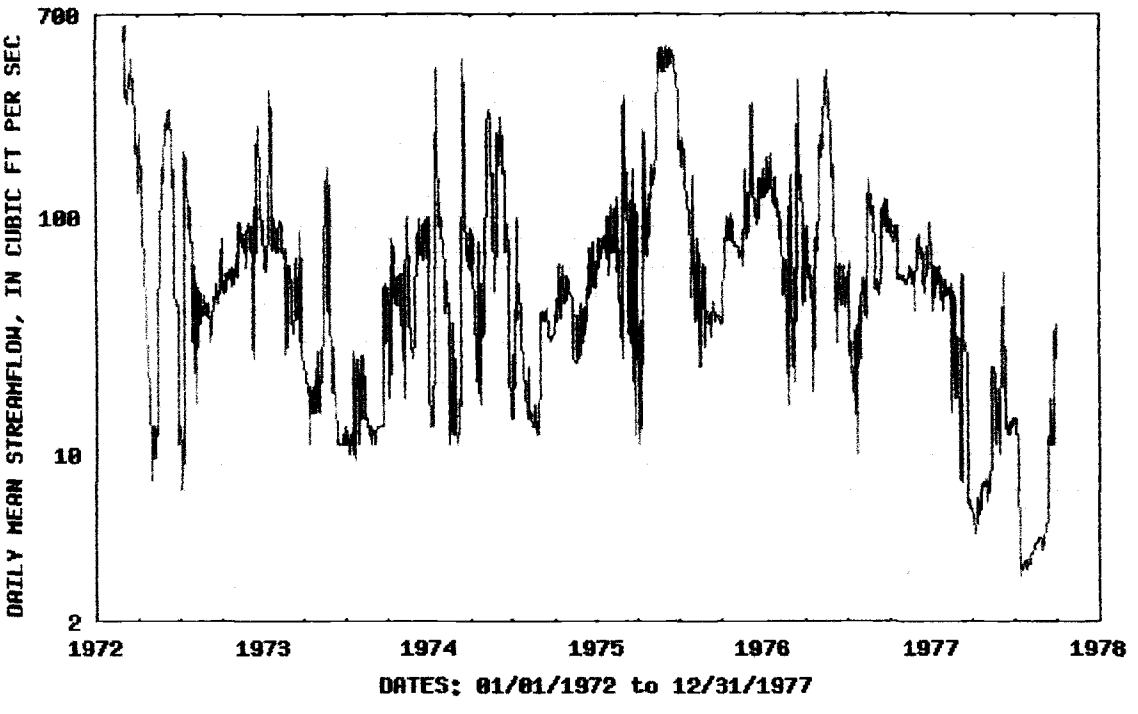
GRAPH #2 – HISTORICAL STREAMFLOW DAILY VALUES GRAPH FOR ROCK CREEK



Provisional Data Subject to Revision

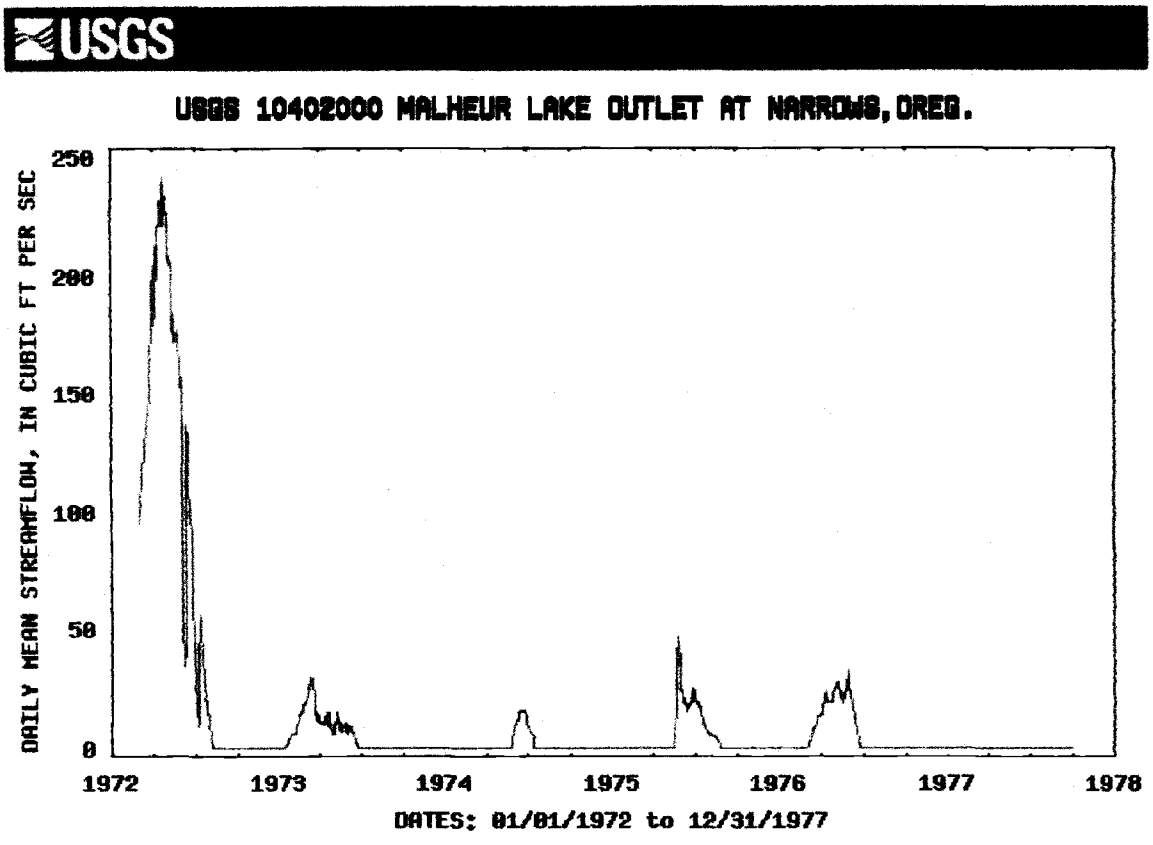
GRAPH #3 -- HISTORICAL STREAMFLOW DAILY VALUES GRAPH FOR DONNER UND BLITZEN RIVER

USGS



Provisional Data Subject to Revision

GRAPH #4 – HISTORICAL STREAMFLOW DAILY VALUES GRAPH FOR MALHEUR LAKE OUTLET AT NARROWS



Provisional Data Subject to Revision

SECTION THREE

HUMAN USES

The two main activities contributing to the sub-basin economy are agriculture, consisting mostly of livestock production, and the providing of services to recreation visitors and sportsmen. Timber harvesting, once a major economic resource, is no longer a primary contributor due to political and environmental issues.

As with the other surrounding sub-basins, agriculture consists of growing alfalfa, spring grains, wild hay for livestock feed, and grazing for livestock and wildlife. Most production comes from irrigated lands rather than dry land farming due to a short growing season with low annual precipitation. Wild hay fields are flood irrigated in early spring and alfalfa and grains are watered with wheel-lines and overhead sprinkler systems from drilled wells later in the summer.

The hydroponic growing of fruits and vegetables near Crane Hot Springs has recently become an economic venture in the sub-basin. It utilizes the hot water from the springs to provide heat for greenhouses and drilled wells as the water source for hydroponic growing solutions.

Water is the limiting factor for cropland irrigation and surface water is at or near full appropriation during the summer months. With the exception of the period between March 1 and May 1, the Malheur Lake Basin program prohibits the issuance of any permit for any use of surface or groundwater if the use has the potential to substantially interfere with surface water unless the applicant shows a preponderance of evidence that unappropriated water is available to supply the proposed use at the time(s) the amounts are requested. Soil conditions also limit production due to shallowness, poor drainage and alkalinity.

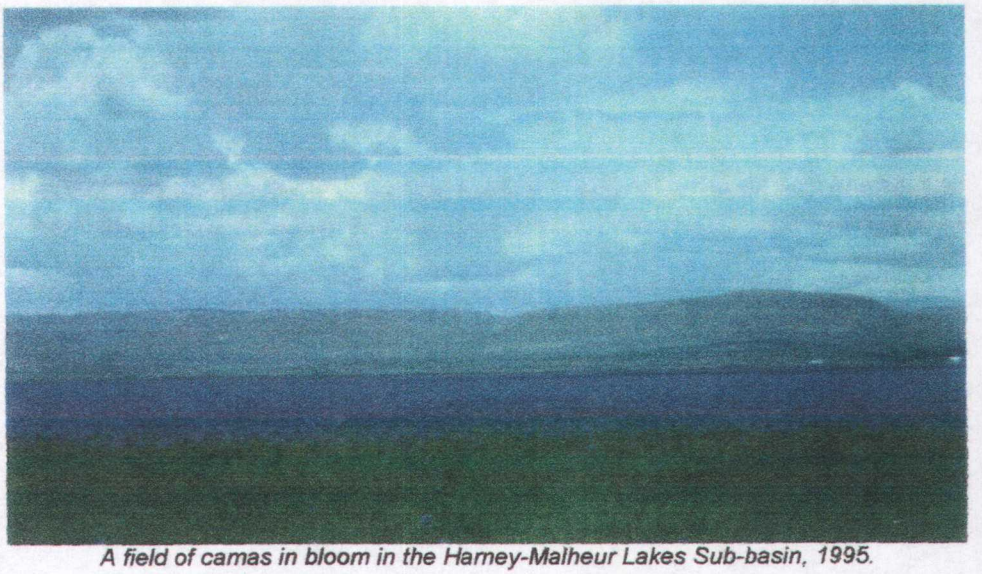
Recreation use continues to increase as more people, both regionally and nationally, become aware of the sightseeing, wildlife viewing and backcountry opportunities offered in southeastern Oregon. Steens Mountain, located in a nearby sub-basin, and the Malheur Wildlife Refuge in the southern part of this sub-basin, are the two best-known natural features that draw visitors to the area. Diamond Craters Outstanding Natural Area is well known for geologically recent volcanic features, while numerous historic structures can be found throughout the sub-basin.

Large numbers of migrating waterfowl, particularly snow geese and pintail ducks, as well as cranes, shorebirds and wading birds arrive in Harney Basin each spring, most staying long enough to replenish their energy reserves before departing for northern nesting areas. The floodplain of the Silvies and of the streams on the northern valley front provide most of the forage they require. An annual waterfowl festival is held each year by local residents to show visitors this phenomenon and enhance the economy of the area. Bird watching continues to draw many visitors throughout the spring and summer.

Goose, duck and upland game bird hunting, and hunting for antelope, deer, and elk account for recreation visits during scheduled hunting seasons. Hiking, rock hounding,

off-highway vehicle use, snowmobiling and stream fishing are also popular recreational pursuits during various times of the year.

The Northern Paiute people have traditionally gathered native plants and continue to gather them for various uses. The lands around Harney and Malheur Lakes were important sources for plant products as were the surrounding foothills and the meadows in the northern part of Harney County.



A field of camas in bloom in the Harney-Malheur Lakes Sub-basin, 1995.

A Native American woman carrying a basket of camas root, circa 1890. Camas root was a staple of the Harney Valley Paiutes.

Plants found in the sub-basin and used by the Harney Valley Paiutes are listed in Appendix B. The lakes and surrounding habitat also provided fish, waterfowl, and other birds for food. Other areas of the valley and foothills provided rabbits, other small mammals, deer and antelope.

WILDLIFE

The Harney-Malheur Lakes Sub-basin has a variety of wildlife and diverse habitats. Different forms of wildlife are associated with each type of area and some are unique to Harney County *(see Appendix A)*. Elk, deer and antelope are the primary big game species found in the sub-basin with elk staying mainly in the northern portion of the Harney Valley and the upper, forested lands.

Elk forage in the higher elevation forest during the summer and winter below the 5,500 feet elevation in the transition zone of sagebrush and juniper between the forest and the valley floor. However, elk have been seen in lower valley areas migrating in small numbers between the high country and winter ranges.

Deer move to upper forest areas in the summer, but also utilize sagebrush and juniper habitats and marshlands on the Malheur Refuge and private lands. Winter will find them in upper elevations below the elk winter range, again using sagebrush and juniper habitats and often moving down to the open, valley meadows and marshlands to feed.

Antelope summer in a variety of habitats, including the upper forested lands as well as sagebrush areas, particularly low sage. As with deer, they are also found in the valley meadows and foothill grasslands. Winter will find them on private meadows and low elevation areas around Harney and Malheur Lakes and in Diamond and Happy Valleys avoiding deep snow.

Coyotes are common within the sub-basin and are often seen in all vegetative types and topography, including the open, meadows in the valley. Bobcats, although secretive and not as numerous, live in the rocky canyon rims above the valleys.

There are a variety of upland game birds in the assessment area such as: pheasant, quail, sage grouse, mourning dove, and chukar. Pheasant numbers are limited as they do not thrive well due to the area's cold, wet springs and lack of grain crops for feed. Some hunting takes place on private agricultural lands and the Malheur Refuge. Quail inhabit many of the same areas as pheasants, although in much greater numbers. Chukar are scattered throughout the sagebrush and rimrock areas with populations varying according to weather and food supplies. Sage grouse, the largest of the native upland game birds are declining in numbers, and can be found in the sagebrush areas of the upper foothills. Mourning doves are common throughout the sub-basin during the summer nesting season, but gather in large numbers to migrate when the first hard frosts come to Harney Valley.

There are a small number of wild turkeys that the Oregon Department of Fish and Wildlife planted on forest service and BLM-managed lands in the northern end of the watershed area during 2000 and 2001. They are the Rio Grande sub-species and were brought from the Medford area in southwestern Oregon.

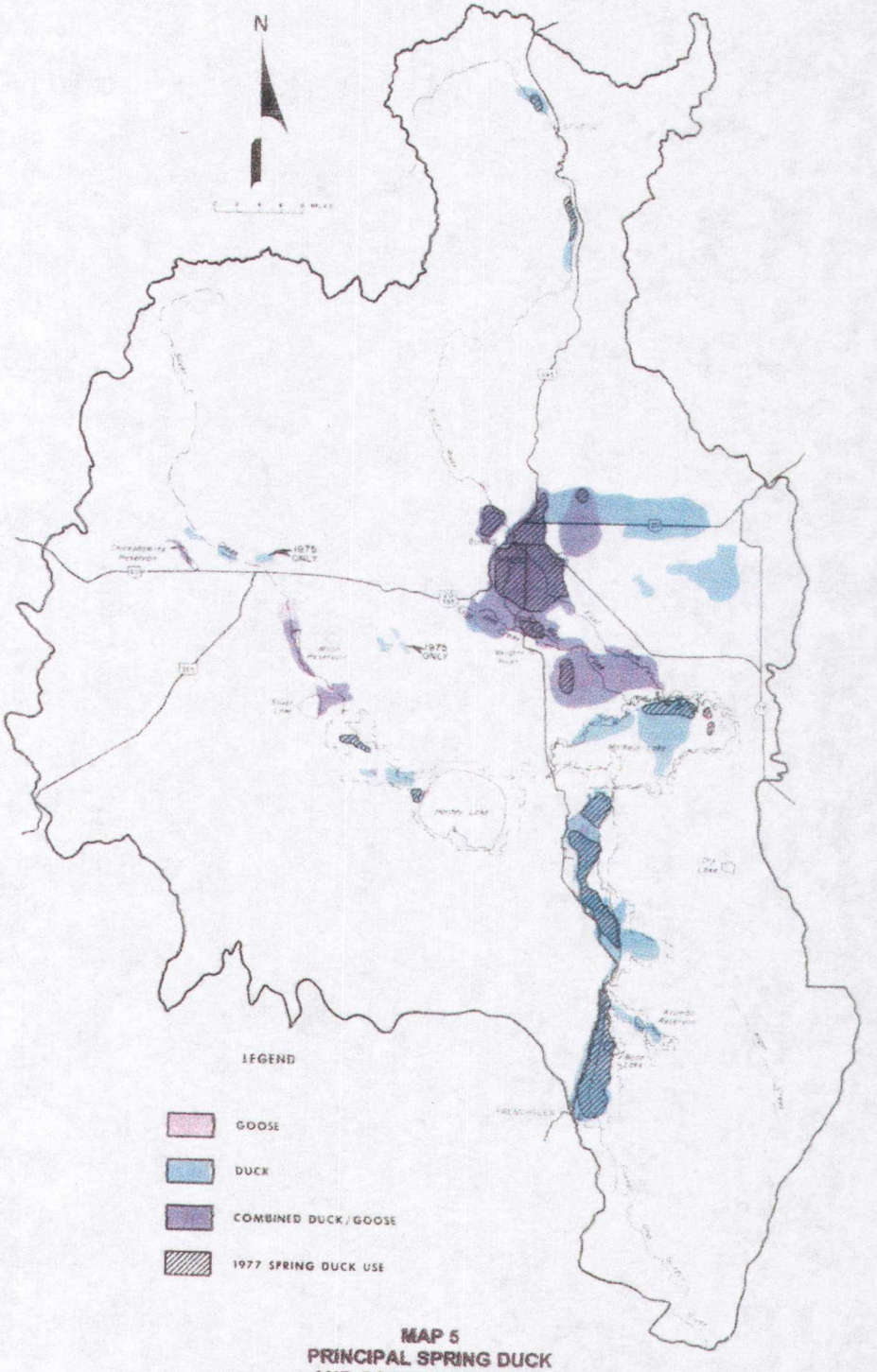
There are also two known active winter eagle roosts in the northern end of the watershed, one 244 acre site totally on forest service lands (Rattlesnake Roost) and the second on a site comprised of 231 acres of forest service lands and 108 acres of BLM lands (Coffeepot Roost). These foothill roosts contain stands of large, coniferous trees near principle feeding areas in Harney Valley. The roost trees are old-aged, dominant, open-structured ponderosa pines, often spike-topped or snags. There is also one suspected bald eagle roost in upper Soldier Creek.

The Malheur-Harney Sub-basin is one of the most important waterfowl and lesser sandhill crane migratory use areas in the Pacific Flyway. The assessment area, notably Malheur Refuge, the Silvies River Floodplain and Diamond Valley, also provides nesting habitat for a number of waterfowl, shorebird and marsh bird species, and greater sandhill cranes. Large numbers of longbilled curlews nest in the Silvies River Floodplain and the alkali flats around Harney Lake on Malheur Refuge support a population of snowy plovers, the largest in Harney County and one of the largest in North America.

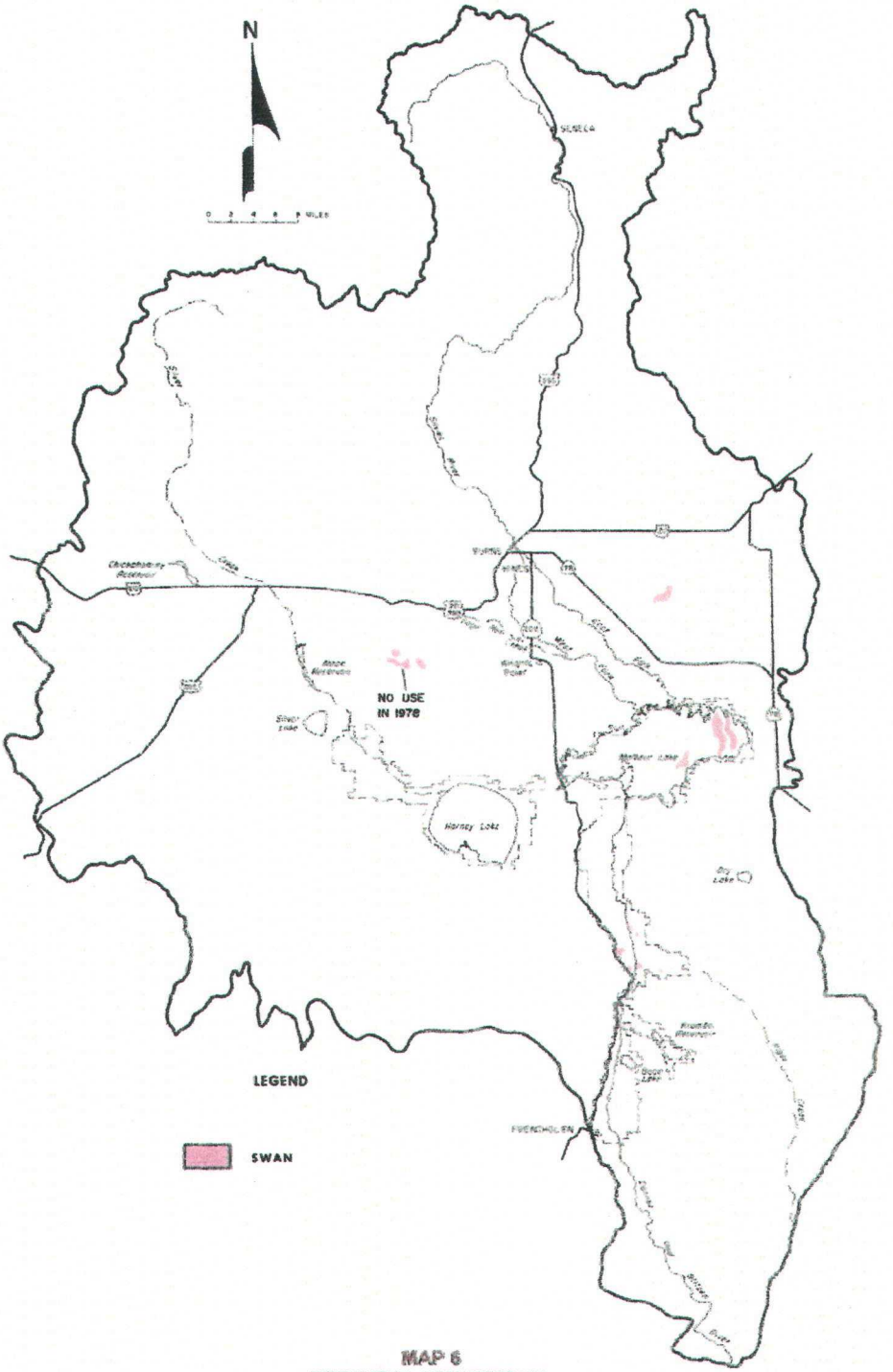
The Silvies River Floodplain is just outside and adjacent to this assessment area. It is an integral part of the Harney Basin waterfowl, marsh bird, and shorebird habitat and closely connected to the resource management of this assessment area. Maps 5 through 13 show principal use areas during the three-year period, 1975-1978, for waterfowl, shorebirds, marshbirds and raptors.

A surface area of about 50,000 acres (about 150,000 acre-feet) is needed on Malheur Lake to create the minimum desirable level of use of Malheur Refuge by waterfowl. Harney Lake, the final destination of the basin's water, is valuable as a nesting area for waterfowl and acts as a collection area for undesirable alkaline water periodically flushed from Malheur Lake (Thompson, et. al., The Fish and Wildlife Resources of the Malheur Lake Basin, Oregon and Their Water Requirements, Oregon State Resources Board, 1968).

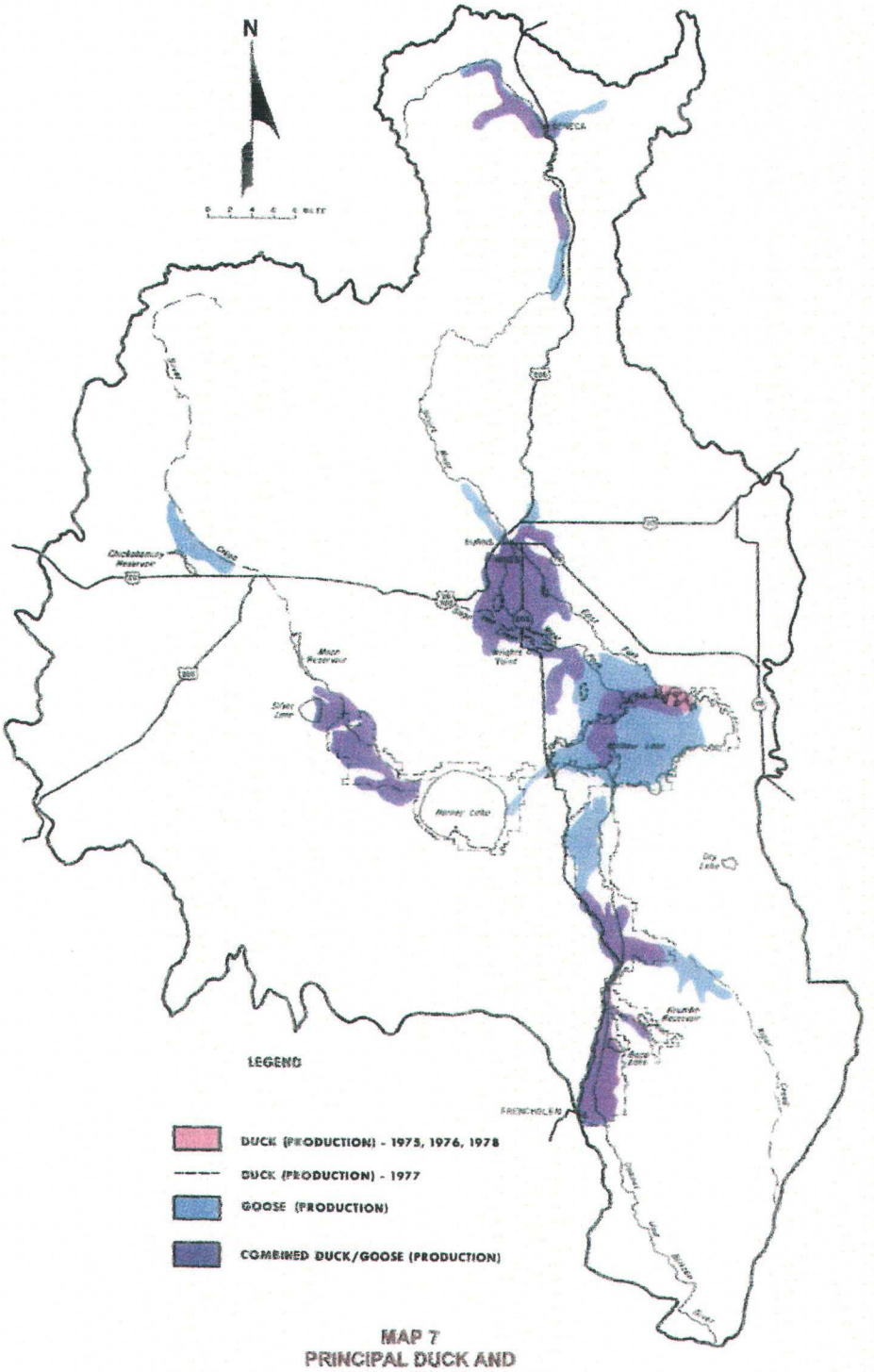
Tundra swans use Malheur Refuge during both spring and fall migration. Snow geese also use the Harney Valley and the refuge on their spring and fall migrations. Most use occurs at Double O, Harney and Malheur Lakes, and the Silvies River Floodplain. Pintail ducks are one of the most abundant species that use the sub-basin with Malheur Lake and the Silvies Floodplain supporting the largest populations. Pintails feed in short meadow vegetation, as do snow geese. The fluctuation of the water level of Malheur



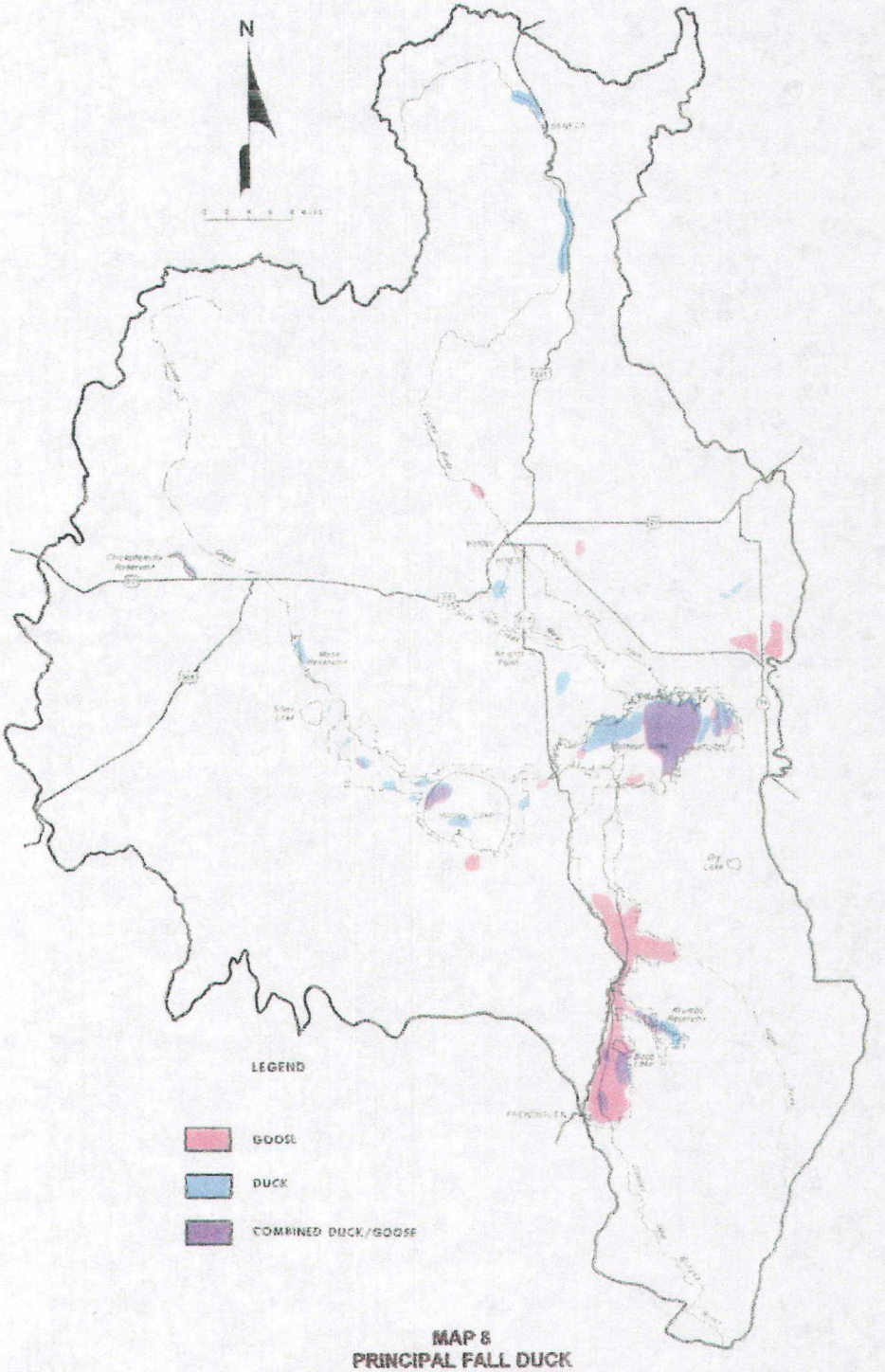
MAP 5
PRINCIPAL SPRING DUCK AND GOOSE USE AREAS 1975-1978



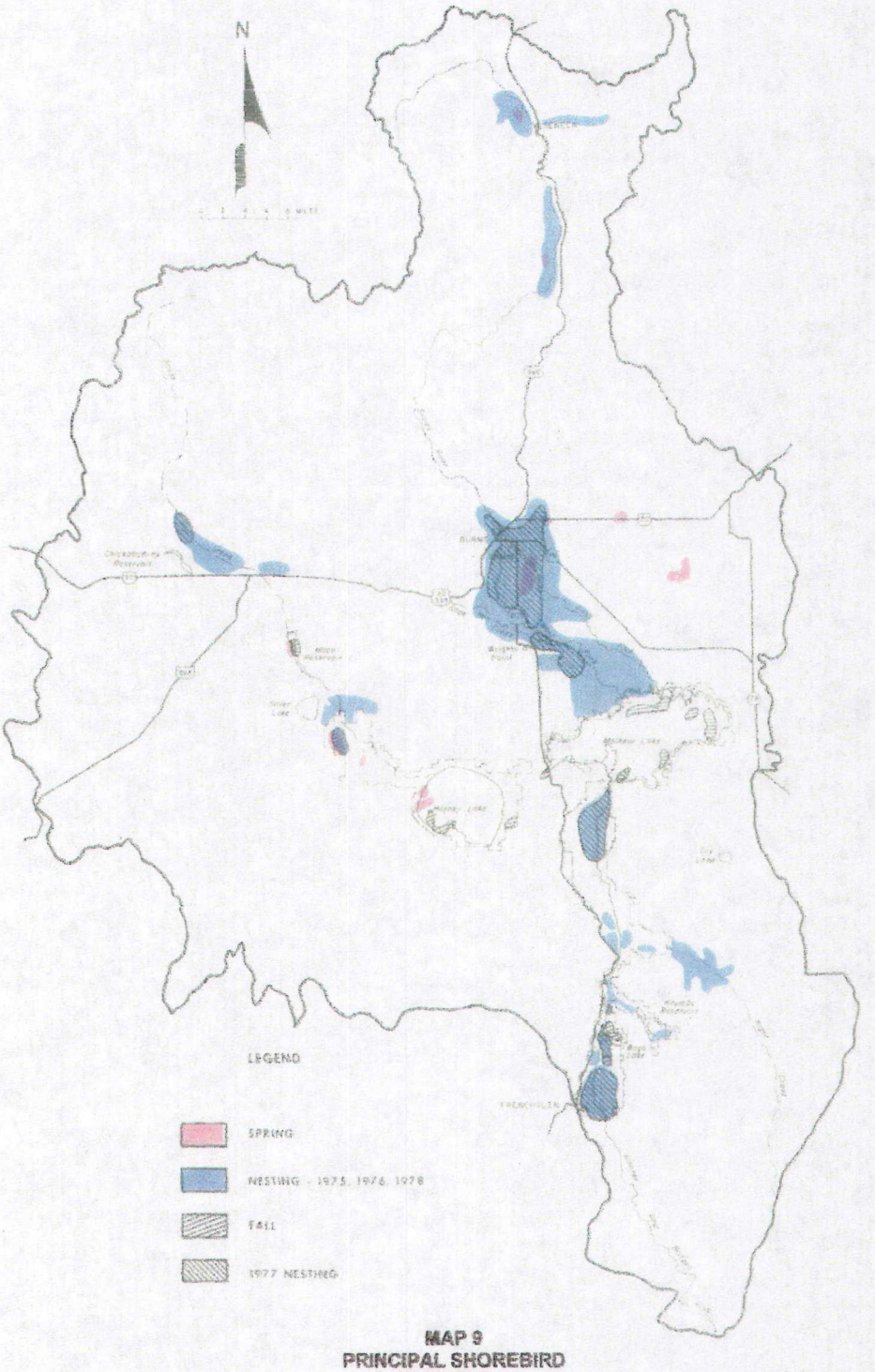
MAP 6
PRINCIPAL SPRING/FALL
SWAN USE AREAS
1975-1978



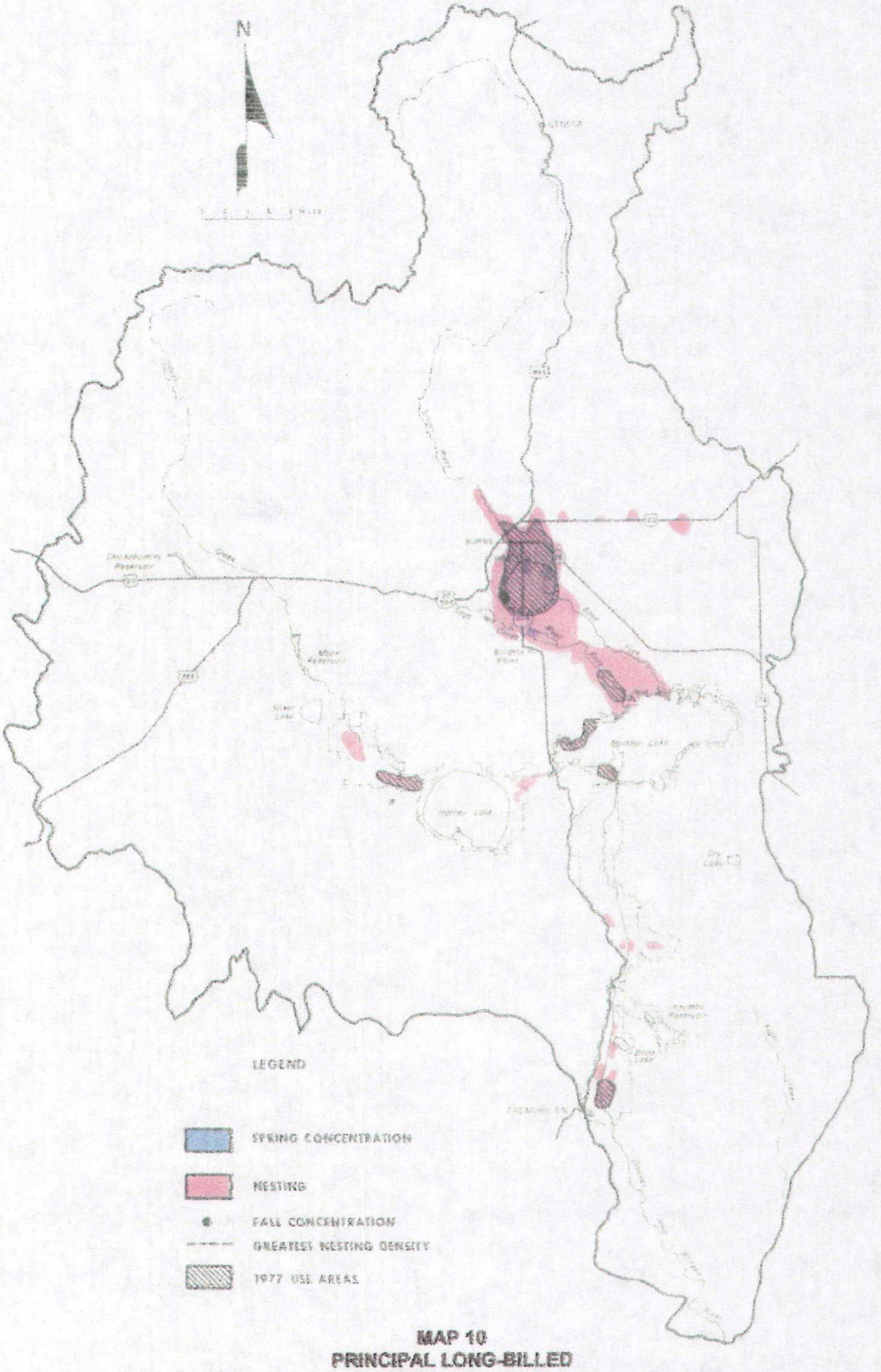
MAP 7
PRINCIPAL DUCK AND
GOOSE USE AREAS
1975-1978



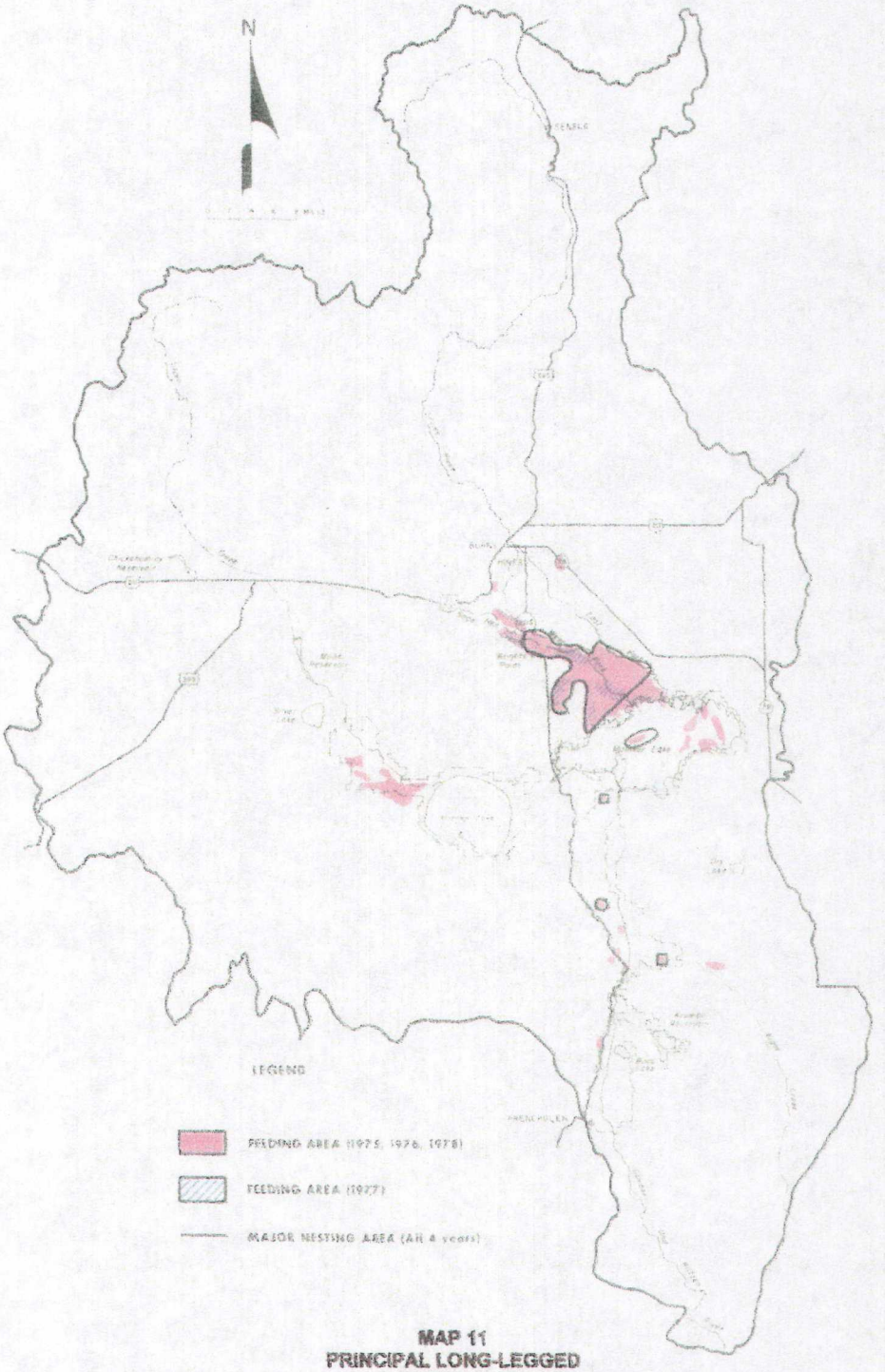
MAP 8
PRINCIPAL FALL DUCK
AND GOOSE USE AREAS
1975-1978



MAP 9
PRINCIPAL SHOREBIRD
USE AREAS
1975-1978



MAP 10
PRINCIPAL LONG-BILLED CURLEW USE AREAS 1975-1978



MAP 11
PRINCIPAL LONG-LEGGED WADERS USE AREAS
1975-1978

MAP 13
PRINCIPAL RAPTOR
USE AREAS
1976-1978

MAP 12
PRINCIPAL SPRING/FALL
MARSHBIRD USE AREAS
1975-1978

Lake is also necessary to provide the growth of submergent vegetation (mainly sego pondweed) as feed for these ducks and many other waterfowl species.

About 1,500 pairs of Canada geese nest in the basin with most use on the Malheur Refuge. However, fewer egg predators exist on the Silvies River Floodplain and Canada geese usually have fair success even when nest concealment is poor in early spring.

Hunting for ducks and geese is popular during the fall and winter hunting seasons. Hunting takes place on private lands as well as certain areas of Malheur Refuge. Some ranchers supplement their income by leasing hunting privileges on their lands to hunters.

Lesser sandhill cranes concentrate in the meadows east and south of Burns while the Greater Sandhill cranes prefer the grainfields on or near the Malheur Refuge, but also are seen the Silvies Floodplain to feed and nest.

Many species of marshbirds come to the sub-basin to feed and most remain to nest. Most nesting occurs on Malheur Refuge. However, a colony of California and ring-billed gulls use an area about 5 miles southeast of Burns and Franklin's gulls and Forster's terns nest in colonies in the north-central portion of Malheur Lake. White pelicans use Malheur Lake as they feed on large numbers of carp.

The Harney-Malheur Sub-basin is located in the high desert steppe with its higher perimeter having desert-type vegetation and an arid climate. The lower, interior closed basin with its marshes, meadows and wetland vegetation creates a very contrasting environment. The annual weather cycle is characterized by hot, dry summers and cold winters. Because of the dry climate, water plays an important role in determining species distribution and populations during extreme conditions. Wildlife species unique to the area evolved as water distribution and geographical isolation lent to their development. The red-band trout and Malheur shrew are examples of such species.

A number of threatened, endangered or sensitive mammals, birds, amphibians and reptiles can be found in the sub-basin (Table #5).

Table #5: Threatened, endangered or sensitive mammals, birds, amphibians and reptiles that are known to occur within the Harney-Malheur Lakes Sub-basin.

COMMON NAME	SCIENTIFIC NAME	STATUS
bald eagle	*Haliaeetus leucocephalus*	Threatened
columbia spotted frog	*Rana luteiventris*	Federal Candidate
ferruginous hawk	*Buteo regalis*	Sensitive
greater sandhill crane	*Grus Canadensis tabida*	Sensitive
long-billed curlew	*Numenius americanus*	Sensitive
peregrine falcon	*Falco peregrinus anatum*	Endangered
preble's shrew	*Sorex preblei*	Sensitive
trumpeter swan	*Olor buccinator*	Sensitive
western sage grouse	*Centrocercus urophasianus phaios*	Sensitive
wolverine	*Gulo gulo luseus*	Sensitive

Of the two lakes (Harney and Malheur), Malheur Lake is primary for the production of waterfowl and provides the major and preferred waterfowl food, sego pondweed.

FISH

Both native and non-native fish species are found in the Harney-Malheur Lakes Sub-basin (Appendix C). The native fish are derived from Columbia River fauna that came from early connections with the upper Snake River and in recent times from the lower Columbia (Klingman, Bond, Cole, et. al., 1971). Non-native species were introduced into streams, lakes and reservoirs primarily by the Oregon Department of Fish and Wildlife (ODFW) to establish game fish populations. Smallmouth bass have been put in Krumbo and Bigfoot Reservoirs. ODFW continues to stock these small reservoirs with bass and rainbow trout, but no longer put hatchery trout in the creeks and rivers. Some of the private reservoirs have also been stocked with non-native species by other individuals.

Carp, another introduced species, is common in the lower portion of the Silvies River, Harney and Malheur Lakes, and the canals and ditches within Malheur National Wildlife Refuge and on private lands. This species creates water quality problems by increasing water turbidity and consuming aquatic vegetation important as food for waterfowl. Other non-native fish scattered throughout the basin include suckers, roach, chisel-mouth, and squawfish.

The main habitats for fisheries are concentrated in three locations: north basin along the valley front, the Riddle Creek area, and the large Harney and Malheur Lakes. The north

basin streams are Poison, Devine, Prater, Soldier Coffeepot, Rattlesnake and Cow Creeks. The Riddle Creek area constitutes the Riddle, Smyth, and Paul Creek system. Trout habitat is poor in the Silvies River below Five Mile Dam to Harney and Malheur Lakes. A combination of natural channel characteristics, irrigations dams and diversions and the presence of non-native fish species all lend to this condition.

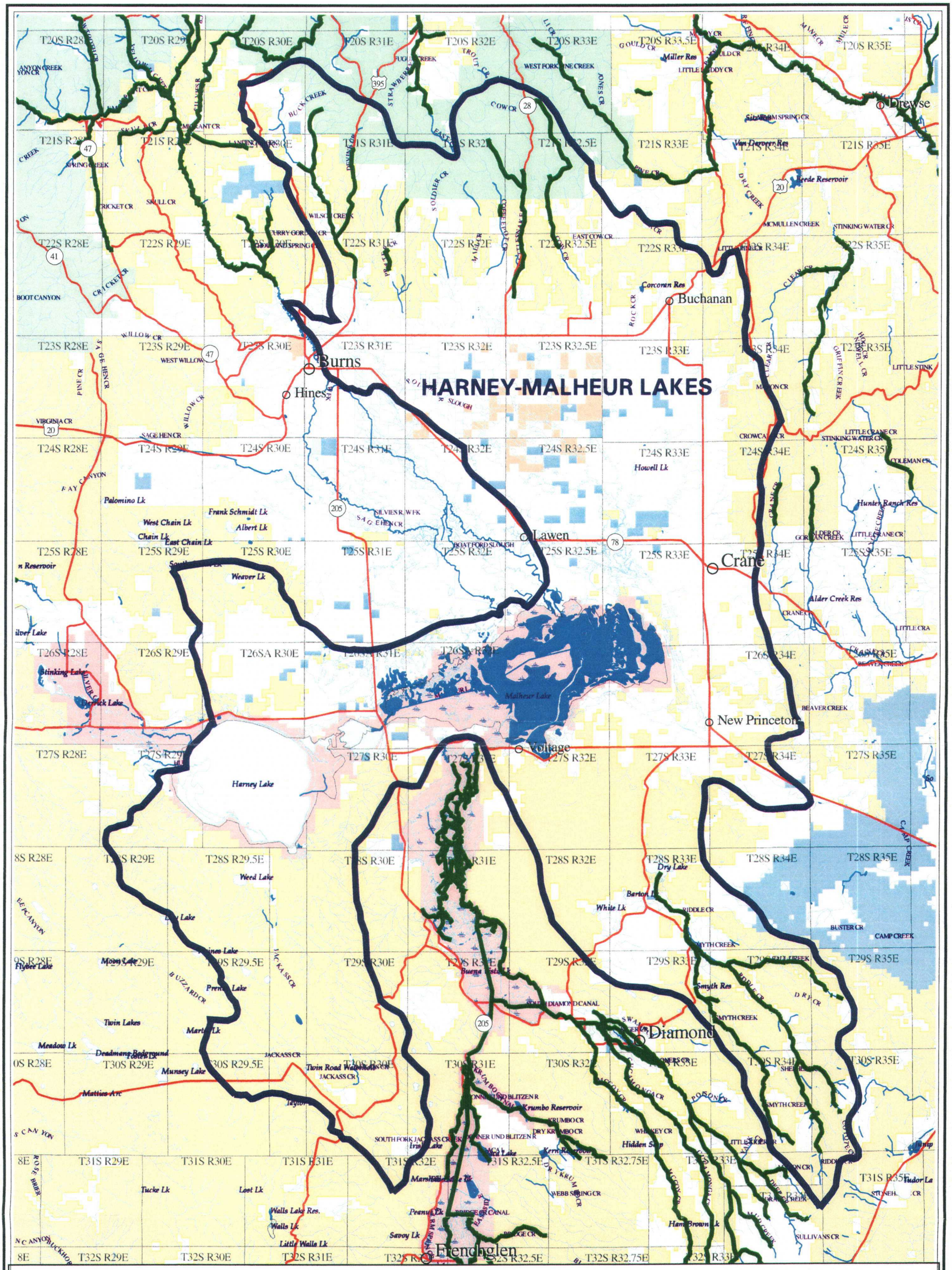
Many fish-bearing streams are disjunct from Harney and Malheur Lakes due to topography, current climatic conditions and irrigation uses. The lakes were also isolated from the Malheur, Snake and Columbia Rivers when the ancient drainage outlet southwest of Princeton was blocked by a Pleistocene lava flow, creating a closed basin water system.

A comprehensive fish and stream survey obtaining genetic samples for native redband trout was completed for Paul, Riddle and Smyth Creeks by ODFW and BLM in 2000. A survey has also been completed for Poison Creek with future surveys planned for Devine, Prater, Soldier, Coffeepot, Rattlesnake, and Cow Creeks. Approximately 100 miles of redband trout stream habitat are located within the sub-basin (Map 14).

The redband trout and the Malheur mottled sculpin are two fish that have been designated as sensitive species in the Harney-Malheur Lakes Sub-basin (Table #6). Both species have similar habitat requirements and prefer cool, clear, fast-flowing water with clean cobbles and gravels. Harney Lake, as well as the cold-water springs to the west of the lake and located outside the assessment area contain Tui chubs. These springs (Hughet, Barnyard, Johnson), provide important habitat to an isolated, genetically unique species.

The recommended minimum flows for streams in the sub-basin are based primarily upon the biological requirements of trout, but will accommodate warm-water fish. These follow seasonal stream discharge patterns to which the natural life cycles of trout have become adapted including spawning needs. Since these requirements are minimums, conditions would be less than optimum.

A certificate of water right was issued to the Oregon Water Resources Department in 1991 to provide a minimum flow for Rattlesnake Creek ranging from 3 cfs to 1 cfs from January through July, and .42 to .94 cfs during the rest of the year. The water right is from the East Fork (T. 215, R. 32.5 E., WM, Sec. 20, SE ¼ SW ¼) downstream to Bain Ditch (T. 225, R. 32.5 E., WM, Sec. 8, SE ¼ SW ¼). It is the only certificate issued for fisheries stream management in the assessment area.



MAP #14 - HARNEY-MALHEUR LAKES SUBBASIN - REDBAND TROUT

Redband Trout (BLM and ODFW data).
99.7 miles within subbasin.

(miles from 100K source lines,
24K source lines will be more)

Subbasin Boundary
Major Roads
Perennial Streams
Intermittent Streams

0 1 2 3 4 5 6
MILES
Scale: 1 inch = 5.6 miles

Note: No warranty is made by Harney County or the Bureau of Land Management as to the accuracy, reliability or completeness of these data for individual or aggregate use with other data. Original data was compiled from various sources. This information may not meet National Map Accuracy Standards. This product was developed through digital means and may be updated without notification.

HARNEY COUNTY GIS
In cooperation with
The Bureau of Land Management
Burns District Office; Burns, Oregon

Date: 30-APR-2001, Pam Keller, subbasin11x17.aml/harmalfish.ps

Table #6: Threatened, endangered and sensitive fish species that are known to occur within the Harney-Malheur Lakes Sub-basin.

COMMON NAME	SCIENTIFIC NAME	STATUS
Malheur mottled sculpin	*Cottus bairdi bairdi*	Sensitive
redband trout	*Onchorhynchus mykiss spp.*	Sensitive

VEGETATION

The sub-basin vegetative types vary according to elevation, topography, precipitation, soil type, and length of growing season. Vegetative types are specific to the forest, foothill transition zone, and the valley with its meadows and lake habitat. Map 15 gives perspective on historic plant associations in the sub-basin while Map 16 shows the current vegetation and general plant communities on BLM-administered lands. These lands are located primarily in the uplands surrounding Harney Valley as well as lower elevation lands in the general locales of Dog Mountain, New Princeton, Voltage and Happy Valley.

Table #7: Following are Harney County historic plant associations.

LOW ELEVATION LAKE BASINS AND VALLEYS

Saline-Sodic Lake Basins & Playas: Soil Association #1		
playas without vegetation		Playas
greasewood/saltgrass, alkaligrass associations		Sodic Flats
basin big sagebrush/greasewood/basin wild rye		Sodic Bottomlands
Playas	No number	
Sodic Flat	024XY001OR	SAVE4/DISPS2
Sodic Dunes	024XY005OR	ARTRT/SAVE4/ORHY/ STCO4
Sodic Meadow	024XY002OR	SPAI/DISPS2/POJU
Sodic Lake Terrace	024XY114OR	SAVE4/DISPS2/PUCCI
Sodic Bottom	024XY003OR	SAVE4/LECI4/DISPS2
Clay Basin 6-8	024XY010OR	ATCO/ARSP5/ELEL5
Dry Basin	024XY009OR	ARTRT/SAVE4/LECI4

Saline-Sodic Lake Terraces & Fans: Soil Association #2		
mixed desert shrubs associations—greasewood, shadscale, spiny hopsage and/or basin big sagebrush		Sodic Terraces and Fans
Low Sodic Terrace	024XY013OR	SAVE4/ATCO/GRSP/ELEL5
Sodic Terrace	024XY014OR	ARTRT/GRSP/SAVE4/ORHY
Sodic Fan	024XY113OR	ARTRT/SAVE4/ORHY/LECI4
Dry Sodic Floodplain	024XY112OR	SAVE4/ARTRT/DISPS2/LECI4

Marshes and Meadows: Soil Association #4		
bulrush, burreed, cattail associations		Marshes
Nebraska sedge, Baltic rush, creeping wild rye association		Meadows
Wet Marsh	023XY115OR	SCAC/SPEU
Semi-Wet Marsh	023XY116OR	TYPHA
Basin Wet Meadow	023XY117OR	CANE2/JUB/ELEOC
Basin Dry Meadow	023XY118OR	LETR5
Loamy Bottom	023XY104OR	ARTRT/LECI4

Seasonal Floodplains, Bottomlands and Playas: Soil Association #2 and 11		
basin big sagebrush/Basin wild rye association		Floodplains
silver sage/Nevada bluegrass/creeping wild rye		Ponded Swale
Wyoming big sagebrush/Sandberg bluegrass		Dry Playas
Dry Floodplain	024XY004OR	ARTRT/LECI4/LETR5
Ponded Clay	023XY200OR	ARCA13/POSE3/LETR5
Lakebed	023XY100OR	ELEOC/RUMEX/JUBA
Lake Terrace	024XY006OR	LETR5
Clayey Playette	024XY008	ARTRW8/ELEL5/STTH2/POSE4
SR Swale 9-12	010XC013OR	ARTRT/LECI4/PSSPS/STCO4
Loamy Bottom	010XY005OR	LECI4
Braided Bottom	010XY010OR	SALIX/CAREX/DECA5
Sodic Bottom	010XY007OR	SAVE4/LECI4/DIST
JD Gravelly Fan 9-12	010XB020OR	ARTRT/PSSPS/STTH2/LECI4

Silty Lake Terraces (Catlow 6-10 ppt): Soil Association #2		
winterfat association		Silty Dry Terraces
Silty 6-10	024XY011OR	KRLA2/ATGA/ORHY
Dry Ponded Clay 6-10	024XY007OR	ATRT/LETR5

Sandy to Loamy Terraces (6-12 ppt): Soil Association #3		
basin big sagebrush/needle-and-thread/ricegrass association		6-10 ppt.
basin big sagebrush/needle-and-thread/Thurber needlegrass		10-12 ppt.
Sandy 6-10	024XY012OR	ATCA2/ARTRT/STC04/ ORHY
Loamy 8-10	024XY016OR	ARTRW8/STTH2/ORH Y/PSSPS
Sandy Loam 8-10	024XY018OR	ARTRT/STCO4/ORHY
Dunes	024XY110OR	ARTRT/STCO4/ORHY
Silt Loam Terrace 10-12	023XY019OR	ARTRT/PSSPS/LECI4
Sandy Loam 10-12	023XY213OR	ARTRT/STCO4/STTH2
Sandy Slopes 10-12	023XY303OR	ARTRT/PUTR2/STCO4 /ORHY
Loamy 10-12/Sandy Loam 10-12 cmx.	023XY212OR 023XY213OR	

WARM LOW PPT TERRACES, FOOTSLOPES AND PLATEAUS

Warm Shallow Terraces and Plateaus (6-10 ppt): Soil Association #5 and 7		
shadscale/budsage		Slightly Sodic Soils
Wyoming big sagebrush/Thurber needlegrass		Non-Sodic Soils
mixed desert shrub associations—Wyoming big sagebrush, shadscale, spiny hopsage and/or ephedra		Pueblo Footslopes
Desert Loam 6-10	024XY015OR	ATCO/ARSP5/ORHY
Shallow Loam 8-10/Desert Loam 6-10 cmx.	024XY017 024XY015OR	
Shallow Loam 8-10	024XY017OR	ARTRW8/STTH2/ORHY/PSSPS
Shallow Loamy Slopes 6-10	024XY030OR	ARTRW8/ORHY/STTH2
Droughty Shallow Slopes 6-10	024XY031OR	ATCO/ARSP5/ORHY/ELEL5
South Slopes 6-10	024XXY032OR	ARTRW8/SADOC2/ORHY/STSP3
North Slopes 6-10	024XXXXY033OR	ARTRW8/PSSPS/STTH2
Shrubby Loam 8-10	024XY020OR	ARTRW8/EPHED/STTH2/PSSPS

Warm Foothills (Malheur Drainage 9-12 ppt): Soil Association #6		
Wyoming big sagebrush/bluebunch wheatgrass association		Foothills
SR Clayey 9-12	010XC021OR	ARTRW/PSSPS/POSE
SR Mt. Loamy 9-12	010XC030OR	ARTRW/FEID/STTH2/ POSE4
SR Shallow 9-12	010XC035OR	ARTRW/PSSPS/STTH 2
SR Adobeland 9-12	010XC018OR	LECI4/PSSPS
SR Loamy 9-12	010XC020OR	ARTRW/PSSPS/STTH 2/STCO4
SR Mountain Shallow 9-12	010XC036OR	ARTRW/FEID/PSSPS/ POSE4
SR Clayey South 9-12	010XC043OR	ARTRW/PSSPS/STTH 2/POSE4
SR Shallow South 9-12	010XC050OR	ARTRW/PSSPS/STTH 2/POSE4
SR Maintain North 9-12	010XC065OR	ARTRW/FEID/PSSPS/ POSE4
SR Shallow Escarpment 9-12	010XC057OR	ARTRW/PERA4/PSSP S/STTH2

SECTION THREE

COLD PLATEAUS, BUTTES AND MOUNTAINS

Cold Plateaus and Uplands (10-12 ppt.): Soil Association #7		
Wyoming big sagebrush/Thurber needlegrass-bluebunch wheatgrass		High Desert Plateaus (Loamy Soils)
low sagebrush/Thurber needlegrass-bluebunch wheatgrass		High Desert Plateaus (Claypan Soils)
Loamy 10-12	023XY212OR	ARTRW8/STTH2
Clayey 10-12	023XY220OR	ARTRW8/PSSPS
Claypan 10-12	023XY214OR	ARAR8/PSSPS/POSE4
Shallow Gravelly Loam 10-12	023XY215OR	ARAR8/STTH2/POSE4
Thin Surface 8-14	024XY021OR	ARARN/ELEL5/POSE4
South Slopes 8-12	023XY300OR	ARTRW8/PSSPS/STTH2
North Slopes 10-12	023XY308OR	ARTRW8/FEID/PSSPS
Swale 10-14	023XY202OR	ARTRT/LECI4PSSPS
Shallow Swale 10-14	023XY324OR	ARAR8/POSE3/POSE4
Shallow Lava 10-12	023XY222OR	ART/STTH2/PSSPS/POSE4
Pumice 10-12	023XXY210OR	ARTRV-PUTR2/FEID/STTH2-STOC2

Cold High Plateaus and Buttes (12-16 ppt): Soil Association #8		
mountain big sagebrush/Idaho fescue-Thurber needlegrass		High Desert Plateaus (Loamy Soils)
low sagebrush/Idaho fescue-Thurber needlegrass		High Desert Plateaus (Claypen Soils)
Loamy 12-16	023XY318OR	ARTRV/FEID/STTH2
Droughty Loam 11-13	023XY316OR	ARTRT/FEID/STTH2
Claypan 12-16	023XY216OR	ARAR8/FEID/PSSPS/POSE4
Thin Surface Claypan 10-16	023XY218OR	ARAR8/POSE4
Droughty South Slopes 11-13	023XY301OR	ARTRT/PSSPS/STTH2
South Slopes 12-16	023XY302OR	ARTRV/PUTR2/PSSPS
North Slopes 12-16	023XY310OR	ARTRV/FEID
Shallow North 12-16	023XY312OR	ARAR8/FEID/PSSPS
Gravelly North Slopes 12-16	023XY314OR	ARTR4/FEID
Juniper South Slopes 12-16	023XY320OR	JUOC/ARTRV/PSSPS/FEID
Deep North 12-16	023XY404OR	ARTRV/SYOR2/FEID
Swale 12-16	023XY406OR	ARTRV/SYOR2/LECI4
Rocky Ridges 12-16	023XY408OR	CELE3/ARTRV/FEID
Wet Meadow	023XY416OR	DECA5/CANE2

Riparian vegetation along the streams is determined by elevation and stream gradient. The dominant overstory species in the upper elevations and foothills above the northern part of Harney Valley are alder, dogwood, willow, chokecherry, juniper, cottonwood and ponderosa pine. The understory is a combination of sedges, rushes, Timothy, meadow foxtail, clover, tufted hairgrass and other forbs. The upper riparian areas in the other surrounding valley foothills contain an overstory of alder, willow, and juniper and an understory of sagebrush, sedges, rushes, meadow foxtail, Timothy, watercress, clover and other forbs. Lower riparian vegetation is willows, sagebrush, rabbitbrush, sedges, rushes and forbs.

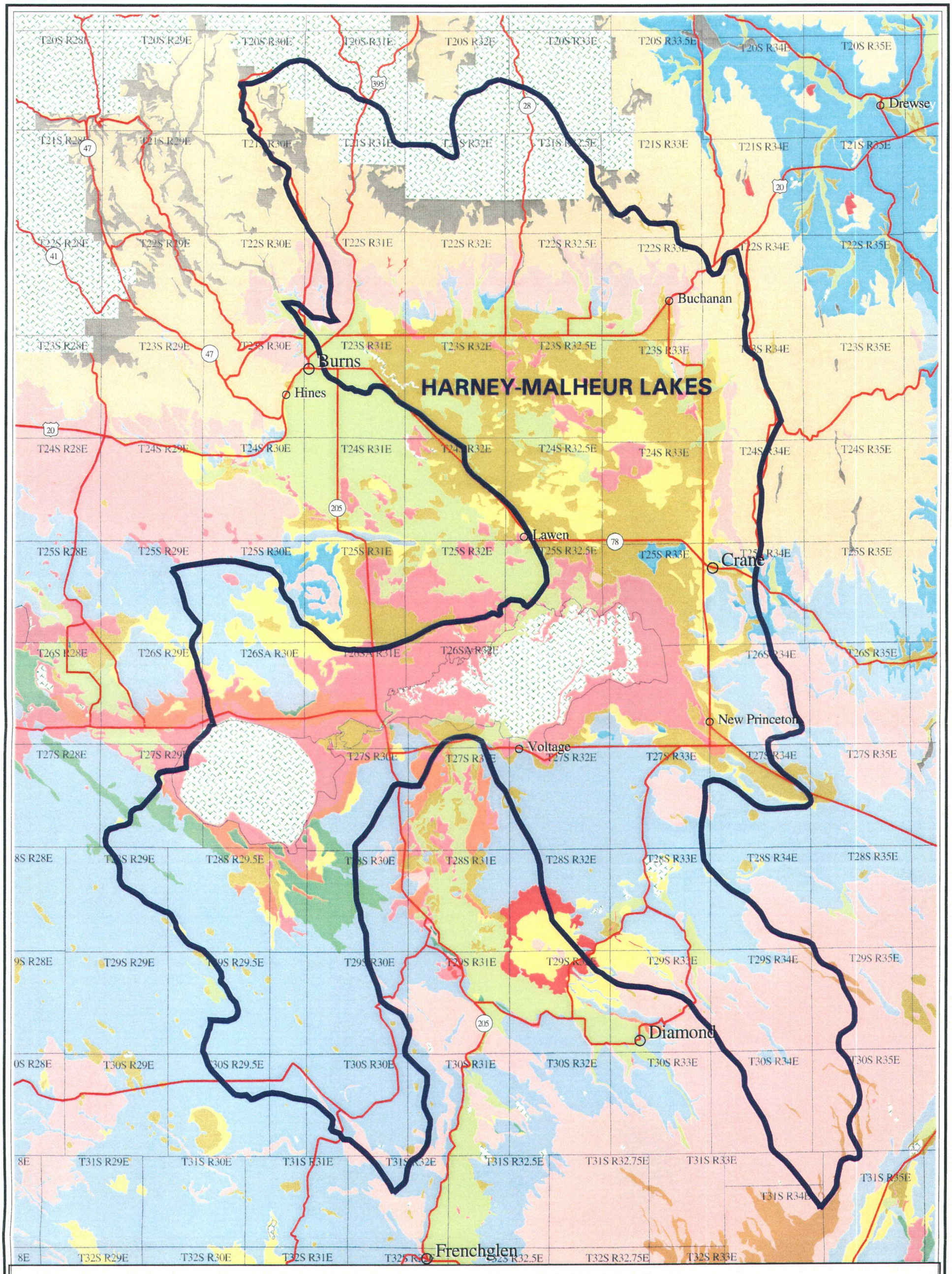
The relatively small area of forested lands in the northern part of the sub-basin consists of pure ponderosa pine stands, pure juniper stands, and mixed conifer stands, which include ponderosa pine and Douglas fir. Fire suppression, insect infestation and areas of dense road construction have negatively impacted this area of the forest. Small stands of quaking aspen are still growing around springs and along streams. Juniper have invaded aspen stands, utilized the water needed to maintain the small aspen groves and eliminated many sites. Aspen usually spread by cloning and are maintained and spread by fire and other disturbance such as felling of older trees by beaver. Lack of such disturbance in recent times has contributed to stand loss.

Below the forest is the foothill transition zone where mountain mahogany, juniper, bitterbrush and sagebrush/grass communities are dominant although interspersed with scattered ponderosa pine and the occasional fir. Juniper has become widespread in the transition zone, although it has also moved into the conifer forest and the lower, sagebrush dominant valley bottoms. The trees were historically found on wind swept ridges where fire was not as frequent as in the lower elevations. Junipers are not fire resistant and any tree less than 4 inches in diameter is very susceptible to fire. Lack of fire has encouraged the spread of juniper.

Sagebrush/grass communities are dominant below the foothill transition zone. In this zone, areas with shallow soil are dominated by low sagebrush and Sandberg's bluegrass. In areas of deeper soil Wyoming big sagebrush is the dominant shrub. The main grasses are blue-bunch wheat grass and Idaho fescue with the fescue being found in slightly higher and moister spots while the wheatgrass is able to tolerate drier areas. Greasewood and rabbitbrush in addition to salt grass and basin wild rye are prevalent in Harney Valley as the soil becomes more alkaline nearer the lakes. Large areas of sagebrush have been removed and replaced with irrigated fields.

The introduction of Russian thistle and cheatgrass has had a major impact on the plant composition of the sub-basin. Once the soil is disturbed, these invasive plants establish quickly before native plants can begin to grow. Large areas of these introduced plants are now evident. Perennial pepperweed is another invasive plant that has covered large areas in the southern part of Harney Valley.

There are 14 sensitive plants known to occur in the sub-basin (Table #8).



MAP #15 - HARNEY-MALHEUR LAKES SUBBASIN - HISTORIC PLANT ASSOCIATIONS (NRCS)

- 1 Saline-Sodic Lake Basins & Playas
- 2 Saline-Sodic Lake Terraces & Fans
- 3 Marshes, Meadows & Bottomlands
- 4 Seasonal Floodplains,Dry Basins,Playas
- 5 Silty Dry Lake Terraces
- 6 Sandy Lake Terraces
- 7 Warm Shallow Terraces & Plateaus
- USFS and Out Areas (No Data Available)
- 8 Warm Foothills
- 9 Cold Plateaus & Uplands
- 10 Cold High Plateaus & Buttes
- 11 Cold Upland & Mountain Plateaus
- 12 Cold High Mountains
- 13 Forest & Forest Fringe
- Rock outcrop and rubble land

0 1 2 3 4 5 6 MILES

Scale: 1 inch = 5.6 miles

Note: No warranty is made by Harney County or the Bureau of Land Management as to the accuracy, reliability or completeness of these data for individual or aggregate use with other data. Original data was compiled from various sources. This information may not meet National Map Accuracy Standards. This product was developed through digital means and may be updated without notification.

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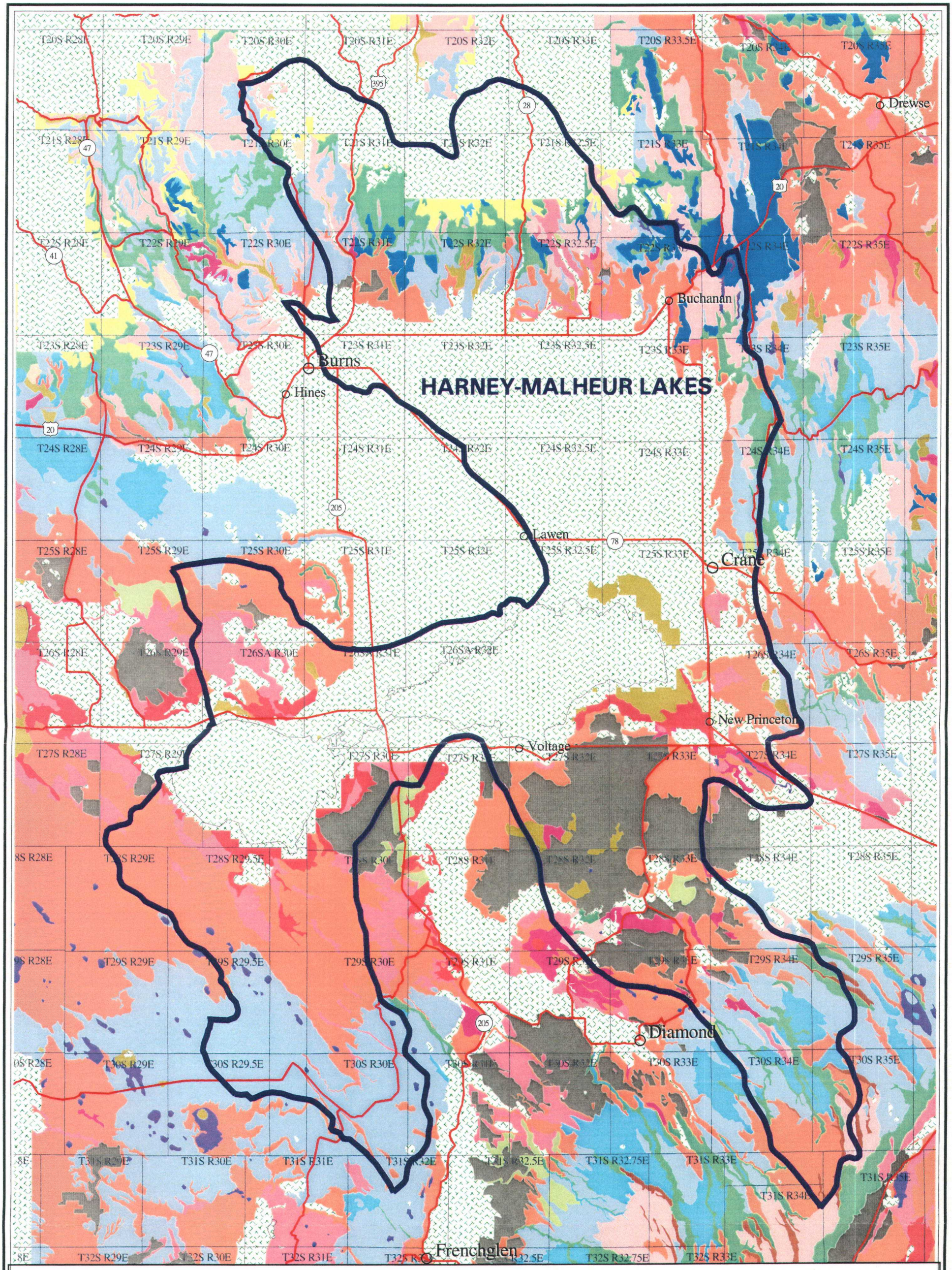

MAP #16 - CURRENT VEGETATION - GENERAL PLANT COMMUNITIES (BLM)

- Big Sagebrush/Annual Grassland
- Big Sagebrush/Perennial Grassland
- Annual Grassland
- Native Perennial Grassland
- Crested Wheatgrass/Sagebrush
- Forested
- Juniper/Big Sagebrush
- Juniper/Low Sagebrush
- Low Sagebrush/Grassland
- Mountain Big Sagebrush/Grassland
- Mountain Shrub/Grassland
- Quaking Aspen
- Rabbitbrush/Grassland
- Salt Desert Shrub/Grassland
- Silver Sagebrush/Grassland
- Stiff Sagebrush
- Out Areas (USFS, USFWS, Private) (No Data Available)

0 1 2 3 4 5 6 MILES

Scale: 1 inch = 5.6 miles

Note: No warranty is made by Harney County or the Bureau of Land Management as to the accuracy, reliability or completeness of these data for individual or aggregate use with other data. Original data was compiled from various sources. This information may not meet National Map Accuracy Standards. This product was developed through digital means and may be updated without notification.

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Table #8: Threatened, endangered and sensitive plant species known to occur within the Harney-Malheur Lakes Sub-basin.

COMMON NAME	SCIENTIFIC NAME	STATUS
Columbia cress	*Rorippa columbiae*	Sensitive
Deschutes milkvetch	*Astragalus tegetarioides*	Sensitive
four-wing milkvetch	*Astragalus tetrapterus*	Sensitive
iodine bush	*Allenrolfea accidentalis*	Sensitive
least snapdragon	*Antirrhinum kingii*	Sensitive
lowland rotala	*Rotala ramosior*	Sensitive
Malheur wirelettuce	*Stephanomeria malheurensis*	Endangered
mousetail	*Myosurus clavicaulis*	Sensitive
nodding melic	*Melica stricta*	Sensitive
raven's biscuitroot	*Lomatium ravenii*	Sensitive
seaside heliotrope	*Heliotropium curassavicum*	Sensitive
short-lobed penstemon	*Penstemon seorsus*	Sensitive
Sierra onion	*Allium campanulatum*	Sensitive
wheat sedge	*Carex atherodes*	Sensitive

SOILS

There are five general soil groups within the sub-basin. These are categorized as: 1) warm soils on terraces, low hills and basin floors; 2) cool soils on terraces and basin floors; 3) cool soils on mountains; 4) cool soils on shrub and grass-covered tablelands and hills having 8-16 inches of precipitation; 5) cool soils on forested, and shrub and grass-covered hills having 12-18 inches of precipitation. Soil types within the soil groups are shown in Table #9.

Table #9:

WARM SOILS ON TERRACES, LOW HILLS AND BASIN FLOORS

Alvodest-Droval-Playas	
Somewhat poorly to very poorly drained. Very deep soils formed in lacustrine sediments on low lake terraces and basin floors.	
Percentage of Survey Area:	4%
Elevation:	4,000 to 4,600 feet
Average Annual Precipitation:	6 to 10 inches
Temperature:	45 ° F. to 49 ° F.
Frost-Free Period:	80 to 100 days
Dominant Slopes	0 to 3%
Dominant Vegetation:	Black greasewood, inland saltgrass, basin wild rye
Minor Components:	Ozamis, Icene, Mesman, Boravall,

	Dixon
Dominant Land Uses:	Livestock grazing and wetland wildlife habitat
Major Limitations for Use:	Hazard of ponding, alkalinity, salinity

Spangenburg-Enko-Catlow	
Well or moderately well drained. Very deep soils formed in lacustrine sediments and alluvium on middle lake terraces.	
Percentage of Survey Area:	8%
Elevation:	4,200 to 5,300 feet
Average Annual Precipitation:	8 to 12 inches
Temperature:	45 ° F. to 49 ° F.
Frost-Free Period:	80 to 100 days
Dominant Slopes	0 to 20%
Dominant Vegetation:	Basin big sagebrush, Wyoming big sagebruse, creeping wild rye, bluebunch wheatgrass, Thurber needlegrass, basin wildrye, Indian ricegrass, needle-and-thread grass
Minor Components:	Outerkirk, Norad, Goldrun, Defenbaugh, Rio King, and Nevador soils
Dominant Land Uses:	Livestock grazing and irrigated alfalfa production
Major Limitations for Use:	Hazard of wind erosion

Atlow-Tumtum-Deppy	
Well drained, very shallow or shallow soils formed in old alluvium, residuum, or colluvium on high lake terraces.	
Percentage of Survey Area:	5%
Elevation:	3,400 to 5,300 feet
Average Annual Precipitation:	6 to 10 inches
Temperature:	45 ° F. to 49 ° F.
Frost-Free Period:	80 to 100 days
Dominant Slopes	2 to 50%
Dominant Vegetation:	Shadscale, bud sagebrush, Wyoming big sagebrush, bluebunch wheatgrass, Indian ricegrass, Thurber needlegrass
Minor Components:	Kerrfield, Bruncan, Vining, and Ladycomb soils
Dominant Land Uses:	Livestock grazing
Major Limitations for Use:	Hazard of water erosion, soil depth, droughtiness

SECTION THREE

WARM SOILS ON HILLS, TABLELANDS AND MOUNTAINS

Gumble-Risley-Mahoon	
Well drained, shallow or moderately deep soils formed in residuum, and colluvium on hills and tablelands.	
Percentage of Survey Area:	3%
Elevation:	3,400 to 4,800 feet
Average Annual Precipitation:	9 to 12 inches
Temperature:	45 ° F. to 49 ° F.
Frost-Free Period:	80 to 100 days
Dominant Slopes	0 to 40%
Dominant Vegetation:	Wyoming big sagebrush, bluebunch wheatgrass, Thurber needlegrass, Sandberg bluegrass
Minor Components:	Porterfield, Torriorthents, and Cagle soils
Dominant Land Uses:	Livestock grazing
Major Limitations for Use:	Hazard of water erosion, soil depth, droughtiness

Felcher-Skedaddle	
Well drained, very shallow to moderately deep soils that formed in colluvium and residuum on mountains.	
Percentage of Survey Area:	4%
Elevation:	4,100 to 7,100 feet
Average Annual Precipitation:	8 to 12 inches
Temperature:	45 ° F. to 49 ° F.
Frost-Free Period:	80 to 100 days
Dominant Slopes	20 to 70%
Dominant Vegetation:	Wyoming big sagebrush, shadscale, bud sagebrush, Indian ricegrass, bluebunch wheatgrass, Thurber needlegrass, desert needlegrass
Minor Components:	Westbutte and Fitzwater soils
Dominant Land Uses:	Livestock grazing
Major Limitations for Use:	Hazard of water erosion, soil depth, steepness, droughtiness

COOL SOILS ON TERRACES AND BASIN FLOORS

Fury-Skunkfarm-Housefield	
Somewhat poorly to very poorly drained, very deep soils formed in alluvium and lacustrine sediments on stream terraces, and lake terraces.	
Percentage of Survey Area:	4%
Elevation:	4,000 to 5,100 feet
Average Annual Precipitation:	8 to 10 inches
Temperature:	43 ° F. to 45 ° F.
Frost-Free Period:	50 to 80 days
Dominant Slopes	0 to 2%
Dominant Vegetation:	Nebraska sedge, Baltic rush, creeping wildrye, hardstem bulrush, broadfruit burreed, and spikerush
Minor Components:	Widowspring, Skidoosprings, Degarmo, Opie, McBain, Cumulic Haploxerolls and Jimgreen soils
Dominant Land Uses:	Livestock grazing, native hay production, and wetland wildlife habitat
Major Limitations for Use:	Hazard of ponding

Poujade-Ausmus-Swalesilver	
Moderately well and somewhat poorly drained, very deep soils formed in lacustrine sediments, and alluvium on middle lake terraces.	
Percentage of Survey Area:	5%
Elevation:	4,000 to 4,500 feet
Average Annual Precipitation:	8 to 12 inches
Temperature:	43 ° F. to 45 ° F.
Frost-Free Period:	50 to 80 days
Dominant Slopes	0 to 5%
Dominant Vegetation:	Basin big sagebrush, black greasewood, silver sagebrush, basin wildrye, inland saltgrass, creeping wildrye, Nevada bluegrass
Minor Components:	Skidoosprings, Crowcamp, The Narrows, Fury, Duckclub, Lolak, playas, and Opie soils
Dominant Land Uses:	Livestock grazing, irrigated alfalfa production, and wetland wildlife habitat
Major Limitations for Use:	Hazard of ponding, alkalinity, salinity

Reallis-Vergas-Lawen	
Well drained, very deep soils that formed in alluvium and eolian material on high lake terraces and fan terraces.	
Percentage of Survey Area:	5%
Elevation:	4,000 to 6,000 feet
Average Annual Precipitation:	10 to 12 inches
Temperature:	43 ° F. to 45 ° F.
Frost-Free Period:	50 to 80 days
Dominant Slopes	0 to 8%
Dominant Vegetation:	Basin big sagebrush, Wyoming big sagebrush, Thurber needlegrass, needle-and-thread grass
Minor Components:	Carvix, Widowspring, Voltage, Swaler, Swalesilver and Sandgap soils
Dominant Land Uses:	Livestock grazing and irrigated alfalfa production
Major Limitations for Use:	Hazard of wind erosion

COLD SOILS ON MOUNTAINS

Baconcamp-Clamp-Rock Outcrop	
Well drained, shallow or moderately deep soils formed in residuum, and colluvium.	
Percentage of Survey Area:	5%
Elevation:	5,100 to 9,200 feet
Average Annual Precipitation:	12 to 40 inches
Temperature:	40 ° F. to 43 ° F.
Frost-Free Period:	30 to 50 days
Dominant Slopes	5 to 80%
Dominant Vegetation:	Mountain big sagebrush, antelope bitterbrush, Idaho fescue, rough fescue, tufted hairgrass, sheep fescue
Minor Components:	Hackwood, Duff, Krackle, Hapgood, Leemorris, Gilispie, Buckwilder, and Dickie soils
Dominant Land Uses:	Livestock grazing, wildlife habitat and recreation
Major Limitations for Use:	Steepness, rockiness, hazard or water erorion, short growing season

COOL SOILS ON SHRUB AND GRASS COVERED TABLELANDS AND HILLS HAVING 8 TO 16 INCHES OF PRECIPITATION

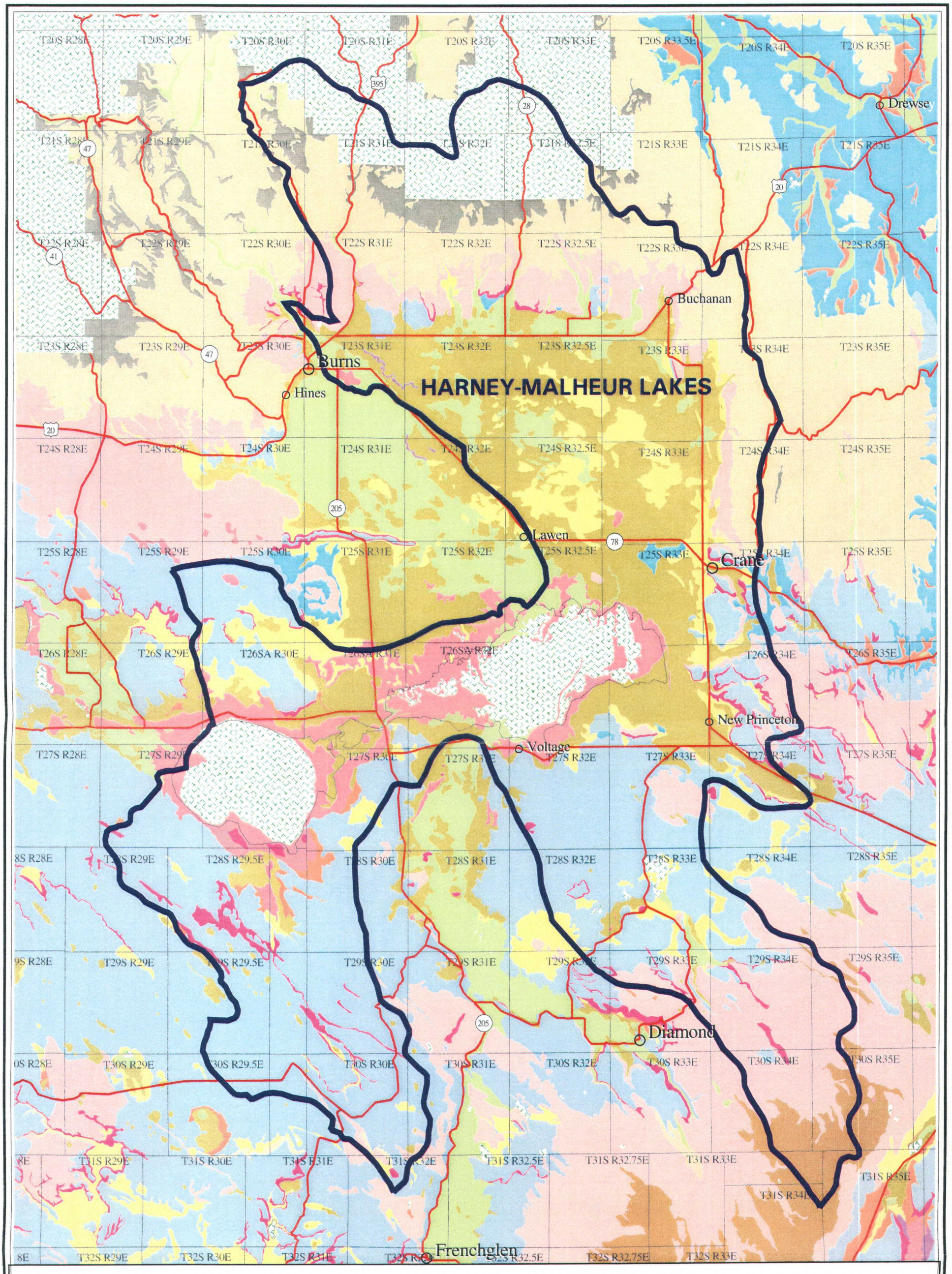
Raz-Brace-Anawalt	
Well drained, shallow or moderately deep soils formed in residuum and colluvium on tablelands having 8 to 12 inches of precipitation.	
Percentage of Survey Area:	30%
Elevation:	4,100 to 6,200 feet
Average Annual Precipitation:	8 to 12 inches
Temperature:	43 ° F. to 45 ° F.
Frost-Free Period:	50 to 80 days
Dominant Slopes	0 to 30%
Dominant Vegetation:	Wyoming big sagebrush, low sagebrush, Thurber needlegrass, bluebunch wheatgrass, Indian ricegrass, needle-and-thread grass, Sandberg needlegrass
Minor Components:	Actem, Robson, Carryback, Lonely
Dominant Land Uses:	Livestock grazing
Major Limitations for Use:	Steepness, rockiness, droughtiness, hazard of water erosion

Ninemille-Westbutte-Carryback	
Well drained, shallow and moderately deep soils that formed in residuum and colluvium on tablelands and hills having 12 to 16 inches of precipitation.	
Percentage of Survey Area:	15%
Elevation:	3,900 to 7,500 feet
Average Annual Precipitation:	12 to 16 inches
Temperature:	43 ° F. to 45 ° F.
Frost-Free Period:	50 to 80 days
Dominant Slopes	0 to 70%
Dominant Vegetation:	Western juniper, low sagebrush, mountain big sagebrush, Idaho fescue
Minor Components:	Pernty, Reluctan, Lambring, Doyn, Teguro, Ateron, and Edemaps soils
Dominant Land Uses:	Livestock grazing
Major Limitations for Use:	Steepness of slope, rockiness, droughtiness, hazard of water erosion

COOL SOILS ON FORESTED, AND SHRUB-AND-GRASS COVERED HILLS HAVING 12 TO 18 INCHES OF PRECIPITATION

Merlin-Observation-Lambring	
Well drained, shallow to very deep soils formed in residuum and colluvium on shrub and grass covered hills.	
Percentage of Survey Area:	10%
Elevation:	3,900 to 6,000 feet
Average Annual Precipitation:	12 to 16 inches
Temperature:	43 ° F. to 45 ° F.
Frost-Free Period:	50 to 80 days
Dominant Slopes	0 to 70%
Dominant Vegetation:	Western juniper, curlleaf mountain mahogany, low sagebrush, mountain big sagebrush, antelope bitterbrush, Idaho fescue, one-spike oatgrass, basin wildrye
Minor Components:	Doyn, Teguro, and Vitale soils
Dominant Land Uses:	Livestock grazing
Major Limitations for Use:	Steepness, rockiness, hazard of water erosion

Gaib-Anatone-Royst	
Well drained, shallow or moderately deep soils formed in residuum and colluvium on forested hills, tablelands and canyon sides having 14 to 18 inches of precipitation.	
Percentage of Survey Area:	1%
Elevation:	4,000 to 6,000 feet
Average Annual Precipitation:	14 to 18 inches
Temperature:	43 ° F. to 45 ° F.
Frost-Free Period:	50 to 80 days
Dominant Slopes	2 to 60%
Dominant Vegetation:	Ponderosa pine, western juniper, curlleaf mountain mahogany, low sagebrush, mountain big sagebrush, antelope bitterbrush, Idaho fescue, and one-spike oatgrass
Minor Components:	Observation, Egyptcreek, Klicker, Mound, Lambring, Merlin, and Teguro soils
Dominant Land Uses:	Livestock grazing and forest products
Major Limitations for Use:	Steepness, rockiness, hazard of water erorion



MAP #17 - HARNEY-MALHEUR LAKES SUBBASIN - GENERAL SOILS (NRCS)

- 1 Alvodest-Droval-Playas
- 2 Spangenburg-Enko-Catlow
- 3 Atlow-Tumtum-Deppy
- 4 Gumble-Risley-Mahoon
- 5 Felcher-Skedaddle
- 6 Fury-Skunkfarm-Housefield
- 7 Poujade-Ausmus-Swalesilver
- 8 Reallis-Vergas-Lawen
- 9 Baconcamp-Clamp-Rock outcrop
- 10 Raz-Brace-Anawalt
- 11 Ninemile-Westbutte-Carryback
- 12 Merlin-Observation-Lambring
- 13 Gaib-Anatone-Royst
- USFS and Out Areas (No Data Available)

0 1 2 3 4 5 6 MILES

Scale: 1 inch = 5.6 miles

Note: No warranty is made by Harney County or the Bureau of Land Management as to the accuracy, reliability or completeness of these data for individual or aggregate use with other data. Original data was compiled from various sources. This information may not meet National Map Accuracy Standards. This product was developed through digital means and may be updated without notification.

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SECTION THREE

PROPER FUNCTIONING CONDITION

Proper Functioning Condition (PFC) is a methodology used by the U. S. Forest Service (USFS), Bureau of Land Management (BLM), Natural Resource Conservation Service (NRCS) and private individuals to assess the functionality of stream systems. PFC of a stream is determined relative to the stream's capability and potential given no political, social or economic constraints. PFC is identified as the minimum standard for streams. This method is beneficial because a wide variety of groups can compare like information, but it is controversial due to the lack of "hard numbers." There are five categories involved in this methodology: 1) PFC; 2) functional-at-risk with an upward trend; 3) functional-at-risk with a downward trend, 4) functional-at-risk—trend not apparent; and 5) non-functional. (See glossary.)

PFC for all stream miles managed by the BLM within the Harney-Malheur Lakes Sub-basin has been assessed. The USFS has determined PFC on many miles of their managed streams, but still have assessments to complete. PFC has not been completed along any streams on private land within the sub-basin. Proper Functioning Condition has been determined for 38.4 stream miles with 19.7 miles at PFC, 18.7 miles functioning at risk and 0 miles as non-functional (Map 18). All assessed stream miles are on BLM-administered lands. No data is available for stream miles on forest service-administered lands or for stream miles on private lands. *(See Appendix E for specific stream PFC. Note that total miles are not the same as shown on Map 18 due to map source data.)*

WATER QUALITY LIMITED STREAMS

Section 303(d) of the Clean Water Act requires the State Department of Environmental Quality (DEQ) to identify those waters that are "water quality" limited based on the requirements of the most sensitive designated beneficial use. Cold-water fish are generally the beneficial use that parameters are based upon in this area.

The majority of 303(d) listed streams in Eastern Oregon are placed on the list because they exceed the seven-day average of daily maximums for temperature during the summer months. Very few streams in this area meet the State Water Quality Standards during the summer months of July through September. It is debatable as to whether or not these temperature standards are realistic or achievable in most stream systems. The Oregon State University Range Department is conducting studies to determine the effect of stream width/depth/gradient ratio and vegetative shading on stream temperature mechanics.

There are five streams in the Harney-Malheur Lakes Sub-basin, totaling 64.1 miles, that have been placed on the 303(d) list (Map 19). Many other streams are likely to be added in the future if the current temperature standard is used.

The streams in the north end of the sub-basin exceeding the temperature parameter are: Mill Creek from the headwaters south to meeting with Coffeepot Creek; Coffeepot

Creek from the headwaters south to meeting with Mill Creek, and Rattlesnake Creek from the headwaters of the west fork south to the main fork and continuing south approximately 1.5 miles above U. S. Highway 20. Rattlesnake Creek has one 303(d) in-stream water right for 17.94 acre feet on the first half of the stream reach and an identical amount on the second half of the stream reach.

The two streams in the southeastern corner of the sub-basin exceeding the temperature parameter are: Paul Creek from the headwaters west to meeting with Riddle Creek and, Riddle Creek from the headwaters west to approximately two miles above Dry Lake.

MAP #18 - HARNEY-MALHEUR LAKES SUBBASIN- RIPARIAN CONDITION

Riparian Condition Data for BLM Only.

- Proper Functioning Condition: 19.7 miles within Subbasin.
- Functioning at Risk: 18.7 miles within Subbasin.
- Non-Functioning: None in Subbasin

(note that miles are from 100K source; miles from 24K source will be higher)

- Subbasin Boundary
- Major Roads
- Perennial Streams
- Intermittent Streams

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0 1 2 3 4 5 6 MILES

Scale: 1 inch = 5.6 miles

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17

HARNEY-MALHEUR LAKES

Burns
Hines
Buchanan
Drewse
Lawen
Crane
New Princeton
Voltage
Diamond
Frenchglen

MAP #19 - HARNEY-MALHEUR LAKES SUBBASIN - 303D LISTED STREAMS - UPDATED 1998

303D Listed Streams.
Miles in Subbasin: 64.1

Subbasin Boundary
Major Roads
Perennial Streams
Intermittent Streams

0 1 2 3 4 5 6 MILES
Scale: 1 inch = 5.6 miles

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SECTION FOUR

ISSUES AND RECOMMENDATIONS

These issues and recommendations are not prioritized in any particular order.

Issue 1: Lowering of the water table due to an increase in the number of wells.

Recommendation: Educate the public as to the importance of establishing a database for the location of wells and baselines of seasonal/periodic fluctuations of ground water in those wells. Inventory historic wells.

Issue 2: Carp control.

Recommendation: Continue the development and use of selective carp management.

Issue 3: Weed control.

Recommendation:

a) Educate the public as to the importance of their input to the existing databases of noxious weed areas.
b) Recommend the continuance of government assistance for both riparian and upland weed control.
c) Encourage interagency and private cooperation to increase efficiency in weed control programs.

Issue 4: Ecological balance of native plant communities.

Recommendation: Continue to manage for ecological balance through the density control of conifers, reduction of invasive juniper populations, prescribed burning and other management practices.

Issue 5: Roads density in the Harney-Malheur Sub-basin.

Recommendation: Create an inventory of the roads in the sub-basin and assess their affect on watershed condition.

Issue 6: Riparian condition throughout the sub-basin.

Recommendation: Protect existing aspen stands and other deciduous species. Reintroduce willows, cottonwood, and alder in areas where they have been depleted.

Issue 7: Water retention/stream bank stability.

Recommendation: Utilize the placement of large woody debris and other methods of slowing the rush of water during peak flows.

Issue 8: Insufficient data exist on stream flows within the basin.

Recommendation: Encourage the collection of data by installing and monitoring gauging stations on both public and private lands.

APPENDICES

APPENDIX A

Following are terrestrial species that occur or have the potential to occur in the Harney-Malheur Lakes Sub-basin.

MAMMALS

COMMON NAME	SCIENTIFIC NAME
badger	*Taxidea taxus*
beaver	*Castor canadensis*
Belding's ground squirrel	*Spermophilus beldingi*
big brown bat	*Eptesicus fescus*
big freetail bat	*Tadarida brasiliensis*
black bear	*Ursas americanus*
black-tailed jackrabbit	*Eutamias minimus*
bobcat	*Felis rufus*
bushy-tailed wood rat	*Neotoma cinerea*
California myotis	*Myotis californicus*
canyon mouse	*Permomyscus crinitus*
chickaree	*Tamiasciurus douglasi*
cougar	*Felis concolor*
coyote	*Canis latrans*
dark kangaroo mouse	*Microdipodops megacephalus*
deer mouse	*Permomyscus maniculatus*
desert wood rat	*Neotoma lepida*
fringed myotis	*Myotis thysanodes*
golden-mantled squirrel	*Spermophilus lateralis*
Great Basin kangaroo rat	*Dipodomys microps*
Great Basin pocket mouse	*Perognathus parvosi*
hairy-winged myotis	*Myotis volans*
hoary bat	*Lasiurus cinerus*
house mouse	*Mus musculus*
least chipmunk	*Tamias minimus*
little brown myotis	*Myotis lucifugus*
long-eared myotis	*Myotis evotis*
long-tailed vole	*Microtus longicaudus*
long-tailed weasel	*Mustela frenata*
Merriam's shrew	*Sorex merriami*
mink	*Mustela vision*
montane meadow mouse	*Micotus montanus*
mule deer	*Odocoileus hemionus*
muskrat	*Ondatra zibethicus*
northern grasshopper mouse	*Onychomys leucogaster*
northern pocket gopher	*Thomomys talpoides*

Nuttall's cottontail	*Sylvilagus nattalii*
Ord's kangaroo rat	*Dipodomys ordii*
pale western big-eared bat	*Corynorhinus townsendii pallescens*
pallid bat	*Antrozous pallidus*
porcupine	*Erethizon dorsatum*
Preble's shrew	*Sorex preblei*
pronghorn antelope	*Antilocapra americana*
pygmy rabbit	*Sylvilagus idahoensis*
racoon	*Procyon lotor*
red fox	*Vulpes vulpes*
Rocky Mountain elk	*Cervus canadensis*
sagebrush vole	*Lagurus curtatus*
silver-haired bat	*Lasioonycteris noctivagans*
small-footed myotis	*Myotis ciliiolabrum*
striped skunk	*Mephitis mephitus*
Townsend's big-eared bat	*Corynorhinus townsendii*
Townsend's ground squirrel	*Spermophilus townsendii*
Townsend's pocket gopher	*Thomomys townsendii*
vagrant shrew	*Sorex vagrans*
water shrew	*Sorex palustris*
western harvest mouse	*Reithodontonys megalotis*
western jumping mouse	*Zapus princeps*
western pipistrelle	*Pipistrellus Hesperus*
western spotted skunk	*Spilogale gracilis*
white-tailed antelope squirrel	*Ammospermophilus leucurus*
white-tailed jackrabbit	*Lepus townsendii*
wild horse	
wolverine	*Gulo gulo luseus*
yellow pine chipmunk	*Tamias townsendii*
yellow-bellied marmot	*Marmota flaviventris*
Yuma myotis	*Myotis yumanensis*

BIRDS

COMMON NAME	SCIENTIFIC NAME
Loons, Grebes:	
Clark's grebe	*Aechmorphorus clarkii*
common loon	*Gavia immer*
eared grebe	*Podiceps caspicus*
horned grebe	*Podiceps auritus*
pied-billed grebe	*Podilymbus podiceps*
western grebe	*Aechmophorus occidentalis*

Pelicans, Cormorants:	
American white pelican	*Pelecanus erthrorhynchos*
double-crested cormorant	*Phalacrocorax auritus*
Bitterns, Herons and Egrets:	
American bittern	*Botaurus lentiginosus*
black-crowned night heron	*Nycticorax nycitcorax*
cattle egret	*Babulcus cassinii*
great blue heron	*Ardea herodias*
great egret	*Ardea alba*
least bittern	*Ixobrychus exilis*
snowy egret	*Egretta thula*
Storks, Ibis:	
white face ibis	*Plegadis chihl*
Waterfowl:	
American wigeon	*Anas americana*
Barrow's goldeneye	*Bucephala islandica*
blue-winged teal	*Anas discors*
bufflehead	*Bucephala albeola*
Canada goose	*Branta canadensis*
canvasback	*Aythya valisneria*
cinnamon teal	*Anas cyanoptera*
common golden eye	*Bucephala clangula*
common merganser	*Mergus merganser*
Eurasian wigeon	*Anas penlope*
gadwall	*Anas strepera*
greater scaup	*Aythya marila*
greater white-fronted goose	*Anser albifrons*
green-winged teal	*Anas crecca*
harlequin duck	*Histrionicus histrionicus*
hooded merganser	*Lophodytes cucullatus*
lesser scaup	*Aythya affinis*
mallard	*Anas platyrhynchos*
northern pintail	*Anas acuta*
northern shoveler	*Anas clypeata*
redhead	*Aythya americana*
ring-necked duck	*Aythya collaris*
Ross' goose	*Chen rossii*
ruddy duck	*Oxyura jamaicensis*
snow goose	*Chen caerulescens*
surf scoter	*Melanitta perspicillata*
trumpeter swan	*Olar buccinator*

tundra swan	*Cygnus colubianus*
white-fronted goose	*Anser albifrons*
white-winged scoter	*Melanitta deglandi*
wood duck	*Aix sponsa*
Vultures, Hawks and Eagles:	
American kestral	*Falco sparverius*
bald eagle	*Haliaeetus leucocephalus*
Cooper's hawk	*Accipiter copperii*
Ferrginous hawk	*Buteo regalis*
golden eagle	*Aquila chrysaetos*
northern goshawk	*Accipiter gentiles*
northern harrier	*Circus cyaneus*
osprey	*Pandion haliaetus*
red-shouldered hawk	*Buteo lineatus*
red-tailed hawk	*Buteo jamaicensis*
rough-legged hawk	*Buteo lagopus*
sharp-skinned hawk	*Accipiter striatus*
Swainson's hawk	*Buteo sawinsoni*
turkey vulture	*Cathartes aura*
Falcons:	
merlin	*Faleo columbarius*
peregrine falcon	*Falco peregrinus anatum*
prairie falcon	*Falco mexicanus*
Grouse, Quail and Pheasants:	
blue grouse	*Dendragapus obscurus*
California quail	*Callipepla californica*
chukar	*Alextoris chukar*
gray partridge	*Perdix perdix*
greater sage grouse	*Centrocercus urophasianus*
mountain quail	*Oreortyx pictus*
ring-necked pheasant	*Phasianus colchicus*
ruffed grouse	*Bonasa umbellus*
wild turkey	*Meleagris gallopavo*
Cranes, Rails and Coots:	
American coot	*Fulica Americana*
greater sandhill crane	*Grus canadensis tabida*
lesser Sandhill crane	*Grus canadensis*
sora	*Porzana Carolina*
Virginia rail	*Rallus limicola*

Shorebirds:	
American avocet	*Recurvirostra Americana*
Baird's sandpiper	*Erolia bairdii*
black-bellied plover	*Squatarola squatarola*
black-necked stilt	*Llimantopus mexicanus*
common snipe	*Gallinago gallinago*
dunlin	*Calidris alpina*
greater yellowlegs	*Tringa melanoleuca*
killdeer	*Charadrius veciferus*
least sandpiper	*Calidris minutilla*
lesser golden plover	*Pluvialis dominica*
lesser yellowlegs	*Tringa flavipes*
long-billed curlew	*Numenius americanus*
long-billed dowitcher	*Limnodromus scolopaceus*
marbled godwit	*Limosa fedoa*
red-necked phalarope	*Phalaropus lobatus*
ruddy turnstone	*Arenaria interpres*
sanderling	*Crocethia alba*
semi-palmated plover	*Charadrius semipalmatus*
snowy plover	*Charadrius alexandrinus*
solitary sandpiper	*Tringa solitaria*
spotted sandpiper	*Actitis macularia*
stilt sandpiper	*Micropalama himantopus*
western sandpiper	*Calidris pusilla*
whimbrel	*Numenius phaeopus*
willet	*Catoptrophorus semipalmatus*
Wilson's phalarope	*Phalaropus tricolor*
Gulls and Terns:	
black tern	*Chlidonias niger*
Bonaparte's gull	*Larus philadelphia*
California gull	*Larus californicus*
Caspian tern	*Sterna caspia*
common tern	*Sterna hirundo*
Forester's tern	*Sterna forsteri*
Franklin's gull	*Larus pipixcan*
herring gull	*Larus argentatus*
mew gull	*Larus canus*
ring-billed gull	*Larus delawarensis*
Pigeons and Doves:	
band-tailed pigeon	*Columbia fisciata*
mourning dove	*Zenaida macroura*
rock dove	*Columbia livia*

Owls:	
barn owl	*Tyto alba*
barred owl	*Strix varia*
burrowing owl	*Athene cunicularia*
flammulated owl	*Otus flammeollus*
great gray owl	*Strix nebulosa*
great horned owl	*Bubo virginianus*
long-eared owl	*Asio otus*
n. saw-whet owl	*Aegolius acadicus*
northern pygmy owl	*Glaucidium gnoma*
short-eared owl	*Asio flammeus*
western screech owl	*Otus kennicottii*
Goatsuckers:	
common nighthawk	*Chordeiles acutipennis*
common poor-will	*Phalaenoptilus nuttallii*
Swifts and Hummingbirds:	
black swift	*Cypseloides niger*
black-chinned hummingbird	*Archilochus alexandri*
calliope hummingbird	*Stellula calliope*
rufous hummingbird	*Selasphorus rufus*
Vaux's swift	*Chaetura vauxi*
white-throated swift	*Aeronautes saxatalis*
Kingfishers:	
belted kingfisher	*Ceryle alcyon*
Woodpeckers:	
black-backed woodpecker	*Picoides areticus*
downy woodpecker	*Picoides pubescens*
hairy woodpecker	*Picoides villosus*
Lewis' woodpecker	*Asyndesmus lewis*
northern flicker	*Colaptes auratus*
pileated woodpecker	*Dryocopus pileatus*
red-breasted sapsucker	*Sphyrapicus ruber*
red-naped sapsucker	*Sphyrapicus nuchalis*
three-toed woodpecker	*Picoides tridactylus*
white-headed woodpecker	*Picoides albolarvatus*
Williamson's sapsucker	*Sphyrapicus thyroideus*
Cuckoos and Roadrunners:	
yellow-billed cuckoo	*Coccyzus americanus*

Flycatchers:	
ash-throated flycatcher	*Myiarchus cinerascens*
cordilleran flycatcher	*Empidonax occidentalis*
dusky flycatcher	*Empidonax oberholseri*
eastern kingbird	*Tyrannus tyrannus*
gray flycatcher	*Empidonax wrightii*
Hammond's flycatcher	*Empidonax hammondii*
least flycatcher	*Empidonax alnorum*
olive-sided flycatcher	*Contopus borealis*
Pacific slope flycatcher	*Empidonax diffiicilus*
Say's phoebe	*Sayornis saya*
western kingbird	*Tyrannus verticalis*
western wood pewee	*Contopus sordidulus*
willow flycatcher	*Empidonax traillii*
Swallows:	
bank swallow	*Riparia riparia*
barn swallow	*Hirundo rustica*
cliff swallow	*Petrochelidon pyrrhonota*
n. rough-winged swallow	*Stelgidopterys serripennis*
tree swallow	*Tachycineta bicolor*
violet-green swallow	*Tachycineta thalassina*
Larks:	
horned lark	*Eremophila alpestris*
Jays, Magpies and Crows:	
American crow	*Crovus brachyrhynchos*
black-billed magpie	*Pica pica*
bluejay	*Cyanocitta cristata*
Clark's nutcracker	*Nucifraga columbiana*
common raven	*Corvus corax*
gray jay	*Perisoreus canadensis*
pinyon jay	*Gymnorhinus cyanocephalus*
scrub jay	*Aphelocoma coerulescens*
Steller's jay	*Cyanocitta stelleri*
Chickadees and Nuthatches:	
black-capped chickadee	*Parus atricapillus*
brown creeper	*Certhia familiaris*
chestnut-back chickadee	*Parus rufescens*
mountain chickadee	*Parus gambeli*
pygmy nuthatch	*Sitta pygmaea*
red-breasted nuthatch	*Sitta canadensis*

white-breasted nuthatch	*Sitta carolinensis*
Dippers, Bushtits and Wrens:	
American dipper	*Cinclus mexicanus*
bewick's wren	*Thryomanes bewickii*
bushtit	*Psaltriparus minimus*
canyon wren	*Catherpes mexicanus*
house wren	*Troglodytes aedon*
long-billed marsh wren	*Telmatodytes palustris*
marsh wren	*Cistothorus palutris*
rock wren	*Salpincies obsoletus*
winter wren	*Troglodytes troglodytes*
Thrashers:	
brown thrasher	*Toxostoma rufum*
gray catbird	*Dumetella carolinensis*
northern mockingbird	*Mimus polyglottos*
sage thrasher	*Oreoscoptes montanus*
Blackbirds, Meadowlarks and Orioles:	
bobolink	*Dolichonyx oryzivorus*
Brewer's blackbird	*Euphagus cyanocephalus*
brown-headed cowbird	*Molothrus ater*
great-tailed grackle	*Quiscalus mexicanus*
hooded oriole	*Icterus cucullatus*
northern oriole	*Icterus galbula*
red-winged blackbird	*Agelaius phoeniceus*
tri-colored blackbird	*Agelaius tricolor*
western meadowlark	*Surnella neglecta*
western tanager	*Piranga ludoviciana*
yellow-headed blackbird	*Xanthocephalus xanthocephalus*
Kinglets, Bluebirds and Thrushes:	
American robin	*Turdus migratorius*
blue-gray gnat catcher	*Polioptila caerulea*
golden-crowned kinglet	*Regulus calendula*
hermit thrush	*Catharus guttatus*
mountain bluebird	*Sialia currucoides*
ruby-crowned kinglet	*Regulus calendula*
Swainson's thrush	*Hylocichla ustulata*
Townsend's solitaire	*Myadestes townsendii*
varied thrush	*Ixoreus naevius*
veery	*Catharus fuscescens*

western bluebird	*Sialia mexicana*
Pipits and Waxwings:	
American pipit	*Anthus rubescens*
Bohemian waxwing	*Bombycilla garrulous*
cedar waxwing	*Bombycilla cedrorum*
Shrikes and Starlings:	
European starling	*Sturnus vulgaris*
loggerhead shrike	*Lanius ludovicianus*
northern shrike	*Lanius excubitor*
Vireos:	
red-eyed vireo	*Vireo olivaceus*
solitary vireo	*Vireo solitarius*
warbling vireo	*Vireo gilvus*
Warblers:	
American redstart	*Setophaga picta*
bay-breasted warbler	*Dendroica castanea*
black-and-white warbler	*Dendroica striata*
blackpoll warbler	*Dendroica striata*
black-throated blue warbler	*Dendroica caerulescens*
black-throated gray warbler	*Dendroica nigrescens*
cape may warbler	*Dendroica tigrina*
chestnut-sided warbler	*Dendroica pensylvanica*
common yellowthroat	*Geothlypis trichas*
hooded warbler	*Wilsonia citrina*
MacGillivray's warbler	*Oporornis tolmiei*
magnolia warbler	*Dendroica magnolia*
Nashville warbler	*Vermivora ruficapilla*
northern parula	*Parula Americana*
northern water thrush	*Seiurus noveboracensis*
orange-crowned warbler	*Vermivora celata*
ovenbird	*Seiurus aurocapillus*
Tennessee warbler	*Vermivora peregrina*
Townsend's warbler	*Dendroica townsendii*
Wilson's warbler	*Wilsonia pusilla*
yellow warbler	*Dendroica petechia*
yellow-breasted chat	*Icteria virens*
yellow-rumped warbler	*Dendroica coronata*
Finches:	
American goldfinch	*Carduelis tristis*

black-headed grosbeak	*Pheucticus melanocephalus*
Cassin's finch	*Carpodacus cassinii*
common redpoll	*Acanthis flammea*
evening grosbeak	*Hesperiphona vespertina*
gray-crowned rosy finch	*Leucosticte tephrocotis*
house finch	*Carpodacus mexicanus*
Lazuli bunting	*Passcrina amoena*
lesser goldfinch	*Carduelis psaltcia*
pine grosbeak	*Pinicola enucleator*
pine siskin	*Spinus pirius*
purple finch	*Carpodacus purpureus*
red crossbill	*Loxia curvirostra*
rose-breasted grosbeak	*Pheucticus ludovicianus*
white-winged crossbill	*Loxia leucoptera*
Towhees and Sparrows:	
American tree sparrow	*Spizella passerina*
black-throated sparrow	*Amphispiza bilineata*
Brewer's sparrow	*Spizella breweri*
chipping sparrow	*Spizella passerina*
dark-eyed junco	*Junco hyemalis*
fox sparrow	*Passerella iliaca*
golden-crowned sparrow	*Zonotrichia atricapilla*
grasshopper sparrow	*Ammodramus savannarum*
green-tailed towhee	*Pipilo chlorurus*
Harris sparrow	*Zonotrichia querula*
lapland longspur	*Calcarius lapponicus*
lark sparrow	*Chondester grammacus*
Lincoln's sparrow	*Melospiza lincolnii*
sage sparrow	*Amphispiza belli*
Savannah sparrow	*Passerculus sandwichensis*
snow bunting	*Plectrophenax nivalis*
song sparrow	*Melopiza melodia*
spotted towhee	*Pipilo maculates*
vesper sparrow	*Pooecetes gramineus*
violet-green swallow	*Tachycineta thalassina*
white-crowned sparrow	*Zonotrichia leucophrys*
white-throated sparrow	*Zonotrichia albicollis*
Weaver Finches:	
house sparrow	*Paser domesticus*

REPTILES AND AMPHIBIANS

COMMON NAME	SCIENTIFIC NAME
boreal toad	*Bufo boreas*
Columbia spotted frog	*Rana luteiventris*
desert horned lizard	*Phrynosoma platyrhinos*
desert night snake	*Hypsiglena torquata*
desert striped whip snake	*Masticophis taeniatus*
e. long-toed salamander	*Ambystoma macrodactylum*
Great Basin fence lizard	*Sceloporus occidentalis*
Great Basin gopher snake	*Pituophis catenifer*
Great Basin spade foot toad	*Spea intermontana*
Great Basin whiptail	*Cnemidophorus tigris*
n. side-blotch lizard	*Utastans buriana*
northern sagebrush lizard	*Sceloporus graciosis*
Pacific tree frog	*Hyla regilla*
rubber boa	*Charina bottae*
sagebrush lizard	*Sceloporus graciosus*
short-horned lizard	*Phyrynosoma douglassii*
valley garter snake	*Thamnophis sirtalis fitchi*
w. yellow-bellied racer	*Coluber constrictor mormon*
wandering garter snake	*Thamnophis elegans vagrans*
western fence lizard	*Sceloporus occidentalis*
western rattlesnake	*Crotalus virdis*
western skink	*Eumeces skiltonianus*

APPENDIX B

Plants used by the Burns Paiute Indian Tribe (USFS, 1997)

COMMON NAME	SCIENTIFIC NAME	NORTHERN PAIUTE NAME
bare stem biscuit-root	*Lomatium nudicaule*	Unknown
beard tongue	*Penstemon spp.*	Namogot
big sagebrush	*Artemesia tridentate*	Sah wabi
big-head clover	*Trifolium macrocephalum*	Poziidapy
bitterroot	*Lewisia rediviva*	Kanicy
camas	*Camassia quamash*	Paazigo
Canby's biscuit-root	*Lomatium canbyi*	Canacuka
chokecherry	*Prunus virginiana*	Toosia bui
cous biscuit-root	*Lomatium cous*	Cuka
field mint	*Mentha arvensis*	Pakwana
Gairdner's yampah	*Perideridia bolanderi*	Yapa, yampa, payapa
German's biscuit-root	*Lomatium gotmanii*	Kwidapoo
golden currant	*Ribes aureum*	Poko pisa
juniper	*Junperus occidentalis*	Waa pi
large-fruit biscuit-root	*Lomatium macrocarpum*	Haapi
Oregon yampah	*Perideridia oregana*	Pamahayapa
ponderosa pine	*Pinus ponderosa*	Ti bi
sagebrush mariposa lily	*Calochortus macrocarus*	Koogi
swamp onion	*Allium madicum*	Sii
taper-tip onion	*Allium acuminatum*	Kyyga
wormwood/prairie sagewort	*Artemesia frigida*	Na te zoowa
yarrow	*Achillea millefolium*	Waa da qusi
yellow bell	*Fritillaria pudica*	Winida

APPENDIX C

Fish species of the Harney-Malheur Lakes Sub-Basin.

NATIVE FISH

COMMON NAME	SCIENTIFIC NAME
bridge lip sucker	*Catostomus columbianus*
chisel mouth	*Acrocheilus alutaceus*
largescale sucker	*Catostomus macrocheilus*
longnose dace	*Rhinichthys cataractae*
Malheur-mottled sculpin	*Cottus bairdi bairdi*
mottled sculpin	*Cottus bairdi*
northern squawfish	*Ptychocheilus oregonensis*
redband trout	*Oncorhyncus mykiss newberii*
redsided shiner	*Richardsonius balteatus*
speckled dace	*Rhinichthys asculus*

NON-NATIVE FISH

COMMON NAME	SCIENTIFIC NAME
bluegill	*Lepomis macrochirus*
brook trout	*Salvelinus fontinalis*
brown bullhead	*Ictalurus nebulosus*
common carp	*Cyprinus carpio*
largemouth bass	*Micropterous salmoides*
pumpkinseed	*Lepomis gibbosus*
rainbow trout	*Oncorhyncus mykiss*
smallmouth bass	*Micropterous dolomieui*
white crappie	*Pomoxis annularis*
yellow perch	*Perca flavescens*

APPENDIX D

HARNEY COUNTY NOXIOUS WEEDS

A-Rated Weeds
(Infestations Are Subject to Eradication Where Found)

COMMON NAME	SCIENTIFIC NAME
black henbane	*Hyoscyamus niger*
diffuse knapweed	*Centaurea diffusa*
leafy spurge	*Euphorbia esula*
musk thistle	*Cardus nutans*
purple loosestrife	*Lythrum salicaria*
rush skeletonweed	*Ghondrilla juncea*
salt cedar	*Tamarix ramosissima*
scotch broom	*Cytisus scoparius*
spotted knapweed	*Centaurea maculosa*
squarrose knapweed	*Centaurea virgata*
tansy ragwort	*Senecio jacobaea*
yellow star thistle	*Centaurea solstitialis*
yellow toadflax	*Linaria vulgaris*

B-Rated Weeds
(Infestations Are Handled at County Discretion)

COMMON NAME	SCIENTIFIC NAME
dalmatian toadflax	*Linaria dalmatica*
Mediterranean sage	*Salvia aethiopis*
medusahead rye	*Taeniatherum caput-medusa*
perennial pepperweed	*Lepidium latifolium*
puncture vine	*Tribulus terrestris*
Russian knapweed	*Centaurea repens*
scotch thistle	*Onopordum acanthium*

C-Rated Weeds
(Infestations Are Handled at Landowner's Discretion)

COMMON NAME	SCIENTIFIC NAME
Canada thistle	*Cirsium arvense*
halogeton	*Halogeton spp.*
morning glory	*Convolvulus arvensis*
St. John's Wort (Klamath Weed)	*Hypericum perforatum*
white top	*Cardaria draba*

APPENDIX E

Proper Functioning Condition (PFC) Information for Streams in Malheur-Harney Lake Sub-basin
(BLM-Administered Stream Miles* Only)

Stream Name	Proper Functioning Condition	Functioning at Risk (Upward Trend)	Functioning at Risk (Downward Trend)	Functioning at Risk (Trend Not Apparent)	Non-Functioning
Mahon Creek	2.67	0.60			
Mill Creek	2.90	0.60			0.60
Paul Creek		1.33			
Rattlesnake Creek	2.67				
Riddle Creek	0.38	2.67		5.88	
Smyth Creek	2.86	2.86			
Prather Creek	1.52				
Coffeepot Creek	0.38		0.50		
Coyote Creek	4.20	1.00			
Devine Creek	4.19				

*PFC for stream miles on Malheur National Forest is not available as of May, 2001. No PFC for private land miles have been completed as of May, 2001.

APPENDIX F

List of Recorded Wells in Harney-Malheur Lakes Sub-basin

Township	Range	No. of Water Wells
20 S	30 E	0
	31 E	1
	32 E	0
	33 E	0
21 S	30 E	0
	31 E	1
	32 E	0
	32.5 E	0
	33 E	1
22 S	30 E	0
	31 E	71
	32 E	50
	32.5 E	35
	33 E	21
	34 E	1
23 S	31 E	123
	32 E	106
	32.5 E	67
	33 E	68
	34 E	31
24 S	32 E	36
	32.5 E	29
	33 E	107
	34 E	25
25 S	29 E	0
	30 E	17
	31 E	0
	32 E	6
	32.5 E	17
	33 E	39
	34 E	69
26 S	30 E	37
	31 E	41
	32 E	13
	33 E	37
	34 E	32
27 S	29 E	2
	29.5 E	0
	30 E	15
	31 E	2
	32 E	5
	33 E	15
	34 E	23
28 S	29 E	0
	29.5 E	5

	29.75 E	1
	30 E	2
	32 E	1
	33 E	10
	34 E	3
29 S	29.5 E	0
	29.75 E	0
	30 E	0
	32 E	0
	33 E	3
	34 E	1
30 S	29.5 E	0
	29.75 E	0
	30 E	4
	31 E	0
	34 E	0
	35 E	0
31 S	32 E	0
	34 E	0
	35 E	0
	TOTAL WELLS:	1,173

NOTE: List does not include any wells not filed with the Oregon Department of Water Resources and found in the Department's internet web site as of April 24, 2001. No monitoring or geologic wells are listed. No differentiation made between domestic and irrigation wells or wells in use or non-use.

GLOSSARY

Alluvial/Alluvium: Sand, clay, etc. deposited by flowing water, especially in a stream bed.

Aquifer: Water-bearing rock or stratum.

Cloning: Producing plants which are directly descended from a single individual as by shoots, budding or grafting.

Evapotranspiration: The release and movement of moisture through evaporation from water and soil surfaces, and loss from living vegetation.

Forb: Broad-leafed flowering plants as distinguished from grasses, sedges, etc.

Functional at Risk: Riparian-wetland areas that are in functional condition but an existing soil, water, or vegetation attribute makes them susceptible to degradation. (USDI Bureau of Land Management, 1995) An upward trend signifies that conditions are improving and moving towards PFC. A downward trend implies that conditions are worsening.

Hydroponic: Science of growing plants in solutions containing the necessary minerals instead of soil.

Lacustrine: Of or found in or on lakes.

Lenticular: Shaped like a lentil or double-convex lens.

Linear Aquifer: Water-bearing rock or stratum consolidated and extended in length from point-to-point; may be straight or serpentine.

Non-functional: Riparian-wetland areas that clearly are not providing adequate vegetation, landform, or large woody debris to dissipate stream energy associated with high flows and thus are not reducing erosion, improving water quality, etc., as listed above. The absence of certain physical attributes such as floodplain where one should be are indicators of non-functioning conditions. (USDI Bureau of Land Management, 1995)

Pleistocene: Geologic time period characterized by the rise and receding of continental ice sheets; appearance of early man, epoch of time is 50,000 to 1,000,000 years ago.

Pliocene: Geologic time period during which plants and animals developed; epoch of time is 1,000,000 to 12,000,000 years ago.

Proper Functioning Condition (PFC): Riparian-wetland areas are functioning properly when adequate vegetation, land form, or large woody debris is present to dissipate stream energy associated with high water flows, thereby reducing erosion and

improving water quality; filter sediment, capture bed load, and aid floodplain development; improve flood-water retention and ground-water recharge; develop root masses that stabilize stream banks against cutting action; develop diverse ponding and channel characteristics to provide the habitat and the water depth, duration, and temperature necessary for fish production, waterfowl breeding and other uses; and support greater biodiversity. The functioning condition of riparian-wetland areas is a result of interaction among geology, soil, water and vegetation. (USDI Bureau of Land Management, 1995)

Pyroclastic: Made up of rock material broken into fragments through volcanic or igneous action.

Riparian: Of, relating to, or living on the banks of a stream, lake, etc.

Sedimentary: Any rock or mass deposited by wind or water.

Tertiary: Geologic era composed of the Pleistocene (latest), Pliocene, Miocene, Oligocene, Eocene and Paleocene (earliest) epochs; era spans 12,000,000 to 60,000,000 years ago.

Tuff: Porous rock, usually stratified and formed by the consolidation of volcanic ash, dust, sand, etc. which are adhered together to form a solid mass.

Welded Tuff: A glass-rich volcanic rock that has been solidified by the welding of its glass shards through an action of heat and hot gas.

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USGS Patuxent Wildlife Research Center: http://www.mbr.nbs.gov/id/framlst/infocenter.html

Harney County Chamber of Commerce: http://www.harneycounty.com/Paiute.htm