IRRIGATION DEVELOPMENT

IN OREGON'S

UPPER DESCHUTES RIVER BASIN

1871 - 1957

A HISTORIC CONTEXT STATEMENT

Prepared for

Deschutes County, the Cities of Bend, Redmond and Sisters

and the

State Historic Preservation Office

by the

Deschutes County Historical Landmarks Commission

Researched and Written by
Michael Hall, Associate Planner
Deschutes County Community Development Department

August 31, 1994

ACKNOWLEDGEMENTS

A number of people and organizations were responsible for the success of this project. Foremost among them is the Deschutes County Historical Landmarks Commission whose foresight and vision directed the project. Two members of the Commission, Ward Tonsfeldt, Vice-Chairman, and Paul Claeyssens, Forest Archaeologist for Deschutes National Forest, played key roles in the development and preparation of the project.

Deschutes County administration and staff are to be commended for a high level of support and assistance. The progressiveness and belief in the worthiness of the project demonstrated by George Read, Community Development Department Director, and the Board of County Commissioners, reflects an administration serving the community. This support was absolutely essential for the project's success. The exemplary work of Mary Jo Zehender, Senior Secretary, and her patience through many revisions was sincerely appreciated. Her professionalism, expertise and interest in the project was crucial to its success.

Several historians deserve praise for their past work in the field of irrigation history. The work of Redmond historian Keith Clark was invaluable and his willingness to share it as well as provide consultation was greatly appreciated. Martin Winch's history of the Tumalo irrigation system stands out as perhaps the best in the field and served as both a source and as a background for the study. The information prepared by Frederick Quivik and Jeffery Hess on Crane Prairie and Wickiup Dams is admirable.

The help of a number of organizations was also important to the project's success. Dwight Smith's (State Highway Division) study of canals in Bend provided a framework from which to begin the project. The assistance provided by staff at the Des Chutes Historical Center (Bend), the Bowman Museum (Prineville), the Oregon Historical Society Library, and the State Historic Preservation Office was tremendously valuable. The research of Mitzi Rossillon of Renewable Technologies, Inc., Butte, Montana, helped provide clarity and depth to the report. Lynne MacDonald at the Bureau of Reclamation, Boise, Idaho, and Michael Ciscell, State Water Resources Department, were also very helpful.

Deschutes County, a Certified Local Government, gratefully acknowledges the grant funding which made this project possible. This report was funded under the National Historic Preservation Act of 1966 through the United States Department of the Interior, National Park Service, as provided through the Oregon State Historic Preservation Office.

The Deschutes County Certified Local Government Historic Preservation Program receives Federal financial assistance for the identification and protection of historic properties. Under Title VI of the Civil Rights Act of 1964 and Section 504 of the Rehabilitation Act of 1973, the U.S. Department of the Interior prohibits discrimination on the basis of race, color, national origin, or handicap in its federally assisted programs. If you believe you have been discriminated against in any program, activity, or facility described above, or if you desire further information, please write to: Office for Equal Opportunity, U.S. Department of the Interior, Washington, D.C., 20240. -- Michael A. Hall

TABLE OF CONTENTS

LIST OF TABLES AND FIGURES

I. INTRODUCTION

Irrigation is the artificial application of water to overcome the deficiencies in rainfall for the growing of crops. Its practice occurs in the arid and semi-arid regions of the world, in areas with a marked seasonal shortage for rain, and in generally humid areas where it is used to safeguard against draught and to promote higher crops yields. In a number of western states, including Oregon, irrigation accounts for nearly all of the water that is consumptively used.

One of the most powerful changes that took place in Oregon between 1895 and 1920 was the reclamation of large areas of desert land by means of irrigation. Both public and private investments were made in irrigation development, adding greatly to the wealth of the state. In 1900, $1.8 million was invested in irrigation enterprises; in 1910, $12.76 million was invested, an increase of over 600 percent in the decade. By 1920 almost $20 million had been invested, an increase of 127 percent from 1910. In 1910, 686,000 acres had been bought under irrigation; in 1920 more than 986,000 acres, an increase of 44 percent, representing the addition of about 9,000 farms by 1920.[1]

The development of irrigation in the Upper Deschutes River Basin is significant in Oregon and national history. This occurrence is important for more than its association with a state and national historic trend. Irrigation development in the Basin defined the trend, making a significant contribution to the development of communities, the State and the Nation. Economic, political and social institutions were intrinsic to irrigation development. Practices, policies and programs established during the historic period still govern the region and continue to affect life today.

In 1902 irrigation prospects in the Basin were reported to be the "best advertised" in the nation.[2] A 1913 *Bend Bulletin* reported that the Deschutes River was classed as the "Best river for irrigation in the world" by the United States Irrigation Commission.[3] An early publication, *Redmond Now*, touted the Deschutes as the "River of Gold".[4]

Presently, it appears that irrigation development in the area has been overshadowed by other historical events: the coming of the railroad, and the development of the lumber and timber industry. It verges on being a largely forgotten part of not only local history, but of state history. The loss of significant historic resources and the gradual dimution of their integrity is a potential consequence.

This study will provide an historic context for the events that shaped the area's history during the latter part of the 19th century and the first-half of the 20th century. Importantly, this study will provide guidance for the preservation of resources directly linked to the historic context of Irrigation Development in the Upper Deschutes River Basin. It will serve as a starting point from which further research, survey and inventory can be directed to assist in evaluation and treatment programs.

There are four components within this historic context: (1) an Historical Overview of Irrigation Development in the Upper Deschutes River Basin; (2) an Identification of resource types associated with the development; (3) an Evaluation, or assessment, of the general status of the resource types; and (4) an initial list of Treatment needs and activities (strategies) for the preservation of these resources.

The historic context theme is a "Resource Type", with "Irrigation Project" being the type. It will explore the history, distribution, character defining features and evaluation criteria for "Irrigation Project" resources.

The temporal boundaries of the study are from 1871 to 1957. The diversion of water from Squaw Creek in 1871 for use on individual farms defines the beginning point for the study. The completion of Haystack Dam in 1957 provides the end point. Although this point does not meet the guidelines of the National Register of Historic Places, which requires resources to be at least 50 years old before they are considered historic, it is an important element of the context and provides a rational end point.

The spatial boundary of the study is the Upper Deschutes River Basin. The area encompasses all of the lands drained by the river system and irrigated with its water, ranging from Crescent Lake in Klamath County to farms in Deschutes and Jefferson counties. Section II F "Upper Deschutes River Basin" provides detailed information on the extent of the study area.

II. HISTORICAL OVERVIEW

A. EARLY IRRIGATION SYSTEMS

The origin of irrigated agriculture is unknown, but it has been a feature of developed societies for thousands of years in the arid and semi-arid areas of Asia, Africa and the Americas. The bible contains frequent references to irrigation.

Irrigation predates recorded history and was practiced in the Nile Valley between 3000 and 2500 B.C. Egyptians developed irrigation systems, including features such as the artesan well, the Nilometer for gauging streams, canals and mechanisms for lifting water from one level to another.

By about 3000 B.C. the Mohenjo-daro civilization in the Indus Valley had developed tanks and irrigation canals. At about the same time the Babylonian Empire prospered, due to a significant extent from its development of irrigated agriculture which brought water from the Tigris and Euphrates rivers through a system of storage and canals.

By about 500 B.C. irrigation technology was being developed in Asia, notably in Persia. China also built great irrigation structures. In about 3 B.C. the Imperial Canal, 700 miles long and one of the worlds great engineering works, was constructed. In India irrigation developed considerably during the first centuries after Christ, both in the Ganges and in the south.

Irrigation technology also found its way to Europe at an early time. From its beginnings in Egypt and Asia, irrigation spread westward to the Phoenicians, who built canals as early as 1500 B.C. In 1 B.C., Julius Caesar introduced irrigation into the countries he conquered, and by 1 A.D., irrigated agriculture was practiced throughout the Roman Empire. During the Middle Ages, the Moors spread irrigation knowledge and developed systems in Spain during the twelfth century. Subsequently, irrigation was practiced extensively in Italy, France and other areas of Europe.

Irrigated agriculture, also, was developed in the Americas before Christ. The Incas of Peru developed large irrigation structures of considerable ingenuity. Similar advanced agricultural civilizations using irrigation technology also developed in Chile and Mexico. Irrigation flourished in the areas of New Mexico and Arizona soon after the birth of Christ. In the Salt River valley of Arizona, for example, it is estimated that more than a quarter of a million acres were irrigated by more than 1,000 miles of canals and ditches.

Spanish missionaries and settlers establishing settlements in the present day areas of California, Arizona, New Mexico and Texas in the seventeenth and eighteenth centuries constructed water supply systems. Spanish technologies, developed after the Moorish conquest, and Indian irrigation practices were merged. Systems included water lifting mechanisms, ditches, stone aqueducts and log flumes.[1]

The Mormons, who settled Utah's Salt Lake Valley in 1847 were the first United States pioneers to establish an agricultural economy using irrigation. They built diversion dams and dug canals. By 1865 almost 1,000 miles of canals irrigated 1.5 million acres, establishing what has been called "the cradle of American irrigation" and becoming home to 65,000 Latter-Day

Saints. In the same year, the Utah territorial legislature passed the first irrigation district law authorizing citizens to organize irrigation companies and to levy taxes upon themselves for the building and maintenance of canals under county government supervision. The Mormons also helped establish a legal precedent for western reclamation by departing from the English common law principle of "riparian rights", which gave landowners bordering water courses the right to use water, to the doctrine of "prior appropriation for beneficial use," or "first in time, first in right". The first appropriator acquired rights to as much water as he could put to use for beneficial purposes.[2]

B. IRRIGATION PHILOSOPHY AND IDEOLOGY

Inspired by the Mormon's development of successful irrigation-based communities, many saw irrigation as the "panacea" for western development. In 1870 Nathan C. Meeker, agricultural editor for Horace Greeley's *New York Tribune*, founded the "Union Colony of Colorado". Greeley, the publisher whose words "Go west, young man" helped to encourage the settlement of the West, wanted to establish a utopian irrigation colony, which became Greeley, Colorado. Other colonies were established at Riverside and Anaheim, California, in the 1870's. Reclamationists across the country pointed to Mormon successes as a way to gain support for their proposals. However, most failed to realize that the successful ventures were products of religious beliefs, cooperation and discipline, development of legal and social institutions, and a geographical setting highly favorable to irrigation.

From 1878 to 1902, irrigation expansion became a critical issue in the West. Eastern speculators and the region's residents reclaimed large portions of the "Great American Desert" to create an economic base to foster settlement. Almost none of the hundreds of irrigation companies formed with eastern capital in the 1870's and 1880's survived beyond 10 years. Their failure resulted from not understanding that expansion of agricultural development required storage reservoirs and sophisticated dams and canals.[1]

John Wesley Powell

One who did understand the realities of irrigation development was John Wesley Powell. In 1869, the Powell Geographic Expedition set out on the Green River from the town of Green River, Wyoming, taking three months to journey to the confluence of the Colorado and the Virgin River and becoming the first white persons to explore the Colorado. Powell made a number of successive trips into the western portion of the country, making him a national hero and the most celebrated adventurer since Lewis and Clark.

In 1876, Powell published *A Report on the Lands of the Arid Region of the United States, with a More Detailed Account of the Land of Utah.* The study urged a scientifically planned reclamation and settlement program to utilize water and land efficiently while avoiding the problems of speculation and monopolistic control. Powell held strong convictions on a number of irrigation issues. Eastern laws and institutions did not adequately address the environmental limitations of the "western district or country".[2] Irrigation expansion required construction of dams and canals to either divert rivers or to store floodwater for summer use. In addition, such structures would require large amounts of capital and technical skills. Moreover, cooperative institutions were critical for survival beyond the hundredth meridian.

Powell told Congress that two-fifths of the United States had a climate that generally could not support farming without irrigation, and that irrigation could reclaim only a fraction of it. The problem with implementing the Homestead Acts in the West was that a 160-acre irrigated farm was too large, while a 160-acre unirrigated farm was too small. Powell also argued that riparian water law was impossible to implement if you provided a square of land for each farmer. He proposed forming states around watersheds in the West, rather than creating borders with straight lines or following rivers or mountains. Importantally, Powell realized that the federal government would eventually have to become a major irrigation developer or see its efforts to settle the West fail.

Powell's ideas for cooperation, reason, scientific research, an equitable sharing of natural resources and a return to the Jeffersonian ideal were not widely welcomed. The socio-economic mood of the nation was not interested in a slow, intelligent, planned settlement of the West. New immigrants did not want to hear of a dry West, nor did they want the federal government involved in controlling water. Congress was even more hostile toward his proposals.

A multi-disciplinary scientist, he headed both the Bureau of Ethnology and the Geologic Survey (USGS) by 1881. In 1888, the USGS, was authorized to survey streams and dam sites in the West. The agency was empowered to withdraw from public entry all areas "necessary for the storage and utilization of water", including canals and ditches and adjacent lands.[3] By 1889, 150 canal sites were identified and 30 million arid acres were deemed irrigable. Powell had withdrawn from entry 850 million acres of the public domain in the decade.

Speculators following the survey parties filed on tracts before they could be reserved. The General Land Office closed the public domain until the survey work was completed, setting off western protests and resulting in Congress restricting withdrawals to reservoir sites and in cutting the survey's budget. Despite this, the USGS continued to study water resources in the region during the 1890's.

Powell consistently urged the federal government to assert control over its western holdings for study and long-term planning. The Senate Irrigation Committee favored federal subsidies with few restrictions attached to water rights or land uses. Powell was forced to resign in 1894 and Congress loosened the controls he had imposed.[4]

William Ellsworth Smythe

William Ellsworth Smythe was another visionary leader of the Progressive Era reclamation movement. Smythe helped mobilize public opinion in support of the reclamation movement as the founder of the National Irrigation Congress and the Journal *Irrigation Age*, beginning in 1891. His articles in other periodicals after he left the journal in 1895 was an important factor in the enactment of the Newlands' Reclamation Act of 1902. His book, *The Conquest of Arid America*, first published in 1900, was so popular with the inauguration of various Reclamation Service projects that a revised version was published in 1905, and new printings followed until at least 1911. He shared John Wesley Powell's dream for the reclamation movement.

Smythe was one of the foremost leaders of the reclamation movement. Irrigation represented more to him than physical structures, water and lands. It was the means for transforming society in the western portion of the country. It was not just an economic reform but "a philosophy, a religion and a program of practical statesmanship rolled into one".[5] He devoted his life to developing a common focus and ideology for the irrigation movement. Social reform was his passion.

American society had traditionally been woven around a cluster of values stemming from its agrarian past, religious faith and individual freedoms. During the 1890's, the Nation's traditional economic and social fabric was subjected to and challenged by the forces of industrialism, urbanization, monopoly capitalism and social tensions arising from a large influx of new immigrants. The Panic of 1893 and the subsequent depression both threatened and benefitted the irrigation movement. The economic downturn threatened the movement, which

emphasized private enterprise, as sources of investment capital disappeared, and as business support for land cession to the States began to weaken. Smythe's message was that the West offered a place of refuge and protection for traditional American values that were being undermined by forces in the East. Agrarian ideals, religious tenets and individual freedoms could flourish. Arid America was hospitable. Americans were ready to listen.

Smythe's book in 1899, *The Conquest of Arid America*, appealed to values in the American heritage, while offering solutions to the country's social problems. Smythe scholar Lawrence B. Lee summarizes Smythe's explanation of how the traditional homestead ideal could be realized:

> The homestead ideal could be fully realized in the West, where colonies of homesteaders would shed the speculator from their midst, live in a state of democratic equality with culture-enhancing institutions close at hand.[6]

Smythe saw irrigation as an influential and beneficial factor in the social life it would create in the West. The change it would bring would amount to a "revolution".[7] It would serve as "the germ of new social possibilities".[8] Rural country life in the East, resulted in loneliness, social discontent and other disadvantages brought about by a lack of human association arising from the physical distances between people. He envisioned prosperous farms of five to twenty acres in contrast to those in the East of about 400 acres, or those in the Mississippi Valley containing 160 acres.

Smaller acreage would allow farmers to form close-knit villages, where they would enjoy most of the social and educational advantages found in the East. Kindergartens, schools, churches and libraries would be prevalent. Electricity, domestic piped water, postal delivery and newspapers would be available. The scene would be one of "intensely cultivated land, rich with its bloom and fruitage, with its spires and roofs, and with its carpets of green and gold stretching to the mountains...This is the miracle of irrigation."[9]

Smythe's book provided an impetus for irrigation development and homesteading in Oregon, particularly east of the Cascade Mountains. He wrote:

> Considered from every standpoint, irrigation is the golden key which may unlock the doors of civilization to wide districts in Oregon, particularly east of the Cascade Mountains...It is a prosperous stock country, but large portions of it are capable of better things...Here the land is chiefly the property of the Government. Large areas are susceptible of irrigation and of serving as the foundation of a very desirable class of homesteads. The water supply is quite abundant...Among the valleys where large opportunities for reclamation may be found, chiefly by means of storage, are those watered by...the Des Chutes...There are also many large natural lakes which may be drawn upon for irrigation.[10]

Smythe's philosophy was designed to gain support for federal legislation. He sought cession of public lands to the states to help initiate projects funded by private enterprise. He advocated State and Federal laws that would abrogate water-rights conflicts and promote efficient planning, engineering and operation of irrigation works. He championed the homestead principle into reclamation law. His *Irrigation Age* journal monitored State and legislative developments, court decisions, irrigation projects and provided farming advice to inexperienced

irrigators. As a writer for the West Coast magazine *Land of Sunshine* (later *Out West*), he followed the progress of federal reclamation, criticized the small sums available under the Reclamation Fund, supported the provision of Reclamation Service water to private landowners, and advocated increasing the number of projects in the West. Historian Lee concludes: "If his championship of a reincarnated homestead ideal seems dated today, one must recognize the strength of the agrarian heritage in Progressive Era America and Smythe's earnest desire to preserve the best of America's heritage in a world of fast-moving change."[11]

C. FEDERAL IRRIGATION ACTS

John Wesley Powell and William Ellsworth Smythe were just several of the many voices recognizing that institutions and ideas applicable to agriculture in the humid East were not equally applicable to the arid West. The 1862 Homestead Act, for example, did not adapt well to the West. Moreover, Congress was slow to abandon the concept of the 160-acre farm after its success in encouraging settlement in more humid areas. Western settlers often had to divert streams, dig canals and construct weirs and flumes before crops could be planted. Dryland farming often failed. Successful farming in the region required the storage of water behind dams during non-growing seasons and capital expenditures beyond the ability of private investors. Larger tracts of land were required to make irrigation financially feasible.[1]

Desert Land Act

In 1877, the Desert Land Act was passed by Congress. The Act which applied to three states -- California, Oregon and Nevada -- and eight territories provided that settlers could purchase one section (640 acres) of desert land in the entire area west of the hundredth meridian if they agreed to irrigate it within three years. The Act was the Federal Government's first major policy specifically for the reclamation of arid lands, and it endorsed the concept that land development should be left to private initiative. Its purpose was to assist homesteaders, however, it was exploited and abused by larger business interests. The Act was amended in 1890 to a limit of 320 acres.[2]

Loopholes in the statute promoted land monopoly and corruption. Residence was not required allowing absentee eastern investors to file on land and hold it for speculative purposes. Large cattle companies used the law to control miles of grazing lands bordering streams. The amount of water to be conveyed to the reclaimed land was not specified, and canals often were plow furrows or non-existent. Typical schemes involved multiple filings with bribed witnesses and false identifications until enough acres were accumulated for a ranch.[3]

General Revision Act

The 1891 General Revision Act was passed to minimize the abuses and to encourage private development. The Act modified the Desert Land Act to provide that an association of individuals could construct canals and ditches. Individuals had to invest in irrigation works and other land improvements, be a resident of the state in which they were filing, and cultivate an eighth of the land within three years. The law also encouraged private development by granting canal right-of-ways across public lands to irrigation companies, similar to the policy which provided for the construction of roads and railroads across public lands.[4]

Carey Desert Land Act

The next phase of the federal government's attempt to encourage settlement of the West was the Carey Desert Land Act, introduced by Wyoming Senator Joseph M. Carey, and approved by Congress on August 18, 1894, with modifications on June 11, 1896 and March 3,

1901. Carey had studied attempts by California and Colorado to provide for irrigation districts to undertake reclamation. Both attempts failed administratively and financially, and reservoirs were unsafe or did not hold water.[5]

Carey's approach was for the federal government to cede up to a million acres of land to each of the 10 arid states if they caused the land to be irrigated, settled and cultivated. Settlers could receive patent on 160 acres of Carey Act land if they lived on the land and, within 10 years, converted at least 20 acres to irrigated agriculture. The state would arrange for the construction of dams and canals by contracting with private construction companies. Benefits to the states included the addition of thousands of taxable acres, increased population, more produce and improved economic conditions.

These private companies contracting to reclaim the land would receive a lien, or first mortgage, on the land as security for their investment in irrigation system development. The companies would colonize the lands, selling water rights for lands disposed of by the State, to recover their costs. When a settler had paid the required sum to the company, the company would relinquish its lien on the property and the government would allow title to pass to the colonist at no cost, but with requirements for operations and maintenance, and other provisions.

Before 1900, however, the law was a failure. Investors were reluctant to invest in irrigation projects and the states were unwilling or incapable of administering the complex program. States were responsible to the federal government to have a map and a plan to irrigate and reclaim specified lands to raise crops and to effect settlement and cultivation of the lands. A significant problem was that the states were forbidden to use land as collateral for raising funds to build irrigation works. At the time, land was one of few resources they had of value.[6]

Another provision of the legislation gave title to the irrigation works to the company, along with the right to charge a company-determined water user fee in perpetuity. This meant Smythe's "homestead ideal" could not be fully realized even though land title passed to the settler who purchased it. Independent farmers were not independent at all.

Reclamation Act

By 1900 the federal government's role in irrigation had become a national issue. Pro-irrigation planks were included in the platforms of all major parties. Three prominent individuals had been pushing for a greater federal role in reclamation. Frederick H. Newell was chief hydrographer for the USGS and served as Secretary of the American Forestry Association for a period. He had studied water resources in arid areas during the 1890's. George W. Maxwell formed the National Irrigation Association in 1897. The Association organized nationwide support for a national reclamation act. At the same time, Nevada Representative Francis G. Newlands worked for Congressional support. By 1901 the three had formulated a proposal for a national reclamation law, though opposition in Congress prevented its passage. On September 14, 1901, Theodore Roosevelt became President following the assassination of President William McKinley. Asked to help draft the President's first annual message to Congress, Maxwell presented the proposal for a Federal reclamation act and multi-purpose water development. Roosevelt's endorsement resulted in the signing into law of the Reclamation Act on July 17, 1902.[7]

The call for federal irrigation development, expounded by John Wesley Powell and William Ellsworth Smythe, had finally been embraced. However, much of Powell's advice was ignored, and Smythe's vision of the "homestead ideal" was not completely realized. Nevertheless, the passage of the Reclamation Act marked a definitive change in American domestic policy.

The Reclamation Act began a progressive program emphasizing engineering and technology as tools to solve many social and economic problems. Federal dams would assist homesteaders in transforming arid lands into productive farms supporting new communities. Financing of water storage and diversion works would come from the sales of public land aggregated into a revolving Reclamation Fund. Local water user associations would assume operation and maintenance responsibilities once half the repayment obligations were met, but the Federal Government would retain title to major works.

The shift in federal policy demonstrated by the Act was illustrative of the Progressive Era. In *Water For The West*, Michael Robinson, the Bureau of Reclamation's semi-official historian states:

> The 1902 Reclamation Act was a significant break with nineteenth-century laissez faire land policies that stressed individualism and self-sufficiency. The law's authors viewed dynamic interaction and cooperation among the homesteaders as keys to success. They believed that the collective efforts of project water users would enable individual settlers to withstand the trials of the settlement process. By engaging in intensive agriculture on small acreage, the colonists would achieve economic stability as well as social equality. Thus, Reclamation was a social experiment that set forth water resource development as the basis for a new civilization in the West.[8]

To administer the program, the Act authorized the creation of the Reclamation Service (later the Bureau of Reclamation), first headed by Frederick Newell. By 1907, twenty-five projects had been authorized. Until March 1907, all projects operated under the Reclamation Service of the Geological Survey, U.S. Department of the Interior (USGS). After that date, until June, 1923, the Reclamation Service, a separated agency, supervised projects and administered the programs. From June 1923 to the early 1930's all projects were under the supervision of the Bureau of Reclamation, Department of the Interior. In 1933, the U.S. Bureau of Reclamation was created as a separate department.

The end to the Bureau's single purpose was dawning. Many changes and challenges appeared on the horizon. By 1928, it was the largest builder of water storage, diversion and transmission structures in the world. The economic hardships of the 1930's allowed the agency to expand into public power development. President Franklin D. Roosevelt's New Deal stimulated the program and expanded construction activities. Hoover Dam, the first major federal project based on multi-purpose objectives, was perhaps the most significant American public works project of the period. Irrigation and hydroelectric development were shown to be compatible and could jointly achieve economic and social objectives. The 1940's saw many changes in the agency, including reorganization and river basin planning. The settlement of the West was achieved, though many mistakes foreseen by Powell were made. Smythe's hope of preserving the best of America's heritage was not laid aside.

D. IRRIGATION DEVELOPMENT UNDER THE CAREY ACT

1. Introduction - Two Types of Projects:

The Carey Act provided an enormous impetus for irrigation development in the Upper Deschutes River Basin. Prior to the Act (1894), settlers had initiated small-scale irrigation as early as the 1870's. Andrew Jackson Tetherow, son of Captain Solomon Tetherow of the Lost Wagon Train of 1845, diverted Deschutes water for crops after homesteading west of present day Redmond in 1878.[1] Water was also diverted from Squaw Creek for use on individual farms, west of present day Redmond, as early as 1871 or 1869.[2]

Often small-scale irrigation projects were cooperative efforts involving settlers who had homesteaded adjoining or nearby lands. These largely ill-fated cooperative ditch companies were formed, for the most part, to serve settlers who had come to occupy the land under the Homestead Act of 1862 and had found dry land farming unsuccessful. These projects were characterized by little or no capital investment and by minimal engineering technology. Ditches were often simply plowed furrows.

The State of Oregon adopted the provisions of the Carey Desert Land Act on February 28, 1901. The enabling legislation created the State Land Board to administer the act and made it State policy that Oregon's arid lands were to be reclaimed and settled, but without the State becoming liable for any costs. The State would rely on private companies to bring about reclamation and settlement. If a project failed, the State would reassign the contract to another development firm.

Between 1901 and 1906, seven projects in the Upper Deschutes River Basin were approved, covering a total of 194,138 acres of segregated land. The Pilot Butte Development Company's planned reclamation of 84,707.74 acres was the second project approved in Oregon (May 31, 1902), followed by the Three Sisters Irrigation Company (later Columbia Southern) as the state's third Carey project with 27,004.83 acres (December 5, 1902). The others included: Deschutes Reclamation and Irrigation Company (fourth in Oregon), Oregon Irrigation Company, Deschutes Land Company, Deschutes Land Board and Deschutes Irrigation and Power Company. Of twenty-three segregations made by the State by the end of 1904, only three in the Upper Deschutes River Basin and one in the Harney Valley had been approved by the Department of the Interior.[3] Figure II, D-1 shows six of the Carey Act segregations recognized by the State Engineer in April, 1907.

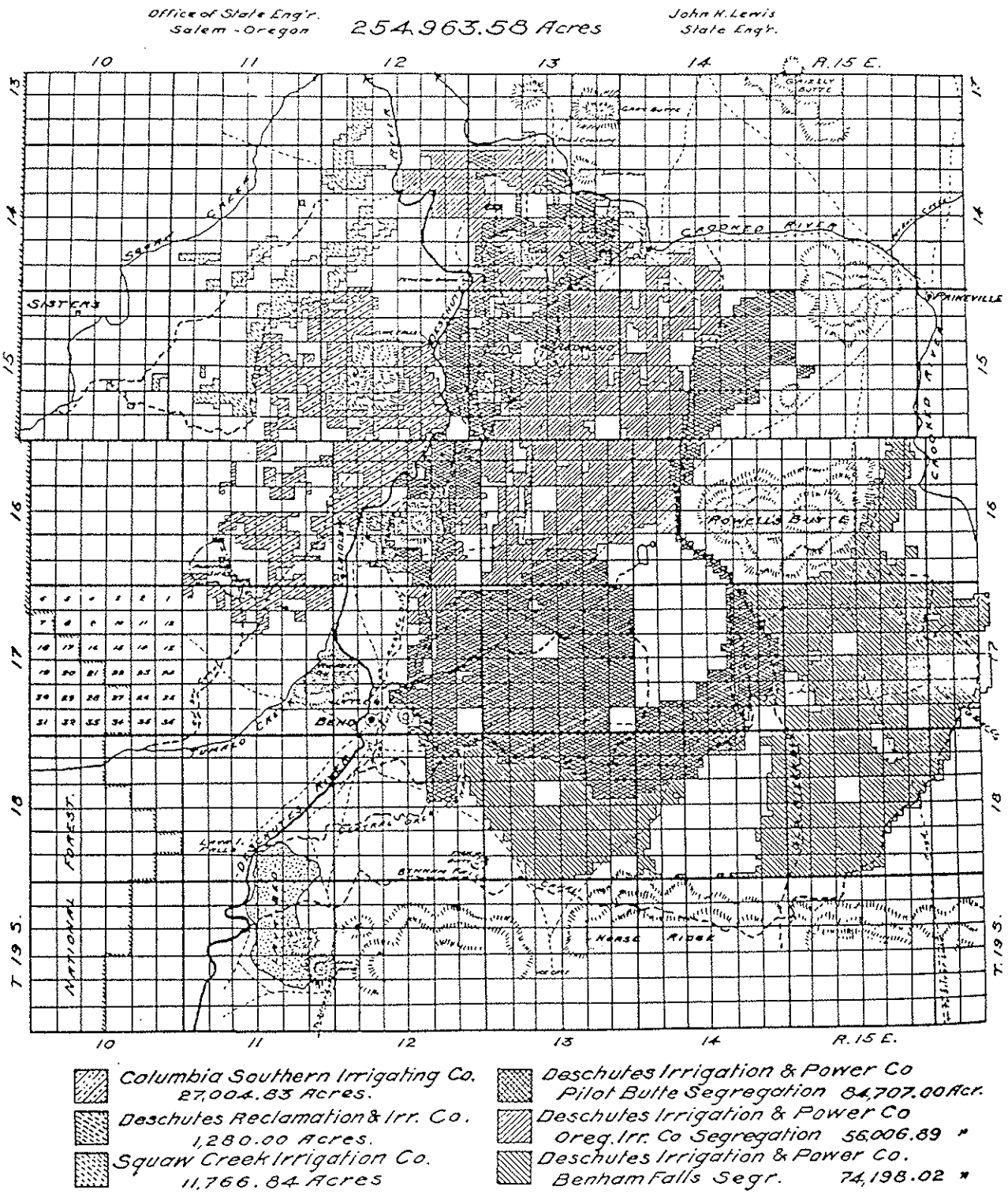

Figure II D-1 Irrigation project segregations in the Upper Deschutes River Basin, according to the State Engineer's office, April, 1907. (OHS Collections, Maps.)

Irrigation ventures in the Upper Deschutes River Basin developed under the Carey Act were of two distinct types. The first type was the company established as a cooperative effort to irrigate the farms and ranches of the organizers. These are the earliest developments and may have initially been begun under the provisions of the Desert Land Act (1877) and the subsequent General Revision Act (1891). These projects seem to have captured some of the "homestead ideal" envisioned by William Ellsworth Smythe. The Squaw Creek Irrigation Company (1895) and the Deschutes Reclamation and Irrigation Company, also known as the Swalley (1899), are two examples of these cooperative ventures.

The second case was the firm organized as a commercial investment enterprise. These are later developments, generally larger in scope and significantly more dependent upon the provisions of the Carey Act. Developments of this nature include projects in the Tumalo Creek area, the Arnold Irrigation Company, Walker Basin companies and ventures which eventually came under the management of the Central Oregon Irrigation Company (Pilot Butte Development Company, Oregon Irrigation Company and Deschutes Irrigation & Power Company).

This section reviews these two distinct types and provides a case study of the largest project of the latter type, the Central Oregon Irrigation Company.

2. Cooperative Ventures Under the Carey Act

The Squaw Creek Irrigation Company evolved from a cooperative venture between neighboring farms to an irrigation district within about two decades. The diversion of water from Squaw Creek for use on individual farms occurred as early as 1871 or 1869.[1] Early water rights on the creek were filed in 1884, 1885, 1889 and 1892. In 1889 the first Squaw Creek canal was built by Sam Davis. In 1892 Oscar Maxwell built a ditch utilizing creek flow. Others in the area brought water to their land with small ditches.

Following the passage of the Carey Act by Congress in 1894, the Squaw Creek Irrigation Company was formed in 1895 with the 1892 rights. Shares in the company were sold and individuals filed on their water rights. Water was allotted and controlled by the state.[2] After the state adopted the provisions of the Carey Act (1901), the company contracted for the reclamation of 11,766.84 acres.[3] In 1910, the company claimed rights to 11,042 acres.[4]

Development proceeded and in 1912-1913 the main canal was enlarged to extend the system to the upper end of Lower Bridge, including the Long Hollow Ranch. All of the work was done with men and horse-drawn equipment. Water users could work on the system to pay for their maintenance charges.

Progress continued. In 1917, the company became the Squaw Creek Irrigation District, the second district to file and be recognized by the State of Oregon. In 1919 a new point of diversion was selected and a new dam and headgate built of concrete. In 1920, however, a flood destroyed the dam. In 1921, a log dam was built. In 1935, the Cloverdale Irrigation Company, formed in 1903 with Squaw Creek rights, merged with the district.

In 1957-1958 a re-regulating facility, the McKenzie Canyon Dam and Reservoir, was built to assist in serving the Lower Bridge area. In 1964, the Watson Reservoir was built in the southwest portion of the Cloverdale area to eliminate irrigation water flow variations arising

from creek fluctuations. In 1970 a new concrete diversion dam was built on Squaw Creek about 200 feet above the old long/wooden dam.[5] Today, there are about 6,500 acres of irrigated land under the project.[6]

The **Deschutes Reclamation and Irrigation Company**, also known as the **Swalley** was another cooperative venture. It was started by two area ranchers, G.W. Swalley and C.R. Swalley, who filed in 1892 for Deschutes River water to irrigate their ranches located north of Bend. This was two years before Congress passed the Carey Act (1894) and nine years before the State of Oregon adopted its provisions (1901).

On September 1, 1899, the Swalleys and six other land-holders filed under the prior claim, and in October 1899 formed the Deschutes Reclamation and Irrigation Company. One of the incorporators was James R. Benham for whom Benham Falls was named. Each man was to receive one-eighth of the "5,000 miners inches" of water by either contracting for or personally working to build the system to deliver water to their ranches. For the next ten years, ditches, flumes and roads were built. The men also worked at the O.B. Riley mill manufacturing lumber for the many flumes required to transport water over the challenging topography. Irrigation began in 1902. In 1904, the corporation issued 4,800 shares of stock divided into 96 blocks of stock as more water users came into the system.[7]

In 1912, when the Central Oregon Irrigation Company built the North Canal Dam, a heading was provided in the dam for the Swalley Canal, or Ditch, honoring a prior right-of-way. The Deschutes Reclamation and Irrigation Company paid the Steidl family $250 for a perpetual easement of 85 feet by 30 feet for the intake pipe at the dam. Steidl & Tweet had claimed a prior right for power development at the site. (See section on Central Oregon Irrigation Company). The heading consisted of one six-foot opening with a sill six feet below the dam's spillway crest, controlled by a hand-operated gate.[8]

The heading was originally about a quarter mile upstream. Construction was begun in 1900, including the building of a half-mile of flume at the head. The flume was reduced to a quarter-mile in length by the construction of the North Canal Dam. It was rebuilt in 1909, 11 feet wide and three feet deep. In 1910-1911 the canal was enlarged for a distance of 5.5 miles below the flume to a width of 21 feet and a depth of about four feet, and from 1912-1915 the lower end of the ditch was enlarged. In 1931, the canal was about 13 miles long, with a 3.5 mile lateral extension.[9]

The project area was north of Bend, bounded on the west by the Deschutes River and on the east by the Deschutes Irrigation and Power Company (later Central Oregon Irrigation Company) project. The northern boundary was to be in the vicinity of present day Peterson Rock Gardens, approximately eight miles north of Bend.[10]

The original filing was for the irrigation of 6,638 acres of land located north and west of Bend. The Segregation approved by the State of Oregon under the provisions of the Carey Act, however, was for 1,280 acres. Of seven Carey Act projects approved between 1901 and 1906, the Deschutes Reclamation and Irrigation Company project for 1,280 acres was the only one completed by 1913.[11] Later segregations and projects increased the acreage. By 1927, approximately 2,175 acres had been irrigated.[12] About 3,600 acres were reported "under cultivation" in 1931.[13] Time for development was extended to October 1, 1933 in which to reclaim and irrigate the remainder of the 6,638 acres.[14]

3. Commercial Enterprises Under the Carey Act

The **Arnold Irrigation Company** was a commercial enterprise organized December 27, 1904 for the purposes of acquiring, buying, owning, selling or improving any real estate or water rights; constructing flumes and canals for irrigation purposes; and for conducting general irrigation business. It was recognized by the State on January 9, 1905 and was managed by a board of directors elected by stockholders. Deschutes River water rights were filed on February 1, April 15 and April 25, 1905.[1]

Construction of irrigation works began in April 1905 and continued late into 1910. Water was diverted at Lava Island Falls, about nine miles south and east of Bend. Water for irrigation was delivered in June 1911.

For the first several years work on a flume and canal was done by shareholders. Engineering problems troubled the project until L.D. Wiest contracted to provide services. Wiest had worked for the Pilot Butte Development Company and the Deschutes Irrigation and Power Company. The engineering features included a headworks with gates 22 feet wide, a wooden flume about 5,500 feet long, 12 feet wide and three feet deep, and a canal 12 feet wide and three feet deep. At the time, the works were of sufficient size to carry water for all the rights sold; however, they were later enlarged to serve a projected 12,000 acres.[2]

At the height of its development, the main Arnold canal was 17 miles in length. It was later shortened to about 14 miles because water volume was insufficient for the most distant lands. In those 14 miles were six other wooden flumes varying in length from 250 to 876 feet. These were known by the following names: Huntington, Suttong, Fry, Slack, Stennick and Billadeu. Another 10 wooden flumes, ranging from 72 to 1,903 feet long, were contained in 27 miles of laterals. These were also named: Gilliland, O'Donnell, Pilot Butte, Trotter, Roberts, Miller, Northwest Blakely, Southwest Blakley, Conway and Nelson.[3]

The system initially ended at the Silver Lake road where two laterals owned by other companies took water. The North lateral, controlled by the North Irrigation Company, was to serve about 2,000 acres northward toward Bend, while the Pine Forest canal, operated by the Pine Forest Ditch Company, was to provide water to about 10,000 acres lying south and southeast of Bend.[4] The North Irrigation Company was incorporated December 12, 1908; the Pine Forest Ditch Company on November 2, 1908. All companies eventually became one under Arnold.

According to a 1922 report, the project size was 16,500 acres with water rights sold to about 8,500 acres, and 3,000 to 4,000 acres were in crops.[5] About 3,200 acres were reported "under cultivation" in 1931.[6] In 1958, the Hamilton Court Decree granted the District water rights for only 4,292 acres.[7]

The Carey Act lands which became known as the **"Tumalo Project"** hold a distinction in history as the most seriously vexed Carey Act project in Oregon, and possibly the Nation, suffering nearly simultaneous engineering, managerial and financial disasters. The history of this series of commercial enterprises began with the incorporation of the Three Sisters Ditch Company on July 3, 1893. In 1900 all assets and rights were conveyed to the Three Sisters Irrigation Company.

The new company's contract with the State Land Board for the reclamation of 27,004.83 acres was the first project in Oregon to be approved by the U.S. Department of the Interior. The lands made up Carey Act Selection List No. 13, which the Secretary of the Interior on January 12, 1904, withdrew from the public domain and set aside for patent to the State, upon certification that an ample supply of water had been furnished in an adequate ditch or canal to each tract. The tracts were bounded, in general, by the Deschutes River on the east, by Cline Buttes and the present day Redmond-Sisters highway on the north, by Deep, Dry and Red Rock canyons and the Snow Creek Ditch on the northwest, by the pine forests on the west, and by Tumalo Creek on the south. The Company planned to irrigate and reclaim the lands with water from Tumalo Creek.[8]

By 1905 trouble had surfaced. Management had misrepresented the number of acres reclaimed, the extent to which irrigation works had been completed and the costs associated with the project. On November 1, 1905 the State Land Board asked the federal government to delay granting the company's second list of lands. On November 8, the company sold the project to the Columbia Southern Irrigation Company.

The Columbia Southern project soon became a major problem for the State. The company was simply incapable of designing and building a workable project, even though it was apparently feasible, desirable and profitable. Settlers brought political pressure to the State to take over the project. Following several attempts to resolve the situation, the State Land Board sued the company seeking cancellation of its reclamation contract. The State lost the case in 1909. In 1911, Columbia Southern deeded the entire project to the Oregon, Washington & Idaho Finance Company, hired by the State to prepare a finance and engineering report on the project.

In February, 1913, the Oregon Legislature passed the Columbia Southern Act, authorizing $450,000 to reorganize and construct the project. In adopting the Act, the State took "an historic step in irrigation, settlement, reclamation and economic development".[9] In essence, it reflected a new state policy for irrigation development in Oregon.

The "Tumalo Project", as it came to be known under state control, is believed to be the first Carey Act project to be taken over, reconstructed and operated by one of the states. The Desert Land Board was given the authority, the direction, the funding, and broad discretion to act as trustee, developer, contractor and promoter in relation to the Tumalo lands. Under the reconstruction program, the State built the Tumalo Diversion Dam on Tumalo Creek, and Tumalo Feed Canal ($109,000); Tumalo Reservoir, including Tumalo Dam and Bull Creek Dam ($185,000); partly built Crater Creek Diversion Canal ($6,000); and made improvements to the Columbia Southern distribution system ($125,000). The work was completed between June 1913 and December 1914.[10]

Olaf Laurgaard served as Project Engineer. A 1903 civil engineering graduate of the University of Wisconsin, he had worked for the U.S. Reclamation Service before being hired for the Tumalo Project. After leaving the project in 1915, Laurgaard worked as a consulting engineer in Portland and served a term in the Oregon House of Representatives during 1917-1918. In 1916 he was elected City Engineer of Portland, a post he held until 1933. He was celebrated as "the father of the Portland waterfront" and "the father of the greatest street widening project in the country".[11]

Another significant figure in the Tumalo Project was Fred Wallace. Wallace was responsible for the operation of the irrigation project under all the private and public organizations which ever owned or governed it. These included: Columbia Southern Irrigation Company (1908-1910), Oregon, Washington & Idaho Finance Company (1910-1912), State of Oregon, Tumalo Irrigation Project (1913-1919), Tumalo Irrigation District (1920-1922), and Deschutes County Improvement District (1922-1924). He took over as Project Manager in 1915. Between 1914 and 1923, while Manager at Tumalo, he served as Secretary and then President of the Oregon Irrigation Congress.[12]

Even with Laurgaard's expertise and Wallace's experience, the project continued to be vexed. In February 1915 the water level in Tumalo Reservoir had dropped from 14 to six feet. The situation initially appeared to improve as the inflow increased from spring snowmelt. However, by April 9, as the water rose to the 25 foot level, "breaks" and "sinkholes" opened up along the eastern perimeter of the reservoir floor. Other holes soon appeared, several 30 feet by 50 feet and 10 to 25 feet deep. Sluicing of water from the Feed Canal and exploding of dynamite to close the holes was tried without success.[13] Engineers had previously reported the potential for problems with reservoirs in volcanic regions, such as the Upper Deschutes River Basin. Tests had indicated voids in the rock underlying the reservoir, suggesting serious losses from seepage through such fissures could occur.[14]

Problems and efforts to resolve them continued until the winter of 1923-1924 when the last major effort to fill the reservoir until 1950 failed.[15] Almost 70 percent of the State's projected acreage remains at present without water. Tumalo Reservoir today impounds only about five percent of its intended capacity.[16] Developments in the 1920's, and later in the 1950's under provisions of the Reclamation Act, provided Deschutes River water for the system. (See section on Crescent Lake Dam.) About 6,500 acres were reported "under cultivation" in 1931.[17] In 1986, only 7,314 acres were irrigated by Tumalo water, representing about 10 percent of the irrigated acreage in Deschutes County.[18]

The **Walker Basin** companies were a commercial investment enterprise that ultimately failed. The project was to reclaim lands approximately 30 miles south of Bend with water from Crescent Lake and Crescent Creek. John E. Morson was a principal in all of the companies involved in the scheme. The first company to claim rights on stored water at Crescent Lake was Morson's Walker Basin Land & Irrigation Company, on May 6, 1901. On May 10, 1902, his Oregon Development Company filed on Crescent Lake for water to reclaim 67,637 acres under the Carey Act.[19]

The Walker Basin companies planned to sell the Crescent Lake and Crescent Creek water with lands on both sides of the Deschutes in the vicinity of present-day La Pine and Crescent. The U.S. General Land Office segregated these lands in Selection List No. 11 on October 21, 1905. No work was conducted. However, on March 20, 1911, the State issued the Walker Basin Irrigation Company a permit to store water in the lake, and, on April 7, 1911, a permit to use the stored water on 31,160 acres in the La Pine-Crescent area.[20]

The financial and managerial relationships between these companies is difficult to ascertain. In addition, at least two other companies were involved in land and/or irrigation development in the area. One was the Morson Land Company. The second was the Deschutes Land Company. This is the company most closely associated with the development, and may

have served as an "umbrella" organization for various ventures. This firm was also associated with the La Pine Townsite Company whose town development project was occurring in parallel to the irrigation development.

Joining Morson in the Deschutes Land Company was Alfred A. Aya. Aya was the president of the townsite company, formed in 1910. He managed Swift interests in Portland, including the Peninsula Industrial Company, Peninsula Drainage Districts Numbers 1 and 2, and Kenwood Land Company, and was a director in the Kenton Traction Company and Peninsula Terminal Company.[21] He was president of the La Pine State Bank.

Problems with the project went on for nearly a decade. A major factor affecting the project was an ongoing feud between Morson and Oregon Governor Oswald West. The governor was dissatisfied with Morson's progress under the Carey Act and was openly critical.

The project moved forward, but capital resources were too unstable to support the scope of operations and the size of the development. Costs associated with a steam shovel which dug canals day and night and horse-drawn scrapers which worked many hours were high. Financing from various private sources, including substantial sums from a group of Minnesota businessmen, was acquired.

Later a group of financiers from Arizona invested large sums. Shortly after making their investment they arrived in Portland on their way to view the project. On the day of their arrival from Arizona, *The Oregonian* newspaper published bitter denunciary statements made against the project by Governor West. The investors demanded that their money be returned.[22]

As difficulties continued, the state reduced the operations to about 28,000 acres.[23] The system was not reaching all of the colonists and sufficient water to comply with state regulations had not been made available. Eventually all private investment ceased. The firm was forced into bankruptcy with Morson appointed as the receiver. Subsequently, the project was reduced to 10,000 acres.[24]

On November 4, 1920 when completion of the Walker Basin project was eight years past its last extended deadline, the Desert Land Board contracted with the company to build its own dam at the lake. However, nothing was built, and after reorganization efforts failed, the company went into receivership and never recovered.[25]

4. Central Oregon Irrigation Company: A Case Study of a Carey Act Commercial Enterprise

One of the first commercial enterprises was the Oregon Development Company, organized by Charles C. Hutchinson in the Spring of 1898. He made his first filing that year.

Hutchinson's engineer surveyed the Deschutes River and irrigable lands in May and June of 1899, filing water claims on the Deschutes in the fall of that year. His nearly 35,000 acres was the largest to that time. On November 14, 1899, Hutchinson organized the Oregon Irrigation Company which received the rights and surveys of the Oregon Development Company.

In 1900, Alexander M. Drake, a wealthy Minneapolis capitalist, and Hutchinson agreed to a partnership with Drake providing needed capital in return for half of the company stock and

a role as president and manager. Soon afterward Drake formed the Pilot Butte Development Company and informed Hutchinson he saw no reason to continue the partnership. On November 5, 1900, Drake made four water filings on the Deschutes, two of which were posted next to Hutchinson's notices.[1]

Hutchinson protested to Oregon's General Land Office and to Congressman Malcolm Moody, pointing out that his prior filings took preference over Drake's and effectively prevented Drake from complying with Carey Act regulations. In 1903, Secretary of the Interior Hitchcock affirmed a General Land Office dismissal of Hutchinson's protest and recognized the legitimacy of the Pilot Butte Development Company.[2]

On May 31, 1902, the Pilot Butte Development Company entered into a contract with the State for the reclamation of lands in Segregation List No. 6, comprising 84,707.74 acres, under the Carey Act.[3] Notices of appropriation had been filed on October 31, 1900. One was filed near the head of what is now the Central Oregon Canal and was to be called the Pilot Butte Canal. The other notice set out that water would be diverted at the point where it was posted, about a mile above the location of the present North Canal Dam. The two filings were made with the idea that the company would use the one most practical.[4]

Before any contracts had been made with settlers and before any considerable amount of construction had been performed, the company sold its contract and rights to the Deschutes Irrigation and Power Company.[5] The delay in acquiring the water rights he required resulted in Drake accepting $70,000. His sawmill, built to produce lumber for the many anticipated flumes, was destroyed by fire in January 1904.[6] Hutchinson also sold his contracts and rights in 1904 to the Deschutes Irrigation and Power Company, receiving about $35,000 for contracts and rights associated with 56,006.89 acres.

Large amounts of capital were critical to successful irrigation development. The Deschutes Irrigation and Power Company was capitalized at $2,500,000. Backing the firm were stockholders with additional resources and financial connections. These included: W.E. Guerin, Sr., New York; J.O. Johnson, president and manager of the Ohio Natural Gas & Fuel Company, Columbus, Ohio; H.W. Scott, editor of *The Oregonian*, Portland; J. Frank Watson, president of the Merchants' Bank, Portland; R.H. Eliott, mayor of Birmingham, Alabama, and chief engineer of the Louisville & Nashville Railroad; John G. Desher, Columbus, Ohio; Geo. W. Sinks, president Desher National Bank, Columbus, Ohio; H.D. Turney, capitalist of Columbus and New York; R.F. Guerin, secretary and treasurer, Portland; and W.E. Guerin, Jr., manager of the D.I.P. Company, as the irrigation company was known. Guerin also served as president of the Central Oregon Banking and Investment Company capitalized at $25,000. The irrigation firm soon erected a telephone line to Prineville, connecting it to the outside world.[7] The Central Oregon Transportation company, a D.I.P. subsidiary, also was formed with $50,000 to provide for transportation of passengers and express between Bend and Shaniko, the end of the railroad at the time. D.I.P. offices were maintained in Bend, Portland and Columbus, Ohio.[8]

By July 1904, D.I.P. was engaged in construction on a large scale. Irrigation construction technology was primitive by today's standards. But where equipment and methods lacked sophistication, energy and enthusiasm pushed canals and laterals across pumice fields and lava outcroppings. Initially, the work was conducted with horses, men and black powder. Much of the excavation was done with horse-drawn scrapers. In areas with lava, steel miners' drills were pounded with sledge hammers to drill holes for blasting charges. After fuses--and

later detonators-- had set off the blast, crews of men removed the loosened rock and shoveled and scraped the canal to grade and depth.[9]

In November 1904, D.I.P. purchased two portable steam boilers, shipped from Columbus, Ohio, to provide power for operating rock drills. One boiler was 20 horsepower and drove four drills. The other was six horsepower and drove one. Together, they could bore 400 feet per day in lava rock, where typically it would take three men to bore 18 to 20 feet per day.[10]

Construction camps were set up and moved as work progressed. In May 1904, the company announced that there would be no work for men accompanied by their families and as a result "eight or ten teams quit work". The company policy reflected a concern for the spread of diseases associated with children such as pneumonia and meningitis, the danger of children getting into the blasting powder, and the necessity of hauling additional water.[11]

The unique geologic qualities of the Upper Deschutes River Basin created peculiar difficulties during construction. In April 1904, a break occurred on the Pilot Butte Canal when water was turned in for testing purposes and suddenly disappeared into the earth in a giant vortex. The flow had apparently broken through an underground channel. A 215 foot flume was soon built across the broken section.[12] In May of that year, a connecting lateral from the Swalley Ditch was taken across the canal. The Swalley flow suddenly disappeared into a subterranean cavern resulting in the ditch being dry for several days while the hole filled.[13]

Despite the limitations of the technology and difficulties associated with the area's geological characteristics, the work progressed at a remarkable rate. On February 9, 1905, the Pilot Butte Canal, some 30 miles in length, was completed to the Crooked River, releasing about 125 men and 40 teams to work on the Central Oregon Canal, where six miles had been completed earlier in the month. A total force of 300 men, 200 teams and machine drills were to be used on the Central Oregon Canal.[14]

Figures II, D-2, 3 and 4 show the Deschutes Irrigation and Power Company's proposed irrigation systems in the Bend, Redmond and Powell Butte areas during the period.

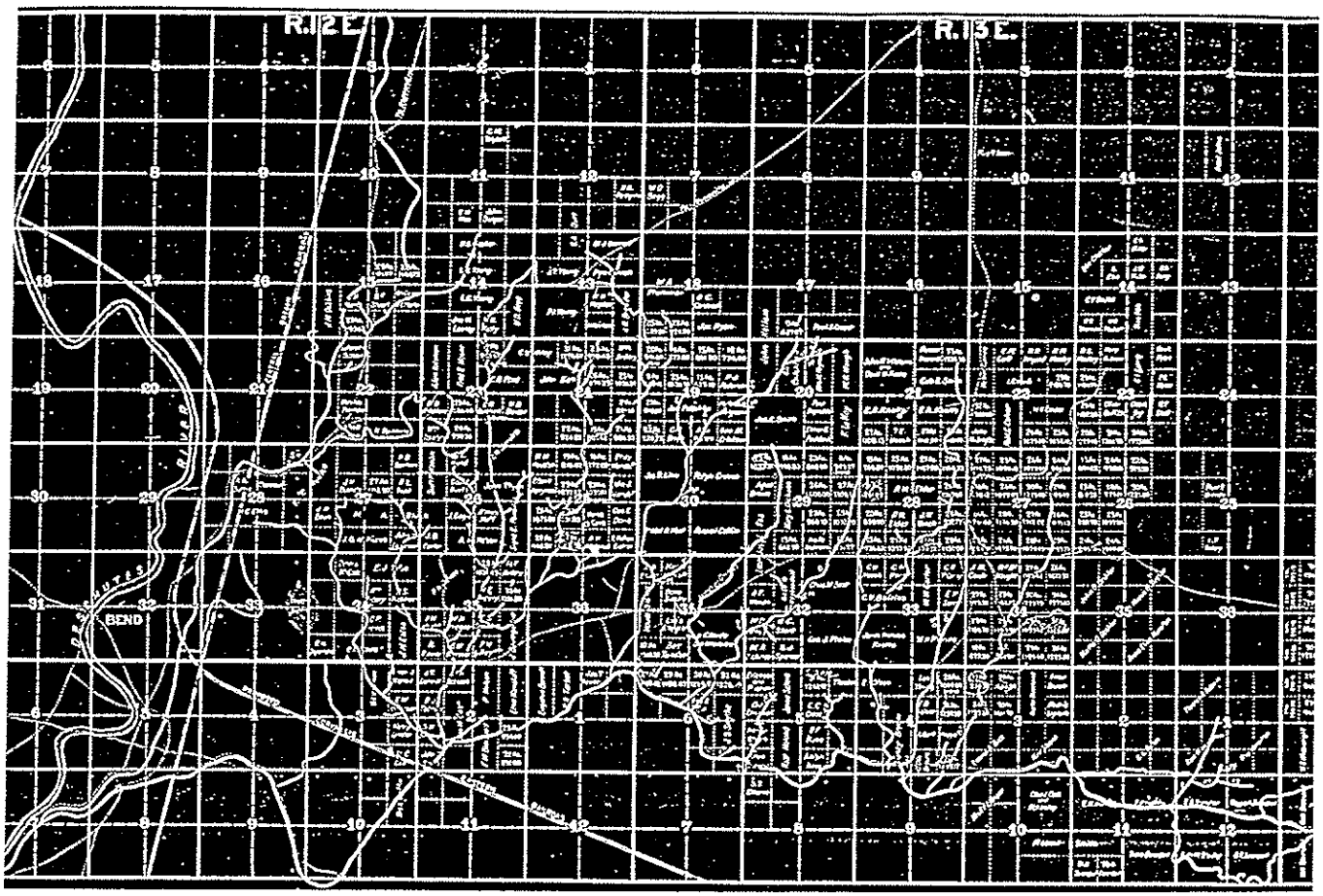

Figure II D-2. The Deschutes Irrigation and Power Company. Irrigated Lands, Bend District, July 7, 1909. OHS Collections, Maps.

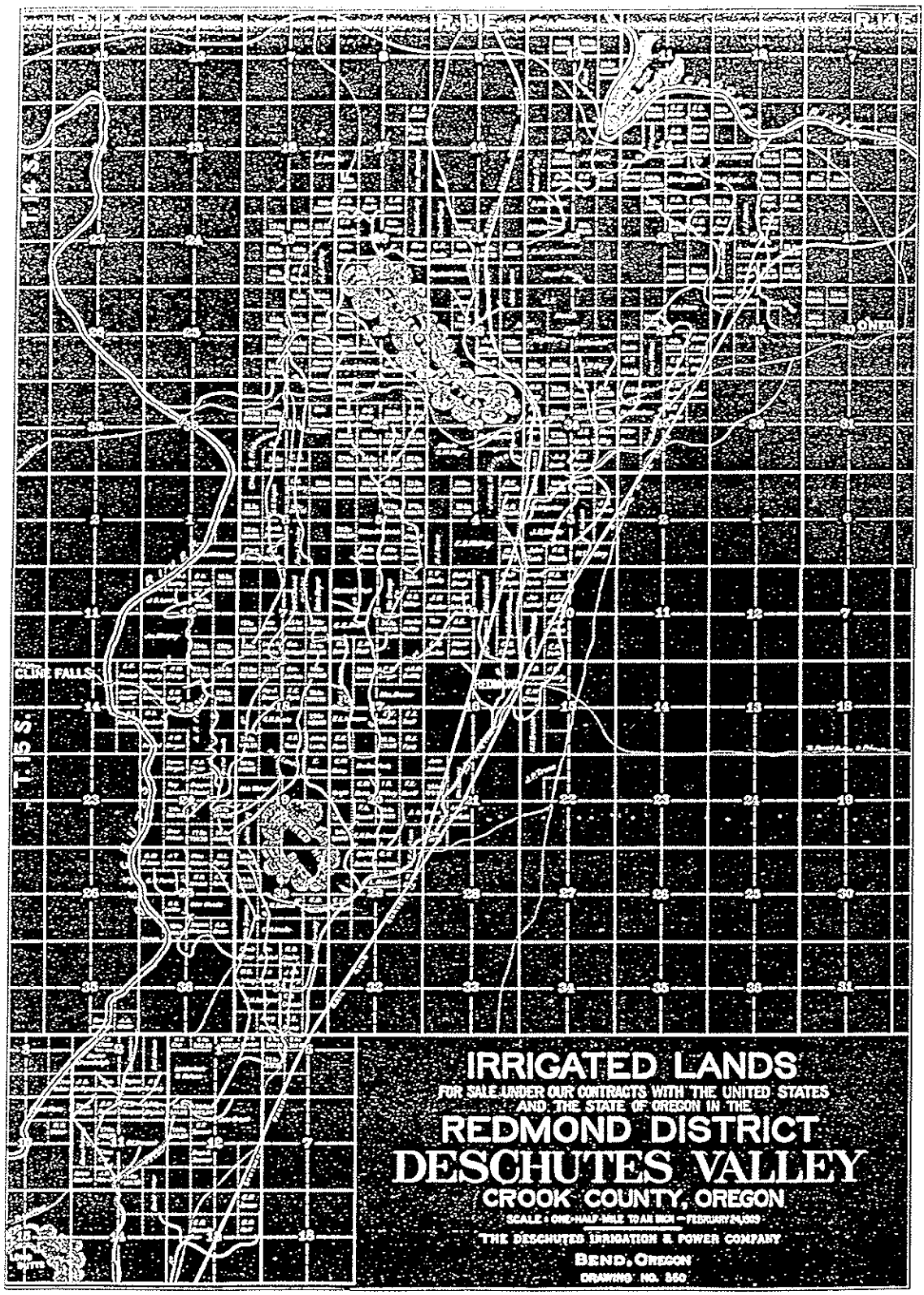

Figure II D-3. The Deschutes Irrigation and Power Company. Irrigated Lands, Redmond District, February 24, 1909. OHS Collections, Maps.

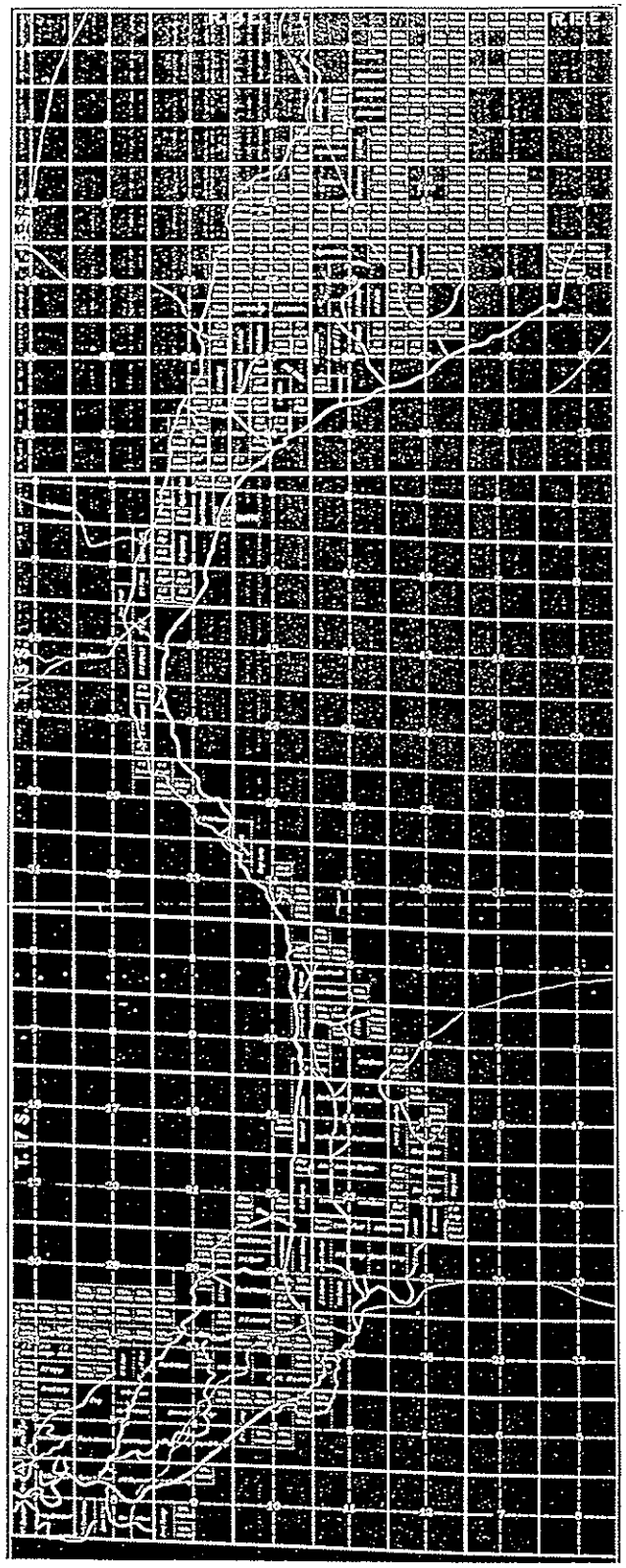

Figure II D-4. The Deschutes Irrigation and Power Company. Irrigated Lands, Powell Butte District, April 20, 1909. OHS Collections, Maps.

In 1905, D.I.P. was getting ready to apply for patent to about 140,000 acres of its segregated lands. These lands included all of the original Drake 85,000-acre segregation and also the 56,000-acre segregation of the Oregon Irrigation Company.[15] On June 7, 1907, the Company entered into a new contract with the State embracing the remainder of the land in Drake's Segregation List No. 6, not under contract with settlers, and the land in Hutchinson's List No. 19.[16]

In addition, the company had applied for contracts and rights for the reclamation of 74,198.02 acres, known as the Benham Falls Segregation, and identified as Segregation List No. 20. The lands adjoined the Pilot Butte segregation on the south and east, taking nearly all of the remaining lands between Crooked River on the west and the mountains on the east. By April 1907, the company had 214,912 acres (about 336 square miles) segregated for reclamation under the provisions of the Carey Act.[17]

Large quantities of pipe and hundreds of thousands of board feet of lumber were used to construct flumes. By July of 1905, work was underway to replace the old wall of the Pilot Butte flume with a 16-foot wide enlarged structure. A 500-foot section had shattered under the water's weight on April 6.[18] While the new flume was being built, water was flowing from the original flume to supply both the Pilot Butte and Central Oregon canals. Without disturbing the flow, the new flume, including its trestle, was put into place. Work was completed in August 1905.

The original channel had a capacity of about 300 cubic feet per second. This was sufficient for the Pilot Butte Canal, but it was modified to make it possible to feed the Central Oregon Canal from the Pilot Butte flume. This represented a change in plans from the original idea of using separate intakes and made necessary the enlargement of the flume.

The new structure was able to deliver about 600 cubic feet of water per second into the two canals--about 250 second feet into the Pilot Butte and about 400 second feet into the Central Oregon. The allowance of water, as calculated in 1905, was one cubic feet per second for each 160 acres of irrigated land. Consequently, it was believed that the enlarged canal would provide water for 96,000 acres. D.I.P. indicated it planned to irrigate only the 85,000 acres of the Drake segregation. Only about 70 percent of the land was tillable.

Engineers, however, claimed the new flume would carry more than 650 second feet and that there would be enough water for the segregations. This change in plans for irrigating the 56,000-acre segregation initiated Bend's first water fight. D.I.P. had agreed with the State to divert water for the project at the Bend townsite, rather than at the headworks of the Pilot Butte-Central Oregon canals, four miles above Bend. A.M. Drake had filed notice of appropriation for power purposes on the edge of the townsite (platted in 1900), potentially adding greatly to the industrial development of the area. D.I.P.'s plan would leave the river dry at Bend and adversely impact the proposed power project, charged the City.[19]

On December 5, 1905, the City of Bend, which had just recently incorporated, adopted a resolution addressed to the State Land Board protesting plans to divert more water from the Deschutes above Bend. D.I.P. responded that the change in plans was made to provide irrigation water at a minimal expense to settlers. Diversion of water below Bend would require the construction of a dam. On January 19, 1906, it was announced that D.I.P. would honor the

original contract and secure water for the 56,000 acres from a canal with headgates below Bend.[20]

Surveyors began studying the Deschutes just north of Bend in September 1907, to identify a desirable diversion point and site for the dam.[21] Construction on the North Canal Dam and North Canal was started in May 1909, but not completed until 1912.[22] During this period, bond holders became restive and litigation arose which resulted a foreclosure by the bond holders and a reorganization of the company, and a transfer of all contract rights of the D.I.P. company to the Central Oregon Irrigation Company on October 25, 1910.[23]

The North Canal Dam was built at a cost of about $220,000 which included the excavation and construction of the North Canal for about 1.41 miles to its junction with the Pilot Butte Canal.[24] The portion of the Pilot Butte Canal which came through the townsite was terminated about 1.5 miles north of the townsite and renamed the Old Pilot Butte Canal. This allowed for a greater water flow for industrial purposes in Bend, and still provided for irrigating the tracts near the city. The larger volume of water passed through Bend and was then diverted at the dam to pass through the short North Canal and into the Pilot Butte. This feature is generally known as the North Canal/Pilot Butte Canal.[25]

The North Canal Dam as constructed by the Central Oregon Irrigation Company in 1912 was a single arch (radius 180 feet), gravity sectioned, overflow concrete structure. The concrete structure, as opposed to typical log-crib, rock-filled, earthen dams, reflected a significant leap in technology and sophistication for the area. The height from the normal water level to the spillway crest was 28 feet, and from the deepest part of the foundation it was 39 feet. The top length of the dam was 313 feet, and the spillway length was 148 feet. In addition to the spillway, the structure included four wasteway openings. One was connected to the penstock of the Steidl & Tweet power plant.[26]

Steidl & Tweet operated a power plant at the site claiming a 1903 right for development of power. In 1921, the Deitricht Decree made the right subsequent in time and inferior in right to those held by the Central Oregon Irrigation Company. The plant was subsequently dismantled.[27] A heading for the Swalley Ditch, which also had a prior right-of-way, and a wooden fish ladder were also included in the structure.

The North Canal Dam, as originally conceived in 1907, would divert river water to the Powell Butte area via a 28-mile-long canal. Plans soon changed to using the Central Oregon Canal to water those lands. A major part of the project was the building of a large flume and a huge stave pipe, or siphon, across the ancient river channel, known today as Dry Canyon.

In the fall of 1907, D.I.P. established a camp composed of 35 men, with 18 teams, at the old river bed. The company had 250,000 board feet of lumber hauled from the Hightower-Smith mill to the site. Pipe was manufacatured in Tacoma, Washington, and cost $6,600 and $1,800 for delivery from Shaniko. The weight of the flume and pipe material was estimated at 85 tons. The structure was completed in January, 1908, at a total cost of $10,000.[28]

By 1913, 25,006 acres were receiving water and 16,804 acres were cropped.[29] The company office, originally in Bend (D.I.P.), had moved to Redmond and was now located in Deschutes. The Deschutes Townsite Company, a subsidiary of the Central Oregon Irrigation Company, had filed formal plat of the townsite on July 18, 1911.[30] (See section on Deschutes.)

Colonization and cultivation efforts were still important to the success of the company and to the settlement of the area. A *Bend Bulletin* article of July 30, 1913 explained how Carey Act lands could be obtained and what the cultivation and residence requirements were:

How to Obtain Carey Act Lands

> First, make application for the 40, 80, 120, or 160 acres you want. Application blanks will be furnished you free at the office of the Central Oregon Irrigation Company in Deschutes or will be sent you upon request.
>
> Second, arrange contract with the irrigation company for perpetual water right for the lands selected. It will be necessary to pay for each 40 acres from $400 to $2,000, according to the number of irrigable acres it contains; of this amount you pay one-quarter down, giving your notes for the balance, payable in five equal payments, due in one, two, three, four and five years, with six percent interest on deferred payment.

Cultivation and Residence Required

> The State Land Board has established the rule that within three years from the date of filing, the settler must put one-eighth of the irrigable acres under cultivation and live upon the place at least 90 days. Or the settler may, if he choose, cultivate one-fourth of the irrigable area, build a substantial house containing not less than 200 square feet floor space and reside on the land for a period of not less than seven days.[31]

Over a ten-year period, D.I.P. and, subsequently, the Central Oregon Irrigation Company achieved impressive results in irrigation system development. By 1914, the Central Oregon Canal had 44.15 miles of main canal and 187.5 miles of laterals. The North Canal/Pilot Butte Canal had 30.1 miles of main canal and 175.08 miles of laterals.[32] The irrigation environment remained tumultuous, however.

Rumors circulated of official investigations, of reorganization, of the sale of the North Canal unit to the State. The State Desert Land Board investigated the project. The Board found that the proposed Benham Falls project, Segregation List No. 20 for 74,198 acres, was not among the three most feasible projects in the Upper Deschutes River Basin. The segregation was released from contract with the government on October 17, 1915.[33]

Other problems arose, also, including a proposal that settlers form an irrigation district.[34] On December 17, 1917, the Central Oregon Irrigation District was organized to take over and operate the irrigation system in lieu of a Water Users Association as provided for in the company's contract with the State of June 17, 1907. The contract stipulated that the system must be turned over to a water users association within five years after completion of construction.[35]

Because both a Water Users Association and the District had been formed, the matter ended being contended in the Circuit Court of the State of Oregon in Deschutes County. A contract of December 13, 1918 had provided for the District to take over the company's irrigation system, but the District's financial weakness and other issues plagued the transaction.

Final Decree, known as the Dietrich Decree, was issued July 9, 1921. The effect of the Decree was to turn the ownership and operation of the system as constructed over to the settlers organized as the Central Oregon Irrigation District, and to fix the appropriation of water for any lands to be reclaimed by the company or its successors by further extensions of the project.[36]

The company transferred water rights, irrigation canals and other assets roughly valued at $3 million to the District.[37] Between 1903 and 1921 approximately 600 miles of canals and laterals had been built. The distribution system consisted of two main canals, the North Canal/Pilot Butte Canal and the Central Oregon Canal. The North Canal/Pilot Butte Canal diverted water from the Deschutes River at the North Canal Dam and ran north through Deschutes, Redmond and Terrebonne to Crooked River. The Central Oregon Canal took water from the Deschutes River four miles above Bend and ran in an easterly direction to Alfalfa, then north through Powell Butte to within a few miles of Prineville.[38]

Irrigation development required a considerable amount of cooperation. On February 8, 1922, the Central Oregon Irrigation District entered into a contract with the Crook County Improvement District No. 1 (originally formed, and generally known, as the Lone Pine District) to deliver water to 2,100 acres lying north of Crooked River and east of Smith Rock, about 10 miles down the Crooked River from Prineville. Water was carried by the North Canal/Pilot Butte Canal to the south rim of the Crooked River where a wooden stave flume transported water across the gorge to district lands.[39] Water rights were purchased by the Lone Pine District from the North Canal Company, and later, in 1926, a right was acquired to store water in Crane Prairie Reservoir to augment the natural flow of the river during the irrigation season.[40] (See section on Crane Prairie Dam and Reservoir.) About 1,800 acres were "under cultivation", with a total of 2,520 acres in the district, according to a 1931 report.[41] The district size has remained fairly constant since 1931.

Tables II D-1 and II D-2 show the irrigable area under each distribution system and the progress of irrigation, as reported by the Federal Power Commission in 1922. (Does not include Lone Pine system.)

TABLE II D-1
IRRIGABLE AREA BY CANAL SYSTEM

	ACRES		
	Sold	Unsold	Total
Central Oregon Canal	27,208	9,170	36,378
North Canal/Pilot Butte Canal	19,169	1,542	20,711
TOTAL	46,377	10,712	57,089

Source: Federal Power Commission, 1922

TABLE II D-2
IRRIGATION PROGRESS 1911-1920

YEAR	ACRES WITH WATER	ACRES WITH CROPS
1911	22,236	11,537
1912	24,991	15,878
1913	25,006	16,804
1914	25,387	17,724
1915	26,872	18,619
1916	28,458	20,106
1917	29,810	21,759
1918	31,097	22,261
1919	32,541	22,965
1920	35,608	29,031

Source: Federal Power Commission, 1922

The Irrigation Situation In Central Oregon, prepared by the Bend Chamber of Commerce in 1931, reported the District as having 34,000 acres "in cultivation", and as encompassing a total area of 48,284 acres.[42]

In 1930, in an effort to utilize an available water right, the Central Oregon Irrigation District purchased rights and land associated with the Cline Falls Power and Irrigation Company. In 1875, the Cline Falls company had taken desert claims near the falls on the Deschutes, west of present day Redmond. This included 1,360 acres of land surrounding the falls as well as 40 acres at Steelhead Falls below Lower Bridge, west of present day Terrebonne. Included in the plans was the development of the Cline Falls townsite. The company had the earliest adjudicated water rights on the Deschutes River, February 2, 1892. Both irrigation and power development were planned, although power development did not occur until 1912.[43]

Progress in irrigation development by the Cline Falls company, however, was slow. A direct pumping plant pumped water to about 300 acres in 1920 and to about 400 acres by 1931 on the adjoining low bench.[44] As the development of irrigation exhausted river water rights, the Irrigation District sought temporary relief by using the Cline Falls rights to irrigate lands east of the river. Long-term help was still some years away, requiring assistance by the federal government to develop more sophisticated systems under the provisions of the Reclamation Act of 1902.

The following section discusses irrigation development under the Reclamation Act, including Crane Prairie Dam and Reservoir, Wickiup Dam and Reservoir, North Unit Canal, Haystack Dam and Reservoir and Crescent Lake Dam.

E. IRRIGATION DEVELOPMENT UNDER THE RECLAMATION ACT

In 1913 the Oregon Legislature accepted the Reclamation Act of 1902 and indefinitely withdrew the Deschutes River from further appropriation until a cooperative study between the state and federal governments could be completed. Between 1914 and the early 1930's numerous studies were conducted by public and private interests. The Bureau of Reclamation began irrigation studies in the Upper Deschutes River Basin in 1921. The focus of most of these studies was the feasibility of the construction of one or more reservoirs on the Deschutes above Bend for both irrigation and hydroelectric projects. In 1935-1937 *Deschutes Investigations, Oregon*, a four volume report, was issued by the Bureau of Reclamation for what had become known as the "Deschutes Project".

By 1931 conditions were warranting action by the federal government. While most of the country's farm population was leaving farms preceding the Great Depression, the population of Deschutes County, excluding Bend and Redmond, increased 35.4 percent from 1920 to 1930. This increase occurred on irrigated farms while the population on dry farms actually decreased.[1] The development of irrigation in the Upper Deschutes River Basin was bringing pressure to supplement the natural flow of the river during irrigation season.

In *The Irrigation Situation In Central Oregon* (1931), the Bend Chamber of Commerce reported:

> The number of farms in Deschutes County increased 23 percent from 1925 to 1930, according to United States census figures, exceeded by only three counties in the State of Oregon, and the value of farm lands and buildings increased 18.5 percent, exceeded, again, by only three counties in the state. These Deschutes County increases were all in irrigated sections as there was an actual loss in the number of dry farms and in the value of land and buildings of dry farms. These increases would have been greater had it not been for the shortage of water for irrigation. Give these districts an adequate supply of water and farmers will be as prosperous as in any section in the United States.[2]

The irrigation situation had become serious during the 1929 and 1930 seasons, reaching a crises stage, and getting even worse in 1931 as a general decline in precipitation placed three parched years on an increasingly exhausted natural flow.[3]

Figure II E-1 illustrates the irrigation systems in the Upper Deschutes River Basin in 1931. (The North Unit project was being proposed, the Snow Creek system was never realized, and the Walker Basin project was defunct.)

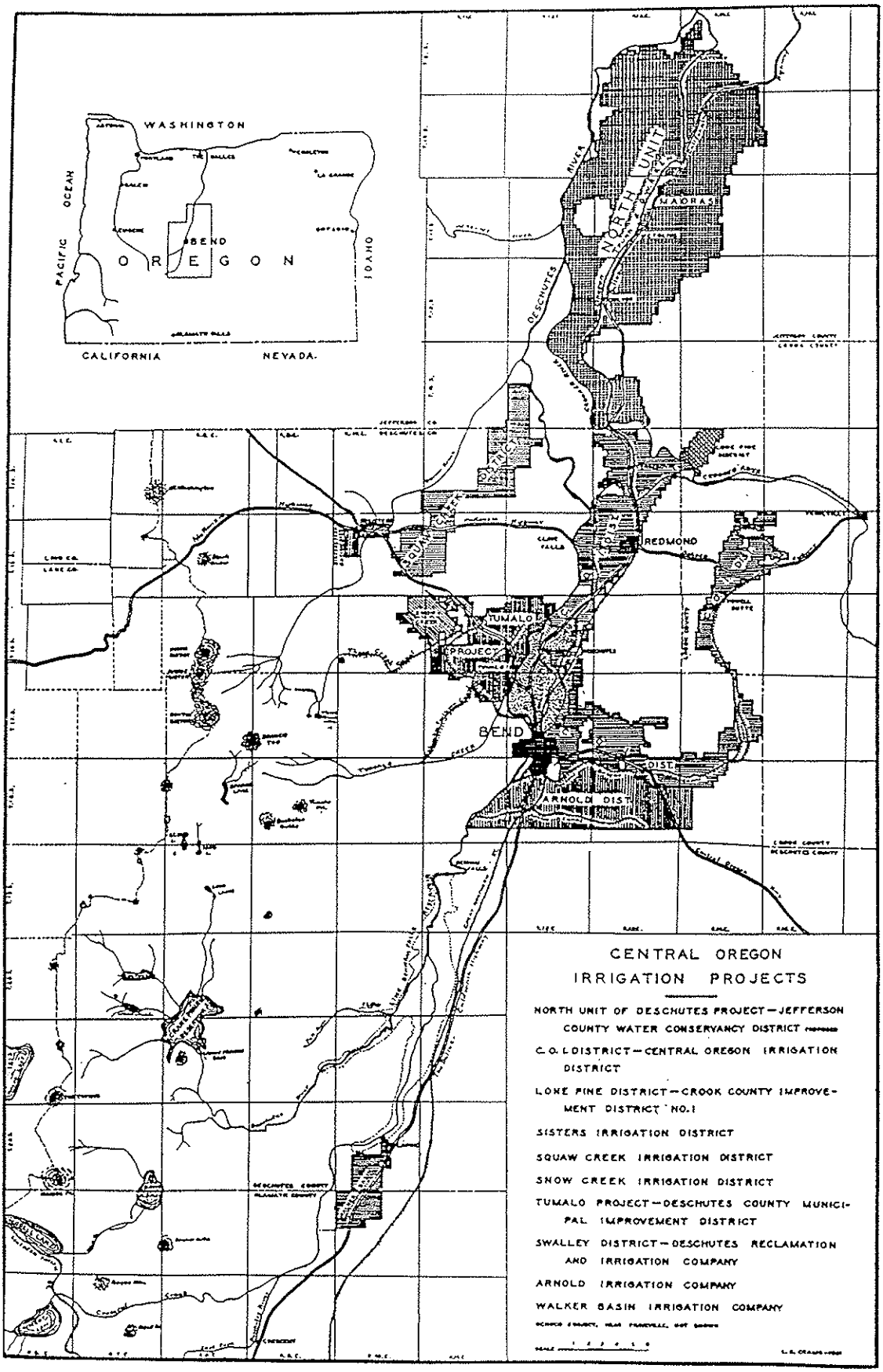

Figure II E-1. Irrigation Systems in the Upper Deschutes River Basin, 1931. Cramb, 1931.

CRANE PRAIRIE DAM AND RESERVOIR

In 1931, the irrigation districts petitioned the federal government to buy out a power company in Bend and rebuild the Crane Prairie Dam. Crane Prairie is about 35 miles southwesterly of Bend.

The Bend Water, Light and Power Company dam and powerhouse, built by A.M. Drake in 1910, was owned by the Pacific Power and Light Company. The power company held a claim to winter flow of the Deschutes and had successfully litigated to prevent the districts from enlarging the dam. The company held a right to the entire flow of the river during the non-irrigation season.[4]

A temporary long-crib rockfill dam was constructed at Crane Prairie in 1922 by the North Canal Company. The company was granted the right to store water for the purpose of reclaiming what was known as the North Canal Segregation, a Carey Act project to the east of Redmond. The company later sold an interest to the Crook County Improvement District No. 1 (Lone Pine District). Because of financial problems, the North Canal Company failed to reclaim the lands and the Federal Court cancelled the company's rights within the Crane Prairie Reservoir site.[5]

The Bend Chamber's 1931 report summarized the districts' and the entire area's plea:

> We are not asking at this time for the development of a new project, but for the relief for existing districts...Accordingly, it is proposed to provide storage in what is known as the Crane Prairie Reservoir...The projects in Central Oregon were started at a time when the summer flow of the Deschutes River was 50 percent or more greater than during the past few years. There was every reason to believe sufficient water would be available for the future...The dry cycle of the past few years has brought on a condition which, unless remedied, will mean the loss of the savings of a life time for many farmers...The only way out is to provide storage of the winter flow of the Deschutes River. The Power Company stands in the way as it has an adjudicated right to the entire flow of the river during the non-irrigation season. Eliminate the Power Company and water will be available...[6]

The Bureau of Reclamation agreed that supplemental storage was necessary, but believed that the best damsite was downstream from Crane Prairie at Wickiup Butte, where the construction of a much larger and tighter reservoir would provide irrigation water not only for about 47,500 acres in the Bend area, but also for an additional 50,000 acres to the north in Jefferson County, which did not have irrigation of any kind. By using the Wickiup damsite, Reclamation indicated it could alleviate the distress of the entire region. In the fall of 1937, the Roosevelt Administration authorized the construction of Wickiup Dam and Reservoir.[7]

Irrigation interests in the Bend area, however, refused to support the plan for a single, region-wide storage facility at Wickiup. They suggested that their cost would be much less if water storage was divided between two facilities--rebuilding Crane Prairie for Bend-area farmers and a reservoir at Wickiup for North Unit farmers. Without a new dam at Crane Prairie, they threatened to withdraw from the entire project and to continue using the old reservoir. Their unwillingness to agree or to compromise placed the Bureau in a difficult predicament. The

agency did not want to build the new Wickiup Reservoir directly below the potentially unsafe Crane Prairie Dam. However, it lacked the legal authority to remove the structure. Finally, the Bureau concluded the best and fastest solution was to rebuild Crane Prairie Dam as soon as possible and to move forward with the rest of the project.[8]

Following its customary practice during the New Deal era, the Bureau designed Crane Prairie Dam in-house and let the construction contract on a competitive basis, awarding the project in August 1939 to Vernon Brothers of Boise, Idaho for $104,000. The design called for a conventional, rock-faced, earthfill dam with a storage capacity of about 50,000 acre-feet. Although studies had indicated that the site was watertight for only about 30,000 acre-feet, the additional capacity was justified by its extremely low cost and by the belief that leakage would be recaptured downstream by Wickiup Dam. Under the supervision of Construction Engineer C.C. Fisher, the dam was completed in the fall of 1940. Since the rebuilt structure served the same purpose as the old dam, its construction did not have a major impact on the region, except for smoothing the way for the larger Wickiup Dam project.[9]

Crane Prairie Dam is a zoned earthfill structure with a height of 36 feet (hydraulic height of 27 feet) and a length at the crest of 285 feet. The crest is 25 feet wide and the dam has a maximum width at its base of 200 feet. When filled to the spillway, the reservoir has a capacity of about 55,300 acre feet and covers about 4,940 acres. The design is so conventional that the Bureau uses Crane Prairie as a text-book example of a small earthen dam.[10]

Three districts--Central Oregon Irrigation, Arnold Irrigation and Crook County Improvement District No. 1 (Lone Pine)--receive water stored in Crane Prairie Reservoir. As a component of the project, the three districts entered into a multi-district cooperative agreement with the federal government on January 4, 1938, which included repayment procedures and agreements regarding water rights. The contract was paid in full in 1959.[11]

WICKIUP DAM AND RESERVOIR

In 1937, a year before the Bureau of Reclamation agreed to rebuild the old Crane Prairie Dam, the Bureau was authorized to build Wickiup Dam several miles below Crane Prairie. With a capacity four times that of Crane Prairie, Wickiup would provide storage to the North Unit in Jefferson County by sending water down the Deschutes to Bend and then through the North Unit Main Canal to Madras, 65 miles north of Bend. Construction of Wickiup Dam and the North Unit Canal would bring irrigation to lands in Jefferson County, where farmers were using dry farming methods to produce wheat.[12]

During the years of ample rainfall leading up to World War I, farmers in the area had prospered, and the farm population had grown to about 400 families. An irrigation project for the North Unit was planned by local landowners between 1917 and 1921 to enhance production, but several dry years caused an economic decline. Soon many mortgages were foreclosed and farmers abandoned their land. Due to the financial climate, organizers of the North Unit Irrigation District were unable to sell bonds to finance construction for the project. The Bureau and the State of Oregon tried to revive the project in the mid-1920's, again with no success. Abandonment of the land continued into the 1930's, until only about 100 families remained in the North Unit area. Construction of Wickiup dam and the North Unit Canal, however, brought an influx of new settlers. By 1948, the area's population had grown to about 200 families, despite the fact that the dam was still a year from completion.[13]

Authorized by the federal government in the fall of 1937, the Deschutes Project was designed "to provide irrigation water for 50,000 acres of dry but fertile lands near Madras on the east side of the Deschutes River in central Oregon."[14] As originally conceived, the Deschutes Project called for two major pieces of construction: (1) an earthfill storage dam and reservoir for conserving 209,000 acre-feet of winter water at Wickiup Butte on the upper Deschutes River about 40 miles southwest of Bend; (2) a 65-mile diversion canal linking the Deschutes at Bend to the North Unit. Total estimated cost was $8 million, with $2.5 million slated for Wickiup Dam and Reservoir. The project's authorization stipulated that the equivalent of at least $2 million dollars of contracted labor was to be supplied by the Civilian Conservation Corps (CCC) under Reclamation's supervision. Also included in the costs was compensation to Pacific Power and Light Company that controlled the winter flowage rights of the Deschutes River. Partly to replace the loss of power, the Bureau installed an additional 1,500-kilowatt generator at the Cove Plant on Crooked River near Culver.[15] The issue of rebuilding Crane Prairie Dam had delayed the project for nearly a year, since the assignment of any storage capacity to Crane Prairie would require a corresponding reduction of capacity at Wickiup.[16]

Although the Bureau had been uncertain how best to apportion construction tasks between the CCC and contract labor, the need to make up lost time suggested the immediate use of the CCC "since CCC construction could be commenced prior to the completion of final contract plans and specifications."[17] The construction of the outlet works was handled under a contract awarded in August 1939 to C.J. Montag and Sons of Portland, Oregon, low bidder at $154,653.50. The extensive use of CCC forces for such a large task as constructing the large earth embankment was unusual. Typically during the New Deal era, the CCC was employed for ancillary tasks conducive to hand labor, such as clearing brush, while tasks requiring extensive use of heavy equipment were assigned to contractors.[18]

From an engineering standpoint, the outlet works are perhaps the most interesting part of the design. The original plan called for a conventional spillway at the end of the dam. But after reviewing hydrographic data the Bureau decided that the Deschutes River was of such constant flow that the dam could dispense with a regular spillway, relying instead on the outlet works to discharge flood waters, with the additional safeguard of an emergency spillway in the reservoir's east dike. To ensure that the Wickiup outlets works were indeed capable of handling potential flood water, two 90-inch diameter control valves were specified. This new device, known as a "tube valve" was designed by the Bureau during 1936-1938. As a valve which could both discharge into open air or be installed within a conduit, "the tube valve signaled a major advance in a key element of outlet works."[19]

The CCC forces began clearing the Wickiup damsite in April 1939, having spent the winter months building their own camp facilities. Although the original plan called for a three-year construction schedule, this was changed to five years, "as it [was] not possible for the CCC forces, with the equipment on hand, to move approximately 2-3/4 million yards of materials required for the construction of the dam and to clear 11,000 acres of heavy timber within the 3 year period."[20] By the summer of 1941, the dam was about 20 percent complete. The onset of World War II, however, brought considerable delay to the project. The CCC forces disbanded on July 1, 1942, and the Bureau's work force was also greatly reduced due to enlistment with the Armed Forces. In December, 1942, a new work force arrived at Camp Wickiup: Mennonite conscientious objectors. Despite their refusal to fight in the war, the Mennonites were very willing to work on the dam construction project, and productivity during 1943, both in building the dam and in clearing the reservoir site, equaled or exceeded that

maintained by the CCC in earlier years. At the end of year, however, the Mennonites were moved to other camps and replaced at Wickiup by a more general population of conscientious objectors, many of whom apparently objected to construction work as well. Work at Wickiup was generally limited to clearing the reservoir site from the beginning of 1944 until the war ended. The conscientious objectors' camp closed in July, 1946. From that point onward Bureau forces finished the project.[21]

The Bureau's work force began construction of the East Dike in 1946, but leakage problems reminiscent of the Tumalo Project occurred. In 1945, the Bureau had already discovered leaks while the reservoir was partially filled. Two large holes opened in the floor of the reservoir near the east end of the dam, allowing water to flow through a fault in the porous lava which comprised bedrock in the area. The two holes were filled with earthen materials that fall. In October, 1947, the Bureau began to store water for the next year, intending to fill the reservoir. As it reached its maximum capacity, several other leaks were discovered, yielding losses estimated at 1,000 acre-feet per day. The major leakage area was at the south end of the reservoir adjacent to a volcanic butte known as Davis Mountain. Other leaks were discovered near Wickiup Butte, which separates the dam from the East Dike. Alder Construction Company, one of the contractors working on the dam and outlet works, was given a special contract to excavate and plug the leaks. These remedial actions continued into 1949, during which time a drainage ditch also had to be dug downstream, because of troublesome seepage below the dam. Although the various leaks did not threaten the structural safety of the dam, they did reduce the available irrigation water. To compensate for the losses, the dam's capacity was increased to 200,000 acre-feet by raising the height of the emergency spillway crest with an earthen plug. Wickiup Dam was completed in 1949.[22]

Wickiup Dam and Reservoir is located along the Deschutes River in Deschutes National Forest, about 35 miles southwest of Bend. The dam consists of the dam proper and a second earth embankment called the East Dike. Wickiup Dam is a zoned earthfill structure with a height of 100 feet (hydraulic height is 81 feet) and a crest 13,860 feet long. The crest, consisting of a gravel road, is 30 feet wide and the maximum width of the base is 550 feet. The East Dike is 3,420 feet long and 28 feet high and constructed of similar earthfill materials. A topographic feature of the basin which forms Wickiup Reservoir necessitated its construction. When filled to capacity, the reservoir covers about 11,170 acres and holds about 200,000 acre-feet of water.[23]

NORTH UNIT CANAL

A young Portland newspaper writer and radio commentator, Tom Lawson McCall, wrote in the Spring of 1946:

> The world of the past will come to an end for the people of Jefferson County along about one o'clock on the afternoon of May 18, 1946.
>
> But it won't be one of those cataclysmic affairs of the type forecast by Nostradamus--and the people of Jefferson County will take immediate delivery on a new world that will make all but a few hardened pioneers forget the old and be genuinely thankful for the opportunity.
>
> Water will sweep out the old and bring in the new.

> The county seat of Madras will be rocked to its still dusty foundations May 18 by the biggest celebration in the town's history.[24]

McCall, who later became Oregon's Governor, captured the essence of the historic event. Irrigation for Jefferson County had been discussed since 1897.[25] Nearly 50 years later it became a reality on May 18, 1946 as the signal was given which sent water down the newly-constructed canals and onto the land.

Irrigation marked the beginning of a new era for Jefferson County and optimism was high. The county population increased from 2,042 in 1942 to 2,870 in 1946. Gross return per acre was expected to increase fivefold with water. The number of ranches was expected to rise from 227 in 1940 to close to 700 within a short time. The number of businesses in the county jumped from 42 to 69 between 1940 and 1945, and expectations were that irrigation would bring 160 new businesses to the county.[26]

A contract for the project was signed by the North Unit Irrigation District and the Bureau of Reclamation on January 4, 1938. It was amended twice, September 5, 1945 and October 26, 1949, to reflect increased costs associated with World War II. Repayment for construction costs amounted to $12,130,000. Landowners were required to repay the federal government through payments to North Unit. The amount owed was based on the appraised value of their land, varying from a $23-per-acre value for first class lands to a $5-per-acre value for grazing lands. Interest free terms were provided.[27]

Canal construction began October 10, 1938. Some of the labor was provided by the Civilian Conservation Corps (CCC). A CCC camp, Camp Redmond, was established on forty acres just east of the railroad in Redmond. It was designed to hold three companies, six hundred men. By September 1938, 43 buildings covered 22 acres with two miles of wooden sidewalks. While two companies moved to Camp Wickiup, one company began construction of a twelve-mile stretch of the North Unit Canal in the spring of 1939. The CCC's worked three shifts per day, clearing right-of-way, moving earth and preparing to blast. Once a day 1,000 to 4,500 pounds of blasting powder opened a new section of the 40-foot wide, six-foot deep canal. Riprap crews reinforced the banks with hand-laid stone. By the summer of 1940, the canal moved northward toward the Crooked River.[28]

In December 1942, following the bombing of Pearl Harbor and the country's entrance into World War II, work was halted by the War Production Board and, except for the labors of a camp of conscientious objectors, construction was suspended for about a year. Late in 1943, the stop order was rescinded on the recommendation of the War Food Administration. The recommendation led to the War Production Board authorizing the construction necessary to irrigate the southernmost 20,000 acres of the North Unit.[29]

By April 1946, the North Unit Canal, known as "The Fabulous Furrow", had reached several miles beyond Crooked River Gorge and laterals to the southernmost acres were being completed. Water was available for approximately 17,000 acres in 1946 and 1947, though only 6,988 acres were actually irrigated the first year. Water was delivered to an additional 6,500 acres at the beginning of the 1948 irrigation season, and to the remaining 26,500 acres at the beginning of the 1949 season. By 1950, 48,000 acres were under water.[30]

The North Unit Canal heads at the North Canal Dam near Bend and extends 65 miles, terminating on the Agency Plains north of Madras. It was initially capable of carrying 1,000 second-feet of water. The major structures along the canal are a reinforced concrete flume 521 feet long crossing the Crooked River Gorge, two concrete-lined tunnels 11-1/4 feet wide in the vicinity of Smith Rock with a total length of 6,900 feet (1.3 miles), an inverted siphon at Sherwood Canyon, and a 1,000 foot concrete and steel siphon across Willow Creek Canyon, west of Madras. Portions of the canal go through fractured basalt flows which resulted in water seepage problems, so a portion of the canal was gunited to prevent excess water loss. Laterals totalling 235 miles were built. Various structures along the route control and distribute water to individual farms. The distribution canals begin at Mile 32.[31]

HAYSTACK DAM AND RESERVOIR

After operating the North Unit project with a four-day lag between water demand and farm delivery, resulting in wastage of 30,000 to 40,000 acre feet per year at the end of the main ditches, the Bureau of Reclamation and the North Unit Irrigation District decided to construct a re-regulating reservoir to be located on Haystack Creek ten miles south of Madras. The construction of this dam began in 1956 and ended in 1957. A 78-year repayment contract was established for the $1.6 million project. Approximately 31,000 acres are serviced below this re-regulating dam. The capacity behind the dam is 6,600 acre feet of water which covers a surface area of 225 acres. The total height of the dam is 105 feet with a 755 foot base and a 25 foot width at the top. The total number of cubic yards of material used in the dam was 535,000. The water outlet is a concrete conduit through the base of the dam controlled by one 3-1/4 by 3-1/2 foot high pressure slide gate.[32]

The reservoir is unique in two ways. First, the dam was constructed in a canyon in which very little surface water originates. Secondly, the inlet canal also serves as a spillway for the reservoir.

In the main canal, at the inlet of Haystack Reservoir, is an automatic flow regulating device called a "Little Man". This device operates to release a predetermined amount of water past the reservoir down the canal and to maintain a constant level in the upstream main canal by controlling the amount of water diverted into Haystack Reservoir. Fluctuations in the main canal are controlled by automatically changing the inflow into Haystack Reservoir.[33]

This re-regulating reservoir allows farmers to have the desired amount of water "on call" with changes in downstream demand being taken care of by changing the outflow from the reservoir. The water stored in Haystack Reservoir eliminates the four-day wait required for additional demand flow to reach the project from Wickiup and also eliminates what was formerly waste--some 30,000 to 40,000 acre feet annually--of water in transit between the time demand changed and flow could be reduced at Wickiup.

CRESCENT LAKE DAM

While the Deschutes Project--Crane Prairie and Wickiup Dams and the North Unit Canal--was being constructed, the Tumalo Irrigation District was a mere observer. As early as 1946, the District had asked the Bureau of Reclamation to inspect Crescent Lake Dam, located in north Klamath County.[34] The dam had been built in 1922-23 of timber-crib, rock and earthfill across the outlet channel of Crescent Lake.[35] The District had acquired the water rights of the defunct

Walker Basin Carey Act project on November 1, 1921.[36] Water was stored in the reservoir in the winter and released down Crescent Creek to the Little Deschutes River to the Deschutes during irrigation season.

Water was diverted at the Tumalo Irrigation District Dam at Bend (generally known as the Bend Diversion Dam) just downstream from the Pacific Power and Light Company dam (Bend Water, Light and Power Company) and above the North Canal Dam. The Bend Feed Canal carried water from that point northwesterly along a lava rimrock on the westside of the river, then overland ending with a 412-foot-long trestle flume crossing 67 feet above Tumalo Creek to a junction with the Tumalo Feed Canal. In its 4.8-mile length, the Bend Feed Canal also included: a 750-foot wood-lined tunnel; a 78-inch diameter, 827-foot wood stave pipe inverted siphon ("Red Rock Syphon") crossing a draw in what is now the Awbrey Meadows subdivision; and 11,436 feet of metal flumes elevated on wooden trestles to span draws between lava headlands and to maintain grade along lava cliffs.[37] Construction on the dam and feed canal was begun August 1, 1922 and completed on June 23, 1923.[38]

The system of storing water in Crescent Lake and conveying it down Crescent Creek and the Little Deschutes River through the Deschutes River and by canal from the diversion dam to the Tumalo Feed Canal assured settlers of water throughout the growing season. The expectation was that they would be encouraged to cultivate all of the land possible. Water from the system was generally not needed until July or August as Tumalo Creek provided sufficient water for the first two months of the growing season. Later, however, creek flow diminished.[39]

As the Crescent Lake Dam deteriorated, threatening Southern Pacific tracks and the Crescent Lake community, the State reduced the allowable storage. In 1951, the Bureau inspected the dam and by the end of 1952 provided an estimate of $200,000 to rebuild it. The Bureau agreed the 86,050 acre-feet capacity was needed to guard against lean water years. The District formally applied for funds to rebuild the dam in 1953. Loan terms were equal annual installments over 50 (later changed to 40) years, without interest.[40]

The Bureau's project dredged the outlet channel and replaced the old dam with a 400-foot long, 40-foot high earthfill dam with a concrete outlet works. Final costs were $297,000 plus $23,000 for engineering. Construction began on April 12, 1955 and was completed October 24, 1956.[41]

Among the storage facilities developed under the Reclamation Act, Crescent Lake (86,050 a.f.) is a distant second to Wickiup (200,000 a.f.), with Crane Prairie (55,300 a.f.) third and Haystack (6,600 a.f.) fourth. Crescent Lake and Haystack are located outside of Deschutes County, in Klamath and Jefferson counties, respectively. Crescent Lake is the only one to utilize tributaries (Crescent Creek and the Little Deschutes River) to convey water for irrigation.

Figure II E-2 illustrates the irrigation systems developed in the Upper Deschutes River Basin under the Carey and Reclamation acts.

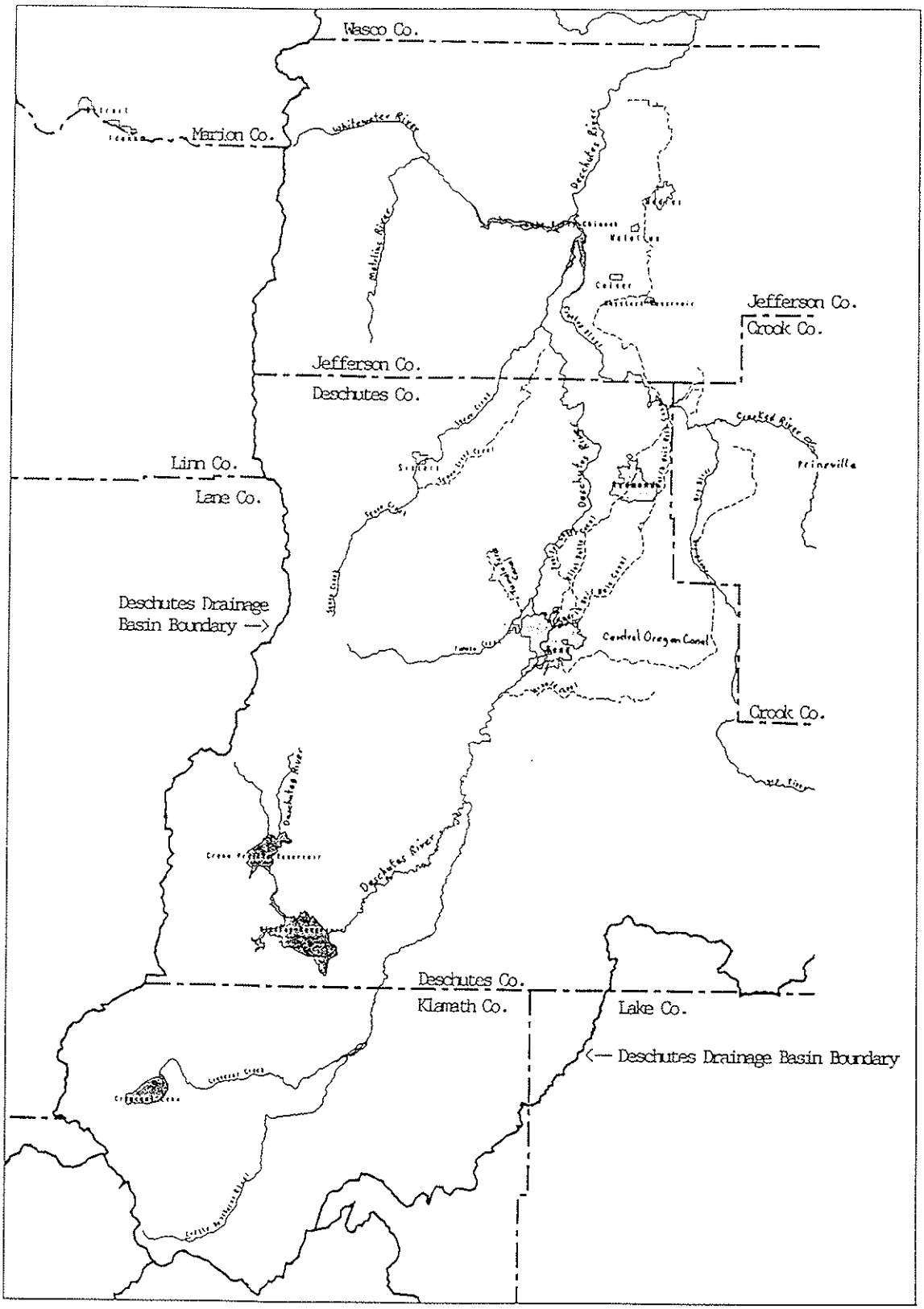

Figure II E-2. Irrigation Systems Developed in the Upper Deschutes River Basin under the Carey and Reclamation Acts. (Main canals only) Source: Oregon Water Resources Department, 1994.

F. UPPER DESCHUTES RIVER BASIN

Deschutes River Basin Overview

The Deschutes River has a more nearly uniform flow than any other river of its size in the United States. It rises in lakes and springs in the Cascade Range and flows generally northward to join the Columbia River 16 miles east of The Dalles. In its middle and lower courses the river runs through a spectacular canyon.

The Deschutes River Basin encompasses 10,400 square miles of the north central part of Oregon. Nearly 91 percent of Deschutes County lies within the Deschutes River Basin. The annual precipitation ranges from about 9 inches along the lower course of the river to 90 inches in places along the crest of the Cascade Range. In general, the precipitation decreases eastward from the Cascade Range and northward along the river.

The uniform flow of the river is attributed to the presence of large areas of spongelike pumice soil and lava rock, which conduct much of the precipitation down to vast underground reservoirs. This ground water percolates out through the porous lava rocks to emerge as large, clear, steady-flowing springs. Taken either individually or as a group, these springs are among the largest in the world. One tributary alone (Metolius River) has a flow, almost entirely derived from springs, some of which are constantly discharging water that fell years earlier.

Lakes in the headwater areas also serve to stabilize the flow of the Deschutes River. Some, such as Crescent Lake and Odell Lake, were dammed by moraines of former mountain glaciers; others were dammed by lava flows. The entire outflow of Davis Lake is by leakage into and through such a lava flow. Still other lakes occupy depressions formed in the lava, and much of their outflow sinks into the ground. East Lake occupies a large volcanic crater, from which the water is lost by evaporation and seepage. Paulina Creek, leaving Paulina Lake as a strong-flowing stream, gradually sinks into the pumice and most of its flow disappears before reaching the Deschutes River. Manmade lakes include Crane Prairie, Wickiup, Ochoco and Prineville Reservoirs, and the reservoirs formed by Round Butte and Pelton dams near Madras.

Near Bend, most of the natural flow, and all the water released from storage in Crescent Lake, Crane Prairie, and Wickiup Reservoirs, is diverted for use in irrigation. The irrigated land lies on broad plateaus near Bend, Redmond, and Madras; only small tracts on the narrow terraces are along the river itself. Large springs in the deep river canyons near Culver and additions from the Crooked and Metolius Rivers swell the summer flow downstream near Madras.

Below Madras, the small east-side streams are inadequate for irrigation needs, and their contribution to the Deschutes River is negligible. Practically all the inflow in this section comes from the west side. Shitike Creek and the Warm Springs River have well-sustained flows fed by winter snows and by large springs. White River is fed by springs and snows of Mount Hood.[1]

The Upper Deschutes River Basin Within Deschutes County

The Upper Deschutes River Basin has its headwaters in Lava and Little Lava Lakes. The source for the groundwater inflow to these lakes is the snowfields in the Mt. Bachelor and Three Sisters area. From Little Lava Lake, the Deschutes flows south to Crane Prairie Reservoir, which was originally constructed in 1922 and reconstructed in 1940. The River continues south a short distance to Wickiup Reservoir, which was constructed in 1940 (completed in 1949). From Wickiup Reservoir, the River flows northeast toward Bend. Fall River joins the Deschutes at river mile 204.7 and is typical of many of the large streams in the Upper Deschutes River Basin in that it arises from a spring source. The Little Deschutes River, which drains an area of 1,020 square miles, including the Crescent Lake and Crescent Creek area, flows into the Deschutes River in the Sunriver area. Below the confluence with the Little Deschutes, Spring River flows in from the west. Below Spring River, the river continues to flow northeast into the Benham, Dillon and Lava Island Falls area. These falls occur within an eight-mile reach of river and were created by the river being pushed out of its original channel by lava flows from Lava Butte, part of the Newberry Volcano complex.[2] See Figure II F-1.

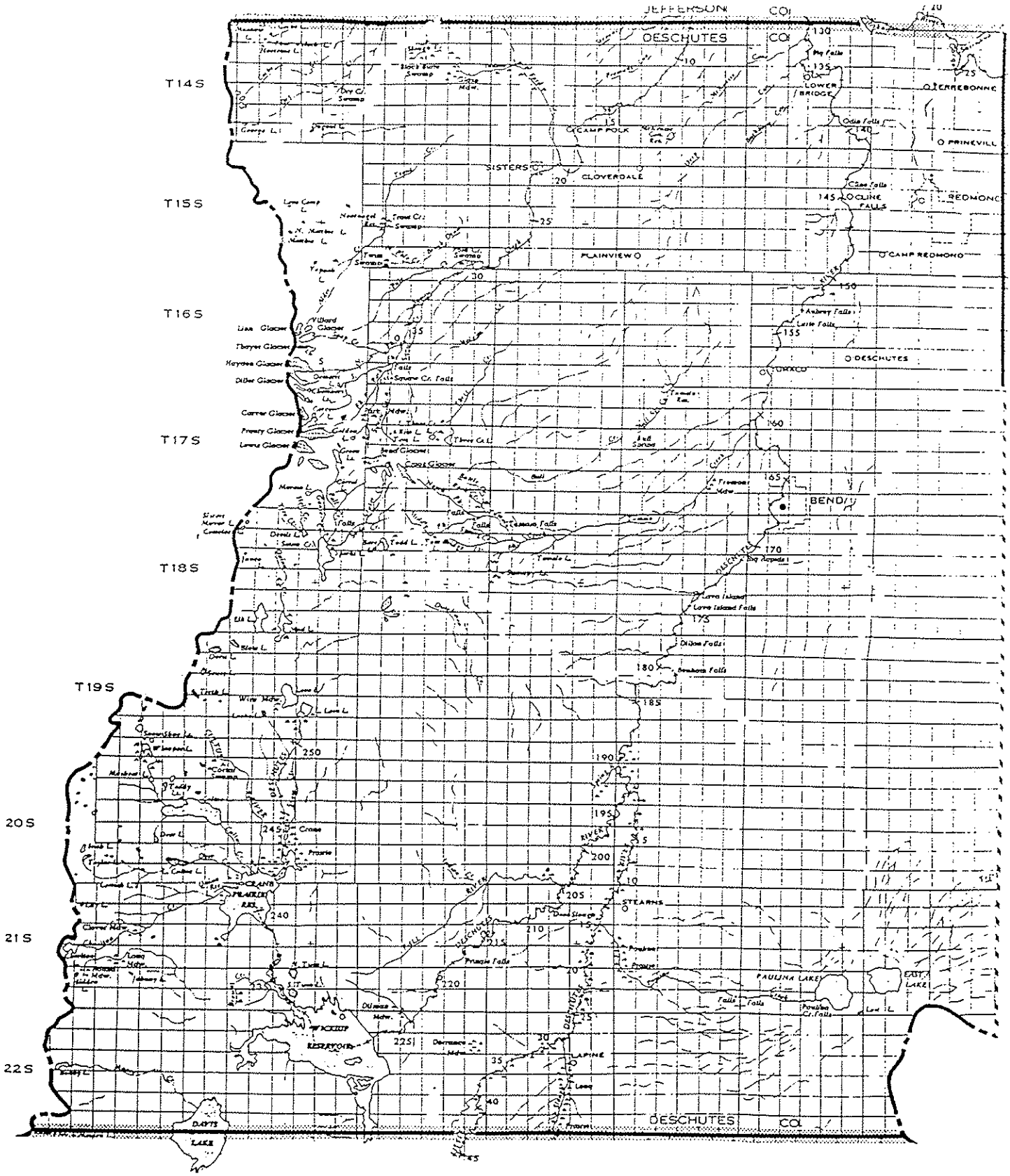

Figure II F-1. Upper Deschutes River Basin within Deschutes County. *Deschutes County/City of Bend River Study*, 1986.

Six historic irrigation projects divert water just upstream of and in Bend. The Arnold Irrigation District diverts water from the Deschutes River at the upper end of Lava Island Falls; the Central Oregon Irrigation District diverts water at the upper end of Big Rapids. During the irrigation season, most of the remaining water in the Deschutes is diverted for irrigation purposes within the City of Bend by the Tumalo Irrigation District at the Bend Diversion Dam and the North Unit, Central Oregon and Swalley Irrigation Districts at the North Canal Dam. Below Bend, Tumalo Creek joins the River at river mile 160.2. There are two diversions from Tumalo Creek (Columbia Southern Canal and Tumalo Feed Canal) which supply water for the Tumalo Irrigation District. Squaw Creek flows into the Deschutes River about 5 miles north of Deschutes County's northern boundary. The Deschutes River then flows into Lake Billy Chinook (Round Butte Dam) and north to the Columbia River.[3] See Table II F-1.

TABLE II F-1
IRRIGATION STORAGE AND DIVERSION FACILITIES
IN THE UPPER DESCHUTES RIVER BASIN

NAME	RIVER MILE	MAXIMUM ACTUAL STORAGE/DIVERSION
Crane Prairie Reservoir	239.0	55,000 acre feet of storage for Lone Pine, Arnold, and Central Oregon Irrigation Districts
Wickiup Reservoir	227.0	200,000 acre feet of storage for North Unit Irrigation District
Crescent Lake	*	86,050 acre feet of storage for Tumalo Irrigation District
Arnold Canal	174.6	135 cfs
Central Oregon Canal	171.0	650 cfs
Bend Feed Canal (TID)	165.8	150 cfs
North Unit Main Canal (NUID)	164.8	1,100 cfs
North Canal/ Pilot Butte Canal (COID & Lone Pine ID)	164.8	600 cfs
Swalley Canal	164.8	120 cfs

* Located at head of Crescent Creek

SOURCE: Deschutes County/City of Bend River Study, 1986

The six irrigation districts divert water near Bend for the irrigation of 120,000 acres in three counties. The diversion rights of these districts are listed in Table II F-2.

TABLE II F-2

DISTRICT DIVERSION RIGHTS AND PRIORITY IN THE UPPER DESCHUTES RIVER BASIN

DISTRICT	MAXIMUM DIVERSION	PRIORITY DATE
Swalley	120.58 cfs	09/01/1899
Central Oregon	1,394.83 cfs	10/31/1900 (985 cfs) 12/02/1907 (409.83 cfs)
Lone Pine	38.80 cfs	10/31/1900
Arnold	212.13 cfs	02/01/1905 (25 cfs) 04/25/1905 (187.13 cfs)
Tumalo	9.50 cfs	/1905
North Unit	1,101.00 cfs	02/28/1913

SOURCE: Deschutes County/City of Bend River Study, 1986

In a typical year, the natural flow of the river will satisfy all rights up through 1905. Natural flow for the North Unit Irrigation District is usually available only in the spring and fall. To augment the natural flow, the districts have built storage reservoirs as indicated in Table II F-3.

TABLE II F-3

DISTRICT STORAGE RIGHTS AND PRIORITY IN THE UPPER DESCHUTES RIVER BASIN

DISTRICT	STORAGE (Acre Feet)	RESERVOIR	PRIORITY
Lone Pine	10,500	Crane Prairie	1913
Arnold	13,500	Crane Prairie	1913
Central Oregon	26,000	Crane Prairie	1913
North Unit	200,000	Wickiup	1913
Tumalo	86,050	Crescent Lake	1911 & 1961

SOURCE: Deschutes County/City of Bend River Study, 1986

G. COLONIZATION AND CITY FORMATION

Large scale colonization efforts were crucial to the success of irrigation projects conducted under federal policies, particularly under the design and provisions of the Carey Act. Irrigation developers had to sell water rights on thousands of acres to recover development costs. In addition, revenues generated through settlement often provided for payments on bonds, allowed a developer to collect operational and maintenance assessments, and helped to keep up with maintenance, particularly on flumes. Thus, well planned colonization campaigns were developed with aggressive promotional programs.

The promotional programs targeted those would be settlers aspiring to Smythe's "homestead ideal". The Deschutes Valley Land and Investment Company advertised:

> The Road to Success is short if you know which one to take -- the door to fortune is open if you know which one to enter -- this is your opportunity. Embrace it NOW!...'Fortune knocks once at every man's door and if not admitted, she leaves and next day sends her daughter, Miss-Fortune'. Which will you admit?[1]

Other promotional programs were distributed less obviously and often contained false information. In 1918 W.D. Cheney, who was associated with several economic interests in the area, including the Bend Park Company, claimed in his book, *Central Oregon:*

> No better farming opportunities exist in the United States than those on the irrigated lands in Deschutes County. ...A large percentage of territory is free from trees or rocks, and with well water obtained at reasonable depth, it is sure to continue to develop into an important wheat growing district. ...There is very little shallow soil, and it is not uncommon to find a soil depth of ten feet... The annual precipitation is about fifteen inches...
>
> We have just come from the north through twenty miles of irrigation. We now see irrigation clear to the horizon -- northern, east and southern. We know that beyond those irrigated lands to the east and south are millions of acres of future grain lands.[2]

During the 1920's a statewide and regional effort evolved "to bring in settlers and to counter the decline of the Jeffersonian vision of America", according to Martin Winch, a former director and employee of the Tumalo Irrigation District.[3] The effort included local chambers of commerce, the railroads, major businesses, and business and trade organizations. In addition, the Oregon State Chamber of Commerce and the Portland Chamber of Commerce helped coordinate the program.

Beginning in 1923, the Tumalo Irrigation District's colonization program offered a 40-acre farm for about $250 as a down payment. Settlers with about $2,500 to invest in improvements were sought. Again, the concept of the "homestead ideal" was exploited. "We Want You, If you are Ambitious To Own a HOME on a Farm", claimed the District.[4] By the end of 1925 the campaign, which had not been as successful as needed under the financial conditions faced by the District, was, essentially, abandoned.

Colonization efforts in the Upper Deschutes River Basin had been ongoing to various degrees before Tumalo's campaign began. Winch notes: "(In 1902) the Deschutes Valley was reported to be 'the best advertised district today in the United States'".[5] The colonization concept was interwoven into federal policies for irrigation development and settlement of the West. The Carey Act encouraged private enterprise to reclaim and develop arid lands by building irrigation systems and then selling water rights to new settlers. The Act is directly associated with the formation of a number of cities in the Upper Deschutes River Basin. These include Bend, Redmond, Laidlaw (now Tumalo), La Pine and others which no longer exist, such as Deschutes, Cline Falls and Plainview.

BEND

In 1900, Alexander M. Drake and his wife came to the Bend area from Minnesota as developers enticed by the Carey Act. Drake purchased land around the bend of the Deschutes River, surveyed and platted it for a town site, and started the Pilot Butte Development Company. By 1905, the town was incorporated and Drake had completed the initial portion of the Pilot Butte Canal with the intention of reclaiming nearly 85,000 acres and attracting hundreds of new settlers. By 1904, only 40 acres had been irrigated, but the future potential was evident and the process of development begun. Figure II G-1 illustrates one of Drake's advertisements.

During Oregon Governor George Chamberlain's second visit to Bend in 1906, he noted that irrigationists had made great strides in two years in transforming "a barren and desert waste into a new and prosperous commonwealth".[6] In 1904 Chamberlain had found only a few scattered homesteads along the river and several buildings on the townsite. In 1906 he found a prosperous city "with well laid streets, beautiful lawns, a fine gravity water pressure system and a new public school building suitable to a city many times the size of Bend".[7]

The prospect of the railroad coming to Bend was widely known. In 1904, Drake observed: "In view of present railroad prospects, we are adding to our construction force and will push the lower canal line to completion".[8] The railroad would link local farmers with markets in the northwest and, later, in California.

In 1909, a race between two powerful railroad magnates, James J. Hill (Great Northern Railroad), and Edward H. Harriman (Union Pacific Railroad), was begun to build a railway up the deep, narrow, and rocky gorge from the Columbia River to the Deschutes Plateau and ultimately Bend. The Hill line was the Oregon Trunk Railway and the Harriman Line was called the DesChutes Railroad. The prize for the winner of this contest was the hoped for extension of their rail control to California (for Hill) and the east (for Harriman). The race ended in October 1911. Hill was applauded for completing a great step in the development of the area.

The railroad linked not only agricultural commodities to distant markets, but also the growth of the area to another resource: timber. The establishment of two large sawmills on the banks of the Deschutes River in 1915-1916 was the most significant economic force in Bend's growth following the city's initial formation spurred by the Carey Act. The Shevlin-Hixon Company and the Brooks Scanlon Lumber Company manufactured billions of board feet of lumber and provided jobs for residents of a rapidly growing mill town. In 1916, the population was 5,193.[9] At the 1916 fall election Deschutes County was divided from Crook County and Bend was designated as the county seat, December 13.

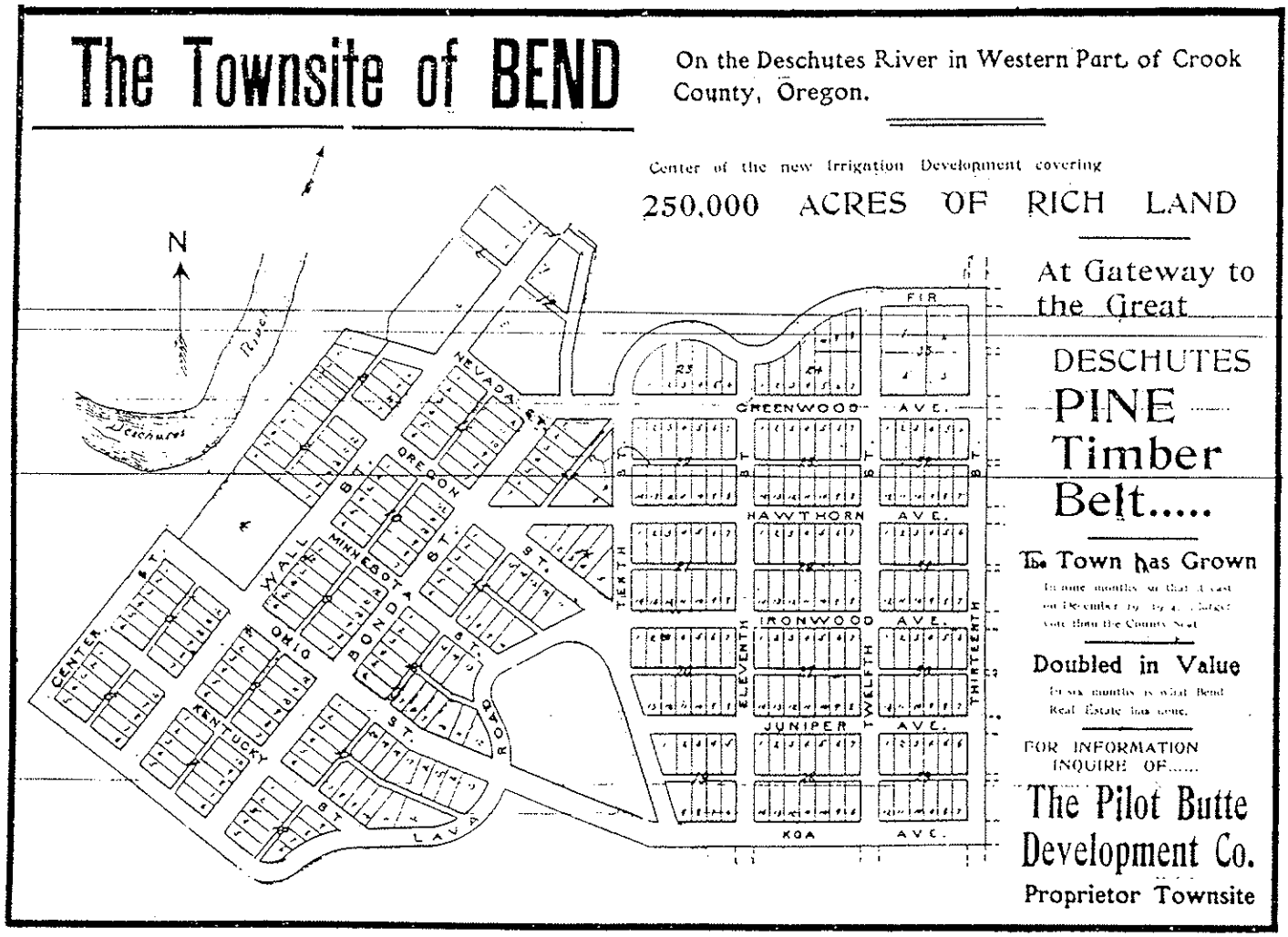

Figure II G-1. Pilot Butte Development Company advestisement. *The Bend Bulletin*, March 17, 1905.

REDMOND

Redmond's formation and development is also associated with irrigation development and the arrival of the railroad. Frank T. and Josephine Redmond, husband and wife, left school teaching jobs in North Dakota, settling in Wasco, where Frank was school principal until 1904. At the end of the school year in 1904, the Redmonds pitched their homestead tent amid the sagebrush and junipers on land soon to be served by a large irrigation project, the Pilot Butte Canal.

The Deschutes Irrigation and Power Company (later the Central Oregon Irrigation Company) had purchased the contract and rights for the project from A.M. Drake's Pilot Butte Development Company on March 14, 1904. The company also had rights for the Central Oregon Canal which would run northeast toward the west side of Powell Butte. An aggressive advertising campaign to attract settlers was initiated. The following promotional text characterizes a typical advertisement:

> FREE LAND IN OREGON. In the richest grain, fruit and stock section in the world. Thousands of acres at actual cost of irrigation. Deeds issued from the State of Oregon. WRITE TODAY. Booklet and map free. Deschutes Irrigation and Power Company, 610-11-12 McKay Building, Portland, Oregon.[10]

By 1907, the two main canals had been completed and the D.I.P. Company, as it was known, had entered into contracts for about 27,000 acres of irrigable land with new settlers.[11]

The Redmonds exemplified the vision held by settlers of the Progression Era who longed for a place of refuge for traditional American values, and for a place to realize the "homestead ideal". They gave up good positions in a well established community to "go west". Arriving in Central Oregon, they travelled through the sagebrush country and with the aid of blueprints provided by the D.I.P. Company selected an irrigable portion of land in the lower desert. The blueprints showed that a large irrigation lateral would pass nearby.[12] Their site selection also considered the rumored extension of the railroad from Shaniko. The Redmonds selected their land on the canal route at a point they believed would be very near to the railroad. Neither the canal nor the railroad arrived for some time, however.

In the fall of 1906, the D.I.P. Company conceived a plan to establish a desert town. The town would be located just west of the main irrigation canal. The exact location of the town, apparently, was by chance. A vacant section of school land not included with the tract segregated for reclamation under the Carey Act was offered by the irrigation company. The section adjoined the Redmond farm. As a tribute to the two settlers, the company suggested the name Redmond.[13] The Redmond Townsite Company was organized, platting the town in 1905. In 1910 the town was incorporated with a population of 216.

Anticipation of Redmond's future began some time before the railroad arrived. Economic and social developments were well underway by the "Railroad Day Celebration", September 30, 1911. In February 1911, the *Redmond Spokesman* reflected the city's optimism and growth, counting a variety of business and social opportunities: a garage, two banks, two doctors, a bakery, a brickyard, four lawyers, three saloons, two dentists, "two railroads", a tailor shop, a skating rink, novelty works, two feed stores, a public library, a reading circle, two newspapers, two drug stores, a harness shop, two barbershops, three restaurants, two transfer

lines, one hand laundry, a city water plant, two lumber yards, a jewelry store, a fire department, a basketball team, two photographers, a millinery store, two meat markets, two bowling alleys, a furniture store, a social dancing club, a wood working plant, two hardware stores, three blacksmith shops, an electric light system, two large general stores, five real estate agencies, four confectionery stores, a central telephone office, five church organizations, two billiard-pool halls, a brass band and orchestra, a passenger and express line, two large sale and feed stables, four fraternal organizations, one cleaning-pressing establishment, ladies auxiliary to commercial club, public school to tenth grade, largest department store in Central Oregon, commercial clubs, and two hotels.[14] By 1913 the community population had risen to 500.

Together, irrigated agriculture and the railroad stimulated the town's growth. Potatoes soon became a tremendously successful crop. In 1907 Frank McCaffery, employed by the irrigation company to sell land to settlers, learned of a potato variety, known as Netted Gems, being grown in Yakima, Washington. McCaffery purchased two tons of seed potatoes, bringing them to Redmond by rail. Excellent results occurred almost immediately from "Deschutes Russets", as they came to be known. *Redmond: Rose of the Desert* author B. Elizabeth Ward observed:

> Looking back at this period, the *Redmond Spokesman* said in the 1958 potato festival brochure: "Potatoes helped build Central Oregon's population. Pamphlets extolling Central Oregon as a garden spot were distributed through the Midwestern and Eastern states shortly after James Hill extended his hard-won rail up the Deschutes River from The Dalles. Redmond's Potato Day was publicized the length and breadth of the land by the railroad press agents. Farmers read the message and headed west to emulate the feats of pioneer growers...".[15]

In Redmond: Where the Desert Blooms, Keith Clark, Redmond historian, notes:

> Immediate plans to exhibit Redmond agricultural produce in a special Great Northern Railroad car were announced by Oregon Trunk officials. Redmond's own would exhibit potatoes in Omaha, Chicago and St. Paul, and in New York's Madison Square Garden.[16]

In an April 23, 1921 letter to Fred Henshaw of the Federal Power Commission Board of Engineers, J.G. McGuffie, Secretary and Counsel for the Central Oregon Irrigation Company, observed "the thrifty town of Redmond with its banks and mercantile establishments is wholly dependent upon the agricultural community surrounding it, which is the result of irrigation".[17]

DESCHUTES (DESCHUTES JUNCTION)

Deschutes is an example of a townsite directly associated with the development of irrigation which exists today only in name. Known today better as Deschutes Junction, the townsite was established by the Deschutes Townsite Company, a subsidiary of the Central Oregon Irrigation Company. The townsite company filed a formal plat of the townsite in the center quarter section of Section 26, Township 16, Range 12, on July 18, 1911. The site was nine miles north of Bend.

The Central Oregon Irrigation Company, which had taken over the assets, rights and operations of the Deschutes Irrigation & Power Company on October 25, 1910 made the town their headquarters. At the time it was designed, five avenues ran parallel to the Oregon Trunk Railway right-of-way. The town was to link irrigation development and the railroad.

The company operated a hotel and grocery store and had an office and storage and maintenance buildings. In addition to the company operations and facilities, businesses in 1917 included: the Deschutes-Tumalo stage line, the Farmers Mutual Telephone Company, a garage, an insurance agency, the Pacific Telephone and Telegraph, a hotel, and a golf club. Deschutes had a school for farm children and a brick plant was nearby.[18] One of the residents was Roscoe Howard, who became the manager of the D.I.P. Company in 1908 and continued with the new firm after the take-over.[19] In March 1931, the Deschutes County Court sold the townsite and surviving buildings for $100.

LAIDLAW (TUMALO)

Following its incorporation in 1904, many expected Laidlaw to be the center of western Central Oregon. Expectations were also tied to irrigation and railroad prospects. The Laidlaw Chronicle for March 28, 1906 carried this advertisement:

> Opportunity! Business! Progress! Buy lots in the town of Laidlaw, the coming metropolis of the vast irrigated district in Crook County, Oregon. The town of Laidlaw is located on the west bank of the Deschutes River and is very near the center of some 3,000,000 acres of Oregon's choicest irrigated lands. Laidlaw is also located at the intersection of the Corvallis and Eastern Railway survey and the Deschutes, which will add prosperity to the town.[20]

The C&E Railway, however, was never able to get across the Cascade Mountains. In 1902, though, Elmer E. Lytle, founder and president of the Columbia Southern Railroad (later, the DesChutes Railroad, controlled by E.H. Harriman) proclaimed "the beginning of a great future by irrigation" in the Central Oregon region. Irrigation development, railroad construction and city formation events in Laidlaw in the coming years were economically intertwined.

Following Lytle's proclamation in 1902, W.A. Laidlaw, with a close but unspecified association with the Columbia Southern Railroad, announced that construction on a major irrigation project in the Deschutes Valley would begin in 1903. Laidlaw served as the secretary and general manager of the Columbia Southern Irrigation Company, the successor to the Three Sisters Irrigation Company, which had been engaged in irrigation development of Tumalo Creek water since 1900. Principle of the new irrigation company was Elmer Lytle. The Harriman railroad company began promoting irrigated Tumalo lands nationwide. In December 1903, it was reported that Lytle would contract with Harriman to extend the Columbia Southern Railroad south into the middle Deschutes Valley.[21]

On August 31, 1904, W.A. Laidlaw, as secretary of Laidlaw Townsite Company, platted 160 acres. About a third of 900 town lots were sold before 1907. By 1906, commercial ventures included a hotel, restaurant and bakery, a market, several feed stores, a general merchandise store, a blacksmith and wheelwright, a millinery and dry goods store, an ice company, a barber shop, a grocery store, an express and transportation company, two doctors, two lawyers, a contractor/builder, a painter/decorator, a wallpaper company, the Laidlaw

Townsite Company, the Laidlaw Land Company, Deschutes Valley Land & Investment Company, Columbia Southern Irrigation Company, the Laidlaw Banking and Trust Company, and probably several saloons. The First Presbyterian Church was in use by 1907. By 1908 Laidlaw featured a community hall, a pool hall, a skating rink, another restaurant, two delivery stables, a stage service and a newspaper. By 1909 Laidlaw was beginning to be called Tumalo on occasion. The Columbia Southern Railroad had reached only to Shaniko by then. In 1924, the Tumalo Grange was formed reflecting a need for greater social interaction and an enhanced effort toward the achievement of community goals.[22]

LA PINE

In 1910, when the Hill and Harriman railroad companies were battling up the Deschutes River gorge, new towns, some of them temporary, others existing only on paper, were being developed as interest in irrigation possibilities in the Upper Deschutes River Basin grew. Hundreds of homesteaders were arriving in the area. There was speculation that the railroad would be extended south from Bend to Klamath Falls.

One of the Central Oregon towns which came into existence early in 1910 was La Pine. Three Portland businessmen, James Gleason, W.R. Riley and Alfred Aya, had formed the La Pine Townsite Company.[23] The firm secured the exclusive townsite rights on the 28,000-acre irrigation project to be developed by the Deschutes Land Company, about 30 miles south of Bend. La Pine would be the principle town on the irrigation tract.

Irrigation entrepreneurship in the area had begun with John E. Morson's Walker Basin Land & Irrigation Company's 1901 claim to right for stored water in Crescent Lake. In 1902, Morson's Oregon Development Company filed on Crescent Lake for water to reclaim 67,637 acres under the Carey Act. The Walker Basin companies planned to sell Crescent Lake and Crescent Creek water with lands on both sides of the Deschutes to settlers in the La Pine and Crescent areas.[24]

The Deschutes Land Company was another company organized by Morson, joined later by Aya. An initial 67,637 acres had been reduced to about 28,000 by the State as a result of concerns that the irrigation system was not reaching all of the colonists, and that not enough water had been made available to fill the requirements of regulation. Following bankruptcy, the project was again reduced to about 10,000 acres. The project never materialized to the extent proponents envisioned. The firm finally went into receivership in 1922. The Tumalo Irrigation District eventually took over operation of some facilities.[25]

The La Pine Townsite Company offered lots at $50 to $350 per lot. Land was listed at $36 per acre. Heavy advertising touted the agricultural potential of the La Pine area. A 1911 *La Pine Inter-Mountain* newspaper advertisement read:

> Over 400 square miles of good agriculture land in the valley of which La Pine is the business center. Deep soil, no rocks.
>
> Large irrigating system partly built. Best type of canals is being constructed.[26]

During city formation, Aya campaigned to attract people and industry. In 1912, he made a trip to the Midwest and East to interest settlers in the irrigation project. He convinced business people in Rosland to move south to La Pine. A mercantile store, a saloon and a hotel all moved their operations. The townsite company built the Riley Hotel, operated by W.R. Riley. Aya donated land and Morson donated lumber to build the Commercial Club building in 1912, satisfying a community need for a social and religious meeting place. It later served as the Little Deschutes Grange. Aya served as president of the Commercial Club, the Townsite Company and the La Pine State Bank. From 1909 to 1918 he focused his time on the development of the region, organizing the Oregon Chamber of Commerce to assist in the effort. By 1911 La Pine had a population of 600 with over 100 students in school.[27]

H. RELATED STUDY UNITS

Many themes are interwoven with the development of irrigation in the Upper Deschutes River Basin. Related study units include the following:

Settlement: Regional Settlement, Subsistence, Colonization.

Agriculture: Homesteading, Early Farming, Stock Raising, Agricultural Improvements, Prominent Individuals, Horticulture.

Transportation: Railways, Wagon Roads, Highways.

Commerce and Urban Development: City Formation and Development.

Industry and Manufacturing: Produce Processing, Flume Lumber Mills, Pipe Manufacturing, Early Concrete.

Government: Water Laws, Land Use Laws, Agricultural Legislation, State Land Board, Bureau of Reclamation, Federal Irrigation Polcies, State Irrigation Policies, Public Land Development, Civilian Conservation Corps.

Culture:

Science and Technology: Irrigation Canal and Dam Engineering and Technology.

Social: Grange Movement.

Education: Agricultural Colleges, Extension Services.

Conservation: Water Conservation.

Philosophy: Irrigation Philosophy and Ideology.

I. ENDNOTES

I.

1. Clark, Robert Carlton, et al
2. Winch, Winter, 1984
3. *The Bend Bulletin*, 7/30/13
4. Deschutes County Historical Society, Scrapbook #82-32-23

II.

A.

1. Cantor
2. Robinson

B.

1. Reisner
2. Reisner
3. Reisner
4. Reisner
5. Lee in Introduction to Smythe
6. Lee in Introduction to Smythe
7. Lee in Introduction to Smythe
8. Lee in Introduction to Smythe
9. Smythe, p. 46
10. Smythe, p. 208-210
11. Lee in Introduction to Smythe, p. XLIII

C.

1. Reisner
2. Reisner
3. Reisner
4. Reisner
5. Reisner
6. Reisner
7. Robinson, Reisner
8. Robinson

D.1.

1. Brogan
2. *The Bend Bulletin*, 8/16/50
   River Study
3. Vaughan;
   The Bend Bulletin, 2/4/31, 5/19/25, 1/27/31; Winch
4. Deschutes County Historical Society (DCHS)

D.2.

1. *The Bend Bulletin*, 8/16/50; *River Study*
2. DCHS
3. Winch, Spring, 1985, p. 54
4. *River Study*
5. DCHS
6. *River Study*
7. DCHS
8. DCHS
9. Federal Power Commission
10. *River Study*
11. Vaughan, p. 49
12. *River Study*
13. Cramb
14. *River Study*

D.3.

1. DCHS
2. *The Bend Bulletin*, 10/5/10
3. DCHS
4. *The Bend Bulletin*, 10/5/10
5. Federal Power Commission
6. Cramb
7. *River Study*
8. Winch, Winter 1984, p. 350-351
9. Winch, Summer 1985, p. 157
10. Winch, Summer 1985, p. 161
11. Winch, Fall 1985, p. 269
12. Winch, Spring 1985, p. 65
13. Winch, Fall 1985, p. 272-274
14. Winch, Summer 1985, p. 173
15. Winch, Winter 1985, p. 388
16. Winch, Fall 1985, p. 275
17. Cramb
18. Winch, Spring 1986, p. 57
19. Winch, Winter 1985, p. 375
20. Winch, Winter 1985, p. 375
21. Clark, Robert Carlton, et al
22. Friends of the La Pine Branch Library
23. *The Bend Bulletin*, 2/25/31
24. Friends of the La Pine Branch Library
25. Winch, Winter 1985, p. 375

D.4.

1. Clark, Lecture Notes
2. Vaughan, p. 46

3. McGuffie
4. Clark, Lecture Notes
5. McGuffie
6. *The Bend Bulletin*, 1/27/31
7. *The Pacific Homestead*, 11/10/04
8. *The Bend Bulletin*, 2/3/31
9. Clark, Lecture Notes
10. Clark, Lecture Notes
11. *The Bend Bulletin*, 1/30/31
12. *The Bend Bulletin*, 1/30/31
13. *The Bend Bulletin*, 1/31/31
14. *The Bend Bulletin*, 2/4/31
15. *The Bend Bulletin*, 2/7/31
16. McGuffie
17. Map, State Engineers Office, April 1907; *The Bend Bulletin*, 3/4/31
18. *The Bend Bulletin*, 2/7/31
19. *The Bend Bulletin*, 2/7/31
20. *The Bend Bulletin*, 2/10/31
21. *The Bend Bulletin*, 2/18/31
22. Clark, Lecture Notes
23. *The Bend Bulletin*, 2/21/31; 2/23/31; 2/24/31; Clark, Lecture Notes; McGuffie
24. McGuffie; Federal Power Commission
25. DCHS, p. 20
26. Federal Power Commission
27. *Statewide Inventory of Historic Properties*
28. *The Bend Bulletin*, 2/18/31
29. Federal Power Commission
30. DCHS, p. 91
31. *The Bend Bulletin*, 7/30/13
32. Clark, Lecture Notes
33. *The Bend Bulletin*, 3/4/31
34. *The Bend Bulletin*, 3/3/31, 3/5/31
35. Clark, Lecture Notes; DCHS, p. 20
36. Clark, Lecture Notes
37. *The Bend Bulletin*, 3/20/31
38. *The Bend Bulletin*, 3/21/31
39. DCHS
40. *The Bend Bulletin*, 8/11/25, 6/6/29, 9/29/26
41. Cramb
42. Cramb
43. DCHS
44. Whistler, p. 17; Cramb

E.

1. Cramb
2. Cramb
3. Cramb

4. Cramb
5. Fisher I, I, p. 185
6. Cramb
7. Quivik & Hess
8. Quivik & Hess
9. Quivik & Hess
10. Quivik & Hess
11. DCHS, p. 17, 21-22; Winch, Spring 1986, p. 37
12. Quivik, & Hess
13. Quivik & Hess
14. Quivik & Hess
15. Endres, *Deschutes Project*
16. Quivik & Hess
17. Quivik & Hess
18. Quivik & Hess
19. Quivik & Hess
20. Quivik & Hess
21. Quivik & Hess
22. Quivik & Hess
23. Quivik & Hess
24. McCall
25. Many Hands
26. McCall
27. Endres, *North Unit Irrigation District Project*; *The Bend Bulletin*, 8/16/50
28. Clark, Keith, 1985
29. McCall
30. McCall; *The Bend Bulletin*, 8/16/50
    Endres, *North Unit Irrigation District Project*
31. Endres, *North Unit Irrigation District Project*
32. Endres, *North Unit Irrigation District Project*; *Madras Pioneer*, 8/5/54
33. Endres, *North Unit Irrigation District Project*
34. Winch, Spring 1986, p. 39
35. Winch, Winter 1985, p. 385
36. Winch, Winter 1985, p. 381
37. Winch, Winter 1985, p. 385
38. Winch, Winter 1985, p. 388
39. *The Bend Bulletin*, 4/4/23
40. Winch, Spring 1986, p. 41
41. Winch, Spring 1986, p. 41-44

F.

1. Phillips, K. N., et al
2. *River Study*
3. *River Study*

G.

1. Vaughan, p. 45
2. Cheney, p. 95, 115-116
3. Winch, Winter 1984
4. Winch, Winter 1984
5. Winch, Winter 1984, p. 351
6. *The Bend Bulletin*, 2/11/31
7. *The Bend Bulletin*, 2/11/31
8. *The Bend Bulletin*, 1/27/31
9. *Woodbeck's Directory*
10. DCHS
11. McGuffie
12. *The Bend Bulletin*, 2/12/31
13. *The Bend Bulletin*, 2/12/31
14. Clark, Keith, 1985
15. Ward
16. Clark, Keith, 1985
17. McGuffie
18. DCHS
19. *The Bend Bulletin*, 2/19/31
20. Ward, p. 12
21. Winch, Winter 1984, p. 352-353
22. Winch, Winter 1984, p. 354
23. Friends of the La Pine Branch Library
24. Winch, Winter 1985, p. 375
25. Winch, Winter 1985
26. Friends of the La Pine Branch Library
27. Friends of the La Pine Branch Library

III.

A. (None)

B.

1. Etcheverry
2. Etcheverry
3. Etcheverry
4. U.S. Department of the Interior, 1965
5. Etcheverry
6. Etcheverry
7. Etcheverry
8. Etcheverry
9. Etcheverry; Smith, June, 1991; Sepulda
10. Etcheverry; Smith, June, 1991; Speulda

C. (None)

IV.

1. U.S. Department of the Interior, National Park Service, 1991
2. U.S. Department of the Interior, National Park Service, 1991
3. Smith, Dwight A., et al, 1985

V.

1. Ragatz Associates; Central Oregon Recreation Association; Hall, 1989
2. Runyan, Dean and Associates
3. National Trust for Historic Preservation
4. U.S. Department of the Interior, National Park Service, 1993
5. Knudson
6. Hansen
7. U.S. Department of the Interior, National Park Service, 1991
8. U.S. Department of the Interior, National Park Service, 1991
9. Cliver

J. BIBLIOGRAPHY

Advertisement.
"Pilot Butte Development Company." *The Bend Bulletin.* March 17, 1905.

Anderson, Terry L., Ed.
Water Rights. San Francisco: Pacific Institute for Public Policy Research. 1983.

Author Unknown.
"Additional Lands Prepared for Water on Tumalo Project". *The Bend Bulletin.* April 4, 1923.

Author Unknown.
"Mid-Oregon Irrigation History Dates Back to Pioneer Times". *The Bend Bulletin.* August 16, 1950.

Author Unknown.
"The Central Oregon Country (No. 248)". *The Bend Bulletin.* May 19, 1925.

Author Unknown.
"Deschutes Irrigation Project Is Described In Detail". *The Bend Bulletin.* Section 4. July 30, 1913.

Author Unknown.
"Jefferson County Population Expected to Treble As Water Flows Over Reclaimed Acres." *The Bend Bulletin.* September 9, 1946.

Author Unknown.
"It Feels The Plow: Arnold District Is Coming Under Cultivation." *The Bend Bulletin.* March 8, 1907.

Author Unknown.
"Another Ditch Started." *The Bend Bulletin.* March 17, 1905.

Author Unknown.
"New Canal Done." *The Bend Bulletin.* October 5, 1910.

Author Unknown.
A New Water Law." *The Bend Bulletin.* July 7, 1908.

Author Unknown.
Untitled Editorial. *The Bend Bulletin.* October 5, 1910.

Author Unknown.
"The Deschutes Irrigation and Power Company at Bend." *The Pacific Homestead.* Salem, Oregon. November 10, 1904. p. 70.

Author Unknown.
"Lone Pine Storage Approved by Forest Service." *The Bend Bulletin.* September 29, 1926.

Author Unknown.
"North Canal Offer - West Plan." *The Bend Bulletin.* February 11, 1914.

Author Unknown.
"History Told At Bend Forum." *The Bend Bulletin.* June 6, 1929.

Author Unknown.
"Huge Irrigation Construction Program Under Way Next Week." *The Bend Bulletin.* July 27, 1922.

Author Unknown.
"Water Right Adjudicated." *The Bulletin.* May 14, 1913.

Author Unknown.
"Snow Creek to Build Ditches." *The Bulletin.* August 10, 1922.

Author Unknown.
"Largest Area Reclaimed Is Close to Bend." *The Bulletin.* July 27, 1922.

Author Unknown.
"C.M. Redfield Dies Suddenly." *The Bend Bulletin.* March 19, 1929.

Author Unknown.
"Lone Pine Lands to be Irrigated Soon." *Crook County Journal.* September 18, 1919.

Author Unknown.
"District Gets RFC Loan to Pay Bonds." *Central Oregonian.* January 7, 1937.

Author Unkown.
"Pay-Off Made on Lone Pine Bonds." *Central Oregonian.* February 4, 1937.

Author Unknown.
"Damage Caused by Water Left on Lands, Claim. *The Bend Bulletin.* August 11, 1925.

Author Unknown.
Title unknown. *Madras Pioneer.* Auguat 5, 1954.

Author Unknown.
Title unknown. *Madras Pioneer.* Auguat 3, 1944.

Brogan, Phil F.
East of the Cascades. Portland: Binford & Mort., Third Edition, 1964.

Cantor, Leonard M.
A World Geography of Irrigation. New York: Prager Publishers, Inc. 1970.

Central Oregon Irrigation District.
The Central Oregon Irrigation Fieldbook. Central Oregon Irrigation District, Redmond, Oregon, 1993.

Central Oregon Recreation Association.
Blended Visitors Industry Research Findings/Special to U.S. Forest Service. Central Oregon Recreation Association, Bend, Oregon, September 25, 1989.

Cheney W. P.
Central Oregon. Ivy Press. 1918.

Clark, Keith
Watering the Land. History of Central Oregon II. Lecture Notes. Redmond, Oregon. Date unknown.

Clark, Keith
Redmond Where the Desert Blooms. Portland: Western Imprints, 1985.

Clark, Robert Carlton, et al.
A History of Oregon. Chicago - New York: Row Peterson and Company. 1926.

Cliver, E. Blaine.
"Historic Transportation Corridors: A New Element of Heritage Preservation." *CRM.* Volume 16, No. 11, 1993. National Park Service, U.S. Department of the Interior, Washington, D.C.

Construction of the Deschutes Project in Oregon.
Hearing Before the Committee on Irrigation and Reclamation, U.S. Senate. January 12, 1928

Corning, Howard McKinley, Ed.
Dictionary of Oregon History. Portland: Binford & Mort Publishing. Second Edition, 1989.

Cramb, L. K.
The Irrigation Situation In Central Oregon: A Proposal that the Federal Government Provide Storage. Bend Chamber of Commerce, Bend, Oregon. 1931

Crook County Historical Society
Echoes From Old Crook County. Crook County Historical Society. Prineville, Oregon, 1991.

Deschutes County.
Ordinance No. 94-022. An Ordinance Amending the Deschutes County Comprehensive Plan to Adopt Conflict Identifications and ESEE Determinations under Goal 5 for Certain Inventoried Historic Sites and Declaring an Emergency. Deschutes County, Bend, Oregon, June 8, 1994.

Deschutes County.
Ordinance No. 94-006. An Ordinance Amending the Deschutes County Comprehensive Plan to Amend the Inventory of Goal 5 Historic Resources, to Amend the List of Goal 5 "1B" Sites, and to Adopt a Policy Requiring Further Review of Certain Potentially Historic Sites and Declaring an Emergency. Deschutes County, Bend, Oregon. June 8, 1994.

Deschutes County Historical Society.
A History of the Deschutes Country In Oregon. Redmond: Midstate Printing. 1985.

Deschutes County Historical Society.
"Redmond in 1911: Water was gold; farming King." *Scrapbook #82-32-23*, p. 98. (A reprint of "Redmond Now" on file in archives of Union Pacific Railroad) Deschutes County Historical Society, Bend, Oregon.

Deschutes Irrigation & Power Company.
Map, Irrigated Lands, Bend District, July 7, 1909. Oregon Historical Society, Collections, Maps, Portland.

Deschutes Irrigation & Power Company.
Map, Irrigated Lands, Redmond District, February 24, 1909. Oregon Historical Society, Collections, Maps, Portland.

Deschutes Irrigation & Power Company.
Map, Irrigated Lands, Powell Butte District, April 20, 1909. Oregon Historical Society, Collections, Maps, Portland.

Endres, Stan
Deschutes Project. Keith Clark File. Redmond, Oregon. Date unknown.

Endres, Stan
North Unit Irrigation District Project. Keith Clark File. Redmond, Oregon. Date unknown.

Etcheverry, B.A.
Irrigation Practice and Engineering: Volume II, Conveyance of Water. New York: First Edition, 1915.

Federal Power Commission.
Report to the Federal Power Commission on Uses of the Deschutes River, Oregon. Printing Office, Washington, D.C. 1922.

Fisher, C. C.
Deschutes Investigations - Oregon. Part I. Storage Investigations. Vol. I and II. U.S. Department of the Interior, Bureau of Reclamation. July, 1936.

Fisher, C. C.
Deschutes Investigations - Oregon. Part II, Crooked River Project. U.S. Department of the Interior, Bureau of Reclamation. May, 1936.

Fisher, C. C.
Deschutes Investigations - Oregon. Part III, North Unit Project. U.S. Department of the Interior, Bureau of Reclamation. July, 1936.

Fisher, C. C.
Deschutes Investigations - Oregon. Part IV, South Unit Project. U.S. Department of the Interior, Bureau of Reclamation. September, 1937.

Fleming, Dorothy and Jeffery McAllister.
"Testing the Dendritic Central Place Model with Historic Railroad Logging Data." Paper presented at Society for Historical Archaeology, Sacramento, CA., 1986.

Friends of the La Pine Branch Library.
History of the La Pine Pioneers. Bend: Sagebrush Printing. 1983.

Hadlow, Robert W.
Findings of Effect on Bend's Historic Irrigation Canals. Oregon Department of Transportation. Salem, Oregon. June, 1992.

Hall, Michael
Historic Development of the Bend Company in Bend, Oregon. A Historic Context Document Supporting a Multiple Property Nomination to the National Register of Historic Places. Oregon State Historic Preservation Office. Salem, Oregon. 1993.

Hall, Michael
A Marketing Analysis, Strategy & Guide for Lava Lands Visitor Center. Deschutes National Forest, Bend, Oregon, November, 1989.

Hansen, Martin E.
Letter to Michael Hall, October 15, 1990.

Hatton, Raymond
Bend In Central Oregon. Portland: Binford & Mort Publishing. 1986.

Hamrick, James and Lou Ann Speulda
Handbook to Historic Preservation Planning in Oregon. Oregon State Historic Preservation Office, Salem, Oregon. 1989.

Hospodarsky, Denver.
The Pacific Northwest Outdoor Recreation Consumption Projection Study: Oregon Project. Forest Resources Management, Oregon State University, Corvallis, Oregon, 1989.

Hunt, R. A.
"Arrival of Water Will Multiply Farm Production Many Fold". *The Madras Pioneer.* May 23, 1946

Knudson, Douglas M.
Outdoor Recreation. New York: MacMillan Publishing. Revised edition, 1984.

Laurgaard, Olaf
Final Report of the Construction Tumalo Irrigation Project to the Desert Land Board, State of Oregon. Laidlaw, Oregon, December 19, 1914.

League of Women Voters.
Water Resources in Oregon. Salem: League of Women Voters, 1984.

Lewis, John H.
Deschutes Projects. Bulletin No. 1. Oregon Cooperative Work. U.S. Department of the Interior Reclamation Service in Cooperation with State of Oregon. 1914.

MacDonald, Lynne
Irrigated Agricultural Development in the Bend Vicinity. Bureau of Reclamation, Boise. 1992.

Many Hands
Jefferson County Reminiscences. Portland: Binford & Mort. 1957.

McCall, Tom Lawson
"Water for Thirsty Acres Due in Jefferson County." *The Madras Pioneer.* May 16, 1946.

McGuffie, J. G.
Letter to Fred Henshaw, April 23, 1921.

National Trust for Historic Preservation.
Update. National Trust for Historic Preservation, Denver, Colorado, Vol. 1, No. 3, Winter/Spring, 1994.

Office of State Engineer, Map.
"Lands Segregated for Reclamation by the State Under the Provisions of the Carey Act, Crook County, April, 1907." Oregon Historical Society, Collections, Maps, Portland.

Oregon Department of Transportation.
Bend Parkway: Draft Environmental Impact Statement. Oregon Department of Transportation, Salem, Oregon, 1991.

Oregon Department of Transportation.
Transportation Enhancement Program: Project Application Handbook. Oregon Department of Transportation, Salem, Oregon, May, 1993.

Oregon State Historic Preservation Office.
Statewide Inventory of Historic Properties. Salem, Oregon. 1976 (with updates).

Oregon State Parks and Recreation Division.
Oregon Outdoor Recreation Plan 1988-1993. Oregon State Parks and Recreation Division, Salem, Oregon, December, 1988.

Oregon Water Resources Department.
Map, Irrigation Systems in the Deschutes River Basin. Oregon Water Resources Department, Salem Oregon, 1994.

Palmer, A. C.
"3 Sisters Irrigation Project Story Told in Pioneer Paper". Reprint of Article from Crook County Journal, January 1, 1901, in *The Bend Bulletin.* May 10, 1947.

Phillips, K. N. et al.
Water for Oregon. Geological Survey Water - Supply Paper 1649. Washington, D.C.: Government Printing Office, 1965.

Polk's Bend City Directory.
"Deschutes County Directory, 1924-25".

Portland State University.
Demographic, Housing & Socioeconomic Characteristics of Crook, Deschutes, Jefferson, Klamath and Lake Counties, Their Cities, and BNA's. Selected Data from the 1990 Census of Population & Housing STF3A. Center for Population Research and Census, School of Urban and Public Affairs, Portland State University, Portland, Oregon.

Public Notice.
"Lone Pine Irrigation District." *Crook County Journal.* September 25, 1919.

Quivick, Fredric L. and Jeffery A. Hess
Determinations of Eligibility for Seven Bureau of Reclamation Dams in the Pacific Northwest Region: Deadwood, Grassy Lake, Crane Prairie, Wickiup, Owghee and Agency Valley Dams. Pacific Northwest Region, Bureau of Reclamation, U.S. Department of the Interior. Boise, Idaho. September, 1989.

Ragatz Associates
Tourism and Recreation In Deschutes County: Economic Benefits and the Role of the Deschutes River. Deschutes County Community Development Department, Bend, Oregon, September, 1985.

Reisner, Marc
Cadillac Desert. New York: Penguin Group. 1986.

River Study.
Deschutes County/City of Bend. April, 1986.

Robinson, Michael C.
Water for the West: The Bureau of Reclamation 1902-1977. Chicago: Public Works Historical Society. 1979.

Runyan, Dean and Associates
Oregon Travel and Tourism: Visitor Profile, Marketing and Economic Impacts. Portland, Oregon, January, 1989.

Sawyer, Robert W., Ed.
"Watering of the Wilderness: A History of Central Oregon Irrigation Company and Pioneer Days in the Bend Country." *The Bend Bulletin.*
January 23, 26, 27, 28, 29, 30, 31, 1931;
February 2, 3, 4, 5, 6, 7, 9, 10, 11, 12, 13, 14, 16, 17, 18, 19, 20, 23, 24, 25, 27, 28, 1931;
March 2, 3, 4, 5, 7, 10, 11, 12, 13, 14, 16, 18, 19, 20, 21, 1931.

Sawyer, Robert W.
"The C.O.I. History". *The Bend Bulletin.* January 23, 1931.

Shaver, F. A. et al.
An Illustrated History of Central Oregon. Spokane: Western History Publishing, 1905.

Smith, Dwight A.
Historic Context: The Development of Irrigation in the Bend Area c. 1890 to 1940. Oregon Department of Transportation. June, 1991.

Smith, Dwight A.
General Guidelines for Evaluating Historic Linear Resources. Highway Division, Oregon Department of Transportation. Salem, Oregon, November 15, 1988.

Smith, Dwight A., et al.
Historic Highway Bridges of Oregon. Oregon Department of Transportation, Salem, Oregon, 1985.

Smith, Dwight A. and Rosalind Clark Keeney
Cultural Resources Research Report, Volume II. Bend Parkway. Oregon Department of Transportation. Salem, Oregon. June, 1991.

Smythe, William Ellsworth
The Conquest of Arid America. (1905) Seattle and London: University of Washington Press. 1969.

Speulda, Lou Ann
Oregon's Agricultural Development: A Historic Context 1811-1940. Oregon State Historic Preservation Office. Salem, Oregon. 1989

Stranahan, Martha
"A.M. Drake Credited With Forming Irrigation District". *The Bend Bulletin.* March 4, 1954.

The Deschutes Project in Oregon.
Hearing Before the Committee on Irrigation and Reclamation House of Representatives. January 10, 1928.

The Pioneer Historical Publishing Company.
History of Oregon. Chicago-Portland: The Pioneer Historical Publishing Company. 1922.

Tonsfeldt, Ward.
Context Statement for Railroad Logging In Oregon. State Historic Preservation Office. Salem, Oregon. October, 1993.

U.S. Department of the Interior, Bureau of Reclamation.
Design of Small Dams. U.S. Government Printing Office, Washington, D.C., 1965.

U.S. Department of the Interior, National Park Service.
National Register Bulletin No. 15: How to Apply the National Register Criteria for Evaluation. U.S. Government Printing Office, Washington, D.C., 1991.

U.S. Department of the Interior, National Park Service.
Protecting Archaeological Sites on Private Lands. U.S. Department of the Interior, National Park Service, Preservation Planning Branch, Interagency Resources Division, Washington, D.C., 1993.

Vaughan, Thomas, Ed.
High & Mighty. Select Sketches about the Deschutes Country. Portland: Oregon Historical Society. 1981.

Ward, Elizabeth B.
Redmond: Rose of the Desert. Redmond: Midstate Printing, Inc. 1975.

Wilkinson, Charles F.
"Crossing the Next Meridian". *Environment.* Vol. 32, Issue 10. December, 1990.

Winch, Martin T.
"Tumalo -- Thirsty Land". Parts I-VI. Vol. LXXXV, No. 4; Vol. LXXXVI, No. 1-4; Vol. LXXXVII, No. 1. *Oregon Historical Quarterly.* Winter 1984 - Spring 1986.

Whistler, John T.
Deschutes Project. Oregon Cooperative Work. U.S. Department of the Interior Reclamation Service in Cooperation with State of Oregon. December, 1914.

Woodbeck's Directory.
"Deschutes County Directory, 1917."

III. IDENTIFICATION

A. PURPOSE AND METHODOLOGY

The purpose of this section is to identify resources associated with Irrigation Development in Oregon's Upper Deschutes River Basin, 1871-1957, as outlined in Section II, Historical Overview. In this phase resource types are defined, known inventories and other data are reviewed, and resource information is complied and presented.

Several methods were used to identify resources. A literature search associated with the development of the Historical Overview served as a beginning point. Second, a review of known inventories and other information was conducted. Part "C" of this section lists some of those sources. Together, the overview and the review of inventories and other data constituted the predictive resource base for a reconnaissance survey--a field study, the final method of resource identification and confirmation.

Resources managed by the Central Oregon Irrigation District, in particular the Pilot Butte Canal and the Central Oregon Canal, were identified for an in-depth reconnaissance survey. Resources managed by the district have been considered by Deschutes County as sites with insufficient information to determine their significance, location, quantity or quality. Central Oregon Irrigation District sites were first listed in the Resource Element of the *Deschutes County Year 2000 Comprehensive Plan* (1979). In 1993 the Oregon Department of Land Conservation and Development ordered that the Statewide Planning Goal 5 (Oregon Administrative Rules, Chapter 660, Division 16) process be completed for these and other resources (Remand Order 93-RA-883). Deschutes County Ordinance No. 94-006, adopted June 8, 1994, provided a Comprehensive Plan policy for complying with that order. This report is the first step in accomplishing that task.

The reconnaissance survey was conducted July 20, 22, 26, 27, 28 and 29 and August 1, 2, 3, 5, 6, 8, 9, and 11, 1994. All sites identified in the overview and presented in Tables III C-1 - C-9 were confirmed during the survey and photographed except for the following: Columbia Southern Ditch (time constraints), Crater Creek Ditch (previously surveyed), Watson Dam (time constraints, poor locational data), (first) McCaffery House (moved, no locational data) and sites without extant resources (Table III C-7). Flumes on laterals in the Arnold system and structures connecting the Tumalo system's Bend Diversion Dam and the Tumalo Feed Canal described in the Overview were also not field checked. Available information indicates the features have been replaced with newer, non-equivalent and non-compatible features since the historic period. Time constraints prevented confirmation of this information. No resources associated with the Walker Basin project were identified.

In addition, the Central Oregon and Pilot Butte canals were surveyed and features photographed by travelling down the adjacent ditch road. Work on the Central Oregon Canal was conducted July 27, 28 and 29, 1994. The entire route from the Headworks to Highway 20 was travelled. Between Highway 20 and Alfalfa, sections were surveyed and photographed to the extent possible, respecting private property. A large lateral with associated sub-lateral, ditches, weirs and other features, was surveyed and photographed. Between Alfalfa and Powell Butte spot checks were made to the extent possible, with a special emphasis placed on Dry Canyon and the photographing of the flume and associated linear features. The Pilot Butte Canal

was surveyed August 1, 2, 3 and 5, 1994. The entire length from the Headgate at the North Canal Dam in Bend to just past the northern edge of Terrebonne was travelled and features photographed.

Features of other canals were also photographed, though an extensive survey was not conducted. Areas receiving the most emphasis were the Old Pilot Butte Canal in Bend and sections of the North Unit Canal in Bend, near Terrebonne, near Smith Rock and in Jefferson County. A field log was maintained throughout the survey linking features with photograph numbers and notes.

B. TYPES OF RESOURCES ASSOCIATED WITH IRRIGATION DEVELOPMENT

As the Historical Overview discussed, irrigation development dates back to ancient times. From that period until modern times, many concepts, theories and procedures for irrigation systems were standardized and formalized. The University of California had a Department of Irrigation at least as early as 1915 when the McGraw-Hill Book Company published a three-volume treatise on irrigation engineering. Nevertheless, irrigation features seem to have always been customized to an extent to address particular problems or to reflect new concepts developed by engineers, farmers or others.

American ingenuity was at the forefront of new ideas during the industrial period of the nineteenth century. Machined-banded bored logs were first manufactured in Michigan in 1874. The use of wood stave pipe dates from about 1884, when it was used by the Denver Water Company in Colorado. Prior to these developments plain bored log pipes had been built in England as early as 1613; in Portsmouth, New Hampshire, in 1798; and in Philadelphia, Pennsylvania, in 1799.[1]

The scope of this section does not permit the accounting of the development of the various irrigation system features. A general overview of the types of features associated with irrigation development will be presented.

Though some areas of the country had pumping irrigation systems, most were gravity systems. A gravity system derived its water supply by diversion of a river or stream and conveyed the water in a system of canals or channels to the land to be irrigated. The diversion raised the water level to force a desired flow through a headgate into the head of a canal. This was usually accomplished by a diversion dam, or weir, across the watercourse. The character and cost of construction was determined by the topography. Hillsides too steep for open canal excavation required fluming supported on benches cut in the hillside or a concrete rectangular section made with a retaining wall on the downhill side. Depressions were crossed with flumes or siphons. Ridges were tunnelled through. From the highest point of the irrigable area, the main canal was constructed on a prominent ridge or along the higher boundary of the land to be irrigated. The lateral canals headed at the main canal and ran along commanding situations, usually down the ridges formed by irregularities of the topography, to supply the sub-laterals and ditches, or distributaries, which delivered the water to each farm.[2]

The elements of an historic irrigation system and the associated resources, or features, can be classified into six main groups, though not all of the resources were found in the Upper Deschutes River Basin:

1. The land and the crops.

2. The source of water supply and, in many cases, the storage works or other works for its development (dam, etc.).

3. The diversion works including:
   a. The diversion weir (dam) and associated features.

b. Canal headgates, or regulator, to control the flow diverted into the head of the diversion, or main, canal.

4. The diversion, or main, canal, including the following structures and forms of construction:
   a. Spillways, wasteways or other features to dispose of excess flow in the canal and to protect the canal.
   b. Sandgates or sluices to prevent the accumulation of, or to remove, sand or silt in the canal.
   c. Tunnels, retaining wall canal sections, and bench flumes for conveying water in difficult country.
   d. Elevated flumes and inverted siphons for crossing wide depressions or natural drainage channels.
   e. Culverts, overchutes, level inlet crossings, et cetera, for the crossing of watercourses.
   f. Falls, rapids or chutes to regulate canal grades and water velocities.
   g. Highway and railroad crossings such as bridges and culverts.

5. The distribution system consisting of:
   a. Main canals, laterals and distributaries (sub-laterals and ditches).
   b. Checkgates across the canals, laterals and distributaries located at points of diversion or delivery where it was necessary to raise and control the water level to force the required flow through the gate structures at the heads of the laterals and distributaries and at points of delivery.
   c. Headgates at the heads of laterals and distributaries, and delivery boxes.
   d. Structures enumerated above, as used on the diversion, or main, canal.
   e. Measuring boxes or devices at points of delivery to water users.

6. The drainage system consisting of:
   a. Natural drainage channels and watercourses.
   b. Artificial drains.[3]

The following is a brief description of the types of features utilized during irrigation development in the Upper Deschutes River Basin.

Dams. Dams may be classified according to use, hydraulic design, or materials comprising the structure. Storage dams are built to impound water during periods of surplus for use in periods of deficient supply. Typically, a storage dam collects water from snowmelt and provides storage until the water is needed later in the irrigation season. Diversion dams are usually constructed to provide head for carrying water into a canal or other conveyance system to the place of use. Overflow and non-overflow dams are the two types of classification by hydraulic design. Overflows, often called weirs, are designed to carry discharge over their crest and are made of materials not easily eroded, such as concrete and steel. Non-overflows are usually built of earthfill and/or rockfill. Earthfill, rockfill, concrete gravity and concrete arch are dam types classified by materials. Earthfill and rockfill dams are the most common type because construction involves using materials in a natural state, minimizing costs. These types require an outlet works and almost always a spillway to protect against floods. Concrete gravity or concrete arch are often used as diversion dams. An arch dam is typically used where the ratio of width between abutments to height is not great and where the foundation at the

abutments is solid rock capable of resisting arch thrust.[4] Wickiup, Crane Prairie, Crescent Lake, and Haystack are examples of non-overflow, earthfill and/or rockfill storage dams. Haystack is a re-regulating storage dam located down the canal system to minimize water flow variation resulting from the distance between users and the principal water source and/or the need to have water "on call". The Tumalo Creek and Bend structure are the concrete gravity overflow type with headgate. The North Canal Dam is a concrete arch overflow type with headgates for several canals. A dike may be found in conjunction with a variety of types of dams. Such a structure is utilized when a topographical feature of a reservoir basin requires an additional impoundment to maintain a water level and storage capacity. These are typically built of earthfill and/or rockfill materials. The East Dike at Wickiup Dam is an example.

Canals. This is a series or network of channels that carry water from a reservoir or natural watercourse; sometimes concrete, rock or gunite lined, sometimes simply dug out from the ground. Though the diversion, or main, canal is usually easily identified, laterals and sub-laterals, or ditches, vary in size and are not always easily identified. In many cases, a sub-lateral in one part of a system may be larger than a lateral located elsewhere in the system. The terms "canal" and "ditch" are often used interchangeably by various irrigationists and irrigation organizations. The usual composition of a canal system begins with the diversion, or main, canal which is diverted into smaller lateral canals which are diverted into yet smaller sub-lateral canals, and then into ditches at the point of water delivery. Generally, the point of delivery is at the high point(s) on each 40-acre tract.

Tunnels. Tunnels were used to overcome difficulties arising from topographic conditions or to produce a more economical canal location. A number of conditions make a tunnel desirable or necessary. In an area with obstacles, such as rocky bluffs, tunnels were utilized rather than expensive flume construction around such features. A tunnel is usually lined with concrete and typically has a higher water velocity than in the canal. The forms commonly used are the rectangular section with a flat or arched roof, the horse-shoe section with a flat or inverted arched floor and the circular section.[5] The two Smith Rock tunnels are concrete lined rectangular section with an arched roof.

Flumes or Aqueduct/Canal Bridge. A flume may be either a bench flume, supported on a shelf or cut in the hillside, or may be an elevated flume for the conveyance of water over a depression or drainage channel. On a steep hillside the uphill side of a flume may be supported on a narrow shelf and the downhill side held up by a substructure of posts or other form. Elevated flumes were usually supported by railroad trestle-like structures. The four types of flumes are (1) wooden rectangular box, (2) wooden stave semicircular, (3) steel or metal sheet, and (4) reinforced concrete.[6] The term aqueduct or canal bridge generally refers to a larger structure often built of stone or concrete. A canal bridge, and often an aqueduct, is closed on the top, in contrast to a flume, permitting vehicular or foot travel. The Dry Canyon Flume is a wooden stave semicircular type; the Arnold Flume utilizes metal sheet; and the Crooked River Flume or Aqueduct/Canal Bridge is made of reinforced concrete.

Inverted Siphons and Pipes. Both inverted siphons and pipes were designed to totally encase a flow of water for conveying it across natural drainage channels or depressions, or along steep, rocky bluffs or hillsides. Either an inverted siphon took the place of a flume on a trestle, or a gravity pressure pipe line was substituted for a bench flume or for difficult canal construction on steep hillsides, in which case the structure followed the route of an open canal or of a bench flume, or it may have been used to shorten the route and avoid construction

difficulties. Siphons were often used to provide the lift necessary to bring water over a ridge between two drainages. In areas with either a rolling character to the land, or highly valued water and small volumes to be conveyed, pipe lines were favored for use as laterals and even main canals, in some cases.

The kinds of materials used most often for these structures were wrought-iron, steel, concrete, reinforced concrete and wooden stave. Early construction in the Upper Deschutes River Basin under the Carey Act favored the use of wooden stave. Cost was low compared to other materials as an abundance of yellow pine was readily available. Other factors also encouraged its use: (1) its life was greater than steel, (2) its carrying capacity exceeded riveted steel pipe, (3) the material was easily transported to difficult locations, (4) its elasticity and strength made it preferable in difficult and unpredictable terrain, (5) bends were made easily, (6) repairs were made easily, and (7) it was well suited to low and moderate pressures.[7]

The continuous stave type, which was built in place, was usually favored over the machine-banded type built in a factory. It was formed of staves milled from lumber to form true radial edges and concentric inside and outside true circular surfaces bound tightly by steel bands. The staves varied in length, and were assembled so as to break joints by about two feet. The joints between abutting ends of staves were generally made by inserting a thin metal tongue in saw kerfs or slits made in the ends of the staves, thus making the pipe continuous. The steel bands were separate hoops of one or two pieces, depending upon the diameter of the pipe. Ends were secured via threads, washers and a hexagonal nut.[8] The semicircular stave flume utilized similar materials and construction techniques.

Examples of continuous stave pipe construction include the Tumalo and Lone Pine siphons. Willow Creek Canyon Siphon is of steel and the Sherwood Canyon Siphon is steel reinforced concrete.

Raceway. A raceway is generally a lined portion of a canal, often concrete, allowing water to be conveyed at a high rate. A lining facilitates the handling of a large volume of water and eliminates erosion and water seepage problems. These may also be called chutes.

Headworks, Outlet Works, Valve House. A headworks is a gate-like device for controlling the flow of water from a diversion site, such as a dam, to a watercourse, usually a canal. A headworks may also be located at a site in a river or stream, such as a falls, whereby water may enter and be conducted down a canal, or other watercourse. These may be referred to as intake structures, pipes, gates or other terms. Outlet works are gate-like mechanisms for controlling the flow of water from a storage or re-regulating dam. The larger a headworks or outlet works is, the more apt it is to be electrically controlled. A valve house may be a part of the outlet works in larger and more sophisticated outlet works, such as that at Wickiup Dam. A valve or several control the flow rather than a gate-like mechanism.

Other Canal Features. Other canal features include: (1) roads or paths for ditchriders (irrigation company personnel); (2) debris fences or mechanical cleaners; (3) associated overcrossing roads and bridges (both vehicle and foot); (4) release gates or headgates, which are terms describing a valve composed of a plate which slides over an opening to regulate water flow into a watercourse, such as from a canal to a lateral; (5) turnouts for laterals, which provide for ditchrider vehicular needs; (6) weirs or checkgates, which maintain water at a certain level in a watercourse for diversion down other watercourses; (7) measuring clocks/water

meters/gauging stations, which are used to monitor and manage water flow through a portion of a system, and may be simple and mechanical or complex and electrical; and (8) weirs, which, in the context of a water measuring device, is a standard width slot through which water is delivered.[9]

Other Irrigation Features. Other irrigation system features, though some not found in the Upper Deschutes River Basin, include: (1) An electric power station may be found in conjunction with an irrigation system. (2) A waterwheel may be used to pump water onto land. (3) Windmills are found where more sophisticated irrigation systems are not feasible or available, in most cases. (4) A tank house is utilized for the storage of small volumes of water. (5) Storage ponds provide for holding larger volumes of water. (6) Culverts allow water to pass under roadways. (7) Drainage ditches allow irrigators to either capture runoff water for storage, or to reduce excess water on irrigated land. (8) A farm or ranch is at the end of the irrigation system and is where crops are raised.[10]

Buildings and Sites Associated with Irrigation Development. These resources include: (1) irrigation company or district offices and other buildings, such as maintenance shops and ditchrider cabins; (2) houses associated with irrigationists; (3) community buildings associated with one or more irrigationists; (4) construction camp buildings and sites; (5) mill sites where lumber for flumes and siphons was manufactured; and (6) townsites associated with irrigation development.

Figures III B-1 - B-40 show irrigation resources and features associated with Irrigation Development in the Upper Deschutes River Basin.

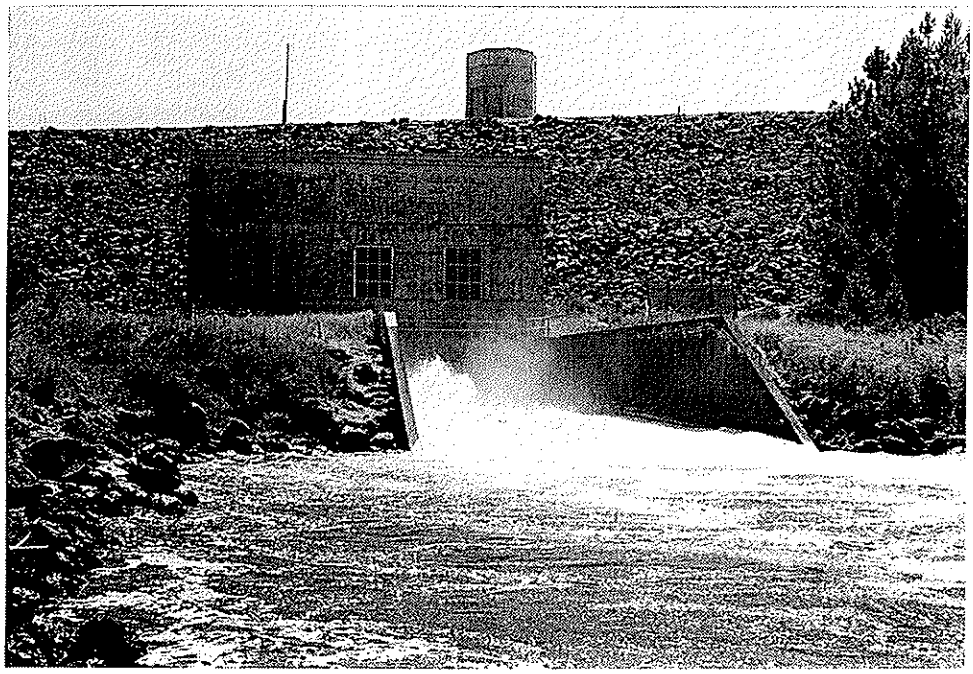

Figure III B-1. Wickiup Dam (earthfill), Valve House/Outlet Works discharging into Deschutes River. Top: Hoist House for emergency gate controls.

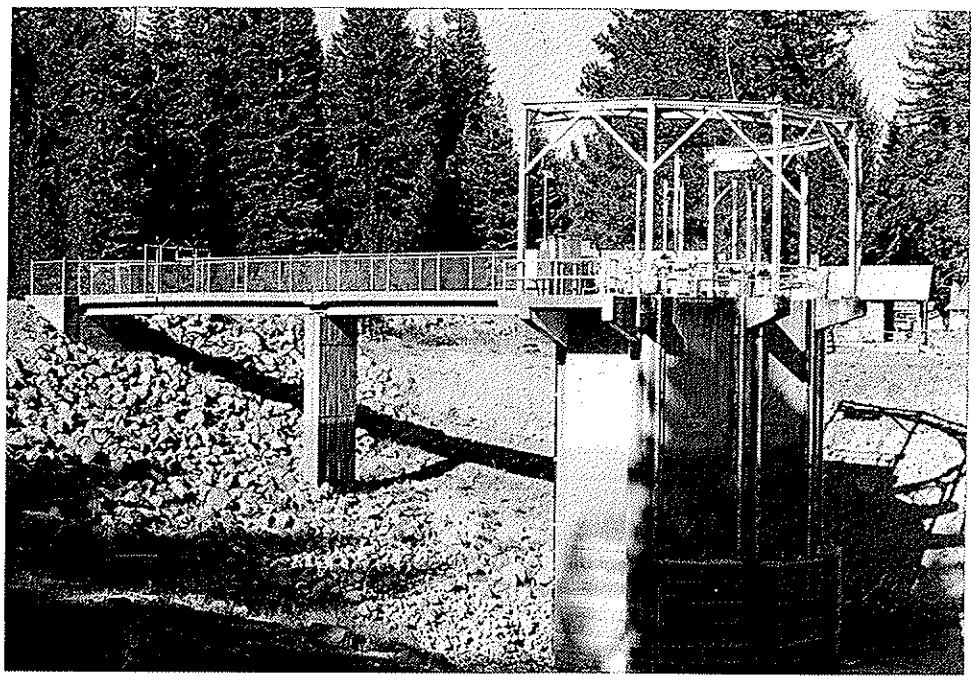

Figure III B-2. Crescent Lake Outlet Works (Control structure, intake/reservoir side). (Drought conditions.)

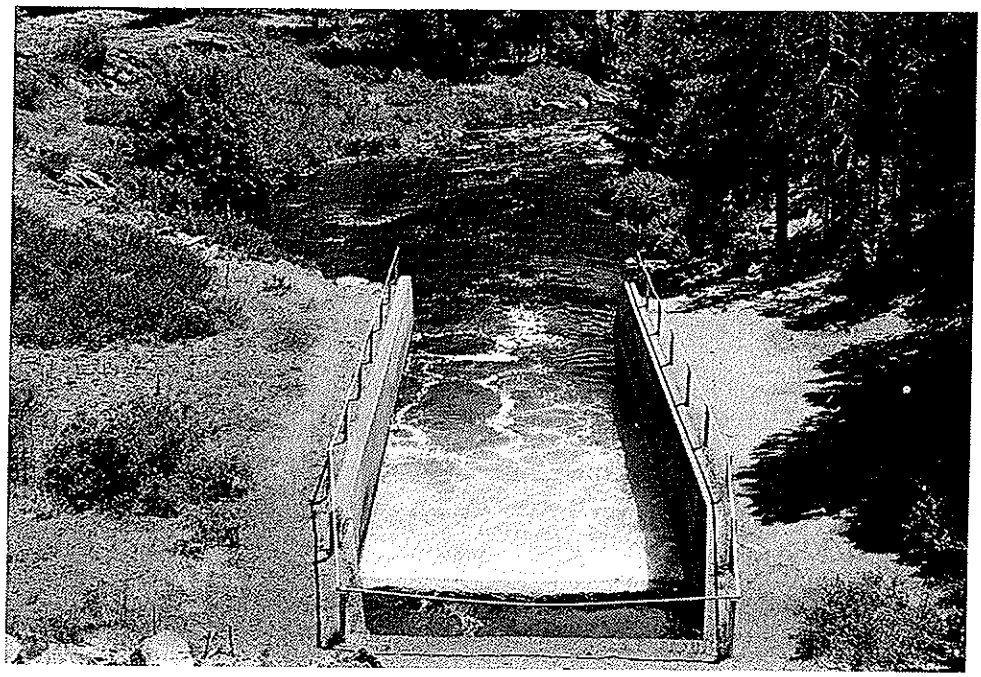

Figure III B-3. Crane Prairie Outlet Works discharging into Deschutes River.

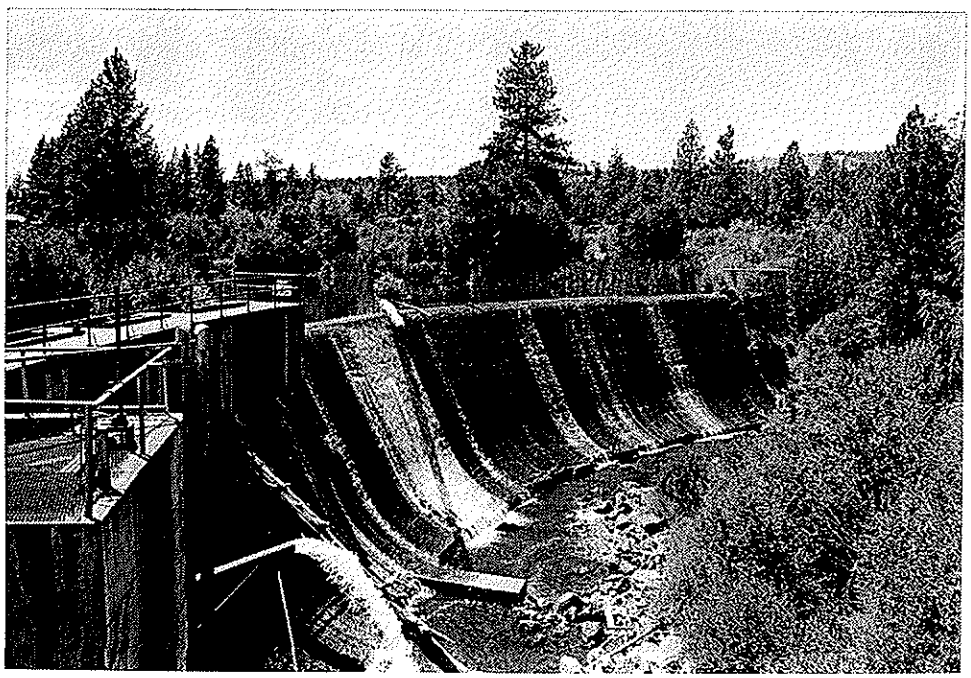

Figure III B-4. The North/Pilot Butte, North Unit and Swalley canals head at the North Canal Dam, a concrete arch overflow type structure.

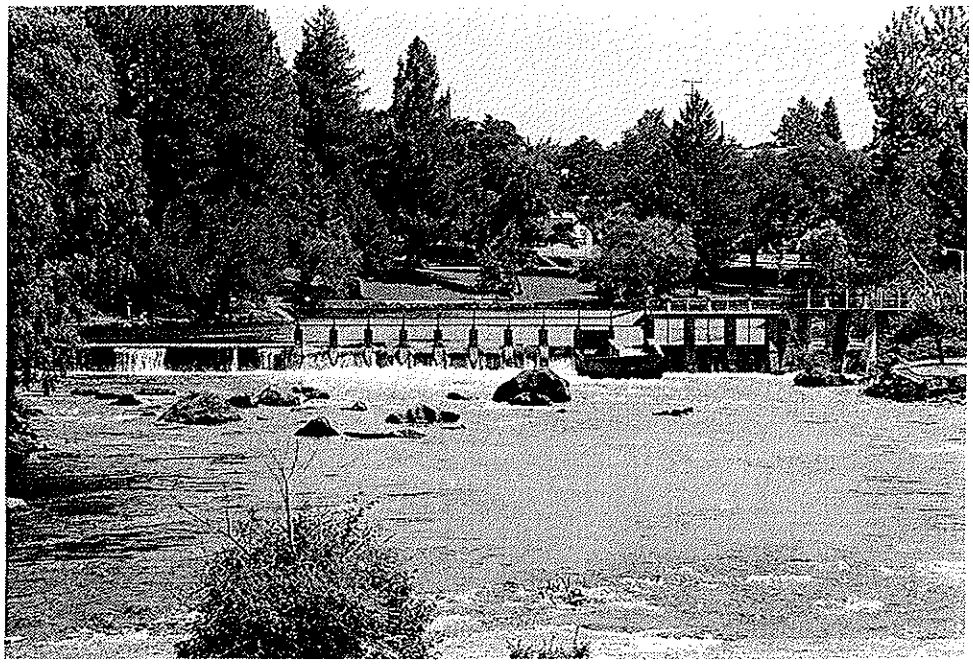

Figure III B-5. The Bend Feed Canal heads at the Bend Diversion Dam, a concrete gravity overflow type dam.

Figure III B-6. Bull Creek Dam (below) and Bridge (above). The dam is a concrete gravity overflow type.

Figure III B-7. North Unit Canal in Bend.

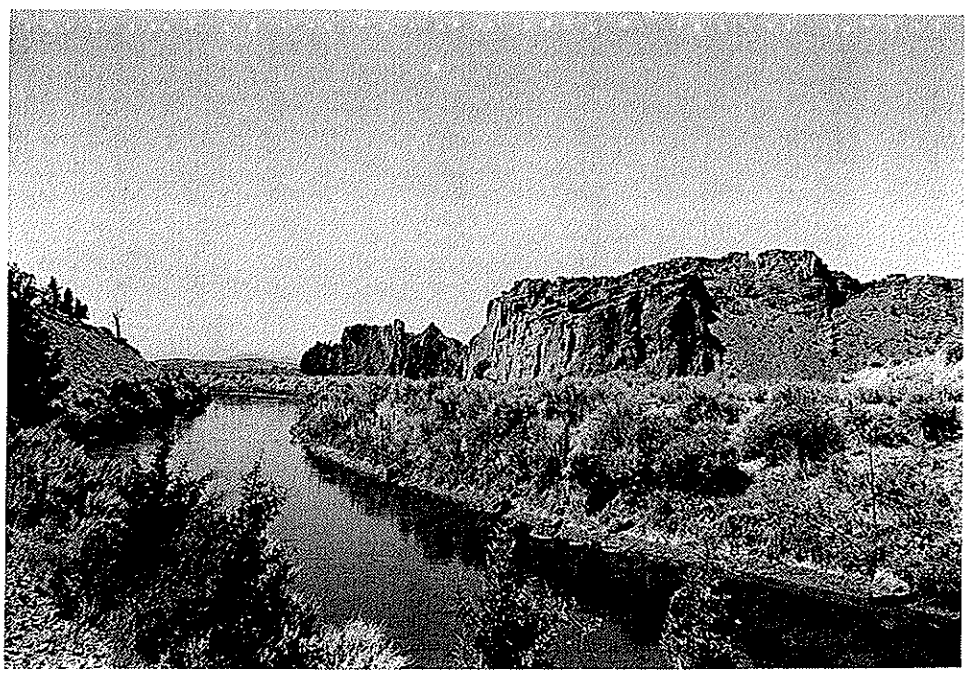

Figure III B-8. North Unit Canal near Smith Rock.

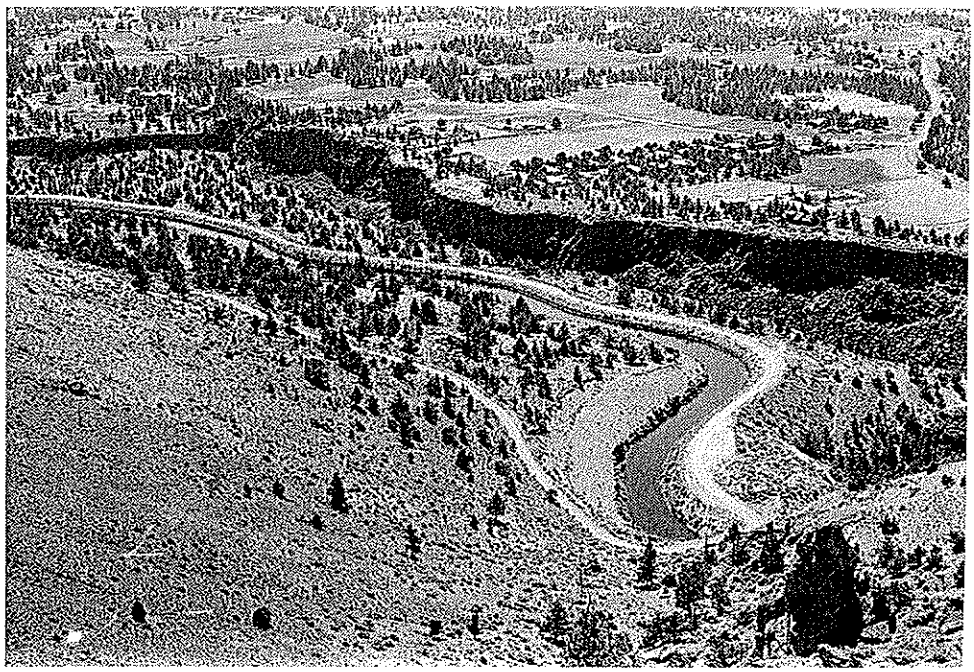

Figure III B-9. North Unit Canal near Smith Rock. The entrance to the South Tunnel is at the lower right.

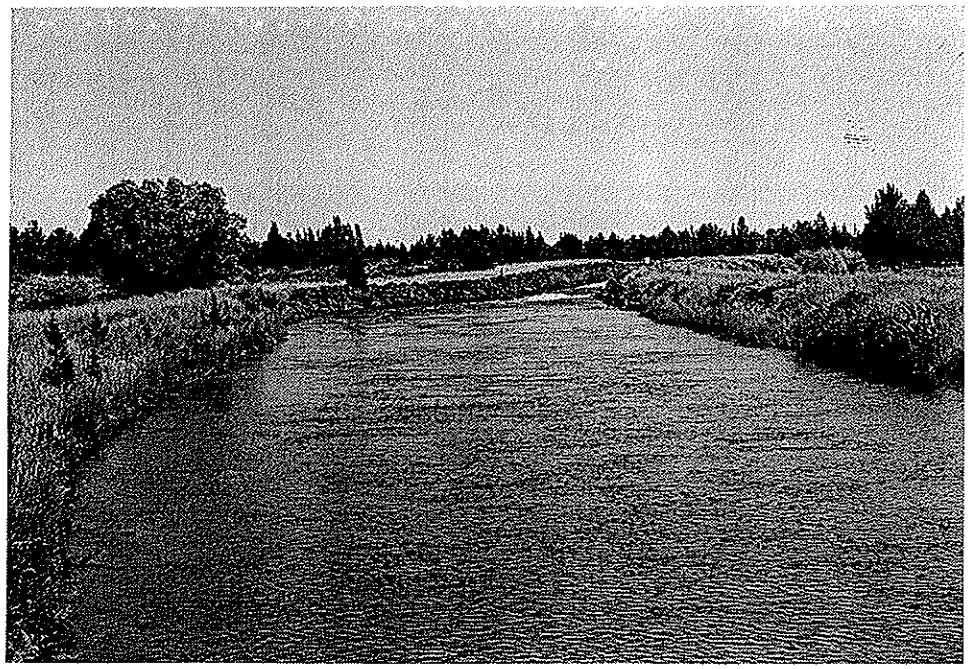

Figure III B-10. North Unit Canal just east of Terrebonne.

Figure III B-11. North Unit Canal at Haystack Dam looking north towards Madras.

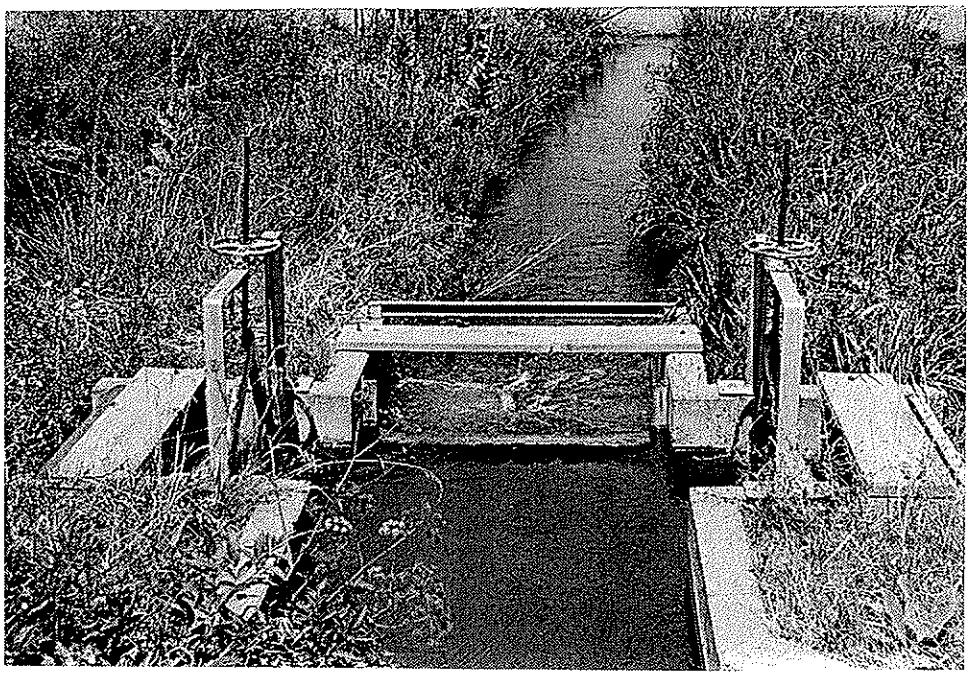

Figure III B-12. A weir, or checkgate, in a lateral of the Pilot Butte system maintains the water level forcing it through two headgates, or release gates, into sub-laterals.

Figure III B-13. One of the numerous waterfalls on the Pilot Butte Canal.

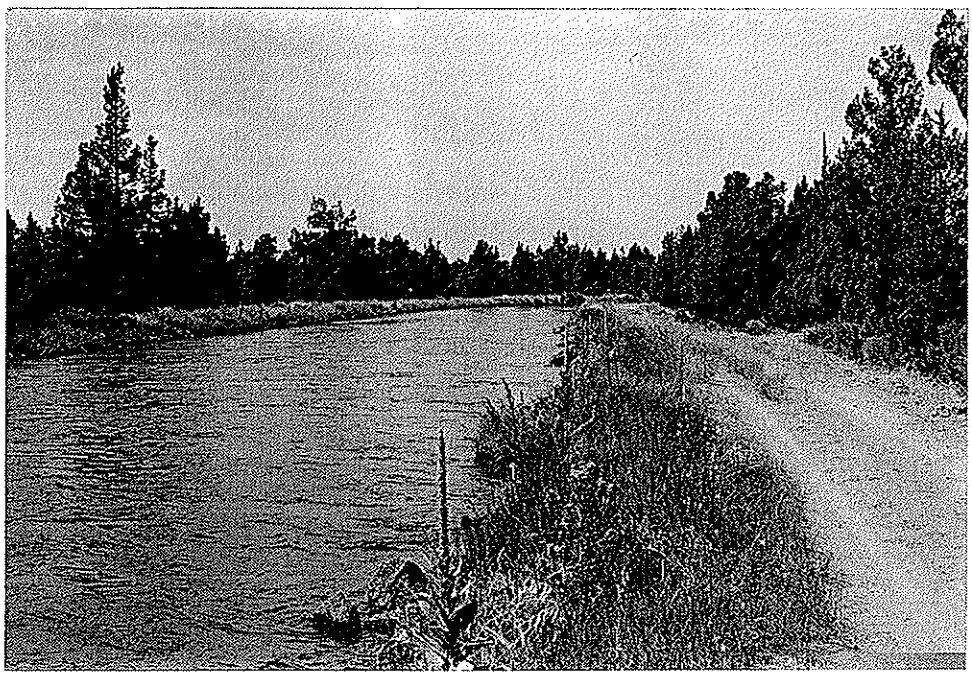

Figure III B-14. A calm stretch on the Pilot Butte Canal. Note adjacent roadway.

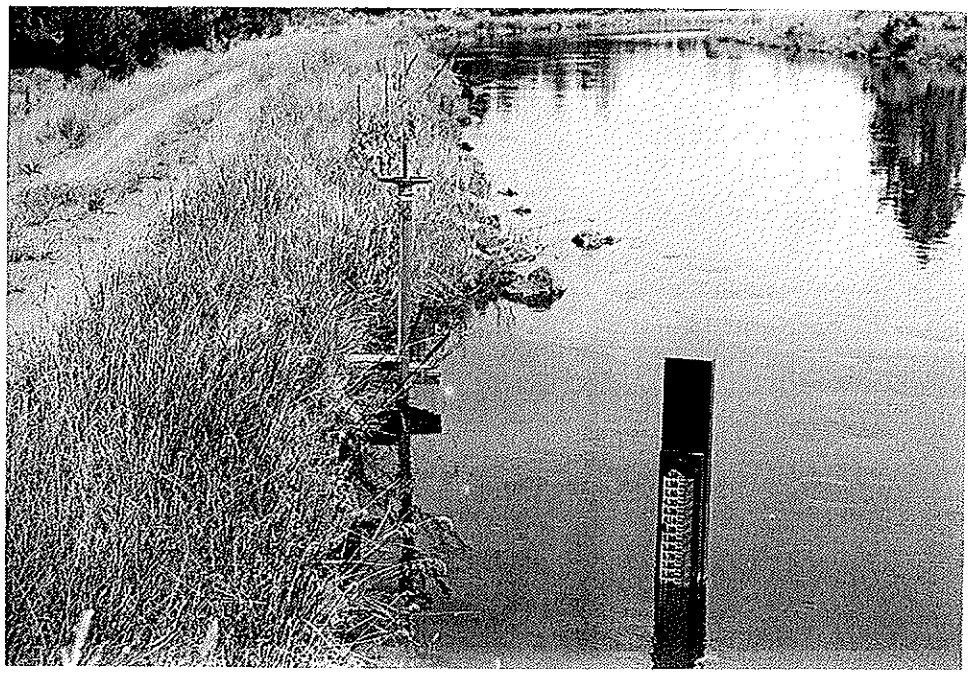

Figure III B-15. A water measuring device on the Pilot Butte Canal is used to monitor and manage water flow through the system. Note small headgate and roadway.

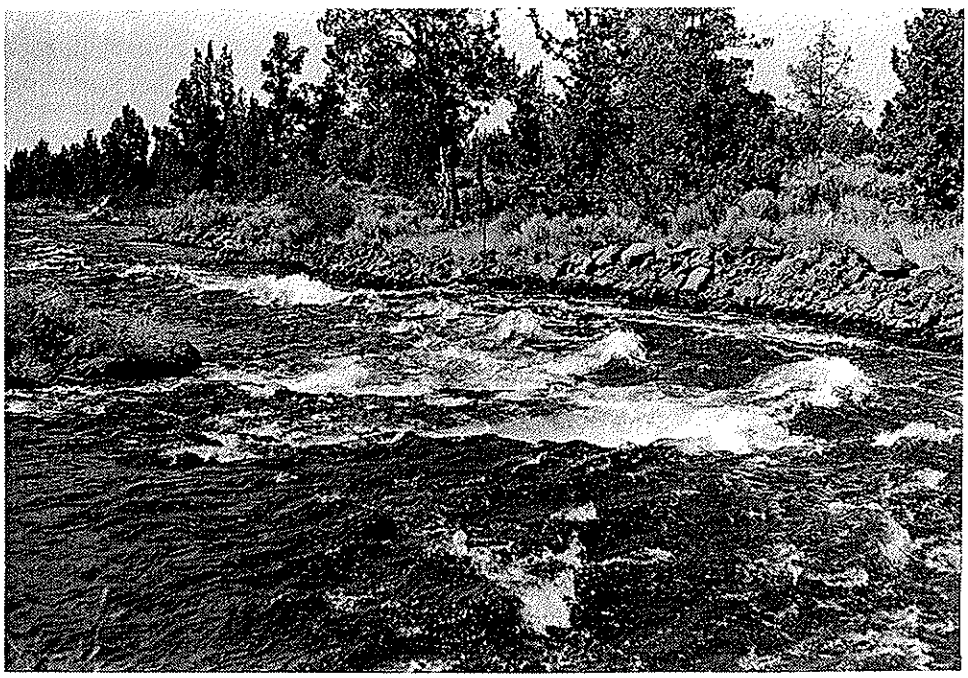

Figure III B-16. One of the many stretches of rapids on the Pilot Butte Canal.

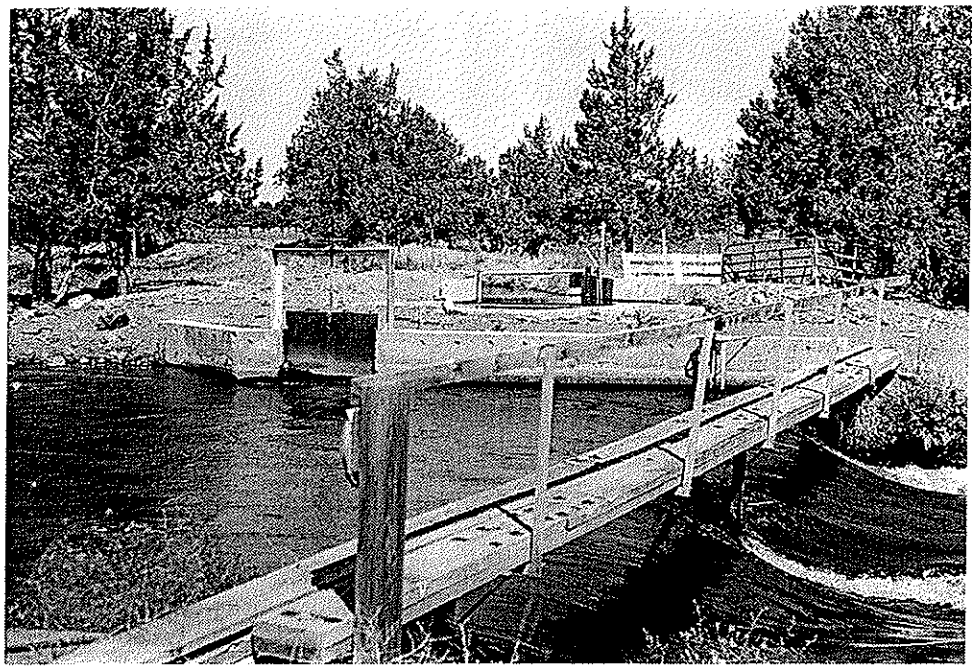

Figure III B-17. A weir structure in the Pilot Butte raises and maintains the water level for diversion through a headgate into a lateral and then into three sub-laterals.

Figure III B-18. A small flume carries water across the Pilot Butte Canal south of Redmond.

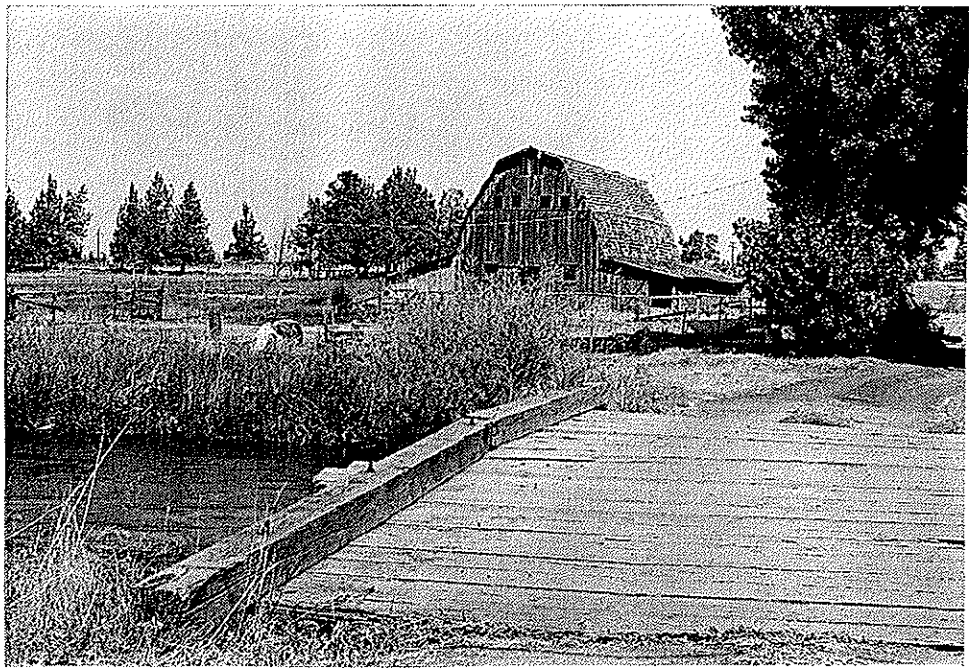

Figure III B-19. A rural landscape on the Pilot Butte Canal near Redmond.

Figure III B-20. Headgate structure of the Central Oregon Canal at the upper end of Big Rapids on the Deschutes River.

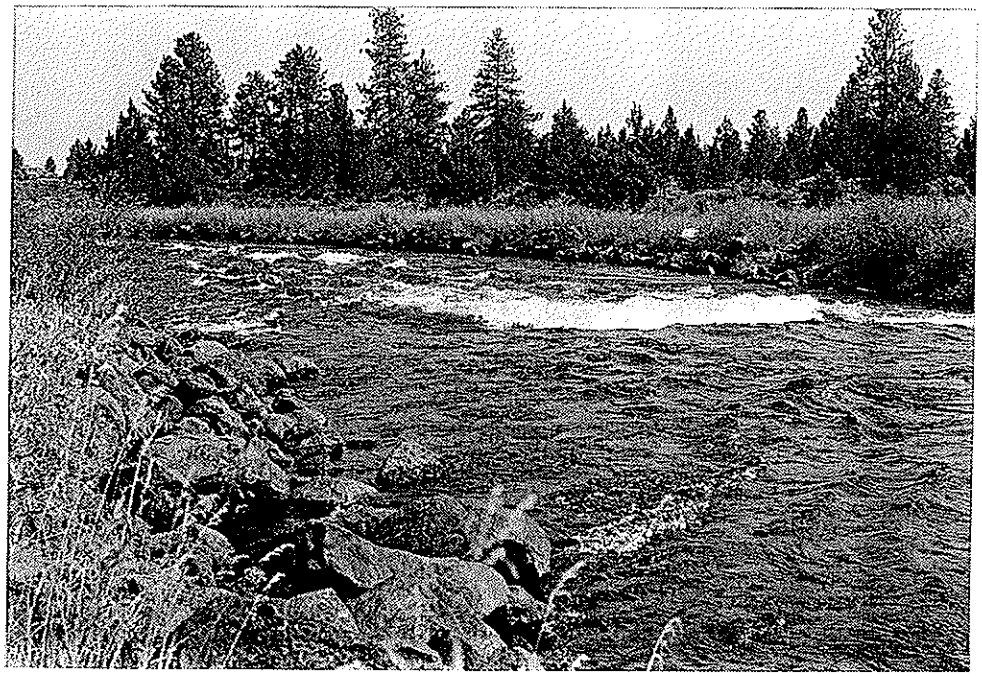

Figure III B-21. A stretch of rapids on the Central Oregon Canal in the Bend area.

Figure III B-22. A raceway on the Central Oregn Canal near Bend.

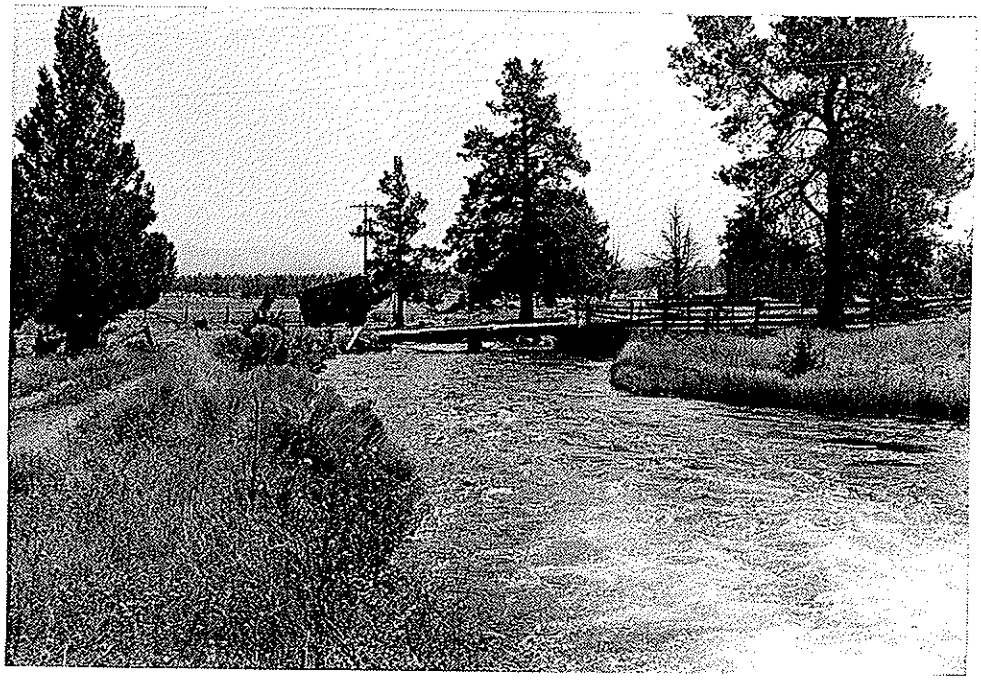

Figure III B-23. A rural landscape on the Central Oregon Canal east of U.S. Highway 20 near Bend.

Figure III B-24. A calm reach of the Central Oregon Canal near Alfalfa looking west.

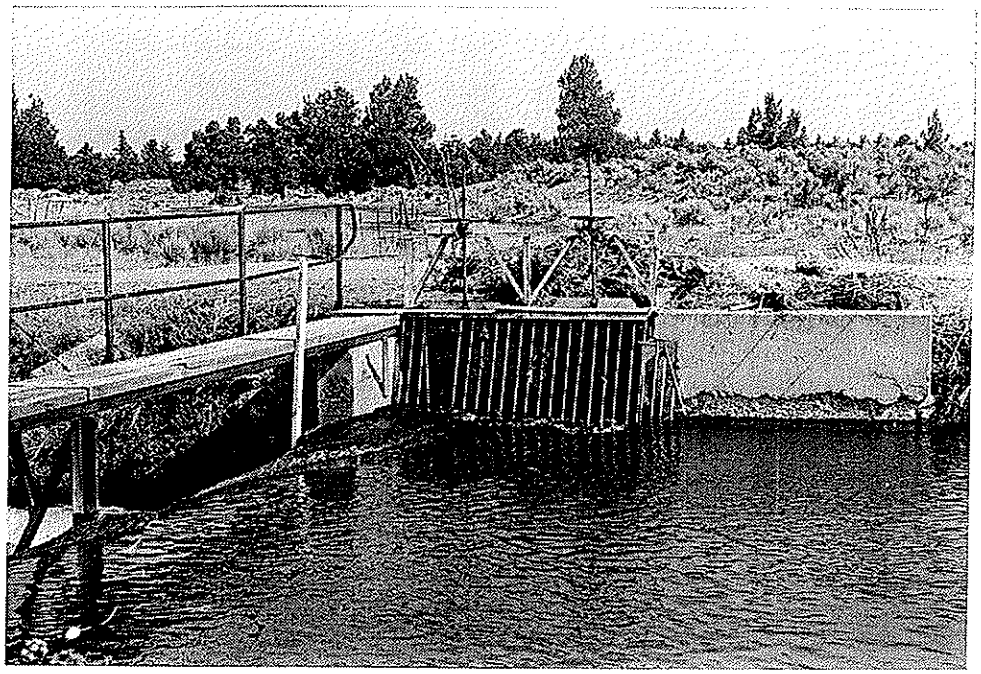

Figure III B-25. A weir on the Central Oregon Canal in the Alfalfa area raises the water level diverting it through a double headgate (with a brush screen) into a large lateral.

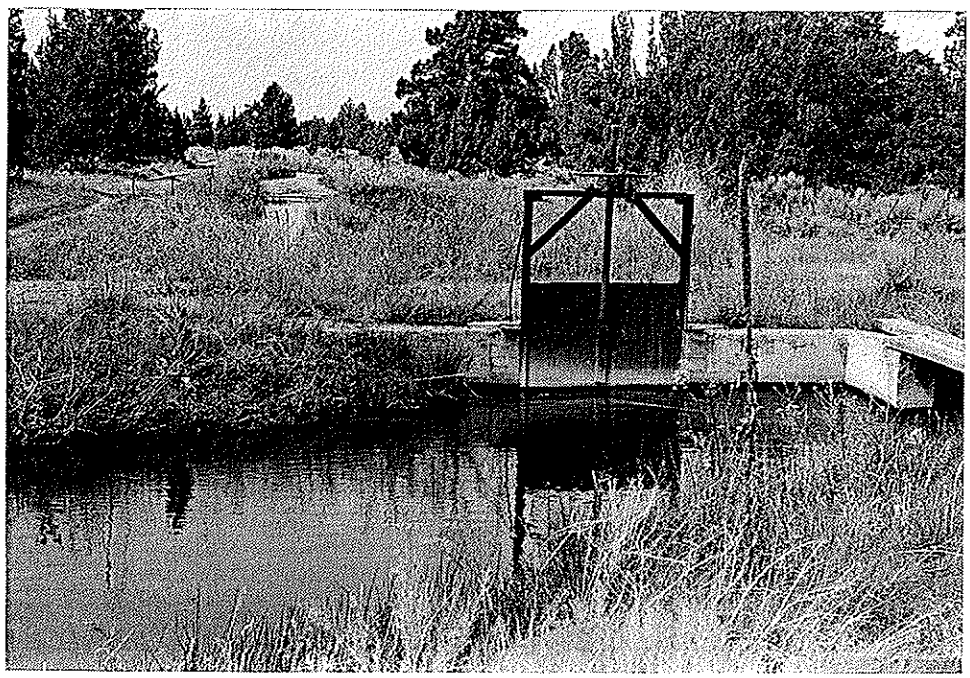

Figure III B-26. A weir, or checkgate, on this lateral, just downstream from the above site, raises the water forcing it through a headgate and into a sub-lateral canal.

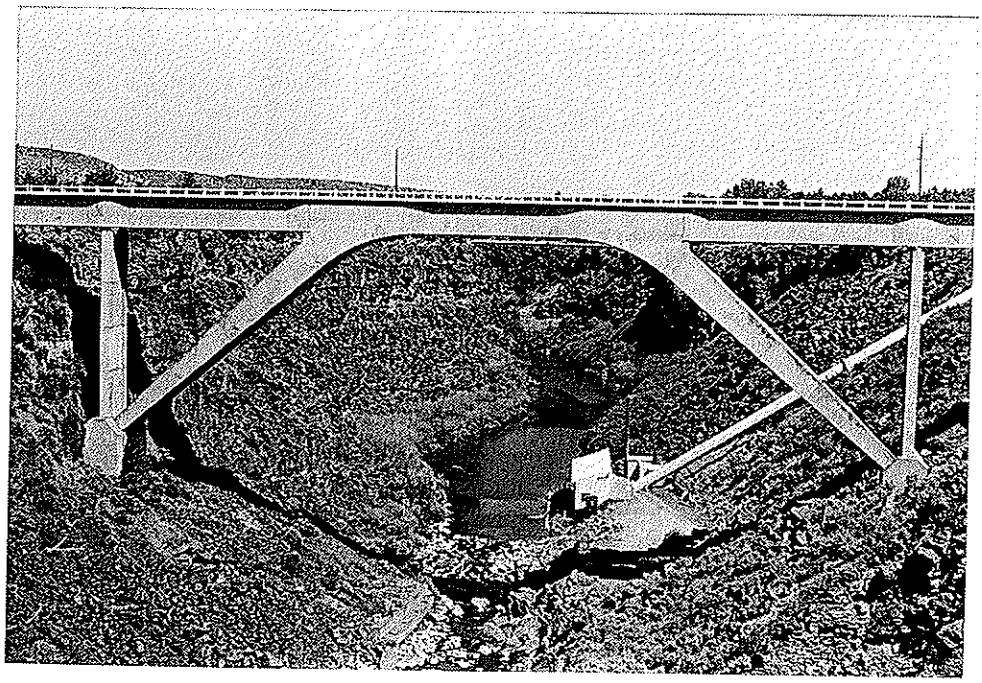

Figure III B-27. The Crooked River Flume (Aqueduct/Canal Bridge) on the North Unit Canal.

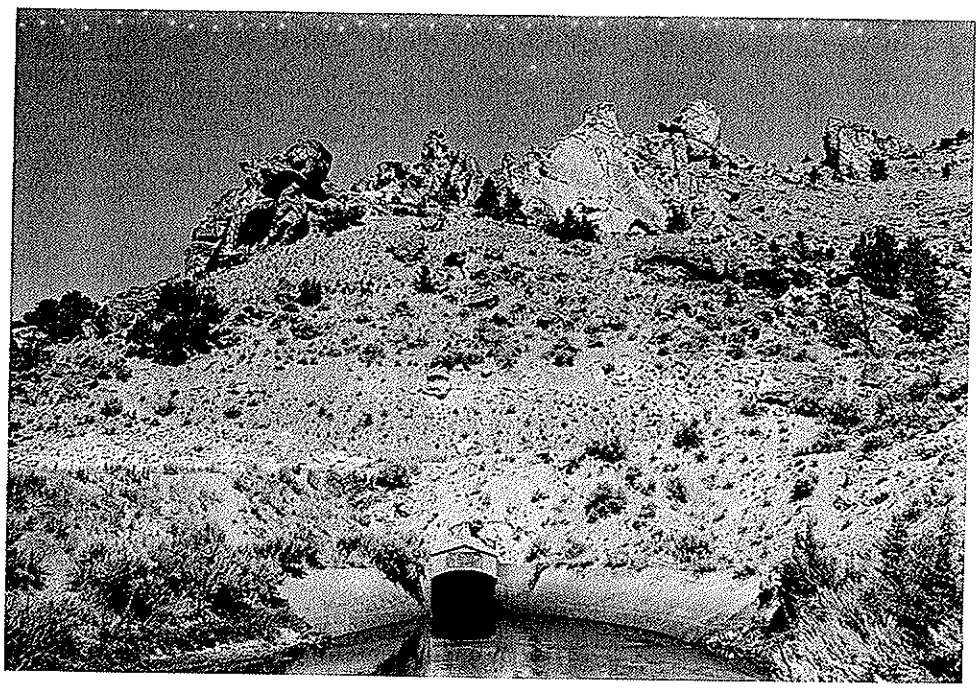

Figure III B-28. The entrance to the south Smith Rock Tunnel (#1) on the North Unit Canal.

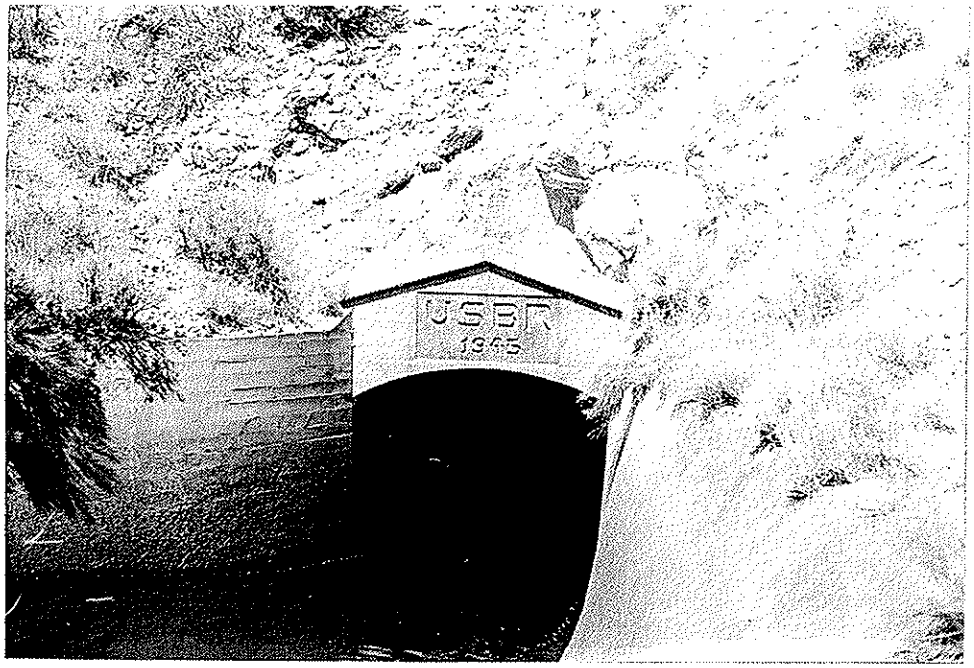

Figure III B-29. A close-up of the entrance to the south Smith Rock Tunnel (#1) on the North Unit Canal. (U.S. Bureau of Reclamation, 1945.)

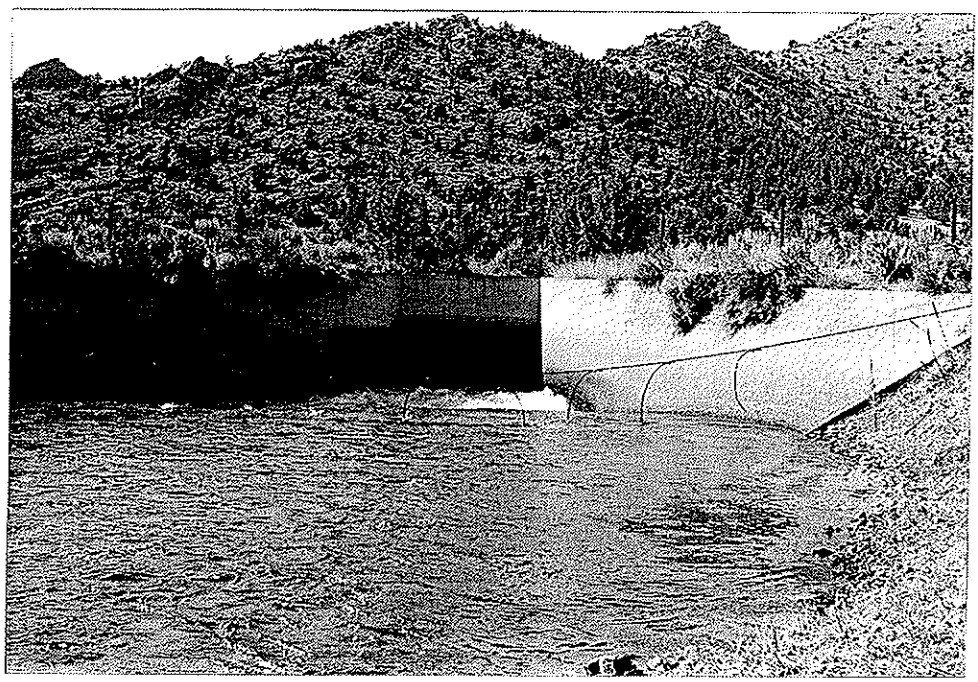

Figure III B-30. The Sherwood Canyon Siphon is located between the two Smith Rock Tunnels on the North Unit Canal.

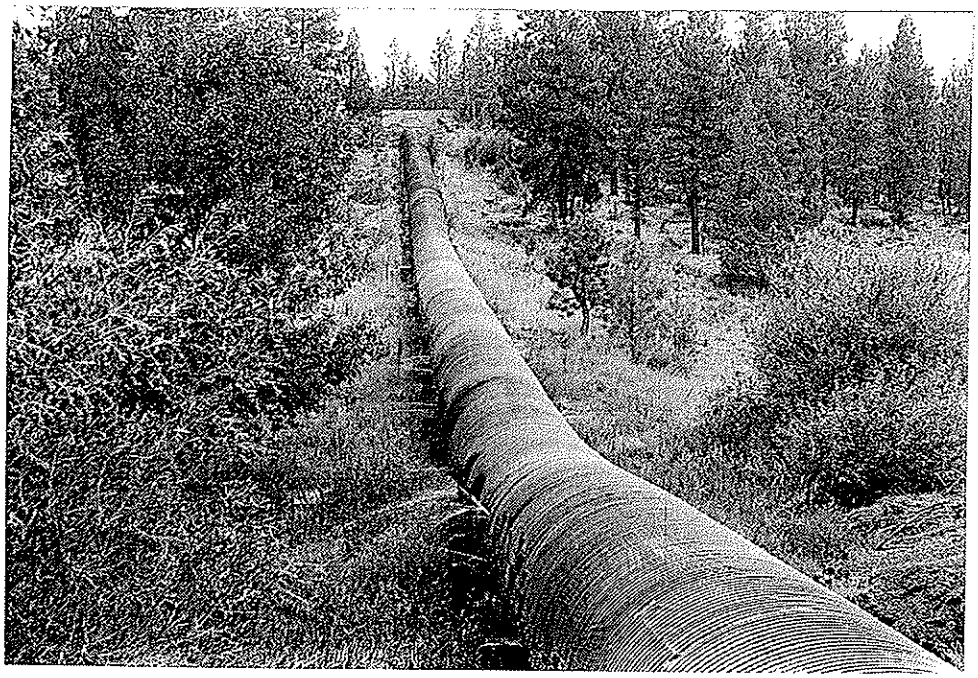

Figure III B-31. The Tumalo Siphon near Awbrey Meadows in Bend is slated for replacement.

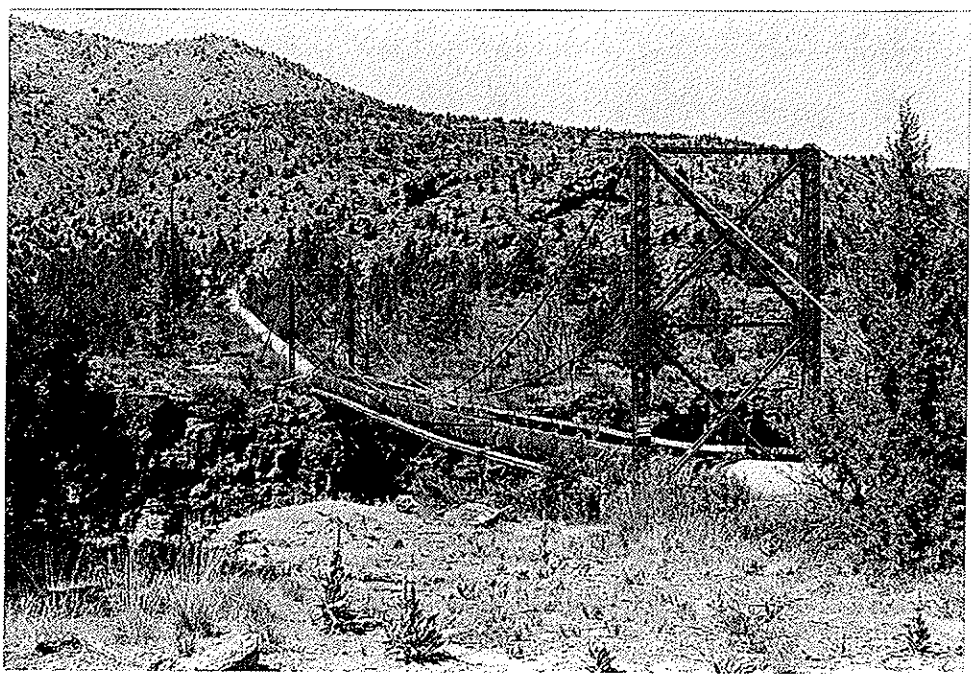

Figure III B-32. The Lone Pine Siphon carries water from the Pilot Butte system across the Crooked River Gorge to the Lone Pine area.

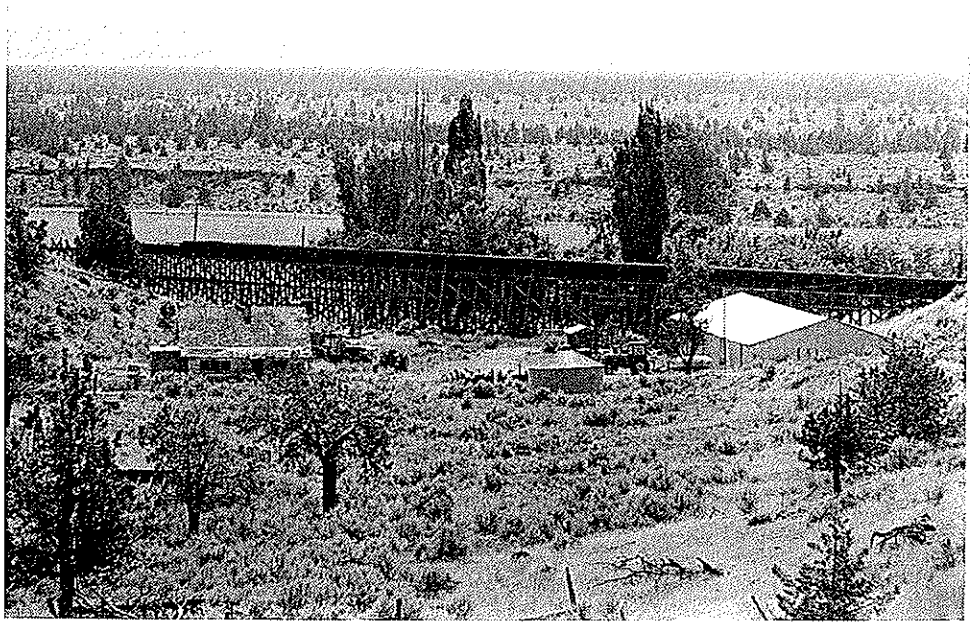

Figure III B-33. Near Powell Butte in Crook County, the Dry Canyon Flume is the last extant resource of its type and period associated with the Central Oregon Canal.

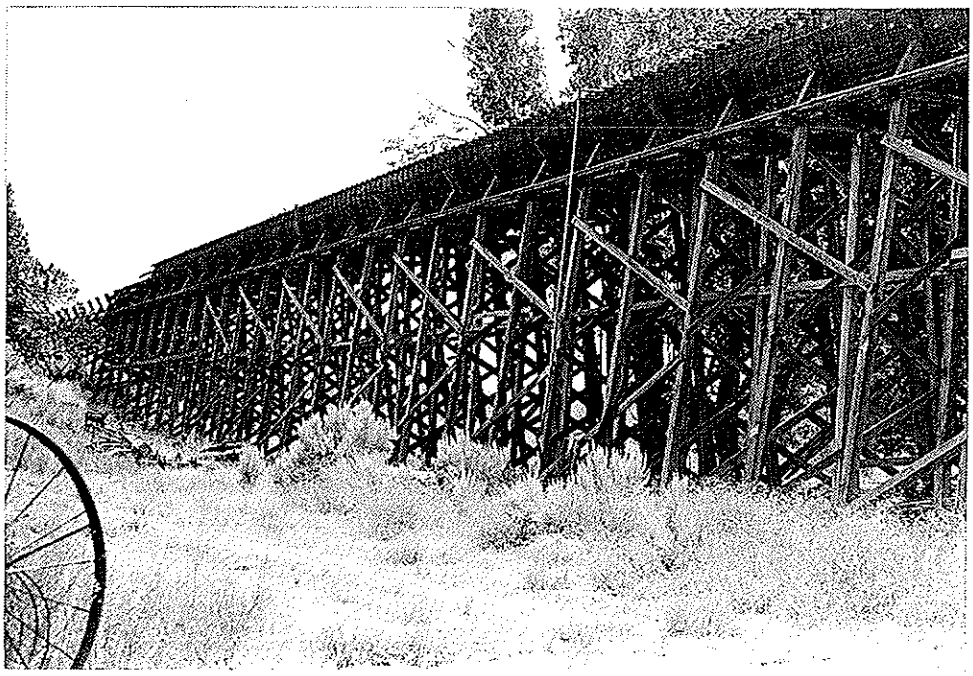

Figure III B-34. The survey in August 1994 found the owner dismantling the structure. Note far left in both photographs.

Figure III B-35. The (main) Arnold Flume heads at the upper end of Lava Island Falls on the Deschutes River.

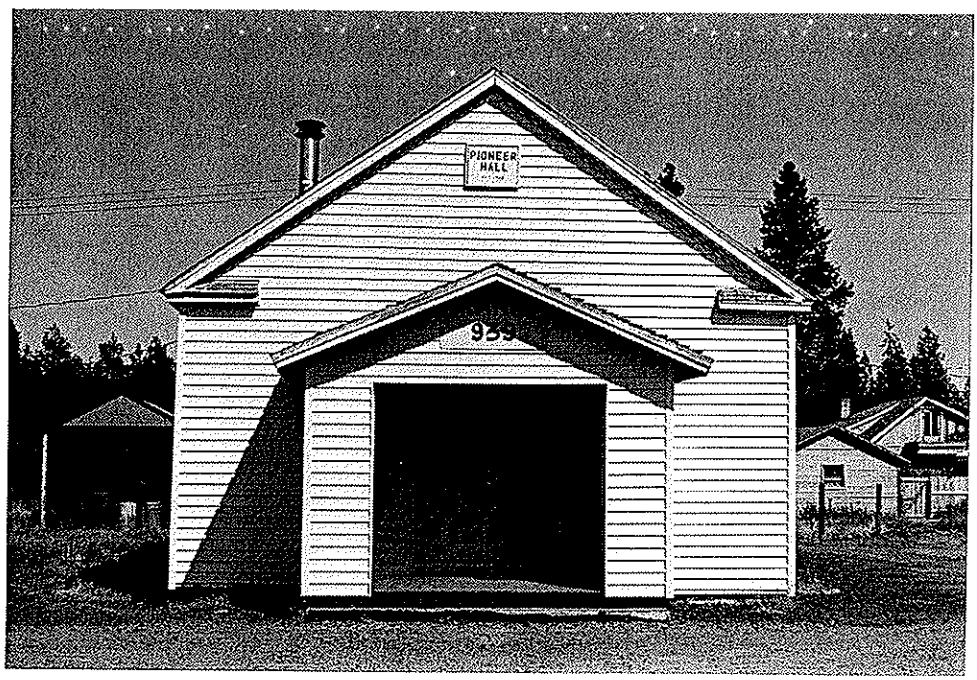

Figure III B-36. La Pine Commercial Club, La Pine.

Figure III B-37. B.F. Nichols House, Tumalo.

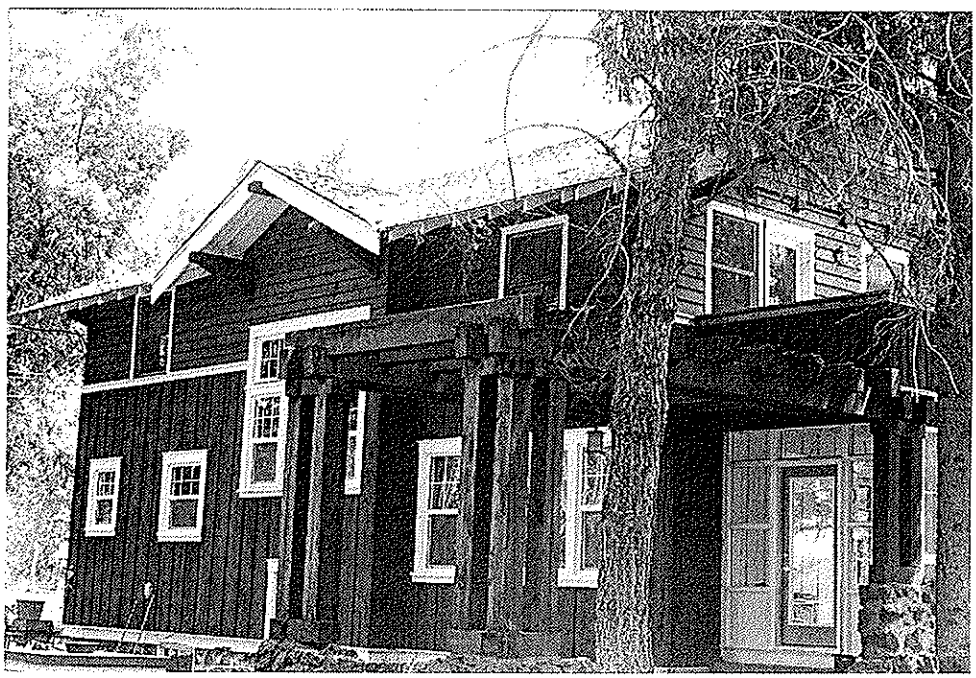

Figure III B-38. Roscoe Howard House near Deschutes Townsite north of Bend.

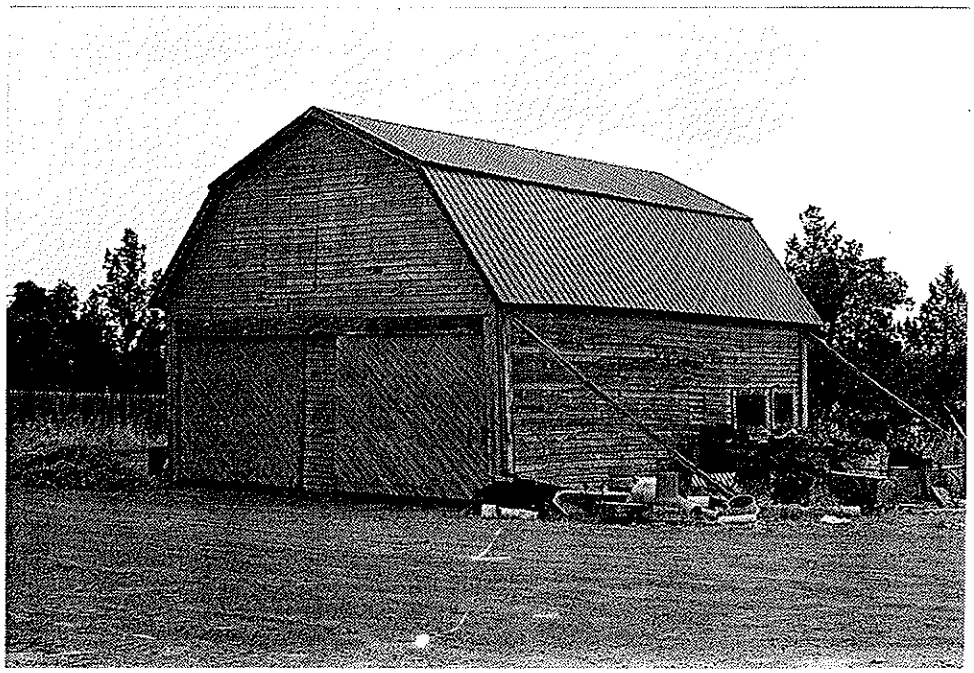

Figure III B-39. Columbia Southern Livery Barn, Tumalo.

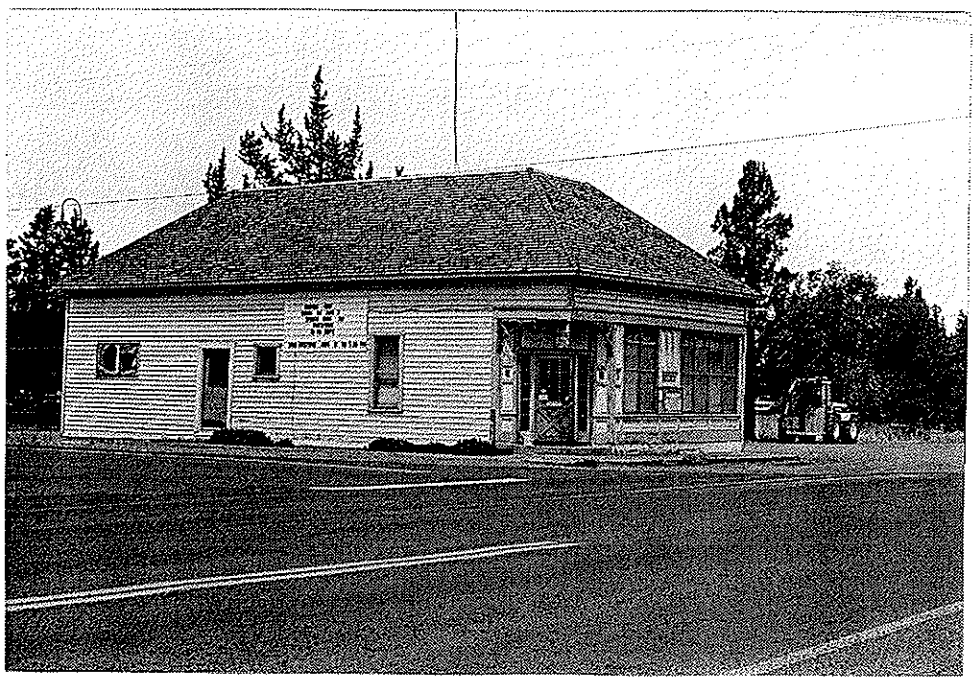

Figure III B-40. The Laidlaw Banking and Trust Company building has served as the headquarters of the Tumalo project since 1913.

C. RESOURCES IDENTIFIED VIA HISTORICAL OVERVIEW, REVIEW OF INVENTORIES AND OTHER INFORMATION

Tables III C-1 - C-9 present the resources identified through the Historical Overview, the review of State and Deschutes County inventories, as well as other information. Additional sources include Determinations of Eligibility to the National Register of Historic Places, *Historic Highway Bridges of Oregon* by the Oregon Department of Transportation, *Tumalo--Thirsty Land* by Martin Winch, and County documents and files. All resources identified via the sources named above were field checked and photographed during the reconnaissance survey, unless noted.

The following guide, or key, will assist in reading, using and applying the tables.

The Type column further defines the type of resource per the notation shown in the table title.

The Name column is the historic or common name of the resource.

The Date column indicates the date or period of initial construction. It does not reflect alterations or new structures, except as noted.

The County column indicates the county, or counties, in which the resource is located:

D	Deschutes
J	Jefferson
C	Crook
K	Klamath

The District column indicates the irrigation district, or districts, presently associated with the resource:

CO	Central Oregon Irrigation District
S	Deschutes Reclamation and Irrigation Company (Swalley)
A	Arnold Irrigation District
T	Tumalo Irrigation District
LP	Crook County Improvement District No. 1 (Lone Pine)
NU	North Unit Irrigation District
N	None. These are private or government owned properties at this time.

The State # column provides the Oregon Inventory of Historic Properties number maintained by the State Historic Preservation Office. A blank space indicates the resource is not listed in the State Inventory.

The Goal 5 column indicates the status of the resource under local implementation of the Statewide Planning Goal 5 Rule--Oregon Administrative Rules, Chapter 660, Division 16:

1A A resource that has been evaluated by the local government and determined to be "insignificant". It is not protected.

1B A resource that has not been evaluated for significance by the local government. It is not protected.

2A A resource designated "significant" by the local government where no conflicting uses have been identified. It is fully protected.

3A A designated and fully protected site. (No "3A" sites are listed in the tables.)

3B A designated resource where a conflicting use has been found to be more important than the resource. (No "3B" sites are listed in the tables)

3C A resource designated "significant" by the local government which requires review by the local landmarks commission to balance its use as a resource and conflicting uses at the site.

The NR column indicates if a Determination of Eligibility for the National Register of Historic Places has been made by the State Historic Preservation Office, or if the property has been listed in the National Register through the federal nomination process:

DE Determined Eligible for the National Register
DNE Determined Not Eligible for the National Register
NR Listed in the National Register

TABLE III C-1

CANALS AND DITCHES IDENTIFIED

TYPE	NAME	DATE	COUNTY	DISTRICT	STATE #	GOAL 5	NR
	Central Oregon	1904-05	D, C	CO	98	1B	DE[1]
	Pilot Butte	1904-05	D	CO		1B	DE[1]
	Old Pilot Butte	1904	D	CO		1B	DE[1]
	North	1909-12	D	CO		1B	DE[1]
	Swalley	1900-15	D	S		1B	DE[1]
	North Unit	1938-49	D,J,C	NU	[2]	1B[2]	DE[1]
	Arnold	1905-10	D	A		1B	
	Squaw Creek	c.1901-13	D	SC		1B	
	Bend Feed	1922-23	D	T		1B	
	Tumalo Feed[3]	1913-14	D	T		1A	
	Crater Creek Ditch[4]	1913-14	D	T	189	DNF[4]	
	Tumalo Irr. Ditch[5]	1913-14	D	T		1B	
	Columbia Southern	1905-14	D	T		1B	

---

1 Canal sections within Bend Parkway Project.

2 Jefferson and Crook counties' inventories were not reviewed for this project.

3 Tumalo Feed Canal was replaced by an underground pipe, beginning near the dam.

4 Crater Creek Ditch was a component of the Tumalo Project designed to tap Crater Creek and several others in the Sparks Lake area to divert their flow into the Middle Fork of Tumalo Creek, and downstream for diversion into the Tumalo Feed Canal. This feature is located on federal land, Deschutes National Forest, and, therefore, is not evaluated or managed under the Goal 5 Rule.

5 The Tumalo Irrigation Ditch begins at the Bull Creek Dam, conveying water to the Tumalo lands.

TABLE III C-2

DIVERSION (D), STORAGE (S), RE-REGULATING (R) AND POWER (P) DAMS IDENTIFIED

TYPE	NAME	DATE	COUNTY	DISTRICT	STATE #	GOAL 5	NE
D	North Canal[1]	1909-12	D	NU, CO, S, LP	135[2]	1B	DE[3]
D	Bend Diversion	1922-23	D	T		1B	
S	Tumalo Project[4]	1913-14	D	T	192[5]	3C	
S	Bull Creek[6]	1914	D	T	191	3C	

---

1 The North Canal dam as constructed was a single arch (radius 180 feet), gravity sectioned, overflow concrete structure. The height from the normal water level to the spillway crest was 28 feet, and from the deepest part of the foundation it was 39 feet. The top length of the dam was 313 feet, and the spillway length was 148 feet. Four wasteway openings were included. The North/Pilot Butte, North Unit and Swalley canals head at this site.

2 The State Inventory incorrectly identifies the dam as the Steidl and Tweet Dam.

3 Confirmed twice by State Historic Preservation Office.

4 As constructed, the Tumalo Project Dam was a 72-feet high earthfill dam with a steel-reinforced concrete core wall and over two feet of hand-laid riprap across both sloping faces of its 350-foot length. A steam shovel excavated 83,000 cubic yards of earth from the reservoir floor, and for about eight months, this fill was moved into place, one cubic yard at a time, by 15 to 20 dump wagons pulled by two to four horses. It was sluiced and compacted by "hydrauluicing", a method that used a steam-driven pump to force it through a hose and a firehose-like nozzle pointed at the earthfill. The outlet works consisted of a 402-foot long, 8-foot by 8-foot partially concrete lined tunnel, a concrete gate shaft and gate house, and two 3-1/2-foot by 6-foot steel gates.

5 The Tumalo Project Control (gate) House is listed as State Inventory number 193. It is protected under a "3C" status with the dam.

6 The Bull Creek Dam is an atypical storage dam. It was designed as a dam to close the outlet from Tumalo Reservoir through Bull Creek Canyon (as a dike is typically used), as a natural spillway for the reservoir, and as a highway bridge over the canyon. It is a concrete, gravity type overflow dam with two cut off walls extended into solid rock at the upper and lower toes of the dam. The dam proper is about 17 feet high from the foundation, though the complete structure is about 25 feet high. Five arches with a span of 19.5 feet surmount the spillway crest to carry the road bed. The structure serves as an outlet into the Tumalo Irrigation Ditch. The bridge portion is identified as a separate structure by the local government and has been determined eligible for the National Register of Historic Places (Table III C-5).

TABLE III C-2 (Continued)

TYPE	NAME	DATE	COUNTY	DISTRICT	STATE #	GOAL 5	NE
D	Tumalo Creek[7]	1913-14 D	T		3C		
S	Wickiup[8]	1940-49	D	NU		DNF[9]	DNE
S	Crane Prairie[10]	1940	D	CO, A, LP		DNF[9]	DNE
S	Crescent Lake[11]	1955-56	K	T	?[12]	DNF[9]	

---

7 The Tumalo Creek Diversion Dam and Headgate of the Feed Canal are also an element of the Tumalo Project. The structure consists of a low overflow weir dam, with a crest 94.2 feet long and 4.25 feet high. Each end features wing walls. The headgates and a waste way consist of heavy buttress walls with four openings, each five feet wide by 6.5 feet high, surmounted by arched foot walks. The entire diversion weir, wing walls, waste way and headgates are all reinforced concrete.

8 Wickiup Dam consists of the dam proper and a second earth embankment called the East Dike, which was necessitated by a topographic feature of the basin which forms Wickiup Reservoir. Wickiup Dam is a zoned earthfill structure with a height of 100 feet (hydraulic height is 81 feet) and a crest 13,860 feet long. The crest, consisting of a gravel road, is 30 feet wide and the maximum width of the base is 550 feet. The outlet works include a hoist house with emergency gates and a valve house. The East Dike is 3,420 feet long, 28 feet high, constructed of earthfill materials, and is adjacent to an emergency spillway.

9 These sites are located on federal land, Deschutes National Forest, and, therefore, are not evaluated or managed under the Goal 5 Rule.

10 Crane Prairie is a zoned earthfill structure with a height of 36 feet (hydraulic height of 27 feet) and a length at the crest of 285 feet. The crest is 25 feet wide and the dam has a maximum width at its base of 200 feet. The 80-foot wide spillway channel features a simple uncontrolled concrete weir set in its floors.

An earth embankment approximately perpendicular to the axis of the dam separates the dam from the spillway channel. The embankment is 20 feet wide and six feet high at the crest, which is about 280 feet long. Ruble and concrete paving covers the channel walls facing the spillway, including the excavated bank opposite the embankment. Rockfill covers the embankment face toward the river.

The outlet works consist of a fish screen and outlet control structure; a twin, concrete, horse-shoe shaped conduit; and a stilling basin. A twelve-sided, concrete control tower 40 feet wide and 29 feet tall comprises the intake, or outlet works. On the downstream side are two 4.8-foot by 6-foot iron fates, each mounted in a concrete conduit that have a length of about 150 feet and a radius of 7 feet.

11 Crescent Lake Dam is a 400-foot long, 40 foot high earthfill dam with concrete outlet works. It is a conventional small earthen dam with many of the characteristics of Crane Prairie Dam reflected in its design and materials and those of the outlet works. It does not have a spillway.

12 Jefferson and Klamath counties' inventories were not reviewed for this project.

TABLE III C-2 (Continued)

TYPE	NAME	DATE	COUNTY	DISTRICT	STATE #	GOAL 5	NE
S, R	Haystack[13]	1957	J	NU	?[12]	1B	
D	Squaw Creek	1970[14]	D	SC		1B	
S, R	McKenzie Canyon	1957-58	D	SC		1B	
S, R	Watson	1964	D	SC		1B	
P	Bend Water, Light & Power	1910	D	N[15]	[16]	3C	DE
P	Cline Falls	1912	D	N[15]	174	3C	

NOTE: Structures associated with these dams, such as headgates, outlet works, valve houses, dikes, and others, are not separately listed, except as noted by footnote 5.

---

13 Haystack is an earthfill, rock covered dam. The total height is 105 feet with a 755 foot base and a 25 foot width at the top. The outlet is a concrete conduit through the base of the dam controlled by one 3 1/4 by 3 1/2 foot high pressure slide gate.

14 Remnants of the 1919 and 1921 dams exist at the site.

15 Properties are owned and managed by Pacific Power & Light Company.

16 Powerhouse at site is listed in State Inventory as number 18.

TABLE III C-3
CANAL HEADWORKS -- NOT ASSOCIATED WITH DAMS -- IDENTIFIED

TYPE	NAME	DATE	COUNTY	DISTRICT	STATE #	GOAL 5	NR
	Central Oregon	1904-05	D	CO	135[1]	1B	
	Arnold	1905	D	A		1B	

[1] Canal listed in State Inventory, number 135.

TABLE III C-4

SIPHONS(S), PIPES (P), FLUMES (F), TUNNELS (T) AND AQUEDUCT/CANAL BRIDGES (A/CB) IDENTIFIED

TYPE	NAME	DATE	COUNTY	DISTRICT	STATE #	GOAL 5	NR
S	Tumalo[1]	1922-23	D	T	196	1A	
S	Sherwood Canyon	1945	D	NU		1B	
F, A/CB	Crooked River Gorge	1945	D	NU		1B	
T (2)	Smith Rock[2]	1945	D, J	NU	[2]	1B[2,3]	
S	Willow Creek Canyon	1949	J	NU	[3]	? [3]	
F	Arnold (main)[1]	1905-10	D	A		1B	
P	Swalley	1909-12	D	S		1B	DE[4]
S	Lone Pine	c. 1922	D	LP		1B	
F	Dry Canyon[5]	1908	C	N[5]	[5]	[5]	

---

1 Available information indicates that flumes on laterals in the Arnold system, and flumes and other structures connecting the Tumalo system's Bend Diversion Dam and the Tumalo Feed Canal, have been replaced with newer, non-equivalent and non-compatible features since the historic period, with the exception of the Tumalo Siphon which is slated for replacement. The field study did not investigate this information.

2 Two tunnels exist at Smith Rock. The Sherwood Canyon Siphon lies between Tunnel No. 1, the south tunnel, which is in Deschutes County, and Tunnel No. 2, the north tunnel which is in Jefferson County. Tunnel No. 1 is about 3,600 feet in length; Tunnel No. 2 is about 3,300 feet.

3 The Jefferson County inventory was not reviewed for this project.

4 Pipe and canal sections within Bend Parkway project.

5 The Dry Canyon Flume was used until about 15 years ago, according to the private property owner on whose land it is sited. At that time, the irrigation district built a siphon under the entire canyon, from rim to rim. The flume is believed to be the only one of its size and period associated with the D.I.P. Company that is extant. The field study in August 1994 found the owner dismantling the structure. In addition to the structure, rock work, a large section of canal, and concrete structures are extant. It is located in Crook County. This project did not review the Crook County inventory.

TABLE III C-5

BRIDGES IDENTIFIED

TYPE	NAME	DATE	COUNTY	DISTRICT	STATE #	GOAL 5	NR
Covered Arch	Rock O'the Range[1]	1963	D	N		1B	NR
	Bull Creek[2]	1914	D	T		2A	DE

---

1 The bridge crosses Swalley Canal on Bowery Lane, a county road. It was an element of a statewide nomination of covered bridges to the National Register of Historic Places in 1979. It is also known as the Swalley Canal Bridge. It does not have a State Bridge Number.

2 The bridge is attached to Bull Creek Dam, but identified as a separate structure by the local government. The dam is listed in the State Inventory, number 191. Located on Seismore, a county road, the bridge is also known as the Tumalo Irrigation Ditch Bridge and is the oldest bridge in Deschutes County. The State Bridge number is 17C02.

TABLE III C-6

HOUSES (H) AND BUILDINGS (B) IDENTIFIED

TYPE	NAME	DATE	COUNTY	DISTRICT	STATE #	GOAL 5	NR
B	Central Oregon I.O.[1]	1952	D	N		1B	
H	Roscoe Howard House[2]	c.1912	D	N		1B	
H	B.F. Nichols House[3]	c.1900	D	N	180	1B	
B	Columbia Southern Livery Barn[4]	c.1905	D	T	178	1A	
B	Tumalo Project Shop[4]	c.1913	D	T	178	1A	
H	L.D. Weist Homestead[5]	c.1901	D	N		1A	

---

1 The Central Oregon Irrigation District Office, located on the south end of Highway 97 in Redmond, was the district's office from 1952 to 1993. Other office or operations sites have not been identified. These include Bend (D.I.P., 1904), Redmond (D.I.P., date unknown), Deschutes (C.O.I. Company, 1911), and Redmond (C.O.I. District, 1922).

2 The Howard House, a two-story Craftsmans style house with a basement, is the only extant resource from the Deschutes Townsite. Howard became manager of the D.I.P. Company in 1908 and continued with the Central Oregon Irrigation Company after the takeover in 1910. The townsite company deeded him the property in 1912 and he lived in the house until 1919.

3 B.F. Nichols was the Secretary of the Tumalo Irrigation Company, with A.R. Lytle the President. The firm was typical of some of the ill-fated irrigation schemes, filing in 1891 to divert Tumalo Creek and in 1893 to do the same in the name of the Turnello Irrigation Company. Neither project was built. Nichols was better known as the state legislator who, in 1881, introduced the bill that created Crook County from Wasco. He was a nephew of Stephen Meek of the Lost Wagon Train of 1845, the first sheriff of Polk County and, for a time, the sheriff of all the territory between the Pacific Ocean and the Rocky Mountains, and from California north to a line that ran east and west through Salem. He lived in the house until his death in 1920. The State Inventory data identifies the house as the Aunt Noll Nichols House.

4 The State Inventory data identified these buildings as the Tumalo Project Barn and Warehouse. Winch's study indicates the barn was the Columbia Southern livery barn, while the other building served as the Tumalo Project shop.

5 The first water from the (old) Pilot Butte Canal was delivered to 40 acres of the L.D. Weist homestead in 1904. The building was moved early from its site at Third and Norton in Bend to its present location at 1352 N.E. Second when Weist built a large house on the site. That house was demolished in 1967 to provide for construction of a service station. Weist was an engineer for the Pilot Butte Development Company, Deschutes Irrigation and Power Company, Central Oregon Irrigation Company, Arnold Irrigation Company, and, possibly, others. He surveyed the townsite of Bend and established the Westoria addition. The local government has determined that the homestead house is "not significant" (1A).

TABLE III C-6 (Continued)

TYPE	NAME	DATE	COUNTY	DISTRICT	STATE #	GOAL 5	NR
H	F. McCaffery House (First) [6]	c.1905	D	N	27	1B	
H	F. McCaffery House (Second)[6]	c.1906	D	N	70	1B	
H	F. Redmond House[7]	c.1906	D	N	53	1A	
B	La Pine Commercial Club[8]	1912	D	N	235	3C	
B	Laidlaw Banking and Trust Company[9]	1905	D	T	30	3C	

---

6 The first Frank McCaffery House was located in Cloverdale, but resited to the Deschutes County Fairgrounds (Redmond) in 1976. In poor condition, it was subsequently moved to an unknown location or demolished. McCaffery moved to the second house sometime after coming to Redmond in 1906. He was an employee of the Deschutes Irrigation and Power Company and is credited with bringing Netted Gem potatoes to the Redmond area, where they received wide acclaim as "Deschutes Russets".

7 Frank and Josephine Redmond homesteaded the Redmond area in 1904 and built their house in 1906. The Deschutes Irrigation and Power Company organized the Redmond Townsite Company, naming the town after the settlers.

8 John Morson and Alfred Aya, associated with the Walker Basin irrigation project near La Pine, are credited with establishing the La Pine Commercial Club. Aya, also president of the La Pine Townsite Company, donated the land and served as the Club's president. Morson donated the lumber.

9 The Laidlaw Banking and Trust Company was incorporated by W.A. Laidlaw in 1905. The firm's building was built in 1904-1905 and served as the Laidlaw office for the Columbia Southern Irrigation Company and Laidlaw Townsite Company. In about 1913 it became the office of the Tumalo Irrigation Project, and has served as the office of the irrigation development from that time to the present.

TABLE III C-7

SITES IDENTIFIED

TYPE	NAME	DATE	COUNTY	DISTRICT	STATE #	GOAL 5	NR
	Deschutes Townsite[1]	1911	D	N	149	1A	
	Cline Falls Townsite	c.1892	D	N	172	1A	
	Camp Redmond	1938	D	N	48	1A	
	Camp Wickiup	1939	D	N		DNF[2]	
	A.M. Drake Homesite[3]	1900	D	N	138	2A	
	L.D. Weist Homesite[4]	1900	D	N	97	2A	
	O.B. Riley Mill Site[5]	c.1900	D	N		1B	
	Hightower & Smith Co. Mill Site[5]	c.1905	D	N	199	DNF[2]	

NOTE: No extant resources were identified at any site except as noted.

---

1 See footnote number 2 following Table III C-6.

2 These sites are located on federal land, Deschutes National Forest, and, therefore, are not evaluated or managed under the Goal 5 Rule.

3 The Drake Homesite, a log lodge, was demolished in 1956.

4 See footnote number 5 following Table III C-6.

5 These mills have been identified as two of the early mills that manufactured material for wooden flumes, the O.B. Riley for the Deschutes Reclamation and Irrigation Company (Swalley) and the Hightower & Smith Company for the Deschutes Irrigation and Power Company.

TABLE III C-8

TOTAL RESOURCES IDENTIFIED

TYPE	TOTAL
Canals and Ditches	13
Dams	14[1]
Headworks--Not Associated with Dams	2
Siphons, Pipes, Flumes, Tunnels and Aqueduct/Canal Bridges	10[2]
Bridges	2[1]
Houses and Buildings	11
Sites	8
TOTAL RESOURCES IDENTIFIED	60[1,2]

[1] Bull Creek Dam and Bull Creek Dam Bridge counted as two resources.

[2] There are two tunnels at Smith Rock.

TABLE III C-9

TOTAL RESOURCES IDENTIFIED WITH DISTRICT ASSOCIATION

DISTRICT	RESOURCES
Central Oregon	7
Squaw Creek	4
Arnold	4
North Unit	9[1]
Lone Pine	3
Tumalo	15[2]
Swalley	3
No Association	20
TOTAL	65[3]

[1] There are two tunnels at Smith Rock.

[2] Bull Creek Dam and Bull Creek Dam Bridge are counted as two resources.

[3] Several resources are associated with more than one district.

IV. EVALUATION

A. PURPOSE AND METHODOLOGY

The purpose of this section is to evaluate the resources identified in Section III, Identification. Evaluation criteria is derived from standards utilized by the National Register of Historic Places program. Both the significance of a resource and its integrity were evaluated. To determine significance, the National Register Criteria recognizes different types of values embodied in resources. These values fall into the following categories:

A. Criterion A: Event. Resources can be eligible for the National Register if they are associated with events that have made a significant contribution to the broad patterns of our history. This includes a specific event marking an important moment in American prehistory or history, or a pattern of events or a historic trend that made a significant contribution to the development of a community, a State or the nation.

B. Criterion B: Person. Resources may be eligible for the National Register if they are associated with the lives of persons significant in our past. The persons associated with the resource must be individually significant within the historic context.

C. Criterion C: Design/Construction. Resources may be eligible for the National Register if they embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction.

D. Criterion D: Information Potential. Resources may be eligible for the National Register if they have yielded, or may be likely to yield, information important in prehistory or history. This criteria is usually applied to archaeological resources and was not applied to irrigation resources.[1]

To be eligible for the National Register of Historic Places, a resource must not only be shown to be significant under the National Register Criteria, but it also must have integrity. Integrity is the ability of a resource to convey its significance. The National Register Criteria recognizes seven aspects or qualities that, in various combinations, define integrity. To retain historic integrity a resource will always possess several, and usually most, of the aspects. The seven aspects of integrity are:

1. Location. Location is the place where the historic property was constructed or the place where the historic event occurred.

2. Design. Design is the combination of elements that create the form, plan, space, structure, and style of a property.

3. Setting. Setting is the physical environment of a historic property.

4. Materials. Materials are the physical elements that were combined or deposited during a particular period of time and in a particular pattern or configuration to form a historic property.

5. Workmanship. Workmanship is the physical evidence of the crafts of a particular culture or people during any given period in history or prehistory.

6. Feeling. Feeling is the property's expression of the aesthetic or historic sense of a particular period of time.

7. Association. Association is the direct like between an important historic event or person and a historic property.[2]

To facilitate the evaluation of integrity, the seven aspects were grouped into three measures of integrity:

1. Measure 1. Location and Setting. Unless a resource had been relocated or rerouted (i.e. a canal), it was rated high under location. Integrity of setting was rated high if the present setting was similar to the original. Changes to the immediate surroundings and how those changes (buildings, land use , foliage, topography, others) have affected the relationship of the resource to the setting were considered.

2. Measure 2. Design, Materials, and Workmanship. Resources retaining the features of its type and the essential elements of what it is intended to represent have high design integrity. Materials integrity considered whether original materials of historic importance had been substantially altered by deterioration or replacement and, if replaced, whether the new materials were equivalent or compatible with the original. This measure captures the element of physical condition, or structural integrity. Workmanship relates to the specific form of different materials and the way they are combined.

3. Measure 3. Feeling and Association. These aspects are interpretive and present if the resource communicates a sense of what it was like in the historic period. This measure was typically higher when the other measures of integrity were present.[3]

A five-point scale for each measure of integrity was used to evaluate each resource: Excellent (5), Very Good (4), Good (3), Fair (2), and Poor (1). The application of the scale is described in Section C, Evaluation Results.

B. RESOURCES ELIMINATED FROM FINAL EVALUATION

Prior to determining significance and integrity, resources identified in Section III, Identification, were eliminated from further consideration for six reasons. First, resources previously evaluated by the local government as insignificant (1A) were removed from further consideration, unless new information or other factors suggested further consideration. Seven sites were eliminated. Two sites, the Columbia Southern Livery Barn and the Tumalo Siphon, were re-considered. While the Barn is associated with the Tumalo Project, new information suggests its significance as one of only two remaining buildings associated with the Columbia Southern project is greater. The Siphon found insignificant by the local government warranted further consideration within the historic context. Second, all sites with no extant resource were eliminated. Another five sites were removed from consideration. Third, all sites where construction was not initiated before 1945 were eliminated to comply with the National Register guidelines requiring that resources achieve significance at least 50 years ago. Criteria Consideration "G" provides that a resource whose construction began over 50 years ago, but the completion overlapped the 50 year period, is eligible. Wickiup Dam (1940-1949) and the North Unit Canal (1938-1949) were not eliminated. Seven others were, however. Fourth, all sites listed or previously determined eligible for the National Register were not re-evaluated. These include the North Canal Dam, Rock O' the Range Bridge, Bull Creek Dam and Bridge (considered as one resource) and the Bend Water, Light and Power Dam. Canal sections within the Bend Parkway project determined eligible were not eliminated. The entire canal was considered unless eliminated for reason number five. Fifth, all canals where the project scope did not permit the gathering of survey data, or sufficient survey data, were not evaluated. Eight canals require survey work. This includes all of the canals and ditches listed in Table III C-1, except the Central Oregon, North/Pilot Butte (2) and North Unit canals. Sixth, the first Frank McCaffery House was eliminated due to no locational data for a survey. Table IV B-1 summarizes the resource elimination process.

TABLE IV B-1
RESOURCES ELIMINATED FROM FINAL EVALUATION

RESOURCE	REASON(S)
Tumalo Feed Canal	1A
Tumalo Project Shop	1A
L.D. Weist Homestead	1A
F. Redmond House	1A
Deschutes Townsite	1A (not extant)
Cline Falls Townsite	1A (not extant)
Camp Redmond	1A (not extant)
Camp Wickiup	Not extant
A.M. Drake Homesite	Not extant
L.D. Weist Homesite	Not extant
O.B. Riley Mill Site	Not extant
Hightower & Smith Co. Mill Site	Not extant
Central Oregon Irr. Office	Not 50 years
Haystack Dam	Not 50 years
Crescent Lake Dam	Not 50 years
Squaw Creek Dam	Not 50 years
McKenzie Canyon Dam	Not 50 years
Willow Creek Canyon Siphon	Not 50 years
Watson Dam	Not 50 years
North Canal Dam	Eligible NR
Rock O' the Range Bridge	Listed NR
Bull Creek Dam & Bridge (2)	Eligible NR
Bend Water, Light & Power Dam	Eligible NR
Canals/Ditches	
Old Pilot Butte	Survey
Swalley	Survey
Arnold	Survey
Squaw Creek	Survey
Bend Feed	Survey
Crater Creek	Survey
Tumalo Irrigation	Survey
Columbia Southern	Survey
F. McCaffery House (1)	Not located

C. FINAL EVALUATION RESULTS

Following the elimination of sites from further consideration, an evaluation team considered the significance and integrity of each resource as described in Section "A", Purpose and Methodology. The team consisted of Michael Hall, report author, project surveyor, and Historic and Cultural Resources Planner for Deschutes County since 1990; Ward Tonsfeldt, Ph.D., Vice-Chairman of the Deschutes County Historical Landmarks Commission, Vice-Chairman of the State Advisory Committee on Historic Preservation, a past member of the State Historic Context Committee, and a private cultural resources consultant; and Paul Claeyssens, Forest Archaeologist for Deschutes National Forest, a member of the Deschutes County Historical Landmarks Commission, and a cultural resources specialist with a background and an interest in historic irrigation resources.

The team determined which, if any, of the National Register Criteria each resource met within the historic context. Then, the three measures of integrity were applied to each resource with a rating variable from one to five. A total score for integrity was derived by adding the ratings of the three measures. A total rating of "10" was established as an integrity standard for National Register eligibility. Twenty-Two (22) sites were determined to be eligible for the National Register, within the historic context. Four (4) were found to be ineligible. Table IV C-1 summarizes the findings.

TABLE IV C-1
FINAL EVALUATION RESULTS

RESOURCE	CRITERIA				INTEGRITY				
TYPE/NAME	MEETS			DOES	MEASURE			TOTAL	NR
	A	B	C	NOT	1	2	3	SCORE	ELIGIBLE
CANALS									
Central Oregon	X	-	X		5	4	4	13	Y
Pilot Butte	X	X	X		4	4	4	12	Y
North	X	-	X		1	1	1	3	N
North Unit	X	-	X		5	5	5	15	Y
DAMS									
Bend Diversion	X	-	X		4	4	4	12	Y
Tumalo Project	X	X	X		4	3	3	10	Y
Tumalo Creek	X	X	X		5	4	4	13	Y
Wickiup	X	-	X		5	5	4	14	Y
Crane Prairie	X	-	-		4	4	4	12	Y
Cline Falls	X	-	-		4	5	4	13	Y
CANAL HEADWORKS (N.A.W.D.)									
Central Oregon	X	-	-		3	1	2	6	N
Arnold	X	-	-		3	1	2	6	N
SIPHONS, PIPES, FLUMES, TUNNELS, ETC.									
Tumalo	X	-	X		3	5	4	12	Y
Sherwood Canyon	X	-	X		5	5	5	15	Y
Crooked River Gorge	X	-	X		4	5	5	14	Y
Smith Rock	X	-	X		5	5	5	15	Y
Arnold	X	-	-		3	4	4	11	Y
Swalley	X	-	-		3	4	3	10	Y
Lone Pine	X	-	X		4	5	5	14	Y
Dry Canyon	X	-	X		5	5	5	15	Y
HOUSES AND BUILDINGS									
R. Howard House	X	X	X		5	5	5	15	Y
B.F. Nichols House	-	X	-		4	5	5	14	Y
Col. Southern Livery	X	-	-		3	5	4	12	Y
F. McCaffery House (2)	-	X	-		2	2	2	6	N
LaPine Commercial Club	-	X	-		3	4	4	11	Y
Laidlaw Banking & Trust Co.	X	X	-		3	4	4	11	Y

V. TREATMENT

A. PURPOSE

The purpose of the Treatment section is to present initial preservation strategies. A primary focus is to determine research and survey needs defined during the Historic Overview, Identification and Evaluation phases of the project. As integral elements of community development, historic and cultural resource management strategies to provide economic, social, environmental and educational benefits are explored. Potential educational and interpretive programs are identified. Available grant programs are presented. Land use activities relating to compliance with local Comprehensive Plans are discussed. Certified Local Government needs are outlined.

While support for various industrial-type resources, such as railroad logging remains, is increasing, considerable education and research must be done if these linkages to our past are to be preserved for future generations. Irrigation-related resources simply are not "pretty" like a Victorian home. Potential for adaptive re-use is limited even for the most creative preservationist.

Both fortunately and unfortunately much of the resource base has been in continued use since the historic period. Ongoing changes to the resources as technologies evolved, typical of industrial and agricultural sites, have eliminated resources and resulted in the gradual dimution of their integrity. This is the greatest threat to the resources. Their continued use, however, is why most are still extant.

As Oregon's first historic context for irrigation development, it is anticipated that awareness of this fascinating history and the associated resources will spread. Preservation of these unique resources will require a broad base of support and a new, holistic approach. Part G, "A Final Observation", discusses this approach.

B. SURVEY AND RESEARCH NEEDS

Canals, Etc. The project identified 13 canals or ditches. However, time and financial constraints permitted an adequate survey of only four. The remaining nine canals require survey and research to determine the significance, location, quantity and quality (integrity) of resources distributed along these linear features. In addition, survey work related to the Walker Basin canal system and its features needs to be conducted. A compilation of information on other defunct and small ditch systems, such as the Suttle Lake and Snow Creek/Three Creeks project also would be worthwhile. Moreover, research to fully identify individuals significant in irrigation history, and to analyze and document their contributions, should be conducted. The identification of their homes and offices would add greatly to our knowledge. Early farm sites, particularly those first receiving water from a system, and flume mill sites should receive additional research. Local governments and the State should encourage further survey and research to augment the findings presented in this report. Grants for such projects are available through the State Historic Preservation Office (SHPO).

Resource Types. Local governments and the SHPO should support further research on "Irrigation Project" type resources. More remains to be learned regarding the character defining

characteristics and the distribution patterns of the various types. This would facilitate comparisons between both local and statewide examples and serve to better identify "best" examples for assessment purposes.

As a resource so closely integrated with the development of the region and the state, there is very little known and much to be discovered. Contextual studies on engineering, technology, construction and development of dams, canals, flumes, siphons and other linear features should be conducted. A statewide historic context statement for irrigation development, similar to those prepared on Oregon's agricultural development and on railroad logging in Oregon should be a priority of the State Historic Preservation Office. This report serves as a starting point.

Related Study Units. Research should also be conducted, with appropriate historic contexts developed, on related study units. A list of the many themes interwoven with irrigation development is presented in Section II, Part H. Priority topics include: Colonization, City Formation and Development, Flume Lumber Mills, State and Federal Irrigation and Water Policies, Early Irrigation Practices on Farms and Ranches, Public Land Development, and the Grange Movement.

Archaeological. Archaeological survey and research should also be considered for sites that are likely to yield information important in our history. Lost structures, objects and artifacts related to irrigation development and linked to human activity through events, construction, settlement and other facets of development offer significant informational and interpretive possibilities. Potential sites include: the Old Pilot Butte Canal area; the Dry Canyon Flume site; Deschutes Project sites, such as the Crooked River Flume, Sherwood Canyon Siphon and Smith Rock Tunnel areas and Camps Redmond and Wickiup; Tumalo Project sites; the Pilot Butte and Central Oregon canals; flume lumber mill sites; the Walker Basin; and some of the early farms first receiving water.

C. INTERPRETIVE EXHIBIT OPPORTUNITY

The preparation of this historic context document provides the background to develop a unique, interactive multi-media interpretive exhibit. Such a project could be conducted in Bend at the Des Chutes Historical Center or The High Desert Museum or in Portland at the Oregon History Center. Interest in the exhibit would bring together a multi-disciplinary team, providing for an accurate, educational and interesting interpretive experience. Historians, geographers, irrigationists, federal agency managers, exhibit design and interpretive specialists, and engineers might be involved.

Irrigation development as a strong unifying theme offers potential for a multi-faceted exhibit with sub-themes addressing a number of intriguing aspects. Sub-themes could include irrigation philosophy and ideology, federal irrigation acts, irrigation development under the acts, the Upper Deschutes River Basin from a national perspective, colonization and city formation, types of resources, early construction techniques, and significant individuals. As water rights and river use issues move to the forefront of public discussion, there exists an exciting opportunity to interpret them juxtaposed with historical events. A topographical map with various dams, canals and other features could provide locational context. A variety of historic and present day photographs could link the past with the present. Publications, speakers, slide shows and other programs might accompany the exhibit. If constructed for travelling, the

exhibit could educate other regions of the state as to an important and interesting aspect of local and state history, possibly encouraging support of preservation activities. Encouraging visitorship to the area might also be accomplished.

D. DEVELOPMENT OF TRAIL SYSTEMS

Possibly the greatest opportunity afforded by irrigation systems to Deschutes County, the cities of Central Oregon and the state is the development of several trail systems. Three irrigation systems have been identified as potential linear corridors: North Unit Canal, North Canal/Pilot Butte Canal, and Central Oregon Canal. Opportunities for outdoor recreation, such as hiking and mountain biking; historic, cultural and natural resource education and interpretation; auto trip and pollution reduction, and other benefits abound.

Research. Research indicates the development and use of roadways along these canals for trails could satisfy a variety of recreational and community needs. *The Pacific Northwest Outdoor Recreation Consumption Projection Study: Oregon Project* (1989) developed three scenarios for demand for recreational activities. Federal agencies, including the Forest Service and Bureau of Land Management, and the State of Oregon are using the data. The *Oregon Outdoor Recreation Plan 1988-1993*, prepared by the State Parks and Recreation Division, adopted recreational activity projections based on the "moderate" scenario. Table V D-1 presents projected growth under the "moderate" scenario for the years 2000 and 2010 for activities that may be associated with potential trails along historic canals.

TABLE V D-1

PROJECTED GROWTH OF RECREATIONAL ACTIVITIES ASSOCIATED WITH TRAILS REGION 10, YEARS 2000 AND 2010 UNDER "MODERATE" SCENARIO (BASE YEAR 1987)

ACTIVITY	PROJECTED GROWTH %	
	YEAR 2000	YEAR 2010
Nature Study & Wildlife Observation	157	432
Outdoor Photography	86	249
Day Hiking on Trails	95	292
Cross Country Skiing & Snowshoeing	38	71
Bicycling On the Road	118	352
Bicycling Off the Road	40	119
Horseback Riding	19	45
Sightseeing & Exploring	41	99
Interpretive Activities	48	145
Picnicking	38	93

Source: *The Pacific Northwest Outdoor Recreation Consumption Projection Study: Oregon Project*, (1989) (Hospodarsky)

Though the figures should be integrated with other information, they represent applicable and reasonable projections. There are several aspects to consider, however: (1) the growth figures include only Oregon residents and do not integrate out-of-state recreationists. Studies for Deschutes County, Deschutes National Forest and the Central Oregon Recreation Association indicate that over half of the area's visitors are from out-of-state;[1] (2) the expected growth is distributed across eight counties--Deschutes, Jefferson, Crook, Wheeler, Wasco, Sherman, Gilliam and Hood River--defined in the model as Region 10. A higher growth rate in Deschutes County, a premier state visitor destination, and a county where visitor spending is about 43 percent higher than the statewide average, is a reasonable assumption.[2]

The *Oregon Travel and Tourism: Visitor Profile, Marketing and Economic Impacts* report prepared for the Oregon Tourism Division in 1989 listed activities and participation rates by both Oregon residents and out-of-state visitors. Several activities may be associated with potential trails along historic canals. Table V D-2 summarizes the report's findings derived from survey data.

TABLE V D-2

PARTICIPATION RATES FOR OREGONIANS AND OUT-OF-STATE VISITORS FOR ACTIVITIES ASSOCIATED WITH HISTORIC TRAILS

ACTIVITY	OREGONIANS (%)	OUT-OF-STATE (%)
Hiking	37.0	35.7
Visiting Historic Sites	32.8	44.8
Wildlife Viewing & Study	25.8	24.8
Picnicking	48.5	35.5

Source: *Oregon Travel and Tourism: Visitor Profile, Marketing and Economic Impacts.* (1989) (Runyan)

Data collected during the 1990 U.S. Census shows Central Oregon residents utilizing a number of modes of transportation to get to work. Though far behind the number driving to work, the number using transportation modes associated with trails and pathways, such as walking and bicycling, warrants attention. The additional number who would select these alternative modes if there were pathways without auto and truck traffic is unknown. Table V D-3 summarizes the number of residents reporting walking or bicycling to work.

TABLE V D-3

TRANSPORTATION TO WORK FOR WORKERS 16+
MODES ASSOCIATED WITH TRAILS/PATHWAYS

MODE	DESCHUTES COUNTY (Uninc)	BEND (City)	REDMOND (City)	TOTAL
Bicycling	418	262	18	699
Walking	1,146	497	160	1,803
Total	1,564	760	178	2,502

Source: *Selected Data from the 1990 Census of Population and Housing STF3A.* Center for Population Research and Census. Portland State University.

Other studies indicate a wide and diverse interest in visiting historic sites. A study by the National Tour Association found that visiting historic sites (known as "heritage tourism") was the favored form of vacation touring among Americans 55 years of age and older; the largest and most significant demographic group for tourism. The U.S. Travel Data Center reported, in 1992, that 51 percent of family vacationers who intended to travel that year with children planned to visit historic sites. A 1993 *Better Homes and Gardens* magazine study found 34 percent of the survey's respondents visiting historic sites. The National Travel and Tourism Awareness Council reported that 33 percent of the over 17 million international visitors to the United States visited historic sites in 1993.[3]

Trail Potential. The Oregon Recreational Trails System is a state trails program for hiking, horseback riding and bicycling. Local examples include the Metolius-Windigo and Pacific Crest to Desert trails. A goal of the program is to provide non-motorized connector trails from metropolitan areas to the mountains and desert. To a certain extent, the North Unit Canal system could serve as a linear corridor for a 65-mile trail system from Madras to Bend. At present the road along the canal is the best maintained of all canals investigated. The canal runs through rural farm land, government-owned land, and across scenic vistas, including the Smith Rock area. A number of sites would provide significant interpretive opportunities, and several sites appear appropriate for the development of camping facilities. Connections with county and state roads and tourist facilities would easily be made.

The North Canal/Pilot Butte Canal offers a somewhat similar opportunity. The road along the canal is narrower than that along the North Unit, is thick with vegetation in places and currently ends in the Cinder Butte area north of Redmond. Opportunities for hiking, biking, sightseeing, photography, nature study and other activities are multiple. Hundreds of rapids and many majestic water falls characterize the Pilot Butte Canal. The waterway traverses some of the most challenging topography of any irrigation system in the area, perhaps the state. Roadway elevation changes, however, are minimal. The length is about 20 miles. A trail developed along the canal would serve primarily those living or visiting in Bend or Redmond. Much of the trail would probably receive its highest use on weekends. However, in the Redmond area, the trail would serve as a generally north-south route through the urban area. A roadway along the canal, in the urban area, does not exist for much of the length or, if it does, it is somewhat narrow and thick with vegetation. Canal Boulevard, however, follows a significant length of the canal. A pathway would provide many benefits to the rapidly growing community.

The Central Oregon Canal offers a beautiful beginning point along the Deschutes River, an east-west corridor through the area south of Reed Market Road in Bend and a connection with Highway 20, east of Bend. A trail along the canal would primarily serve Bend residents and visitors. Connections to roads and streets and other trails would be imperative and, for the most part, easily made. At present, the roadway is generally well maintained and of sufficient width for multiple uses. Its potential for serving the growing bicycling population of Bend and reducing auto trip and auto pollution is apparent. It, too, provides waterfalls and rapids. Past Highway 20 private ranches could deter a longer route to Alfalfa and Powell Butte. However, portions of the system within federal lands might be developed.

Easements. The use of easements as tools to develop trails along canals should be explored. Means to address property owner concerns are paramount to any canal trail project.

An easement is a partial interest or right in a property which is less than the full, or fee simple, interest. Typically, the rights or interests conveyed by an easement are only those needed to protect specific resources; all other rights remain vested in the landowner. Easements may be acquired by purchase, exchange, will, or eminent domain, but usually they are acquired by gift.

Easements protect a variety of resources. Conservation easements protect environmental and natural resources. Historic preservation easements protect historic properties. Other resources are protected by open space, scenic and agricultural preservation easements. Another type of easement, a right-of-way or access easement, is held by the irrigation districts, providing for access to facilities. A conservation easement is often used for trails along linear corridors. This helps reduce land costs since trails do not require large blocks of land.[4]

National organizations such as the Nature Conservancy, the National Wildlife Federation and others accept donations of easements. A number of government agencies have the authority to accept or buy easements. Local and regional land and historic preservation groups are often excellent recipients and subsequent administrators of conservation easements. In Oregon, a non-profit organization, the Historic Preservation League of Oregon, operates an easement program for resources listed in the National Register of Historic Places.

Advantages of easements to the grantor can be considerable. Usually, sale or donation of conservation easement rights entitles the landowner to significant tax benefits. Most land is worth something less on the market when development rights have been restricted, so property taxes are reduced. Also, a deduction of the value of a conservation easement, donated to a government agency or to a tax-exempt, charitable organization for perpetuity, is allowed by the Internal Revenue Service for federal income tax purposes. Additionally, when a landowner dies, the land is appraised to determine federal and state estate taxes. Because the value of the land protected by the easement is less than its fair market value, estate taxes are generally lower, to the degree that the easement limits development.[5]

Liability. Issues of property owner liability are usually raised when the development of recreational facilities is considered. A brief review of Oregon's statute which grants immunity to private landowners who open their land to the public follows.

In 1971, the legislature adopted the Public Recreational Use of Private Lands Act, which is codified in ORS 105.665-105.680. The operative section of that statute is ORS 105.675, which provides as follows:

> (1) An owner of land owes no duty of care to keep the land safe for entry or use by others for any recreational purpose or to give any warning of a dangerous condition, use, structure or activity on the land to person entering thereon for any such purpose.
>
> (2) An owner of land who either directly of indirectly invites or permits any person to use the land for any recreational purpose without charge does not thereby:
>
> (a) extend any assurance that the land is safe for any purpose;

(b) confer upon such person the legal status of an invitee or licensee to whom a duty of care is owned; or

(c) assume responsibility for or incur liability for any injury, death or loss to any person or property by an act or omission of that person.

This statute was adopted by the Oregon legislature to facilitate the use of property and structures for recreation. Under ordinary liability laws, any property owner would have liability to anyone he invited on the property or structure or allowed to use the property if there was a danger that could not be readily seen by such a user. In an effort to open up land and structures to public use, the legislature recognized that the single biggest impediment to such use would be the typical landowner's liability laws. For that reason ORS 105.665 was adopted to grant immunity to the owners of such property or structures when those properties or structures are opened to the public.

The only exceptions to the immunity from liability occur when the owner of the land or structure engages in wilful, wanton or reckless conduct or fails to warn against a "known dangerous structure or other improvement or a known dangerous activity on the land". The only other exception to the immunity occurs when the public is charged a fee to use the structure or land.

When the statute is analyzed in conjunction with the canal systems it is apparent that any property owner could preserve immunity from any liability provided a fee was not charged to the public and provided signage was offered for any "known dangers". The statute itself eliminates the need for the landowner to offer signage for any obvious dangers. The only liability to the landowner for not posting signs on a property or structure is if a failure to post such signs would be deemed wilful, wanton or reckless. Thus, most signs would not have to be placed to warn people of danger that is obvious. The only type of signage that would be required under the statute would be if the owner knew there was danger that was not obvious. In that case, such signage would be appropriate under the statute. However, the purpose of the statute was to eliminate nearly all the normal signage requirements that exist under ordinary liability laws.[6]

Grants. Grant funding for trail development is available from a variety of sources. The most encouraging source is funds available under the federal government's Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA). The Act's goal is to develop a balance between transportation facilities and services and other cultural, social, environmental and energy needs. The Oregon Transportation Commission administers the Transportation Enhancement Program. Activities eligible for funding fall into ten categories:

1. Provision of facilities for pedestrians and bicycles;
2. Acquisition of scenic easements and scenic or historic sites;
3. Scenic or historic highway programs;
4. Landscaping and other scenic beautification;
5. Historic Preservation;
6. Rehabilitation and operation of historic transportation buildings, structures, or facilities (including historic railroad facilities and canals);

7. Preservation of abandoned railway corridors;
8. Control and removal of outdoor advertising;
9. Archaeological planning and research; and
10. Mitigation of water pollution due to highway runoff.

A number of bicycle and pedestrian trail projects in Oregon have been funded, including a canal bicycle trail project by the Bend Metro Parks and Recreation District. Clearly, projects related to canal trails are eligible under the provisions of the ISTEA program. Between $4 and $6 million is expected to be available for projects in Oregon each year. Pedestrian and bicycle projects require a 20 percent non-federal match. Other activities, such as easement acquisition, require a 10.27 percent match.

Another source is the Historic Preservation Fund grants available through the State Historic Preservation Office. Funds may be used for a variety of projects including surveys, inventories and evaluation of historic resources; for planning and educational activities related to preservation activities; and for pre-development and development projects. Priority is given to projects that seek to implement programs developed in existing historic context documents, such as this report. An engineering or feasibility study, for example, could be conducted. Grants are awarded on a 50 percent reimbursable basis (50/50 match). Most grants are in the $5,000 to $15,000 range.

A third source is the Preservation Services Fund available from the National Trust for Historic Preservation, a non-profit organization. Eligible activities include hiring consultants to undertake planning or design projects. Maximum grant awards are $5,000 and must be matched on at least a dollar-for-dollar basis. The Trust also offers below-market rate loans up to $150,000 to non-profits and public agencies to help preserve historic resources listed in or eligible for the National Register of Historic Places.

Though not a grant program, the Trust for Public Land works with the National Trust for Historic Preservation and/or local organizations to preserve historic sites. Generally, the way the Trust operates is to purchase a property and enter into an agreement with a public agency or non-profit organization for later repurchase of the property from the Trust. In the last several years the Trust has expended million of dollars in Oregon. Recent purchases of historic sites along the Oregon Trail are examples.

The State of Oregon has approximately a dozen programs that assist in providing outdoor recreational lands and facilities. A few of these include: the Bikeway Fund, Land and Water Conservation Fund, State Grant-In-Aid Program, County Campground Grant Program, and the Oregon Community Development Block Grant Program. Eligibility, grant cycle, and contact agency information is available from the State Parks and Recreation Division.

Funding opportunities expand when partnerships with federal agencies, such as the Forest Service and the Bureau of Land Management, can be established. The Challenge Cost-Share Program, Windows On The Past, Adventures In The Past and Trails West significantly increase the funding options. The canals cross or are adjacent to federal lands in a number of locations. Trails connecting urban areas with federal lands and partnerships with urban publics have received support from both agencies.

Partnerships. The development of one or more trail systems along the canals would require partnerships in a number of areas besides funding. Multi-agency, multi-county, and multi-city relationships with assistance from non-profit and volunteer organizations would be needed. In addition to funding, partnerships would address the range of recreation and preservation management activities, including development and maintenance of the system and facilities, recreation services, information and interpretation. Partnerships would advance programs and activities to better meet the preservation and recreation needs and interests of the area's residents and its visitors.

E. HISTORIC LINEAR DISTRICTS

The National Register of Historic Places recognizes buildings, sites, districts, structures and objects. Both canals and entire irrigation systems can be treated as a district. "A district possesses a significant concentration, linkage, or continuity of sites, buildings, structures or objects united historically or aesthetically by plan or physical development."[7] It is a unified entity that derives its identity from the interrelationships of its resources. A canal or irrigation system may be eligible for the Register as a district even if all of the features "lack individual distinction, provided that the grouping achieves significance as a whole within its historic context"[8] and provided that the district possesses integrity as a whole.

The Certified Local Government should actively investigate the potential for listing the three canals discussed in this section of the National Register. Listing provides many benefits, including tax advantages, increased funding options and public recognition and interest. Listing of a district requires permission of the majority of the property owners. Initially, a determination of eligibility should be sought from the State Historic Preservation Office. Following the determination and public discussion, a nomination could be prepared. Additionally, the State Historic Preservation Office should give high priority to the solicitation of irrigation-related nominations to the National Register. No irrigation-related resources from Oregon are currently listed.

F. OTHER TREATMENT ACTIVITIES

A number of other activities should be undertaken by the local governments:

1. HABS/HAER Documents. HARS/HAER documents should be prepared on canals, dams and other structures. These documentation projects undertaken by the Historic American Buildings Survey/Historic American Engineering Records of the National Park Service include measured drawings, large-format photographs and a written history of historic sites. All materials reside in the HABS/HAER Collection in the Library of Congress. HABS is the oldest federal agency devoted to historic preservation, established in the 1930's as part of the Depression-era makework programs. Grants for such projects are available and many are conducted by university historic preservation program students.

2. National Register Information. Owners of properties determined eligible for the National Register of Historic Places or found eligible by this report should be notified. Information on the program and associated tax benefits should be mailed.

3. Determinations of Eligibility. In 1989, the Bureau of Reclamation contracted with consultants to evaluate and determine the eligibility of Crane Prairie Dam and Wickiup Dam for the National Register of Historic Places. The consultants concluded that Wickiup was eligible, but that Crane Prairie was not. Subsequently, the State Historic Preservation Office determined that neither dam was eligible. Local governments should request another review of the data.

   In addition, local governments should seek a determination of eligibility of structures located along the North Unit Canal by the Bureau of Reclamation, the State Historic Preservation Office and the North Unit Irrigation District. Structures recommended for review are the Crooked River Flume, the two Smith Rock Tunnels, and the Sherwood Canyon Siphon, all c. 1945. The Willow Creek Canyon Siphon could also be evaluated at that time.

4. Parkway Canal Mitigation. The Oregon Department of Transportation has agreed through the Bend Parkway Environmental Impact Statement to provide mitigation measures with respect to impacts to canals by the project. The Department will conduct on interpretive signage program at the North Canal Dam in conjunction with the Deschutes County Historical Society. During the 1993-1994 winter, portions of several canals were placed in underground watercourses. The local government should seek to initiate the signage program immediately.

5. Memorandum of Understanding. Where appropriate, or non-existent, Deschutes National Forest should seek to establish a Memorandum of Understanding, or an appropriate programmatic agreement, with the Bureau of Reclamation to address preservation issues. Sites to consider include: Crane Prairie, Wickiup, and Crescent Lake dams. The Memorandum of Understanding is the simplest instrument used to sanction partnership agreements that do not entail exchange of funds, goods or services.

6. Notification of Findings. A copy of this report with a cover letter outlining the findings should be sent to Crook and Jefferson counties and to the irrigation districts.

7. Goal 5--Historic Designation. Where appropriate local governments should move forward with the Goal 5 process to designate significant resources as historic resources within the Comprehensive Plan. The twenty-two sites found eligible for the National Register (Table IV C-1) should be added to the appropriate Goal 5 Inventories. In 1994, Deschutes County, the Tumalo Irrigation District and the Deschutes County Historical Landmarks Commission cooperatively and successfully prepared a "Conflicts Analysis and ESEE Determination" for two Tumalo sites: (1) Tumalo Creek Diversion Dam and Headgate of the Feed Canal, and (2) Bull Creek Dam. The document outlined a process for protecting the sites, while enabling the district to operate and maintain the facilities without encumbrances or hardship. Similar documents, as appropriate, should be developed for other sites determined to be significant under Goal 5. A new, more holistic approach is outlined in the following portion of the report, part G, "A Final Observation," for linear corridors, such as canals.

G. A FINAL OBSERVATION

Historic linear corridors are diverse and complex resources. What type of treatments, or preservation strategies, to employ to protect these vital links to our past is not easily answered. To simply utilize a strategy appropriate for a building would be shortsighted and naive. Their management requires a new, holistic approach.

A linear corridor is more than a group of individual parts to consider in terms of preservation and integrity. It is an assemblage of features joined together by a "thread" of space and time to create an experience. Corridors are historically and aesthetically significant as whole entities because of what they represent, not because of individual features. A single phrase or image does not capture the essence of a linear corridor. There are many phrases and many images. We do not just experience a "sense of place" as we travel along a linear corridor, we experience many places and a multitude of sights, sounds, motions and emotions.

So, what is the answer? The answer lies somewhere in defining the experience and in preserving the essential elements of that experience while allowing these corridors to exist in an environment of continual change. The fact that a canal may change over time or that a feature at a particular location is not the one built during the historic period, may not be relevant to the experience one might still find hiking or bicycling down the corridor. Care, however, must be taken to maintain the historic associations that define the experience and the elements that give it meaning.[9]

The answer needs to be found. Local governments, the State, property owners, irrigation organizations and the public must work together to find it. The resources are much too valuable to do otherwise.