UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

WILLAMETTE RIVER BASIN STUDY

Supplemental Report to the

WILLAMETTE RIVER BASIN COMPREHENSIVE

INTERAGENCY Type II STUDY

by

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June 1968

WILLAMETTE RIVER BASIN STUDY

BLM Supplemental Report

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A Comprehensive Watershed Management Plan for BLM Lands in the Willamette River Basin, Oregon

A Supplement to the Comprehensive Willamette River Basin Study

I. Summary

A. General

1. The objective of this report is to provide a broad guide to the apparent best use, or combination of uses, of water and related land resources on BLM lands in the Willamette Basin to meet foreseeable short and long term needs.

2. Consideration is given to the timely development and management of these resources as essential aids to the economic and social development and growth in the Willamette Basin.

3. Consideration is given to preservation of resources such as land, water, wildlife, natural beauty, recreation sites, and the forests to insure that they will be available for their best use as needed.

4. The well being of the people is the over-riding determinant in this study.

5. Impact studies are presented showing the extent to which proposed water impoundments will affect BLM resource management programs.

6. Recommended BLM programs reflect correlation of BLM's program with present and future programs of other public agencies and private endeavor.

7. No cost-benefit analysis of proposed BLM programs is presented because of the preponderance of social benefits to be derived for which there is as yet no satisfactory yardstick for value.

B. Forest Watershed Management

1. Wood fibre processing is the major industry of the basin and is the mainstay of the local and regional economics.

2. There will be continued nationwide demand for lumber, plywood, paper, and pulp from the Pacific Northwest.

3. In the period from 1985 to year 2020 there will not be sufficient privately owned timber stumpage to maintain the existing wood fibre industry of the Willamette Basin.

4. In the public mind BLM's management objectives appear more heavily committed to production of wood fibre [1/] as contrasted to the Forest Service concern with general resource conservation. This idea is supported by the fact that 3 of the 5 major purposes in the Secretary's policy statement (Department Manual 585.1.2) have to do with the timber resource. This policy may be justified in that the O&C lands are found on the prime timber growing sites of the basin while the Forest Service lands lie at higher elevation with poorer site values but more important for recreation and water production.

5. The anticipated continued rise in timber stumpage prices into the future warrants greater investment to accelerate production of wood fibre by such measures as prompt seeding after harvest, fertilization, and irrigation of appropriate areas.

6. BLM can best contribute to the economy of the area by programing for and initiating forest management measures beamed at making maximum supplies of stumpage available to sustain industry during the "lean" stumpage years from 1985 to 2020. By 2020 sufficient second growth timber will have become merchantable on private lands to supply much of the stumpage demand.

7. Recreation funding should be made available to carry its share of access road construction and maintenance costs.

8. An accelerated access road construction program is needed to make possible more effective insect and disease control and expedite the salvage of mortality loss in mature timber.

C. Range Management

1. The forest lands of the Willamette Basin have little value for livestock grazing. Many counties have herd laws keeping stock from running at large.

2. The Federal Water Pollution Control Administration has identified biotic pollution of streamflows by livestock as a major pollution problem. Use of BLM lands for grazing is limited by the need for expensive investment in fencing to keep stock out of the streams.

3. Increasing hunter demands warrant giving priority to wildlife for use of the limited forage available on recently cutover land.

1/ "Forest Land Policy in the Willamette Basin", Oregon Dept. Commerce, Div. Planning and Development 1965

D. Recreation

1. Recreation and tourism is the third largest industry of the State and is classed as an export industry.

2. There is obvious need for development of additional day use recreation sites on BLM lands in the Willamette Basin due to its proximity to population centers.

3. There is a serious shortage of water based recreation opportunity in the lower portion of the basin, especially west of the Willamette River.

4. There is a considerable amount of BLM land frontage on the streams of the basin. The need is to provide road access and sanitary facilities to satisfy immediate public needs.

5. There is a critical need for recreation specialist positions in both the Salem and Eugene Districts to give the needed technical guidance in recreation resource protection, development, and management.

6. Future access road planning should be modified to the extent possible to meet current and future recreation needs.

E. Minerals

1. Except for limited occurrences of rock and gravel on the BLM lands there are no known valuable minerals. Potential for commercial use of the extensive deposits of ferruginous bauxite and kaolin clays has not been proven. Many mining claims have been located on BLM lands for this type material.

2. P. L. 167 actions have been taken on all areas where mining claims are known to exist on BLM lands for resolving surface management responsibilities. This amounts to about 21% of the BLM acreage.

3. Preparation of a mineral inventory is underway to catalog and map the types and locations of minerals in the basin.

F. Water

1. Because BLM lands lie below the snow pack zone, there is little opportunity for management of BLM lands to control the timing or amount of water runoff.

2. BLM's resource management activities can have a major impact on water quality, especially as to sedimentation, biotic and chemical contamination, and water temperatures.

3. There is opportunity for BLM to improve its flood damage control program by yarding all cull logs and debris away from streams, draws, and ravines that may carry flood water flows. Much of the damage from floods in the basin is caused by debris in the water.

4. There is need for a water resource management staff man to review the districts' programs for road construction and maintenance, proposed timber sales, and proposed recreation developments.

5. Soil surveys are needed on the BLM lands as basis for an effective watershed management program. Soil surveys have been initiated in the Eugene District, and the work should be extended to cover the balance of the BLM land. An initial reconnaissance survey finds that there are extensive areas of unstable soils in the forest areas which could cause serious water quality problems if improperly roaded or logged. There are also highly stable areas of mountainous land where few watershed management precautions are needed in harvesting the timber.

6. Soil survey interpretations and guidelines for management are needed relating soil type to the amount of soil erosion to be expected as result of different logging practices and road building and maintenance practices.

G. Open Space and Natural Beauty

1. Most of the BLM land in the basin lies within the recreation day use zone of the major metropolitan areas of Portland, Salem, and Eugene.

2. Economic projections over the next fifty years predict that the urban growth will take place on the agricultural lands and have little direct impact on the forest lands of the basin. This means that the forest lands must provide most of the open space and natural beauty opportunities.

3. BLM is found to have many miles of land frontage on public roads in the basin, providing a good opportunity for natural beauty management. Currently only 24 miles of road frontage in the basin has been classified as a Natural Beauty Area.

4. Because driving for pleasure constitutes one of the major forms of outdoor recreation it is probable that all BLM lands on public roads in the Lower Willamette Subarea will have value as Natural Beauty Areas by 1980. Current and future timber harvest in this area should be done with this in mind.

5. Future congestion on public highways will force more and more people onto BLM roads for their Sunday drives. Single purpose roads for log hauling on public lands will soon be obsolete.

H. Fish and Wildlife

1. The many miles of stream frontage on BLM lands provide extensive fish habitat and spawning areas.

2. Anadromous fish spawning areas are of great importance to both the commercial fishery industry and sports fishery. Spawning areas are found to have a tremendous value per acre for fish production, warranting special protective measures in other resource management.

3. The BLM access road program opens up new areas for hunters. In the fall of the year the major use of many of these roads is for hunting. Much of this use takes place after start of the fall rains resulting in severe damage to and erosion from unsurfaced roads. The effects caused by increasing recreational traffic should be a consideration in road standards for multiple use concepts and in programing for maintenance funds.

4. Posting boundaries of the BLM lands is needed to aid hunters and other recreationists to find lands open to public use.

5. Wildlife management specialists are needed in the district offices to develop positive programs for wildlife and fisheries' habitat management.

6. There is immediate need for identification and classification for protection of those key or critical portions of game ranges and choice fish habitat or spawning areas.

7. The districts should program for adequate annual stream clearance and improvement projects on those streams valuable for anadromous fish.

I. Lands

1. BLM timber lands in the Willamette Basin have an estimated value of $224,472,820. Recreation lands have much higher per acre value, and anadromous fish spawning areas are found to have values of at least $185,000 per acre, based on annual smolt production values.

2. Projected tripling of population of the basin within 50 years anticipates urban expansion onto agricultural lands with little demand for residential use on forest lands other than for summer homes.

3. Only 19,000 acres of the BLM land in the basin is Public Domain subject to the many public land laws, most of which is in the Salem District. A pending withdrawal dated July 17, 1962, O-012693, would remove these lands from entry except under the mining laws, issuance of leases and permits, and rights of way, and disposal of forest products. The withdrawal leaves the land open to disposition on Bureau motion, other than for agricultural use or scrip satisfaction.

4. A large scale exchange program to block up the BLM lands in the basin is neither practical nor altogether desirable.

5. The BLM land acreage is subject to continual depletion for uses other than timber production, such as power line rights of way, large reservoir impoundments, municipal watersheds, public highways, and recreation developments.

6. There is immediate need for formal withdrawal of all developed and identified potential recreation sites from acquisition under the mining laws. This action should be extended to cover identified valuable anadromous fish spawning areas, critical wildlife habitat areas, and municipal watershed lands.

7. Intensive effort at cooperation with county officials is needed to secure needed zoning to protect natural beauty and other resource values.

8. There is found to be an insignificant problem of fractional interests on BLM lands in the basin except for mining claim locations.

9. Public pressures on BLM land and water areas will reflect a fourfold increase in personal income by year 2020. Heavy impact will also be felt from a shorter work week, better roads, and increased numbers of retired people.

LOCATION MAP
WILLAMETTE RIVER BASIN
OREGON

OCTOBER 1964

SUBBASINS

UPPER WILLAMETTE AREA

1 Coast Fork

2 Middle Fork

3 McKenzie

4 Long Tom

MIDDLE WILLAMETTE AREA

5 Santiam

6 Coast Range

7 Pudding

LOWER WILLAMETTE AREA

8 Tualatin

9 Clackamas

10 Columbia

11 Sandy

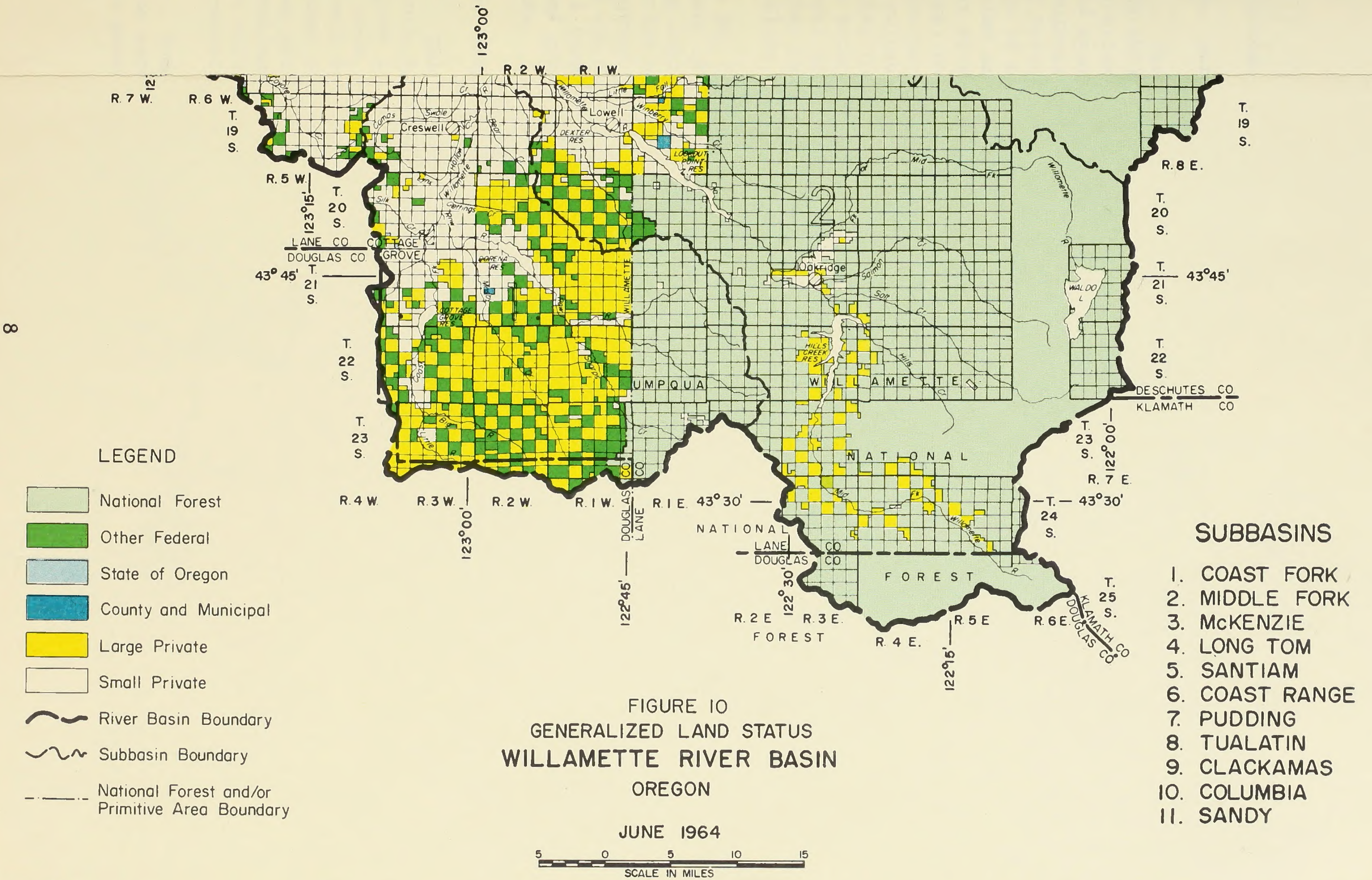
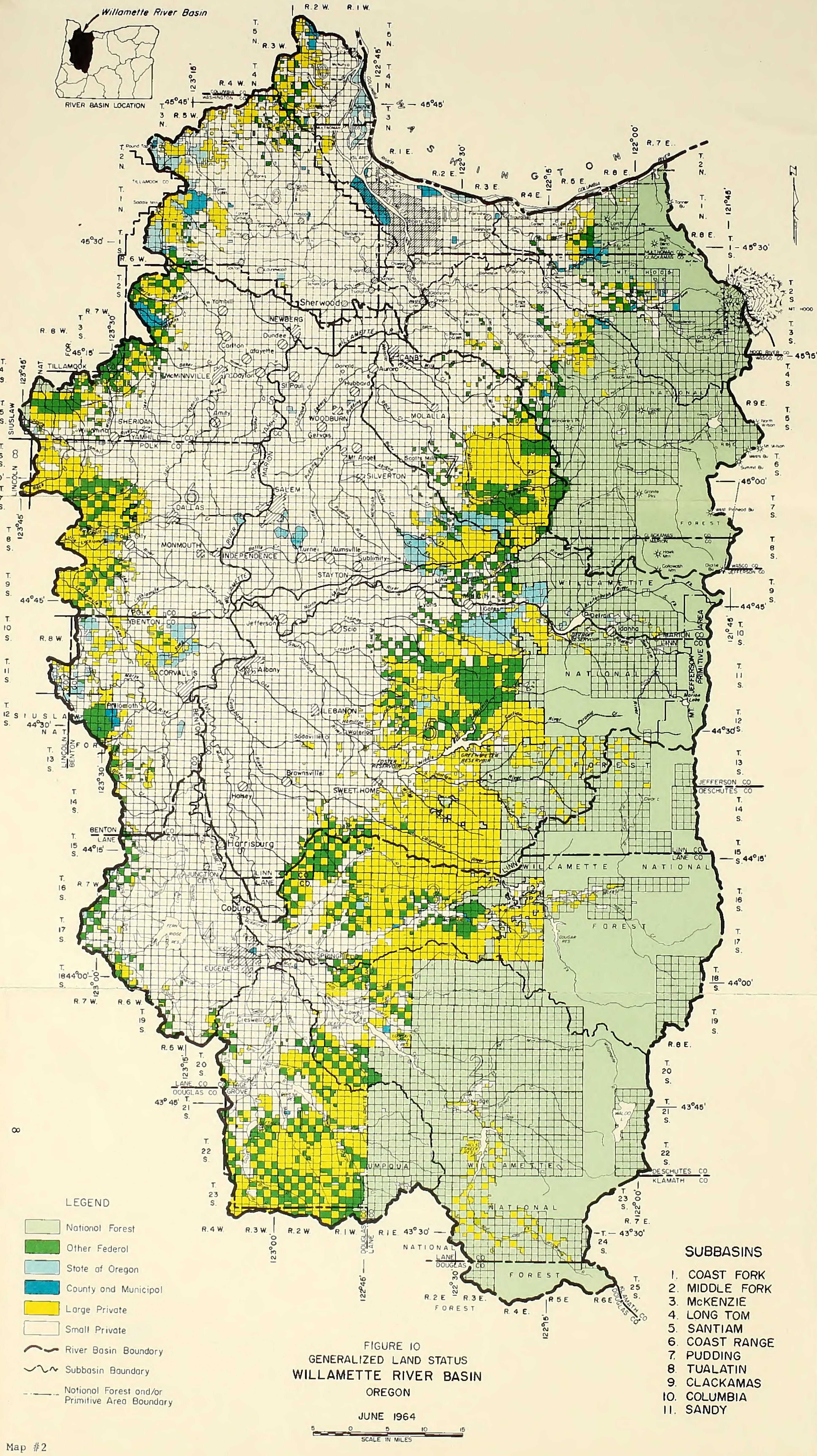


FIGURE 10
GENERALIZED LAND STATUS
WILLAMETTE RIVER BASIN
OREGON

JUNE 1964

Map #2



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II. Introduction

A. Authority

The Classification and Multiple Use Act of September 19, 1964 (P.L. 88-607), and the O&C Act of August 28, 1937 (50 Stat. 874), require consideration of multiple resource use by the Bureau of Land Management in its land management program. The Water Resources Planning Act, P.L. 89-80, 89th Congress, July 22, 1965, provides for the means of full collaboration between States and the Federal Government in comprehensive planning for the best use of water and related land resources. The Federal Water Project Recreation Act, P.L. 89-72, 89th Congress, July 9, 1965, provides for uniform policies with respect to recreation and fish and wildlife benefits and costs of Federal multiple purpose water resource projects having either national or less than national significance. The Act specifies that some project areas may be suitable for Federal administration "...as part of the public lands classified for retention in public ownership....." The Secretary is authorized to enter into agreements with, or to transfer project land or facilities to Federal agencies "...as will best promote the operation of such lands or facilities in the public interest for the enhancement of recreation and fish and wildlife facilities."

On June 28, 1963, the Secretary of the Interior directed cooperation of Department of the Interior agencies in river basin planning. The assignment is being implemented through the Director, Resources Programs; the Assistant Secretaries of the Interior; the Regional Coordinators; the Columbia Basin Inter-Agency Committee; the Willamette Basin Task Force; and the participating Federal and State agencies. The Willamette Basin Inter-Agency study is both a Type I framework study and a detailed Type II study, with recommended projects and programs to make better use of the basin's water and related land resources.

B. Purpose and Scope

This report is supplemental to the Comprehensive Willamette River Basin study being prepared by the Willamette Basin Inter-Agency study team. Its purpose is to present a description of the unappropriated and revested public lands in the basin and show their relationship to the economy and social well being of the people in the area. The needs and potential for development of the resources on these public lands are presented to the degree that they are pertinent to the water and related land resources of the basin. Major problems in the use and management of the forested watershed are presented, together with a description of projects or programs needed to overcome existing or potential watershed problems.

Federal construction agencies are investigating a large number of sites for water impoundments for flood control, irrigation, recreation, and other purposes. A total of 185 of these sites lie in areas where BLM has

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Federal construction agencies are investigating a large number of sites for water impoundments for flood control, irrigation, recreation, and other purposes. A total of 185 of these sites lie in areas where BLM has management responsibilities. Only 127 of these appear to have current development potential, 44 in the Eugene District and 83 in the Salem District. Studies are being made to determine the impact of these projects on the BLM resource management programs, resources and facilities. This report also reflects the comprehensive planning needed to provide modified or accelerated programs, projects, and facilities to mitigate losses from water projects or to complement the water projects by appropriate upstream treatment measures. Often the water development project enhances site value for recreation or wildlife, providing opportunities for new programs in the area. The tremendous recreational attraction of such developments involving BLM lands requires major modifications in BLM programs to meet the new responsibilities to provide for public needs and prevent pollution and contamination of these areas.

There are 422,767 acres BLM managed lands in the basin. Of this 29,157 acres are remnants of the Public Domain and 393,610 acres are revested O&C Grant lands. The O&C Act of August 28, 1937 (50 Stat. 874) provides that the O&C lands "...shall be managed for permanent forest production -- in conformity with the principle of sustained yield for the purpose of providing a permanent source of timber supply, protecting watersheds, regulating stream flow, and contributing to the economic stability of local communities and industries, and providing recreational facilities." These lands are now classified for timber production, making them unavailable under the agricultural land laws. Except for small areas reserved for recreation and administrative purposes, these lands are subject to entry under the general mining laws. The small acreage of public domain lands in the basin has been incorporated into the BLM district forest management units for blocking up of ownership and to provide access to the O&C lands. The public land status of these tracts is stabilized by BLM withdrawal application recorded July 17, 1962. Recordation of this proposed withdrawal on the public records of the Oregon Land Office segregates the land from private entry. The withdrawal does not preclude issuance of rights-of-way easements or preclude use of it as basis for exchanges to block up ownership.

A primary purpose of this report is to develop a broad guide to the best use or combination of uses of water and related land resources on these lands to meet both current and foreseeable long-term needs. Consideration is given to programs of other agencies and the private sector of the economy in attempting to correlate production of pertinent goods and services in meeting present and foreseeable future needs. By indicating future demand for BLM resources, this study is designed to assist the State Director and the District Managers in programing to meet the established goals, of making needed land tenure adjustments for land pattern improvement, and coordinated management with other agencies where appropriate, to manage the lands being retained in accord with the Classification and Multiple Use Act (78 Stat. 986; 43 U.S.C. 1411-18) "in the combination that will best meet the present and future needs of the American people," and to the greatest extent possible preserve or enhance the natural beauty of the area and preserve open space.

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C. Coordination and Acknowledgments

There are 65 Federal and State agencies in Oregon involved in planning for the physical development of the State. Thirty-five of these concern themselves with how Oregon's land area is used, 28 plan for the development, conservation, and utilization of the State's natural resources, 17 are involved in transportation. 1/ One objective of this report is to show opportunities for better correlation of BLM's programing with that of other agencies engaged in similar endeavors. See Table #1.

Information developed by the inter-agency Willamette Basin Study group is used in this report to the extent it has a relationship to BLM resource management responsibilities. This study is more comprehensive than the inter-agency report in that the latter is primarily concerned with the water resources of the basin. The BLM report examines all phases of watershed management.

D. Assumptions and Limitations of Study

Due to its exceptional value for structural timber and plywood, Douglas fir has a national market. Therefore, national demands have a direct effect on the economy of the basin. This report is based on the following assumptions: 1. Population of the U. S. to rise to 260 million people by 1985 and to 325 million by the year 2000. 3/ 2. Number of households will increase from 54.7 million in 1962 to 101 million in 2000. 3/ 3. Gross national product will increase 2.2 times to $1,175 billion by 1985 and to $1,920 billion by 2000. 4/ 4. Disposable personal income will rise from $379 billion in 1962 to $960 billion in 1990, and to $1,340 billion in 2000. Disposable personal income will double by the year 2000. 4/ 5. Use of industrial raw materials will rise 1½ times by 1985. Construction expenditures will double by 1985. The national demand for timber products will continue to increase to the year 2020. 5/ 6. Oregon's population will increase from 1,768,687 in 1960 to 3,096,000 in 1985, and to 4,448,000 by 2010. 7. The high level of employment at 96 percent civilian labor force will continue to 2010. 8. That the Federal Government, as a matter of national policy, will actively support programs designed to stimulate economic growth.

III. General Description of the BLM Managed Lands in Willamette Basin

A. Location and Size

The BLM lands in the basin occur mostly as alternate sections of land, 640 acres or less in size, intermingled with private forest lands. The

1/ "Summary Report - Oregon Comprehensive Statewide Planning Study," Oregon Department of Planning and Development, March 1964.

3/ U. S. Bureau of Census Projections, "Population Estimates," 1964, Ser. P. 25, #283.

4/ "Timber Trends in United States," U.S.F.S. 1965.

5/ "Prospective Timber Supplies and Forest Industrial Development in Willamette Basin," U.S.F.S., 1965.

TABLE 1

AREAS OF PLANNING RESPONSIBILITY
OF FEDERAL AND STATE AGENCIES [2/]

Agencies Federal	Land Use	Management of Natural Resources	Transportation
U. S. Department of Agriculture			
Ag. Stabilization & Conservation Service	x		
Forest Service	x	x	x
Soil Conservation Service	x	x	
Civil Aeronautics Board			x
Columbia Basin Inter-Agency Committee		x	
Department of Defense			
Department of Army	x		
Corps of Engineers	x	x	x
Department of Navy	x		
Department of Air Force	x		
Federal Aviation Agency			x
General Services Administration	x		
Dept. of Health, Education & Welfare		x	
Department of the Interior			
Bonneville Power Administration	x	x	
Federal Maritime Board			x
Fish and Wildlife Service	x	x	
Geological Survey		x	
Bureau of Indian Affairs	x	x	x
Bureau of Land Management	x	x	x
Maritime Administration			x
Office of Minerals Exploration		x	
Bureau of Mines		x	
National Park Service	x	x	x
Bureau of Outdoor Recreation		x	
Bureau of Public Roads			x
Bureau of Reclamation	x	x	
Under Secretary of the Interior for Transportation			

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Department of Defense			
Department of Army	x		
Corps of Engineers	x	x	x
Department of Navy	x		
Department of Air Force	x		
Federal Aviation Agency			x
General Services Administration	x		
Dept. of Health, Education & Welfare		x	
Department of the Interior			
Bonneville Power Administration	x	x	
Federal Maritime Board			x
Fish and Wildlife Service	x	x	
Geological Survey		x	
Bureau of Indian Affairs	x	x	x
Bureau of Land Management	x	x	x
Maritime Administration			x
Office of Minerals Exploration		x	
Bureau of Mines		x	
National Park Service	x	x	x
Bureau of Outdoor Recreation		x	
Bureau of Public Roads			x
Bureau of Reclamation	x	x	
Under Secretary of the Interior for Transportation			x
United States Coast Guard	x		
State			
Board of Aeronautics	x		x
Capitol Planning Commission	x		
Columbia River Gorge Committee	x		
Board of Control	x		
Department of Employment	x		
State Engineer	x	x	
State Fair Commission	x		
Dept. of Finance & Administration	x		
Fish Commission	x	x	
Board of Forestry	x	x	
Game Commission	x	x	
Dept. of Geology & Mineral Industries		x	
Board of Higher Education	x		
State Highway Commission	x	x	x
State Land Board	x	x	
Liquor Commission	x		
Marine Board		x	
Military Department	x		
Department of Motor Vehicles			x
Bureau of Municipal Research & Service	x		
Committee on Natural Resources	x	x	x
Board of Pilot Commissioners			x
Dept. of Planning & Development	x	x	x
Public Utility Commission of Oregon			x
State Sanitary Authority		x	
Soil and Water Conservation Committee	x	x	
Water Resources Board		x	x

2/ "Planning by Federal and State Governments in Oregon," Oregon Department of Planning and Development, March 1964

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Department of Navy	x		
Department of Air Force	x		
Federal Aviation Agency			x
General Services Administration	x		
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Department of the Interior			
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Federal Maritime Board			x
Fish and Wildlife Service	x	x	
Geological Survey		x	
Bureau of Indian Affairs	x	x	x
Bureau of Land Management	x	x	x
Maritime Administration			x
Office of Minerals Exploration		x	
Bureau of Mines		x	
National Park Service	x	x	x
Bureau of Outdoor Recreation		x	
Bureau of Public Roads			x
Bureau of Reclamation	x	x	
Under Secretary of the Interior for Transportation			x
United States Coast Guard	x		
State			
Board of Aeronautics	x		x
Capitol Planning Commission	x		
Columbia River Gorge Committee	x		
Board of Control	x		
Department of Employment	x		
State Engineer	x	x	
State Fair Commission	x		
Dept. of Finance & Administration	x		
Fish Commission	x	x	
Board of Forestry	x	x	
Game Commission	x	x	
Dept. of Geology & Mineral Industries		x	
Board of Higher Education	x		
State Highway Commission	x	x	x

Willamette River drainage embraces parts of two BLM Resource Management Districts. Of this, 170,000 acres BLM land are found in the Eugene District and 252,767 acres are in the Salem District. They are found in all the counties in the basin. Although they comprise but 8½ percent of the forest lands of the basin, they are contributing to the economy 14 percent of the current wood fibre production.

B. Physical Profile

1. Topography

BLM lands are interspersed throughout the 3000-4000 foot high Coast Range Mountains which cover about one-sixth of the Willamette River watershed. They are also found in the lower elevations of the Cascade Range, beginning at about the 1000 foot contour and rising to 3000 to 4000 foot elevation. This zone provides optimum site conditions for the growth of Douglas fir timber, and in this zone is produced the bulk of the basin's wood crops.

2. Climate

The area is blessed with a temperate, maritime climate resulting from proximity to the Pacific Ocean and exposure to the middle latitude westerly winds. Winters are mild and wet and summers are dry. Only 5 percent of the precipitation occurs in the summer. Often there is only a trace of rain from July to October. Precipitation averages from 48 to 120 inches in the Coast Range and in the lower slopes of the Cascades where BLM lands are found. It occurs mostly as rain in this zone, whereas much of it comes as snow above the 4000 foot elevation in the Cascades.

3. Soils

The Coast Range is an upfold of sedimentary rock with some volcanic intrusions of lava flows and basalt. Soils resulting from weathering of this rock are of fine texture and moderate depth. Soils near the summit are found as intergrades between the yellowish-brown lateritic and reddish-brown lateritic great soils groups with inclusion of the lithosol great soil group. They have moderate structure, medium texture, pH below 5, and a base saturation from 10 to 20 percent. 6/

Soils near the valley are dominantly reddish-brown lateritic, having strong structure, fine texture, pH above 5, and a base saturation greater than 25 percent. 6/

The Cascade Range soils are derived from igneous rock, from pyroclastic rock, and from glacial deposits. Soils formed from igneous material vary in characteristics according to age and topography. Soils on steep slopes or from geologically young rocks tend to be medium textured, shallow, and stony. Small areas of lava flows are so young as to be without soil. Soils forming on gentle slopes or from older rocks are moderately deep, medium to moderately fine textured, and relatively stone-free.

6/ "Willamette River Basin, Oregon," U.S.D.A. Interim Report, November 1964.

Willamette River drainage embraces parts of two BLM Resource Management Districts. Of this, 120,000 acres BLM land are found in the Eugene District and 122,767 acres are in the Salem District. They are found in all the counties in the basin. Although they comprise but 8% percent of the forest lands of the basin, they are contributing to the economy 14 percent of the current wood fibre production.

B. Physical Profile

1. Topography

BLM lands are interspersed throughout the 3000-4000 foot high Coast Range Mountains which cover about one-sixth of the Willamette River watershed. They are also found in the lower elevations of the Cascade Range, beginning at about the 1000 foot contour and rising to 3000 to 4000 foot elevation. This zone provides optimum site conditions for the growth of Douglas fir timber, and in this zone is produced the bulk of the basin's wood crops.

2. Climate

The area is blessed with a temperate, maritime climate resulting from proximity to the Pacific Ocean and exposure to the middle latitude westerly winds. Winters are mild and wet and summers are dry. Only 5 percent of the precipitation occurs in the summer. Often there is only a trace of rain from July to October. Precipitation averages from 45 to 120 inches in the Coast Range and in the lower slopes of the Cascades where BLM lands are found. It occurs mostly as rain in this zone, whereas much of it comes as snow above the 4000 feet elevation in the Cascades.

3. Soils

The Coast Range is an uplift of sedimentary rock with some volcanic intrusions of lava flows and basalt. Soils resulting from weathering of this rock are of fine texture and moderate depth. Soils near the summit are found as intergrades between the yellowish-brown lateritic and reddish-brown lateritic great soils groups with inclusion of the lithosol great soil group. They have moderate structure, medium texture, pH below 5, and a base saturation from 10 to 20 percent. 2/

Soils near the valley are dominantly reddish-brown lateritic, having strong structure, fine texture, pH above 5, and a base saturation greater than 25 percent. 2/

The Cascade Range soils are derived from igneous rock, from pyroclastic rock, and from glacial deposits. Soils formed from igneous material vary in characteristics according to age and topography. Soils on steep slopes or from geologically young rocks tend to be medium textured, shallow, and stony. Small areas of lava flows are so young as to be without soil. Soils forming on gentle slopes or from older rocks are moderately deep, medium to moderately fine textured, and relatively stone-free.

2/ "Willamette River Basin, Oregon," U.S.D.A. Interim Report, November 1964.

Soils formed from pyroclastic rocks tend to be fine textured and fairly deep on gentle slopes and moderately fine textured and shallow to moderately deep on steep slopes.

Soils formed from glacial deposits tend to be deep, porous, and stony.

Progressing from the Cascade foothills east toward the crest, the following soil groups are found: Reddish-Brown Lateritics, Yellowish-Brown Lateritics, Brown Podzolics, and Podzols. 6/

4. Water

There are found to be 126 tributary watersheds in the basin, ranging in size from 3000 to 760,000 acres.

Most of the water that appears as stream flow is produced on the higher, forested portions of the basin. The major forest area which begins at about 1,000' elevation receives 70 percent of the total precipitation and produces 80 percent of the runoff. Average water production from forest lands of the basin is 21,699,000 acre feet. BLM lands produce about 8% of this amount or 1,735,920 acre feet of water per year. About 75 percent of the precipitation is presently excess to the basin's needs and is not consumptively used. The problem is one of timing. The rivers and streams are generally too low in summer and fail to satisfy all existing demands, including pollution dilution. The main argument for reservoir construction is for water storage and flood control.

Most of the municipal water used by the cities of the basin is surface water that flows from forest watersheds.

5. Stream Systems

a. Upper Willamette Basin Subarea (See Map 1)

This subbasin covers 2,500,000 acres which is 35 percent of the entire Willamette Basin. All but 11 percent of the basin is within Lane County. Only 76 percent of Lane County lies in the basin, 13 percent of Linn County, 5 percent of Benton, and 2 percent of Douglas. There are 170,000 acres BLM lands in this subarea.

Named streams in this area total about 800. There are even a larger number of unnamed streams. Total stream length is about 5,400 miles, of which perennial streams total about 3,400 miles. Of the 25 major streams and rivers, 14 originate in the Cascades, 6 in the Calapooya Mountains, and 5 in the Coast Range. This area encompasses 41 miles of the Willamette main stem, 41 miles of the Coast Fork of the Willamette, 84 miles of the Middle Fork of the Willamette, 90 miles of the McKenzie River, and 55 miles of the Long Tom River.

6/ "Willamette River Basin, Oregon," U.S.D.A. Interim Report, November 1964.

The McKenzie subbasin has the highest unit water yield with nearly 2,900 acre feet per square mile, followed by the Middle Fork with 2,100 acre feet per square mile; the Coast Fork with 1,750 feet per square mile. Average total yield from this subbasin equals 8,624,000 acre feet.

The sedimentary formations of the Coast Range generally reject ground water infiltration and have little water storage capacity. This results in high winter stream flows and low or nonexistent summer flows. On the other hand, the porous lavas of the high Cascades store large quantities of snow melt and release water gradually. Thus, the yield of water during summer months from Cascade streams is often in excess of winter precipitation flows.

b. The Middle Willamette River Basin Subarea

This portion of the Willamette Basin as shown in Map 1 covers approximately 5400 square miles or 45 percent of the entire basin. It encompasses the following counties: Linn, 88%; Marion, 94%; Polk, 87%; Yamhill, 89%; Benton, 69%; and Clackamas, 27%. The main stem of the Willamette has an inbasin length of 113 miles, 60 percent of its total. There are 214,732 acres of BLM managed lands in this subbasin. The area is divided into three subbasins: #5, Santiam; #6, Coast Range; and #7, Pudding. These reflect basic differences in physical and hydrological characteristics.

The Santiam subbasin contains a total of 6 major tributaries to the Willamette River, totaling 330 miles in length. They have gradients from 230 to 390 feet per mile in the mountains and from 40 to 62 feet per mile in the foothills. In the upper reaches, they are characterized by steep gradients and numerous falls and rapids.

The Coast Range subbasin has 7 main tributaries to the Willamette River with a total length of 262 miles. These show gradients from 260 to 530 feet per mile in the mountains and from 37 to 57 feet per mile in the foothills.

The Pudding subbasin shows 4 main drainages with a total length of 140 miles. They have an average gradient of 210 feet per mile in the mountains and from 40 to 79 feet drop per mile in the foothills.

c. Lower Willamette Basin Subarea

The Lower Willamette Basin Subarea encompasses the Portland metropolitan area, the Sandy River drainage, 32.7 miles of the Willamette River, and a total of 1,748,800 acres. It takes in all of Multnomah County, most of Washington County, a large part of Clackamas County, and portions of Columbia, Marion, Tillamook, and Yamhill Counties. Elevations vary from 10 to 11,245 feet. The average annual water yield after current consumptive use withdrawals is about 6 million acre feet.

The largest yields are produced by the Sandy subbasin from the high area near Mt. Hood. BLM has responsibility for 38,035 forested acres in this subarea.

The Lower Willamette Subarea is divided into 4 major subbasins. The Tualatin subbasin encompasses a total of 8 major drainages. The Clackamas subbasin takes in 6 major streams. The Columbia subbasin includes 6 streams. The Sandy subbasin has only 5 major drainages. This subbasin is characterized by extremely steep stream gradients in the mountain areas.

6. Natural Vegetation

Douglas fir timber is of dominant occurrence on the BLM lands. There is also a scattering of western hemlock, western red cedar, and several species of true fir. Red alder, bigleaf maple, ash, and Oregon white oak are the hardwoods found over the area, but they currently are of little economic value. Vine maple, Oregon grape, salal, huckleberry, devil's club, swordfern, snowbrush, willow, and hazelbrush make up the understory. Today two-thirds of the basin is still forested.

7. Minerals

The most important mineral resources in the Willamette Subbasin are crushed rock, sand, and gravel. This subbasin has the largest known deposits in the State and because of their location, near Oregon's population centers, are the most intensely worked deposits. Outcrops of various sediments and igneous flows are quarried, crushed, and used for road materials and construction purposes. Sand and gravel can be found along the entire length of the Willamette River and many of its tributaries. Most of the deposits being worked are on private land, but good grade deposits also exist on Bureau of Land Management and Forest Service administered lands.

Low grade ferruginous bauxite deposits underlie large areas of timbered lands in this drainage. Northwest of Portland, north of Hillsboro, and in the Salem hills, large deposits have been drilled and sampled but no production has resulted from the work. These deposits may be valuable in the future if a profitable method can be found to mine and beneficiate the material.

Coal is found at several localities in the drainage but none of the deposits are of economic importance. Coal from a lease near Molalla is used for agricultural purposes partly because it is too low grade to mine at a profit.

Base metals in the Willamette drainage include gold, silver, copper, lead, and zinc. Various other minerals also occur in minor amounts, such as mercury, antimony, and clay. Several old mining districts are in this drainage--North Santiam, east of Salem; Quartzville, east of Albany; Blue River, north of Blue River; Fall Creek, on upper Fall Creek; and the Bohemia, southeast of Cottage Grove. Part of the Blackbutte-Elkhead mercury district and several small mercury properties along the Oak Grove Fork of the Clackamas River are also located in the drainage.

All but one of the large mining districts were once worked extensively for gold and silver. As the placers and enriched surface deposits were worked out, the production of copper, lead, and zinc developed when sulphides were encountered at deeper mining levels. The future of all but the mercury deposits will probably depend on silver and base metals instead of gold as in the past.

Mining claims in the Willamette drainage probably number several thousand. There are known to have been over 300 claims located for low grade ferruginous bauxite on O&C lands. A large percent of the other claims are located on Forest Service lands. No immediate large problems are posed by the mining claims on Bureau of Land Management administered land.

8. History of the Public Lands

The public domain lands remaining in the basin are the remnants of the lands acquired by the Federal Government through treaty with the Indians and by the Compromise of 1846 with Great Britain. These are the lands which were not found suitable for settlement by the pioneers. They are generally too rough and mountainous for cultivation and were remote from roads and public utilities.

The O&C lands are those once granted to the Oregon and California Railroad Company as an inducement to build a railroad line from Portland to California. The grant covered alternate sections in a strip extending 30 miles on each side of the railroad right-of-way. The grant encompassed over 3,728,000 acres. The railroad company sold some of these lands. Because the company grossly violated the terms of the grant, Congress in 1916 revested the balance of the lands to the United States. These lands received little protection or management until passage of the Sustained Yield Act on August 28, 1937. They are now able to provide substantial economic and social benefits to the community.

IV. Economic Profile

A. Purpose and Use

The economic profile identifies and describes (1) the present level of the Willamette Basin's economy as related to the use and production on BLM lands, (2) projects the level of the economy to 1980 as related to resource requirements from BLM lands, and (3) projects the level of economy to 2020 for the same reason. The economic profile is an overview of present and long-term needs of the people and is a guide for maximizing the contribution from the BLM lands. It shows BLM's relationship to the economy of the State. It is a tool for program guidance for enlargement of BLM's contribution to the public welfare and economic growth. Although the economic profile is a dynamic guide, it is not a precise guide in predicting future conditions. It sets only the direction and general magnitude of future needs.

B. General Planning Assumptions for BLM Programing

1. There will not be a major war with related economic impact as experienced during World War II.

2. There will be a continuation of the "Cold War" requiring present pattern of defense expenditure.

3. There will be no profound change in the existing socio-political order.

4. There will be no severe widespread depression.

5. There will be no dramatic scientific technological change having a major impact on the public lands. Technology in general will continue to improve.

6. There will be a continuation of population growth and a steady increase in individual prosperity.

7. Population will continue to shift to urban centers with development of new "towns" within reasonable commuting distance of urban centers.

C. Physical Relationship

Only 10 percent of Oregon's land is suitable for cultivation. The largest number of acres are devoted to forests, covering 45 percent of the State. Nearly 42 percent is grazing land.

Only one-third of the Willamette Basin is farm land. Nearly two-thirds is forest. Practically all the BLM land in the basin is forested. Forest land ownership is equally divided between public and private. The Forest Service has the largest forest land ownership, amounting to 39 percent. BLM manages 8 percent. Private holdings are equally divided between large private corporations and small owners. The latter consist mostly of small scattered tracts on farms. These generally are poorly managed for wood fibre production.

D. Population

The nature of present and future population is a key to resource planning because the function of resource planning is to provide for human needs. Population projections indicate increasing future needs for food, fibre, land, recreational activity, water, and other basic commodities. In analyzing this data, it is important to examine not only the numbers of people, but also their make-up as to age distribution, family size, education, sex, income, and type of employment. Willamette Basin Task Force population statistics are used, based on Bureau of Census data.

In 1960, Oregon had a population of 1,768,687. The 9-county Willamette Basin study area covers only 12 percent of the State but contains 67 percent of the State's population. See Table 2. The 1,169,000 people living here in 1960 were found concentrated in the valley portion of the basin, averaging 300 people per square mile. Due to the city of Portland, Multnomah County shows a population density of 1233 people per square mile. Population of the basin is expected to increase 70 percent by 1985. Nearly half of this growth will be in the Portland metropolitan area. The trend has been toward population expansion in urban areas and decreasing populations in rural areas.

Due to differences in economy, topography, and drainage patterns, the basin has been divided for study purposes into three subareas, (see Map #1). Each subarea is characterized by having one large metropolitan center. Eighty-nine percent of the people of the Lower Subarea live in the Portland "urban area," which includes portions of Washington and Clackamas Counties, as well as Multnomah County. The 5-county Middle Willamette Subarea pivots on the Salem urban area. Sixty percent of the people here live in urban areas and incorporated towns. The Eugene-Springfield complex is the heart of the Upper Basin Subarea. Urban population includes 68 percent of the people.

Population density of the basin in 1960 averaged 85 people per square mile compared to a national average of 51.

Oregon has the third highest population density per square mile of all the western states. California has 5½ times the population density of Oregon. The State of Washington has nearly 2½ times greater density than Oregon. Oregon ranks fifth in median family income in the western states and is one of the lowest in families with earnings over $10,000 per year.

Table 3 shows the past and projected population growth of Oregon, the three Willamette Basin Subareas, its counties, and major cities. From 1950 to 1960 population expanded faster in the Willamette Basin than in the state as a whole, but slightly less than the national average. The Upper Basin Subarea led the other two in rate of population increase from 1930 to 1960, due largely to expansion of the lumber industry in that area. Washington County, the "bedroom area" of Portland, was the second fastest growing county. This is reflected in a slight decline in the City of Portland population and increasing urban sprawl.

Table 4 compares population growth of the 11 western states and the Willamette Basin. It is apparent that the southwestern states are attracting immigrants at a much faster rate than those in the northwest. The more favorable climate in the southwest seems to be more attractive to new industries, military expenditures, and to retired people. On the other hand, Oregon and Washington have a much higher rate of population increase than the inland states of the Northwest--- Idaho, Montana, Wyoming, and Colorado.

TABLE 2
BASIC POPULATION DATA [7/]

Area	Density per Sq. Mile	Residence Percent Urban	Residence Percent Rural	1959 Income per Family Median	1959 Income per Family Under $3,000	1959 Income per Family $10,000 and Over	Education 1960 Population 25 yrs. Old & Over Median School Yrs. Completed	Completed Less Than 5 yrs. School	Completed High School or More
United States	50.5	69.6	7.5	$5660	21.4%	15.1%	10.6%	8.4%	41.1%
Oregon	18.4	62.2	7.8	5892	17.1	13.9	11.8	3.3	48.4
Washington	42.8	68.1	5.7	6225	15.2	16.6	12.1	3.4	51.5
California	100.4	86.4	2.1	6726	14.1	21.8	12.1	5.7	51.5
Montana	4.6	50.2	15.6	5403	20.2	11.5	11.6	4.1	47.8
Idaho	8.1	47.5	19.9	5259	20.8	10.5	11.8	3.2	48.5
Wyoming	3.4	56.8	13.0	5877	16.5	14.6	12.1	3.7	52.0
Colorado	16.9	73.7	7.3	5780	18.5	14.6	12.1	4.7	52.0
New Mexico	7.8	65.7	6.1	5371	24.3	14.2	11.2	12.1	45.5
Arizona	11.5	74.5	3.8	5568	21.3	14.5	11.3	10.0	45.7
Utah	10.8	74.9	4.9	5899	14.8	13.8	12.2	2.8	55.8
Nevada	2.6	70.4.	3.5	6736	12.3	22.0	12.1	3.9	53.3
Clackamas Co.	60	56.7	10.2	6129	16.5	16.0	12.0	2.8	49.7
Multnomah Co.	1233	96.4	0.5	6378	14.4	16.6	12.0	3.6	50.4
Washington Co.	129	55.0	10.2	6523	14.2	20.1	12.2	2.4	54.6
Benton Co.	59	52.8	7.7	5860	16.6	15.8	12.5	1.5	62.4
Linn Co.	26	37.6	14.2	5436	19.0	9.5	11.2	2.7	44.2
Marion Co.	103	63.5	11.5	5591	20.9	12.2	11.3	5.3	45.9
Polk Co.	36	33.8	19.0	5245	22.7	9.4	10.9	4.8	43.3
Yamhill Co.	46	36.5	20.1	4910	26.8	8.6	11.0	4.0	44.0
Lane Co.	36	61.1	5.1	5946	14.6	13.6	12.0	2.4	51.4
Portland	5546	100	-	6335	15.1	16.9	12.0	3.3	50.3
Salem	3809	100	-	5859	19.4	15.3	11.5	6.0	47.1
Eugene	3516	100	-	6267	13.2	18.3	12.0	2.4	51.4

7/ "Census of Population 1960," U. S. Bureau of Census

TABLE 3

WILLAMETTE BASIN POPULATION--PAST, PRESENT, 7/ AND PROJECTED 8/

Area	Size Sq. Miles	Population 1930	Population 1940	Percent Increase	Population 1950	Percent Increase	Population 1960	Percent Increase	Population 1980	Population 2020
State of Oregon	96,981	953,786	1,089,684	14.2	1,521,341	39.6	1,768,687	16.3	2,783,000	5,030,000
Lower Willamette Subarea	3,673	414,721	451,423	8.8	615,728	17.3	722,711	17.4	1,047,300	2,298,000
Clackamas Co.	1,887	46,205	57,130	23.6	86,716	51.8	113,038	30.4		
Multnomah "	424	338,241	355,099	5.0	471,537	32.8	522,813	10.9		
Washington "	716	30,275	39,194	29.5	61,269	56.3	92,237	50.5		
Columbia "	646	20,047	20,971	4.6	22,967	9.5	22,379	-2.6		
Middle Willamette Subarea	5,577	140,690	170,685	21.4	247,089	44.8	277,921	12.4	437,700	729,000
Benton Co.	668	16,555	18,629	12.5	31,570	69.5	39,165	24.1		
Linn "	2,288	24,700	30,485	23.4	54,317	78.2	58,867	8.4		
Marion "	1,173	60,541	75,246	24.3	101,401	34.8	120,888	19.2		
Polk "	739	16,858	19,989	18.6	26,317	31.7	26,523	0.8		
Yamhill "	709	22,036	26,336	19.5	33,484	27.1	32,478	-3.0		
Upper Willamette Subarea										
Lane Co.	4,560	54,493	69,096	26.8	125,776	82.0	162,890	29.5	282,500	564,000
Total Willamette Basin	13,810	609,904	691,204		988,593		1,163,522	17.7	1,767,500	3,591,000
Eugene		18,901	20,838	72.2	35,879		50,977	42.1		
Springfield		2,364	3,805	184.0	10,807		19,616	81.5		
Salem		26,266	30,908		43,140		49,142	13.9		
Portland		301,815	305,394		373,628		372,676	-0.3		
United States	2,975,000	123,202,624	132,164,569	7.3	151,325,798	14.5	179,323,175	18.5	245,313,000	469,126,000

7/ "Census of Population 1960," U. S. Bureau of Census
8/ "National Economic Growth Projections," Ad Hoc Water Resources Staff, 1963

TABLE 4

POPULATION TRENDS OF UNITED STATES AND THE ELEVEN WESTERN STATES 8/

State	1940	1950	1960	Percent Increase 1940-60	1980 9/	2000	2020
Arizona	499,261	749,587	1,302,161	160.8	2,640,000		
California	6,907,387	10,586,223	15,717,204	127.5	28,440,000		
Colorado	1,123,296	1,325,089	1,753,947	56.1	2,712,000		
Idaho	524,873	588,637	667,191	12.1	981,000	1,332,000	
Montana	559,456	591,024	674,767	20.6	853,000		
Nevada	110,247	160,083	285,278	158.8	532,000		
New Mexico	531,818	681,187	951,023	78.8	1,558,000		
Oregon	1,089,684	1,521,341	1,768,687	62.3	2,783,000	3,866,000	5,030,000
Utah	550,310	688,862	890,627	61.8	1,398,000		
Washington	1,736,191	2,378,962	2,853,214	64.3	4,401,000	6,148,000	
Wyoming	250,742	290,529	330,066	31.6	432,000		
Total	13,883,305	19,561,524	26,777,165	92.9	46,730,000		
United States	131,669,275	150,697,361	179,323,175	36.2	245,313,000	338,219,000	468,126,000
Willamette Basin	609,904	691,204	1,163,522	91	1,768,000	2,422,000	3,591,000
% Population Western States to United States	10.54%	12.98%	14.93%		18%		
% Population Willamette Basin to United States	0.44%	0.35%	0.44%		0.64%	0.72%	0.76%
% Population Willamette Basin to Oregon	56%	45.4%	66%				

8/ "National Economic Growth Projections," Ad Hoc Water Resource Staff, 1963
9/ "Current Population Reports," Series 301, 1965, P. 25

The soundness of Oregon's position with no benefits from military expenditures is evidenced by a growth rate comparable to that of Washington State, which has major military contracts with Boeing. In the period of 1940 to 1960 Oregon's growth rate is shown to be much higher than the national average. Growth of the Willamette Basin area has been nearly one-third higher than the State average, nearly equaling the average growth rate of the 11 western states.

Table 5 shows that the median age in Oregon is slightly higher than that of the other western states and the United States average. However, Oregon ranks among the highest in percent of people in available work force, 18-64 years of age, and just under the national average. Oregon has the highest percentage of people 65 years and older. This indicates a large number of retired people here and a need for recreation and other facilities to absorb their energies. The percentage of people under 18 is close to the average for the other western states, and nearly identical to the United States average. Continued pressure for educational facilities may be anticipated.

E. Education

Tables 2 and 6 show that Oregon ranks very high in the educational level of the people and quality of schooling in comparison to the other states. The Willamette Basin counties rank even higher. This is an important factor in attracting new industry. Most of the adults have at least a high school education. A well-educated labor pool reduces management problems, provides a source of potential managers, and provides good community leadership.

F. Urban and Rural Populations

Table 7 shows tremendous increase in urban growth in both the Lower Willamette and the Upper Willamette Subareas. Washington County, adjacent to the Portland metropolitan area, nearly tripled its population in 10 years. New freeways providing rapid transit have stimulated urban sprawl into Washington and Clackamas Counties. However, most of these urbanites are dependent on Portland for employment, marketing, services, and social interests. The urban expansion is primarily due to the efforts of large development projects following the freeways, building new home subdivisions and shopping centers. Unfortunately, this expansion is not only taking the best farm land but is gobbling up the open space which once made our highways attractive.

Census studies shown in Table 8 predict the development of 19 major metropolitan areas or strip cities in the United States. 11/ One of these is the Seattle-Portland-Eugene complex. It is ranked eleventh in rate of gain between 1960-1970. Average rate of growth of all metropolitan areas is expected to be 23 percent. The Seattle-Portland-Eugene rate is projected at 20 percent, compared to 2 percent for the rest of the United States.

11/ "Oregon Economic Statistics 1964," State of Oregon Department of Planning and Development.

TABLE 5

COMPARATIVE AGE DISTRIBUTION IN WESTERN STATES, 1960 7/

Area	Percent Under 18 Yrs.	Percent 18-64 Yrs. of Age	Percent 65 Yrs. or Older	Median Age	18 Yrs. Old and Over % Male
United States	35.8	55.0	9.2	29.5	48.4
Washington	36.0	54.2	9.8	29.6	50.0
Oregon	35.7	54.0	10.4	30.8	49.2
California	34.7	56.6	8.8	30.0	49.3
Montana	38.6	51.7	9.7	27.6	51.1
Idaho	40.2	51.1	8.7	26.0	50.5
Wyoming	38.6	53.5	7.8	27.3	51.3
Colorado	37.0	54.0	9.0	27.9	48.9
New Mexico	43.0	51.6	5.4	22.8	50.3
Arizona	39.7	53.3	6.9	25.7	50.0
Utah	42.9	50.4	6.7	22.9	49.2
Nevada	34.9	58.7	6.4	29.5	52.3

7/ "Census of Population, 1960," Bureau of Census

TABLE 6
OREGON EDUCATION PROFILE 10/

Item	Oregon	50 States	Rank of Oregon
Median school year completed, persons 25 yrs. & older, 1960	11.8	10.6	8
Percent population 25 yrs. & older with less than 5 yrs. schooling, 1960	3.3	8.3	4
Percent population 25 yrs. & older with at least 4 yrs. high school, 1960	48.4	41.4	9
Percent population 25 yrs. & older with at least 4 yrs. college, 1960	8.5	7.7	15
Estimated percent elementary school teachers with at least Bachelor's degree	78%	---	25
Estimated percent elementary school teachers with at least Master's degree	11.2%	---	26
Estimated percent secondary school teachers with at least Bachelor's degree	99.3		11
Estimated percent secondary school teachers with at least Master's degree	35		19
Percent selective service registrants failing mental test, 1961	5.5	23	5
Votes cast presidential election as to percent number people of voting age	71.2	64.3	28
High school enrollment in 1962 as percent 8th grade enrollment 1957-58	77.9	70.6	14
Per capita expenditure of state & local govt. for all public education, 1961	$144.86	$112.40	9
Per capita general revenue of state & local govt. from own sources	$281.27	$256.26	13
Estimated current expenditure for public elementary & secondary schools per pupil in average daily attendance, 1962-63	$501.94	$432.00	9
Estimated average salaries of classroom teachers in public schools in 1962-63	$6050	$5735	15

OREGON EDUCATIONAL GROWTH TRENDS

Schooling Factors	1930	1940	1950	1960	50 State Average	Rank of Oregon
School enrollment 5-24 yrs.	62.8%	59.1%	65.3%	74.9%		
Median school years completed by adults		9.1%	10.9%	11.8%	10.6	8

10/ "Rankings of States, 1963," National Education Association, U.S. January 1963

TABLE 7

WILLAMETTE BASIN URBAN GROWTH TRENDS [11]

Area	1960 Population Density Per Sq. Mile	Urban Population 1950	Urban Population 1960	Percent Urban 1950	Percent Urban 1960	Percent Change
Lower Willamette Subarea						
Clackamas Co.	59.9	37,999	64,074	43.8	56.7	68.6
Columbia Co.		4,711	5,022	20.5	22.4	6.6
Multnomah Co.	1,233	425,968	503,766	90.3	96.4	18.3
Washington Co.	128.8	18,858	50,749	30.8	55.0	169.1
Middle Willamette Subarea						
Benton Co.	98.8	16,207	20,669	51.3	52.8	27.5
Linn Co.	50.4	19,591	22,137	36.1	37.6	13.0
Marion Co.	232.1	45,930	76,815	45.3	63.5	67.2
Polk Co.	70.3	7,846	8,969	29.8	33.8	14.3
Yamhill Co.	85.5	10,581	11,860	31.6	36.5	12.1
Upper Willamette Subarea						
Lane Co.	705.9	50,222	99,581	39.9	61.1	98.3

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[11] "Oregon Economic Statistics 1964," State of Oregon Department of Planning and Development

TABLE 8

U. S. POPULATION - 1960-1970 - METROPOLITAN AREAS 12/

(MILLIONS)

	1960	1970 (est.)	Increase 1970	Percent Gain
EAST				
Boston-Washington	31.5	35.8	4.3	14
Albany-Cleveland-Pittsburgh	10.3	11.5	1.2	12
Richmond-Norfolk	1.2	1.7	.5	37
Raleigh-Atlanta	2.4	3.0	.6	29
Jacksonville-Miami	3.0	5.1	2.1	67
CENTRAL				
Detroit-Cincinnati-Columbus	9.3	11.1	1.8	20
Milwaukee-Chicago	8.9	10.1	1.1	13
Peoria-St. Louis	2.7	3.1	.4	13
Knoxville-Tuscaloosa	1.6	1.9	.3	17
New Orleans-Pensacola	1.4	1.9	.5	35
Sioux Falls-Kansas City	2.1	2.4	.3	17
Duluth-Minneapolis-St. Paul	1.8	2.1	.3	19
San Antonio-Dallas-Houston	4.5	6.4	1.9	41
Wichita-San Angelo	1.7	2.1	.4	27
WEST				
Denver-Pueblo	1.2	1.8	.6	48
Phoenix-Tuscon	.9	1.6	.7	74
Salt Lake City-Ogden-Provo	.6	.8	.2	34
San Francisco-San Diego	13.6	19.2	5.6	41
Seattle-Portland-Eugene	2.4	2.9	.5	20
TOTALS - 19 "Strip Cities"	101.0	124.5	23.5	23
All Other Metropolitan Areas	14.8	18.2	3.4	23
Rest of United States	64.2	65.6	1.4	2

12/ U. S. News and World Report, January 13, 1964, based on data compiled by Bureau of the Census

Census projections (Table 9) indicate that cities and urban areas will cover 41 million acres in the United States by the year 2000, compared to an area of only 16.6 million acres in 1950. A jump is shown from 2.3 million acres urban in 1950 to 8.4 million acres in 2000. Estimated average density in the west will increase from 3840 persons per square mile to 4120, indicating a slightly increased efficiency in land use in accommodating the greater number of people. The same rate of increase is projected nationwide. This anticipated growth will displace additional acreages of prime agricultural lands in the Willamette Basin.

G. Industries and Employment

1. General

Economic development of the Willamette Basin has been handicapped to some degree by its distance from major markets. Its economy has been developed at the expense of its natural resources: timber, agricultural products, and fisheries. It has furnished raw or semiprocessed products to other parts of the country for processing and distribution. Oregon has been able to absorb the high freight costs and compete in national markets only by producing quality manufactured products selling in the higher price ranges. Douglas fir lumber and plywood have unlimited markets because of their superior qualities of strength and durability as construction material. Its sportswear and electronic gear also compete on the basis of high quality merchandise.

The population explosion in California is creating new markets and offering opportunities for expansion of manufacturing enterprises and increased production of agricultural products in the basin.

The Portland metropolitan area dominates the economic picture of the Willamette Basin. It is the financial center and embraces a major portion of the population. Most important is its location as a major seaport at the confluence of the Willamette and Columbia Rivers, making it the logical distribution center for the Pacific Northwest and Alaska. Dams being built on the Columbia and Snake Rivers will permit cheap barge traffic to the east as far as Lewiston, Idaho.

Economic studies show that Oregon has one of the soundest, most well balanced economies in the nation and that it will continue to grow at an ever-quickening pace. It has practically no defense or outer space industries vulnerable to curtailment. It does have the resources to attract new industry, an abundance of pure water, great amounts of cheap electric power, cheap water transportation, a well-educated labor pool, good climate, good schools and cultural opportunities for employees, ready availability of good industrial site locations, and an excellent supply of raw materials.

TABLE 9

ESTIMATES OF FUTURE CITY AND URBANIZED AREA, BY REGIONS, 1950, 1980, and 2000

Item	Unit	North-east	North Central	South	West	United States
1950 [1]						
Total urban population	Mil.	31.4	28.5	23.0	13.6	96.5
Cities and urban places	No.	1,195	1,484	1,449	613	4,741
Average population per place	Persons	26,280	19,200	15,880	22,150	20,354
Estimated average density	Persons	4,100	3,660	3,370	3,840	3,710
Estimated total area	Mil. A.	4.9	5.0	4.4	2.3	16.6
1980 [2]						
Total urban population	Mil.	46.9	49.0	55.8	34.1	185
Cities and urban places	No.	1,645	2,350	2,779	1,330	8,100
Average population per place	Persons	28,500	21,000	20,000	25,600	22,800
Estimated average density	Persons	4,200	3,760	3,690	4,040	3,900
Estimated total area	Mil. A.	7.1	8.3	9.7	5.4	30.3
2000 [2]						
Total urban population	Mil.	61.9	64.0	75.8	54.1	255
Cities and urban places	No.	2,080	2,860	3,500	1,960	10,400
Average population per place	Persons	29,750	22,350	21,650	27,600	24,500
Estimated average density	Persons	4,260	3,840	3,790	4,120	3,980
Estimated total area	Mil. A.	9.3	10.7	12.8	8.4	41.0

[1] Using the new census definition of urban areas. Data on number and population of cities and urbanized areas in the United States from Appendix B, Table B-1; density and land area calculated from formula on relationship between size of city and density in 1950 ($Y=3,295 \cdot \log X - 10,500$). Area is higher than in Table 10 because it includes an allowance for cities not reporting area and for other urbanized areas.

[2] Population and number of cities and urbanized areas for the nation taken from projections in Appendix B, Table B-1; for regions, rough projections of past trends adjusted to yield national totals; density and area estimated from 1950 relationship between city size and density.

The three leading industries in Oregon are, in the order listed, forest products, agriculture, and tourism. The value of forest products produced in Oregon in 1963 was $1.3 billion. 13/ Oregon's forest products account for over half of its nearly 5,000 manufacturing establishments, over half the manufacturing employees, and over half the value added by manufacturing industries. A healthy diversification in manufacturing activity is making the economy somewhat less dependent on wood products. Although wood products employment has increased, it represented only 80 percent of total manufacturing employment in 1960 as compared with 86 percent in 1950.

In relationship to the national economy, in 1963 Oregon's economy contributed about one percent to the Gross National Product, about $6 billion in goods and services. The net import balance was about $450 million, about 7.5 percent of the Gross State Product. Four exporting industries account for 85 percent of the exports. They are: paper and allied products, lumber and wood products, primary nonferrous metals, and agriculture (principally grains). An increasing national demand for wood assures that the basin's production will be limited only by the economically available supply of timber. 5/ This indicates that the basin's economy will continue to need maximum wood fibre production from BLM lands. Of the nation's plywood output, 67 percent comes from Oregon, as does 38 percent of its hardboard production. 14/

2. Forest Industries

In the Willamette Basin the total value added by manufacture of forest products was $366 million (1958 dollars) in 1963. An increase of 22 percent in the national demand for timber products is anticipated in the next 23 years. The demand for plywood, veneer and paper products should double by 1985. Reduction of forest inventory on private lands shows a declining net annual growth to a point where growth cannot be maintained. The downward trend in net annual growth after 2000 on private lands will level off or even start to increase. 5/ The decreasing inventory on private lands will greatly increase the demand for stumpage from the public lands.

The natural resource oriented economy of Oregon is closely related to its land use and ownership. Table 10 shows this breakdown. Because of the high capital investment required to build modern sawmills, plywood plants, paper and pulp mills, and establish marketing and distribution outlets, it is essential to the forest industry that they have an assured supply of wood fibre. Accordingly, we find that about half the private timberlands in the Willamette Basin are owned and managed by a few

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13/ "The Oregon Economy and Outlook," 3rd Edition, Department of Commerce, 1965.

5/ "Prospective Timber Supplies and Forest Industrial Development in Willamette Basin," U.S.F.S., 1965.

14/ "Oregon Forest Industry Facts," Oregon Department of Planning and Development, 1963.

TABLE 10

LAND USE AND OWNERSHIP, WILLAMETTE RIVER BASIN, OREGON, 1963[6/]

Land Use & Ownership	Percent of Forest Land	Total Willamette Basin 1,000 Acres	Upper Willamette 1,000 acres	Middle Willamette 1,000 acres	Lower Willamette 1,000 acres	Percent Basin
Forest Lands	100	5,117.3	1,791.3	2,121.6	1,204.4	32.2
U. S. Forest Service	39.0	2,019.3	905	450.5	663.8	
Bureau of Land Management	8.2	427.0	170	213	44	
Corps of Engineers	0.3	17.3	8	9.3	-	
State	2	103	6	72.8	24.2	
Other Government	0.5	26.8	2.6	8.2	16	
Large private	26	1,320.6	635.7	599.9	85.0	
Small private	24	1,203.3	64	767.9	371.4	
	Agri. Land					
Agricultural	100	1,684.2	193.9	1,167.0	323.3	45.1
Federal	0.5	3.1	3.1	-	-	
State, County, Municipal	0.5	4.0	1.0	3	-	
Private	99	1,677.1	189.8	1,164	323.3	
Other		915.9	503.6	184.1	228.2	22.7
U. S. Forest Service	47	429.8	396.4	20.2	12.9	
Other Federal	2.8	25.2	18.6	5.4	1.2	
State, County, Municipal	8.2	77.8	6.2	55.4	16.2	
Private	42	383.6	82.4	103.1	197.9	
Totals - Willamette Basin		7,709.2				
U. S. Forest Service	32	2,449.1	1,301.4	471	676.7	
Bureau of Land Management	5	420	170	213	44	
Corps of Engineers	0.6	48.3	35	13.3	-	
State	2	162.6	7.6	114.7	40.3	
County, Municipal	0.6	48.8	8.2	24.6	16.0	
Private	59.8	4,584.7	971.9	2,635.0	977.8	
Total	100	7,709.2				

6/ "Willamette River Basin, Oregon," U.S.D.A. Interim Report, 1964

extremely large wood products companies, such as Weyerhaeuser, Crown-Zellerbach, Georgia-Pacific, International Paper Company, and Willamette Valley Lumber Company. Although a major portion of the land in the Upper Basin is in public ownership, a large part of that in the Lower Basin and a major portion of the Middle Basin is in private ownership.

Tables 11 and 12 show a continuous need for current acreage of forest and farm lands in the United States to the year 2000.

3. The agricultural picture of the basin is depicted in Table 13.

4. Tourism

There is no scarcity of recreation land in the Willamette Basin since over 2½ million acres are publicly owned and available for many types of use. See Table 10. Oregon leads all states in per capita use of State park recreation facilities. 16/ Out-of-state visitors totaled over 6 million in 1960. By 1975 the number will rise to 15 million a year. 1/ Of the overnight visitors, 50.3 percent used commercial facilities, 21 percent stayed with friends or relatives, and 18 percent camped out. Studies show that 75 percent of the visitors will be from California and Washington, and 25 percent from the other states. The expenditures of out-of-state tourists reached $244 million in 1964. 13/ The excellent freeway into Portland from the east and the Seattle to California freeway through the Willamette Basin tend to funnel tourists through the basin. Scenic roadside strips of timber have been preserved along many of the highways, and the State has an active highway beautification program. As yet, there has been no serious problem in preservation of "open space" and scenic areas at the lower elevations. However, with accelerated urban growth, these problems are developing and must be overcome. Table 14 shows a tremendous expansion in future needs for recreational lands.

5. Other Industries

The economy of the basin is found to be well diversified. There has been a gradual but significant growth in metal working industries. The electronics industry now ranks fifth among the manufacturing industries of the basin.

6. Employment

Table 15 lists employment in Oregon in relation to its payrolls. Wholesale and retail trade is most important followed by lumber and wood product manufacturing. Table 16 shows the major industries in relation to the three subbasins.

1/ "Summary Report, Oregon Comprehensive Statewide Planning Study," Oregon Department of Planning and Development, March 1964.

13/ "The Oregon Economy and Outlook," Oregon Department of Commerce, 1965, page 2.

16/ "Oregon Outdoor Recreation," Oregon State Highway Department, 1962.

TABLE 11

LAND USE IN WILLAMETTE BASIN - PERCENTAGE

County	Urban	Industrial	Military	Intensive Agriculture	Dryland Farming	Forests	Parks	Conservation	Grazing	Non-Productive	Total Land Area	Public	Federal
Lower Willamette Subarea													
Clackamas	1.76	-	-	19.50	-	72.22	-	0.20	5.79	0.53	100	54.0	50.7
Multnomah	25.60	0.48	-	20.51	-	50.08	-	3.02	-	0.31	100	27.6	27.6
Washington	3.19	-	-	46.28	-	50.53	-	-	-	-	100	17.3	2.7
Columbia	1.17	-	0.12	12.73	-	77.10	-	4.67	3.04	1.17	100	9.3	2.9
Middle Willamette Subarea													
Benton	0.57	-	-	34.82	-	57.65	-	2.74	4.22	-	100	24.4	17.3
Linn	0.33	-	-	25.02	-	65.86	-	5.62	2.71	0.46	100	40.9	37.9
Marion	4.13	-	-	47.46	-	42.71	1.25	1.32	2.25	0.88	100	30.8	30.8
Polk	-	-	-	41.68	-	51.58	-	-	6.74	-	100	11.8	9.0
Yamhill	1.70	-	-	45.16	-	52.71	-	-	-	0.43	100	19.0	15.1
Upper Willamette Subarea													
Lane	1.78	-	-	8.85	-	81.29	-	5.08	2.58	0.16	100	60.9	59.0

TABLE 12

PROJECTED LAND USES IN UNITED STATES

Category	Million Acres 1960	Million Acres 1980	Million Acres 2000
Crop land, including pasture	447	443	476
Grazing land	700	700	700
Farm land, nonproducing	45	45	45
Commercial forest land	484	484	484
Recreation (excl. reservoir areas & city parks)	44	76	134
Urban land (including city parks)	21	32	45
Transportation	26	28	30
Wildlife refuges	15	18	20
Reservoirs	12	15	20
Other land (residual)	110	63	-50 [1]
Totals	1904 [15]	1904 [15]	1904 [15]

1/ Additional crop land and recreation land needed to satisfy demand.

15/ Landsberg, et al, "Resources in America's Future," Resources for the Future, John Hopkins Press, 1962, p. 373.

TABLE 13

OREGON 1959 RURAL LAND USE INCOME DATA

Area County	Land in Farms 1954 1,000 A.	Land in Farms Total Acres 1,000	Land in Farms Percent of all Land	Number Farms	Average Size Acres	Commercial Farms Total Number	Commercial Farms Under $2,500 Products Sold	Commercial Farms $10,000 & over Products Sold	Tenant Operated Percent	Value of Farm Products Sold Total $1,000	Value of Farm Products Sold Crops $1,000	Value of Farm Products Sold Dairy Products $1,000	Value of Farm Products Sold Livestock $1,000	No. Cattle and Calves 1,000
Lower Willamette Subarea														
Clackamas	311	319	26.4	4267	75	1640	285	504	4.2	22,231	11,163	2,012	3,228	37
Multnomah	71	89	32.9	1104	81	560	30	302	6.0	10,625	8,054	1,275	848	14
Washington	236	211	46.1	2785	76	1342	95	447	4.5	18,256	10,429	3,503	1,845	28
Middle Willamette Subarea														
Benton	214	205	48	895	229	453	87	137	9.2	5,487	3,535	591	979	12
Linn	510	490	33.5	2539	193	1369	146	759	8.4	22,372	15,012	2,604	3,354	33
Marion	368	351	46.8	3788	93	2055	115	874	6.3	32,404	23,245	2,954	3,433	32
Polk	237	233	49.2	1363	171	741	60	312	7.1	10,435	7,548	1,320	1,111	13
Yamhill	273	261	57.4	2094	125	1072	120	440	5.5	17,205	9,415	2,487	1,986	20
Upper Willamette Subarea														
Lane	442	365	12.5	3004	122	1184	112	480	4.7	15,896	8,195	1,943	3,354	35

TABLE 14

USE OF LAND IN THE UNITED STATES, SELECTED YEARS 1900-1950 AND PROJECTIONS TO 2000 17/
(Million Acres)

Use of Land For	1900	1910	1920	1930	1940	1950	1980	2000
Cities of 2500 or more population	6	7	10	12	13	17	30	41
Public recreation areas	5	9	12	15	41	46	72	95
Agriculture								
Crops	319	347	402	413	399	409	388	388
Pasture	77	84	78	73	68	69	70	70
Other*	53	57	58	45	44	45	45	45
Subtotal	449	488	538	531	511	523	503	503
Commercial forestry								
Continuous management	0	30	60	200	300	359	385	405
Little or no management	525	482	440	295	188	125	90	50
Subtotal	525	512	500	495	488	484	475	455
Grazing	808	775	730	735	740	700	700	680
Transportation	17	19	23	24	24	25	28	30
Reservoirs and water management	-	1	2	3	7	10	15	20
Primarily for wildlife	-	-	1	1	12	14	18	20
Mineral production, deserts, swamps, mountain tops, noncommercial forests, miscellaneous, and other	94	93	88	88	68	85	63	60
Total	1904	1904	1904	1904	1904	1904	1904	1904

* Farmsteads, farm roads, feed lots, lanes, ditches, wasteland

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17/ "Land for Amercians, Trends, Prospects and Problems," Marion Clawson, 1963 p. 129

TABLE 15

PAYROLLS OF MAJOR INDUSTRIAL GROUPS IN WILLAMETTE BASIN 17/

INDUSTRY	1962		1961		1960		1955	
	Payroll (1000)	% Total	Payroll (1000)	% Total	Payroll (1000)	% Total	Payroll (1000)	% Total
Wholesale and Retail Trade	$519,693	23.5	$486,133	23.5	$482,983	23.7	$357,538	25.7
Lumber & Wood Products	$387,648	17.5	$365,705	17.7	$382,533	18.8	$382,957	27.6
Other Manufacturing	$314,282	14.2	$294,354	14.2	$289,229	14.2	$196,071	14.1
Transportation, Public Utilities, Communications	$201,755	9.1	$188,052	9.1	$181,916	8.9	$136,627	9.8
Contract Construction	$165,861	7.5	$152,087	7.4	$155,268	7.6	$94,474	6.7
Services	$158,419	7.2	$146,672	7.1	$138,927	6.8	$88,906	6.4
Federal Government	$137,113	6.2	$127,517	6.1	$119,160	5.8	-	-
Finance, Insurance, Real Estate	$107,694	4.9	$99,439	4.8	$92,710	4.6	$60,074	4.3
Food & Kindred Products	$105,103	4.8	$103,187	5.0	$98,123	4.9	$66,212	4.8
State Government	$97,217	4.4	$91,340	4.4	$83,694	4.1	-	-

17/ "Oregon Economic Statistics 1964," Bureau of Business Research, University of Oregon

TABLE 16

EMPLOYMENT IN WILLAMETTE BASIN IN 1960 [7]

Industry	Upper Willamette Subarea 1,000	Middle Willamette Subarea 1,000	Lower Willamette Subarea 1,000	Total Willamette Basin 1,000
Goods, Total	19.4	31.1	67.5	118.0
Agriculture, forestry, fish, mining	2.6	10.9	9.8	23.3
Manufacturing, Total	16.8	20.2	57.7	94.7
Lumber, wood products, furniture, pulp, paper	13.8	12.4	13.4	39.6
Food and kindred	1.2	3.0	8.3	12.5
All other manufacturing	1.8	4.8	36.0	42.6
Construction	4.0	6.3	17.2	27.5
Military	.1	.6	1.5	2.2
Services	34.1	56.6	192.7	283.4
Total Employed	57.6	94.6	278.9	431.1
Unemployed	3.7	6.8	14.8	25.3
Total Labor Force	61.3	101.4	293.7	456.4

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[7] U. S. Census of Population, 1960

TABLE 16

EMPLOYMENT IN WILLAMETTE BASIN IN 1960 7/

Industry	Upper Willamette Subarea 1,000	Middle Willamette Subarea 1,000	Lower Willamette Subarea 1,000	Total Willamette Basin 1,000
Goods, Total	19.4	31.1	67.5	118.0
Agriculture, forestry, fish, mining	2.6	10.9	9.8	23.3
Manufacturing, Total	16.8	20.2	57.7	94.7
Lumber, wood products, furniture, pulp, paper	13.8	12.4	13.4	39.6
Food and kindred	1.2	3.0	8.3	12.5
All other manufacturing	1.8	4.8	36.0	42.6
Construction	4.0	6.3	17.2	27.5
Military	.1	.6	1.5	2.2
Services	34.1	56.6	192.7	283.4
Total Employed	57.6	94.6	278.9	431.1
Unemployed	3.7	6.8	14.8	25.3
Total Labor Force	61.3	101.4	293.7	456.4

7/ U. S. Census of Population, 1960

Table 16 is a more generalized breakdown of employment in the basin which shows that the service industries provide by far the most jobs. As may be expected, the proportion in service industries was much the highest in the Lower Willamette Subarea. It is also interesting to note that unemployment in relation to labor force is less in the Lower Willamette Subarea. No doubt this is due to the greater diversification of job opportunities and less seasonal employment in the service industries. Table 19 shows that the median family income in Oregon is higher than the United States average. It ranks fifth in comparison to the nine western states. The cities of Portland and Eugene show a higher median family income than the State of Oregon average.

The Willamette Basin Counties are found to have the highest rates of employment and highest payrolls in the State. The Portland area had the highest net effective income in 1962, with an average of $2431 per capita. The City of Eugene ranked second: Salem, fourth; and Corvallis, fifth. 1/ Oregon's rate of unemployment averaged 5.4 percent of its labor force from 1952-62. 8/ The Oregon State Board of Census assumes this rate will continue through 1985. This may be compared to an unemployment rate on a national level of 5.3 percent in 1950 and 5.1 percent in 1960, and a forecast rate of 4 percent of the civilian labor force to 1985. This indicates that unemployment will be higher in Oregon than on a national level.

As an indication of the economic well being of the Willamette Basin, it should be noted that motor vehicle registration increased two and one-half times from 1940 to 1963. Tourist travel increased by 63 percent between 1955 and 1962. Value of building permits tripled between 1952 and 1963.

Forecasts indicate that government will become the number one employer in the Willamette Basin by 1985. Nearly 20 percent of those employed will be in this activity, reflecting demands in education, social services, and recreation. Projections show that manufacturing, based largely on wood fibre resources, will be the second most important factor in the economy by 1985. In third place will be wholesale and retail trade. Agriculture will drop from fifth to sixth place, representing only 7 percent of the labor force as compared to 11 percent in 1960.

Table 17 shows the projected growth of Oregon's labor force to 1985. It shows a steady decline in employment in both agriculture and lumber and wood products. However, the decline in the lumber industry is more than offset by increasing employment in paper and allied products from wood fibre.

1/ "Summary Report - Oregon Comprehensive Statewide Planning Study," Oregon Department of Planning and Development, March 1964.

8/ "National Economic Growth Projections," Ad Hoc Water Resources Staff, 1963.

TABLE 17

EMPLOYMENT TRENDS IN OREGON 13/

Year	Total Labor Force 1,000	No. Employed 1,000	Employment in Thousands: Agri-culture	Nonagri-culture	Manufac-turing	Lumber & Wood Products	Paper and Allied Products	Percent of Unemployment
1947	618.5	582.2	85.7	417.4	132.8	73.9	4.8	5.9
1950	652.5	605.2	81.0	435.3	135.5	80.0	5.1	7.1
1960	719.5	682.3	76.2	509.2	144.4	71.9	7.3	5.1
1964	765.6	730	62.7	567.5	149.5	72.2	7.2	4.6
1970	803.0	760	69.5					5.4
1980	899	850	65					5.4
1985	946	895	65	830	162.5	53		5.4

7. Income Distribution

Table 18 shows personal income by source and county for the Willamette Basin. Manufacturing contributed most to personal income in 8 of the 10 counties. Wholesale and retail trade was most important in Multnomah County. Government provided major employment in Marion County, the location of the State Capitol. Multnomah County income from manufacturing was 39 percent of the State's total in 1960.

Table 19 shows that the City of Eugene, the center of the lumber industry, in Lane County, had the highest per capita spendable income. Multnomah County led the other counties. The counties with large metropolitan trading centers were the ones with the highest net income. Because the economy of Lane County is primarily dependent on the wood fibre industries, it is important that a source of raw material be maintained to sustain the industry. Table 13 showed the small acreage of agricultural land available in Lane County to take up the slack in employment. An economy based primarily on one industry is subject to the ups and downs of the market. It is obvious that new or supplemental industries are needed for a better balanced economy.

H. Shifting Trends in Major Land Uses

Marion Clawson's studies indicate that the populations and areas of our cities will about double by the year 2000. 18/ By then, 85 percent of the population of the United States (260 million people) will be urban residents.

13/ "The Oregon Economy and Outlook," 3rd Edition, 1965, Oregon Department of Commerce.

18/ "Land for Americans, Trends, Prospects, and Problems," Marion Clawson, 1963, page 127.

TABLE 18

PERSONAL INCOME AND SOURCE BY COUNTIES, 1960 18/

Area	Total Personal Income 1950	Total Personal Income 1960	Total Wages & Salaries 1950	Total Wages & Salaries 1960	Income from Major Industry 1950	Income from Major Industry 1960	Major Industry
	(Millions Dollars)		(Millions Dollars)			(Millions Dollars)	
State of Oregon	$2,453.	$3,964	$1,490	$2,531	$485	$750	Manufacturing
Benton	36.74	66.56	20.40	44.08	6.79	11.77	"
Clackamas	77.31	154.70	42.22	92.28	18.77	32.47	"
Columbia	26.56	30.66	15.41	17.16	9.31	9.67	"
Lane	182.33	326.95	117.01	218.19	48.81	84.45	"
Linn	76.80	108.64	45.87	69.79	26.94	34.65	"
Marion	150.09	247.73	85.84	159.40	23.31	58.79	Government
Multnomah	977.97	1,615.97	647.70	1,111.40	178.28	291.38	Wholesale & Retail Trade
Polk	31.88	36.42	18.29	23.23	10.62	12.37	Manufacturing
Washington	58.23	128.10	28.28	74.93	8.54	30.30	"
Yamhill	41.13	51.66	20.92	27.56	8.68	9.38	"

18/ "Oregon Personal Income by County," Oregon Department of Planning and Development, 1950-61

TABLE 19

PERSONAL INCOME

County or Area	Per Capita Income 1950	Personal Dollars 1960 [17]	Net Effective Buying Income 1962 [18] Per Capita	Net Effective Buying Income 1962 [18] Per Household	Wage & Salary Disbursements--1960 Millions of Dollars Farms	Mining	Contract Construction	Manufacturing	Wholesale & Retail Trade
Lower Willamette Subarea									
Clackamas	$1408	$2049	$1950	$6381	2.75	.20	6.29	32.47	18.94
Columbia	1233	1494	1497	4787	.60	-	.36	9.67	1.77
Multnomah	1893	2814	2280	6706	3.73	.88	72.82	241.65	291.38
Washington	1503	2022	2205	7393	2.16	.27	6.62	30.30	11.90
Middle Willamette Subarea									
Benton	1150	1668	2039	7295	.53	.08	3.09	11.77	5.84
Linn	1439	1892	1548	5149	2.44	.10	2.54	34.65	10.12
Marion	1554	2135	1835	6262	6.77	.25	9.24	26.70	25.26
Polk	1369	1669	1579	5131	1.83	.08	.82	12.37	2.92
Yamhill	1229	1599	1614	5247	2.11	.13	1.07	9.38	4.43
Upper Willamette Subarea									
Lane	1452	1828	1860	6210	2.31	1.42	19.08	84.45	38.36
Oregon	1629	2267	1947	6189	51.00	6.00	155.00	750.00	522.00
United States	1491	2217	2368						
Eugene			2356	7413					
Springfield									
Salem			2289	7473					
Portland			2431	6717					

[18] "Oregon Economic Statistics 1964," Bur[illegible] of Business Research, University of Oregon

[17] "Oregon Personal Income by County 1950-1961," Oregon Department of Planning and Development

Urbanization of the western states will continue at a faster rate through the year 2000 than in other regions of the United States. Increasing proportions of the urban population will continue to congregate in the very large metropolitan areas, one of which is the Seattle-Eugene complex. Anticipated shifts in land use are shown in Table 20.

TABLE 20

SHIFTS IN LAND USES IN THE UNITED STATES 19/

Land Use	1959	Reductions	Additions	Net Change	1980 Projections
	Millions of Acres				
Cropland	458	-68	+17	-51	407
Grassland, pasture and range	633	-30	+48	+18	651
Forest land	746	-32	+27	- 5	741
Farmsteads & farm roads	10	-	-	-	10
Special purpose uses	147	-	+49	+49	196
Misc. other land uses	277	-11	-	-11	266
Total	2271	-141	+144	-	2271

From 1950 to 1960, approximately one million acres of agricultural land per year were required for urban expansion, highways, airports, and other intensive uses in the United States. In that period, total acreage of lands being cropped declined by 20 million acres, cropping being concentrated on the better lands. Lands devoted to recreation, wildlife, and reservoirs increased by over 5 million acres.

Competition for land will increase the demand for sale or transfer of public lands to meet expanding urban needs. The Classification and Multiple Use Act of September 19, 1964 enables BLM to make public lands available to meet such needs. BLM also has authority to exchange lands for blocking up ownership and to achieve cheaper and more efficient administration of the public lands. More withdrawals of public lands will be needed to protect critical watersheds, recreation, and wildlife lands to satisfy increasing public demands. Current resource use pressures were found to be given major consideration, influencing public land use policies. Development of a broadly based, nonpolitical institution may be needed to give emphasis to the long-term resource needs and uses. In the Willamette Basin we are faced with two fairly immediate facets of alternative uses of BLM lands. One is for reservoir sites, which is an open conflict with the

19/ "Land Use Trends," Economic Research Service, U.S.D.A.

sustained yield timber production now practiced on the site area. Secondly, with the accelerating metropolitan growth of the basin, some of the public lands may be needed for production of municipal water. An educational program may be needed to convince the public that multiple use resource management can be practiced on a municipal watershed rather than limiting its use to only water production.

I. Conclusions & Policy Implications

1. Resource Needs from BLM Lands

a. Timber

There is national demand for Douglas fir timber from the Pacific Northwest. Old growth timber stumpage on private lands will be nearly depleted by 1985. There will be a shortage of private stumpage until large acreages of second growth stands become merchantable about the year 2000. Heavy pressure will be put on public land management agencies for greatly accelerated timber sales between 1985 and 2020 to carry the industry through the "lean year" period of private stumpage shortage. Federal agencies should be programing and be financed today to initiate greatly intensified timber management programs in anticipation of the developing stumpage shortage crisis expected in fifteen years. Measures which should be explored for increasing the amount of wood fibre for this critical period between 1985 and 2020 include fertilization, irrigation, intensified programs of thinning and pruning to increase quality, accelerated reforestation, an accelerated forest nursery program to make available superior planting stock, and better protection against fire, insects, and disease. Indications are that future timber sale contracts may have to make a greater allowance for road construction and maintenance costs, for site protective measures in logging and slash disposal, for protection of water quality, recreation, wildlife, and natural beauty.

Hopefully, increasing future stumpage prices may make possible a more effective watershed management program in connection with road construction, timber harvest, and slash disposal.

b. Agriculture

It is expected that 800,000 acres of additional farmland will be brought under irrigation during this study period. Most of the irrigation water will be derived from the forested watershed. This will be accomplished to a large degree by means of large water storage projects on the headwater streams of the basin, mostly in forest areas. The increased demand for water will tend to increase water values and force greater recognition for the need for good watershed management of the watersheds.

c. Recreation, Tourism, & Natural Beauty

Population projections for Oregon, California, and other nearby states reflect a zooming prospective demand for outdoor recreation in the Willamette Basin's outstanding beautiful scenery, majestic forests, and

abundance of water based recreation. Forest management programs must be modified to meet accelerating recreational demands and insure protection of natural beauty areas. BLM lands are bisected or lie in the vicinity of major highways, rivers, and stream systems. Scenic timber corridors and scenic vistas must be preserved and maintained by restricted or selective timber harvest, careful slash and debris clean up, and needed revegetation, plus elimination of commercial signs and billboards. Accelerated development of recreation sites on streams and lakes will be needed to control the ever growing problem of pollution and biological contamination resulting from heavy public use. Increasing demand for wood fibre will permit sale of thinnings and cull material not now merchantable. Thus, timber sale stumpage quotas can be met even while diverting some forest lands to recreational use.

d. Population

With a doubling of population of the basin by the end of the century and most of the people urban residents, it is imperative that outdoor recreational opportunities be available for their mental and social well being, that an abundance of high quality domestic water be available, that basic natural resources be accessible to maintain a healthy economy. BLM will have the responsibility for meeting much of these needs. Only by carefully balancing and intensifying our multiple use programs on the BLM lands will we be able to meet the demands of the future.

e. Water

Most of the water of the basin originates on its forested watershed. Water is an essential raw material for industry and is basic to human life. It must be considered as a natural resource subject to management. Decisions must be made whether to export part of it or retain it to sustain the health and economy of the basin. Its value is more than local.

Irrigation is the greatest consumptive user of water in the basin. Currently only 200,000 acres are now under irrigation. Field studies have identified 1,200,000 acres of farm land as suitable for irrigation, indicating that this will be the dominant use of water for the period of this report. Community development and growth is dependent on high quality water for domestic, municipal, and industrial use. A large amount of clean water is needed to sustain the many pulp and paper mills in the basin and the food processing plants. Water quality and temperature control is needed for sustenance of substantial anadromous and sport fish populations. Quality of the water limits the kind and intensity of recreational use. Large volumes of water are needed to maintain navigation and for pollution abatement and dispersal.

Although generally plentiful in the basin, water presents problems in the context of proper timing of flows, quality, location, and required amounts. An overabundance in winter results in costly floods while semi-drouth conditions in summer preclude full farmland production. On the

other hand inadequate drainage results in thousands of acres in the valley being "wet" most of the year. As a result in some years some of these wet soils cannot be cultivated.

On a national scale, alternative uses of this water in California may be greater than if retained here. In the past we have been complacent about our water, have taken it for granted. One day it may be our most valuable resource.

f. Summary

(1) Because of expanding national, regional, and local demand for all resources from BLM lands, BLM must intensify all its resource management programs to meet accelerating future demands. Tables 21 and 22 show the present and future timber supply situation in the Willamette Basin.

TABLE 21

INVENTORY OF PRESENT AND FUTURE MERCHANTABLE TIMBER IN WILLAMETTE BASIN 5/

Land	1963	1985	Change
	(MM BF International ¼-inch Rule)		(Percent)
National Forest	95,849	75,721	-21
Other Public (BLM)	18,943	15,723	-17
Private	31,325	16,916	-46
Total	146,117	108,360	-26

TABLE 22

DISTRIBUTION OF WESTERN OREGON GROWING STOCK OF TIMBER (IN PERCENT) 5/

Diameter Classes	National Forest 1963	National Forest 1985	Private 1963	Private 1985	Other Public (BLM) 1963	Other Public (BLM) 1985
6-10	6	8	11	25	7	13
12-18	18	21	23	43	19	34
20-28	25	26	21	20	24	32
30-38	22	20	16	5	20	13
40-48	16	13	13	2	13	3
50-58	8	7	8	2	9	2
60+	5	5	8	3	8	3

5/ "Prospective Timber Supplies and Forest Industrial Development in Willamette River Basin," Pacific Northwest Forest and Range Experiment Station, 1965.

(2) Priorities, Conflicts and Alternatives

To a degree, each resource use of forest lands conflicts with other uses. Road construction and logging impair water quality and scenic values but improve the site for wildlife. Recreation sites and scenic strips preclude timber harvest and have potential for degrading water quality where sanitary facilities are inadequate. The best water for municipal use comes from watersheds in their natural state. Wildlife eat tree seeds and seedlings and limit forest regeneration. Domestic livestock damage ground cover by browsing on forest seedlings and may also biologically impair water quality by wading in streams. There is no argument but what production of municipal water takes priority over other land uses. This does not mean that municipal water needs would preclude other resource uses since timber harvest, recreation, wildlife, and other resource uses can be accomplished on the watershed without impairment of domestic water quality or quantity.

Certainly a continued supply of wood fibre is needed to support Oregon's economy. By the year 2020 private forest lands will improve their position in meeting stumpage demands of the industry, relieving Federal agencies in some degree from this responsibility of supplying the timber resource.

V. Communications Profile

Peoples' interests and desires are reflected by the groups to which they belong. A democratic society is responsive to group efforts and pressures. Public decision makers must be alert to facts reflecting the social and political environment. Competition between interest groups often finds BLM in the middle of the problem as arbiter. By working closely with these groups the administrator can often prevent problems from arising. Group support is basic to initiation of new programs. The abundance of outdoor oriented interest groups is both a blessing and a problem to the natural resource administrator. The variety of such groups makes it fairly easy to find one or several which will support a particular program. Many times the resource interest of a group is very narrow, clashing with the limited objectives another group may be pushing. For example, the group promoting wilderness legislation is opposed by recreation groups wanting intensive recreation developments for mass type of use.

There are natural resource oriented organizations on a national, regional, state, county, city, and local level. A listing of all such groups with which an administrator must deal becomes quite formidable. He could not possibly belong or keep close contact with all these groups. He must identify the most effective groups and work with as many of these as possible. The National Wildlife Federation, 1412 16th Street N.W. Washington, D.C. 20036, publishes an annual conservation directory listing organizations and officials concerned with natural resources. Due to the economic importance of timber in the Willamette Basin, timber resource groups are very forceful in this area. BLM films, slide pictures, and other informational material offer opportunities for contact and discussion with these groups.

Some of the more important of these organizations in western Oregon are listed as follows:

American Forest Products Industries, 847 Pittock Block, Portland, Ore. 97205
Association of Oregon Counties, P. O. Box 2051, Salem, Ore. 97308
Federation of Western Outdoor Clubs, 4534½ University Way, N.E., Seattle, Washington
Izaak Walton League of America, 714 N.E. 192nd Ave., Portland, Ore. 97220
Industrial Forestry Assn., 1410 S.W. Morrison St., Portland, Ore. 97205
Northwest Timber Assn., P. O. Box 1847, Eugene, Ore. 97401
Oregon Wildlife Federation, P. O. Box 3021, Portland, Ore. 97208
Oregon Forest Protection Assn., 1326 American Bank Bldg., Portland, Oregon 97205
Pacific Logging Congress, American Bank Bldg., Portland, Ore. 97205
Western Wood Products Assn., Yeon Bldg., Portland, Oregon 97204
Western Forestry & Conservation Assn., 1326 American Bank Bldg., Portland, Oregon
Western Forest Industries Assn., 1500 S. W. Taylor St., Portland, Ore. 97205
Assn. of Oregon Counties, c/o Ray Doerner, Douglas County Courthouse, Roseburg, Oregon

VI. BLM Resource Management Responsibilities and Relationships

A. Local Goals and Objectives

Over 52% of the land in Oregon is owned by the Federal Government and managed by 12 Federal agencies. Slightly less than 3% is under State ownership. Fifty-four percent of the commercial forest land of the Willamette Basin is in public ownership. Due to heavy cutting on private lands about 80% of the remaining sawtimber is on Forest Service and BLM managed lands. 5/ It is obvious that the management of these Federal lands will have a major impact on the economy of the State of Oregon.

In Western Oregon BLM operates under two sets of general goals and objectives. First are the national goals and objectives applicable to the public domain lands as set by legislation and administrative interpretation. But in Western Oregon much of the public land is revested Oregon California Railway grant lands on which Congressional legislation sets out quite specifically how it should be used. Administrative goals and management of the Oregon and California lands are much more limited then than is the case with other public lands. The Act of August 28, 1937 set up a "balanced use" concept for management of the O&C lands. The Classification and Multiple Use Act (78 Stat. 986, 43 U.S.C. 1411-18) provides that those public domain lands to be retained in Federal ownership shall be managed for multiple use and sustained yield of the several products and services obtainable therefrom. Multiple use means utilization of the various resources "in the combination that will best meet the present and future needs of the American people". It is similar to the multiple use management concept of

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5/ "Prospective Timber Supplies and Forest Industrial Development in the Willamette River Basin" Pacific N.W. Forest & Range Exp. Sta., Misc. Pub. Sept. 1965.

the United States Forest Service. Both economic demand and intangible social needs are considered in striving for that use or combination of uses which will provide the maximum net long term benefit to the general public. All viewpoints, national, regional, state, and local, are fully considered. Specified program objectives must be achieved in the least expensive manner possible.

The O&C Act of August 28, 1937 (50 Stat. 874) provides that the lands ". . .shall be managed--for permanent forest production--in conformity with the principle of sustained yield for the purpose of providing a permanent source of timber supply, protecting watersheds, regulating stream flow, and contributing to the economic stability of local communities and industries, and providing recreational facilities." The legislation emphasizes the objective of social benefits and welfare of local residents by contributing to the economic stability of dependent local communities and industries. Timber management decisions are influenced by local needs for material to support local forest products industries and to aid in the stability of the working force. Community social and welfare benefits from the O&C lands are also provided from the recreation resources, fish and wildlife, and by watershed management. On community water supply watersheds BLM develops and carries out special management measures on the public lands so that impairment of water quality is minimized. Restrictive cutting is required where it is desirable to protect attractive scenic conditions. Special planning is undertaken to preserve favorable habitat and conditions for game and fish. The 1937 O&C legislation does stress sustained timber production from these lands, whereas this emphasis is not found in the Multiple Use Act of September 19, 1964, applicable to the other public domain areas. In many situations the small size and isolated location of the public land precludes providing for all potential uses. Here the most valuable use must be given emphasis with provision for as many complementary resource uses as practical.

B. State and National Goals and Objectives

Douglas fir timber is in National demand. Major production is from the Pacific Northwest. The O&C lands make a significant contribution to the lumber production from Western Oregon. Therefore, administration of the O&C Act has an impact on both state and national lumber markets and the construction industry. The management goal on O&C lands for stabilizing local wood fibre industries helps stabilize the lumber market and the construction industry on state and national levels.

BLM's multiple land use guidelines helps protect and develop Western Oregon's unique attractiveness as a recration spot for local people as well as those from adjacent states. Under the Multiple Use goal recreation sites are developed and natural beauty spots and scenic areas are protected. Over 6 million out-of-state visitors came to Oregon in 1960.

By 1975 this figure is expected to rise to 15 million per year. Western Oregon's delightful summer climate, scenic mountains, rivers, and lakes, excellent highways, and beautiful forests tend to make the tourist industry the third largest endeavor in the state. BLM lands are found in the foothills and lower mountain slopes below National Forest boundaries and are generally more accessible to the public for recreational use.

Both BLM's multiple land use guidelines and the O&C Act give emphasis to production of good quality water from the public lands. This is important locally to municipalities who derive their water from these watersheds. It is important from a National level as it relates to the many food processing plants and paper mills in the basin which need large quantities of high quality water. These satisfy nationwide demands for canned and frozen foods and paper products. Maintenance of water quality both in purity and temperature is also a requisite for protection of anadromous and other fish in the basin. Sustaining the salmon fishery is economically important to the state and to the consuming public. Summer flows in the Willamette currently are marginal in quality for sustaining fish life due to inadequate sewage and waste treatment. Thus, it becomes doubly important that public agencies take no action to further aggravate the situation through road construction, timber harvest, insect and disease control, or slash disposal.

VII. Present Resource Situation in Willamette Basin

A. Timber Resource

The Pacific Northwest Forest and Range Experiment Station in 1965 completed a study on "Prospective Timber Supplies and Forest Industrial Development in the Willamette Basin." This is the most accurate and up to date reference in regard to the timber resource currently available. Major findings are as follows:

1. An increasing national demand for wood assures that the basin's production will be limited only by the economically available supply of timber.

2. Roundwood consumption will continue to increase to the year 1985.

3. Changing demands will change the composition of the industry and with increased labor productivity will result in a decrease and redistribution of employment in the basin.

4. The value added by manufacturing of forest products will increase, most of the gain coming from the pulp and paper industry.

5. The forest inventory volume will continue to decline through 1985.

6. There will be a reduction in timber harvest after 1985 due to continued reduction of inventory.

7. Current levels of timber cutting cannot be maintained between 1990 and 2020, reducing log harvest to 82% of the 1963 level by 2020.

8. By year 2020 the total inventory volume will be only 50% of the 1963 inventory volume.

9. National Forests contain 67% of the basin's softwood timber, BLM 12%, the forest industry 12%, farmers and miscellaneous owners 8%, and state and county land 1%.

The indicated future timber resource in the Willamette Basin is shown in the following tables:

TABLE 23

FUTURE TIMBER RESOURCE

Owner	1963 (MM BF International ¼" Rule)	1985	Change Percent
National Forest	95,849	75,721	- 21
BLM, State, County	18,943	15,723	- 17
Private	31,325	16,916	- 46
Total	146,117	108,360	- 26
Net Annual Growth of Sawtimber			
National Forest	172	320	+ 86
BLM, State, County	168	258	+ 54
Private	408	480	+ 18
Total	748	1,058	

Most of the reduction of timber inventory will be in the harvest of the large mature and over mature timber. Replacement of the old growth stands by faster growing young trees accounts for the increased increment. The low level of stocking on private lands results in the smaller growth rate. The experiment station study shows that after 1990 the long trend of increasing growth stops and begins to decrease. Between 1990 and the year 2000 growth will decrease 19 million board feet, almost 2 million board feet per year. This is because the proportionate increase in net growth will be reduced after the second growth forests replace virgin timber stands.

An inventory of the commercial forest land by ownership is shown on the following table taken from the experiment station report.

Table 24

Area of Commercial Forest Land in the Willamette River Basin by Subbasin 3/

Subbasin	Total Acres	National Forest	BLM	Other Public	Forest Industry	Farmer & Small Pri.	% BLM
Upper Subarea							
Coast Fork	379,000	85,000	83,400	-	162,000	48,000	22%
Middle Fork	760,000	628,000	26,000	-	77,000	29,000	3%
McKenzie	481,000	336,000	40,000	-	84,000	21,000	8%
Long Tom	146,000	-	20,600	7,000	33,000	86,000	14%
Total	1,766,000	1,049,000	170,000	7,000	356,000	184,000	9%
Middle Subarea							
Santiam	1,065,000	375,000	102,600	35,000	235,000	317,000	9%
Coast Range	602,000	23,000	68,100	10,000	184,000	317,000	11%
Pudding	307,000	-	44,000	25,300	117,000	121,000	13%
Total	1,974,000	398,000	214,700	70,300	536,000	755,000	11%
Lower Subarea							
Tualatin	229,000	-	11,000	61,900	8,000	153,000	4%
Clackamas	561,000	423,000	11,400	-	13,000	99,000	3%
Columbia	97,000	-	6,000	5,000	36,000	50,000	7%
Sandy	336,000	232,000	9,700	18,000	7,000	69,000	3%
Total	1,223,000	655,000	38,100	84,900	64,000	371,000	4%

These tables show that the Eugene BLM District has major resource management responsibilities in the Coast Fork Subbasin whereas the Forest Service has primary interests in the Middle Fork Subbasin. However, the Eugene-Springfield area is the manufacturing center for the entire Upper Subarea so the breakdown by subbasins is not especially relevant from a forest management standpoint. Federal lands constitute nearly 70% of the land area, being mostly National Forest. Thus, forest management decisions on the Federal lands in the Upper Subarea will have major impact on its economy.

Private forest lands dominate the acreage in the Middle Subarea while acreage of BLM lands is comparable to National Forest acreage. The important factor here is the amount of commercial stumpage remaining on the public lands compared to what remains on the private lands. The BLM lands constitute the most important Federal forest lands in the Coast Range Subbasin.

The modest acreage of BLM land in the Lower Subarea may eventually prove more valuable for municipal water supplies, recreation, and natural beauty than for wood fibre production due to proximity to the Portland metropolitan area.

3/ "Prospective Timber Supplies and Forest Industrial Development in Willamette River Basin: Pacific Northwest Experiment Station

A review of log production from land ownership classes in the Willamette Basin points up the importance of BLM lands to the forest industry. The experiment station report shows the following data:

TABLE 25

ANNUAL LOG PRODUCTION IN THE WILLAMETTE RIVER BASIN
(In thousand board feet, International ¼ Inch Rule)

Owner	1950	1954	1958	1960	1962	1963
Private	2,895,567	2,294,303	1,566,852	1,644,905	1,734,412	1,637,204
BLM	181,943	274,664	283,785	298,038	384,217	525,678
Nat'l.For.	573,687	823,536	1,001,816	1,097,981	1,553,650	1,494,507
State	136,176	74,064	13,019	27,225	24,609	59,570
Total	3,787,373	3,466,567	2,865,472	3,068,149	3,696,888	3,716,959

BLM efforts to get its forest under intensive management is reflected in the 1963 log harvest. This shows a BLM production of 14% of the total yield of the basin from only 8% of the forest land area. Heavy cutting on private lands is reducing the inventory to the extent that a substantial decline in harvest from these lands is forecast for the period from 1990 to 2020.

Between 1985 and 2000 total roundwood consumption by the lumber and wood products industry is projected to decline 21% from 5 billion to 4 billion board feet (International ¼ inch rule). In the 20 years between 2000 and 2020, consumption is expected to drop 6% to 3.8 billion board feet.

Although sawlog and veneer log consumption is expected to decline, consumption of wood fibre by paper and allied products industry is expected to remain stable between 1985 and 2020 at about 260 million cubic feet, providing a ready market for forest thinning material and cull logs.

Better forest utilization will result in better logging cleanup and less need for slash burning. Where areas are burned the small amount of material on the ground will provide less fuel. There should be less destructive heat to destroy soil humus and structure and potential water absorption capacity. The remaining commercial old growth timber will probably be completely harvested in about 90 years.* The second growth timber will be harvested at smaller size, permitting use of smaller, more maneuverable harvest equipment. Smaller more versatile mills may again become practical in timber manufacturing, opening up local markets for thinning material and other low quality logs.

Federal agencies are under considerable pressure to increase their annual allowable timber harvest cut. This would reduce the inventory of merchantable timber, leaving no stockpile of available stumpage to carry the industry through the lean years until second growth timber on private lands reaches harvest size. With the old growth timber depleted on the public lands and

* U.S.D.A. Willamette River Basin Oregon 1964

second growth not yet of commercial size, stumpage prices would rise and the few large companies having large reserves of old growth timber would reap a windfall at the expense of the public from prices from lumber and other wood products. Maintaining an even flow of wood fibre from public lands in the basin tends to stabilize prices for wood products and makes them more competitive with substitute products now appearing widely on the market, thus stabilizing the industry.

The large timber companies provide some resources from their lands free of charge to the public. These include recreation, opportunities for hunting, fishing, water, and natural beauty and scenic areas.

B. Range Resource

Most of the livestock grazing on forest land in the Willamette Basin is on areas in or near the Willamette Valley, primarily on privately owned lands. Most forests have dense canopies and a heavy brush and fern ground cover which precludes grass growth. After harvest of the timber there are a few years of forb and browse production palatable to livestock but the trees soon crowd these out. If grazed, there is some damage to the small conifer reproduction. The small amount of forage available does not usually warrant cost of fence construction for control of the animals. Cost of fence maintenance in forest lands is excessive due to windthrow of limbs and trees. For these reasons livestock grazing on forest lands in the basin is negligible except that found on small farm woodlots.

C. Recreation Resources of the Basin

There are two major types of outdoor recreation practices in the basin. There is extensive recreational land use for hunting, fishing, hiking, and pleasure driving. The intensive recreation uses such as water sports, skiing, camping, boating, and picnicking have a major impact on the land. Some of the privately owned lands are closed to hunting and fishing. Most forest lands are open to hunting, fishing, and other recreational uses. Most of the skiing and mountain scenery is found on National Forest lands. An abundance of water based recreation is, or will be, available from 14 constructed or authorized Corps of Engineers reservoirs in the basin plus two Bureau of Reclamation reservoirs soon to be built plus half a dozen private electric power dams available for public use. Most of these water bodies are in either the upper basin or the middle basin. Interstate Freeway 5 makes them readily accessible from Portland. Although the Columbia River offers great potential for water recreation, lack of recreation facilities, including boat launching ramps and moorage docks, has limited its use. The Willamette River offers even greater recreational potential, currently limited by a serious pollution problem. Many small natural lakes have been developed for recreation by the Forest Service. Stream locale provides major opportunity for campground development on both Forest Service and BLM lands.

Private participation in outdoor recreation is largely limited to facilities for trailer parks and motel accommodations. Continued growth is expected in both these categories.

D. Minerals

There is little if any mining of metallic minerals in the basin. The gold properties in the Bohemia district on the Santiam River drainage appear to have been worked out and are shut down. Ferruginous bauxite is found in substantial quantities in Washington, Columbia, and Marion Counties. High cost of beneficiation has precluded commercial use. A great many mining claim locations of undetermined number are known to exist on BLM lands. These often present serious resource management problems in road construction, recreation development, and timber harvest. Sand and gravel are the minerals of greatest economic importance in the basin. Oregon's production in 1962 was valued at $14,556,000. Most of this was mined and used in the Willamette Basin.

E. Water

An abundant supply of high quality water is one of the basin's major assets. The annual yield of the 12,045 square mile watershed averages 27,424,000 acre feet in excess of current consumptive use. 6/ Of this approximately 22 million acre feet come from the forest lands, and 1,735,000 acre feet comes from the BLM land. Problems arise from too much water in winter and too little in summer. Many of the drainages from the Coast Range dry up in the summer because geologic conditions preclude good infiltration and subsurface storage as is found in the Cascades. Since there is little moisture storage in the Coast Range, water run-off is greater and flood crests proportionately higher from Coast Range streams than from those arising in the Cascades. Because the Coast Range drainages are relatively short, opportunities for controlling water run-off by large storage dams are scarce.

The major burden for flood damage and water quality control currently rests upon watershed management measures. The watershed conditions are quite different in the three basin subareas.

1. The Upper Willamette Subarea is most critical in watershed planning because of the large amount of water produced from drainages with extremely steep gradients. This subarea is broken down into four major subbasins described in the following table:

TABLE 26

HYDROLOGY OF UPPER WILLAMETTE SUBAREA

Subbasin	Acres	% of Subbasin	Miles of Streams Perennial	Miles of Streams Intermittent	Total	Ft./Mi. Average Gradient	Source
1. Coast Fork	425,600	17%	630	380	1,010	95	Calapooya Mt.
2. Mid.Fork	866,600	35%	1,460	450	1,910	107	Cascade Mts.
3. McKenzie	858,900	34%	1,040	740	1,780	81	" "
4. Willamette	336,600	14%	300	400	700	9.7	Coast Range
Total	2,487,700	100%	3,430	1,970	5,400		

6/ "Willamette River Basin Oregon" U.S.D.A. 1964

About 90% of the Coast Fork Subbasin is mountainous, 75% lying above the 1,000 foot contour and 40% above 2,000 feet. Snow accumulates during the winter above 4,000 feet. Snow cover below this elevation is ephemeral. The soils are fine textured and of high clay content. They are readily puddled when disturbed in wet weather. Water permeability is poor to moderate. Lands on the Calapooya Mountains because of steep slopes have perhaps the greatest water erosion potential of all subbasin lands. Water turbidity from logging has been a problem in Layng Creek which provides municipal water to the town of Cottage Grove. Summer stream flows in nearly all streams are below that desirable for maintaining fish life. High water temperatures detrimental to trout and anadromous fish are found in both the Coast Fork and Row River below the reservoirs.

Almost all the Middle Fork Subbasin is mountainous, lying almost entirely in the Western Cascades. Over 90% lies above the 1,000 foot contour and 75% above 2,000 feet. Winter snows accumulate above 4,000 feet, reaching maximum depth and water equivalent during the month of April. This results in relatively high early summer flows in streams originating in the Cascades. Base flows remain stable throughout the summer as a result of inflow from the large quantities of ground water stored in the porous lava beds of the high Cascades. Turbidity in Salmon Creek during high water is a problem affecting Municipal supplies of the town of Oakridge. Lands on the Cascades because of their steep slopes, shallow soil mantle, and high precipitation have great water erosion potential.

The McKenzie Subbasin is mountainous in character, 90% lying above the 1,000 foot elevation and 70% above 2,000 feet. It is estimated that at the elevation of 4,000 feet approximately one-third the precipitation falls as snow, accumulating to maximum depth during the month of May. Except for the Mohawk and Blue River watersheds, good ground water storage contributes to relatively high summer stream flows. The City of Eugene depends upon the McKenzie River for nearly its entire municipal supply. This watershed also has high water erosion potential due to steep slopes, shallow soil mantle, and high precipitation.

95% of the Long Tom Subbasin lies below 1,000 foot elevation. It consists of a flat alluvial plain bounded by gently rolling hills and some moderately rough topography. Most of the precipitation occurs in the form of rain. The Coast Range stream systems are characterized by relatively short lengths and flat gradients, presenting quite different problems from those in the Cascades. Streamflow patterns here follow the seasonal precipitation patterns since the principal source of streamflow is direct run-off from rainfall. Tight soils and poor aquifers create little inflow from ground water to support summer stream flow. Stream discharges are extremely low in late summer. At times some have zero flows. Warm stream water temperatures favor spawning of warm water fish over trout. No anadromous fish are produced in this basin.

Water yields in relation to consumptive use by subbasin within the Upper Willamette subarea are shown in the following table:

TABLE 27

WATER YIELDS IN RELATION TO CONSUMPTIVE USE IN UPPER WILLAMETTE SUBAREA

		Area Water Yield Relationships			Legal Consumptive Depletion				
Subbasin	Mean annual yield in acre ft.	% basin yield	Yield ac.ft. /sq.mi.	Yield ac.ft. /acre	Domestic	Irrigation	Municipal	Industrial	Total
Coast Fork	1,166,000	13.5	1,750	2.73	940	16,050	16,290	3,840	37,120
Mid.Fork	2,783,000	32.3	2,060	3.22	2,390	5,640	16,290	18,530	42,850
McKenzie	3,847,000	44.6	2,860	4.47	11,580	298,500	84,780	58,720	453,580
Long Tom	828,000	9.6	1,570	2.45	1,230	24,070	150	21,650	47,100
Total	8,624,000	100	2,220	3.47	16,140	344,260	117,510	102,740	580,650

Only about 6% of the water produced in the basin is consumptively used there. Irrigation is the major consumptive use. There is great potential for increasing the acreage of irrigated lands. Low summer flows in the Coast Range streams are not adequate to meet all existing water rights. The recreational values of many streams originating in the Coast Range and Lower Cascades are reduced because of low summer flows. Average annual flood damages are listed by subbasin.

TABLE 28

AVERAGE ANNUAL FLOOD DAMAGES

	1960 Impoundment				Impact Proposed 1975 Develop.			
Subbasin	Aver. annual yield $1,000	Reduction by reservoirs $1,000	Residual damages $1,000	% dollar residual	Aver. annual yield $1,000	Reduction by reservoirs $1,000	Residual damages $1,000	% dollar residual
Coast Fork	$1,840	$1,570	$ 270	15%	$2,500	$2,100	$ 400	16%
Middle Fork	180	145	35	19%	250	200	50	20%
McKenzie	1,030	790	240	23%	1,400	1,100	300	21%
Long Tom	3,510	2,850	660	19%	4,700	3,900	800	17%

Damage by floods is caused both by the high water and by logs and debris picked up by the water. These not only gouge out the banks of stream channels, they pile up against road culverts and bridges backing up the water until enough pressure develops to wash out the road or the bridge. It is also costly to clean up the debris deposited on roads and agricultural lands.

Stream gradients are found to be extremely steep in much of the Upper Willamette subarea. Drainage areas are fairly large. Need for careful watershed management is apparent. The following tables show watershed management factors by subbasin.

A total of 14 major streams extending 471 miles are found to originate in the Cascade Mountains compared to only 5 with a length of 124 miles coming from the Coast Range and 6 covering 130 miles originating in the Calapooya Mountains.

2. Middle Willamette Subarea

The Middle Willamette Subarea covers 5,424 square miles, 45% of the total Willamette River Basin. Stream gradients in the mountains and foothills are steep, becoming relatively flat when reaching the valley as shown in the following table:

TABLE 29

STREAM LENGTHS AND GRADIENTS

Subbasin and Stream	Total Length Miles	Mountains Length Miles	Mountains Av.Gradient Ft./Mi.	Foothills Length Miles	Foothills Av.Gradient Ft./Mi.	Valley Length Miles	Valley Av.Gradient Ft./Mi.
Willamette River mi.146 to mi.33	113					113	2
5. Santiam Subbasin							
Calapooya River	76	6	390	35	40	35	5
Mid.Santiam R.	39	9	230	30	41	-	-
Thomas Creek	42	10	230	12	62	20	16
S.Santiam R.	68	-	-	31	42	37	9
N.Santiam R.	93	6	250	60	51	27	15
Santiam R.	12	-	-	-	-	12	4
Subtotal	330	31		168		131	
6. Coast Range Subbasin							
Mary's River	40	-	-	23	14	17	6
Little Luckiamute	26	8	260	18	37	-	-
Luckiamute R.	58	5	340	9	56	44	5
Rickreall Cr.	32	4	490	14	55	14	11
S.Yamhill R.	62	-	-	-	-	62	8
N.Yamhill R.	33	3	530	11	57	19	5
Yamhill R.	11	-	-	-	-	11	1
Subtotal	262			75		167	

TABLE 29 (Contd.)

STREAM LENGTHS AND GRADIENTS

Subbasin and Stream	Total Length Miles	Mountains Length Miles	Mountains Av.Gradient Ft./Mi.	Foothills Length Miles	Foothills Av.Gradient Ft./Mi.	Valley Length Miles	Valley Av.Gradient Ft./Mi.
7. Pudding Subbasin							
N.Fork Silver Creek	11	11	210	-	-	-	-
Silver Creek	16	-	-	16	51	-	-
Pudding River	63	-	-	7	79	56	3
Molalla River	50	9	210	26	40	15	13
Subtotal	140	20		49		71	

Approximately 61% of the Middle Willamette Subarea is forested compared to 74% of the Upper Willamette Subarea. About 72% of the Santiam subbasin is hilly or mountainous, encompassing a large proportion of the Western and High Cascades. The heavy snow pack in the High Cascades and the high water storage and yield capability of its porous lavas makes the Santiam subbasin the most important water producer in this subarea. Protection of water quality is important since the towns of Albany, Lebanon, and Sweet Home derive municipal water from the South Santiam while Salem and Mill City get their water from the North Santiam. The major problem with water taken from the South Santiam is that of water quality. Extensive treatment is required, especially during periods of heavy silt loads in the winter and spring.

Only 56% of the Coast Range subbasin is hilly and mountainous. The fine-grained, compact, and relatively impermeable sedimentary rocks of the Coast Range Mountains have negligible to low ground water yield capability. Winter snow pack is negligible. Therefore, streamflows are tied closely to the precipitation pattern, high in winter, scanty in summer. High clay content of the soils precludes accelerated erosion from disturbed watersheds. However, proper watershed management is extremely important to the towns in this subbasin since most depend on streams for municipal water. Corvallis, Philomath, and Adair Air Force Station find it necessary to treat for sedimentation water taken from Rock Creek and the Willamette River. The town of Carlton gets its water from Panther Creek. Dallas depends upon Rickreall Creek, McMinnville on Haskins Creek, Monmouth on Teal Creek, Willamina on Willamina and Sady Creeks, and Yamhill on Turner Creek.

About one-half the Pudding subbasin is hilly or mountainous with less acreage in forest than the other two subbasins. Streamflows originate in the Western Cascades which contain steep slopes, sharp ridge tops, and deep canyons. The geologic formation is basalts, boeccias, tuffs, and lavas of low ground water yield capacity. They tend to be fine textured and moderately deep.

These soils often have high landslide potential. The town of Molalla secures its water from Molalla River. Treatment for sedimentation is needed on water from Abiqua used by the town of Silverton.

Subbasin water yields and consumption are shown below:

TABLE 30

WATER YIELDS IN RELATION TO CONSUMPTIVE USE IN MIDDLE WILLAMETTE SUBAREA

Subbasin	Mean annual yield in acre ft.	Area Water Yield Relationships: % basin yield	Yield ac.ft. /sq.mi.	Yield ac.ft. /acre	Legal Consumptive Depletion (Acre Feet): Domestic	Irrigation	Municipal	Industrial	Total
Santiam	6,736,000	54%	2,800	4.37	10,000	65,210	70,350	59,040	204,600
Coast Rge.	3,644,000	29%	2,000	3.12	24,990	112,410	59,700	53,180	250,280
Pudding	2,120,000	17%	1,800	2.81	5,870	98,140	16,520	33,040	153,570
Total	12,500,000	100%	2,300	3.60	40,860	275,760	146,570	146,260	608,450

About 5% of the water produced is used in the Middle Willamette Subarea. Irrigation is again the major use. Municipal use is the second heaviest drain. Nearly ten times the acreages of cropland now being irrigated could beneficially be put under water. Demand for irrigation water will increase as demands for foodstuffs rise. Due to population increase and increasing per capita use of water, it is anticipated that requirements for municipal water in this subarea will double by 1985. * Low summer flows in Coast Range streams preclude or adversely affect their use for irrigation, recreation, and fisheries.

High winter rainfall on an area of relatively tight soils results in fast run-off and perennial lowland flooding. Construction of large water storage reservoirs on major drainages in the Cascades has reduced flood crests and damages. Relatively short drainages with flat gradients characteristic of streams in the Coast Range do not provide good sites for water storage. Through construction of storage reservoirs the Corps of Engineers propose to reduce flood damage potential by 81%. Watershed management measures will be needed to supplement flood protection by reservoirs since much damage results from deposition of silt and debris on farm lands and in reservoirs.

3. Lower Willamette Subarea

Problems of water quality and quantity are most critical in this subarea because a major portion of the basin's population live here with extensive commercial and residential development subject to damage from floods. The relatively flat gradients of the Willamette and Columbia Rivers results in serious flood plain overflows by high water where the rivers are not controlled by levees and dikes. Hydrological characteristics of the area are shown in Table 31.

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* "Middle Willamette River Basin" State Water Resources Board 1963

TABLE 31

HYDROLOGY OF LOWER WILLAMETTE SUBAREA

				Miles of Streams					
				Mountains		Foothills		Valley	
Subbasins	Acres	% of Sub-area	Total Length	Length	Average gradient ft./mi.	Length	Average gradient ft./mi.	Length	Average gradient ft./mi.
Tualatin Subbasin	461,440	26%							
E. Fork Dairy Cr.			22	9	164	13	11	-	-
Scoggins Cr.			18	8	220	10	16	-	-
Gales Cr.			28	10	188	18	18	-	-
Tualatin R.			83	8	241	19	14	56	1
Subtotal			151	35		60		56	
Clackamas Subbasin	652,160	37%							
Deep Cr.			14	10	102	4	37	-	-
Clear Cr.			30	12	290	18	30	-	-
Collawash Cr.			19	19	137	-	-	-	-
Clackamas R.			85	28	192	35	33	22	11
Subtotal			148	69		57		22	
Columbia Subbasin	275,840	16%							
Johnson Cr.			25	-	-	25	28	-	-
Sandy Subbasin	375,040	21%							
Bull Run R.			25	20	128	5	67	-	-
Salmon R.			35	35	154	-	-	-	-
Sandy R.			56	18	288	21	40	17	9
Subtotal			116	73		26		17	
Total	1,764,480								

A large proportion of the streams in this subarea flow through mountainous country and have extremely steep gradients. Extreme care in use of resources on such land is required to prevent stream bank damage or other water quality impairment.

The Tualatin Subbasin streams head in the Coast Range. The Columbia Subbasin drains a portion of the Tualatin foothills, while the Clackamas and Sandy Subbasins arise in the Cascades.

Though the Columbia Subbasin does not carry the large waterflows of the streams coming from the mountains, Johnson Creek in this basin has been one of the most troublesome from flooding. This is due to the fact that it bisects the Portland Metropolitan area and causes frequent flooding of houses, roads, and business areas.

Sixty-nine percent of this subbasin is forest land and only 18% is in agriculture. The high percentage in developed areas, 13% in cities, towns, and roads, reflects the intensity of land use and potential future demands.

Low summer flows in the Tualatin and Columbia Subbasins reflect the light summer precipitation and low ground water storage capability. This part of the basin is underlain by fine grained sedimentary rocks which either rejects water infiltration or greatly inhibit its movement.

The following table shows major uses of the land in this subarea:

TABLE 32

Subbasin	Acreage	Forest Land Acreage	Percent	Agriculture Land Acreage	Percent
Tualatin	461,440	224,000	49%	151,580	33%
Clackamas	652,160	546,000	83%	55,120	8%
Columbia	275,840	79,000	29%	47,720	19%
Sandy	375,040	298,000	80%	13,580	4%

In spite of the location of a major metropolitan area in this part of the basin, most of the land is devoted to forest use.

Tualatin Subbasin

The Tualatin Subbasin is the most important of the four subbasins in terms of agricultural land and agricultural production. Potential for irrigation is high due to favorable topography. Suburban residential developments overflowing from the City of Portland are encroaching on much good farm land.

The acreage of forest land slightly exceeds that suitable for agricultural use. Demands for water are accelerating rapidly. The need is not only for more water for irrigation but for municipal, industrial and recreational use where water quality is of critical importance. High summer water temperature in the Tualatin River is adverse to most sport-fish and salmon. The foothill character of most of the other streams in the subbasin also results in warm summer stream temperatures.

Clackamas Subbasin

The Clackamas Subbasin is rough and mountainous, containing relatively little agricultural land. Because it drains an extensive area of the Cascade Mountains it is the greatest water producer in this subarea. Due to the residential and industrial growth of the area, there is growing demand on the Clackamas River for municipal use. The Clackamas River and tributaries are the most important producers of salmon and steelhead in the subarea. Good trout fishing adds to its recreational value. Much of the river is accessible by road. Its high mountain lakes and sustained summer streamflows draw heavy recreation use. Present and potential high demands on water from this subbasin and its proximity to the Portland Metropolitan area points up the need for careful watershed management of the subbasin.

Columbia Subbasin

The Columbia Subbasin is relatively small, draining only a part of the lower Tualatin foothills. It embraces the City of Portland and surrounding suburbs. A considerable acreage (29%) remains in timber production. Even though mostly in private ownership this timberland provides open space, scenic vistas, and natural beauty in addition to its wood fibre and watershed functions. Special incentives to encourage the owners of these forest properties to retain these lands in properly managed forest cover may be in the public interest.

The only BLM managed lands in this subbasin are found on the north slopes of the Tualatin hills with drainage into the Columbia River.

Watershed management of timberlands to enhance scenic values should be given prime consideration, including water quality protection.

Sandy Subbasin

The Sandy Subbasin is the most important of any in the basin from a watershed management standpoint. This is because it furnishes municipal, industrial, and domestic water to the Portland Metropolitan area. Another reason is that it has the highest potential for recreation development due to proximity of large populations to a highly attractive undeveloped recreation resource on the Bull Run watershed. Several beautiful lakes and fishing streams are found in the Bull Run Reserve. As the supply of outdoor recreation areas diminishes under increasing population demands, public pressure may eventually force the opening of the Reserve to public use. The Sandy River and its tributaries are important producers of salmon and steelhead.

VIII. A. BLM Forest Resource Management Responsibilities and Opportunities

1. The Timber Industry and Demand for Forest Products

The national demand for West Coast forest products results in shipping out of the area most of the wood fibre processed in the Willamette Basin. In 1963, 34% of the nation's softwood veneer and plywood, 9% of the nation's lumber production, and 3% of its woodpulp was manufactured here. National demand for lumber is expected to increase by 22% by 1985. Plywood and veneer demand will double, as will demand for pulpwood, paper, and hardboard.

The forest resource is the mainstay of the local and regional economies. In 1964 employment in lumber, wood products, paper and allied products was 40% of the basin's total manufacturing employment. The wage payment amounted to nearly $245,000,000. Total value added by timber manufacturing in Oregon was approximately $400 million, 36% of this being in the study area. The distribution and type of the basin's forest industries is shown in the following table.

Table F-1

Forest Industries in the Willamette Basin 1/

Industry	Upper Basin	Middle Basin	Lower Basin	Basin Total
Logging	213	245	178	636
Lumber & Wood Products	114	155	187	456
Veneer & Plywood	34	30	18	82
Paper & Allied Products	6	9	34	49
Total Industries	367	439	417	1,223
Total Employees	14,218	11,693	13,264	39,175

In spite of a short local supply of stumpage, it should be noted that the largest sawmill, the largest plywood plant, largest wood pulp mill, and one of the largest wood composition board plants are all located in the lower subarea of the basin. This means a continued importation of logs into this subarea. Future growth and continued operation of the lumber and wood fibre industry is limited to the economically available supply of timber. Because of the developing shortage of private stumpage, BLM forest management decisions will have a major impact on the economy, not only of the basin but the entire state. Current and estimated future consumption of forest stumpage is shown in the following table.

1/ "Willamette Basin Study-Economic Appendix" Willamette Basin Task Force 1967

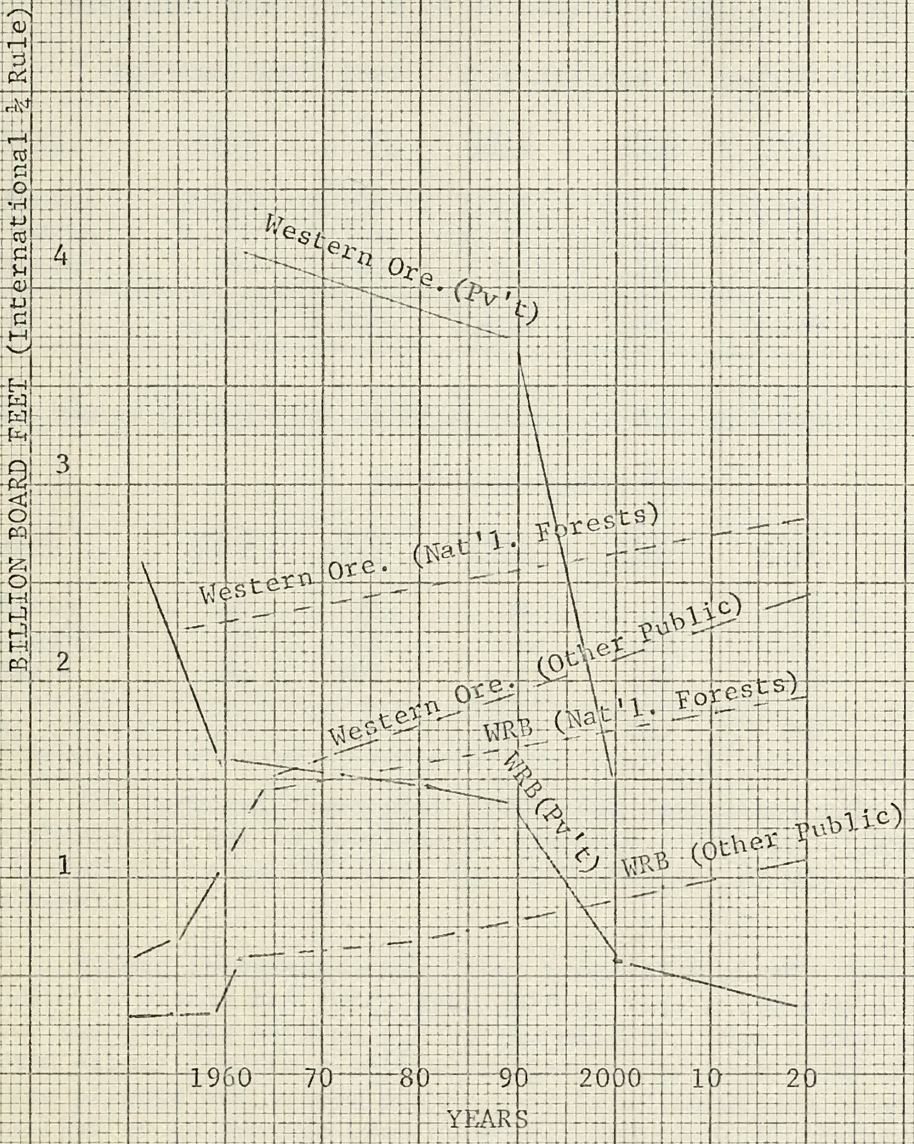
TABLE NO. F-1-A Wood Production Output in the Willamette River Basin[1/]

Year	Output Total WRB	Output by Major Ownerships[2/] National Forests W. ORE.	National Forests WRB	Other Public W. ORE.	Other Public WRB	Private W. ORE.	Private WRB
1963	3.7	2.34	1.5	1.47	.6	4.17	1.6
1965		2.36					
1970	3.7	2.41	1.5	1.59	.6	4.05	1.6
1975		2.46					
1980	3.8	2.50	1.6	1.76	.7	3.90	1.5
1985		2.55					
1990	3.9	2.60	1.7	1.96	.8	3.78	1.4
2000	3.3	2.60	1.8	2.20	.9	1.50	.6
2010	3.4	2.60	1.9	2.20	1.0		.5
2020	3.5	2.60	2.0	2.20	1.1		.4

1/ Western Oregon output is extension from PNWES inventory data, Willamette River Basin output forecast is developed at same rate as western Oregon. Data by Bryan Wall: Telcon. 4/7/66.

2/ International 1/4, live cut (without dead), billion board feet.

CHART NO. 1 Forecast of Available Log Supply (Production)



Sources: Timber Trends in Western Oregon and Western Washington, Pacific Northwest Experiment Station, October 1963.

Prospective Timber Supplies and Forest Industrial Development in the Willamette River Basin, Pacific Northwest Experiment Station, September 1965

Table F-2

Estimated Consumption of Roundwood in Willamette Basin

Million Board Feet - International ¼ Inch Rule 1/

Basin Area	1965	1970	1975	1980	1985	2000	2020
Upper Basin	2,026	2,026	2,037	2,032	2,047	1,630	1,526
Middle Basin	2,203	2,238	2,261	2,275	2,308	1,849	1,756
Lower Basin	753	742	741	734	735	561	518
Total	4,982	5,006	5,039	5,041	5,090	4,040	3,800

Estimated Consumption of Wood Fiber by Pulp and Paper Industries 1/

In Million Cubic Feet

Basin Area	1965	1970	1975	1980	1985	2000	2020
Upper Basin	21	25	29	32	37	37	37
Middle Basin	38	47	54	62	69	67	67
Lower Basin	83	105	119	137	153	156	156
Total	142	177	202	231	259	260	260

The forecast shows that sawmilling operations will peak in 1985 and decline thereafter due to shortage of stumpage. The wood fiber processing industry will continue to expand until the Year 2000 and become relatively stabilized at that level.

Modern integrated wood fiber processing plants require high capital investments in plants and equipment. Medium size kraft process pulp plants represent investments of from $30 to $40 million. Small size wood composition board plants require a capital investment of from $1-$2 million. Twelve new plywood and veneer plants were built in Oregon between July 1962 and July 1964 at an average cost of $1,475,000 each. 2/ Fourteen new lumber and wood product mills were built during this period at an average cost of $151,071. An investment of $750,000 was made in the expansion of two existing sawmills. Because of high capital investments in these plants, a sustained source of wood fiber is needed to assure continued operation. Due to the competition for and the high price of stumpage, expansion of the industry is largely limited to opportunities for more efficient use of wood by-products and waste through pulping or chemical conversion.

1/ "Willamette Basin Study - Economic Appendix" Willamette Basin Task Force 1967

2/ "Annual Report" Oregon Department Planning and Development, June 1964

Oregon's timber economy must compete with the Southern pine region which is proving to be an attractive area for future expansion of the wood products industry. This is due to its more favorable freight rates, low labor costs, fast timber growth, and easy roadability. Oregon's foresters are well advised to exert every effort to grow and supply the needed wood fiber to retain in the Northwest this vital segment of its economy.

2. BLM Timber Management Policy Guidelines and Opportunities

Based on Sec. 5 of the O&C Act of August 28, 1937, three policy guidelines relating to timber management on O&C lands have been developed (D.I. Manual 585.1.2).

a. Contribute to the economic stability of communities in Oregon dependent upon timber by practicing sustained yield forest management.

b. Increase employment and business opportunities by encouraging more intensive utilization of the timber supply.

c. Provide a more abundant timber supply by accelerating the rate of timber growth through intensive forest management.

Accomplishment of these objectives requires long-range programing and budgeting because of the great length of time required to grow a tree. The Pacific Northwest Experiment Station forecasts a 46% reduction of commercial forest inventory from 1963 to 1985 on private lands, leaving industry with only 16% of the remaining stumpage. Much of this will be controlled by a few large companies, and there will be an extremely limited supply of timber for processing by the smaller operators. Federal timber management agencies' programs should have enough built in flexibility to help meet such problems as they arise.

Nearly half the Eugene BLM District lies outside the basin as does 39% of the Salem District. However, the basin portion of the Eugene District conforms closely to the Upper Basin Subarea. The basin portion of the Salem District is included in the Middle and Lower Subareas of the basin study. The following table shows comparative forest land ownerships.

What the statistics fail to show is the higher site productivity of the BLM lands than most of the Forest Service lands. This is because the BLM lands are at a lower elevation with a longer growing season, deeper soils, and less precipitous topography. The site advantage of the BLM lands finds trees growing faster and of better quality than on the National Forest. Private forest lands also are potentially high forest yield lands. Much of the timber held by large private industry is being intensively managed so as to yield a high rate of growth. The large acreage of small forest land ownership accounts for the rather poor growth pattern trends from private forest acreages.

The following Table F-4 shows the timber situation on forest lands of the basin.

Table F-4[3/]

Volume of Growing Stock and Sawtimber on Commercial Forest Land in Willamette River Basin 1963

Ownership Class	Growing Stock Million Cubic Feet Total	Soft-woods	Hard-woods	% of All Timber	Sawtimber International ¼" Rule Million Board Feet Total	Soft-woods	Hard-woods	% of All Timber
Upper Subarea (Eugene District)								
National Forest	8,475	8,408	67	80	49,696	49,537	159	81
Other Public	948	928	20	9	5,953	5,900	53	9
Forest Industry	893	858	35	9	5,240	5,083	157	8
Small Private	225	131	94	2	903	504	399	2
Total	10,541	10,325	216	100	61,792	61,024	768	100
Middle Subarea (Salem District)								
National Forest	3,103	3,077	26	35	18,204	18,103	101	36
Other Public	1,881	1,784	97	21	11,192	10,887	305	22
Forest Industry	1,969	1,892	77	23	11,945	11,703	242	24
Small Private	1,861	1,325	536	21	8,985	7,435	1,550	18
Total	8,814	8,078	736	100	50,326	48,128	2,198	100
Lower Subarea (Salem District)								
National Forest	4,712	4,669	43	76	27,949	27,824	125	82
Other Public	419	371	48	7	1,798	1,668	130	5
Forest Industry	181	163	18	3	839	798	41	2
Small Private	853	636	217	14	3,413	2,767	646	11
Total	6,165	5,839	326	100	33,999	33,057	942	100

3/ "Prospective Timber Supplies and Forest Industrial Development in the Willamette Basin" Pacific Northwest Forest and Range Experiment Station, September 1965.

Table F-4 shows that the future of the wood fibre industry in both the Upper and Lower Subareas rests largely on management decisions of the Forest Service as to both its growing stock and sawtimber. Because BLM sawtimber volumes in these two subareas equals or exceeds forest industry volumes in the Upper Area and in the Lower Subarea, BLM management decisions will also have a critical effect on the economies of these subareas. There is a better balance in sawtimber ownership in the Middle Subarea, the Salem-Albany utilization area. Although over one-third the sawtimber is on National Forest, the balance is evenly distributed between BLM, Forest industry, and small private holdings. The large amount of hardwood timber and growing stock on the small private holdings renders such lands of much less value to the economy in the immediate future. The small proportion of growing stock on fairly large acreage of small private ownership indicates that these lands present the area of greatest opportunity for improved forest management practices. However, until the economic situation improves to encourage small landowners to improve silvicultural practices, the public lands and large industry holdings must intensify management of forest resources to compensate for the limited productivity from the small private segment.

The Forest and Range Experiment Station statistics show a greater reserve of sawtimber on BLM lands than does the BLM inventory. This is largely due to the difference in log measurement rules used. The International 1/4" Rule used by the Experiment Station results in greater stumpage volume than does the Scribner Decimal C Rule used by BLM.

There was little authorized timber cutting on the O&C lands until 1942. Except for areas in old burns or trespass areas, the second growth stands on BLM lands in the basin have become established since 1942. Little of BLM's second growth will reach optimum sawlog size until after year 2020. With depletion of supply of private timber after 1985, the question must be faced whether the Federal timberlands (U.S.F.S. and BLM) can furnish the additional needed stumpage to keep the mills in operation until private second growth timber becomes merchantable. Without the needed stumpage many mills will go out of business. Because of the large investment required, it is problematical whether or not new mills will be built to make use of the increased amounts of wood fibre available when the Basin's second growth forests are ready for harvest. The few large companies with private timber reserves will have a monopoly on stumpage in the interim period except for the Federal timberlands. Maximum efforts on the Federal forests should be made during this period to get these lands fully roaded to salvage deteriorating old growth timber and mortality in younger stands as well as intensifying thinning programs.

The volume of BLM stumpage put on the market can affect stumpage and lumber prices. In the BLM Siuslaw Resource Management Area of the Eugene District, it is estimated that the old-growth timber will last about 30 years, to the Year 2000, at current rates of cut. There the average site index for Douglas fir is 145, and the potential producing capacity is 1000 board feet per acre per year. At this rate and with $40 stumpage value,

the timber growth potential equals $40.00 per year. Capitalized at 5% this indicates a land value of $800 per acre, well warranting the cost of site protective measures in use of these lands. Mature timber stands average 54 M. board feet per acre worth over $2,000 per acre at today's prices.

The economy of the basin is tied to the manufacture of softwoods, but the plentiful supply of hardwoods warrants expansion of the furniture, veneer, and other industries using hardwoods. The growing shortage in softwoods, due in part to the log export trade, may force some sawmills to switch to manufacture of hardwoods. This is expected due to the limited competition for hardwood stumpage, plus the ready availability of this material. Demand for hardwood for pulp is also expected to increase.

Douglas fir will continue to be the important tree crop of the Basin due to its relatively fast growth and its exceptional quality for structural lumber and plywood. BLM has the major reserve of commercial timber in the Coast Range Subbasin needed to sustain mills in the Dallas-McMinnville area. A large quantity of commercial hardwood timber occurs as a component of the conifer stands on BLM lands in the Santiam, Coast Range, Tualatin, and Sandy subbasins. Low stumpage prices for hardwood timber presents serious problems in that such sales are not able to support the cost of needed access road construction.

At current rate of harvest most of the old growth timber on BLM lands in the Basin will have been cut by the Year 2000. However, the sawtimber inventory in the Eugene District is supplemented by 928 million cubic feet of growing stock and 53 million board feet of hardwood timber. The inventory in the Salem District is supplemented by 2,155 million cubic feet softwood growing stock and 435 million board feet of hardwood timber.

The Experiment Station report forecasts a major deficiency in availability of private stumpage after the Year 1990. Large timber companies are anticipating this by making heavy investments in the southern pine region. Other companies are experimenting with methods of accelerating timber growth to meet the timber shortage by thinnings, fertilization, and irrigation of second-growth reproduction.

Accelerated conversion of old growth stumpage on the public lands of the basin to thrifty young growth forests would tend to hold stumpage prices down. This would tend to prevent faster liquidation of private timber should stumpage prices become excessively high. Federal timber management programs should anticipate the problem which will arise from the forecasted 46% depletion of private stumpage between 1963 and 1985 and the critical shortage of stumpage for the 35-year period thereafter.

In summary, a major shortage of private timber stumpage will develop about 1990. Mills will face the alternative of paying higher prices for softwood stumpage, converting to hardwood manufacture, or going out of business. The large volume of logs being exported indicates there is no unusual shortage of stumpage available for sale. The problem is that many of the local mills cannot compete with the high prices being paid for export logs. Due to the rather poor competitive situation of West Coast wood products, about the only way mills can meet anticipated rising stumpage prices is through more efficient operations and utilization of more of the wood.

From 1910 to 1960 the trend in Douglas fir stumpage prices relative to the general price level increased at an average annual rate of 4%.[12/] Even though mills are now in an economic squeeze, it is not unreasonable to believe that stumpage prices will continue to rise at this rate due to the forecast future accelerating demand for wood products. There are many wood products for which there are no satisfactory substitutes. Due to the length of the timber growth cycle, anticipated stumpage prices tend to limit the intensity of timber management.

3. BLM Timber Management Problems

a. Public Relations

In view of conflicting demands for BLM resources, BLM is walking a tightrope in resource management in trying to meet the needs of the lumber industry and at the same time protect water quality, fishery and wildlife interests, recreationists, and other interest groups. Our operations are under constant scrutiny. At the same time the counties urge maximum timber harvest in order to increase their returns from Oregon and California Railroad Grant Land funds.

Recent staffing trends in the specialties of Recreation, Fish & Wildlife, Soils, and Watershed Management bolster BLM's posture as a multiple use resource management agency.

b. Economic

Most of BLM's timber management problems could be overcome by adequate funding to provide needed road construction and maintenance and

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12/ "Timber Trends in Western Oregon and Western Washington" Pacific Northwest Forest and Range Experiment Station 1963

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12/ "Timber Trends in Western Oregon and Western Washington" Pacific Northwest Forest and Range Experiment Station 1963 intensive forest management measures such as thinnings, forest revegetation, fertilization, etc. This would make it possible for the districts to meet much of the growing demand from industry for increased stumpage sales.

4. BLM Timber Management Alternatives

a. Irrigation and Fertilization of Forest Crops

Forest Service long-range plans anticipate the tripling of wood fibre production in the basin through irrigation, fertilization, and control of major competing, unwanted vegetation on forest lands. Irrigation is needed to extend the tree-growing period during the summer months of sparse rainfall. By 1975 it is expected that each seed orchard and seed production area will be irrigated where water spreading is feasible. National Forest people assume that irrigation to increase timber growth on National Forest lands will be under way by 1980. Irrigation will be accomplished through installation and use of a series of parallel contour ditches, spaced at about 50-foot intervals. As of 1985, irrigation will be limited to areas where with two miles of mainline diversion ditch, an area of at least 160 desirable acres can be irrigated. By the Year 2000 small water impoundments in headwaters locations will be used to store and divert irrigation water and five miles of mainline diversion ditch per 160 acres of irrigation will be considered practical.

Research is needed on types of soil suitable for forest irrigation and time and intensity of water application to avoid growing shallow-rooted trees susceptible to windthrow damage.

Initial study indicates there may be 5,000 acres BLM forest land suitable for irrigation in the McKenzie Subbasin of the Eugene District. About 10,000 acre feet water would be needed for irrigation.

Estimates of irrigable BLM lands and water needs in the Salem District are as follows:

	Potential Irrigation Water Needs - Salem District			
Subbasin	Irrigable Acres	Water Need Acre Feet	Irrigable Acres	Water Need Acre Feet
Santiam	1,040	2,330	3,000	6,397
Coast Range	2,000	1,506	2,000	1,506
Pudding	100	271	1,000	2,107
Tualatin	100	76	100	76
Clackamas	200	437	400	878
Columbia	200	151	200	153
Sandy	100	223	500	1,095
Total	3,740	4,994	7,200	12,212

Total water needs on BLM lands in the basin then will be nearly 15,000 acre feet by 1980 and over 22,000 acre feet by the Year 2020. Because of an existing shortage of water in summer streamflows for meeting current water needs, BLM would not be able to take irrigation water from streamflows. Construction of storage facilities to conserve winter flows will be needed before BLM can embark on any major forest irrigation program in the basin. Or water may become available from other Federal water storage projects proposed for construction in the basin.

b. Slash Disposal

Requirements of P. L. 89-753, Clean Water Restoration Act of 1966, and E. O. 11288 may necessitate modifications of BLM slash disposal programs. The burning of logging slash destroys much of the organic material in and on top of the soil, exposing it to storm damage and erosion. The soluble ash may contaminate streamflows. Retention of organic matter in the soil is found to have a value of $10 per acre for soil protection and $3 per acre for reduction of flood and erosion losses. 5/ Costs of slash burning are estimated to be $50 per acre. 5/ Thus, a good case can be made for the purchase of portable chippers by BLM for chewing up the slash and leaving it to protect the soil or selling it for pulping. Several districts may need to combine efforts to justify the purchase and use of such a machine. An added benefit would be reduction of air pollution by avoidance of slash burning.

c. Commercial Forest Thinnings

Benefits are listed as follows:

(1) Provides merchantable timber volume to meet market demands.

(2) Enhances quality of residual timber stand.

(3) Increases wood fibre yield from land.

d. Precommercial Forest Thinnings

There is great opportunity for precommercial forest thinning in the Eugene District. Out of a total of 150,676 forest acres in the Willamette Master Unit, 41,462 acres support Douglas fir reproduction 30 years of age or younger. Much of this could be improved by thinning. Average cost for such work is $27 per acre. Benefits are :

(1) Prolongs good rates of growth of selected trees.

(2) Speeds the diameter growth of the remaining trees.

(3) Permits genetic improvement of the stand.

5/ "Costs of Securing Complete Log Utilization in Douglas Fir Region" John Grantham, P.N.W.U.S. Forest and Range Experiment Station

(4) Reduces danger of insect and disease attack.

(5) Produces better quality trees.

(6) Provides an example of good timber management for influencing private industry.

(7) Provides work opportunities for unemployed.

In 1966 FY 5,212 acres in the Salem BLM District needed precommercial thinning. Only 42 acres were thinned during the year, leaving 5,170 acres needing treatment. *

There are 28,000 acres BLM timberland in the Eugene District known to need precommercial thinning. At a cost of $30 per acre, $840,000 is needed for the improvement of these stands.

No pruning or other release work was identified in the Salem District. In the Eugene District 868 acres forest land was identified as needing release work, such as brush or weed tree removal. 10/

e. Mortality Salvage

Mortality salvage offers an opportunity to immediately increase the volume of stumpage made available to industry. In the Eugene District's Willamette Master Unit the presently operable volume of this type of material is 4.7 MM board feet annually. This would equal nearly a 1% increase in the annual sales from the unit. An intensive mortality salvage program is dependent on completion of an access road system throughout the BLM holdings. It is important that this road system be completed as soon as possible.

f. Reforestation

A relatively small reforestation backlog exists on the BLM lands in the basin. A backlog develops because the fixed level of financing for this type of work does not make allowance for reforestation failures nor for rising planting costs. Catastrophies such as the recent Columbus Day hurricane put a heavy burden on the district's reforestation program from which it may take a number of years' work to become current.

The Eugene District harvests the timber from over 6,000 acres of forest land per year. All this should be seeded or planted to meet the objective of getting the land back into timber production as soon as possible. Prompt revegetation also gives the tree seedlings competitive advantage over brush. The Eugene District's 1970 FY program package shows a need for $252,000 for a three year program to become current with reforestation needs.

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* "Land Measures Needs Inventory, Willamette Basin Study," 1965, Interagency Study Team

10/ "Oregon Business Review" Vol. XXV July 1966, No. 7.

In the Salem District 5,050 acres of timber were cut in FY 1966. This was in addition to the 5,058 acres cutover forest land needing reforestation surveys. Reforestation surveys were completed on 8,364 acres, leaving 1,809 acres unclassified. Of the 1,837 acres classified as inadequately stocked at beginning of 1966 FY, 413 acres had been denuded five years or longer. Surveys made during the year found 6,992 acres inadequately restocked to timber. None was classed as not feasible to treat. Initial reforestation was made on 4,765 acres. Retreatment within five years was made on 712 acres, and retreatment subsequent to five years was made on 285 acres. Total reforestation in the Salem District in 1966 FY equaled 5,762 acres. A total of 4,416 acres was classified as inadequately stocked at end of year. Of this, 182 acres had been denuded five years or longer. Total reforestation to date in Salem District covered 73,062 acres. Total found not feasible to treat was 1,227 acres. Only a small amount, 309 acres, of cutover was left for natural regeneration. This is the only area of logged land in the district left for natural regeneration.

In the Salem District 1,584 pounds of seed were used to seed 2,104 acres, and 1,897,000 seedlings were used in planting 3,572 acres in 1966 FY. All the reforestation work was done with appropriated funds except for 30 pounds of seed used on 60 acres with funds made available by a timber purchaser. Other site improvement work in the Salem District that year consisted of 100 acres aerial spraying to remove brush and five acres scarified to improve the seedbed. Seeding or planting is recommended over waiting for natural regeneration following timber harvest because of greater assurance of getting full stocking; the trees get an earlier start and can better compete with the brush; and by more quickly establishing the forest crop, several years are saved in the timber rotation cycle yielding a quicker return on investment.

g. Seed Production

By producing its own seed for forest regeneration, BLM will have control of its seed source and be assured of seed acclimated to the area and from good parent stock. For these seed production areas healthy vigorous stands of the appropriate age are selected. Undesirable trees and brush are removed. Fertilization and insect control may be found to be advantageous for increasing the cone crop and its viability. The Eugene District has no seed orchards in the basin.

h. Tree Improvement Program

The object of this program is to increase productivity and improve timber quality on BLM lands by producing seed from parent stock from a genetically improved strain of trees showing superior growth characteristics. This involves identification of superior growth trees in the forest from which scion material is taken and grafted on root stock in a seed orchard. The orchards are cleared of brush to reduce competition for

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5. Forest Protection

a. Insects and Disease

BLM has the benefit of the U. S. Forest Service annual insect and disease damage survey. Reports of incipient infestations are plotted on timber management maps. Control is then accomplished by silvicultural methods or by harvesting damaged and susceptible trees. Success of this practice is limited to areas already roaded or where roading can be accomplished in a short time. This has been an effective system of control and will become more so as the BLM lands become more fully roaded.

b. Timber Trespass

Timber trespass problems on BLM lands are related to the type of ownership of the surrounding private lands. Little trespass occurs where the intermingled private lands are owned by the large timber companies. Theft of government timber more often occurs on the more isolated tracts of BLM land surrounded by small private holdings. In such areas ownership of individual tracts is more difficult to identify. The small owners usually have little knowledge of land survey methods and often lack knowledge of the exact location of their own property lines. Posting the boundaries of the BLM lands should do much to discourage timber trespass and such action should be given a high priority.

c. Fire Protection

The BLM lands in western Oregon are provided fire protection by the State of Oregon Department of Forestry under a contract arrangement. Various intensities of protection may be secured depending on the degree of hazard found on the land. Most of the actual work of fire detection and suppression is done by private fire control associations through agreements with the State Department of Forestry.

BLM fire presuppression activity consists of snag falling and construction of firebreaks and fire trails. Intensity of this type of work is related to the timber age class, proximity to logged areas, and the slash disposal program on the logged land. Fire trails are built around logged areas as a precautionary measure. This reduces risk of fire spread should the slash become ignited. On the other hand, some of these fire trails are on steep slopes subject to severe washing and erosion unless adequately ditched and cross-ditched and drained. More attention must be given to ditching and draining of fire trails.

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BLM's fire prevention and suppression responsibilities increase each year as more large campgrounds are constructed and more roads are built which require patrolling during dry hunting seasons.

6. Timber Access Roads

a. Construction

Access road construction determines to a large degree the timing and location of BLM timber sales. Access road construction is largely financed from timber sale receipts. High road construction costs result where all weather roads for heavy hauling must be provided. Typical examples of BLM road construction costs are $59,374 per mile for a high standard road and $19,792 per mile for a low design speed road. 6/ BLM builds about 400 miles new road per year in Oregon and also improves an average of 100 miles of road per year at a cost of about $10,000 per mile.

The Eugene BLM District had 839 miles permanent roads and about 1,000 miles of temporary roads and fire trails in FY 1966. The Salem District reported 930 miles permanent road and 350 miles substandard other road.

Although timber sales pay for building a large share of BLM roads in western Oregon, heavy users of these roads are the hunters, fishermen, and other recreationists who contribute nothing to their construction or maintenance. The limited funding available for recreation roading is used in or to provide access to BLM recreation developments. If recreation is to be truly recognized as a major forest land resource, then this activity should pay its way in providing access for the recreation user of BLM forest lands, not designated as recreation areas.

b. Mainline Road Engineering

The large size of the logging trucks and the heavy loads hauled require construction of high standard mainline roads. High standard roads have minimum grade specifications and wide sweeping curves. The amount of soil disturbed in construction is proportional to the standard of the road, the higher the road standard the more soil moved. On the other hand the higher the road standard the less maintenance required and less damage to water quality during rain storms and floods. Multiple use management concepts in both construction and maintenance are being incorporated into present design considerations. Present design criteria take into consideration alignment, grade, erosion factors, water passage, siltation, & fish passage.

Control of sediment from erosion can be accomplished through seeding, mulching, proper fill compaction, and road alignment. Culvert outlet protection and proper culvert placement can greatly reduce erosion. Implementation of all these practices will increase road construction costs above those presently being experienced.

6/ "An Analysis of Two Logging Road Standards for BLM's Tillamook Project" Pacific Northwest Forest Experiment Station Bulletin, PNW-48. 1967.

The argument that the most serious erosion occurs in winter when fish use is minor is not relevant because the high water does not carry all the sediment away. On the other hand topographical limitations often give little or no latitude in choosing the location of a road. Our forest access road locators ordinarily do an excellent job of fitting the road to the topography.

c. Road Maintenance

Of the 949 miles permanent BLM roads in the Eugene District FY 1967, it was anticipated that 255 miles would receive no maintenance. 7/ By 1972 permanent road mileage is expected to reach 1,115 miles with 295 miles without maintenance. Apparently no funds are available for maintenance of temporary roads and fire trails. An additional $51,000 was needed in FY 1967 by the Eugene District to properly maintain its permanent road system. Temporary road maintenance may be equally expensive due to the increased lost time costs resulting from the relatively short mileage of the individual temporary roads and the distance between them. By 1972 the Eugene District will be short by $85,000 of anticipated funding for accomplishment of needed road maintenance on permanent roads. The Eugene estimate is based on an average annual maintenance cost of $360 per mile. This includes stockpiling of rock for road resurfacing and patching, and operating funds for force account labor.

The situation is much the same in the Salem District, where about one-third of the permanent road system receives no annual maintenance due to inadequate funding. Three additional Bureau of Public Roads maintenance crews are needed to adequately maintain the Salem road system. A recent study finds that Bureau of Public Roads road maintenance costs on BLM low design speed roads averaged $637 per mile in the Salem District in 1963-64. The study found that a maintenance cost of $500 per mile is realistic on the higher class BLM roads. 6/

A traffic count taken in the BLM Siuslaw Management Area FY 1964 shows the use made of BLM access roads in that area. This is shown as follows:

6/ "An Analysis of Two Logging Road Standards for BLM's Tillamook Project" Pacific Northwest Forest Experiment Station Bulletin, PNW-48, 1967.

7/ See Table W-IV "Eugene Road Maintenance Program Trends" in Water Resource Management Section

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FY 1964 Average Daily Traffic Count Siuslaw Unit, Eugene District 8/

Location	Logging Traffic	Recreation Traffic	Total	Percent Recreation Traffic
B	94	29	123	24
C	22	17	39	44
D	37	10	47	20
E	86	13	99	13
F	65	14	79	18

d. Special Road Construction Problems

Some of the more serious problems caused by road construction have been:

(1) Culvert installations on stream channels which do not accommodate fish migration.

(2) Stream channel changes which impede fish migration and contribute to erosion.

(3) Unprotected fills which contribute to siltation of stream beds.

(4) Sidecasting waste from cuts into stream channels.

(5) Insufficient installation of culvert drainage aprons.

(6) Inadequate buffer strips between roads and streams

(7) Inadequate cross-drainage of roads.

8/ "Siuslaw Unit URA Report, Eugene District." 1967.

FY 1964 Average Daily Traffic Count Siuslaw Unit, Eugene District [8/]

Location	Logging Traffic	Recreation Traffic	Total	Percent Recreation Traffic
B	94	29	123	24
C	22	17	39	44
D	37	10	47	20
E	86	13	99	13
F	65	14	79	18

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8/ "Siuslaw Unit URA Report, Eugene District." 1962.

7. Timber Management Recommendations for BLM Lands

a. Complete a site improvement survey of commercial public forest lands and undertake site preparation and rehabilitation where needed.

b. Reforest all nonstocked or poorly stocked commercial forest areas.

c. Study feasibility of acquisition and use of chippers for slash disposal following logging to protect watershed values rather than burning slash. Cost of chipping is arount $70 per acre. The preserved organic material that would be destroyed by burning has an estimated value of $10 per acre. 5/

d. Watershed management guidelines and criteria are needed to guide timber harvest decisions. Specifically, land managers need to know about how much more stream sedimentation and erosion will result on different types of soils from clearcut logging than from selective logging, or from high lead logging rather than from slack line skyline yarding or balloon logging. Another problem needing answers is to quantify and relate stream sedimentation from logging to the State of Oregon limit of five Jackson turbidity units.

B. BLM Forest Management Opportunities 1965 - 1980

1. Market Projections for Forest Stumpage 3/

a. An increasing national demand for wood products assures availability of markets for the maximum potential production from forest lands of the basin. 3/

b. The prospect of major increases in lumber markets to house the millions of new family formations and keep up with industrial expansion suggests a generally higher price level for lumber. 10/

5/ "Costs of Securing Complete Log Utilization in Douglas Fir Region" John Grantham, U.S. Forest and Range Experiment Station.

3/ "Prospective Timber Supplies and Forest Industrial Development in Willamette Basin" Pacific Northwest Forest and Range Exp. Sta. 1965.

10/ Oregon Business Review, Vol. XXV July 1966 - No. 7.

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c. Timber species and grades previously regarded as non-commercial will come into general use as will log sizes previously considered too small. 10/

d. Current sales of Federal stumpage at more than double their appraisals reflect the existence of greater log using capacity operating in the basin than there is log supply. Installed plant capacity in northwest Oregon in 1960 exceeded prospective log harvest by 0.7 billion board feet. 11/

e. West side National Forest stumpage sales show 4th quarter 1965 prices paid were above 1962 sales by following amounts: Douglas fir 182%, Western hemlock 240%, Larch 202%. 10/

There is no reason to believe this upward trend in prices will not continue in view of strong competitive demands for export and excessive plant capacity.

f. From 1910 to 1960 the trend in Douglas fir stumpage prices relative to the general price level increased at an average annual rate of about 4%. 12/ This plus an anticipated 4% return on investment in growing stock indicates that proper forest management is a good investment from a cost-benefit relationship.

g. Most of the increasing wood fibre demand will come from the pulp and paper industry.

h. Construction expenditures are expected to double by 1985, resulting in a 55% increase in consumption of construction materials.

i. Demand for lumber is expected to increase by 22%.

j. Plywood and veneer demand should double by 1985.

k. Demand for woodpulp, paper, and paperboard should nearly double by 1985.

l. There will be net imports of lumber, veneer logs, and pulpwood into the United States to help meet industry demands.

m. An increasing level of forest management will continue in respect to forest protection, reforestation, utilization, and intermediate timber harvests.

n. No substantial change is expected in the amount of forest land available for timber production.

10/ Oregon Business Review, Vol. XXV July 1966 - No. 7.

11/ Forest Industry Capacity, Production, and Available Log Supplies in Douglas Fir Subregion - Pacific Northwest Forest and Range Exp. Sta. 1964.

12/ "Timber Trends in Western Oregon and Western Washington" Pacific N.W. Forest and Range Experiment Station 1963.

o. Forest inventory volumes will decline through 1985 by 26% from 1963 levels.

p. Between 1963 and 1990 there will be an annual gain in growth of immature timber of 13 million board feet per year.

q. By 1985 private landowners will have reduced their forest inventory by 46% from the 1963 supply. 3/

r. The trend in consolidation of private forest ownerships is expected to continue with the big users of wood fibre acquiring an assured supply of the forest resource. The large number of forest industries now existing will no doubt be greatly reduced due to lack of stumpage. Future bidders for BLM timber may very likely be limited to the industrial giants of wood processing: Crown Zellerbach, Weyerhaeuser, Georgia-Pacific, Boise-Cascade, International Paper Co., U. S. Plywood, Publisher's Paper Co., Pope and Talbot, Stimson Lumber Co., Willamette National Lumber Co., and others in this category. Having the most efficient and highly integrated operations, they are in a position to outbid the small processor. However, there will probably be a strong continued demand for logs for export unless future legislation limits sales of public timber for export.

s. Out of basin timber and wood chips will compete strongly to supply the large wood fibre processing plants on the Columbia River and on the lower Willamette River and will relieve to some degree cutting pressure on the basin's forests.

2. Competitive Demands for Forest Land

a. Recreation

The basin's population is expected to increase by 51% by 1980 and per capita income will increase by 55%. People will have an additional 187 hours (12 days) of annual leisure time. Projected outdoor recreation demand shows a need to satisfy 19,725,000 water-related recreation days demand and 41,661,000 nonwater-related recreation days demand. The major outdoor recreation pressure will be on the area surrounding the Portland Metropolitan area. Nonwater-related demand will be double the water-related demand. Recreation inventories show that BLM can satisfy nearly 3 million recreation days demand on 8,541 acres Class II and IV lands and 394,489 acres Class III lands. Practically all BLM lands in western Oregon are found of value for extensive recreational use, such as hunting, fishing, sightseeing, hiking, etc., but these uses are seldom competitive with timber management programs. Development of the Class II lands will greatly reduce timber harvest potential on the 8,541 acres identified. This closely approximates the annual timber harvest acreage of the Salem District. Careful coordination of recreation developments

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3/ "Prospective Timber Supplies and Forest Industrial Development in Willamette Basin" Pacific Northwest Forest and Range Experiment Station, 1965.

with timber management programs is essential in order to reduce impact on the wood-processing economy. Gradual reduction of forest acreage to meet recreation demands imposes the necessity for more intensive forest management on remaining forest lands to forestall a drop in wood fibre production. If this is done, there should be little conflict between forest management objectives and the recreation goal to increase the choice of leisure time activity consistent with people's desires. Nor need it conflict with our goal to maintain a desirable basin environment for the aesthetic enjoyment of the people.

b. Fish and Wildlife

Fish and wildlife management factors are related in part to recreation benefits and to the substantial commercial benefits of the basin's anadromous salmon and steelhead trout. Here we face conflicting resource production goals in attempting to maximize production and economic expansion through the most efficient allocation of resources. The many miles of BLM stream frontage require modification of timber harvest so as to leave buffer strips along streams both to protect water temperatures and to trap silt and debris from upland surface waterflows. Wildlife eat forest tree seeds and reproduction. Here again more intensive forest management on the better sites and use of new types of wildlife repellents should nullify the wood fibre loss resulting from the wildlife programs.

c. Occupancy

Accelerating population growth will increase the rate of demand for transfer of timber-producing lands to other uses. Increasing flood plain values will intensify need for and rate of construction of water storage reservoirs and attendant electric power transmission lines on forest watersheds. More automobiles and increasing prosperity will force construction of new highways, much of it on forest lands. More intensive forest management should balance out the lost production of wood fibre from the diverted acres. More difficult to control will be impact on the sustained yield allowable timber harvest needed to sustain the wood fibre industry. Even this can be overcome to some degree by modification of the District's planned timber sale program to substitute the stumpage from the impact areas.

d. Livestock Grazing

The public's demand for quality meat and the relatively undeveloped potential for irrigated pasture in the basin indicates that livestock grazing will not be an important competitive demand for forest land.

3. Indicated Goals for BLM Future Resource Management Programs

The Willamette Basin Study goals seem applicable to BLM management programs. These are the indicated goals of the Comprehensive Study:

a. Production - To insure maximum production and economic expansion with the most efficient allocation of resources.

b. Conservation - To conserve land and natural resources and preserve their latent capacity for future use.

c. Environment - To maintain a desirable basin environment for the aesthetic enjoyment of the people.

d. Health and Safety - To provide for the health and safety of the people, animal, and fish life of the basin. Water quality is important here.

e. Leisure - To increase the choice of leisure time activity consistent with people's desires.

These goals are in harmony with the O&C Act and the Bureau's stated policy goals. They more clearly relate to the needs of the people than do the BLM policy goals. The more intensive management required to meet these increasing demands will require a much higher level of funding than BLM has had in the past.

4. Indicated Modifications of BLM Forest Program to Meet Goals

a. The current forest sustained yield timber harvest program provides optimum environment for wildlife. Only slight modifications in road construction and timber harvest are needed for protection of water quality and wildlife habitat.

b. Small acreages can accommodate recreational use by large numbers of people. Preserving open space for aesthetic enjoyment will have a greater impact on forest management. Timber sale and logging costs will be higher where selective cutting is needed to preserve natural beauty along highways and around recreation areas. Little modification of the over-all timber harvest program will be needed to accommodate an accelerating recreation program since more intensive forest management on other lands can make up the loss of wood fibre productivity.

c. Forest land occupancy for power lines, reservoirs, and highways will have the greatest impact on the BLM forest program. A sizable increase in funding for intensified management on other forest lands will be needed to make up for this anticipated loss of wood fibre production area.

5. Program Alternatives

The increasing public demands for resources from BLM lands leaves little alternative but to continually increase intensity of management on the BLM lands. Options would be to expect private industry to carry more of the load in meeting these demands. But it has been shown

to be impossible for the private sector to produce the needed wood fibre to sustain the economy until second growth forests start becoming merchantable by Year 2000. Also, all watershed users must share responsibility for water quality. Historically the public expects to use the public lands for outdoor recreation, fishing, and hunting. BLM must continue to meet its responsibilities in this regard.

Another alternative is to shift to state and local government the responsibility for meeting the people's needs. However, in the Willamette Basin, state and local governments have already done much more to meet local needs with the resources available to them than has the Federal Government.

The only real alternative in BLM programing then is whether or not to accelerate existing programs. Decisions must be made whether to gear forest management to production of saw logs, peeler logs, poles and piling, or for wood pulp. Fertilization is relatively inexpensive and results in substantial increased tree growth. Irrigation is moderately expensive but results in more than twice the increase in growth achieved by fertilization. Applying both fertilization and irrigation results in nearly double the normal annual growth of timber of younger age classes. 13/ Thinning of excessively dense stands serves to shorten the harvest rotation cycle. Alternative choice will depend on access, available funding, site capabilities, water availability, current and projected demand for wood fibre in the area, plus rate of diversion of forest lands to other uses.

Alternatives must be practical on economic, social, environmental and political grounds. There seems no limit to the timber demand. The problem is in forecasting the type of resource need, the timing of management actions to meet the needs, and securing the needed funding to meet the BLM goals.

Reconnaissance soil stability surveys show there are extensive areas of unstable soils or soils where logging compaction will preclude natural regeneration of coniferous timber or successful seeding. Until this data is supplemented by medium intensity soil surveys, the logical management alternative would seem to require treatment of all new areas being opened to harvest as though the soil were unstable and compaction a problem.

Recreation is becoming one of Oregon's leading industries. BLM has the alternative of shifting more of its resources to this type of use as a contribution to the recreation industry economy. The relative economic benefits can be assessed by comparing the contribution of timber resources and recreation benefits to the Gross State Product. Then comes the need to evaluate which sector of the economy is in the best position to provide the resource which is in short supply on the timetable of the

13/ From Crown Zellerbach studies in Clackamas Tree Farm

future. In this analysis it should be borne in mind that the acreage of forest land is limited while it would be relatively easy for the private sector to provide much more of the outdoor recreation opportunities on a commercial basis. Because small private forest lands for the most part are being poorly managed for forest production, outdoor recreation on these lands would have less impact on the forest economy than would converting intensively managed forest lands to recreation.

C. BLM Forest Management Opportunities 1980 - 2020

1. Market Projections

a. In this period continued reduction of forest inventory is expected to result in lower total growth and a consequent reduction in timber harvest.

b. By the Year 2020 the total forest inventory volume will be only 50% of the 1963 inventory volume. 3/

c. After Year 1990, net annual forest growth in the basin will show a decrease of almost 2 million board feet a year, leveling off by Year 2000.

d. It is estimated that by Year 2020 total forest cut will be only 82% of the 1963 log harvest.

e. By Year 2000 national demand for lumber will increase by 54% over 1962 levels. Plywood and veneer demand will increase by 158%. Pulpwood demand will increase by 192%. 14/ By Year 2020 consumption of timber stumpage is expected to decline in all categories except pulpwood due to shortage of available stumpage.

f. By Year 2000 a fourfold increase in Gross National Product is forecast with a doubling of per capita income and consumption of materials. 14/

g. Demand for timber products will exceed supply by 1990 unless production is increased by

(1) More intensive timber management (timber stand improvement).

(2) Increased tree planting effort.

(3) More intensive management of farm forests.

(4) Better utilization of available timber (damaged or poor quality).

3/ "Prospective Timber Supplies and Forest Industrial Development in Willamette Basin" Pacific Northwest Forest & Range Exp. Station 1965.
14/ "Timber Trends in United States" U.S.F.S. 1965.

2. Competitive Demands for Forest Lands 1980 -2020

a. Recreation

The basin's population is expected to triple by Year 2020. The increased recreation demands could largely be met by provision for more intensive use of outdoor recreation facilities existing as of 1980. This requires conversion of suitable Class II sites to intensive use Class I recreation areas. This means substitution of money for development and manpower in lieu of additional acreage to meet recreation demands. This is one alternative for reducing competitive demands for needed timber-producing lands. There will be need for BLM to keep the more accessible timberlands in a somewhat parklike condition to contribute to natural beauty and permit more intensive public use for such things as bird watching, nature study, photography, and hiking.

b. Fish and Wildlife

Nearly all the old growth forests will have been cut during this period, opening much more area to big game use. Thinnings and selective cuttings on second growth stands will permit better growth of browse, vines, and weeds needed for wildlife. Forest lands will become completely roaded during this period opening up new areas to sportsmen as well as reducing damage to streamflow from road construction. In other words, the BLM lands will become more susceptible to total resource management once the old growth timber is harvested.

c. Occupancy

Due to rough topography and distance from population and transportation centers, relatively little pressure is anticipated for conversion of the forest lands of the basin to urban or industrial uses. Anticipated roading density of five miles road per section of land will decrease forest production area by 3%-4%. New reservoirs and power transmission lines will reduce forest land acreage between 4%-5%. Together this amounts to about 1/10 the production capacity of the forest sustained yield cycle. This situation alerts the forest manager to the need for more intensive management on other lands to compensate for this loss. It provides justification for increased funding for silvicultural measures needed to make available undiminished supplies of wood fibre in spite of the acreage loss.

3. Indicated Goals for BLM Resource Management Programs 1980- 2020

The major objective of BLM resource management will continue to be the advancement of the areas productivity and livability. Much more intensive resource management will be required to meet the expanded social and economic demands of a much larger population. Emphasis on protection of water quality will be needed in view of its greatly accelerated consumption in this period.

4. Indicated Modifications BLM's Forest Program to Meet Goals

Modifications will be needed in BLM's road building, timber harvest, and slash disposal programs in order to meet the high water quality and air pollution requirements during this period. Much more intensive utilization of the felled timber will leave less debris on the ground to be burned or otherwise disposed of.

5. Programing Alternatives

By this time water may be the most important commodity coming from the forest watershed. Programing management alternatives may be limited by the degree to which they affect water quality. In view of the limited acreage available to meet the needs of a tripled population, the public will probably be much more interested in the operations of the public lands than they are today, thus reducing management alternatives.

Protection of the BLM lands from fire and other public use damage will become an ever-increasing responsibility and financial burden. A visitor protection program will be needed as a more and more urban oriented society makes use of the forested watershed as recreation area. Provision for search and rescue teams must be made as well as for first aid treatment. Lifeguards may be required by BLM developed water areas. An improved policing system will be a necessity to maintain law and order in the recreation areas and to control vandalism. All of these things point to an increasingly costly BLM program.

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13. "Clackamas Tree Farm Studies," Crown Zellerbach Timber Co., 1967

14. "Timber Trends in the United States," U.S.F.S., 1965

IX. A. Range Resources - Present

1. General

The forest lands of the Willamette Basin offer little opportunity for livestock grazing. The dense forest canopy and heavy non-edible brush understory effectively precludes growth of grass or browse suitable for livestock forage. Although there is some browse and grass growth on the land for a few years following logging, this growth is primarily needed to support the deer and other wildlife of the area. Further trampling and trailing by livestock on the soil disturbed by logging and slash burning further aggravates the erosion and watershed damage problems. Lack of succulent vegetation in the winter forces the stock to eat the conifer reproduction which is needed to revegetate the area. Because of the need to protect watershed values grazing permits are generally limited to the period from June 1 to October 15. However, most of the BLM logging operations are back in the hills a long distance from ranches, making impractical any attempt to put livestock on them. The limited forage available on the BLM lands does not warrant the expense of fencing needed to control livestock use.

Demand for grazing livestock on these public forest lands is expected to decrease in the future as the availability of water for irrigated pasture increases. Adequate supplies of irrigation water are becoming available to ranchers as more and more of the large water impoundments are constructed by Federal agencies. Approximately 1 million additional acres of farm land in the basin are suitable for irrigation, and irrigated pasture is one of the more logical anticipated uses.

2. Eugene District Range Management Program

There are only 12 grazing leases covering 26,555 acres BLM land in Eugene District portion of the basin. Cattle use is predominant. The steep, rough, and broken character of the lands limits cattle movement. Winter grazing is not usually allowed since damage to forest reproduction and soil is likely to occur at this time. In some cases trespass grazing use has been detrimental to forest regeneration. Livestock grazing on BLM lands in this area will never become a significant part of the multiple resource use management program since livestock forage cannot compete with timber growth.

3. Salem District Range Management Program

The Salem District has issued 10 grazing leases covering 21,960 acres BLM land. These benefit 409 head of cattle and horses and 200 sheep. The district has had a problem with trespass cattle in the Crabtree area of the Santiam Master Unit. Passage of county herd laws have reduced trespass in some areas. The almost total absence of grazing lands precludes the inclusion of this phase of resource management into the multiple use program of the district.

4. Recommended Actions

The Federal Water Pollution Control Administration has identified biotic pollution from livestock access to streams as a major pollution problem. BLM subscribes to that agency's recommendation that on grazing allotments the basin's streams be fenced to preclude livestock access. Because fencing the BLM lands in the basin has little practicability, livestock use of BLM lands adjacent to live streams should be discouraged, and not be permitted.

B.& C. Range Resource - 1965 - 1980 and 2020

1. General

Projections show increasing personal incomes, a more affluent society in the basin. The public demand for high quality meat will intensify. Producers will be turning more and more to irrigated pastures to meet market requirements for quality products. This is possible due to the increasing availability of water for irrigation from proposed impoundments and the large acreage farm land suitable for irrigation. Herd laws are being passed in more and more counties limiting livestock use of unfenced forest lands. Fence construction and maintenance on forest lands is extremely expensive and is not economically feasible for the low quality forage found on hand to graze steep hillsides. For this reason plus the danger of stream contamination by livestock, livestock grazing is expected to be a minor use of BLM lands in future years.

Livestock use of forest lands is competitive for forage needed to sustain the wildlife of the area. Increasing hunter demands warrant giving priority of use of the limited available forage to wildlife.

X. A. Recreation Resource - Present Situation

1. General

Public Law 85-470 reflects the conviction that outdoor recreation is essential to the well-being of the American people and should therefore continue to be an important part of American life. People of the Willamette Basin are fortunate in having a wide choice of recreation opportunities. Although the Pacific Ocean beaches lie outside the basin, they are readily accessible and supply a major share of the recreation demand of basin residents. The excellent skiing relatively close to population centers attracts vast numbers. Skiing is primarily on National Forest lands in the Cascades. The BLM lands lie below the snow zone so have little potential for development of ski facilities.

In addition to skiing the Willamette Basin offers vast opportunity for boating, swimming, fishing, hunting, hiking, driving for pleasure, picnicking, camping, mountain climbing, and similar outdoor activities. An extensive stream system is supplemented by an abundance of natural lakes and a large number of Corps of Engineer Reservoirs. Although Oregon has an excellent State Park program, it has concentrated its park development efforts along the Coast. The towns and cities have done a creditable job providing for local outdoor recreation needs as have many of the counties of the basin. The Corps of Engineers has good recreation developments on its impoundments. There are no National Parks in the basin but the Forest Service has been a major contributor of outdoor recreation facilities. The electric utilities have been generous in providing for recreation opportunities on their impoundments. Big timber companies like Weyerhaeuser and Crown-Zellerbach not only open their lands to hunting and fishing but also provide picnic and campgrounds.

BLM having only recently entered the recreation field shows only a modest development of the land it administers. The BLM lands do have an important place in meeting recreation needs of the basin. Being located in the foothills and lower slopes of the Cascades, they are generally in the day use zone (within 40 miles) from population centers. Thus, they are readily accessible for picnics and outdoor play. Also, BLM lands constitute the major Federal land holdings on the basin portion of the Coast Range. There is a dearth of State Park campgrounds in this zone so BLM has a major opportunity for providing for camping recreation in the Coast Range portion of the basin.

Even though the Willamette Basin is the population center of the State, relatively few of BLM's recreation developments are found here. Only nine of the 61 existing BLM recreation sites in Oregon are in the basin. One of these is in the Eugene District and eight are in the Salem District. Construction of the Wildwood Recreation Area by the Salem District on Highway U. S. 26 below Mt. Hood will serve a major demand from the Portland Metropolitan Area. The initial development will be completed in 1969 F.Y. Both the Eugene and Salem Districts have developed recreation areas outside the basin which are accessible and used by basin residents, but this study is limited to a review of resources within the basin.

2. Existing Recreation Situation

Population of the Willamette Basin in 1965 was 1,338,900 people. Its per capita income was 6% higher than the national average. Total resident and non-resident outdoor recreation demand in 1960 was estimated at 34,026,000 recreation days. About one-third of this was water related recreation demand, two-thirds non-water related. An excellent highway system through the valley makes any portion accessible for overnight or weekend use. Because of the scenic attractions of the Cascades and the competition from the ocean, the recreation potential of the basin portion of the Coast Range is relatively undeveloped.

Tourism is Oregon's third largest industry. There were 7.1 million out-of-state visitors to Oregon in 1961 and 9.2 million in 1962. In 1963 9.5% of the visitation at Oregon's recreation facilities were tourists. Out-of-state tourists added $245 million dollars to Oregon's economy in 1964. Studies show that Pacific Northwest residents vacation more in their own region than do residents of other regions and that more tourist dollars are spent in the Pacific Northwest by non-residents than are spent by tourists from the Pacific Northwest in other regions. 1/ Thus, tourism generates a significant net credit in the Pacific Northwest's balance of interregional payments and is properly classified as a basic or export industry. Tourist dollars are believed to spark a relatively high multiplier in the economy which, because of the chain of spending and respending created further augments employment and income in the region. 1/

Unlike most other basic industries, tourism does not contribute conspicuously to either water or air pollution, nor does it concentrate workers in already congested metropolitan areas. Furthermore, the resource upon which it depends - scenic and other outdoor attractions - is not subject to depletion when properly managed. 1/

BLM can make a significant contribution to the economy of the Willamette Basin through development and maintenance of scenic roads and recreational facilities to help meet the accelerating recreation and tourism demands. From a social viewpoint, too, there is need to provide for healthful outdoor activities to the ever-increasing number of retired workers and to occupy the time of a population with an ever-increasing amount of leisure.

The skyrocketing outdoor recreation demand is both a problem and a challenge. It is a problem in funding for the construction of needed new recreation facilities and for their operation and maintenance. This is demonstrated by the size of the 1962 Oregon State Park expenditures which amounted to $2,087,700. The U. S. Forest Service presently spends approximately $8½ million a year on recreation facilities in Oregon and Washington. Over $5 million has been spent for recreation facilities at sixteen Corps of Engineers projects in the Pacific Northwest. They spend in excess of $600,000

1/ "Pacific Northwest Economic Base Study for Power Markets - Recreation" BPA 1967.

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annually on the few sites they operate in this area. Local governments in Oregon spend $8,000,000 per year on Parks and Recreation. In view of the extensive acreage of BLM lands in Oregon these figures make BLM's Oregon 1969 F.Y. recreation budget of $801,000 look quite modest.

The following table showing increases in recreation demand by activity on National Forests in the basin reflects comparable pressure for use of BLM lands.

Table R-1

1963 OUTDOOR RECREATION USE BY TYPE ON NATIONAL FORESTS IN THE WILLAMETTE BASIN 1/

Activity	Visits	Percent Change 1958-1963
Swimming	75,900	+578
Hunting	56,400	+205
Wilderness use	18,400	+179
Boating	44,200	+175
Fishing	354,700	+ 64
Hiking & riding	42,400	+ 63
Camping	206,200	+ 61
General enjoyment	1,987,400	+ 62
Winter sports	377,700	+ 9

The large number in general enjoyment reflects a major demand for sight-seeing and driving for pleasure.

3. Eugene BLM District Recreation Alternatives

a. Recreation demand

The Eugene BLM District embraces a major part of Lane County, including the heavily populated Eugene-Springfield metropolitan area. The district includes the Upper Willamette sub-area which had a population in 1965 of 198,000. Recreation demand in this area in 1963 was estimated at 6,025,000 recreation days, slightly more than one-third of which was water oriented.

b. Recreation supply

The upper sub-area is blessed with an abundance of surface water for recreational use as shown in the following table.

1/ "Willamette River Basin, Oregon - Interim Report" USDA 1964

Table R-II

Reservoir	Natural Lakes Acres	Stream Miles	Annual Recreation Use Factor	Surface Acres	Annual Recreation Potential
Dorena			500/acre	1840	920,000
Cottage Grove			500	1140	570,000
Fall Creek			500	1880	940,000
Dexter			500	1025	512,500
Lookout Point			500	4360	2,180,000
Hills Creek			500	2735	1,367,000
Blue River			500	975	487,500
Cougar			500	1280	640,000
Trail Bridge			500	73	36,500
Smith River			500	170	85,000
Carmen			500	31	15,500
Fern Ridge			500	9360	4,680,000
Waldo	5500		500		2,750,000
Major stream mileage		2415	1,000 days per mile		2,415,000
Minor stream mileage		2985	100 " " "		298,500
Small natural lakes-	1550		500		775,000
Total	7050	5400		24,869	18,673,000

These sites are classified as being a medium development area (Class II) where developed lands will support 250 recreation visits per acre per year.

Water areas will support 500 visits per acre per year. Table R-II shows that there is an excess of water-based recreation over existing population needs in the Upper sub-area. For this reason much of the recreation demand from the Middle and Lower sub-areas will be satisfied in this area. Basinwide water-based recreation demand is estimated at 10,229,000 recreation days for 1960, still below the resources available in the Upper sub-area.

There is an additional 12,472,370 recreation days non-water related recreation opportunity in the Upper sub-area, for a total available recreation resource of 31,145,370 recreation days. Basin-wide total outdoor recreation demand equals 24,848,790 days, well below the existing supply. The problem then is one of location.

There are insufficient numbers of recreation facilities within the day use zone. All but one of the Eugene District's developed recreation sites lie within a 40-mile radius of Eugene. In fact all the Eugene District's land in the basin lies within the day use zone, emphasizing its potential for satisfying future recreation demands. There are 182 miles of stream frontage on this BLM land although some of the streams may be too small to have significant recreation values.

Federal construction agencies are making functional evaluation of 17 proposed water storage sites in the Eugene District portion of the basin. Eight of these are in areas affecting either BLM lands or BLM roads. Any that are built will provide new recreation opportunities and reduce need for constructing other similar outdoor recreation facilities. Action on these will affect the timing and location of proposed new BLM recreation developments. The Eugene District has been alerted to these projects. Map R-1 shows proposed locations of these reservoirs.

BLM lands in the Eugene District, Upper Willamette Subarea have been classified for recreational use as follows:

Subbasin	Number of Class II Sites	B.O.R. Classification - Acres I	II	III	IV	V	VI	Acres Total
1. Coast Fork	7		180	84,100	40			84,320
2. Middle Fork	2		145	26,035				26,180
3. McKenzie	16		1,039	38,741				39,780
4. Long Tom	0		0	19,720				19,720
Total	25		1,364	168,596				170,000

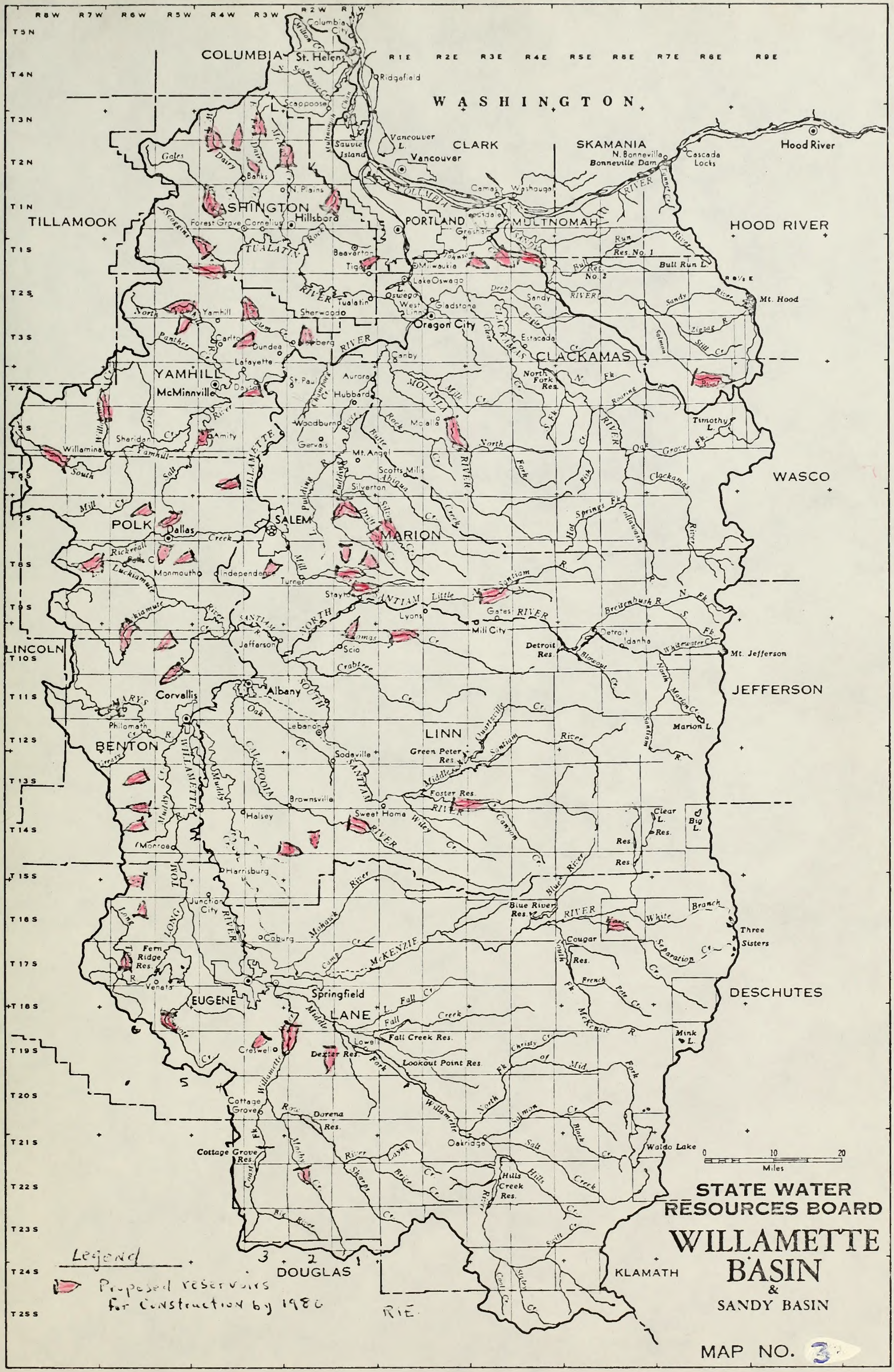
The 25 identified sites relate to the Type II Class which are suitable for substantial development as picnic, campgrounds, swimming, or boating areas. The balance of the BLM land is suitable for dispersed recreation in a natural environment such as hunting, fishing, birdwatching, hiking, and photography. Development in these areas is light with some trails, roads, and primitive facilities where needed.

The State of Oregon is in the initial phase of study for development of a Willamette River Greenstrip Waterway and Recreation area. This will involve reducing current levels of pollution of the river and the acquisition and development of public access areas and boat launch facilities. BLM has 15 acres frontage on the Willamette in section 30, T. 16 S., R. 3 W., W.M. which is suitable for development as part of this plan. It has potential for development of boat launch facilities, water sports, picnic, and camping facilities. One-half mile road construction is needed to provide access.

4. Salem BLM District Recreation Program Potential

a. Recreation demand

The Salem District embraces both the Middle and the Lower Willamette River Basin Subareas as designated by the Willamette Basin Task Force. This area is large in size, embracing the basin portions of Linn, Marion, Benton, Clackamas, Polk, Yamhill, Washington, Columbia, and Multnomah Counties. Because of the size of the study area it is necessary to review the recreation aspects of each of the seven subbasins making up the area. BLM lands


STATE WATER RESOURCES BOARD
WILLAMETTE BASIN
&
SANDY BASIN
MAP NO. 3
Legend
Proposed reservoirs for construction by 1980
WASHINGTON
COLUMBIA
TILLAMOOK
WASHINGTON
YAMHILL
POLK
MARION
CLACKAMAS
MULTNOMAH
CLARK
SKAMANIA
HOOD RIVER
WASCO
JEFFERSON
LINCOLN
BENTON
LINN
LANE
DESCHUTES
DOUGLAS
KLAMATH
Portland
Vancouver
Oregon City
Salem
Albany
Corvallis
Eugene
Springfield
Hillsboro
McMinnville
Dallas
Mt. Hood
Mt. Jefferson
Three Sisters
Detroit Res.
Green Peter Res.
Foster Res.
Blue River Res.
Cougar Res.
Fern Ridge Res.
Dexter Res.
Lookout Point Res.
Fall Creek Res.
Dorena Res.
Cottage Grove Res.
Hills Creek Res.
Waldo Lake
Miles
0
10
20

R-I

are expected to help meet the outdoor recreation needs of both the Portland Metropolitan area and the Salem-Albany-Corvallis urban complex. Table R-III shows the recreation demand by subbasins as computed for the Comprehensive Basin Study.

Table R-III

ESTIMATED 1960 OUTDOOR RECREATION DAYS DEMAND IN PART OF WILLAMETTE BASIN

Subbasin	Water Related	Non-water Related	Total Demand
Santiam	1,396,000	3,246,000	4,642,000
Coast Range	1,726,000	4,014,000	5,740,000
Pudding	1,663,000	3,869,000	5,532,000
Tualatin	875,000	2,034,000	2,909,000
Clackamas	913,000	2,126,000	3,039,000
Columbia	1,806,000	4,202,000	6,008,000
Sandy	540,000	1,256,000	1,796,000
Total	8,919,000	20,747,000	29,666,000

Although a major share of the recreation demand comes from the Portland area, an excellent highway system makes readily accessible most of this study area, much of it on a day use basis.

b. Recreation supply

There is an abundance of slack water impoundments and lakes in the Cascade Mountains portion of the basin while there is practically none west of the Willamette River. More stable streamflows from the Cascades offer much greater attraction than the rather insignificant summer streamflows from the Coast Range. A comparison of the water-based recreation opportunities is shown on Table R-IV.

Table R-IV

COMPARISON OF WATER-BASED RECREATION OPPORTUNITIES BY SUBBASIN

Reservoirs	Natural Lakes	Stream Miles	Annual Recreation Use Factor Acres-Capac.	Reservoir Surface Acres	Annual Recreation Days Potential
Santiam Subbasin (mostly Linn County)					
Detroit Res.			500	3,580	1,790,000
Big Cliff			500	100	50,000
Foster			500	1,220	610,000
Green Peter			500	3,720	1,860,000
Stream Miles		368	1,000 da. per/mi.		368,000
Small Ponds			500	295	147,500
	Marion L.		500	325	162,500
	Natural L.		500	738	369,000
Subtotal		368		9,978	5,357,000

Table R-IV (continued)

Reservoirs	Natural Lakes	Stream Miles	Annual Recreation Use Factor Acres-Capac.	Reservoir Surface Acres	Annual Recreation Days Potential
Coast Range Subbasin (Benton, Polk, Yamhill Cos.)					
	Natural L.[1/]		500	89	44,500
Stream Miles		375	1,000 da. per/mi.		375,000
Subtotal		375		89	419,500
Pudding Subbasin (most of Marion Co., 40% in Clackamas)					
	Goose L.		500	20	10,000
	Natural L.		500	75	37,500
Stream Miles		214	1,000 da. per/mi.		214,000
Subtotal		214		95	261,500
Tualatin Subbasin (Washington Co.)					
Stream Miles		159	1,000 da. per/mi		159,000
Clackamas Subbasin (most of Clackamas Co.)					
	Elk L.		500	63	31,500
Timothy			500	1,200	600,000
Harriett			500	23	11,500
North Fork			500	350	175,000
River Mill			500	100	50,000
Faraday			500	70	35,000
	Natural L.		500	240	120,000
Stream Miles		156	1,000 da. per/mi.		156,000
Subtotal		156		2,046	1,179,000
Columbia Subbasin (part of Columbia & Multnomah Cos.)					
	Oswego L.		500	42	21,000
	Blue L.		500	20	10,000
Stream Mi. (incl. Columbia)		82	1,000 da. per/mi.		82,000
Subtotal		82		62	113,000

1/ Carlton Lake was washed out by the 1964 flood and has not been reconstructed.

Table R-IV (continued)

Reservoirs	Natural Lakes	Stream Miles	Annual Recreation Use Factor Acres-Capac.	Reservoir Surface Acres	Annual Recreation Days Potential
Sandy Subbasin (Eastern Multnomah & Northern Clackamas Cos.)					
Roslyn			500	160	80,000
	Trillium L.		500	10	5,000
	Benson		500	20	10,000
	Mirror L.		500	7	3,500
	Wahkeena		500	20	10,000
Columbia R.			500	2,000	1,000,000
6 Reservoirs			500	1,600	800,000
	Goodfellow		500	28	14,000
	Small lakes		500	155	77,500
Stream Miles		116	1,000 da. per/mi.		116,000
Subtotal		116		4,000	2,116,000
Total		1,470		16,270	9,705,000

The available supply of water-based recreation opportunity on a subarea basis appears adequate to meet current demands. Problems arise because of the uneven distribution of this resource. Virtually no slack water recreation is available in the basin west of the Willamette River. The Willamette River is included in the inventory data and given equal use rating as other major streams. Potential recreation use of the Willamette is high but dependent upon overcoming the pollution and lack of access problems. Existing nonwater related recreation resources provide opportunity for 31,948,000 recreation days use. This would appear adequate to satisfy recreation demand on an annual basis. Excessive use problems arise because recreation demand is largely concentrated on weekends with peak use in the month of July. Fifty percent of the use takes place on weekends. Size of visitor party averages four in number. The design day load for water-related recreation can be based on a 2% of expected annual visitation. Nonwater-based recreation is found to be less intensive, reflected by a design day load of 0.9% of total annual visitation. This is because the recreation season is longer for this type of use, and covers a wider range of activities. The Mt. Hood area is the primary outdoor recreation attraction in the Lower Subarea.

Because the BLM lands lie at a much lower elevation than Forest Service lands, recreational facilities on them provide a much longer season of use.

c. Salem BLM District Recreation Opportunities & Alternatives

All the Salem District's recreation developments lie within the 40-mile day use radius from either Portland or Salem. Only a small bit of the basin portion of the district lies outside the 40-mile radius from urban

centers. The area outside this radius is the Upper Middle Fork of the Santiam and Quartzville Creek headwaters. Scenic and water attraction renders this area desirable for overnight camping. Most of the BLM lands in the district which are accessible by road have potential day use recreation values.

This district has 268 miles BLM stream frontage in the basin with 106,440 acres stream frontage lands. Not all these streams will be found to have recreation attraction. However, these figures do indicate a high potential for water-based recreation development.

Federal construction agencies are making functional evaluation of 70 proposed water storage sites in the Salem District part of the basin. Evaluation by the Salem District finds that only 16 of these affect BLM resource management operations. Nearly all have potential for recreational development. BLM recreation responsibilities will be increased to the extent the reservoir pools front on BLM lands. On the other hand such new reservoirs away from BLM land will satisfy a portion of the local recreation demand and reduce for a time the necessity for meeting these needs on BLM land.

BLM lands in the Middle and Lower Willamette Subareas of the Salem District have been classified for recreational use as follows:

		B.O.R. Classification - Acres						Acres
Subbasin	Number of Class II Sites	I	II	III	IV	V	VI	Total
5. Santiam	9		3,420	99,160				102,580
6. Coast Rge.	11		1,006	67,124				68,130
7. Pudding	10		1,029	38,411				39,440
Subtotal	30		5,455	204,695				210,150
8. Tualatin	1		7	10,953				10,960
9. Clackamas	6		699	15,271				15,970
10. Columbia	1		12	5,928				5,940
11. Sandy	2		310	9,420				9,730
Subtotal	10		1,028	41,572				42,600
Total	40		6,483	246,267				252,750

The 40 Class II sites classified suitable for recreational development as picnic, campgrounds, etc. are only those found having exceptional recreation attraction for meeting current recreation needs. Nearly all the Class III lands having road access have potential value for more intensive recreation use.

There are three tracts of BLM land on the Willamette River which fit in with the State sponsored Willamette River Greenstrip Waterway and Recreation Area. These are the Judson Rocks area containing 30 acres in T. 9 S., R. 4 W., sec. 1, the Coffee Bar area of fifteen acres in T. 4 S., R. 3 W.,

secs. 26-35, and Wells Island with 61 acres on the river in T. 9 S., R. 4 W., secs. 14-23. These tracts should be developed in cooperation with other public agencies as the Greenstrip Parkway plan is implemented. There is gravel road access to Judson Rocks and the Wells Island land, but a mile of road is needed to provide access to the Coffee Bar site.

There are also a number of unsurveyed tracts of public land on the river which should be considered in the development of the Willamette River Parkway. These are listed as follows:

Township	Range	Section	Approximate Acreage
3 S.	1 E.	22	30
3 S.	1 E.	23	10
3 S.	1 E.	27	5
5 S.	3 W.	11	20
5 S.	3 W.	26	15
8 S.	4 W.	35	30
9 S.	4 W.	1	15
9 S.	4 W.	23	60
12 S.	5 W.	1	25
4 S.	3 W.	26 & 35	15
5 S.	3 W.	13	20
6 S.	3 W.	5	2
Total			247

d. BLM Recreation Management Problems

(1) Neither the Salem nor Eugene BLM District Offices have the benefit of a recreation specialist on their staffs. In view of the backlog of recreation inventory, recreation land classification, and recreation development needing to be done in each district, it is obvious that a recreation man is needed to accomplish this work in a timely manner. Recreation in this area requires long-term advance planning in view of the time it takes to grow a new crop of trees once a potential recreation site or a natural beauty area is laid bare by a clear-cut timber sale.

In view of the size of Oregon's recreation program and need for its expansion, it is evident that additional assistance at the State level is also needed. The BLM recreation program in Oregon is found to far exceed that in any other state, but even so we are unable to meet the increasing demands of the public. The large resource and investment values involved warrant the assignment of manpower in proportion to the responsibility of the work.

(2) The checkerboard land ownership pattern complicates establishment of scenic corridors in BLM Management Areas.

(3) The heavy volume of logging truck traffic on BLM roads during the week tends to limit recreational use to weekends.

(4) Driving for pleasure and sightseeing is relatively low in the Coast Range portion of the basin because there are few good loop roads through this area and because the area lacks the scenic attraction of the Cascades.

e. Summary

The State of Oregon Park Department is giving emphasis to recreation development on the Coast. This leaves a major burden for satisfying the basin's local recreation demand to the counties, cities, and Federal agencies. There is a major deficiency of water-based recreation opportunity in the Lower Basin subarea, resulting in serious over-crowding at developed recreation sites on water. Success of the proposed Willamette River Recreation Greenway will do much to alleviate this problem by reducing pollution and providing public access to the river with needed facilities. The four tracts of BLM lands on the river should be made available to implement this program.

Recreational opportunities in the Coast Range portion of the basin are relatively deficient. The Corps of Engineers and the Forest Service have concentrated their efforts on the Cascade Mountains portion of the basin. Only four of the twelve BLM recreation sites of the Salem District are in the Coast Range. There is better balance in the Eugene District where all but one of its developed sites are in the Coast Range. Corps and Forest Service developments are able to satisfy most of the existing demand on the east side of the Upper Basin subarea. The location of BLM lands in the Salem District provides good opportunity for meeting more of the recreation needs in the Coast Range portion of the basin. The 66 miles of BLM land stream frontage in the Coast Range subbasin indicates there is opportunity for more intensive recreation development of this area.

5. Recommended Action

a. That the Eugene District cooperate with the State Parks Department as to the BLM land on the Willamette River for inclusion in the proposed Willamette River-Greenway Recreation area, and that the Salem District take similar action in regard to its lands on the river.

b. That recreation specialists be assigned to the Salem and Eugene Districts for the immediate evaluation and classification for recreational value the many miles of stream frontage lands in each district, as well as other lands having recreation values.

c. That priority for new recreation development be given to projects in Multnomah, Washington, Columbia, and Clackamas Counties to help meet the burgeoning needs for outdoor recreation of the Portland area. Particular emphasis should be given to the recreation deficient area west of the Willamette River.

d. That potential recreation sites be identified on all district maps and that their boundaries be posted on the ground to insure protection from other resource management operations.

e. That preliminary informal recreation site development sketch maps be made of all identified potential sites so as to identify problems that may develop. This would also provide a basis for setting priorities for construction of the needed facilities and establishing relationship to the districts' road building program.

f. There is need for a new BLM recreation inventory in the basin for better identification and evaluation of potential sites near large population centers. The new inventory should cover all types of potential recreation uses as described in BLM Manual 6000.05B, including: 1. Recreation complexes, 2. Recreation areas, 3. Recreation sites, i.e. campgrounds, picnic grounds, scenic overlooks, organization sites, archaeological and historical sites, 4. Transfer tracts, 5. Buffer and scenic zones, 6. Recreation reserve sites, 7. Joint recreation sites, 8. Potential transfer tracts, and 9. Recreation homesite lease areas.

B. Future Recreation Resources and Demand 1965-1980

1. General

By 1980 the basin's population is expected to grow from the 1,168,900 level to 1,767,500, a 51% increase. This increase primarily will be urban growth. Demand for outdoor recreation is expected to double, due to increasing leisure time, greater per capita income, and better roads, as well as the increasing numbers of people. Intensively developed lands in or near cities are expected to furnish 51% of the outdoor recreation use.

However, competing land uses and accelerating urban land prices and taxes may preclude private endeavor from participating in the needed urban outdoor recreation expansion. Public agencies should program to meet at least half of the 1980 recreation needs. Trends indicate that more of the burden for meeting these needs will fall on forest lands, particularly those close to cities. In addition to the attraction of the forest environment this is also because topography, soils, and legal restrictions limit more intensive competing uses. Also much of this land is in public ownership, traditionally available for public use. Because most of the BLM land is relatively close to population centers there will be increasing pressure for their recreational use and development.

Table R-V shows the National Forest program for meeting some of the increasing water-based recreation demands in the basin. This data may be helpful in correlating BLM recreation programs.

Table R-V

NATIONAL FOREST RECREATION PROGRAM IN WILLAMETTE BASIN

Type of Recreation Development	1963 Inventory	Additions 1963-1970	New Starts 1963-1970	New Starts 1970-2010	Totals
Wading	78	18	37	106	239
Swimming	36	6	16	41	99
Boating	28	6	14	25	73
Water skiing	16	4	8	18	46
Fishing	162	27	58	277	524
Total	320	61	133	467	981

The Comprehensive Willamette Basin Study shows there will be a shortage of recreation land in the basin by 1990 which will increase at a rapid rate thereafter. Although there will be no shortage of forested lands for some types of recreation use, possible problems are foreseen in loss of specific types of land. These are: (1) rural "open space", loss of agricultural lands to subdividers; (2) recreation areas that are close in to urban centers, being converted to other use; (3) lower elevation scenic areas. BLM can play an active role in meeting needs in problem areas numbers (2) and (3).

2. Eugene District Recreation Opportunities and Alternatives 1965-1980.

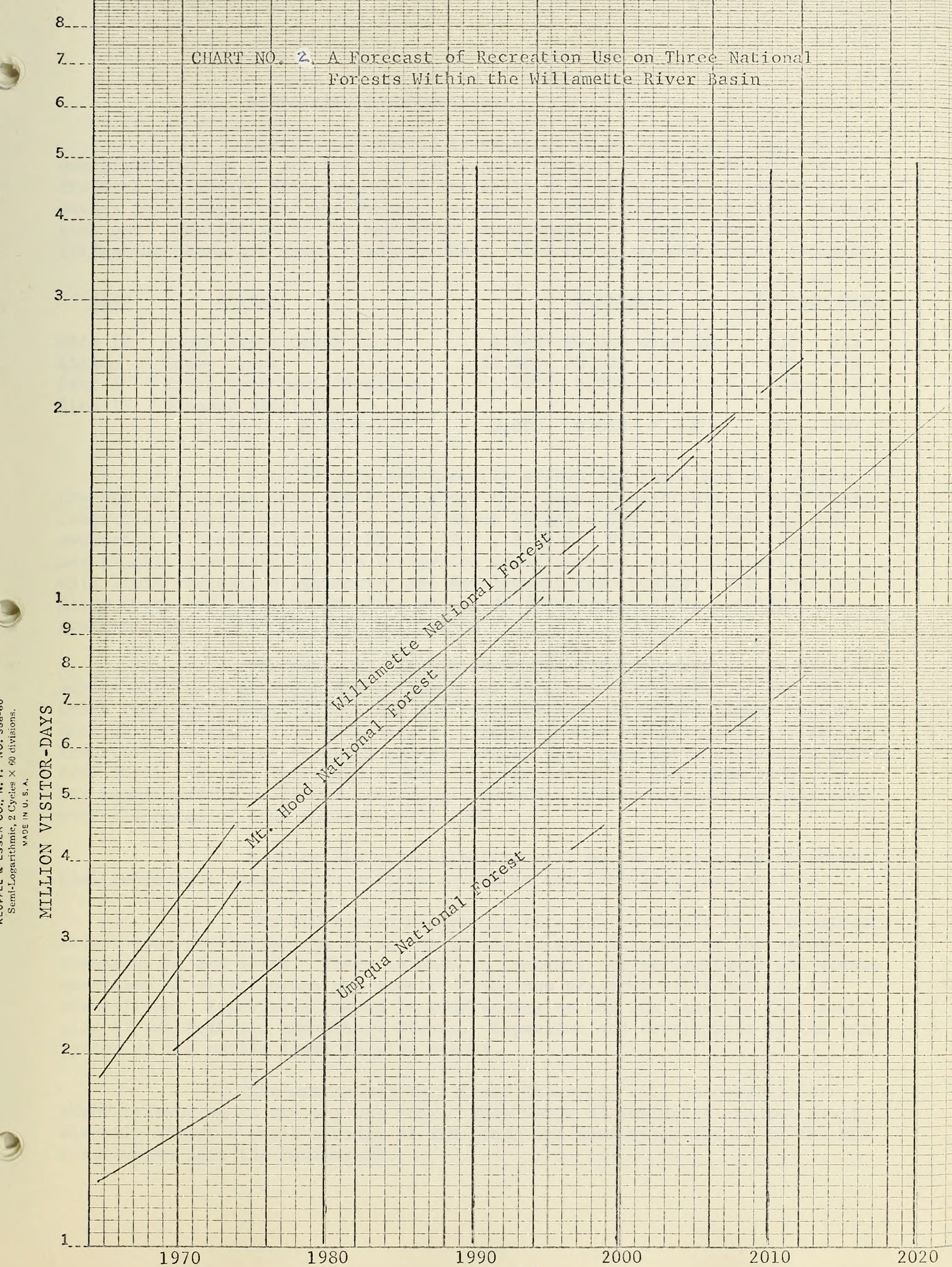
a. Recreation Demand

A doubling in recreation demand over 1960 levels is expected by 1980. The water-related demand is expected to increase faster than nonwater-based recreation. This is due in part to the abundance of slack water in this area, stimulating interest in this type of use.

b. Recreation Supply

Proposed Corps of Engineer projects will have major impact on the recreation supply in this area. Projects being studied are: Foley Ridge damsite on mainstem McKenzie River, Twisty Creek Reservoir on mainstem McKenzie, Rebel Creek site on South Fork McKenzie, Horse Creek Reservoir on Horse Creek, Upper North Fork Site on North Fork of Middle Fork Willamette River, Moolack Mountain site on North Fork of Middle Fork Willamette, Mile 56 on Middle Fork Willamette, and Campers Flat on Middle Fork Willamette. None of these proposed reservoirs directly affect BLM lands. A Forest Service study finds the following sites most compatible with forest resource development: Horse Creek site on the McKenzie, Upper North Fork site on the North Fork of the Middle Fork, and Campers Flat site on the Middle Fork Willamette. It is probable that at least three of these reservoirs will be built in the 1965-1980 period. Any that are built will help to meet the increasing demands for water-based recreation.

CHART NO. 2. A Forecast of Recreation Use on Three National Forests Within the Willamette River Basin



c. Recreation Opportunities

Daytime use demand is expected to be very high compared to overnight use due to proximity to the Eugene-Springfield metropolitan area. Proposed irrigation developments in the basin will have prior claims on the waters in Cottage Grove and Dorena reservoirs, greatly impairing their recreation use. Possibilities for new water impoundments to supply downstream irrigation needs are being studied. Four sites being studied are as follows:

Site	Stream	Storage	Acres Surface Area
Site 16	Camas Swale Creek	4,000- 20,000 acre ft.	400 - 825
Abrams	Mosby Creek	30,000- 80,000 " "	490 - 920
Site 3	North Fork Camas Swale Cr.	1,400- 6,300 " "	115 - 275
Site 15	Unnamed (sec. 32, T. 18 S., R. 2 W.)	2,000- 9,000 " "	100 - 340

Site 15 will not directly affect BLM lands but may affect the BLM road system into BLM lands above the proposed reservoir. The Abrams reservoir on Mosby Creek would flood about 70 acres BLM land, covering BLM ownership in sections 15 and 23, T. 22 S., R. 2 W., W.M. Because primary use of this reservoir will be irrigation water storage, pool fluctuations will limit recreation attraction and development opportunity. BLM lands on Allen Creek and Cedar Creek offer potential development sites providing the reservoir pool level could be maintained.

The proposed reservoirs on Camas Swale Creek do not directly affect BLM lands although BLM holdings are in close proximity. Either of these reservoirs could affect BLM road systems and may affect timber management in protection of natural beauty. Because these are primarily irrigation reservoirs the Eugene District should largely disregard their recreation potential until they are built and a water storage operating plan developed. At any rate existing outdoor recreational resources appear adequate to meet the over-all needs of this subarea until 1980.

A major BLM responsibility will be the protection of potential recreation areas which will be needed in the 1980-2020 year period.

The BLM action program in this period should be to accelerate access road development to allow the public to make full use of the stream resources on BLM lands. There is need to conserve the recreational and scenic qualities of watercourses and scenic drives and preserve water quality in streamflows. Especially needed is good access to the BLM lands on the south side of the McKenzie and Mohawk Rivers. Expansion and development of the trail system on the public lands is also needed.

The authorized Gate Creek Reservoir will increase water-based recreation in the day-use zone. This Corps of Engineers project would directly affect a small acreage of BLM lands and have major impact on the BLM road system into the headwaters.

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Termination of the Vietnam conflict could result in sharp program increases. Depending on availability of funds the Eugene District has identified the following project which should be developed in the interim period to 1980.

Name	Type of Development	Approx. Developed Acreage	Location	Estimated Constr. Cost
Elk Meadows	Camp -Picnic 15-acre fish. reservoir	120	T. 23 S., R. 2 W., sec. 35 on Coast Fk.-Umpqua Div.	$118,750

Additional projects proposed under an accelerated program are as follows:

Name	Type of Development	Approx. Developed Acreage	Location	Estimated Constr. Cost
Edward's Cr.	Picnic	8	T. 23 S., R. 2 W., sec. 7 on Big River at Edwards Cr.	$21,250
Row River	Camp-picnic	20	T. 20 S., R. 2 W., DLC #39 (acquired land)	41,250
Miner's Rd.	Camp-picnic	20	T. 23 S., R. 1 W., secs. 1 & 12 on Sharp's Cr.	93,750
Sharp's Cr. enlargement	Camp-picnic-swimming	+10	T. 22 S., R. 1 W., sec. 15	10,000
Silica Mt.	Picnic-overlook	1	T. 23 S., R. 1 W., sec. 34	1,500
Clark Cr.	Picnic-wayside	1	T. 23 S., R. 1 W., sec. 27	1,500

These proposed projects are within the day-use area from Eugene and Springfield and heavy use can be anticipated.

The BLM lands in the Long Tom Subbasin are mostly steep, brush, and forest covered hillsides in the upper reaches of tributary drainages. There are no major streams on BLM lands. There appears to be little opportunity for recreation development on BLM lands in this subbasin.

3. Salem District Recreation Opportunities and Alternatives

a. Recreation Outlook in Santiam Subbasin 1965-1980

The potential for private investment in recreational development is great along the Willamette and Lower Santiam Rivers. Private opportunities include golf courses, riding stables, hunting and fishing areas, vacation cabins, youth camps, water sports areas, and home sites near wooded streams and ponds. A considerable area of this type of land in private ownership lessens the need for this kind of use on the public lands. The Willamette Basin Study

recreation inventory shows an ample supply of water-based recreation opportunity in the Santiam Subbasin to meet local needs to 1980. However, the supply may not be ample for meeting peak season demands such as occur on weekends in July and August. The immediate future recreation needs in this area are for non-water developments in the day-use zone from the major towns.

b. Proposed Recreation Developments in Santiam Subbasins

The Corps of Engineers is studying several sites in this area for construction of large water storage reservoirs. These sites are as follows:

Site Name	Stream Location	Lands Affected
Elkhorn	Little North Santiam River	BLM, Private, U.S.F.S.
Canyon Creek	" " " "	U.S.F.S. & Private
Lyons	" " " "	BLM & Private
Byars Creek	North Santiam River	U.S.F.S.
Tunnel	" " "	U.S.F.S. & Private
Jordan	Thomas Creek	Private & BLM
Packers Gulch	Quartzville Creek	BLM, Private, U.S.F.S.
Bear Gulch	Middle Santiam River	U.S.F.S. & Private
Chimney Creek	" " "	U.S.F.S.
Wiley Creek	Wiley Creek	Private
Patterson	South Santiam River	U.S.F.S. & Private
Upper Soda	" " "	U.S.F.S. & Private

Forest Service impact studies find that the following sites would have the least adverse impact on forest resource values: Canyon Creek, Byars Creek, Packers Gulch, and Wiley Creek. Of these only the Packers Gulch site materially affects BLM lands. About 900 acres of the reservoir will be on private lands and BLM lands. It will inundate BLM's Yellowbottom Campground and several miles of a paved BLM road system. A timber annual yield of 663 M. board feet would be lost by the change in land use. Longer truck hauls will depreciate upper drainage timber values. Winter deer range of medium value will also be lost. Should BLM assume recreation management on this reservoir, the following is a guide to project imposed costs which should be programed.

Item	Costs: Initial Investment	Costs: Annual
1. Planning	$5,000	
2. Administration		
During Construction		$10,000
After Construction		$ 1,000
3. Recreation		
New Facilities	$100,000 - $300,000	
Facility Maintenance		$5,000 - $15,000
4. Reservoir Debris		
Disposal Facilities	$15,000	
Annual Sweeping		$10,000
5. Protection		
Fire - During Construction		$ 3,000
Fire - After Construction		$ 1,000
Total	$120,000 - $320,000	$19,000 -$29,000

The Jordan Reservoir on Thomas Creek would inundate only a small acreage of BLM land but the existing road system would have to be replaced.

The Lyons site would inundate 600 acres of highly productive BLM timber land as well as BLM recreation areas at Elkhorn and Salmon Falls. The beauty of the Little North Fork as a free-flowing stream would be destroyed by the reservoir. It would have major adverse impact on the BLM road system and bridges. This site is given secondary priority for construction by the Corps so should be given little consideration at this time in BLM planning.

c. BLM Recreation Program Opportunities in Santiam Subbasin 1960 - 1980.

Major recreation needs on BLM lands in the Santiam Subbasin are substantial recreation developments within the day-use zone. There appear to be suitable BLM lands on Butte Creek, Mill Creek, and the Little North Santiam for day-use recreation development as needs arise. Of more immediate concern is the need for improved road access to lakes, streams, and hunting areas on the BLM lands. There is 102 miles of stream frontage on BLM lands in this subbasin, much of which has potential for recreation development.

d. Recreation Outlook in Coast Range Subbasin 1965 - 1980

There is practically no slack water for recreation in the Coast Range subbasin and opportunities for overnight camping are insignificant. The primary recreation asset is a large acreage of forest land. Streamflows become insignificant in summer severely limiting their recreation value. City and County parks currently supply most of the local outdoor recreation needs. It is expected that the State's new Willamette River Parkway program will open much of the river to public use.

e. Recreation Demand in Coast Range Subbasin 1965 - 1980

Recreation demand is expected to nearly double between 1960 and 1980. Water-related demands will increase at a faster rate than nonwater-related. By 1980 it is expected that water-related demand will reach 3,358,000 recreation days compared to 7,081,000 recreation days nonwater-related demand. Existing undeveloped acreage is adequate for meeting recreation needs through 1980, but development of additional facilities is needed. BLM lands constitute the only extensive public land area open to the public for hunting and other extensive recreational uses, such as fishing, hiking, berry picking, and sightseeing.

Both the Corps of Engineers and the Bureau of Reclamation have been studying opportunities for improving streamflows and water storage through reservoir construction. The recreational value of such developments would be proportional to reservoir drawdown for irrigation. BLM lands would be affected by construction of the following reservoirs:

Name	Stream	Reservoir Surface Area Acres	Storage Acre Feet	Remarks
Agency Creek	Agency Cr.	570	30 - 50,000	Will inundate 40 acres BLM lands, requires relocation BLM roads.
Coast Cr.	Coast Cr.	355	5.5 - 25,000	Would flood out 6 miles existing road. Contiguous small area BLM land.
Gorge Dam	Mill Cr.	563	- - -	Floods out BLM recreation development.
Tindle Cr.	Tindle Cr.	330	2.5 - 15,000	About 1/8 mile frontage on BLM land, requires BLM road relocation.
Lower Pike	N.Yamhill River	1,820	50 - 150,000	No potential recreation development on BLM lands.
Lower Fairdale	N.Yamhill R.	2,360	60 - 150,000	No potential recreation development on BLM lands.
Willamina Cr.	Willamina Cr.	2,000	70 - 200,000	No potential recreation development on BLM lands.
Willamina Cr.	Willamina Cr.	240	7.5 - 18,000	No potential recreation development on BLM lands.

Of the 43 identified reservoir sites in the Coast Range subbasin only the Agency Creek and the Gorge site offers opportunity for BLM water-oriented recreation development. It is expected that at least the Gorge site will be developed before 1980. The north third of the subbasin lies within the 40-mile day-use zone from Portland, and recreational development should be given priority in this area.

f. BLM Recreation Development Opportunities in Coast Range Subbasin 1960 - 1980

BLM lands in the Coast Range subbasin are accessible to both the Portland area and to the Salem-Albany-Corvallis urban areas and has potential for satisfying much of the recreation demand from these areas. In addition to streamside developments there is need for improvement in road access to the streams and hunting areas on BLM lands. Particularly needed are facilities for overnight camping. Because of the length of the subbasin, recreation facilities should be well-dispersed in order to meet local needs. BLM administers 66 miles stream frontage in this subbasin. Much of it is attractive and suitable for intensive recreational development. The greatest potential for large campground developments west of the Willamette River is on Agency Creek. The 160-acre site in section 9, T. 5 S., R. 8 W. would cost about $100,000 to develop.

Sites suitable for day-use recreation development are listed as follows:

Hidden Brook	20 acres in sec. 7, T. 3 S., R. 5 W.,	development cost	$40,000
Coast Creek	40 " " " 7, T. 7 & 8, T. 5 S., R. 7 W.	"	50,000
Meadow Lake	12 " " " 17, T. 3 S., R. 5 W.	"	20,000

g. Recreation Outlook in Pudding Subbasin 1965 - 1980

There is practically no slack water recreation opportunity available in this subbasin. Even the Pudding River is not attractive due to pollution, and recreation use is further hampered by lack of access and recreation development. This subbasin has great potential for recreational development due to its proximity to both the Portland and Salem metropolitan areas.

The Bureau of Reclamation has identified six sites for large water storage reservoirs and the Department of Agriculture has nine sites for small water impoundments. Proposed Silver Creek reservoir below Silver Creek Falls State Park bisects BLM lands but the precipitous topography appears to preclude recreational development of these public lands.

Several tracts of BLM lands are on or near the proposed Butte Creek reservoirs. Recreational development on these reservoirs will attract a large number of visitors due to proximity to large population centers. Additional fire protection and sanitation policing on the BLM lands will be required and perhaps modification of timber harvest to protect aesthetic values of the area.

The proposed North Fork reservoir on Molalla River would affect three parcels of BLM land and inundate a hundred acres of it. There will be three-quarters of a mile of BLM waterfront lands ideally situated for recreation development.

Proposed Pelkey reservoir on Molalla River is practically surrounded by BLM lands though there is only about two miles of frontage on the pool. The reservoir would inundate over 150 acres BLM timber land, a new concrete and steel bridge, and many miles of permanent forest road system. The potential for recreation development of the BLM lands is excellent. However, this site is given only second priority in the Bureau of Reclamation program.

h. Recreation Demand - Pudding Subbasin - 1965 -1980

Water-related recreation demand is expected to increase from the 1960 level of 1,663,000 to 2,832,000 to 1980. Nonwater-related recreation is expected to expand from 3,869, 000 in this period by 5,984,000. Although there is an adequate supply of nonwater-related recreation to meet current needs, it will be short by 2,115,000 recreation days of meeting needs in 1980. The existing inadequate supply of water-based recreation will add up to a shortage of 1,682,000 recreation days unless new water-based recreation facilities are provided.

i. BLM Recreation Opportunities in Pudding Subbasin 1965 - 1980

In view of the growing shortage of both water-based and nonwater-based recreation in this period, BLM has a good opportunity for meeting some of this recreation demand. There are about 50 miles of stream frontages on BLM lands in this subbasin. The Salem BLM District can help relieve the water-based recreation shortage by providing more access to BLM stream frontage lands and constructing recreation facilities at the more attractive sites. The Salem District must be alert to water project construction programs of other agencies affecting BLM lands in order to integrate recreational development and management of the BLM lands with that on the other lands on the reservoir. The Salem District proposes to meet some of this recreation need by construction of a day-use area and campground on 80 acres of BLM land at Joyce Lake costing $65,000 in section 19, T. 7 S., R. 5 E., W.M. Other potential developments are as follows:

Bear Creek Campground	20 acres,	in sec. 6,	T. 7 S.,	R. 3 E.,	costing	about	$50,000
Table Rock - Fork Molalla River	45 "	, " " 14,	T. 7 S.,	R. 3 E.,	"	"	150,000
Upper Molalla Oxbow	60 "	, " " 24,	T. 7 S.,	R. 3 E.,	"	"	100,000
Willhoit Springs picnic -day-use area	90 "	, " " 16,	T. 6 S.,	R. 2 E.,	"	"	100,000
Butte Cr. Picnic - day-use area	80 "	, " " 15,	T. 7 S.,	R. 2 E.,	"	"	60,000

Much of the BLM land in this subbasin is not accessible by road. BLM can make a major contribution to nonwater-related recreation by providing road access to the larger blocks of public lands for hunting, hiking, and general enjoyment. Road access across private lands is needed to "round-out" the desired BLM recreation program.

j. Recreation Outlook in Tualatin Subbasin 1965 - 1980

A continued expansion of the Portland Metropolitan area into Washington County is accelerating demand for day-use outdoor recreation opportunity in this area. Water-related recreation demand is projected to grow from 875,000 recreation days demand in 1960 to 1,832,000 by 1980. Non-water-based recreation demand forecasts show a jump from the 1960 figure of 2,033,000 to 3,870,000 recreation days in 1980. There is virtually no slack water recreation in this basin. Lack of access and the polluted condition of both the Tualatin River and the Willamette River limits their use for recreation. The inventory of recreation areas shows a total of only 525 acres recreational developed land for the entire subbasin. Of the 33 developed areas, 24 are city and county, two are State Fish & Game, four are private, one is State Parks, one is Pacific University, and one is by BLM. The inventory shows no public campgrounds.

k. Recreation Potential for Tualatin Subbasin 1965 - 1980

The Tualatin Subbasin has no outstanding scenic or recreation attractions. Its proximity to Portland gives special value to its farmlands, orchards, and forest lands for scenic drives and picnicking. The authorized Bureau of Reclamation Scoggin Reservoir will provide some recreation benefits when built, although recreation use will be limited by heavy water drawdown during the summer.

l. BLM Recreation Opportunities in Tualatin Subbasin 1965 - 1980

Although BLM land acreage is relatively small in this subbasin, there are some sizeable concentrations of BLM lands in the upper Tualatin River, upper Scoggin Creek, McKay Creek, and East Fork Dairy Creek. County roads through the forested uplands are not well marked as to destination, discouraging use by other than local inhabitants. BLM lands need to be identified, giving the public notice that these lands are open for their enjoyment. The biggest problem is lack of good access roads to the BLM lands in this area. Recreational development is limited by the need for construction of good access roads to potential recreation areas, cost of these roads would be from $100,000 to $500,000.

The 14 miles of stream frontage on BLM lands gives opportunity for development of swimming and picnic areas. Although the BLM recreation inventory shows little potential for recreation development, a more intensive review is recommended for the BLM lands in this subbasin to identify a site suitable for development for overnight camping. Such a development is especially needed to serve the requirements of scouts, campfire groups and similar organizations. Expansion of facilities is also needed at BLM's Little Bend Recreation site as proposed by the Salem District at a cost of about $15,000. The Salem District has identified the Shadybrook day-use picnic site as having potential for development. This is on 40 acres in section 29, T. 2 N., R. 2 W. Cost of development is estimated at $18,600. Ready access from Portland via Sunset Highway indicates the desirability of this project.

m. Recreation Outlook in Clackamas Subbasin 1960 - 1980

The proximity of the Portland metropolitan area results in extremely heavy use of existing outdoor recreation facilities. An increasing demand is projected from 913,000 water-related recreation days use in 1960 to 1,654,000 in 1980. Nonwater-related recreation demand is expected to rise from 2,126,000 in 1960 to 3,496,000 by 1980. It is estimated there are 270 miles of streams suitable for recreation. There are numerous small lakes in addition to constructed reservoirs. A rugged, forested landscape adds to scenic interest. Although the supply of nonwater recreation facilities is adequate to meet demands to 1980, there will be a need to supply an additional 631,000 recreation days water-based recreation. The day-night use relationship is expected to be three to one. Higher

overnight use can be expected in the more remote areas. About one-third of the streams are accessible to public use.

Federal agencies are studying the potential for development of three new reservoirs on the Clackamas River. These are Lower Austin Point, Upper Austin Point, and Big Bottom sites; all on National Forest lands. Construction of any of these sites would help meet the increasing needs for water-based recreation.

n. BLM Recreation Opportunities in Clackamas Subbasin 1965 - 1980

BLM has identified six potential new sites for recreation development in this subbasin, covering 699 acres. Most of these are water-oriented and all should be developed by 1980 to help alleviate the growing shortage in water-oriented recreation opportunity. New road construction is needed to provide access to the 15 miles of BLM stream frontage lands as well as to provide access to other blocks of BLM land to open them for hunting and other recreational uses. Proposed new recreation developments are listed as follows:

N.Fk. Clackamas River Campground	100 acres,	sec. 7,	T. 4 S.,	R. 5 E.,	cost	$155,000
Williams Lake Campgr.	15 " ,	" 26,	T. 5 S.,	R. 4 E.,	"	50,000
Helen's Lake Campgr.	15 " ,	" 36,	T. 5 S.,	R. 4 E.,	"	50,000

o. Recreation Outlook in Columbia Subbasin 1960 - 1980

In spite of embracing a large portion of the Portland Metropolitan Area this subbasin has high recreation use potential. It provides access to both the Columbia and Willamette Rivers. It embraces part of the Tualatin Mountains and the West Portland hills. Streamside recreation is limited due to the small size of the water courses. It has the advantage of excellent road access to nearly all areas. Thirty-one percent of the area is still forested. Portland's Forest Park, containing 7,000 acres, remains little developed and offers great potential for meeting increased recreation demand. All developed recreation sites in the subbasin are for day-use only.

Recreation demand in this subbasin is expected to increase in water-related demand from 2,035,000 recreation days in 1963 to 3,592,000 recreation days in 1980. Nonwater-related demand is projected to increase from 4,749,000 recreation days in 1960 to 7,590,000 in 1980. Present demand cannot be met due to the inadequate supply of developed recreation sites. Only 2,300 picnic units exist to serve a population of 625,000. Of the 155 existing outdoor recreation sites, 133 are city or county, 18 are private, and four are State.

Much of the water-related demand could be met by recreational developments on the Willamette and Columbia Rivers, together with pollution control. The 50 miles of streamside areas within the subbasin lack any development for picnic sites. Of the eight major lakes in the subbasin, only Blue Lake has been developed for recreation. There are no reservoirs or proposed dams

which have recreation potential. The basin does hold considerable undeveloped water-related recreation potential on both the lakes and rivers. Forest Park also offers great opportunity for development for supplying more intensive recreational use.

p. BLM Recreation Opportunities in Columbia Subbasin 1960-1980

BLM has no recreation developments in this subbasin. The recreation inventory shows potential for development of a twelve-acre site on the Nehalem divide in section 15, T. 4 N., R. 3 W. at a cost of $39,000. The nine miles of BLM stream frontage in the basin indicates possibilities for additional recreational development, especially on North and South Scappoose Creeks. Improved road access is also needed to make accessible the BLM lands in this unit. A heavy expenditure for road construction will be needed to provide access to potential recreation sites.

The Portland Metropolitan Planning Commission report indicates that twice as much recreation land as was available in 1962 will be needed by 1975 to meet demands. Accordingly, BLM should program to completely develop the recreational potential of its lands in this subbasin by 1980.

q. Recreation Outlook in Sandy Subbasin 1960 - 1980

There is an extreme shortage of water-related recreation opportunity in this subbasin which will increase to a deficit of 240,000 recreation days by 1980. Development of the potential of the Columbia River could meet 25% of the needs. The Corps of Engineers is making a feasibility study on construction of a 700-acre reservoir on Salmon River within Mt. Hood National Forest. Construction of this Linney Creek reservoir would meet the balance of the water-related recreation needs to 1980. Water-related demand is expected to increase from 540,000 recreation days in 1960 to 865,000 in 1980. The 1963 use of 4½-million recreation days reflects high quality and easy accessibility of developed areas. This is remarkable in view of the fact that less than half of the subbasin is accessible by car. The large area of the upper Bull Run watershed containing Portland's water supply is closed to the public.

r. BLM Recreation Opportunities in Sandy Subbasin 1960 - 1980

Completion of BLM's Wildwood Recreation Area during this period will meet some of the accelerating demand for outdoor recreation opportunities. There is opportunity for improved road access to the BLM lands in the basin, particularly those on the Sandy River, Salmon River, Buck Creek, Gordon Creek, and Cat Creek. The 11 miles of BLM stream frontage in this subbasin indicates the potential for additional recreational development. There is opportunity for cooperation with the State and the Forest Service to connect trails through the BLM lands in the Columbia Gorge. About 780 acres of BLM land would be affected. Cost of this trail system will be about $25,000.

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Other recreation development opportunities on BLM land in the Sandy subbasin are as follows:

Buck Cr. Campground	50 acres in sec. 3, T. 1 S., R. 5 E., cost	$100,000
Sandy River Gorge Campground	320 " " " 23, 25, T. 1 S., R. 4 E., "	200,000
Alder Cr. Campground	80 " " " 19, T. 2 S., R. 6 E., "	100,000

s. Summary

(1) There is need for examination of all BLM lands close to population centers and classification of them as to their recreational potential. Recreation classifications or withdrawals should then be made on those found to have recreation values. Future resource management planning should be coordinated with recreation planning so as to get maximum benefits from new road construction and other resource use of the lands.

(2) The recreation responsibilities and opportunities in the Salem and Eugene Districts warrant the addition of a recreation specialist to each office. Priority should be given to recreation site identification, protection, planning, and development, plus maintenance of those in service.

(3) A stronger program of natural beauty area formal designations and protection is needed in both districts.

(4) A study is needed for development of a good system of trails to enhance the recreational potential of many of the subbasins, tying in to trail systems on other Federal and State lands.

C. Future Recreation Demand and Opportunities 1980-2020

National Forest planners expect outdoor recreation use to increase 600% during the next 40 years. Other projections reflect at least a five-fold increase in demand. 1/ The Bureau of Outdoor Recreation says "by the year 2000-participation in the major forms of outdoor recreation activities will be four times greater than it was in 1960." 2/ More important from an economic standpoint is the forecast that recreation expenditures will be six times greater in 2000 than in 1960. 3/ This means that people will be driving farther and spending more for recreation equipment, facilities, and services. Lack of facilities in California will result in more and more out-of-state tourists using Oregon's recreation facilities. Programing for tourist use is essential in view of the beneficial impact on the economy of the basin. Out-of-state tourist use currently constitutes 9.5% of the total recreation demand. 4/

1/ "Willamette Basin Comprehensive Study -Recreation Appendix" Willamette Basin Task Force 1969

2/ "Outdoor Recreation Trends" Bureau of Outdoor Recreation April 1967

3/ "Pacific Northwest Economic Base Study for Power Markets -Recreation" B.P.A. 1967

4/ based on percentage of tourists using State Parks, National Forests, and Corps Projects in 1963

A State Park study rates recreational interests of tourists as follows: camping 28%, fishing 24%, sightseeing 14%, water sports 6%, rock hounding 5%, ocean enjoyment 4%, and miscellaneous 19%.

The problems to be overcome are in finding adequate acreage of Class I lands for recreational development and in having good distribution of such lands. Comparing projected demand to year 2020 with the estimated recreation supply finds a whopping deficiency of 82,775,000 recreation days short of demand.

This does not include estimates of hunting and fishing use which will also be in short supply. The shortage of total recreation land in the basin is expected to occur in the 1990's and will increase at a rapid rate thereafter. Authorized Cascadia and Holley Reservoirs are expected to be in operation by 1980. Jordan Reservoir is expected to be in operation by year 2000. These will satisfy some of the increased need for water-based recreation.

The Willamette Valley is likely to be a continuous urban strip from Portland to Eugene with heavier concentrations of people around present centers. The proportion of day-use recreation demand, already 40% of the total, probably will double by year 2020. Water areas are preferred for most types of outdoor recreation. In planning for the future recreation needs of the basin at least 80% should be related to some type of water,either stream, lake, or reservoir. All fishing streams will be receiving very heavy use by this time. Boating, water skiing, and swimming uses are increasing twice as fast as population growth and there is no reason to expect this rate of demand to diminish. Overnight camping use at State Parks in the basin increased 51% from 1960 to 1965. The rising popularity of truck campers adds to this increased demand for overnight facilities. Day-use of State Parks has increased at even a faster rate, by 54% from 1960 to 1965 basinwide. Greatest increase was the 66.5% in the Upper Willamette Subarea, compared to 62% in the Lower Willamette, and only 22% increase in the Middle Willamette area.

In forecasting outdoor recreation demand 60% should be focused on the day-use zone, 30% in the weekend-use zone (40 - 125 miles), and 10% as vacation or extended trips (over 125 miles). 1/

Estimates of future recreation use and capacities by the major recreation agencies in the basin based on a long range development program is shown in the following table:

1/ "California Outdoor Recreation Plan, Part II", p. 13, Nov. 1960

Table R-VI

ESTIMATES OF FUTURE RECREATION DAYS USE AT WILLAMETTE BASIN SITES

Corps of Engineers	1965 (actual)	1980	2000	2020
Upper Basin	1,341,000	3,095,000	4,795,000	6,235,000
Middle Basin	106,000	965,000	1,795,000	2,425,000
Total Corps of Eng.	1,447,000	4,060,000	6,590,000	8,660,000
U.S.F.S.	4,200,000	7,000,000	14,000,000	27,000,000
State Parks	3,617,636	6,000,000	9,250,000	12,500,000
Total	9,264,636	17,060,000	29,840,000	48,160,000

Forecast recreational use is based on the following population estimates:

	1965	1980	2000	2020
Lower Subarea	811,000	1,047,300	1,476,000	2,298,000
Middle Subarea	329,900	437,700	556,000	729,000
Upper Subarea	198,000	282,500	390,000	564,000
Total	1,338,900	1,767,500	2,422,000	3,591,000

1. Eugene District Recreation Opportunities and Alternatives 1980 - 2020

a. Recreation Demand

By year 2020 water-related outdoor recreation demand is expected to equal 7,866,000 recreation days, nonwater-related 15,900,000 recreation days for a total demand of 23,766,000 recreation days outdoor demand in the Upper Subarea as embraced by the Eugene BLM District. About one-quarter of this will be supplied at Corps of Engineers reservoirs. In this period demand pressures are expected to be such as to make profitable private operation of outdoor recreation facilities, and private endeavor will meet much of the need. There will still be tremendous demand for the rather unique type outdoor recreation experiences to be found on Forest Service and BLM lands.

b. Eugene BLM District Recreation Opportunities 1980 - 2020

There are substantial acreages of BLM lands in close proximity to the Eugene-Springfield metropolitan area. These lands lie on the Camp Creek and lower Mohawk drainages, on McGowen Creek drainage, on Coburg Ridge, Buck Mountain, and Mt. Tom which lie to the north and east of Eugene. There are also important acreages on Camas Swale Creek, Lynx Hollow Creek, Doak Creek, and Coyote Creek to the south and west of Eugene. During this time period these lands may become more valuable for recreational use than for timber production. Intensive management may make possible both recreation

use and timber production. Class I intensive recreation use facilities should be planned so as to serve large numbers of people with a minimal acreage requirement. The recreation potential of any stream frontage on BLM lands should be fully developed during this period. Scenic drives on BLM lands should be identified and view points provided where possible and desirable. Hiking and riding trails should also be provided in order to permit maximum use of the forest lands. Boat launching sites should be constructed with needed parking at suitable stream frontage sites, particularly on the McKenzie River. Streamside management to preserve and enhance scenic beauty will need emphasis in this period. Growth and expansion of urban areas will envelop the lowlands and impose a critical strain on land resources within and near population concentrations. The land resource will be hard-pressed to provide opportunities to meet demands for such things as playgrounds, parks, open space, and natural beauty areas. BLM lands will be expected to meet at least some of these needs. The most critical and urgent needs of the upper basin will continue to be for readily accessible day-use recreation which BLM is in good position to supply. To optimize water-based recreation use in the day-use zone will require additional water surface acreages. BLM could provide some of this on some of the streams with small removable type impoundments as is currently being done in some areas by the district.

It is estimated that at least one major water storage project will be built in this period. A project near Mile 1.4 on the Mohawk River is being considered. It is doubtful that it would directly affect the BLM lands in the area, but it would provide much of the slack water needed for recreation if built.

2. Salem District Recreation Opportunities 1980 - 2020

The Salem District now has and will continue to have the greatest responsibility for recreation management of all BLM districts in the State since it embraces the major population area of the State. Intensive high quality development will be required to satisfy demands of an opulent urban populace. The new Wildwood Recreation Area being built off U. S. Highway 26 to Mt. Hood is the long needed first step towards really meeting the Portland area and tourist needs. A substantial BLM acreage in this same area offers great opportunity for additional recreation development.

a. BLM Recreation Opportunities in Santiam Subbasin 1980 - 2020

BLM lands in the Santiam drainage are well located to serve recreation needs of the Salem area due to excellent direct road access. Camping, picnicking, swimming, boating, fishing, hiking, hunting, and outdoor sports are major uses most in demand. The recreational attributes of this subbasin will continue to draw many people from outside this study area. Total effective population is projected from the 1960 figure of 109,100 to 289,600 in 2020. Recreation days use demand are expected to increase from 4,642,000 in 1960

to 20,307,000 in 2020, a fivefold increase. Because of the large acreage of National Forest lands in this subbasin that agency can be expected to meet a great deal of the increasing outdoor recreation needs. Some will be met on new reservoirs to be built by the Corps of Engineers. Development of the Willamette River Parkway by the State and counties will make available much needed water-based recreation. Primary outdoor recreation needs will continue to be in the day-use area within an hour's drive from town. It is believed that BLM can make the greatest contribution by supplying facilities for day-use enjoyment as close as possible to the towns. The recreation use season will be of much longer duration at the lower elevation BLM lands than on National Forest facilities.

b. BLM Recreation Opportunities in Coast Range Subbasin 1980 - 2020

The BLM recreation responsibilities are unique in the Coast Range, Tualatin, and Columbia subbasins in that there is little if any National Forest land to help meet public demands. Population of the subbasin is expected to grow from 96,500 people in 1960 to 251,000 by 2020, with a fourfold increase of recreation days demand from 5,740,000 to 22,134,000. It is doubtful that the cities and counties can continue to provide the bulk of the outdoor recreation as they do now. Competing land uses and high land prices in urban areas will force more of the recreation demand onto the public lands. One of the biggest problems will be in providing adequate hunting and fishing opportunity for a burgeoning population. Fishing demand is expected to double between 1980 and 2020. Road access will be needed to streams on BLM lands and to other public lands for hunting. In view of the existing lack of overnight camping facilities in this subbasin, BLM should give emphasis to providing this type of opportunity. Heaviest recreation pressure will be on the north portion of the subbasin since Highways 18 and 22 draw a major portion of the Portland and Salem recreation traffic having destination west of the Willamette River. The north one-third of the basin lies within the 40-mile day use zone from Portland. Development of the Willamette River Parkway will have major impact on this subbasin with 113 miles Willamette River frontage. This will supply much of the needed water-based recreation. Because driving for pleasure is a major recreation use there is opportunity for BLM to identify and post scenic drives on BLM lands.

Comparison of future recreation needs with existing supply finds need to devote substantial additional acreages of land to satisfy 1980 - 2020 demands for hunting, hiking, scenic areas for pleasure driving, picnicking, camping, swimming, boating, and outdoor sports. It is believed that the BLM lands in this area can be managed both to grow trees and provide needed recreation without too much impact on the timber growth potential. Loss of timber production on a limited acreage devoted to recreation can be made up by more intensive management of other forest lands. It is recognized that the more intensive timber management will be more costly and require additional financing in order to permit conversion of lands to recreation use without loss in needed stumpage production.

c. BLM Recreation Opportunities in Pudding Subbasin
1980 - 2020

The Pudding Subbasin is a problem area recreationwise due to the existing inadequacy of outdoor recreation opportunities plus the fact that there is practically no Forest Service land in the basin to help meet the demand. The problem is aggravated by the location of the City of Salem in this subbasin plus proximity to the City of Portland.

Aside from 74 miles of Willamette River frontage, the major recreation feature of the basin is Silver Falls State Park with ten major waterfalls. The 8,179 acres of State land in the park is misleading since most of this acreage is undeveloped. It does offer good opportunity for future development, especially for hiking and horseback riding trails.

Projections show a need for an additional 13,908,000 recreation days use by year 2020. It appears that a number of reservoirs will be required in addition to development of the Willamette River if future water-related recreation demands are to be met. It is possible BLM could meet some of the swimming needs through installation of suitable removable dams on appropriate streams.

It is probably that major water storage reservoirs will be built in this time period. These would likely be the Pelkey Dam on the Molalla River, a reservoir on Little Pudding River, North Fork Reservoir, a reservoir on the main channel Pudding River, one on Battle Creek, and one on Rock Creek. BLM's program will be affected by and must be correlated with construction of these projects. Basically, the big job facing BLM in this period will be to provide day use recreation readily accessible to the towns.

d. BLM Recreation Opportunity in Tualatin Subbasin
1980 - 2020

During this period it is expected that the Tualatin Valley will become a heavily populated addition to the Portland Metropolitan Area. Competitive land uses and high land prices will limit the availability of lands for recreational use. Excellent road access to all parts of the basin gives emphasis to the potential for recreational development and use of the BLM lands found here. Heavily travelled U. S. Highway 26 and State Highway 8 bisect the basin, U. S. 30 gives good access to the north side, and U. S. 99 W traverses the west side. Resident population is expected to more than triple by year 2020 for a total of 364,000. Recreation demand will increase from 2,908,000 recreation days in 1960 to 17,276,000 recreation days by 2020, a sixfold increase. The existing supply of developed recreation resources is inadequate to meet even current demands. Full and intensive development of available resources will be needed to meet increased future demands. Consideration must also be given to the fact that the entire subbasin is within the day use recreation zone of Portland. Thus, there is little chance for overdevelopment of recreation facilities in this subbasin.

There is opportunity for BLM to cooperate with county highway officials in development and designation of scenic drives, especially on Skyline Drive, the Dixie Mt. Road, and Tater Hill road where there is BLM ownership. Construction of small watershed ponds or removable dams to provide summer swimming on BLM lands would help solve the lack of water-based recreation opportunity. Hiking and riding trails should be programed on BLM lands where acreage concentrations permit. Little Bend Recreation site should be investigated for possible development into a major recreation area with swimming facilities, hiking, riding trails, and provision for outdoor games. Especially needed at the Little Bend site will be provision for additional day use facilities.

Chances are good that the proposed McKay Creek reservoir will be constructed in this period. The pool would cover 198 acres with a storage capacity of 6,340 acre feet. It is possible that BLM lands on McKay Creek above the dam will be affected by the reservoir, though dam height will be only 80 feet.

Another probability is construction of a water storage reservoir on East Fork Dairy Creek. One site is in section 28, T. 3 N., R. 3 W., W.M. A 120-foot dam is proposed which will provide a 150-acre pool and have 7,200 acre feet storage. This reservoir could intrude upon several tracts of BLM land and enhance their potential for recreational development.

e. BLM Recreation Opportunity in Clackamas Subbasin 1980 - 2020

The population of this subbasin is expected to increase from 35,700 in 1960 to 113,900 in year 2020. The potential for recreation development of the Clackamas subbasin is extremely high due to proximity to Portland, its varied and rugged topography, and the scenic aspects of its streams. The several Portland General Electric power reservoirs draw large numbers of recreation users.

Recreation demand is expected to increase nearly fivefold by year 2020 for a total of 14,659,000 recreation days. The heavy demand from the Portland area outside the county, places an unduly heavy burden on local government in trying to meet recreation needs. There is abundant opportunity to develop camp-picnic ground recreation sites through the subbasin. Most of the identified potential sites are within the National Forest.

The possibility for development of new reservoirs looks dim during this time period because of better opportunities for controlling excess water flows in other subbasins. The rivers and streams of the basin would add greatly to water-based recreation opportunities upon construction of needed road access and recreation development. Due to the anticipated shortage of water-based recreation by 1980, development of stream access and facilities on BLM lands should be expedited in this period. Higher

standard roads providing scenic loop drives will be needed to satisfy demand for pleasure driving and to disperse present recreation use concentrations. Because of the ready access to much of the BLM lands, recreational emphasis should be given to day use facilities, including organizational campgrounds with sports areas. Roadside vista points will be needed to open scenic views to travelers.

f. BLM Recreation Opportunity in Columbia Subbasin 1980-2020

The Columbia Subbasin presents a challenge to the outdoor recreation planner because it embraces the entire City of Portland. Also, access is possible to every corner of the subbasin by automobile via six major highways from Portland. The subbasin population is forecast to increase from the 1960 level of 526,300 to 1,776,700 by 2020. This will be reflected in a recreation demand increase from 6,784,000 to 38,790,000 recreation days, an increase of nearly six and one-half times. Urban expansion will be predominantly at the expense of the agricultural lands, leaving to the forest lands the satisfaction of outdoor recreation needs.

The Willamette and Columbia Rivers can be made to satisfy most of the water-based recreation demand. There will still be opportunity and need for BLM to construct small water impoundments on such streams as North and South Scappoose Creeks so as to provide for summer swimming and wading. Possibility for scenic drives exists such as Dutch Canyon Rd., North Scappoose Creek Rd., and the Cox Creek Road. BLM cooperation with the County probably will be needed to develop these into scenic loop roads. Properly developed roads of this nature through an area protected for its scenic beauty would satisfy large numbers of people seeking this type of experience. Developed recreation sites along the way on BLM lands would add greatly to the attractiveness of these scenic drives.

The Willamette Basin Study shows that an additional 7,263 acres Class I nonwater-related recreation lands will be needed by year 2020 in this subbasin.

The current supply of 2,300 picnic units in the subbasin is grossly inadequate to meet current needs. Probably the main contribution of the nearly 6,000 acres BLM land in this basin will be satisfaction of day use recreation. Picnic facilities will continue to be the prime need. The Nehalem Divide area offers opportunities for development of overnight camping, facilities for which this subbasin is totally devoid. The BLM lands in this area should be closely examined to determine their potential for campground development. Construction of hiking and riding trails should also be programed.

g. BLM Recreation Opportunity in Sandy Subbasin 1980 - 2020

The Sandy Subbasin has high potential for meeting increasing recreation needs of the Portland area due to its adjacent location and excellent road access. It is bisected by U. S. Highway 26, the Mt. Hood highway, and standard roads providing scenic loop drives will be needed to satisfy demand for pleasure driving and to disperse present recreation use concentrations. Because of the ready access to much of the BLM lands, recreational emphasis should be given to day use facilities, including organizational campgrounds with sports areas. Roadside vista points will be needed to open scenic views to travelers.

5. BLM Recreation Opportunity in Columbia Subbasin 1980-2020

The Columbia Subbasin presents a challenge to the outdoor recreation planner because it embraces the entire City of Portland. Also, access is possible to every corner of the subbasin by automobile via six major highways from Portland. The subbasin population is forecast to increase from the 1960 level of 526,300 to 1,776,700 by 2020. This will be reflected in a recreation demand increase from 6,784,900 to 38,790,000 recreation days, an increase of nearly six and one-half times. Urban expansion will be predominantly at the expense of the agricultural lands, leaving to the forest lands the satisfaction of outdoor recreation needs.

The Willamette and Columbia Rivers can be made to satisfy most of the water-based recreation demand. There will still be opportunity and need for BLM to construct small water impoundments on such streams as North and South Scappoose Creeks so as to provide for summer swimming and wading. Possibility for scenic drives exists such as Dutch Canyon Rd., North Scappoose Creek Rd., and the Cox Creek Road. BLM cooperation with the County probably will be needed to develop these into scenic loop roads. Properly developed roads of this nature through an area protected for its scenic beauty would satisfy large numbers of people seeking this type of experience. Developed recreation sites along the way on BLM lands would add greatly to the attractiveness of these scenic drives.

The Willamette Basin Study shows that an additional 7,253 acres Class I nonwater-related recreation lands will be needed by year 2020 in this subbasin.

The current supply of 2,300 picnic units in the subbasin is grossly inadequate to meet current needs. Probably the main contribution of the nearly 8,000 acres BLM land in this basin will be satisfaction of day use recreation. Picnic facilities will continue to be the prime need. The Nehalem Divide area offers opportunities for development of overnight camping, facilities for which this subbasin is totally devoid. The flatlands in this area should be closely examined to determine their potential for campground development. Construction of hiking and riding trails should also be programmed.

6. BLM Recreation Opportunity in Sandy Subbasin 1980 - 2020

The Sandy Subbasin has high potential for meeting increasing recreation needs of the Portland area due to its adjacent location and excellent road access. It is bisected by U. S. Highway 26, the Mt. Hood Highway, and

U. S. 80N gives access to the north side. Forests cover about nine-tenths of the subbasin. The balance most likely will become completely urbanized during the 1980 - 2020 period. The population is expected to increase from 9,700 people in 1960 to 22,800 by year 2020. A great deal of nonurban settlement is anticipated with development of both summer homes and commuter residences. The secluded forest areas are highly prized for both types of use, both on private and on public lands.

Most of this subbasin's recreation demand comes from out of the basin, mostly from the Portland area. A nearly fivefold increase in recreation demand is anticipated by year 2020. Inventoried recreational use in 1963 was four and one-half million recreation days. With proper development, identified recreation lands have the capacity to meet nonwater recreation needs throughout the study period. With proper development and lifting of legal restrictions against use of the Bull Run watershed, the subbasin has potential for meeting anticipated water-based recreation needs also.

Much of the Lower Sandy River is undeveloped and comparatively wild. It has good potential for development for hiking, riding, and fishing. Considerable acreage of BLM lands along the river could readily be included in such a program. BLM lands on Salmon River should also be made accessible by a good road and trail system. The Forest Service has given emphasis to provision of overnight camping facilities. Because of the more ready access to BLM lands, BLM recreation endeavor should be oriented to meeting the unsatisfied demand for day use facilities for organizational camps and picnicking. It is probable that BLM will need to give recreation management equal importance with timber management on its lands in the Sandy Subbasin by the 1980 - 2020 year period.

3. BLM Recreation Program Summary for 1980-2020 Period

Very possibly recreation will supplant forestry and wood products as the basin's primary industry by this time period. Public demand will necessitate adjustment of timber management practices so as to enhance natural beauty and recreational use. This means that both the Salem and Eugene Districts must be staffed with a number of recreation and landscape architect people by this time period in order to meet the recreation responsibility of multiple land use management.

XI. A. Minerals Resource - Present Situation

1. General

Except for sand, gravel, stone, clay, lime, silica sand, and trap rock, the Willamette Basin is a relatively mineral deficient area. Continued gains are projected in production of the common variety of minerals needed for road building and construction. The sporadic occurrence of low grade coal found in 6 of the 9 counties of the basin holds little promise for extensive commercial development. Numerous test holes for petroleum and natural gas in the basin and offshore have been discouraging.

2. BLM Minerals Management - Eugene District

Mines in Lane County have supplied over 98% of the value of metals produced in the basin since 1900. Mercury production from 1900 to 1964 was valued at $1.6 million. Most of this has come from the Black Butte Mine in Lane County in T. 23 S., R. 3 E., W.M. in an area of considerable BLM land ownership in the southeast corner of the Coast Fork subbasin. The Black Butte is the one metallic mine in the basin currently in operation. The once important gold and silver producing Bohemia mining district lies within the Willamette National Forest but is currently nonproductive.

Nonmetal minerals comprise over 95% of the total values of minerals produced in the basin. Trap rock, sand, and gravel are relatively abundant throughout the basin. Current production is either from the Willamette River channel or its flood plain and major tributaries, primarily the McKenzie River. Demand for such common variety minerals needed for construction is reflected by a nationwide consumption of about 5 tons per person per year. Consumption is even higher than this in the basin due to the rapid growth of the area. Except for basalts for crushing there is as yet little current demand for this type material from BLM lands. The basalts are widely distributed in the Cascades but are of scattered occurrence in the Coast Range. They are needed by BLM for surfacing and maintenance of its access roads. In order to have continued access for rock for road use, BLM has found it necessary to withdraw from public entry some of its lands containing hard rock. In addition to the cinnabar mine a firebrick clay mine is found on BLM lands in the Eugene District. There are no known fraudulent claims. In 1965 F.Y. 1500 cubic yards of sand, gravel, and rock were sold from BLM lands in the Eugene District.

Historical mineral interest in Lane County is reflected by the recorded locations of 8,242 lode claims, 785 placer claims, and 52 mill sites on public lands including National Forests. Determination of responsibility for management of surface rights on unpatented mining claims under P.L. 167 on BLM lands has been completed on 58,000 acres or 34% of the BLM lands in the Eugene District portion of the basin. Mining claim validity determinations are needed on about 400 acres of BLM land in the Sisulaw Resource Management Unit.

3. BLM Minerals Management - Salem District

a. Ferruginous Bauxite

Extensive bauxite deposits are found in Washington, Columbia, and Marion Counties. The two largest deposits are in the Pumpkin Ridge -Dixie Mountain area of the Tualatin subbasin encompassing most of the BLM land in northeast Washington and Columbia Counties. Aluminum Company of America has discovered a reserve of at least 25 million tons of usable bauxite in its exploration and testing program in this area.

Reynolds Metals Company has a major interest in the Salem Hills bauxite deposits, but these deposits do not affect public lands.

b. Limonite Bog Iron Ore

Bog iron deposits are exposed in Clackamas and Washington Counties. The deposits are small. The only production has been from Iron Mountain deposit near Oswego in Clackamas County. This operation was discontinued in 1894 and there is little prospect of future development.

c. Metals

There was a small production of gold and silver from the Quartzville mining district in Linn County up to 1940. The mines can not be operated under current economic conditions. This mining district lies mostly within the Willamette National Forest.

The old North Santiam mining district in Marion County embraces both BLM and National Forest lands in T. 9 S., R. 4 E. but production has been insignificant. Last production was in 1941. Surface management responsibilities on unpatented claims have been completed under P.L. 167 procedures for all the major mineralized areas in the district.

d. Clay and Shale

Clay mined in the basin is used almost entirely for manufacturing building brick, draintile, and other heavy clay products. Part of the shale is expanded into lightweight aggregate to be used in concrete and other structural products. Three high-alumina clay areas are located in the basin. There are eleven brick and tile plants in the basin. They are mostly in the Middle and Lower Subbasin on the Willamette River floodplains and its tributaries fairly close to population centers.

High-alumina clays are found in three major deposits in the basin. The kaolin-laterite zones surround and underlie the ferruginous bauxite deposits in the Washington and Marion Counties. Additionally, there is the Molalla clay area in Clackamas County which does not affect BLM

operations. Finally, there is the Hobart Butte clay area in Lane County which again is away from BLM operations. The extraction of alumina from clay is technically feasible but not as yet economically operational. Potential of the resource is estimated at 200 million tons.

e. Limestone

A small number of limestone deposits occur in Clackamas and Polk Counties. Seven of the deposits are in Polk County, two in Clackamas. The deposit on Butte Creek is either on or near BLM lands. The deposits at the head of Mill Creek in Polk County also appear to be on or near BLM lands. The most important deposit now being worked is that controlled by Oregon Portland Cement Co. three miles southwest of Dallas.

f. Sand and Gravel

Sand and gravel operations are also the leading mineral industries of the Salem BLM District portion of the basin. Production is mainly from the Willamette River, the Clackamas, Pudding, Molalla, Rickreall Creek, and Santiam. A total of 26,230 cubic yards of rock, sand, and gravel were produced from BLM lands in 1965 F.Y. Thus, BLM is making a substantial contribution to the mineral economy of the area.

g. Administration of Mining Laws

There are a total of 2,850 lode claim locations, 2,392 placer locations, 17 mill sites, and 3 tunnel site locations in Columbia, Linn, and Marion Counties, embracing both BLM and National Forest lands. Right to manage surface resources on unpatented claims has been completed under P.L. 167 procedures on 29,440 acres of BLM land in the Salem District covering most of the mineral problem areas on the BLM lands.

As urban sprawl and industrial development covers more and more of the valuable gravel and rock deposits close to the cities there will be increasing demand for production of common variety minerals from BLM lands. Because of the high value of lands containing deposits of this type of material and the public need for construction material, major decisions must be made as to whether the highest and best use of such land is for continued timber production or for production of common variety minerals.

The pulp and paper industry required 53,600 tons of Kaolin clay for filler and coating purposes in 1956. Current need is estimated between 65,000 -70,000 tons annually. Sulfite papermills which produce quality paper products requiring coating and filler clay are situated in the Willamette Basin. The kaolin being used is obtained from Georgia and Idaho. Because of the large reserves in Marion, Washington, and Columbia Counties there is opportunity for development of this untapped resource. Ready availability of this material on private lands may deflect pressure

on the public lands for production of this resource. Due to proximity to the bauxite deposits, development of the kaolin clays may have to await the utilization of the bauxite ores.

About 45,000 tons lime were shipped into the basin in 1963 for use in sulfite-pulp paper mills for calcium carbide manufacture, quicklime, hydrated lime, and for agricultural use as a soil conditioner, and in certain manufacturing purposes. Estimated requirement of the nine-county area in 1963 was between 400,000 and 450,000 tons. The poor quality of known limestone occurrences in the basin results in a major portion being shipped in from British Columbia. Potentially increasing demands for local sources of limestone may affect BLM lands in Polk and Clackamas Counties.

A mineral resource inventory is being made for the basin as part of the Bureau's multiple resource use management program. This will result in a map showing the location of minerals in the basin together with card files and narrative field reports describing the mineral as to relative value including reserves and recovery problems if any. The report should be expanded to show impact on water quality which might be expected if these minerals were developed. It should also indicate what measures should be taken in mining the mineral to reduce adverse impact on water quality.

B. Minerals Management 1965 - 1980

1. BLM Minerals Resource Management Factors

Problems with mining claim locations on the public lands will continue as long as the mining laws make it so simple to segregate public land for private use by mining claim locations. Few locators understand the requirements of the law as to sufficiency of mineralization needed to validate a claim. Opposition by the mining industry to changing the mining laws indicates these problems will continue.

Surface rights to management of surface resources under P.L. 167 have been completed on about 21% of the BLM acreage in the basin. Lack of mineralization or interest in mining claim location indicates that P.L. 167 action will not be needed on about 1/2 the BLM acreage. The small amount of such work remaining to be done should be completed during this period.

BLM lands in the basin found to have high value for recreation, wildlife, historical, and natural environment areas should be classified and withdrawn from mining claim location.

The BLM minerals inventory should be completed during this period and made available to the public to expedite development of the mineral resource. Areas withdrawn from mineral location should be shown on the mineral inventory map.

Large tonnages of sand, gravel, and stone will be needed for the many large water impoundments proposed for construction by the Corps of Engineers during this period. There will be demands on BLM lands to supply some of this material.

C. Minerals Management 1980-2020

The bulk of the mineral production in the Willamette Basin is used locally for construction and road-building. Reserves of the common varieties of sand, gravel, and stone needed to serve the greatly expanding population growth are believed to be adequate. However, urbanization and zoning regulations are making some reserves inaccessible. This trend will continue, causing local shortages. Supplies for such material will be needed from BLM lands as other sources become unavailable.

There is a limited supply of basalt for crushing on the west side of the basin. Accessible supplies on BLM lands will be in demand. BLM should withdraw such areas needed for its own access road program.

The outlook for the mining industry in the basin then is one of continued gains in production of sand, gravel, stone, clay, cement, and lime, largely to supply the local demand for these commodities. Expansion and modernization of interstate, primary, and secondary roads will continue to demand large amounts of crushed rock. Based on a projected population of the basin of 4.9 million by 2020, output of sand, gravel, and stone will be approximately 55 million tons annually, compared to 14.5 million tons in 1964.

Historically, sand and gravel operations have contributed large quantities of sediment to streamflows. Sales of such material from the public lands should contain stringent restrictions in operating procedures for protection of water quality.

XII. A. Water Resource Management - Present Situation

1. General

The Federal Water Pollution Control Act (33 U.S.C. 466) contains a direction to the Secretary of the Interior to develop comprehensive programs for controlling pollution of interstate waters and their tributaries. This affects BLM's management program because the mainstem of the Willamette River is classed as an interstate stream. Many of its tributaries drain BLM lands.

Soil stabilizing practices are imposed on Federal agencies by the terms of Executive Order 11288: "Prevention, Control, and Abatement of Water Pollution by Federal Activities". Guidlines for water quality management have been adopted by the State of Oregon. The portion of these guidelines relating to western Oregon were approved by the Secretary of the Interior on August 10, 1967. The Oregon Water Quality Standards are in two parts (1) Water Quality Criteria and (2) a Plan of Implementation and Enforcement of These Criteria. These are our standards for implementing compliance with Executive Order 11288. The Federal Water Pollution Control Administration proposes to review programs of Federal agencies engaged in land management having an effect on water quality.

BLM has recognized the need for more intensive programs of watershed management in the Departmental Manual, Part 585.1.2, policy in administration of O&C lands. It states that one of the policies of the Secretary is "Protecting Watersheds, regulating streamflow, and preventing soil erosion by conserving the basic forest resource". The basic forest resource with which we are concerned in this context is the land upon which the trees grow.

Forest Watershed Management has been defined as the balancing of land resource use so that the watershed is in the best possible condition to accept the rain and snowfall and provide for water run off without damage, to keep the water as clean as possible and to keep the flows as steady as possible.

The function of a watershed depends on its ability to catch, hold, store, and release water.

Watershed management is the improved control of the basin's "little waters" for multiple purposes and benefits having to do with conservation of water, land, soil, and general environment.[1/] Benefits include soil and moisture conservation, run-off retardation, small stream regulation and flood control, irrigation and drainage, water supply, water quality, siltation abatement, fish and wildlife enhancement, and general environmental quality. This complements the objectives of the major water control measures

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1/ "Outline for Willamette Basin Report" Walter D. Jaspers 1967.

such as large reservoirs, channel improvement, etc. A major objective of watershed management is to conserve the latent capacity of the land for meeting of future resource demands. The need for cooperation by the many forest land owners in achieving an effective watershed management program is a big problem yet to be overcome.

Opportunities for increasing streamflow on BLM lands in the Willamette Basin or materially delaying water run off through forest land management are negligible. This is because most of the BLM lands lie below the snow pack zone. The constant drizzle of winter rains maintain the soils in nearly saturated condition. Consequently, precipitation from heavy storms results in rapid runoffs without regard to vegetative cover. The major function of the vegetation on the ground is to protect the soil from the impact and soil dispersal action of the rain. It is the overland flow of storm waters that results in loss of top soil and depletes the productive capacity of the land.

Road construction, logging, and slash disposal are the three forest management programs having most impact on water quality in the basin. The main thrust of the BLM water resource management program should be towards protection and improvement of water quality. Water quality is both a measure of the usefulness of a stream and a consequence of the nature and degree of use of the watershed. Water quality affects both public health and industrial development of an area. Land use practices can alter the physical environment of a river basin and affect water quality. The following waste materials are identifiable as present or potential pollutants from land use in the Willamette Basin: sediment, minerals, toxicants, temperature, bacteria, and organic matter.

The aesthetic appearance of a stream, fish spawning grounds, and aquatic food supplies can be destroyed by sediment. Bank cutting and channel scour are the major sediment sources in the basin. Approximately 1,467,000 tons sediment per year comes from this source on forest lands. About 40,000 tons per square mile additional sediment comes from logged forest land and only 20 tons per square mile comes from forest land with good cover.[2/] Land management practices alone cannot control the bank cutting and channel scour. Channel protection measures and small watershed storage projects are needed to supplement the large flood control impoundments.

Use of chemicals in forest land management presents a growing threat to water quality. Vast amounts of sodium and calcium borate, sodium alginate, and other chemicals are dumped on the watershed in fighting forest fires. Asphalt and wax coatings are sometimes used in slash disposal. Sulfite liquors are often used on unpaved roads for dust control. Sodium and calcium chlorides are used for ice control. A number of chemicals are used to reduce animal damage to trees. Another chemical is used for tree disease control. Residues of herbicides and insecticides have long been a problem. Fertilizers

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2/ "Water Quality Control and Management-Willamette" Fed. Water Pollution Control Adm. 1967.

are being used to accelerate tree growth and are expected to become increasingly important in forest management. Motor vehicles and power boats contribute both to air and water pollution. Even weather modification, using silver iodide, contributes to air and water pollution. Federal agencies practice extreme care in use of toxic herbicides and pesticides. None of these toxicants is currently considered to be a problem in the Willamette Basin but future use must continue to be closely regulated.

Cutting trees adjacent to streams can result in water temperature increases up to 8°F. until revegetation restores the shade. Scattered clear cuts however have little over all effect on temperatures of major streams in the basin.

Biotic contamination from recreation use and livestock grazing is becoming an increasing problem. Estimates of potential fecal streptococci from animal sources in the Willamette Basin in 1959 were over 78 times that of human sources. 2/ Streams in areas of livestock use should be fenced to preclude contaminations.

Forest and logging debris was a major factor in the damage caused by the 1964 flood. The blockading effect of debris jams against bridges and culverts backed up the water until the pressure caused the bridge or fill to give way, releasing a large surge of water to accelerate downstream problems. Farm lands and urban areas in the flood plain were literally covered with debris, as were many sections of the roads.

Table I gives the estimated cost of cleaning debris, logs, rocks, and soil from flooded agricultural lands in the basin after the December 1964 - January 1965 floods. Much of this debris came from unlogged areas. But damages would have been materially reduced had loggers yarded all sizeable cull material away from bottoms of draws, ravines, and stream channels. Future logging on public land should require the yarding of cull material away from potential water courses to prevent a recurrence of the damage. In addition to damage to agricultural lands shown in Table I, the debris and silt also caused damage to transportation systems, residential, commercial, and industrial properties, and to public facilities and recreation developments.

Log storage ponds also cause problems in water quality. Accumulated bark and debris in the water decomposes, biochemical oxygen demand becomes high, and the suspended solids become the base for development of Sphaerotilus. Tannin and humic acid complex solutes leached from the decomposing organic material add to chemical pollution problems and may discolor streamflow and cause odor problems. BLM should not permit log storage ponds on BLM lands where water from the ponds returns to the natural streamflow.

Wood fibre left in streams absorbs oxygen from the water, reducing the levels needed for maintenance of fish life.

2/ "Water Quality Control and Management-Willamette River Basin" Fed. Water Pollution Control Adm. 1967.

Table W-I

December 1964 - January 1965 Flood in Willamette Basin

Agricultural Cleanup Expenses 3/

Reach or Tributary	Agriculture Acres Involved	Agricultural Damage	Estimated Cleanup Expense
Main Stem			
Eugene	1,000	$55,000	$11,000
Harrisburg	18,000	$1,672,000	$338,000
Albany	29,000	$1,211,000	$163,000
Salem	22,000	$2,635,000	$594,000
Grand Island	18,000	$3,541,000	$424,000
Newberg	9,000	$703,000	$46,000
Oregon City	2,000	$140,000	$87,000
Subtotal	99,000	$9,957,000	$1,663,000
Tributaries			
Coast Fork	4,000	$247,000	$50,000
Middle Fork	1,000	$103,000	$17,000
McKenzie River	6,000	$344,000	$117,000
Long Tom R. & Amazon Cr.	10,000	$151,000	$20,000
Mary's R. & Muddy Cr.	2,000	$59,000	$4,000
East Muddy Cr.	1,000	$18,000	$6,000
Calapooya R.	18,000	$460,000	$48,000
Santiam (main stem)	9,000	$772,000	$137,000
So. Santiam	23,000	$1,551,000	$271,000
No. Santiam	24,000	$793,000	$156,000
Luckiamute R.	7,000	$315,000	$71,000
Yamhill R.	11,000	$318,000	$35,000
Redding & Trib.	2,000	$373,000	$18,000
Molalla R.	2,000	$366,000	$99,000
Tualatin R.	11,000	$178,000	$28,000
Clackamas R.	1,000	$415,000	$56,000
Subtotal	132,000	$6,463,000	$1,133,000
Total	231,000	$16,420,000	$2,796,000

3/ From Corps of Engineers Survey - Table 12, Dec. 1964-Jan. 1965 Willamette River Flood Damages.

The Federal Water Pollution Control Administration states that research and program development should be an integral part of a water management plan. "The most obvious research need is found in problems posed by wastes that are not amenable to collection and treatment.....including the wastes of land use... Sediment concentrations increase in most tributaries and the (Willamette River) mainstem in times of high runoff." 2/

Table W-II shows the sediment loadings of major streams in the Willamette Basin. The South Yamhill River presents the gravest problem with sediment concentrations up to 800 parts per million. The Molalla River shows sediment loadings up to 560 ppm. The Santiam and Mary's Rivers also carry heavy sedimentation during parts of the year. Control of watershed operations should be adequate to assure that turbidity in the rivers and streams will not be increased to a level above 5 Jackson Turbidity Units, the level set by the State Sanitary Authority. 4/ The only exception to this is certain short term activities which may be specifically authorized by the Sanitary Authority under such conditions as it may prescribe and which are necessary to essential operations where turbidities in excess of this standard are unavoidable. A turbidity level above 25 Jackson Turbidity Units precludes effective disinfection in municipal systems because the silt clogs the filters. Also, when siltation is above 25 Jackson Turbidity Units, loss of perception in the water occurs rendering it undesirable for recreation or fishing. Siltation of spawning gravels smothers fish eggs, and the opaque color makes it impossible for the "fry" to find food for survival. Under the State's definition "pollution" means such contamination...of the physical, chemical, or biological properties of waters of the State, including change in temperature, taste, color, turbidity, silt, or odor of the waters... The highest and best practicable treatment or control of wastes, activities, and flows shall in every case be provided so as to maintain dissolved oxygen and over-all water quality at the highest possible levels and water temperatures, coliform bacteria concentrations, ...turbidities, colors, odor, and other deleterious factors at the lowest possible levels." 4/

In the rough country where access roads must be built, large amounts of dirt are often moved to get straight tangents and even grades. The more the watershed is disturbed the higher is the probability of soil washing into the streams. Analysis of its impact on water quality should be an integral part of each proposed BLM road construction job, considering both the construction and maintenance phases.

2/ "Water Quality Control and Management" Federal Water Pollution Control Adm. 1967.

4/ "Standards of Quality for Public Waters of Oregon" Oregon State Sanitary Authority 1967.

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2/ "Water Quality Control and Management" Federal Water Pollution Control Adm. 1967.

4/ "Standards of Quality for Public Waters of Oregon" Oregon State Sanitary Authority 1967.

Table W-II

Report on Sedimentation - Willamette River Basin, Oregon, U. S. Army Corps of Engineers
December 1948 - July 1951

Stream	Drainage Area Square Miles	Sediment Concentration Parts per Million Max.	Min.	Total Sediment load-tons 1/ 1949	1950	1951 2/
Tualatin River	568	390	10	123,030	60,200	56,220
Molalla River	323	560	T	95,620	73,370	56,940
Pudding River	493	315	T	96,270	60,780	66,950
So. Yamhill	502	800	12	280,480	112,380	134,180
Willamette River	7,280	400	10	1,926,250	1,738,900	1,916,960
Luckiamutte River	240	410	T	90,700	46,240	49,150
Santiam	1,790	508	T	574,850	622,800	633,340
N. Santiam	665	250	T	148,910	110,630	130,750
S. Santiam	640	370	T	212,420	178,090	187,140
Calapooya River	362	340	10	90,340	60,590	54,590
Mary's River	155	500	T	65,700	28,080	46,390
Long Tom (below dam)	252	279	10	43,410	45,230	57,580
Long Tom (above dam)	100	126	7	12,640	9,570	12,500
Coyote Creek	100	156	16	9,890	10,820	16,050
McKenzie River	1,310	240	T	255,310	105,630	233,010
Willamette River	2,030	350	T	380,000	276,000	614,900
Coast Fork Willamette (above reservoir)	69	400	T	13,000	7,650	13,640
Coast Fork Willamette (below reservoir)	104	260	T	8,890	9,420	15,110
Row River (above reserv.)	211	330	T	27,150	12,550	8,490
Row River (below reserv.)	265	130	T	-	-	32,780
Mid. Fork Willamette (below reservoir)	994	380	T	93,660	63,210	390,990

1/ Based on 80 lbs. per cubic foot dry soil weight - reflects year's load
2/ Based on part year - October-June

a. The Water Resource Situation - Eugene BLM District

Waters coming from the forest watersheds of the Upper Willamette Subarea for the most part have been excellent except for turbidity during high waters. This may be due to the fact that a large portion of the watershed is still virgin timber, undisturbed by logging and road-building. Now that timber cutting is being accelerated in this area and the road system is being extended into the higher, more unstable mountain areas, water quality can be expected to decrease. Nearly all the old growth timber has been cut in the Long Tom subbasin. The Long Tom River is the one major drainage in the subarea exhibiting problems of high summer temperature and rather constant turbidity.

There are about 1,000 miles of dirt road on BLM lands in the Eugene District. Use of these roads in wet weather by hunters and other recreationists results in rutting and gullying and accelerated streamflow sedimentation. Such roads should either be surfaced to accommodate this type of use or blocked to travel in wet weather. The district is currently blocking many such roads. But this is not the answer to multiple resource management since hunter access is considered an important recreational use of the public lands.

Reference to the U.S.D.A. Bulletin No. 166 "Sprinkler Irrigation in the Pacific Northwest" November 1956 finds that the investment and operation cost of a well and pump for irrigation resulted in a cost of around $1.00 per acre foot for a source of irrigation water pumped from underground. Applying this value to the water coming from BLM lands in the Eugene District as an alternative source of supply, we find an annual water flow in excess of half a million dollars per year. Recreation and other values of water would be in addition to this, far exceeding the value of water for irrigation. Such a valuable resource warrants special management measures for its protection.

Another indication of the value of water is the fact that the Bull Run drainage of the Mt. Hood National Forest provides water to the Portland Metropolitan Area valued at $6,000,000 per year compared to an annual timber harvest of only $2,500,000 per year. This is an indication of what may be expected in increasing water resource values in other areas as the population expands.

The relationship of the Eugene District BLM lands to the water resources of the basin is shown in the following table.

Subbasin	Acre ft. water yield per sq.mi.	Water yield BLM land acre ft.	Acres BLM land on stream	Miles BLM front.on stream	% BLM stream front.
Coast Fork	1,750	230,202	29,100	81.25	26%
Middle Fork	2,060	84,300	9,160	21.75	7.5%
McKenzie	2,860	177,008	23,780	56.0	31%
Long Tom	1,570	48,314	10,000	23.25	21%
Total		539,824	72,040	182.25	

This shows that the BLM lands in the McKenzie and Coast Fork subbasins produce a large quantity of water, and constitute a high percentage of the stream frontage. This indicates that BLM has major watershed management responsibilities in these subbasins.

BLM lands contribute about 6% of the water coming from the Long Tom subbasin. Their management is important due to the substantial percentage of frontage on the streams.

Although there is a considerable amount of BLM lands on Hills Creek, Lost Creek, Anthony Creek, and Guiley Creek in the Middle Fork subbasin, the relatively small percentage of BLM land limits the impact of BLM management programs here. The high gradients of the streams in the Coast Fork and McKenzie subbasins point up the need for careful watershed management on BLM lands in these basins.

Management practices recommended to protect water quality in the upper basin are intensified soil conservation measures in road building and logging and the precluding of livestock use from streams. The Eugene District's review of its watershed rehabilitation needs finds that the greatest problems are needs for road and slump drainage, road stabilization, and road washing and gully control. See Table W-III-A-C. Another problem area in the Eugene District is for sheet erosion control on road bank slopes and in some newly logged areas. Table IV shows part of the financial problem due to inadequate road maintenance funding. This shows that in 1967 FY 255 miles of permanent BLM roads in Eugene District would receive no maintenance due to lack of funding. This is expected to increase to 295 miles permanent roads without maintenance by 1972. Table IV also shows need for an additional $51,000 in 1967 and $85,000 in 1972 to provide for proper maintenance of permanent roads. This then raises the question of maintenance of temporary roads and fire trails which are even more susceptible to erosion if funds are not available even for maintenance of permanent roads. This surely justifies the Eugene District's estimate of need for over $406,000 to take care of existing watershed management problems. It should be pointed out that the needed additional road maintenance work cannot be funded from the limited amount of O&C Grant Land funds. Heavy recreation and hunting use of these roads warrants serious effort to secure the needed additional road maintenance financing from Activity 6000, Recreation and Wildlife Management.

b. The Water Resource Situation - Salem BLM District

(1) Middle Willamette Subarea

Quality of the waters of the middle basin varies with place and time. Drainages from the Coast Range present special problems due to low summer flows. The Mary's River, Luckiamute, Rickreall Creek, and Calapooya River are much alike in quality. Summer temperatures customarily exceed 70°, bacterial concentrations are high, and excessive turbidity is common.

"SPECIFIC PROBLEMS" KEY Chart No. 3

1. Road once used, or part of management system(but now abandoned or will be abandoned soon) - accelerated erosion and/or washing.

2. Existing land slump or slide - raw exposed soils, high erosion hazard. indicate whether man-caused or geologic.

3. Excessive bank wasting.

4. Biological or chemical contamination.

5. Accelerated gully erosion in Harvest units(fire trails, spur roads, etc.)

6. Drawdown slopes on existing reservoirs - exposed to wave action & sheet erosion.

7. Log debris and/or trash in the stream channel(man-caused or geologic?)

8. Trail once used or part of management system - accelerated erosion and/or washing.

9. Accelerated gully erosion in alpine meadows.

10. Sheet erosion on raw slopes above conservation pool level at existing reservoirs.

11. Drainage restrictions and/or of potential slump areas.

12. Stream channels indistinct, widespread meandering.

13. Road backslopes and/or fillslopes eroding - need further stabilization.

14. Channel scour - remaining stream slopes raw.

15. Heavy gullying on system road.

16. Mining activity contamination.

17. Maintenance of log debris along stream channel - trash racks.

18. Dangerous eroding and wasting of stream channels near improvements(lack of revetments, gabions, etc.).

Table W-III
Watershed Rehabilitation Needs on BLM Lands in Willamette Basin

Eugene District

Map Key	Restoration Measure	Miles	Acres	Dollars Cost
#1	Road Rehabilitation	8		$ 6,400
#2	Sheet Erosion Control		895	151,540
#4	Stream Stabilization	10.5		6,000
#5	Gully Control		23.5	11,250
#7	Stream Clearance	14		13,500
#11	Road and Slump Drainage		421	126,300
#13	Road Stabilization		324	52,330
#15	Road Washing and Gully Control	20.5		20,500
#17	Debris Control	27.25		18,700
	District Total Cost			$406,570

Salem District

Map Key	Restoration Measure	Miles	Acres	Dollars Cost
#2	Sheet Erosion Control		85	25,350
#4	Stream Stabiliation	0.63		5,400
#5	Gully Control		3	1,500
#11	Road and Slump Drainage		18	4,200
#13	Road Stabilization		148	40,620
#15	Road Washing and Gully Control	14.70		14,580
#16	Mining Rehabilitation		10	3,000
	District Total Cost			$ 94,650
	Total Basin BLM Cost			$501,220

TABLE III A

DATA CONFIRMATION:

Willamette River Basin Comprehensive Study

Ownership BLM & Priv. Date 4-10-67 Rep's ________

County Lane Subbasin Coast Fk. Tributary ________

Land 1/ Measure Problem	Name (Local) of Project	Type of Project & Location 2/	Existing Water Stor. Development	Priority	Benefits	Amount Unit	Costs Total $
5	Clark Creek	5 - 1	Dorena Reservoir	20	Water quality	0.50 miles	$ 1,500
13	Big River	13 - 1 3 none	Cottage Grove Reservoir	1	Water quality, site protection, protection fisheries.	200 acres	16,500
17	Big River	17 - 1	Cottage Grove Reservoir	16	Flood damage control	7.0 miles	5,600
17	Sharps Creek	17 - 2	Dorena Reservoir	15	Flood damage control	10.0 miles	8,000
17	Mosby Creek	17 - 3	None	18	Flood damage control, site protection, protection improvement	2.0 miles	1,600
1	Mosby Creek (Need maintenance on 8 miles temporary road for recreational use)	1 - 1	None				6,900
16	Sharps Creek	16 - 1	Dorena Reservoir		Site protection, water quality.		
		7 - 0	None		Enhance fisheries		
		8 - 0	None				
5	Sharps Creek	5 - 2	Dorena Reservoir	22	Site protection	0.25 miles	500
17	Rat Creek	17 - 4	Dorena Reservoir	23	Flood damage control, site protection, protection improvement	0.25 miles	300
5	Cerro Gordo	5 - 3	Dorena Reservoir	21	Site protection	1.0 acre	200
2	Cerro Gordo	2 - 1	Dorena Reservoir	5	Water quality	50.0 acres	15,000
11	" "	11 - 1	Dorena Reservoir	14	Protect fisheries	1.0 acres	300

1/ See Land Measure Problem code

2/ Consult map

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TABLE III A

DATA CONFIRMATION:

Willamette River Basin Comprehensive Study

Ownership BLM & Priv. Date 4-10-67 Rep's ________

County Lane Subbasin Coast Fk. Tributary ________

Land 1/ Measure Problem	Name (Local) of Project	Type of Project & Location 2/	Existing Water Stor. Development	Priority	Benefits	Amount Unit	Costs Total $
2	Cobblestone Road	2 - 2	Dorena Reservoir	.10	Site protection, protect fisher.	20.0 acres	6,000
11	Cobblestone Road	11 - 2	Dorena Reservoir	17	Water quality	5.0 acres	1,500
11	Harms Creek	11 - 3	Dorena Reservoir	7	Water quality	40.0 acres	12,000
2	Harms Creek	2 - 3	Dorena Reservoir	8	Site protection, fisheries, Prot. improvement	40.0 acres	12,000
5	Harms Creek	5 - 4	Dorena Reservoir	19	Site protection, fisheries,	1.0 miles	3,000
2	Harms Creek	2 - 4	Dorena Reservoir	6	Site protection, fisheries, water quality	40.0 acres	12,000
11	Smith Creek	11 - 4	Dorena Reservoir	13	Water quality, fisheries, site protection, protect. improvements.	15.0 acres	4,500
2	Dorena South	2 - 5	Dorena Reservoir	2	Water quality, fisheries, protection improvements	75.0 acres	22,500
11	Dorena South	11 - 5	Dorena Reservoir	3	Site protection, fisheries	50.0 acres	15,000
11	London West	11 - 6	Cottage Grove Res	4	Site protec.-fisheries, water quality, improvements	50.0 acres	15,000
2	London West	2 - 6	Cottage Grove Res	11	Site protection, fisheries, water qual, prot. improv.	20.0 acres	6,000
2	Hoodoo Mountain	2 - 7	Cottage Grove Res	12	Site protection, fisheries water quality, improvements	15.0 acres	4,700
11	Jasper Creek	11 - 7	Cottage Grove Res	9	Site protection, fisheries, water quality improvements	40.0 acres	12,000
	TOTAL						$182,600

1/ See Land Measure Problem Code

2/ Consult map

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TABLE III B

DATA CONFIRMATION:

Willamette River Basin Comprehensive Study

Ownership BLM Date 4-12-67 Rep's ____

County Lane Subbasin Middle Fk. Tributary ____

Land 1/ Measure Problem	Name (Local) of Project	Type of Project & Location 2/	Existing Water Stor. Development	Priority	Benefits	Amount Unit	Costs Total $
5	Lost Creek	5 - 1	N/A	11	Site protection, fisheries, prot. improv., water quality	1.0 miles	$ 3,000
15	Lost Creek	5 - 2	N/A	10	Site protection, fisheries, protection improvement	1.0 miles	1,000
15	Hills Creek	5 - 3	N/A	6	Site protection, fisheries, protection improvement	6.0 miles	6,000
15	Winberry Creek	5 - 4	N/A	8	Site protection, fisheries, protection improvement	2.0 miles	2,000
2	Lost Creek	2 - 1	N/A	1	Water quality, site protection, fisheries, prot-improvement	125 acres	37,500
13	Lost Creek	13 - 1	N/A	7	Protection improvement, site protection, water quality	3.0 acres	4,860
13	Hills Creek	13 - 2	N/A	9	Protection improvement, water quality	1.0 miles	1,620
2	Hills Creek	2 - 2	N/A	3	Fisheries, site protection, water quality	50.0 acres	15,000
7	Lost Creek	7 - 1	N/A	12	Fisheries, Flood damage, reduc., site improvement.	1.0 miles	5,000

1/ See Land Measure Problem code   2/ Consult map

TABLE

DATA CONFIRMATION:

Willamette River Basin Comprehensive Study

Ownership BLM Date 4-12-67 Rep's ________

County Lane Subbasin Middle Fk Tributary ________

Land 1/ Measure Problem	Name (Local) of Project	Type of Project & Location 2/	Existing Water Stor. Development	Priority	Benefits	Amount Unit	Costs Total $
11	Lost Creek	11 - 1	N/A	2	Site improvement, site protection and protection improvement	20 acres	$ 6,000
11	Fall Creek	11 - 2	Little Fall Creek	4	Site protection and improvement, protection improvement	10 acres	3,000
11	Hills Creek	11 - 3	N/A	5	Prot.site & improvement	10 acres	3,000
	TOTAL COST						$87,980

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1/ See Land Measure Problem code 2/ Consult map

TABLE III C

DATA CONFIRMATION:

Willamette River Basin Comprehensive Study

Ownership BLM Date 4-10-67 Rep's ________

County Lane Subbasin McKenzie Tributary ________

Land 1/ Measure Problem	Name (Local) of Project	Type of Project & Location 2/	Existing Water Stor. Development	Priority	Benefits	Amount Unit	Costs Total $
5	McGowan Creek	5 - 1	N/A	11	Flood damage control, enhance fisheries.	1.0 miles	$ 3,000
15	McGowan Creek	15 - 1	N/A	9	Site protection	2.0 miles	2,000
15	Shotgun	15 - 2	N/A	8	Protect site & improvements, water quality - fisheries.	2.5 miles	2,500
15	East Mohawk	15 - 3	N/A	7	Protect site & improvements, water quality - fisheries.	3.0 miles	3,000
15	Walterville	15 - 4	N/A	12	Protect site & improvements, water quality - fisheries.	1.0 miles	1,000
15	Vida	15 - 5 2 - 0	N/A	10	Protect site & improvements, water quality - fisheries.	2.0 miles	2,000
7	Shotgun	7 - 1	N/A	6	Flood damage control, enhance fisheries.	3.0 miles	15,000
17	Shotgun	17 - 1	N/A	5	Flood damage control, enhance fisheries.	4.0 miles	3,200

1/ See Land Measure Problem code 2/ Consult map

TABLE III C

DATA CONFIRMATION:

Willamette River Basin Comprehensive Study

Ownership BLM Date 4-10-67 Rep's ______

County Lane Subbasin McKenzie Tributary ______

Land 1/ Measure Problem	Name (Local) of Project	Type of Project & Location 2/	Existing Water Stor. Development	Priority	Benefits	Amount Unit	Costs Total $
11	McGowan Creek	11 - 1	N/A	1	Site & improvement protec. water quality.	60.0 acres	$18,000
11	Shotgun	11 - 2	N/A	2	Protect site & improvements.	60.0 acres	18,000
11	East Mohawk	11 - 3	N/A	3	Protect site & improvements.	30.0 acres	9,000
11	Walterville	11 - 4	N/A	4	Protect site & improvements.	30.0 acres	9,000
Linn County							
3	Horse Rock	3 - 1	N/A	2	Water quality, site prot., fisheries	0.50 miles	5,000
15	Crooked Creek	15 - 6	N/A	4	Protect site & improvements, water quality	1.0 miles	1,000
2	Cougar Ridge	2 - 1	N/A	1	Protect site, water quality, fisheries	10.0 acres	3,000
	TOTAL COST						$94,700

1/ See Land Measure Problem code

2/ Consult map

TABLE III D

Willamette River Basin Comprehensive Study

County Lane Subbasin Long Tom Tributary Long Tom

Ownership BLM Date April 1967

Land 1/ Measure Problem	Name (Local) of Project	Type of Project & Location 2/	Existing water stor. Development	Priority	Benefits	Amount	Unit	Costs Total
13	Siuslaw	13 - 1	Fern Ridge Res.	1	Water quality	5.0	acres	$ 1,000
13	Siuslaw	13 - 2	Fern Ridge Res.	1	Water quality	90	acres	27,500
2	Siuslaw	2 - 1	Fern Ridge Res.	2	Water quality	410	acres	17,240
4	Siuslaw	4 - 1	Fern Ridge Res.	2	Water quality	10	acres	30,000
7	Siuslaw	7 - 1	Fern Ridge Res.	1	Water quality	10	acres	15,000
2	Siuslaw	2 - 2	Fern Ridge Res.	1	Water quality	40	acres	800
	TOTAL COST							$91,540

EUGENE ROAD MAINTENANCE PROGRAM TRENDS
AND DEVELOPMENT OF FUND NEEDS
TABLE IV

TABLE A

ANTICIPATED MAINTENANCE OF PERMANENT BLM ROAD

FY	Total mi. of Perm Rd	BPR MAINT. MILES Heavy Mi.	Mod. Mi.	Prev. Mi.	Total Mi.	Tbr. Sale Oper. Maint. Mi.	Other Maint. Mi.	No Maint. Mi.
1	2	3	4	5	6	7	8	9
67	949	60	187	263	510	148	36	255
68	989	91	200	259	550	150	40	249
69A	1029	96	210	274	580	150	40	259
70	1065	96	210	294	600	140	40	275
71	1085	96	215	309	620	140	40	285
72	1115	96	215	329	640	140	40	295

TABLE B

ESTIMATE OF MAINTENANCE NEEDED

FY	BLM COST PERS. AND OPERATING COST		NEED FOR BPR MAINTENANCE FUNDS AT CURRENT LEVEL OF OPERATION -- IF ALL PLANNED MILEAGE WAS MAINT. (PATCH ROCK RESURFACING EXCLUDED)				NEED FOR STOCK-PILING OF PATCH ROCK AND FOR ROAD RESUR-FACING DONE THRU MAINTENANCE FUNDS
	Man Mos.		Heavy @$1600/mi	Moder. @$700/mi	Prevnt. @$190/mi	Total	
		($1000)	($1000)	($1000)	($1000)	($1000)	($1000)
67	17	17	96	131	50	277	47
68	21	17	169*	140	50	396	70
68A	21	17	151	146	52	349	47
70	26	22	151	146	56	353	46
71	27	23	151	150	59	360	46
72	30	26	151	150	62	363	46

*Oxbow fire hauling minimum of 10 mi Oxbow Access Road x $2400 mi extra = $24,000

EUGENE ROAD MAINTENANCE PROGRAM TRENDS
AND DEVELOPMENT OF FUND NEEDS
TABLE IV

TABLE C

ANTICIPATED CONTRIBUTED MAINTENANCE AND NEEDED APPROPRIATIONS ($1000's)

FY	BLM Approp Col3,Tab.II Dist. Oper.	BPR MAINTENANCE (1000's)			PATCH ROCK AND RESURFACING BY BLM/BPR MAINT.			TOTAL FUNDS NEEDED		
		Needed Appro.	Antici. Contri. **	Total Col7, Tab.II	Needed Appro.	Antici. Contri. *	Total Col 8, Tab. II	Approp	Contri	Total
67	17	176	101	277	13	34	47	206	135	341
68	17	219	150	369	20	50	70	256	200#	456
69A	17	248	101	349	13	34	47	278	135	413
70	22	255	98	353	14	32	46	291	130	421
71	23	262	98	360	14	32	46	299	130	429
72	26	265	98	363	14	32	46	305	130	435

*25% of contributed maint. (3.5 ÷ 13.5) **75% of contrib. maint. (10 ÷ 13.5)
#Estimate for increased collections in Oxbow fire area included .

TABLE D

COMPARISON OF NEED AND CURRENT FUNDS ADVICE ($1000)

FY	AVAILABLE FUND ADVICE: BLM SALARY OPER.	AVAILABLE FUND ADVICE: PROJECT WORK (BPR MAINT)	TOTAL APPRO ADVICE	ANTICI CONTRI Col 10 Tab III	TOTAL AVAIL-ABLE	FUNDS NEEDED Col 11 Tab III	ADDI-TIONAL FUNDING NEEDED
1	2	3	4	5	6	7	8
67	17	138	155	135	290	341	51
68	17	200	217	200	417	456	39
69A	17	220	237	135	372	413	41
70	-	220	220	130	350	421	71
71	-	220	220	130	350	429	79
72	-	220	220	130	350	435	85 / 24%

Table V

Anticipated Watershed Protection Needs in Eugene District
Road Maintenance Funding *
Funding Needed to Protect Water Quality

.Y.	Total Miles Perm. Roads	Total Miles Temp. Roads	Total Miles BLM Roads	Approp. Maint. Funding $1000	Timber Sale Maint. Funding $1000	Total Maint. Funding $1000	Estimated Maint. Cost per Mile $1000	Maint. Funds Needed $1000	Maint. Funding Needed $1000
67	949	1000	1949	155	135	290	360	521****	231
68	989	1000 0/	1989	217	200	417	461	656	239
69	1029	1000	2029	237	135	372	401	613	241
70	1065	1000	2065	220	130	350	395	621	271
71	1085	1000	2085	220	130	350	395	629	279
72	1115	1000	2115	220	130	350	390	635	285
73	1145	1000	2145	220**	130**	350	400***	658	291
74	1175	1000	2175	220	130	350	400	670	297
75	1205	1000	2205	220	130	350	400	682	303
76	1235	1000	2235	220	130	350	400	694	309
77	1265	1000	2265	220	130	350	400	706	315
78	1295	1000	2295	220	130	350	400	718	321
79	1325	1000	2325	220	130	350	400	730	327
80	1355	1000	2355	220	130	350	400	742	333

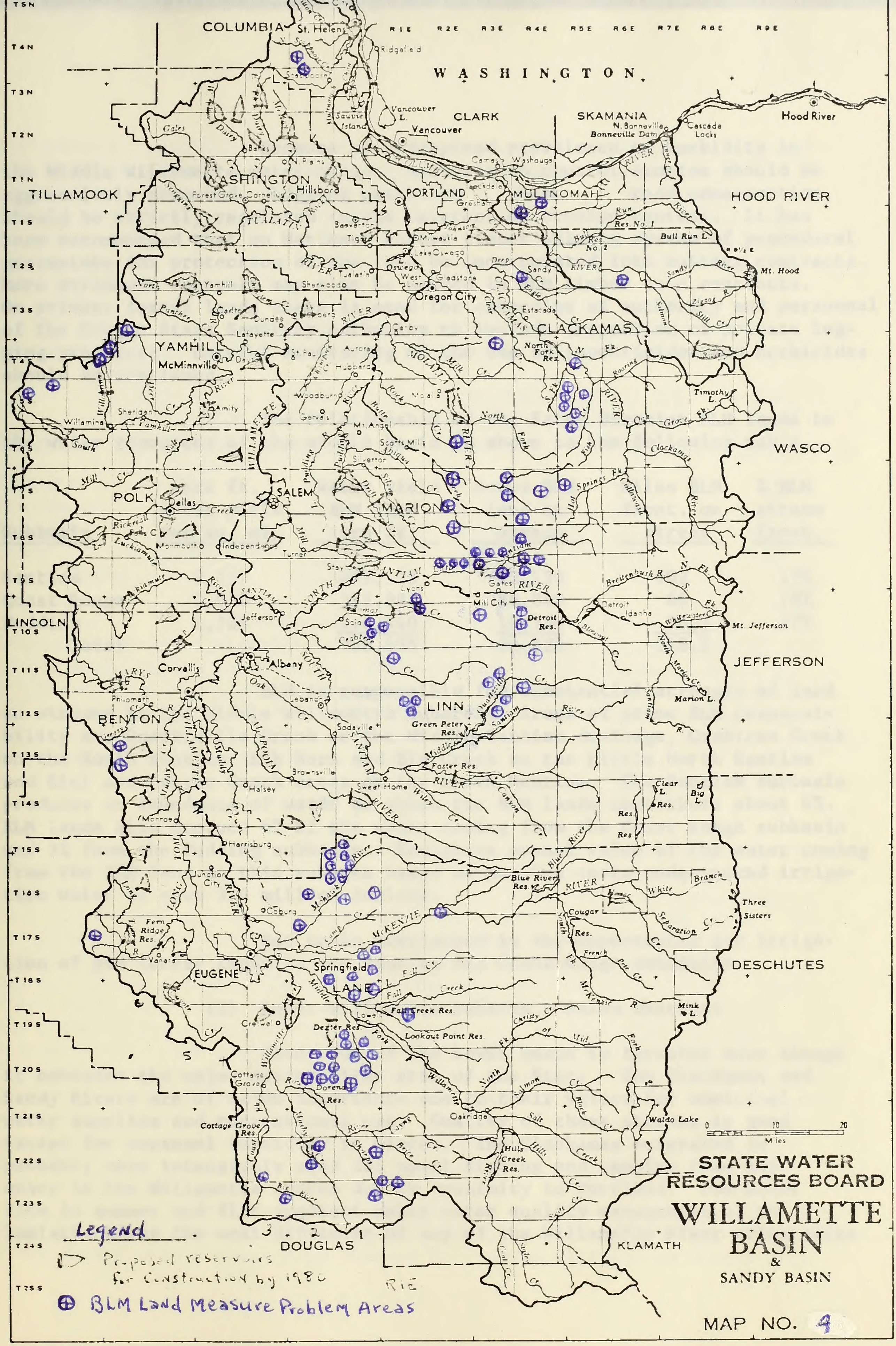
* Basic data from Table IV prepared by Eugene District Engineer.

0/ Mileage should remain fairly constant, some roads being blocked and replanted as new ones are built.

** Projected on same level as previous 3 years.

*** Table IV shows average maintenance cost permanent roads from 1967-1972 as $400 per mile.

**** Maintenance temporary roads set at $200 per mile to cover cost of grading, ditch and culvert cleaning, and waterbar maintenance.



STATE WATER RESOURCES BOARD
WILLAMETTE BASIN
&
SANDY BASIN
MAP NO. 4
Legend
Proposed reservoirs for construction by 1980
BLM Land Measure Problem Areas
WASHINGTON
COLUMBIA
CLARK
SKAMANIA
HOOD RIVER
TILLAMOOK
WASHINGTON
MULTNOMAH
CLACKAMAS
YAMHILL
POLK
MARION
WASCO
LINCOLN
JEFFERSON
BENTON
LINN
LANE
DESCHUTES
DOUGLAS
KLAMATH
PORTLAND
SALEM
EUGENE
Corvallis
Albany
Oregon City
Vancouver
Mt. Hood
Mt. Jefferson
Three Sisters
Miles

R-I

Because of widespread prevalence of turbidity in the Middle Willamette watercourses, measures to control erosion should be aggressively promoted. Logging practices and road construction, should be strictly regulated in the interest of erosion control. It has been recommended that on National Forest timber sales a system of procedural guarantees for protection of the land be incorporated into cutting contracts. More stringent controls may also be needed in BLM timber sale contracts. On private forest lands there is need for extension of authority and personnel of the Oregon State Sanitary Authority to include inspection of private logging practices. Careful monitoring of the use of insecticides and herbicides should be continued.

The relationship of the Salem District BLM lands to the water resources of the middle basin is shown in the following table.

Subbasin	Acre ft. water yield per sq. mi.	Water yield BLM land acre ft.	Acres BLM land on stream	Miles BLM front. on stream	% BLM stream front.
Santiam	2,757	442,133	43,120	102	17%
Coast Range	2,030	215,982	28,840	66	14%
Pudding	1,789	110,440	18,560	50.5	17%
Total		768,555	90,520	218.5	

BLM is responsible for substantial acreages of land on streams in the Middle Willamette Subarea. Areas of prime BLM responsibility are Quartzville Creek on the Middle Santiam drainage, Crabtree Creek on the South Santiam, Elk Horn and Big Creek on the Little North Santiam and Kiel and Canyon Creek areas on the North Santiam. The Santiam subbasin produces an abundance of water to which the BLM lands contribute about 6%. BLM lands also produce 6% of the water coming from the Coast Range subbasin and 5% from the Pudding subbasin. Tentative annual value of the water coming from the BLM land in this subarea based on pumping costs underground irrigation water is over 3/4 million dollars.

Not to be overlooked is the opportunity for irrigation of BLM forest lands in the Santiam and Coast Range subbasins.

(2) Lower Willamette Subarea - Salem District

About 70% of the lower basin is forested even though it embraces the major metropolitan area of the State. The Clackamas and Sandy Rivers are of major importance due to their values for municipal water supplies and recreational use. Quality of these streams is good except for seasonal turbidity in winter. The Clackamas watershed is probably more intensively used for sport fishing and camping than any other in the Willamette system due to proximity to Portland. Low water flow in summer and flat gradient makes water quality management of the Tualatin River the most difficult of any of the Willamette River tributaries.

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Proximity to population centers warrants measures for improvement of the existing low water quality. Effective land management practices are particularly important in the Tualatin Basin, and measures to control erosion should be aggressively promoted throughout the lower Willamette to reduce turbidity. In the headwaters of all tributaries, logging practices, particularly road construction, must be strictly regulated in the interest of erosion control.

The BLM Salem District has important watershed management responsibilities in this subarea, as shown in the table below.

Subbasin	Acre ft. water yield per sq. mi.	Water yield BLM land acre ft.	Acres BLM land on stream	Miles BLM front. on stream	% BLM stream front.
Tualatin	1,500	25,646	3,600	14	8%
Clackamas	2,370	59,200	4,200	15	8%
Columbia	1,320	12,236	2,680	9.25	18%
Sandy	3,770	57,436	5,440	11.5	8%
Total	.	154,518	15,920	49.75	

Watershed management to reduce flood damage and maintain high quality water is of critical importance in this subarea due to the high population densities found here. At the indicated value of $1.00 per acre foot, water coming from the BLM lands in the Lower Subarea has a resource value of over $150,000 per year. This added to the value of water coming from BLM lands in the Middle Subarea equals nearly $1,000,000, based on the least valuable use of water.

c. Flood Control as Related to BLM Programs

Flooded river courses are almost an annual event in the Willamette Basin due to prolonged, heavy rainfall in December, January or February. Major damaging floods as occurred in December 1964 and January 1965 are unusual and may be anticipated only once in 50 to 100 years. Yet tremendous damage caused by such a flood cannot be completely ignored. Damages to BLM lands alone in Oregon amounted to nearly $15,000,000. The repair bill on National Forest lands was estimated at $12,000,000. Total flood damage has been estimated at nearly $71,000,000. Land management and construction programs cannot be geared to a 50-year risk probability. Neither should such flood risks be completely ignored where more adequate facilities can be provided at but little extra cost. This is because local record breaking storms occur at much more frequent intervals. Major floods occur about every four or five years. Smaller floods in the major rivers are almost an annual occurrence. Many small streams flood several times a year.

Research shows that logging and other vegetative manipulation programs in the main forest zone have little effect on flood flow peaks. Flood damage can be materially reduced by removal of logs and debris from

watercourses during timber harvest. Besides blockading of stream channels and deposition on lowland areas, this material causes boating hazards on reservoirs and rivers. The Salem District faces a formidable job in keeping clean 268 miles of permanent stream plus many more miles of intermittent watercourses. This is also a big job in the Eugene District with 182 miles of stream frontage. See Table W-V.

The Salem District finds that the cost of stream channel clearance to remove log jams averages $3,000 per mile of stream. Averages are not too applicable to this type of work due to the great variance in size of such blockages. It has cost the State Game Department as much as $7,000 to clear a small area. One job required 170 hours work with a 98-link belt crane with grapples. The removal of debris from watercourses during timber harvest is money well spent in view of the saving in subsequent stream channel clearance or flood damages.

Another costly item is the need for debris sweeping of reservoirs to clear vegetative material swept downstream. Following the flood of 1964 it cost the U. S. Forest Service the following amounts for reservoir sweeping: Hills Creek - $53,000, Cougar - $39,000, and Detroit - $112,500. In ordinary years the cost is much less. The 1966 costs were: Hills Creek - $5,000, Cougar - $11,000, and Detroit - $15,000. BLM may be faced with such expenses should it take responsibility for resource management on proposed new large reservoirs. Again this problem would be reduced by gross yarding of all material away from drainages during logging.

Conclusions and recommendations of a U. S. Forest Service storm damage evaluation committee relative to the 1964-65 floods [6] are pertinent to BLM operations. These are summarized as follows:

(1) Land managers and construction people should be alert to the potential damages from storms of 50-100 years intensity.

(2) Localized severe storms occur in mountainous areas with much greater frequency.

(3) Mass soil failures occur throughout the region during extreme flood producing storms.

(4) We must learn to recognize unstable landscapes, especially specific problem areas and learn what to do to increase stability. Mantle stability and soil surveys with adequate interpretations and training in use are needed.

(5) Due to the delicate balance of forces on steep mountainous lands we must avoid disturbance that upsets this balance.

6/ "A Report of the Region VI Storm Damage Evaluation Committee" U.S.F.S. Dec. 1966.

(6) The value of vegetative cover, especially on pumice and granitic soils, must be recognized and replaced by planting if vegetation is delayed following logging.

(7) Immediate efforts to restore vegetation to slump or slide areas should be considered.

(8) One of the single greatest contributors to aggravated storm damage is debris.

(9) We must recognize the potential damage from the power of water to move bed-load and debris. Design of waterways must be modified to handle movement of bed-load and debris.

(10) Hardwoods may be more valuable than softwoods for streamside protection.

(11) A coordinated program of debris abatement is needed. Table W-V shows estimated stream clearing costs on BLM lands in the basin.

d. Reservoir Protection

The Salem District manages substantial acreages public lands draining into the Portland General Electric dams on the Clackamas River and the Corps of Engineers Green Peter and Foster Reservoirs on the Santiam. The Eugene District has BLM lands above Fern Ridge, Dorena, and Cottage Grove reservoirs. According to Corps studies average annual siltation at Green Peter and Foster is 193 acre feet per year reducing the value of the project $32,230 per year. Siltation of Cottage Grove reservoir is found to be 26 acre feet per year with an annual project loss of around $5,000. Siltation at Dorena is 66 acre feet diminishing the project by $17,100 per year. Fern Ridge averages 92 acre feet siltation per year with $11,500 impact.

Average annual storage depletions from siltation in Cottage Grove and Fern Ridge reservoirs were 0.24 and 0.33 acre foot per square mile of tributary drainage area, respectively. A storage depletion rate of 0.25 acre foot per square mile was considered applicable to most other major drainages. Siltation cost over the 100 year life of the thirteen Corps impoundments in the basin amounts to $183,735,000. This shows that extra care and expense is warranted in soil stabilization measures on lands lying above such projects.

e. Watershed Management Needs

Road stabilization, road washing and gully control, and sheet erosion control on road banks and newly logged areas were the major watershed management problems identified in the Salem District. See Table W-III and W-III E-J. Lack of adequate funding for road and fire trail maintenance is a problem here as in the Eugene District. The Coast Range and Santiam subbasins are the major problem areas. Road stabilization is the

TABLE III C

Willamette River Basin Comprehensive Study

County Lane Subbasin McKenzie

Ownership BLM Date 4-10-67

Land 1/ Measure Problem	Name (Local) of Project	Type of Project & Location 2/	Existing water stor. Development	Priority	Benefits	Amount Unit	Costs Total
5	McGowan Creek	5 - 1	N/A	11	Flood damage control, enhance fisheries.	1.0 mile	$ 3,000
15	McGowan Creek	15 - 1	N/A	9	Site protection	2.0 miles	2,000
15	Shotgun	15 - 1	N/A	8	Protect site & improve., water quality - fisheries	2.5 miles	2,500
15	East Mohawk	15 - 3	N/A	7	Protect site & improve., water quality - fisheries	3.0 miles	3,000
15	Walterville	15 - 4	N/A	12	Protect site & improve., water quality - fisheries	1.0 mile	1,000
15	Vida	15 - 5 2 - 9	N/A None	10	Protect site & improve., water quality - fisheries	2.0 miles	2,000
7	Shotgun	7 - 1	N/A	6	Flood damage control, enhance fisheries.	3.0 miles	15,000
17	Shotgun	17 - 1	N/A	5	Flood damage control, enhance fisheries.	4.0 miles	3,200
11	McGowan Creek	11 - 1	N/A	1	Site & improvement protection., water quality	60.0 acres	18,000

1/ See Land Measure Problem code

2/ Consult map

TABLE III C

Willamette River Basin Comprehensive Study

County Lane   Subbasin McKenzie

Ownership BLM   Date 4-10-67

Land 1/ Measure Problem	Name (Local) of Project	Type of Project & Location 2/	Existing water stor. Development	Priority	Benefits	Amount Unit	Costs Total
11	Shotgun	11 - 1	N/A	2	Site protection & improve.	60.0 acres	$18,000
11	East Mohawk	11 - 3	N/A	3	Protection site & improve.	30.0 acres	9,000
11	Walterville	11 - 4	N/A	4	Protection site & improve.	30.0 acres	9,000
Linn County							
3	Horse Rock	3 - 1	N/A	2	Water quality, site protec., fisheries	0.50 miles	5,000
15	Crooked Creek	15 - 6	N/A	4	Prot. site & improve., water quality	1.0 miles	1,000
2	Cougar Ridge	2 - 1	N/A	1	Prot. site, water quality, fisheries	10.0 acres	3,000
	TOTAL COST						$94,700

1/ See Land Measure Problem code

2/ Consult map

TABLE III D

DATA CONFIRMATION:

illamette River Basin Comprehensive Study

Ownership BLM Date April 1967 Rep's ________

ounty Lane Subbasin Long Tom Tributary Long Tom

and 1/ easure roblem	Name (Local) of Project	Type of Project & Location 2/	Existing Water Stor. Development	Priority	Benefits	Amount Unit	Costs Total $
13	Siuslaw	13 - 1	Fern Ridge Res.	1	Water quality	5.0 Acres	$ 1,000
13	Siuslaw	13 - 2	Fern Ridge Res.	1	Water quality	90.0 Acres	27,500
2	Siuslaw	2 - 1	Fern Ridge Res.	2	Water quality	410.0 Acres	17,240
4	Siuslaw	4 - 1	Fern Ridge Res.	2	Water quality	10.0 Acres	30,000
7	Siuslaw	7 - 1	Fern Ridge Res.	1	Water quality	10.0 Acres	15,000
2	Siuslaw	2 - 2	Fern Ridge Res.	1	Water quality	40.0 Acres	800
	TOTAL COST						$91,540

1/ See Land Measure Problem code

2/ Consult map

TABLE III E
Willamette River Basin Comprehensive Study
County Linn, Marion   Subbasin Santiam
Tributary Santiam

DATA CONFIRMATION:

Ownership BLM   Date 5-3-67

Land 1/ Meas. Prob.	Name (Local) of Project	Type of Project & Location 2/	Existing water stor. Development	Priority	Benefits	Amount Unit	Costs Total $	Remarks
15	Little N.Fk. Rehab.	0-15-1	None	1	Water quality	$1\frac{1}{4}$ mile	$1,250	T.8 S., R. 3 E., Secs. 29,33,35
15	Little N.Fk. Rehab.	0-15-2	None	1	Water quality	1/16 mile	250	T.8 S., R.4 E., Sec. 19
15	Little N.Fk. Rehab.	0-15-3	None	1	Water quality	1 mile	1,000	T.9S., R.2 E., Secs. 1 & 1
2	Little N.Fk. Rehab.	0-2-1	None	1	Water quality	2 acres	600	T.9S., R.2 E., Sec. 1
4	Little N.Fk. Rehab.	0-4-1	None	1	Water quality	$\frac{1}{4}$ mile	2,500	T.9 S., R.2 E., Sec. 11
15	Little N.Fk. Rehab.	0-15-4	None	1	Water quality	3 miles	3,000	T.9 S., R.3 E., Secs. 7-13
15	Little N.Fk. Rehab.	0-15-5	None	1	Water quality	$\frac{1}{2}$ mile	500	T.9 S., R.4 E., Sec. 7
5	Little N.Fk. Rehab.	0-5-1	None	1	Water quality	2 acres	500	T.9 S., R.4 E., Secs. 6 &
2	Little N.Fk. Rehab.	0-2-2	None	1	Water quality	2 acres	600	T.9 S., R. 4 E.,Secs. 6 &
2	Thomas Cr. Rehab.	0-2-3	None	1	Water quality	1 acre	300	T.10 S., R. 1 E., Sec. 1

1/ See Land Measure Problem Code
2/ Consult map

TABLE III E
Willamette River Basin Comprehensive Study
County Linn, Marion Subbasin Santiam
Tributary Santiam

DATA CONFIRMATION:
Ownership BLM Date 5-3-67

Land 1/ Meas. Prob.	Name (Local) of Project	Type of Project & Location 2/	Existing water stor. Development	Priority	Benefits	Amount Unit	Costs Total $	Remarks
5	Thomas Cr. Rehab.	0-5-2	None	1	Water quality	1 acre	500	T.10 S.,R. 1 E.,sec. 1
2	Crabtree Rehab.	0-2-4	None	2	Water quality	2 acres	600	T.10 S.,R.1 W., sec.25
15	Crabtree Rehab.	0-15-6	None	2	Water quality	1/2 mile	500	T.10 S.,R.1 W.,sec. 25
15	Thomas Cr. Rehab.	0-15-7	None	1	Water quality	1/16 mile	250	T.10 S.,R.1 E.,sec. 29
2	Santiam Rehab.	0-2-5	None	1	Water quality	1 acre	300	T.10 S.,R.3 E.,sec. 7
15	Santiam Rehab.	0-15-8	None	1	Water quality	1/4 mile	400	T.10 S.,R.4 E.,sec. 17
2	Santiam Rehab.	0-2-6	None	1	Water quality	1 acre	300	T.10 S.,R.4 E.,sec. 17
15	Crabtree Rehab.	0-15-9	None	1	Water quality	1/2 acre	500	T.11 S.,R.1 E.,sec. 15
2	Quartzville Rehab.	0-2-7	Green Peter Res.	1	Water quality	14 acres	4200	T.11 S.,R.3 E.,secs.26

1/ See Land Measure Problem Code
2/ Consult map

TABLE III E

Willamette River Basin Comprehensive Study

County Linn, Marion Subbasin Santiam

Tributary Santiam

DATA CONFIRMATION:

Ownership BLM Date 5-3-67

Land 1/ Meas. Prob.	Name (Local) of Project	Type of Project & Location 2/	Existing water stor. Development	Priority	Benefits	Amount Unit	Costs Total $	Remarks
16	Quartzville Rehab.	0-16-1	Green Peter Res.	2	Water quality	10 acres	3000	T.11 S.,R.3E.,sec.35
13	Quartzville Rehab.	0-13-1	Green Peter Res.	2	Water quality	5 acres	1600	T.11 S.,R.4E.,secs.9, 10, 15
2	Quartzville Rehab.	0-2-8	Green Peter Res.	1	Water quality	3 acres	900	T.11 S.,R.4E., secs.31, 32
15	So. Santiam Rehab.	0-15-10	None	1	Water quality	2-1/2 miles	2500	T.12 S.,R.1E.,secs.3, 10,25
2	So. Santiam Rehab.	0-2-9	None	1	Water quality	5-10 acres	3000	T.12 S.,R.1E.,sec. 11
13	So. Santiam Rehab.	0-13-2	None	1	Water quality	2 acres	500	T.12 S.,R.1E.,sec. 23
15	Quartzville Rehab.	0-15-11	Green Peter Res.	1	Water quality	1/2 mile	500	T.12 S.,R.3E.,sec. 15
4	Quartzville Rehab.	0-4-1	Green Peter Res.	1	Water quality	1/8 mile	1250	T.12 S.,R.1E.,sec. 3
						Total	31,100	

1/ See Land Measure Problem Code

2/ Consult map

TABLE III F

DATA CONFIRMATION:

illamette River Basin Comprehensive Study

Ownership BLM Date 5-3-67

ounty Polk & Yamhill Subbasin Coast Rng. Tributary Yamhill River

and 1/ easure roblem	Name (Local) of Project	Type of Project & Location 2/	Existing Water Stor. Development	Prior-ity	Benefits	Amount Unit	Costs $ Total	Remarks
13	Willamina Cr. Rehab.	13 - 1	None	1	Water quality	7 miles	$11,200	T. 4 S., R. 7 W., Secs. 1, 11, 12, 13, 14, 23, 24
13	Willamina Cr. Rehab.	13 - 2	None	1	Water quality	5 miles	8,000	T. 3 S., R. 6 W., Secs. 28, 29, 30, 31, 32
13	Willamina Cr. Rehab.	13 - 3	None	1	Water quality	3 miles	4,800	T. 4 S., R. 6 W., Secs. 5, 6, 7
13	Gleason Cr. Rehab.	13 - 4	None	1	Water quality	1 mile	1,600	T. 13 S., R. 6 W., Sec. 1
13	Agency Cr. Rehab.	13 - 5	None	1	Water quality	1 mile	1,600	T. 5 S., R. 8 W., Sec. 17
13	Yoncalla Cr. Rehab.	13 - 6	None	1	Water quality	3 miles	4,800	T. 5 S., R. 8 W., Secs. 3, 10, 15
13	Beaver Cr. Rehab.	13 - 7	None	1	Water quality	2 miles	3,200	T. 13 S., R. 6 W., Secs. 19-21
					TOTAL		$35,200	

/ See Land Measure Problem code 2/ Consult map

TABLE III G

DATA CONFIRMATION:

…lamette River Basin Comprehensive Study

Ownership BLM Date 5-3-67

…nty Clackamas Subbasin Pudding Tributary Pudding River

…d 1/ …sure …blem	Name (Local) of Project	Type of Project & Location 2/	Existing Water Stor. Development	Prior-ity	Benefits	Amount Unit	Costs $ Total	Remarks
…5	Cedar Cr. Rehab.	0 - 15 - 1	None	1	Water quality	3/4 mile	$ 750	T.4 S., R. 3 E., Secs. 9-10
…3	Butte Cr. Rehab.	0 - 13 - 1	None	1	Water quality	2 acres	500	T.6 S., R.2 E., Sec. 25
2	N. Fk. Molalla	0 - 2 - 1	None	1	Water quality	5 acres	1,500	T.6 S., R.4 E., Sec. 12
…5	Butte Cr. Rehab.	0 - 15 - 2	None	1	Water quality	1/2 mile	500	T.7 S., R.2 E., Sec. 3
2	Molalla R. Rehab.	0 - 2 - 2	None	1	Water quality	14 acres	4,200	T.7 S., R.3 E., Secs. 13 14 and 24
2	Molalla R. Rehab.	0 - 2 - 3	None	1	Water quality	10 acres	3,000	T.7 S., R.4 E., Sec. 21
2	Molalla R. Rehab.	0 - 2 - 4	None	1	Water quality	5 acres	1,500	T.7 S., R.5 E., Sec. 7
…5	Abiqua Cr. Rehab.	0 - 15 - 3	None	1	Water quality	1/2 mile	500	T.8 S., R.2 E., Sec. 15
…5	Butte Cr. Rehab.	0 - 15 - 4	None	1	Water quality	1/2 mile	500	T.8 S., R.4 E., Sec. 7
…5	Abiqua Cr. Rehab.	0 - 15 - 5	None	2	Water quality	1/2 mile	500	T.7 S., R.2 E., Sec. 33
					TOTAL		$13,450	

…/ See Land Measure Problem code 2/ Consult map

TABLE III H

DATA CONFIRMATION:

Willamette River Basin Comprehensive Study
County Clackamas Subbasin Clackamas #9 Ownership BLM Date 5-3-67
Tributary Clackamas

Land 1/ Meas. Prob.	Name (Local) of Project	Type of Project & Location 2/	Existing water stor. Development	Priority	Benefits	Amount Unit	Costs Total $	Remarks
11	Eagle Cr. Rehab.	0-11-1	None	1	Water quality	10 acres	$3,000	T.3 S., R. 4 E., W.M. Sec. 11
2	Cazadero Rehab.	0-2-1	P.G.E. Dam	1	Water quality	3 acres	900	T.4 S., R. 5 E., W.M. Secs. 29-32
2	Clackamas Rehab.	0-2-2	P.G.E. Dam	1	Water quality	10 acres	3,000	T.5 S., R. 4 E., W.M. Sec. 12
15	Clackamas Rehab.	0-15-1	P.G.E. Dam	1	Water quality	½ mile	500	T.5 S., R. 4 E., W.M. Sec. 12
13	Clackamas Road	0-13-1	P.G.E. Dam	1	Water quality	5 acres	1,400	T.5 S., R. 4 E., W.M. Sec. 24
15	Clackamas Rehab.	0-15-2	P.G.E. Dam	1	Water quality	1 mile	1,000	T.5 S., R. 4 E., W.M. Sec. 24
2	Clackamas Rehab.	0-2-3	P.G.E. Dam	1	Water quality	2 acres	600	T.5 S., R. 4 E., W.M. Sec. 26
		TOTAL					$10,400	

1/ See Land Measure Problem code

2/ Consult map

TABLE III H

DATA CONFIRMATION:

Willamette River Basin Comprehensive Study
County Clackamas Subbasin Clackamas #9
Tributary Clackamas

Ownership BLM Date 5-3-67

Land Meas. Prob. 1/	Name (Local) of Project	Location 2/	Type of Project & Development	Existing water stor.	Priority	Benefits	Amount Unit	Costs Total $	Remarks
11	Eagle Cr. Rehab.	0-11-1	None		1	Water quality	10 acres	$3,000	T.3 S., R. 4 E., W.M. Sec. 11
2	Cazadero Rehab.	0-2-1	P.G.E. Dam		1	Water quality	3 acres	900	T.4 S., R. 5 E., W.M. Secs. 29-32
2	Clackamas Rehab.	0-2-2	P.G.E. Dam		1	Water quality	10 acres	3,000	T.5 S., R. 4 E., W.M. Sec. 12
15	Clackamas Rehab.	0-15-1	P.G.E. Dam		1	Water quality	½ mile	560	T.5 S., R. 4 E., W.M. Sec. 12
13	Clackamas Road	0-13-1	P.G.E. Dam		1	Water quality	5 acres	1,400	T.5 S., R. 4 E., W.M. Sec. 24
15	Clackamas Rehab.	0-15-2	P.G.E. Dam		1	Water quality	1 mile	1,000	T.5 S., R. 4 E., W.M. Sec. 24
2	Clackamas Rehab.	0-2-3	P.G.E. Dam		1	Water quality	2 acres	600	T.5 S., R. 4 E., W.M. Sec. 26
			TOTAL					$10,400	

1/ See Land Measure Problem code

TABLE III I

Willamette River Basin Comprehensive Study

County Columbia Subbasin Columbia Tributary Scappoose Cr., Willamette River

Ownership BLM Date 9-9-9-66

Land 1/ Measure Problem	Name (Local) of Project	Type of Project & Location 2/	Existing water stor. Development	Priority	Benefits	Amount Unit	Costs Total
13	Columbia T.M.A.	13 - 1	None	1	Water quality, fishery protection, site prot., recreation environment, natural beauty	2 acres	$1,200
11	Columbia T.M.A.	11 - 1	None	1	Water quality, esthetics, fisheries, recreation	8 acres	2,400
	SUBBASIN TOTAL						$3,600

1/ See Land Measure Problem code
2/ Consult map

TABLE III J

DATA CONFIRMATION:

Willamette River Basin Comprehensive Study

ounty Multnomah & Clackamas Subbasin Sandy

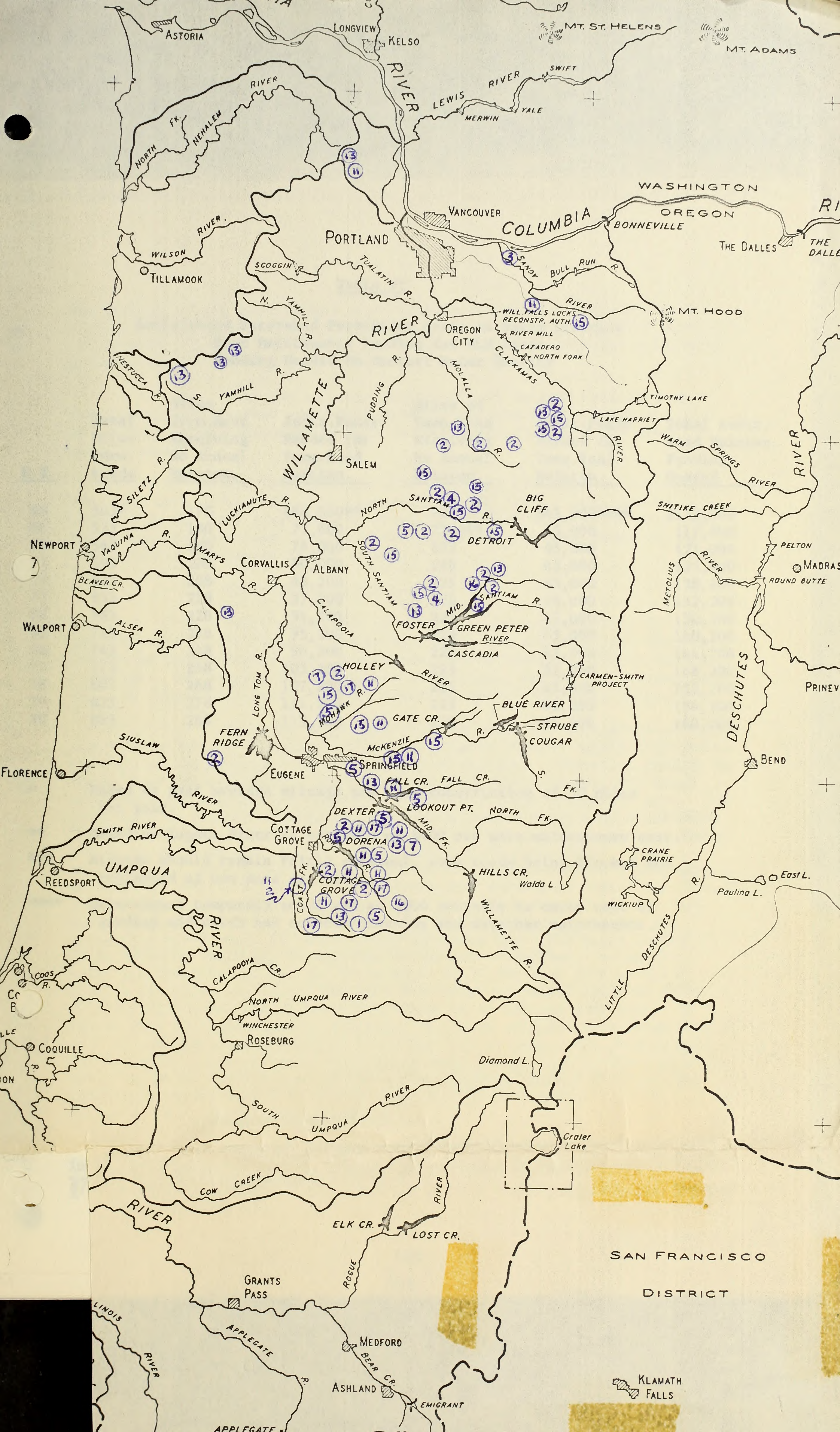
Tributary Sandy

Ownership BLM Date 5-3-67

Land 1/ Meas. Prob.	Name (Local) of Project	Type of Project & Location 2/	Existing water stor. Development	Prior-ity	Benefits	Amount Unit	Costs Total $	Remarks
3	Sandy R. Rehab.	0-3-1	None	1	Fish passage	1/8 mile	$1,250	T.1 S., R.4 E., Sec. 11
3	Sandy R. Stabil.	3-2	None	2	Fish passage	1/8 mile	1,250	T.1 S., R.4 E., Sec. 15
15	Brightwood Gully Control	0-15-1	None	1	Water quality	1/2 mile	500	T.2 S., R.6 E., Sec. 33
			TOTAL				$3,000	

1/ See Land Measure Problem code

2/ Consult map



ASTORIA
LONGVIEW
KELSO
MT. ST. HELENS
MT. ADAMS
RIVER
LEWIS
RIVER
SWIFT
YALE
MERWIN
NORTH FK. NEHALEM
RIVER
WASHINGTON
OREGON
VANCOUVER
COLUMBIA
BONNEVILLE
THE DALLES
PORTLAND
RIVER
WILSON
TILLAMOOK
SCOGGIN
TUALATIN R.
SANDY
BULL RUN R.
RIVER
WILL. FALLS LOCKS RECONSTR. AUTH.
RIVER MILL
CAZADERO
NORTH FORK
MT. HOOD
N. YAMHILL R.
RIVER
OREGON CITY
CLACKAMAS
MOLALLA
NESTUCCA R.
S. YAMHILL R.
WILLAMETTE
PUDDING
R.
TIMOTHY LAKE
LAKE HARRIET
RIVER
WARM SPRINGS RIVER
RIVER
SALEM
SILETZ R.
NORTH SANTIAM R.
BIG CLIFF
DETROIT
LUCKIAMUTE R.
SHITIKE CREEK
NEWPORT
YAQUINA R.
MARYS R.
CORVALLIS
ALBANY
SOUTH SANTIAM
PELTON
RIVER
MADRAS
ROUND BUTTE
METOLIUS
BEAVER CR.
MID. SANTIAM R.
WALPORT
ALSEA R.
CALAPOOIA
FOSTER
GREEN PETER
RIVER
CASCADIA
LONG TOM R.
HOLLEY
RIVER
MOHAWK R.
CARMEN-SMITH PROJECT
DESCHUTES
PRINEV
BLUE RIVER
GATE CR.
STRUBE
COUGAR
FERN RIDGE
SIUSLAW
MCKENZIE R.
S. FK.
FLORENCE
EUGENE
SPRINGFIELD
FALL CR.
FALL CR.
BEND
RIVER
LOOKOUT PT.
NORTH FK.
MID. FK.
COTTAGE GROVE
DEXTER
DORENA
SMITH RIVER
UMPQUA
ROW R.
CRANE PRAIRIE
REEDSPORT
COAST FK.
COTTAGE GROVE
HILLS CR.
Walda L.
East L.
Paulina L.
WICKIUP
R.
RIVER
WILLAMETTE R.
DESCHUTES
LITTLE
COOS R.
CALAPOOYA CR.
NORTH UMPQUA RIVER
WINCHESTER
ROSEBURG
COQUILLE
R.
Diamond L.
SOUTH UMPQUA RIVER
Crater Lake
COW CREEK
RIVER
RIVER
ELK CR.
LOST CR.
SAN FRANCISCO DISTRICT
ROGUE
GRANTS PASS
ILLINOIS
RIVER
APPLEGATE R.
MEDFORD
BEAR CR.
KLAMATH FALLS
ASHLAND
EMIGRANT
APPLEGATE

Table VI

Anticipated Watershed Protection Needs in Salem District
Road Maintenance Funding for BLM Roads
Funding Needed to Protect Water Quality

F.Y.	Total Miles Perm. Roads	Miles Perm.Road Receiving No Annual Mainten.	Addit.Funds Needed for Perm.Road Mainten.	Miles of Temp.Road Receiving No Annual Mainten.	Addit.Funds Needed for Temp.Road Mainten.	Total Addit. Road Mainten. Funding Needed
68	503*	170	$68,000**	225	$45,000****	$113,000
69	533	180	72,000	225***	45,000	117,000
70	563	190	76,000	225	45,000	121,000
71	593	200	80,000	225	45,000	125,000
72	623	208	83,200	225	45,000	128,200
73	653	218	87,200	225	45,000	132,200
74	683	228	91,200	225	45,000	136,200
75	713	238	95,200	225	45,000	140,200
76	743	248	99,200	225	45,000	144,200
77	773	258	103,200	225	45,000	148,200
78	803	268	107,200	225	45,000	152,200
79	833	278	111,200	225	45,000	156,200
80	863	288	115,200	225	45,000	160,200

* Based on past average mileage new road construction of 30 miles per year.

** Based on Eugene District estimate of $400 per mile maintenance cost.

*** Mileage should remain fairly constant, some roads being blocked and replanted as new ones are built.

**** Maintenance temporary roads set at $200 per mile to cover cost of grading and ditch and culvert cleaning and waterbar maintenance.

big problem in the Coast Range. Road washing and gully control and sheet erosion control present the main problems in the Santiam area. The District's estimate of about $95,000 funding for overcoming these watershed management problems appears reasonable and conservative.

Soil and Moisture funding should be made available to overcome these watershed management problems because of the needs for site protection for all resources as well as downstream fisheries and water quality benefits.

The land measures need inventory presented in Table W-III show only part of the rehabilitation needs on BLM lands. Many problem areas have either not been identified or properly recorded so as to be available for future consideration. Resource Managers must give more attention to water quality management in the future.

f. Water Needs on BLM Lands

Small quantities of water will be consumptively used on the BLM lands in the basin at recreation sites, for wildlife use, domestic livestock, fire control, road construction and maintenance, timber harvest operations, for storage and transportation of logs, and in timber manufacturing. No formal withdrawal of water rights is needed for these minor uses.

However, large quantities of water for irrigation of forest crops may be needed to maintain the annual timber harvest required to sustain existing milling capacity and the economy of the area. Competing demands for forest land for recreation, power line and road rights-of-way, and large reservoirs are continually reducing the forest acreage production base. The problem is to produce more wood fibre to meet future needs from a shrinking land acreage. Bold and drastic measures will be needed to accelerate timber growth to overcome the forecast future shortage of wood fibre. It is expected that fertilization and irrigation will triple current timber growth on suitable lands. A Forest Service survey has found a potential for irrigating 203,700 acres. National Forest lands, requiring roughly 407,400 acre feet of irrigation water. The Eugene BLM District finds potential for irrigating 5,000 acres fo forest land, and there are 7,200 acres in the Salem District which may be suitable for forest irrigation. Irrigation water requirements for the BLM lands would be 22,200 acre feet of water. Thus, a potential use of 429,400 acre feet water on public lands is forecast out of a total annual basin production of 26 million acre feet. If forest crop irrigation proves feasible, the large private timber companies will be wanting large amounts of water for this purpose. The problem will be that this increased water consumption comes at the time of the year when water flows are insufficient to meet other existing needs. Water storage reservoirs may be needed to supply water for forest crops, as well as having value for fire control and recreation.

Research studies show that clear cutting the timber results in an increase in the minimum summer stream flows. [8] However, the increase

8/ "Streamflow from Small Watersheds on Western Slope Cascade Range, Oregon" Pac. N.W. Exp. Sta.

is relatively small and lasts only a few years until the area is restocked. For the foreseeable future water storage by existing and proposed reservoirs will be able to satisfy the needs of the basin during the summer dry period.

2. Long Term Objectives of BLM Watershed Management Program

a. Provide reasonable permanent control and prevention of nongeologic erosion.

b. Protect, maintain, improve renewable resources within watersheds for management under principles of sustained yield and multiple use.

c. Enhance on site resource use values, including fish and wildlife, livestock grazing, timber production, outdoor recreation, industrial development, mineral production, and wilderness preservation.

d. Enhance off-site values, including improvement of water quality, improved timing and yield of streamflow, renewal of groundwater supplies, control of floods, prevention of lake and reservoir siltation, protection of public health, and stabilization of local economies.

e. First priority is directed toward curbing deterioration of watersheds.

3. Immediate Goals for Watershed Management on BLM Forest Lands

a. Watershed Problem Areas

(1) Promptly revegetate burns as needed to protect soil and water values.

(2) Immediately provide drainage on firelines and fire roads upon suppression of fire. Waterbarring of firelines on steep slopes should be done by hand.

(3) Provide streambank stabilization such as revetments where needed to protect both potential and developed recreation sites.

(4) Through training and work assignments, alert personnel to watershed problems.

b. Timber Harvest Problem Areas

(1) In logging plans identify areas of unstable soils needing protection. Use selective cutting on suitable ground in delicate areas.

(2) Restrict use of tractors in logging in wet weather or on steep slopes. Tractor use should be correlated to soil type and mantle stability information.

(3) Require overhead (skyline) cable logging in areas of unstable or fragile soils.

(4) Give priority to harvest most decadent timber stands first to reduce accumulation of debris in stream channels.

(5) Push an aggressive salvage and prelogging program to reduce debris accumulation.

(6) Encourage relogging where market exists to reduce debris problems.

(7) Treat landings and skid trails to prevent erosion by scarification, reseeding, and waterbarring.

(8) Construct sediment settling basins where needed in drainages below landings.

(9) Keep tractors out of stream channels and permit their use only where soil is firm enough to support them.

(10) Prevent felling or yarding of trees across streams.

(11) Logging practices should disperse rather than concentrate run off.

(12) Skid trails should be kept as far away from stream channels as possible.

(13) Provide drainage on skid trails, landings, and spur roads.

(14) Include site damage as a logging cost in timber appraisals and sales, covering factors of soil loss, soil compaction, and water quality disturbance.

(15) Remove temporary culverts and bridges at end of logging operation.

(16) Logging debris should be yarded away from stream channels.

(17) Remove log jams from stream channels. Streams in contract area should be opened for fall fish migration, not left blocked during entire period of the contract.

(18) Modify slash burning where residue is needed to protect soil and water.

(19) Plan winter logging so as to minimize damage from high water flows.

(20) Promptly install erosion and run off control measures as logging is progressively completed.

(21) Strictly supervise logging operations for compliance with requirements for avoiding damage to soil and water.

(22) Make sure that sale contract specifications for watershed protection are adequate.

(23) Identify on management maps areas where severe watershed damage may be caused by logging or road building.

(24) Log only one side of a stream at a time and keep clear cut units small in size when on unstable soils or adjacent to streams.

c. Road Construction Guidelines

(1) Build roads away from creeks, swales, and elongated depressions.

(2) Build roads on benches, ridges, and tops of slopes where feasible.

(3) Road locations should avoid seeps, clay beds, slide areas, and steeply dipping formations.

(4) Adequate buffer strips of at least 50 feet should be left between roads and streams.

(5) Avoid altering natural stream channels.

(6) Locate gravel and borrow pits so as to avoid soil displacement contributing to stream pollution.

(7) Avoid placement of cut and fill material and debris which may reach stream channels.

(8) Avoid making excessive road clearing widths.

(9) Gradient of cut and fill slopes should be modified to fit the soil class encountered. Steepness of yarding road grades should be limited in erodable or unstable soil areas.

(10) Road cut and fill slopes should be stabilized by mulching, planting, retaining walls, or other appropriate measures.

(11) Fill materials should be suitable to withstand wet season slump.

(12) Fills should be compacted by rolling during construction to insure stability.

(13) Road surfaces should be crowned to prevent concentration of water on road.

(14) Fill slopes on granular type soils should be safeguarded from road surface run off by a protective bern, shoulder, or ridge.

(15) Adequate size and length culverts or bridges should be placed at all stream crossings.

(16) Culverts should be installed on the natural slope of the land with adequate headwalls and footwalls. Truck and yarding roads should be waterbarred and seeded after use. All roads must be adequately cross drained. Prevent culvert discharge on fill slopes.

(17) Bog holes in roads should be drained promptly upon discovery.

(18) Water diversions from roadside ditches should be of sufficient frequency to prevent ditch scouring from excessive water flows.

(19) Drainage ditches should be placed above cut slopes where needed to divert run off from the slopes.

(20) Culverts, drainage ditches, and trash racks need systematic inspection and clearing of debris during the fall and winter.

(21) Roads should be maintained during summer use.

(22) Trails should be waterbarred to prevent erosion.

(23) It would be desirable to close non-system dirt BLM roads to public travel except during the dry part of the year.

(24) Incomplete construction should be adequately drained at the end of the season's work.

(25) Ditch blading should be done in a manner so as not to undercut road side slopes.

(26) Watershed management staff men should review road plans prior to approval.

d. Opportunities for Improvement BLM Road Construction Program.

(1) Recent flood damages indicate that plugged culverts are one of the biggest problems in road maintenance. This points up the need for more and bigger culverts and in some places bridges in lieu of culverts to handle storm run offs. Better data on storm frequencies and intensities is needed for estimating water flow problems.

(2) In some instances the spacing of ditch relief culverts have been too far apart. They should be placed on an angle facing the ditch, and the exit needs outlet protection.

(3) In road construction above stream channels excavate full width of road and end haul waste away from the stream where practicable.

(4) In livestock use areas, seed low palatability plants on road slopes to discourage animal use because they tear up back slopes, fill drainage ditches, and plug culverts in grazing the forage.

e. U. S. Forest Service Evaluation of Storm Damage to Forest Roads 1964-65 Floods.

(1) Road locators must be better trained to recognize critical land forms and critical soils.

(2) For areas with unstable soils, transportation planning should be accomplished well ahead of need.

(3) Road designers must design specifically for the conditions encountered in the field rather than applying generalized or average criteria.

(4) One of the most important requisites to preserve soil and water values is to fit the road location to topography so that minimum alterations of natural conditions are necessary.

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(4) One of the most important requisites to preserve soil and water values is to fit the road location to topography so that minimum alterations of natural conditions are necessary.

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(5) Disposition of waste material must be considered in design more adequately than in the past. Stabilization of waste is as important as stabilization of the road prism.

(6) Design should incorporate stabilization measures to hold the soil.

(7) Vegetative materials should not be incorporated into fills.

(8) In fill construction road prisms should be compacted where construction is done in certain critical soil types.

(9) A major contributor to storm damage in 1965 was failure of the excavated side-cast material in steep country. Failure resulted from imposing additional weight on lands already at steepest allowable angle of repose. By end hauling to a less steep area the material will be stable and useful in production of vegetation. In steep country full bench road construction is preferable to part bench and part uncompacted fill.

(10) Spur roads should be adequately cross drained. Do not permit debris to be incorporated into roadway prisms.

(11) Landings in steep country should be outsloped and drained and have no debris incorporated into the fill portion of the landing.

f. Conclusion

(1) The Willamette River drainage includes several contrasting physiographic landscape units, each of which responds differently to flood producing storms.

(2) Detailed soil surveys should be completed for all landscape units as soon as possible.

(3) Land managers and engineers should be thoroughly trained in the geomorphic history, climate, vegetation, soils, and landscape features in which they work. They should be made aware of soil stability problems and what limitations these impose on land management and road construction practices.

(4) Multiple use plans should recognize the characteristics and problem areas of the physiographic areas concerned.

(5) Water management should be given resource status in the same manner as forestry, recreation, or grazing in BLM's organizational system.

(6) Effective watershed management in the field is seriously handicapped by lack of specific guidelines correlating type and intensity of management to water quality. For example what intensity of road maintenance is needed to maintain water quality above the minimum of 5 Jackson Turbidity Units? Knowledge of soil types would be needed to develop such criteria since soil types react differently to erosion effects. Without better criteria resource managers are limited to a "trial and error" type of management.

B. Watershed Management on BLM Lands 1965 - 1980

1. General Situation in Basin

The Oregon State Sanitary Authority is the State's legal agent for enforcing the State's laws against stream pollution, including siltation and debris deposits in streams. Its public policy declaration indicates the wide scope of its objectives. "For some time the number of separate logging operators for which State Foresters issue permits has been in excess of 15,000 per year. Most of the towns of the basin rely on surface flow for municipal water. Their purification treatment plants are aimed at elimination of bacterial contamination. Siltation of the water clogs the chlorination systems making them ineffective against bacteria. With logging moving into the steeper lands the State finds management of the timbered watersheds of expanded importance for the whole range of public health, recreation, and fishery interests." (ORS 449.077) Insufficient funding drastically reduces the effectiveness of the Oregon State Sanitary Authority. This situation is not expected to improve much in the foreseeable future.

Public opinion will no doubt influence many loggers to use care in their operations on forested watersheds. Public land management agencies must set the example for private industry to follow in achievement of optimum watershed management operations for protecting of water quality. "In some places accelerated run off from newly logged or fireswept timberlands has resulted in disruption of normal stream channels, abnormal channel overflow, burial of lands downstream, and damage to fish and wildlife habitat." 9/ Timber stands on steep slopes that must be "clear cut" should be harvested at intervals of time and in smaller patches so as to lessen danger of erosion.

9/ "Water for Oregon" Geological Survey Water Supply Paper 1649, 1965, p. 95.

2. Future Water Demand

Currently municipal water consumptive use averages 180 gallons per capita per day. Peak monthly demands average 185% of the average monthly use. Projections of future water requirements indicate the Willamette Basin's needs may increase threefold by the Year 2010. This anticipates a per capita consumption of 210 gallons per day by 1985 and 230 gallons per day by 2010. Water consumption for irrigation is expected to increase from 200,000 acres irrigated in 1964 to 350,000 acres irrigated by 1985, requiring an additional 384,000 acre feet of water. Use of water in the pulp and paper industry in 1985 is expected to increase 170% over the demand in 1960 and industrial use increase by 145%. Because most consumptive uses are from surface water sources, the demand for high quality water will increase. The most bothersome quality problems are found to be turbidity, taste, and odors. 2/ The coincidence of peak water demands with summer low flow periods magnifies the water quality problem.

3. Recommended Action on BLM Lands

a. Soil surveys of first priority should be the completion of a soils survey of the BLM lands to identify unstable areas requiring special management to reduce soil movement and loss, especially as related to engineering for road construction.

b. Road Construction

The need for financing new road construction through timber sales limits the amount that can be spent on the road in meeting water quality protection objectives. Special funding should be made available to cover additional costs related to watershed protection, some of which are listed as follows:

Watershed Protection Requirements in Road Construction

New Road Construction

(1) Make soil and cut bank stability studies in area before laying out new roads in order to avoid problem areas.

(2) Keep roads away from natural drainage channels. Use bench or ridge top locations where possible. Sacrifice of optimum gradient may be needed in some cases to reduce erosion potential.

2/ "Water Quality, Control, & Management" Federal Water Pollution Control Adm. 1967.

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(3) Select stream crossing points which will involve a minimum disturbance of banks and existing channels.

(4) End haul all excavated material at stream crossings or in heads of draws and deposit where least likely to erode into stream channels.

(5) Undertake road construction during time of year when there is least interference with the water resource.

(6) Rough grading should be carried no further than can be finished during current season, including backsloping, drainage installations, and ditching.

(7) On sidehills and near channel crossings road drainages should discharge where sediment can settle out before reaching a stream channel. An undisturbed buffer strip at least thirty feet wide 4/ should be left along channel edges.

(8) Excavate the full road width above stream channels and end haul the waste material away from the stream where possible and where fills are necessary they should be compacted.

(9) Help stabilize cuts and fills by adequate sloping in original construction to avoid erosion.

Old Road Construction

(1) On temporary roads - scarify, waterbar, replant, and block when no longer needed.

(2) Surface all permanent roads with rock or oil, adequately ditch, mulch, fertilize, and seed erodable cut banks and fills.

(3) Culverts should have protected outfalls and may need trash racks.

(4) Temporary culverts and bridges must be removed.

Logging - New

(1) Skyline or balloon logging should be used in areas of unstable soils. Higher logging costs are offset by site protection, lower watershed disturbance and water pollution.

4/ "Watershed Control for Water Quality Management" Pollution Control Council Pacific N.W. Area 1961.

(2) High lead logging uphill is preferable to tractor yarding in protection of the water resource. On heavy and erodible soils tractor logging should be limited to slopes less than 15% 4/ and generally to slopes less than 20%. Tractor yarding should not be used at all on heavy clay soils during wet weather or on saturated ground.

(3) Service areas and landings should be diked to contain muddy drainage and oil or gas spills.

Logging - Old

(1) Old skid roads, landings, and abandoned roads need rehabilitation by scarification, waterbarring, and reseeding.

(2) Revegetation of some areas is needed to accelerate reforestation and restore ecologic and hydrologic site conditions.

Fire Protection and Prevention

(1) Use of chippers to dispose of logging slash is recommended instead of burning as a means of preserving soil litter and humus. Burning increases the water siltation hazard by destroying the soil cover, and the ash may cause chemical contamination of streamflows.

(2) Construction of small reservoirs in upper stream tributaries is needed to provide water for fire control as well as wildlife use and recreation.

(3) Firelines and temporary fire roads should be waterbarred and drained immediately following suppression of the fires.

Flood Control

(1) Clearing of log jams from streams is needed to reduce bank cutting and potential flood damages. Revetments may be needed to protect some stream banks.

(2) Gross yarding in timber harvest should be required to remove debris from water drainages including intermittent stream channels. Experience shows that the debris carried by floods is the cause of major damage to downstream values and improvements.

(3) More trash racks are needed to protect culverts and bridges from being plugged and washing out. Their use should be limited to areas that are accessible during the winter for cleaning the debris from the racks.

4/ "Watershed Control for Water Quality Management" Pollution Control Council Pac. N.W. Area 1961.

Water Project Impact Mitigation

(1) The extremely high investment in major water impoundments makes mandatory a prudent approach to resource utilization programs on the watersheds above. Extra care must be taken to keep silt and debris out of watercourses above these impoundments. Special consideration should be given to gross logging, balloon, or skyline yarding in such areas.

(2) Special effort should be devoted to cleaning out debris and other fire hazards on BLM lands surrounding the project, including the buffer strip. This both improves the appearance of the area and provides opportunity for landscaping with fire resistant types of shrubbery.

4. Conclusion:

"Three major sources account for nearly all of the water pollution in the basin. These are (1) industrial waste, (2) municipal waste, and (3) land management practices. Industrial waste is responsible for nearly 95% of all pollution in the Willamette River system. Total stream loadings are expected to double by 1985. In the issue of water pollution control, the free market process cannot be relied upon to achieve optimum distribution of benefits. [10/] The consequences of water pollution pervade the entire basin. Loss of esthetic and recreational opportunities due to poor water quality reduces the livability of the region. There is potential danger to the health and safety of water users."

A program of stream classification is needed related to the proposed use and water quality requirements of each stream. This would be a guide to the forest manager as to intensity of protection of water quality. The forthcoming Comprehensive Willamette Basin Study will provide such a classification. The varied and dispersed ownership of the forest lands of the basin is a constraint in an effective program for water quality control. Even so the public land management agencies are charged with the responsibility for setting a good watershed management example for private owners to follow. Even though industrial waste is the major pollutor, siltation and turbidity from poor land management can cause serious damage to downstream resources and add greatly to the cost of water rehabilitation. More attention to the water resource must be given in BLM operations.

C. Watershed Management on BLM Lands 1980 - 2020

1. General Situation

Projections show increasing demands for all resources from the forest lands, including water and wood fibre. Highly intensive forest management will be the order of the day. This will include fertilization

10/ "Water Pollution Control Policy" Oregon Dept. Commerce, Div. Planning & Development 1965.

of timber reproduction on the better sites and perhaps irrigation to some degree. Construction of additional water storage impoundments on the forest watershed will be needed to supply the increasing water needs of the basin during the critical low flow summer periods.

2. Recommended BLM Watershed Management Program

a. Care must be exercised in embarking on a fertilization program on forest lands to avoid adding nutrients to streamflows. Nutrients in the water stimulate undesirable algal growths.

b. Anticipated massive public recreation use of the BLM lands necessitates an accelerated construction program for facilities to preclude biotic contamination of streamflows.

c. BLM should be prepared to work with the Federal Water Pollution Control Administration who will review and evaluate BLM land management practices and programs for effectiveness in pollution control as authorized by Executive Order 11288.

d. Any degradation of water which can interfere with a legitimate use will be considered contrary to national policy.

e. Rehabilitation of denuded forest areas should be done even though not economically feasible. The long term social needs for control of floods and sedimentation as well as increased future supplies of wood fibre and natural beauty considerations makes rehabilitation imperative.

f. Sliding or undercut stream banks should be stabilized by vegetation or structures.

g. Logging roads should be built away from streams to protect their natural beauty, as well as protecting water quality.

3. Conclusion:

Stream loadings of pollutants by Year 2010 are expected to be four times worse than today unless more effective controls are implemented. Increasing demands for water coupled with a more affluent society with more leisure time will result in a greater awareness and demand for

b. Immediate classification of natural beauty areas and scenic strips on BLM lands adjacent to major streams and highways is needed in both the Salem and Eugene Districts.

B. Open Space and Natural Beauty Program 1965 - 1980

1. General

The State Director's policy statement of August 23, 1960 implemented by Instruction Memorandum ORE-WASH-65-123 of April 5, 1965 emphasized the need for including natural beauty and open space in resource management planning. So far very little BLM acreage has officially been identified as being in these categories. To a degree all the BLM lands being managed for wood fibre production provide open space. BLM can make the greatest contribution to this program by giving more consideration and emphasis to natural beauty in its road building and timber harvest operations. In a statement on July 8, 1965 the State Director set forth a plan of action for implementing the natural beauty program:

(1) Identify and alleviate unsightly conditions on public lands in each district.

(2) Intensify beautification in our road construction program through harmonious designing, disposal of debris, etc., through additional funding.

(3) Plant trees and take other actions to increase aesthetic values in areas of public use.

(4) Enlist cooperation of contractors and permittees in meeting responsibilities to maintain or restore terrain and natural beauty during logging, road building, etc.

(5) Assist in roadside litter cleanup projects by providing trucks and dump sites.

(6) Increase vigor of campaign to remove unauthorized billboards and control dumping.

(7) Assist other agencies in cooperative beautification projects.

2. Aesthetics in Timber Harvest

Aesthetic values should be considered in timber management plans, especially in landscape management areas. The objective should be

optimum environmental esthetics. Good quality water will no doubt continue to be the pivot for improved livability of the basin. BLM is in a good position to help protect the watershed's ability to produce clean water and should program and manage its resources with this in mind.

4

*- Streamcourse Cleanup

The costs of actual stream cleanup work consists of $37.00 per station base cost plus $0.85 per station for each percent of streamcourse sideslope. In appraising timber, it is difficult to ascertain what portions of a stream designated for cleanup will require actual cleanup.

Logging debris will not normally accumulate in the bottom of streamcourses with sideslopes between 0 to 40 percent, due to the effect of gravity. The logging operator can usually prevent the occurrence of debris in streamcourses with sideslopes under 40 percent. Streamcourses with sideslopes above 40 percent are more canyon-like and the effect of gravity in causing the movement of debris to the bottom of the streamcourse becomes more pronounced. Gravity plays an important part in causing the accumulation of debris in the bottom of streamcourses with sideslopes over 60 percent.

Streams designated for cleanup with sideslope under 40 percent will usually require actual cleanup on only a relatively small segment of their length designated for cleanup. Streams with sideslopes between 40 to 60 percent will probably require actual cleanup on a substantial portion of their length designated for cleanup. Streams with sideslopes over 60 percent will probably require actual cleanup over their entire length.

The following table is based on the above costs and assumptions and should be used as a guide only. Local experienced data may be used in lieu of the below costs.

Streamcourse Sideslope	Cost per Station
0-10%	$5.00
11-20%	10.00
21-30%	20.00
31-40%	30.00
41-50%	50.00
51-60%	70.00
61-70%	95.00
71-80%	105.00
81-90%	115.00
91-100%	125.00

Add $10.00 per station for each additional 10 percent slope above 100 percent.

Streamcourse cleanup costs are to be computed as a contractual cost. Base yarding costs do not include any costs for streamcourse cleanup.-*

References - Water Resource Management

1. "Willamette River Basin Comprehensive Study" 1969, Willamette Basin Task Force.

2. "Water Quality Control & Management - Willamette River Basin" Fed. Water Pollution Control Adm. 1967.

3. "Table 12 Dec. 1964-Jan. 1965 Flood in Portland District, Willamette River & Tributaries", Corps Engineers.

4. "Watershed Control for Water Quality Management" Pollution Control Council, Pac. N.W. Area 1961.

5. BLM Instruction Memo. PSC-66-57 1-20-67.

6. "Report of the Region VI Storm Damage Evaluation Committee" U.S.F.S., Region VI, Dec. 1966.

7. "Land Measures Study for Willamette River Basin Report" BLM and U.S.F.S. 1965.

8. "Streamflows from Small Watersheds on Western Slope Cascade Range, Oregon" Pac. N.W. For. & Range Exp. Sta.

9. "Water for Oregon" U.S.G.S. Water Supply Paper 1649, 1965, p. 95.

10. "Water Pollution Control Policy" Oregon Dept. Commerce, Div. Planning & Development, 1965.

XIII. A. Open Space and Natural Beauty

1. General

Both the Outdoor Recreation Resources Review Commission Report and the Comprehensive Willamette Basin Study indicate that driving for pleasure will constitute the major recreation activity of the basin's populace. The participation rate in this type of recreation is expected to increase during the period of this study to year 2020. In order to insure a pleasant future environment, decisions and actions are needed now for preservation of open space and natural beauty. Our open farmlands and timbered mountains are too much taken for granted. Population projections predict twice as many people in the basin by year 2000 and three times as many by year 2020. Most of the increase will be in our cities. The City of Portland extended its boundaries from 71.48 square miles in 1961 to 78.31 square miles in 1964. However, much of the urban growth has been outside the city. In 1964 25.6% of Multnomah County was classified as urban, covering 108 square miles. It is expected that the mass migration to the suburbs will continue.

In the Willamette Basin Comprehensive Study the urban portions of Multnomah, Washington, and Clackamas Counties are consolidated for study purposes into one Standard Metropolitan Statistical Area. This S.M.S.A. had a total population of 618,589 in 1960 and covered 164 square miles. Average density was 3,772 people per square mile. The following table shows present and future population intensities of the Standard Metropolitan Statistical Areas of the basin.

Current and Forecast Population Intensities by S.M.S.As. in Willamette Basin

S.M.S.A.	1960 Popul.	Urban Area Sq.Mi.	Average Density	1980 1/ Popul.	Projected Urban Area Sq.Mi.	2020 Popul.	Projected Urban Area Sq.Mi.
Portland	618,589	164	3,772	780,000	206.7	1,600,000	424.2
Salem	85,000	48.44	1,755	163,000	59.0 2/	332,000	120.1 2/
Eugene-Springfield	99,581	81.4	1,223	168,000	113.0 3/	340,000	151 4/
Total	803,170	293.84	2,250	1,111,000	378.7	2,272,000	695.3

1/ "Economic Base Study-Appendix C -Willamette River Basin" Willamette Basin Task Force 1969.

2/ Computed on basis Portland S.M.S.A. 1960 density as norm for area averaged with present density.

3/ Computed based on average 1960 density Salem & Eugene, reflects increasing density with size of area.

4/ Computed based on average 1960 density Portland, Salem, & Eugene, reflects increasing density with size.

There are 2,801,800 acres in the valley portion of the basin. Of this 2,457,050 acres are classed as farmland. This leaves 344,750 acres (12% of the valley) in cities, towns, airports, highways, and other intensive uses. A total of 188,058 acres of this is taken up by the three S.M.S.As. Growth of the three S.M.S.As. will take an additional 54,310 acres out of production by 1980 and 256,934 acres by 2020. This means that at least 28% of the valley will be in cities, towns, airports, highways, etc. by the year 2020. A solid metropolitan area extending from Portland to Eugene by 2020 is predicted by economists. Growth will parallel Interstate Highway Route 5. This is where the concern for natural beauty and open space begins. Although there are no Bureau of Land Management lands adjacent to Interstate Highway 5 in the basin, there are BLM lands adding to the scenic beauty of the cross State Highways feeding into Interstate Highway 5. A listing of such highways together with mileage of BLM lands nearby is shown in the following table.

Potential BLM Natural Beauty Areas in Willamette Basin

Subbasin	Highway Identification	Miles BLM 5/ Road Frontage	Acres BLM Road Frontage	Miles BLM Stream Frontage	Acres BLM Stream Frontage
Upper Willamette Subarea					
Eugene District (BLM)					
1. Coast Fk.	Row R. Rd.	5.75	2,880	81.25	29,100
2. Middle Fk.	---	0	0	21.75	9,160
3. McKenzie	U.S. 126	5.0	1,120	56.00	23,780
4. Long Tom	(State 36	1.5	800		
	(Rt. F-Elk Cr.	1.0	200	23.25	10,000
Subtotal		13.25	5,000	182.25	72,040
Middle Willamette Subarea					
Salem District					
5. Santiam	State 22	1.5	400	102	43,120
6. Coast R.	State 20	0.25	40	66	28,840
7. Pudding	State 214	0.25	40	50.5	18,560
Subtotal		2.0	480	218.50	90,520
Lower Willamette Subarea					
8. Tualatin	---	0	0	14	3,600
9. Clackamas	---	0	0	15	4,200
10. Columbia	---	0	0	9.25	2,680
11. Sandy	U.S.80N-Col. R.	1.75	320	---	---
	U.S. 26	4.0	1,040	11.5	5,440
Subtotal		5.75	1,360	49.75	15,920
Basin Total		21.00	6,570	450.50	178,480

5/ Defined as the immediate foreground area, not necessarily adjacent to road.

Due to rough terrain of the Coast Range and Cascade Mountains highways follow closely the drainage ways of the rivers and streams. For this reason the BLM highway mileage and acreage statistics are similar to the BLM stream mileage and frontage statistics.

This initial survey indicates that 42% of the BLM lands in the basin has some natural beauty values. Verification of this on the ground may require modification in management and harvest practice in order to protect scenic values. Currently only 14 miles of natural beauty area has been classified on BLM lands in the Salem portion of the basin and 10 miles in the Eugene District. Opportunity for enlargement of the natural beauty classification and protection program is obvious.

2. Eugene BLM District Program Opportunities

The Eugene District has designated as a scenic strip or natural beauty area the BLM lands on the important U. S. 126 Highway on the McKenzie River. Similar classifications are needed on the Row River Road due to its heavy recreational use, State Highway 36, and Route F - Elk Creek Road. In the Coast Fork subbasin consideration should be given to such classification to BLM lands on the South Fork Big River, Bear Creek, Silk Creek, Camas Swale, Lynx Hollow, Mooten Creek, Row River, Mosby Creek, and Teeter Creek.

On the Middle Fork Willamette classifications are needed on Rattlesnake, Lost Creek, Hills Creek, Fall Creek, Little Fall Creek, and North Fork Fall Creek.

In the McKenzie Subbasin BLM lands on Camp Creek, Gate Creek, McGovern Creek, Parsons, Cash, Shotgun, Cartwright, Mill, Martin, and Deer Creeks appear to warrant classification.

In the Long Tom subbasin classifications should be considered for BLM lands on Long Tom River, Ferguson Creek, Poodle Creek, Coyote Creek, and Fox Hollow Creek. Proximity of the roaded public lands in the district to large population points to a need for an aggressive anti-litter campaign together with roadside and dumping area cleanup. Placement of litter barrels may be helpful in areas receiving heavy public use.

3. Salem District Program Opportunities

The natural beauty roadside scenic strip designated by the Salem District lies on a BLM access road on the Middle Santiam River and Quartzville Creek. Consideration should be given to such classification of the BLM lands on State Highways 20, 22, 214, U. S. Highway 26 to Mt. Hood, and U. S. 80N, the Columbia River Highway.

Study of the following streams in the Santiam subbasin is needed to verify need for Natural Beauty classifications of the BLM lands thereon: Calapooya River, Brush Creek, Courtney Creek, North Santiam River, Thomas Creek, Neal Creek, South Fork Thomas Creek, Canal Creek, Tally Creek, Elkhorn Creek, Crabtree, Roaring Creek, and Little North Fork Santiam.

Similar study is needed in the Coast Range subbasin for these streams: North Yamhill River, Turner Creek, Panther, Baker, Deer, Willamina, Coast, Casper, Agency, Gooseneck, Mill, Rickreall, Luckiamute, Pedee, Shotpouch, Greasy, Beaver, and Oliver Creeks.

In the Pudding subbasin review is needed for Natural Beauty or scenic strip classification on these streams: Molalla River, Nate Creek, Canyon Creek, Rock Creek, Dead Horse, Lukens, North Fork Molalla, Butte, Table Rock, Silver, Abiqua, and Mill Creek.

Such review is needed of these streams in the Tualatin subbasin: East Fork Dairy Creek, McKay Creek, Seine, Lee Creek, and Tualatin River.

In the Clackamas subbasin the following streams need review for classification: Clear Creek, Abernathy Creek, Collawash, Clackamas River, Eagle Creek, and South Fork. In the Columbia subbasin only the Scappoose Creek BLM lands appear to warrant scenic strip designation.

Proximity to Portland warrants early study for scenic strip classification on the following streams in the Sandy subbasin: Salmon River, Sandy River, Little Sandy, Cedar Creek, Buck Creek, and Gordon Creek.

An anti-litter and roadside cleanup campaign warrants adoption into the Salem District program.

4. Open Space and Natural Beauty Management Problems

Designation of BLM lands as scenic strips on natural beauty areas does not preclude harvesting timber therefrom. It does preclude clearcutting in most cases. To a great degree this is not compatible with the high timber sale quotas set by the Director's Office for the districts. More manpower is required to process selective cut timber sales. Road costs are higher. Especially evident is the need for recreation specialists in both the Salem and Eugene District Offices to identify and classify natural beauty and scenic strip areas, develop management recommendations for each, and initiate an accelerated anti-litter and roadside cleanup campaign.

5. Recommendations

a. It is recommended that recreation specialists be added to the staffs of the Salem and Eugene Districts in order that the important recreational and natural beauty resources on the public lands in these districts be promptly identified, classified, and included in a recreation management program.

to maintain or develop the attractive appearance of a thrifty, healthy, well-managed forest. In clearcuts consideration should be given to cutting only one side of a road at one time. In steep terrain clear-cut units below a road may serve a significant public use as vista opportunities. Landings should be located so as to be inconspicuous from publicly used roads as is feasible. When not feasible there should be good cleanup of the landing, scarification, planting with large stock and fertilizing. Proper slash disposal is particularly important to maintenance of aesthetics.

3. Timber Management in Immediate Foreground of Natural Beauty Area

"Immediate foreground" includes roadside zones, trailside zones, waterfront zones, buffer zones around developed recreation areas, and other areas that are viewed at close range by many people. Plans for timber harvest or cultural treatments must be made with the idea of protection and maintenance of the scenic aspect. The following Forest Service guidelines are applicable:

a. Timber cutting to provide a positive scenic treatment such as opening of scenic vistas; varieties in boundary and structure of timber stands along roads; removal of unsightly dead, dying, diseased, and unattractive trees; opening up of dense stands to expose a deeper view into the forest, or to provide better view of large, attractive trees.

b. Provide variety in roadside landscape by providing variations in stand structure by making irregular cutting lines and small openings along the right-of-way.

c. Provide transition variation such as shrubs and small trees between roadway and tall trees. Rhododendrons and azaleas are ideal for this purpose.

d. An open park-like appearance can be provided by selective cutting of dense timber stands or thinnings. Variety can be provided by the intensity of the thinning and extent of cleanup of whips and understory brush.

e. Logging roads, skid roads, and landings should be located and constructed to be as unobstructive as practical from the viewing area.

f. Trees should be felled away and yarded away from the viewing area.

g. Stumps should be cut low enough to be inconspicuous from viewing area. Slash at immediate roadside should be cleaned up completely, tapering off with lesser cleanup farther away. Chipping is preferred where practical.

h. Leave special interest trees to add variety and interest to the forest scene. Examples are trees that are unique in size or shape such as wolf trees, hollow trees offering a home for wildlife, deformed, low vigor trees.

i. In harvest of immediate foreground timber, shelterwood cutting is recommended for most situations. Removal of shelterwood should be delayed until reproduction gives appearance of forest cover.

j. Clearcuts in immediate foreground area should be as small as practical. Boundaries should follow topographic features to provide natural appearing outlines. Partial screening of the clearcut with other timber or topographic features is desirable. Reforestation should be accomplished immediately by planting large, vigorous tree stock.

k. In planting and in thinning provide variety in spacing and density of the planted or leave trees. Leave occasional thickets unthinned.

l. As seen from viewing area tree growth in bottom of ravines should be left in natural state rather than being thinned. This is due to the artificial appearance created by thinning done in ravines.

m. Leave groups of shrubs and hardwood trees for greenery, flowers, fall color, and variety in form and texture.

n. Where natural healthy limb growth extends to the ground, it should be maintained in this condition as seen from the viewing area.

4. Timber Management for Natural Beauty in Primary Foreground Area

The "Primary Foreground Area" is the intermediate area between the Immediate Foreground Area and the land beyond the landscape management zone. Timber harvest in this zone is blended from those practices applied in the Immediate Foreground Area outward to the normal timber harvest area. The objective is to produce a thrifty, healthy, natural appearing forest. The primary restriction is to avoid large openings in the forest canopy as seen from the viewing area. Applicable Forest Service guidelines are as follows:

a. Application of a shelterwood timber cutting system in lieu of clearcutting is often desirable.

b. Locate needed clearcuts so that only portions of it will be exposed to view.

c. If exposure of clearcut is unavoidable, particular attention should be given to limiting the size and shape to lessen the undesirable impact on aesthetics.

d. Use irregular cutting boundaries in required exposed clearcuts, not squared off straight line boundaries extending perpendicular to viewing area.

e. To obtain a natural appearance boundaries of exposed clearcuts should follow topographic features and where possible follow contour lines.

f. Consideration to windthrow damage should be given in opening of scenic vistas. Buffer trees growing in exposed locations should not be removed if needed to protect trees that are less stable. Prevailing direction of strong winds should be considered. Open scenic vistas at nearly 90° angle to strong winds.

5. Salem BLM District Open Space and Natural Beauty Opportunities

The strategic location of Portland as the seaport trading center for Oregon and the Inland Empire assures major population expansion in this area. A 26% increase in population of the Portland area is projected by 1980, over the 1960 level. Competitive demands for land will accelerate. Accordingly BLM must be alert to the increasing need for conservation of natural beauty areas and open space in Multnomah, Columbia, and Washington Counties. By 1980 it is anticipated that all BLM lands on public roads in the Lower Willamette Basin subarea will have value as scenic strips and natural beauty areas. Driving for pleasure will become an increasingly major form of outdoor recreation. The increased number of drivers will necessitate improvements of all public roads as well as construction of new roads in the developing areas. Consideration should be given to connecting up BLM logging roads so as to make loop drives for weekend recreation use.

The 1980 population forecast indicates a 192% expansion of growth in the Salem Standard Metropolitan Service area, nearly doubling the 1960 population. This means that BLM lands in this area will be needed to provide natural beauty and open space also. Natural beauty considerations should be included in every logging plan.

6. Eugene BLM District Open Space and Natural Beauty Opportunities 1960 - 1980

The Comprehensive Willamette Basin Economic Base Study shows a 169% expansion of the Eugene-Springfield area by 1980 over 1960 populations. With urban growth swallowing the valley lands, the forest lands will have to meet the needs for recreation and natural beauty. Some of the Eugene District lands appear to have good potential for meeting such needs. Logging roads should be so constructed as to serve natural beauty objectives. All logging plans should give consideration to natural beauty.

7. Conclusion and Action Recommendation

Rapid urban expansion in this period will put a premium on open space and natural beauty. Both the Salem and Eugene Districts manage lands near expanding urban areas and have roadside areas which should be protected for their natural beauty resources. Timber harvest on BLM lands in these areas must be modified to protect aesthetic values. Access roads should be built to serve multiple uses of recreation and scenic drives, as well as log hauling. Especially important is the need for road access to the rivers and streams on BLM land and to scenic viewpoints. Roadside littering, refuse dumping, and vandalism problems will increase requiring aggressive management actions to overcome them.

C. Future Needs for Open Space and Natural Beauty Opportunities - 1980 - 2020

1. BLM Open Space and Natural Beauty Alternatives 1980 -2020

By year 2020 Portland area population will have expanded 158%; Salem, 291%; and Eugene, 241%; embracing much of the nonforest lands of the basin. Also, increased mobility, more leisure time, and greater spendable income will be bringing more and more tourists to enjoy the unique scenic attractions of this area. The limited acreage of public lands to satisfy an ever increasing need will warrant intensive development of the BLM lands. In addition to facility construction there will be need for landscaping of suitable areas by planting both native and exotic flowers and shrubs such as rhododendrons, azaleas, dogwood, and other appropriate vegetation. As the highways become more crowded, more and more people will be wanting to explore BLM roads on their Sunday drives. BLM's road building program must take into consideration the ever increasing trend in driving for pleasure. This is expected to constitute 30% of the basin's outdoor recreation use by year 2020. Applying this 30% anticipated use to the total year 2020 non-water recreation days demand gives a whopping 32,506,500 6/ days demand for pleasure driving by year 2020 in the Willamette Basin. Since much of this will be concentrated on weekends, it appears that all available road facilities will be taxed to their limit to handle the traffic.

By year 2020 single purpose roads on public lands for log hauling will be obsolete. They will have to be multi-purpose roads providing benefits to a much broader segment of the public than just the timber industry. They will have to be built to higher standards. Timber stumpage should not be required to meet the full cost of construction. By the same token aesthetic considerations may require major modification of timber harvest operations, either smaller clearcuts or selective cutting. Immediate planting after cutting should be required to quickly restore the scenic aspect.

2. Conclusions and Action Recommendations

As the urban density of the valley increases, needs of the people to get away for refreshment of spirit in the out of doors will increase. More and more people will come to expect public forest lands to have a park like appearance for their appreciation and enjoyment. In anticipation of this and to provide needed natural beauty areas, extra effort and expense are warranted to assure revegetation of logged or burned BLM lands near major streams and roads. Lands in this category needing rehabilitation should be identified and programed for improvement. Planting of flowering shrubs along public use roads should become a common practice. No doubt road patrolling will be needed to reduce vandalism, roadside littering, and refuse dumping on the BLM lands, as well as reducing fire hazards in the summer.

6/ "Willamette River Basin Comprehensive Study - Recreation Appendix" - 1969

XIV. A. BLM Fish and Wildlife Habitat Management

1. General

The importance of the fish and wildlife resource in BLM land management programs is identified in BLM Manual.

IX. 8.1.7A. BLM's objective in wildlife management is to maintain the optimum numbers of wildlife on the public lands and to keep them in balance with the needs for other public uses. (IX 8.1.5)

Basically the BLM wildlife management program includes the following steps:

1. Recognition of the species to be either benefited or controlled.
2. Determination of optimum, compatible population levels.
3. Knowledge of the species requirement.
4. Plan development and implementation to improve inadequate habitat sufficiently to support desired populations through their seasons of use.
5. Control of undesirable or over abundant species (porcupines).
6. Integrated management of the wildlife, vegetation, and other resources to maintain optimum multiple use of all resources.
7. Cooperation with State and Federal agencies engaged in wildlife management.

2. Major Game Species on Forest Lands of the Willamette Basin

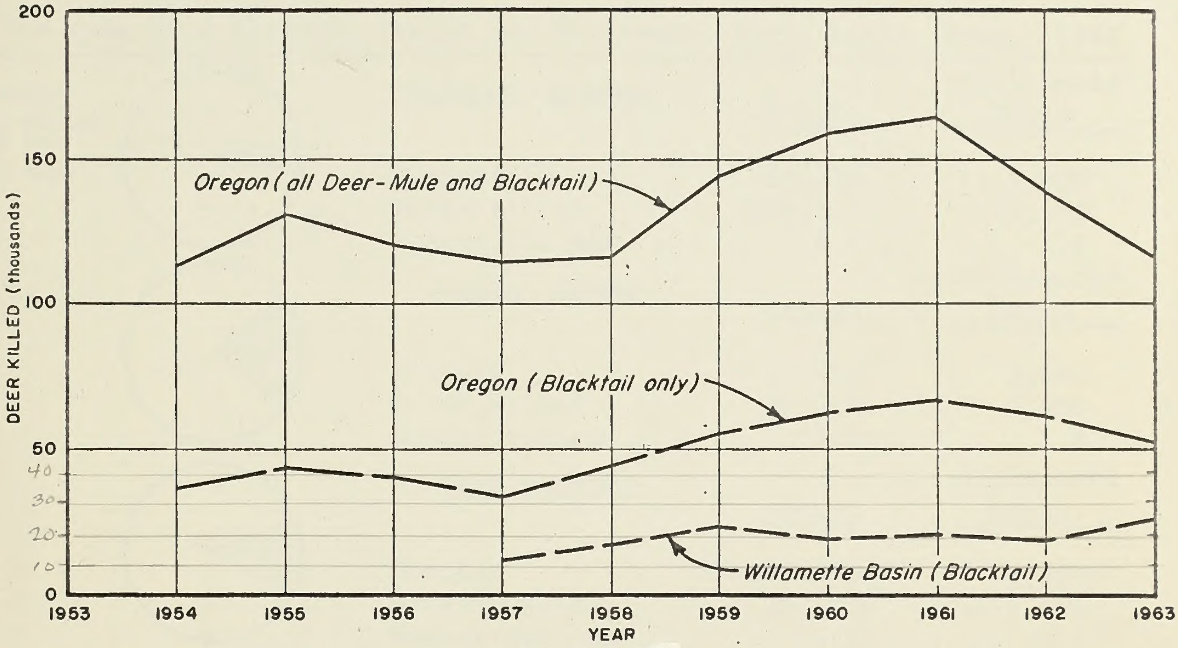
The game population of the basin is estimated at 135,000 blacktail deer, 2,000-4,000 elk, and 14,000 black bear. An average of 24,400 deer are harvested per year, providing 20% of Oregon's total deer harvest. Deer hunting in the basin provides 310,300 hunter days. Cut-over timberlands provide good deer habitat for a period of years.

Blacktail Deer Census for Western Oregon 1/

Year	Deer Per Sq. Mile	Average No. Per 100 Does: Bucks	Average No. Per 100 Does: Fawns	Hunter Days Use	Hunter Success	Hunter Pressure Days Use Per Sq. Mile
1963	56	47	92	-	-	-
1964	33	28	61	11,120	54	34
1965	38	18	97	14,340	34	44
1966	44	31	61	-	-	-

1/ Oregon State Department of Game Statistics.

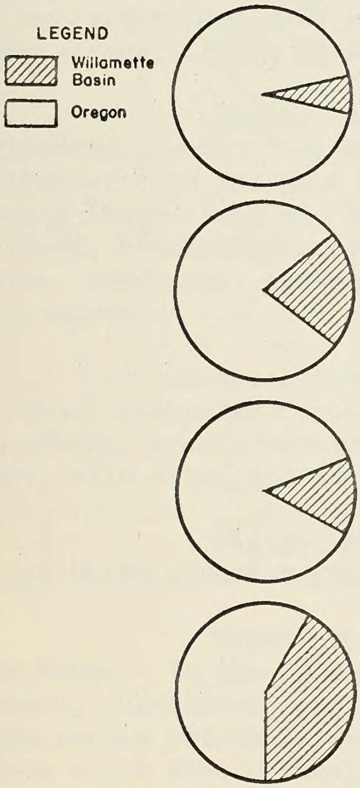
Annual deer harvest of last decade, Oregon and Willamette River Basin, 1954 to 1963



Figure

Data obtained from Oregon State Game Commission.

Upland game bird harvest, Oregon and Willamette River Basin, Oreg., 1963



PHEASANT HARVEST	Oregon	Willamette Basin	
Hunters	84,024	9,600	10.2
Birds killed	374,243	27,600	8
Hunter success	4.5	2.9	
FOREST GROUSE	**Oregon**	**Willamette Basin**	
Hunters	13,944	3,480	25
Birds killed	34,553	5,490	16
Hunter success	2.5	1.8	
DOVE HARVEST	**Oregon**	**Willamette Basin**	
Hunters	184,030	25,000	
Birds killed	16,542	1,650	
Hunter success	11.1	15.1	
PIGEON HARVEST	**Oregon**	**Willamette Basin**	
Hunters	11,997	4,800	
Birds killed	90,505	37,900	
Hunter success	7.5	7.9	

Figure 2

Oregon State Game Commission.

3. Wildlife Population Control Factors

a. Food and Cover

(1) Habitat quality is the relationship between wildlife, food, cover, and water. Many streams provide ample supplies of water on the forest lands. Old-growth stands of Douglas fir shade the ground to such an extent that only slow growing, [redacted] plants such as sword-fern, Oregon grape, salal, and fine maple provide the understory.

Timber harvest opens the forest floor to an invasion and accelerated growth of weeds, browse, and shrubs, providing abundant supplies of food for game birds and animals. Some of the herbs found on recently logged land are blackberry, fireweed, twinflower, willow weed, swordfern, brackenfern, deerfern, oxalis, pearleverlasting, groundsel, peavine, deervetch, penstemon, lupine, grass, bleeding heart, and bunchberry dogwood.

Brush invaders are vine maple, rhododendron, snowbrush ceanothus, whitebark raspberry, elderberry, Oregon grape, thimbleberry, salmonberry, salal, huckleberry, chinquapin, dogwood, yew, ribes, bitter cherry, wild rose, and snowberry.

Bigleaf maple, red alder, and Oregon ash are hardwood tree species which sprout profusely when cut and provide forage for big game.

Reproduction is different in the Cascades than in the Coast Range. In the Cascades [redacted], blackberry, woodland groundsel, fireweed, twinflower, and modest whipplea were the main invaders appearing in the second and third years after harvest. In the 5th season after logging brush covers about 20% of the unburned areas and 10% of the burned harvest area. Vine maple and rhododendron grow more densely on the unburned ground while snowbrush ceanothus comes in more densely on the burned portion. Herb foliage covers about the same proportion of area on burned and unburned ground.

In the Coastal area swordfern ground cover predominates after timber harvest, appearing in greater density on unburned ground. Brush cover comes back more densely here than in the Cascades, providing 28% of the ground cover in the fourth growing season 1/ on unburned land compared to only 19% on burned areas. However, there is little difference in density of herbaceous plant cover on burned and unburned forest lands in the Coast Range, being 45% density on burned land and 40% on unburned.

1/ "Influence of Flash Burning on Regeneration, Other Plant Cover, and Fire Hazard in the Douglas Fir Region" Wm. G. Morris, Research Paper #29, 1958, U.S.F.S. Forest and Range Experiment Station.

During the first few years after a slash fire, herbaceous plants appear unable to grow on large patches of severely burned soil. In contrast they quickly cover adjacent areas moderately or lightly burned. 1/

BLM sustained yield timber management programs continually open up areas of dense forest canopy, permitting browse and shrub growth for deer and elk forage. The present balanced forest cutting practice results in approximately equal acreages clear cut each year, maintaining a fairly stable big game population. A larger game population could be achieved either by harvesting a larger acreage of timber or by special plantings of grass, legumes, and browse on cutover lands. However, a balanced timber harvest is needed to maintain the wood fiber based economy of the area. Because of a limited forest acreage base, increasing the forest cut now would result in a decreased area available to cut in future years, resulting in a reduction in big game at that time. Reseeding to browse or grass prevents germination and growth of new tree cover needed for future timber crops. ~~Hunter pressure in the basin does not warrant the costly sacrifice of future timber crops for increase of big game numbers~~. However legumes can be seeded to provide soil protection since they provide big game forage while giving minimal competition to forest tree regeneration.

(2) Food supply and quality can be improved either by habitat management or reduction of game population through increased hunting. BLM's timber harvest program improves habitat, and access road construction permits better hunter access and use of the BLM lands.

(3) Cover is needed by wildlife for protection from weather, predators, and hunters. Lack of sufficient food and cover results in concentrations of animals and birds and accelerates transmission of disease and parasites and results in starvation in winters of heavy snow fall.

b. Water as Related to Game Population

(1) Quantity. Water quantity becomes a problem in wildlife management when normal forage areas are inundated by reservoirs or where reservoir levels are subject to major fluctuations. BLM impact reports should point out such problems where recognizable.

(2) Quality - Water pollution from insect and weed sprays can cause losses to wildlife through their toxic effect or indirectly by degrading habitat and food supply. Caution is needed in use of insecticides and herbicides on BLM lands near streams.

1/ Influence of Slash Burning on Regeneration, Other Plant Cover, and Fire Hazard in the Douglas Fir Region", Wm. G. Morris, Research Paper #29, 1958, U.S.F.S. Forest and Range Experiment Station.

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4. Fisheries

a. Coast Fork Subbasin

Steelhead trout are found in the Coast Fork Willamette River south to Cottage Grove Reservoir where the dam precludes fish passage. They are in Row River as far as Dorena Reservoir where migration is blocked. Coho salmon are found in the lower portion of the Coast Fork and in Row River up to Dorena Dam. Both steelhead and coho make use of Mosby Creek.

Spawning gravels are scarce in many of the streams of the Coast Fork Subbasin. Mosby Creek is the only stream in the subbasin having a high percentage of spawning gravels. Summer stream discharges are relatively low and temperatures high. Stream siltation and debris jamming results from improper logging. Siltation has long term adverse effects by sealing the spawning gravels. For this reason silt deposits entering streams at any time of the year destroy the fish habitat.

A total of 29,300 acres BLM land front on 81.75 miles of the streams of this subbasin, 8% of the 1,000 miles of streams found here. Streams of most importance to fish are the Coast Fork Willamette, Row River, and Mosby Creek. A fairly large acreage of BLM land is found on the upper tributaries of the Coast Fork. Although there is only one mile of BLM land frontage on Row River, a substantial acreage is also found on its tributaries. There is 4.75 miles BLM frontage on Mosby Creek including that on the Middle Fork and East Fork. To help protect the fishery resource of this subbasin, BLM should take special construction and management measures in road building and timber harvest to prevent siltation of these streams and remove debris from stream channels. The major drainages should be examined for existing debris jams on BLM lands. BLM experience finds stream clearing operations have cost an average of $3,000 per mile. Clearance of the BLM lands on Mosby Creek may cost as much as $15,000, if such work is found to be needed. It is important that streamside trees be left to help reduce high summer water temperatures.

b. Middle Fork Subbasin

Eighty percent of the river drainage of this subbasin is closed to salmonoids by existing dams. Thus, the protection and improvement of the remaining open streams takes on special significance. Debris jams block several tributary streams. The principal anadromous fish streams are Fall Creek, Little Fall Creek, Wineberry, Lost Creek, Guiley Creek, and Middle Fork Willamette. BLM has 1,320 acres with 3.25 miles of frontage on Fall Creek and its tributaries. It has 1,200 acres with 2.5 miles frontage on Lost Creek, 640 acres with two miles frontage on Guiley Creek, and extensive acreages on other tributaries to the Middle Fork Willamette.

Because this is one of the more important subbasins for anadromous fish, special management considerations by BLM are warranted. Priority should be given to removal of existing debris jams where they occur on BLM lands on Fall Creek and its tributaries, Lost Creek, and Guiley Creek.

Gross yarding on the upper drainages of these streams is recommended to preclude further channel debris problems. Special attention should be given in road building and logging to keep sediment out of these streams. Trees for shading the water should be left to help reduce high summer water temperatures. BLM water management responsibilities are pinpointed by its ownership of 9,160 acres stream frontage land and 21-3/4 miles stream frontage in this subbasin.

c. McKenzie Subbasin

The McKenzie River is the most important stream in the Willamette Basin for fish life. It provides spawning area for about 50% of the spring Chinook run above Oregon City. Principal spawning streams in order of importance are: McKenzie River main stem, South Fork, Horse Creek, Lost Creek, Gate Creek, Mohawk River, Mill Creek, Camp Creek, Shotgun Creek, Cash Creek, McGowan Creek, Parsons Creek, South Fork Mohawk, North Fork Mohawk, Ritchie Creek, Holden Creek, and Cartwright Creek.

Upstream logging and road building result in sedimentation and high turbidity of these waters, damaging the fishery resource and making the water unattractive for angling and other recreational use. Substantial amounts of spawning and rearing habitat have been eliminated by dam construction and inundation of spawning areas. The utmost protection of the remaining fishery resource is warranted.

BLM management responsibilities on these important fish streams are indicated by the following table:

Table Fish and Wildlife - 1

Stream	Acres BLM Land On Stream	Miles BLM Stream Frontage
McKenzie River	800	4.5
Gate Creek	200	0.75
Mill Creek	60	0.5
Camp Creek	560	1.25
Shotgun Creek	2,880	3.5
Cash Creek	1,440	3.75
McGowan Creek	1,120	2.25
Parsons Creek	640	1.0
Ritchie Creek	160	0.5
Cartwright Creek	240	1.0
Total	8,100	19.00

From this can be seen that a BLM stream channel clearance project in this subbasin could cost $57,000 for just the critical streams. With a total of 23,780 acres of BLM land on the streams of the subbasin and 56.00 miles frontage, BLM is found to have a major opportunity for watershed management in this subbasin.

d. Long Tom Subbasin

No anadromous fish are produced in this subbasin due to low summer water flows and high temperatures. Both trout and warm water fish are produced. The habitat is best suited for warm water species. Although BLM has 10,000 acres of land on the streams of this subbasin with 23-1/4 miles of frontage, fishery management opportunities are pretty much limited to protection of the water from siltation and protection of tree growth on the streams to provide shade for enhancement of trout habitat.

e. Santiam Subbasin

The Santiam Subbasin is one of the more important areas for production of anadromous fish in the Willamette Basin. The more important spawning drainages are the Calapooia River, North Fork Santiam River, the Little North Fork Santiam River, Sodom Ditch, Courtney Creek, Brush Creek, South Fork Santiam River, Middle Santiam, Wiley Creek, Crabtree Creek, Quartzville Creek, Thomas Creek, Cedar Creek, Elkhorn, Evans, Sinker, Little Sinker, Mad, Rock, Stout, Ames, Canyon, Owl, South Fork Crabtree, Hamilton, Scott, McDowell, Bear, Pyramid, Canal, Rumbaugh, Whitcomb, Tally, Moose, Soda, Jordan, Neal, Burmester, and Little Wiley Creeks. These represent 197.7 miles good spawning area and 204.5 miles fair spawning area.

BLM land ownership on these streams is as follows:

Stream	Acres BLM Land On Stream	Miles BLM Frontage
Calapooia River	80	0.5
North Fork Santiam	240	0.75
Little North Fork Santiam	1,480	3.25
Middle Santiam	200	0.5
South Santiam	-	-
Thomas Creek	680	2.5
Courtney Creek	640	1.0
Brush Creek	160	0.5
Crabtree	2,600	4.25
Quartzville	2,840	6.75
South Fork Thomas	80	0.5
Elkhorn	920	2.5
Evans	520	1.25
Sinker	120	0.5
Little Sinker	320	1.0
Mad Creek	80	0.5
Rock Creek	880	1.75
Canyon Creek	.400	1.5
South Fork Crabtree	160	0.25

Continued

Stream	Acres BLM Land on Stream	Miles BLM Frontage
Hamilton	360	1.25
Scott incl. South Fork	1,240	3.25
Canal Creek	1,560	2.5
Whitcomb	1,600	2.0
Moose	520	1.5
Soda	320	1.0
Neal	1,280	2.0
Burmester	480	1.0
Total	19,760	44.25

This shows that BLM has primary management responsibility on 15% of the important spawning streams of this subbasin. Total fishery management opportunities are much greater than this in view of 43,120 acres of BLM lands with 102 miles stream frontage in the subbasin. Major considerations are removal of debris drifts in the stream channels, gross yarding to keep debris out of the channels, and prevention of stream siltation for protection of the trout and other sport fish found here.

f. Coast Range Subbasin

Warm, low summer streamflows in this subbasin limit production of salmonoids in most streams. Coho salmon and winter steelhead spawn in the following streams listed in order of importance: Yamhill River, Luckiamutte River, Rickreall Creek, Marys River, Mill Creek, Willamina Creek, East Fork Willamina, Coast Creek, Greasy Creek, Oak Creek, Oliver Creek, Shotpouch Creek, Turner Creek, Baker Creek, Agency Creek, Deer, Rogue River, Ritner, Clayton, Shethe, Teal, Maxfield, Pedee, North Fork Pedee, South Fork Pedee, Price, Woods, Blakesley, Rock (Muddy), Alder, Mulkey, West Fork Marys River, Woods, Fairchild, Haskins, Panther, Cosper, Gold, Gooseneck, Rock, Cow, Joe Day, Jackass, Rowell, West Fork Salt Creek, Burton, and Canada Creeks. These add up to 362.5 miles of fair spawning area.

Extent of BLM land ownership on these streams is as follows:

Stream	Acres BLM Land On Stream	Miles BLM Stream Frontage
North Fork Yamhill River	400	1.25
Luckiamutte River	160	0.5
Little Luckiamutte	40	0.25
Rickreall Creek	1,160	3.25
Mill Creek	880	3.25
Willamina	2,040	4.25
East Fórk Willamina	160	0.5
Coast Creek	1,320	2.25
Greasy Creek	640	1.0
Oliver Creek	1,280	2.25
Shotpouch	320	0.75

Continued

Stream	Acres BLM Land on Stream	Miles BLM Stream Frontage
Turner Creek	400	0.75
Baker Creek	720	2.0
Agency Creek	1,320	2.25
Deer Creek	40	0.25
Ritner Creek	160	0.5
Clayton Creek	80	0.25
Teal	120	0.5
Maxfield	480	0.5
North Fork Pedee	480	0.75
South Fork Pedee	640	1.0
Fairchild	1,000	2.0
Panther	320	1.0
Cosper	920	1.25
Gold	240	0.5
Gooseneck	960	1.5
Rowell	800	1.5
Total	17,080	36.0

BLM has 17,080 acres with 36 miles frontage on important fishery streams in this subbasin. This is over half the 28,840 acres BLM land with 66 miles stream frontage found here. The additional streams are important for trout and warm water fisheries where year around flow exists. Due to the large acreage BLM lands on streams here, BLM has major responsibility for keeping them free of silt and forest debris. BLM manages 10% of the mileage of streams found valuable for spawning.

g. Pudding Subbasin

fall Fall Chinook

Anadromous fish spawning in this subbasin are mostly the Coho salmon, a smaller number of spring Chinook, and some steelhead. Spawning gravel is plentiful in much of the Molalla River system, entire length Mill Creek, and most of the tributaries of Pudding River, though not in Pudding River main stem. The streams are listed in the order of their fishery importance: Molalla River, North Fork Molalla, Milk Creek, Abiqua Creek, Table Rock Fork, Butte Creek, Silver Creek, Drift, Canyon, Nate, Woodcock, Copper, Gravley, Jackson, Dead Horse Canyon, Mill, Lukens, Powers, Avalanche, Bull, Dickey, Copperhead, Hay Barn Creek, Cougar, Scorpion, Trout, Davis, Little Abiqua, West Fork Drift Creek, North Fork Silver, and South Fork Silver Creek.

Extent of BLM land ownership on these streams is as follows:

Stream	Acres BLM Land on Stream	Miles BLM Stream Frontage
Molalla River	1,440	5.0
North Fork Molalla	520	1.5
Abiqua Creek	920	2.25
Table Rock Creek	960	4.0
Butte Creek	520	2.25
Silver Creek	200	0.75
Drift Creek	40	0.25
Canyon Creek	40	0.25
Nate Creek	320	1.5
Gawley	40	0.25
Jackson	40	0.25
Dead Horse Canyon	960	3.0
Mill Creek	240	1.25
Lukens	1,920	5.0
Avalanche	640	0.75
Bull	640	1.0
Hay Barn	640	1.0
Cougar	160	0.5
Scorpion	640	1.25
Little Abiqua	40	0.25
West Fork Drift Creek	40	0.25
Total	10,960	32.50

The 32.5 miles of spawning stream frontage on BLM lands equals 16% of the total in the subbasin. Care should be taken in the development of recreation sites near spawning grounds because of the disturbance of the water by people. Concentrated recreation use and fish spawning ordinarily are not compatible because of the tendency of the public to throw rocks or otherwise disturb the large fish. In some streams swimmers and scuba divers have caused problems with Spring Chinook resting in the larger pools for September spawning. On the other hand fish spawning could be a natural phenomena recreation attraction. While there may be opportunities for designation as a recreation attraction, certain spawning areas on [redacted] some [redacted] large rivers, there may also be the necessity to fence from public disturbance spawning areas on smaller streams such as Abiqua or Silk Creek. Ordinarily, there is an ample supply of stream front on BLM lands for recreational development without disturbing the fish spawning areas.

Extensive logging in the upper Molalla drainage has impaired water quality and contributes to formation of debris jams that block upstream migration of anadromous fish. Considering all the streams of the basin which are valuable for trout or warm water game fish, BLM is responsible for 50.5 miles stream frontage on 18,560 acres land. Log jam clearance may be needed on these lands. This could be costly at an average cost of $3,000 per stream mile as experienced by the State Game Department. Special care must be exercised in road building and logging to keep sediment and debris out of these drainages.

h. Tualatin Subbasin

Low, warm stream flows are a limiting factor in salmon and trout production in this subbasin. On the other hand, it is an excellent fishery for bass and other warm water fish. However, spawning gravel is plentiful in most major tributaries. Coho Salmon are the most widespread of the anadromous fish. Gales Creek is the most important stream for steelhead.

Listed in order of importance are the anadromous fish spawning streams: Gales Creek, West Fork Dairy Creek, Scoggin Creek, East Fork Dairy Creek, McKay Creek, Seine Creek, Tualatin River, Beaver, Clear, Denny, Plenty Water, Witcher, East Fork McKay, Iler, Murtaugh, Williams, Roaring, North Fork Gales, McFee, Baker, Heaton, and Tanner Creeks. A total of 3,480 acres BLM land has 14 miles of frontage on streams in this subbasin. A majority of it has value for salmonoids.

Stream	Acres BLM Land on Streams Valuable for Salmonoids	Miles BLM Stream Frontage on Lands Valuable for Salmonoids
East Fork Dairy Creek	440	1.75
McKay Creek	1,000	3.0
Tualatin River	200	1.25
Denny Creek	200	0.75
Plenty Water Creek	80	0.25
Seine Creek	160	0.50
McFee Creek	80	0.50
Total	2,160	8.00

BLM has substantial holdings on McKay Creek. The watershed is largely on the poorly drained and erodable clay Cascade soils. Severe soil slippage problems will be experienced where road cuts on slopes remove natural bracing and expose subsurface water flows. There are also severe erosion problems in forest areas on East Fork Dairy Creek needing water sediment control measures. Due to the already marginal quality of the waters of the Tualatin Subbasin for trout and anadromous fish, extreme caution is needed in management of the BLM lands to not further reduce fisheries potential by siltation or removal of streamside vegetation. Proximity to major population centers of the basin emphasizes the importance of sports fisheries in this area.

City, County, State and Federal agencies are working to improve the water quality of the Tualatin River, not only for improvement of fish habitat, but also to restore the river's recreation potential and improve the natural beauty and habitat environmental situation. In view of the high public interest potential of the several resources, including fisheries, local agencies are working with Federal people to clean up the river for restoration of its former resource values.

i. Clackamas Subbasin

The Clackamas River and most of its tributaries are valuable for sport fisheries and support heavy runs of salmonoids. About 85% of the watershed is forested, keeping streams well shaded and cool. However, the several high dams on the river have seriously interfered with salmonoid migration and spawning. The streams receive heavy sport fishing pressure from the Portland metropolitan area.

BLM has 4,200 acres of land bordering streams in this basin with 15 miles stream frontage. This is small compared to the 840 stream miles of the basin, but is important in considering the number of recreationists it can accommodate during the year. Because these BLM stream frontages lie within the day use area from Portland, it is important that resource management give priority to maintaining the high quality of these waters for fishery production.

j. Columbia Subbasin

Significant numbers of anadromous fish are produced in Scappoose, Johnson, Milton, and Kellogg Creek drainages. Sucker Creek is also of importance to fish life. Nearly all the BLM land lies on the Scappoose Creek drainage, being 2,480 acres with 8.25 miles frontage. Proximity to Portland makes mandatory protection of the fishery habitat, and the recreation potential of the area.

k. Sandy Subbasin

Although the Sandy River is of great importance for salmonoids and other game fish, other valuable fishing streams are Cedar Creek, Tanner Creek, Horsetail Creek, Bull Run River. Large amounts of glacial silt coming into the Sandy River from Mt. Hood reduce spawning and rearing areas. BLM has 5,440 acres of land fronting these streams with 11½ miles frontage. Nearly all of this is on the Sandy and Little Sandy drainages. In view of the natural silting problems of this river, extreme care is needed to preclude additional silting from logging or road construction. This is one of the most popular recreation areas around Portland, warranting priority in resource management to the fishery, recreation, and natural beauty resources on these lands.

B. BLM Fish and Wildlife Management Program 1965 - 1980

1. General

Projected increased basin populations with more leisure time and a higher spendable income indicate an accelerating demand for the enjoyment of the fish and wildlife resources of the basin. Major forest land uses will continue to be hunting and fishing. There will be increasing enjoyment of wildlife by bird watchers, camera enthusiasts, hikers, and others.

The BLM access road program opens up new areas to hunters which should result in higher game kill ratios. Conversion of old-growth timber stands to a second growth rotation, subject to periodic thinning, should result in more understory browse for wildlife forage. Better ways must be found to protect and maintain BLM unsurfaced access roads and fire trails if they are to serve hunter needs. Use of 4-wheel drive vehicles on dirt roads in wet weather, during deer season especially, tears [redacted] the roads to pieces and results in excessive soil movement into stream flows.

BLM resource managers face the alternatives of blocking off unsurfaced roads to public use or contributing to the water pollution problem of the basin by permitting hunter use in wet weather. Two major problems must be overcome in solving this dilemma.

The biggest problem has been the need for financing of most access roads from timber sale receipts. Management needs for an extensive road system results in the construction of the maximum mileage of road built to the minimum standard fitting the situation. Small timber sales can finance only limited road construction. Although there may be far more recreational use of the road than use in timber management, the timber stumpage must pay the entire cost of the road system. Water, too, is a major product of the forest watershed. Yet no funds have been available to reduce water siltation from road problems for protection of water quality. Roads to be used by hunters ~~, should~~ must be surfaced, both to protect the road itself and to prevent road gullying and stream siltation.

The second problem to overcome is to achieve more flexibility in road maintenance standards. Only limited funds have been available for road maintenance. Under existing road maintenance standards only a portion of the road system receives maintenance every year. In the Eugene District over 25% of the permanent road system has received no maintenance due to lack of funding. No improvement of this situation is reflected in programing for future needs. In 1970 about 275 miles of the district's permanent road system will receive no maintenance in spite of continued use by hunters and recreationists. The district cannot be held accountable for stream siltation problems resulting from lack of road maintenance if funds are not made available to prevent these problems. Neither is the district practicing multiple-use land management if it blocks the public from using these roads for hunting or other recreational use.

2. Recommended BLM Wildlife [redacted] Program 1965 - 1980

a. One of the most important contributions that BLM can provide for fish and wildlife resource management in the basin is to provide road access to hunting and fishing areas. New access roads should be so located as to maximize useability for recreation, including hunting, as well as timber harvest. This is in accord with the BLM Program Outlook Guide, F.Y. 1968-72 which gives emphasis to public access to BLM lands.

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b. Roads not hard surfaced or regularly maintained should be blocked to public use in wet weather to protect both the road and streamflows from accelerated siltation. Closing these roads may result in much adverse publicity.

c. Legumes, browse, and grass should be planted under powerline rights-of-way in suitable areas to both stabilize the soil and provide forage for wildlife. This can be done where it is not practical to plant and harvest Christmas trees.

d. The districts should have a continuing program for wildlife habitat enhancement through planting of legumes and other forage species and fertilization on portions of newly burned or logged areas to act as a buffer zone from the balance of the area being reforested. One objective is to provide palatable forage in March and April during the period that big game are attracted to tree seedlings. Wedgeleaf Ceanothus is one shrub with good potential for browse planting. Grass and legume plantings for streambank, roadbank, and skid trail stabilization are also beneficial to wildlife habitat.

e. Further study is needed to evaluate the desirability of additional new plantings of Roosevelt elk, or [redacted] exotic game animals, on BLM lands.

f. Watershed protection and erosion control measures must be programed in connection with resource use activities to protect the on-site productivity of the land for continued multiple resource use, thereby meeting the first priority for programing as set forth in the BLM Program Outlook Guide, BLM Manual 1603.

g. An accelerated program for posting the boundaries of BLM lands is needed, especially on roads, to make it easier for hunters and other recreationists to find lands open to public use. This involves locating and posting about 800 separate tracts at an estimated annual cost of $10,000, until all the land is posted.

h. Wildlife Management specialists are needed in the district offices to develop positive programs for wildlife and fisheries habitat management.

3. Recommended BLM Fishery Habitat Management Program 1965 - 1980

a. General

~~a.~~ (1) Important spawning gravels on streams crossing BLM lands must be located and identified and designated for special protection from other resource use including logging and recreation. The economic value of spawning gravels in Willamette Basin watersheds for anadromous fish production has been shown to be $9,263 per acre per year. 1/

(2) ~~b.~~ To prevent siltation of spawning gravels, logging controls must be enforced to prevent yarding down or across streams and locate to ~~of~~ yarding settings away from streams.

1/ "Economic Value of Anadromous Fish Waters on National Forest Lands" M.H. Naggiar, Oregon Fish Commission, 1966.

(3) ~~c~~. In the Eugene District special care in resource management is needed on Mosby Creek since it is the only stream in the Coast Fork Subbasin with a high percentage of spawning gravels. In the Middle Fork Willamette drainage special watershed protective measures are warranted for protection of fishery values in Fall Creek, Lost Creek, and Guiley Creek.

(4) ~~d~~. Log jam and debris removal to permit fish passage is warranted on all BLM lands where such blockage occurs.

(5) ~~e~~. In the Salem District there is opportunity for small lake developments on BLM lands west of the Willamette River to help distribute fishing pressure, as well as reduce winter runoff, and as a source of water for forest fire control.

(6) ~~f~~. Stream bank maintenance is required to prevent bank cutting and deposition of soil into the streams.

(7) ~~g~~. BLM road location and construction, including culvert placement, should be coordinated with the State fish and game agencies. There should be no sidecasting of dirt into streams in road construction.

(8) ~~h~~. Gravel mining must be precluded in fishery spawning areas by appropriate withdrawal action of this high value land.

(9) ~~i~~. Streamside habitat must be preserved and enhanced.

(10) ~~j~~. Significant amounts of stream clearance have been done on the following streams by the State: (1) Mohawk River and tributaries, (2) North Yamhill River and tributaries, (3) Wiley Creek, (4) Clear Creek, (5) Abernathy Creek, (6) Calapooya River, (7) Molalla River and tributaries. BLM should cooperate to the extent these streams cross BLM lands.

(11) ~~k~~. Identify and classify as unsuitable for disposal any key or critical portions of game ranges and choice fish habitat areas.

(12) ~~l~~. In view of a sustained stream debris problem on the Molalla, the Little North Santiam, and Calapooya Rivers, BLM should make requirements in timber sale contracts on these watersheds for yarding of all debris away from water drainages.

(13) ~~m~~. There are opportunities for stream improvement for fish spawning, rearing, and travel by placement of structures such as sill logs for water baffles to create pools at certain spots in the following streams:

(1) Tributaries of the Upper Calapooya River
(2) Smaller tributaries Upper Clackamas River
(3) Smaller McKenzie tributaries
(4) Upper Mohawk River
(5) Smaller Middle Santiam tributaries
(6) Upper Wiley Creek
(7) Little Wiley Creek
(8) Small Upper Molalla tributaries

(14) ~~a~~. In accord with BLM's Program Outlook Guide for FY 1968-1972 giving first priority to conservation of existing resource potentials, all erosion control precautions [1] should be followed in new road construction, road maintenance, and in timber harvest operations for protection of the fishery habitat and spawning areas.

(15) ~~b~~. Important fishery streams should be examined to determine opportunity on BLM lands for removal of natural obstacles to fish passage such as the falls at Mile 12 on Willamina Creek.

(16) ~~c~~. Other watershed protective measures needing consideration in management programs are listed as follows:

(1) Log only one side of a stream at a time where water water quality is important
(2) Keep clearcut units small in size when logging adjacent to streams.
(3) Use selective cutting on suitable ground in delicate or unstable areas.
(4) Limit yarding road grades in erodable or unstable areas.
(5) Waterbar and seed truck and yarding roads after use and block where appropriate.
(6) Adequately cross drain all roads.
(7) Prevent culvert discharge on fill slopes.
(8) Restrict tractor yarding and skid road construction during the wet season.

(17) ~~d~~. Construction of spawning channels in streams that have limited spawning area is needed on the following streams:

(1) Upper Thomas Creek
(2) Upper Crabtree Creek
(3) Table Rock Fork of the Molalla River
(4) Little Luckiamutte if passage is achieved at falls
(5) Upper Clackamas River
(6) Upper Mohawk River
(7) Upper Silver Creek below falls

Spawning channel construction is expensive. Average cost is $5 per square foot, and the requirement for a pair of salmon is 100 square feet. Construction of a channel to handle 100 pair of fish would come to $50,000. A sediment settling basin should be provided above the channel to prevent siltation of the gravels. Benefits are high in proportion to the investment. An example is the 4½-mile spawning area in Battle Creek, California which supports an annual run of 12,000 Fall Chinook. Value of fish production from the 10 acres is $173,000 per year. Capitalized at 5%, this gives a land value of nearly $3,500,000, or $350,000 per acre. This type of work fits into BLM's long-term programing to be implemented at a time when increased population pressures require more food production, or recreation demand for better fishing must be satisfied.

1/ "Trends In Economics of Wildlife Management" N. B. Livermore, Jr., Natural Resources Agency, State of Calif.

b. Recommendations by Subbasin

Other than for stream channel improvement projects, very little work has been programed on BLM lands in the basin specifically for wildlife enhancement. Increasing demand by sportsmen for this type of use will require more attention by BLM to satisfying this need. Currently, Fish and Wildlife Management in BLM is not set up as a separate section. Neither does it have the advantage of funds specifically made available for this type of work other than as programed in the district in conjunction with forest management programs. This situation will have to be remedied before a strong fish and wildlife management program can emerge. Specific needed projects are as follows:

Coast Range Subbasin

1. Stream clearance is needed on the part of Agency-Yoncolla Creeks in T. 5 S., R. 8 W., plus debris removal on five miles of these streams. Estimated cost is $15,000.

2. Stream clearance is needed on Fairchild Creek in sec. 13, T. 2 S., R. 6 W. and remove a large log jam at a cost of $15,000.

3. Plan for a small water impoundment on Upper Kutch Creek in sec. 2, T. 3 S., R. 6 W. at cost of $2,000. Benefits would be fish and wildlife habitat improvement, recreational use, plus providing a water storage site for fire control.

4. Stream clearance, lake clearance, and water impoundment at a cost of $3,000 is needed to improve fish and wildlife habitat at Clear Lake.

5. Stream improvement with fish ladders over the falls is needed on Agency Creek in sections 9 and 16, T. 5 S., R. 8 W. at a cost of $5,000 to permit fish passage.

Clackamas Subbasin

1. Road access is needed to Joyce Lake in sec. 19, T. 7 S., R. 5 E. to permit public use. One-quarter mile new road is needed at cost of $5,000.

2. Stream clearance and water impoundment is needed at Williams Lake in sec. 26, T. 5 S., R. 4 E. at estimated cost of $10,000.

3. Stream clearance, lake clearance, and water impoundment at Helen's Lake in sec. 36, T. 5 S., R. 4 E. at a cost of $4,000 will provide 200+ man days' use per season.

McKenzie Subbasin

1. Long range plan is for a dam on Crooked Creek 30 feet high and 200 feet long in sec. 24, T. 15 S., R. 2 W., covering 10-15 acres for trout habitat, swimming, and fire protection water, cost $100,000.

2. Construct a number of small headwater impoundments, a series of step pools of a fraction acre to several acres in size, to increase stream rearing areas for trout and also provide water supply for fire protection. About 16 miles of small yearlong streams can be improved in this manner at cost of about $400 per pool for 500 pools.

3. Construct three boat ramps on McKenzie River in following locations: sec. 31, T. 16 S., R. 3 E.; sec. 34, T. 16 S., R. 2 E.; sec. 35, T. 16 S., R. 2 E., W.M., at a cost of $1,500 each.

4. Maintain and clean trash racks to remove debris at cost of $2,000 per year.

Middle Fork Subbasin

Construct boat ramp on Fall Creek reservoir in sec. 31, T. 18 S., R. 1 E., W.M., at cost of $1,500.

Coast Fork Subbasin

Grass seeding of 200 acres abandoned roads and spurs to provide big game forage at cost of $86.

C. General Basinwide programs needed on BLM lands [redacted]:

1. Annual stream clearance, debris removal at $16,000 per year.

2. Classification, posting, and protection of fish spawning grounds - a 3-year program @ $20,000 per year.

3. Stream improvement of flood-gutted streams - boulder emplacements, baffles, etc. at cost of $12,000 per year.

4. Construct access roads to lakes and streams on BLM roads and to open areas to hunters five miles per year @ $15,000 per mile equals $75,000.

5. A survey of BLM lands is needed to investigate and determine location of sites for construction of fishing lakes which will also provide water storage for fire control. Possibilities of land exchanges to acquire such sites on private land is an integral part of such a survey. Estimated cost $14,000.

6. Construction of artificial spawning grounds where BLM lands offer good opportunities for such development are in the long range planning picture. Probably not more than one per year would be built at an estimated cost of $50,000 each.

7. Post BLM lands to inform hunters, anglers, and recreationists which lands are open for their use, cost $10,000 per year.

C. Fish and Wildlife Management 1980 - 2020

1. General

The long term view of fish and wildlife management in the basin reflects a diminishing land base for meeting ever increasing demands of an expanding population. More and more of the agricultural lands will be directed to other uses or posted against public use. Forest lands will have to satisfy a much greater proportion of public use demands. Forest management road systems will be completed during this period, opening up much new country to the sportsmen. The result will be heavy public use of these roads. Severe road damage and stream siltation may be expected as hunters churn up soft roads with their 4-wheel drive campers or vehicle pulling trailers during deer season. Public agencies will be condemned for not keeping the roads in passable condition and will be damned if access to these roads is blocked.

During this period nearly all the forest lands will have been converted to a second growth management program, subject to periodic thinnings to accelerate tree growth and shorten the cutting cycle rotation. The forest lands will be more open and will provide much better wildlife habitat than is found on the old growth forests on the public lands today. For this reason popularity of hunting in the western Oregon forest areas will increase over what it has been in the past. Resource Managers will face a much bigger problem in protecting the timber from fire and other damage from the increasing public use.

2. Recommended BLM Fish and Wildlife Programs 1980 - 2020

a. The two most important services BLM can perform will be to provide good fish and wildlife habitat and provide adequate roads and trails to make use of these resources.

b. BLM should consider construction of small fishing impoundments to 100 acres in size in suitable areas useful also as source of water for forest fire control.

c. BLM should program for fishery habitat improvement by placement of sill logs or gabions on streams important for spawning, rearing, and transportation of anadromous fish. The need is most urgent on the following streams:

(1) Tributaries of the Upper Calapooya River
(2) Smaller tributaries Upper Clackamas River
(3) Smaller McKenzie tributaries
(4) Upper Mohawk River
(5) Smaller Middle Santiam tributaries
(6) Upper Wiley Creek
(7) Little Wiley Creek
(8) Small Upper Molalla tributaries

d. Special measures in logging should be taken to keep debris from washing into the following fishery streams where significant amounts of stream clearance has been done.

(1) Mohawk River and tributaries
(2) North Yamhill River and tributaries
(3) Wiley Creek
(4) Clear Creek
(5) Abernathy Creek
(6) Calapooya River
(7) Molalla River and tributaries

XV. BLM Resource Management Responsibilities and Relationships

A. Lands

1. General

Many vital land uses must be provided in the Willamette Basin to meet projected burgeoning population growth. A land use plan sets out the goals, principles, and guidelines for a better use of land and resources in its treatment and its management. There is need for better correlation and harmonization of land uses and patterns among lands of various ownerships. Counties must take the lead in land use zoning. Federal agencies should relate their land classification actions to the county program. Cooperation with local Soil Conservation Service Districts is needed to correlate BLM programs with those on private lands.

Basic considerations in land classification follow:

a. Protect land, water, open space, and related resources for continued use in the future.

b. Enhance resource values such as recreation and fish and wildlife.

c. Provide a high degree of service at minimum cost in the several functional land use fields and maximize net benefits.

d. Provide for full development of the potential represented by sites, water resource, and other resources in demand.

e. Control rate of development so as to meet current and future demands.

f. Take steps to assure the highest practicable degree of local acceptance.

g. Assure an adequate supply of good quality water throughout the year. A significant amount of development is often required to assure enhancement of "related" land resources. Land and capital must be economized and investments placed where they will be put to their highest use.

h. Investments in water developments may lead to intensive summer home development where open space would otherwise provide optimum public benefits.

2. BLM Lands

There are 422,767 acres of BLM land in the Willamette Basin Study area. Approximately 6000 acres of this is noncommercial forest land.

The balance is extremely valuable predominantly Douglas fir forest land. Good site timber producing lands has ready salability at high prices due both to the rapid tree growth rate in this area and the need by the timber companies to become self sustaining in timber production. Forest lands from which timber has been cut sell from $60 and up per acre for timber production. Stumpage value of one tree may be as much as $300. The stumpage on an acre of forest land may bring $6,000 or more.[21/] The average value of the BLM forest lands in Oregon has been estimated at $460[22/] per acre, reflecting the lower values of eastern Oregon timber. Even at this modest appraisal the BLM lands in the basin would have a value of at least $224,472,820. Benefits to local communities are many times this from the payrolls and money brought from timber harvest and manufacture. The high value of the BLM lands for timber production must be considered in relation to alternative uses such as recreation or livestock grazing.

Mature timber stands in the Siuslaw Unit of the Eugene District average 54 M.bd.ft. per acre. At $40 per M. this gives a resource value of over $2,000 per acre. Forest lands stocked with pole size timber are found to have a market value of $500 per acre.

The BLM lands lie in the principal forest zone of the basin where site conditions for Douglas fir growth are optimum. This area extends from the lower foothills to 4000' elevation. In this zone is produced the bulk of the basin's woodcrops. A major portion of this area is in private ownership.

The National Forest lands lie mostly in the upper slope. About 80% of the National Forest land is forested with the true firs and Mt. Hemlock which are in less demand than Douglas fir. Much of the area is nonforested. Although soil moisture is high, the elevation results in a shorter growing season.

3. Land Tenure

With triple the population in the basin by year 2020, competing demands for all types of land will become severe. The problem is to anticipate and program for meeting these demands. Lands must be available and used to permit and encourage growth of the economy for support of the increased population commensurate with the economy of the nation as a whole. Recognition must be given to the varied productive capacities of land acres in the basin for meeting these needs. One objective is to achieve an orderly transition in use of the BLM lands for meeting the needs of an expanding population such as increasing demands for high quality water, recreation and wildlife demands, and increased production of wood fibre. Concurrently the natural beauty must be protected.

21/ "How Much Douglas Fir Will Grow on an Acre?" Jour. Forestry, Vol. 56, No. 10, Oct. 1958.

22/ "Public Land Statistics 1965" BLM U.S.D.I.

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1/ "How Much Douglas Fir Will Grow on an Acre?" Jour. Forestry, Vol. 56, No. 10, Oct. 1958.

2/ "Public Land Statistics 1965" BLM U.S.D.I.

There are only about 19,000 acres of unappropriated Public Domain land in the basin. This is removed from entry under the public land laws by Bureau motion withdrawal application, Oregon 012693 dated July 17, 1962. Of this, 3240 acres are in the Eugene district and 16,000 acres are in the Salem District. Major land classification activity will be in the Salem District due to the greater acreage and because of proximity of these lands to the Portland metropolitan area.

The revested Oregon and California grant lands administered by BLM comprise the major land management responsibilities of both the Salem and Eugene districts. Classification of these lands as timber lands removed them from entry under the public land laws and retention in public ownership appears imminent. Although they are subject to entry under the mining laws, there is little locatable mineral of consequence in the Willamette Basin.

Increasing municipal water needs may restrict intensity of resource use on certain areas. Ordinarily highest priority is given to water production where needed for public use. Experience has shown that multiple use resource management can be continued on municipal watersheds. Current importance of BLM lands in the basin for municipal water supply is shown in the following table. By virtue of carefully controlled timber harvest from these BLM watershed lands, multiple use management has been possible without damage to the water.

Municipal Water Supplies Dependent on BLM Lands

City	Population	Water Source	Acres BLM Land on Watershed	Miles Frontage BLM Land on Stream
Eugene-Springfield	50,000	McKenzie R.	800	4.5
Oregon City-West Linn	20,000	So.Fk.Clackamas	3,000	1.5
Corvallis-Philomath	24,000	Rock Cr.	40	---
Dallas	5,100	Rickreall Cr.	1,280	4.0
Yamhill	400	Turner Cr.	400	0.75
Hillsboro	8,200	Scoggins Cr.	320	1.0
McMinnville	8,300	Haskins Cr.	280	---
Carlton	1,000	Panther Cr.	320	1.0
Willamina	1,300	Willamina Cr.	2,200	4.75
Canby	1,300	Molalla R.	1,440	5.0
Silverton	4,100	Abiqua Cr.	960	2.5
Scappoose	1,250	So. Scappoose Cr.	160	0.5
Corbett	1,400	Gordon Cr.	960	3.0
Vaughn	500	Hardy Cr.	160	1.0
Total	126,850		12,320	29.50

The O&C lands are subject to application for rights of way for public highways. States may file applications to acquire use of these lands for primary or secondary Federal aid highways or for material sites needed for such construction. BLM has the responsibility for determining whether or not the right of way may be granted with stipulations needed to protect the interests of the United States. Natural beauty considerations are now of major importance. In its application the state should show its proposed landscaping plan or natural beauty program on the entire highway which may cross many ownerships. Under current BLM manpower limitations about all BLM can do in this regard is to add a stipulation to the easement requiring road beautification to be in accord with Bureau of Public Roads standards and guidelines.

Due to the relatively large acreage of BLM lands on major streams and roads, classification of all such land as scenic strips would have an adverse impact on BLM timber harvest programs. But, the many public roads crossing BLM lands indicate need for review leading to increasing the existing scenic strip acreages.

Flood control water storage reservoirs being built on major Willamette River tributaries take large acreages out of timber production. The 13 existing Corps of Engineers reservoirs in the basin cover 34,273 acres of forest land. The 87 proposed dam sites now being studied in the basin may result in reservoir construction covering comparable acreages. Resource management programs must make allowance for loss of this timber producing potential while acknowledging increased recreation opportunities.

High voltage electric power transmission lines require 300 foot wide clear cuts through the forest plus the cutting of danger trees beyond the right of way limits. About 20,000 acres of agricultural and forest lands have been converted to this use in the basin. The Forest Service estimates that 4,500 acres of National Forest lands in the basin are in this category. Statistics are not available to show such acreage on BLM lands but no doubt the acreage would be smaller than on the National Forest. The Forest Service estimates that power line right of way occupancy of the forest area results in a loss of timber production of 7-10 million board feet timber per year. The power lines also have an adverse impact on the natural beauty of an area. Increased demands for electric power results in a forecast for needs doubling this acreage for future power line construction during the next 15-20 years.23/ Thermal power electric plants must be located where large amounts of water are available and will require tie-in with hydro-plants to supplement the peaking power capacities of the latter. As more intensive uses make the valley lands more valuable, the tendency to put power lines on forest areas will increase.

23/ "Appendix J, Willamette Basin Study" Willamette Basin Interagency Task Force, 1969

Other public land laws applicable to the O&C revested lands are permits for grazing domestic livestock; special land use permits for limited types of use; leases, permits, and licenses for recreational use; permits for private logging roads and microwave transmission sites; and sales of homesites to residential occupants of unpatented mining claims. The O&C lands are subject to mining location and patent subject to restrictions on use and ownership of the timber growing thereon. Except for the ferruginous bauxite and the Kaolin-laterite clay zones in Washington and Columbia Counties, there is relatively little mineralization on the public lands in the Basin. Occupancy of unpatented mining claims on BLM lands in the basin is practically non-existent so activity under the Mining Occupancy Act (Johnson-Church) of October 23, 1962 (76 Stat. 1127) should be nil.

Recreational use is expected to become one of the greatest competitors for timber lands in the basin. Leases, permits, and licenses for recreational use of O&C lands may be granted under several types of application, but for the most part the BLM lands having high recreational potential will be developed by BLM. Future recreational and natural beauty demands may require changes from clear cut timber harvests to selective cut harvests on extensive areas of O&C lands.

4. Action Program

a. Land Classification

The Classification and Multiple Use Act (78 Stat. 986), although not directly applicable to O&C lands, provides for classification of the public lands into areas for retention for public management and those suitable for disposal. This requires a comprehensive inventory of resource and land use information, analysis of individual resource current production, use, condition, and trend, and identification of opportunities to increase production and use or improve conditions through management or treatment.

Generally the O&C lands fit the Type II category of a fragmented land pattern under 50% ownership. Management effort is towards consolidations of land ownership by exchange or developing working agreements with intermingled landowners to build a base for better management. Identification will be made of those lands classified for retention and those suitable for disposal by exchange or other means so as to provide the maximum benefit to the general public. In considering economic demand and social need for land, all viewpoints - national, regional, state, and local must be fully considered. The public lands must do their share toward meeting anticipated future national needs for resources and products. Timber for wood and paper produced from these lands is a major factor in meeting national demands for this type of material.

Proposals have been made to launch a massive exchange program in the O&C areas of western Oregon for the purpose of blocking the O&C forest lands into compact management units. Studies indicate that an exchange program for blocking all the O&C lands into solid units is impractical. Manpower costs for timber cruises and appraisals of both the selected and offered properties,

appraisals of roads and other improvements, and preparation of reports and other paperwork adds up to staggering costs. The 1963 estimated cost of $30 per acre for processing forest land exchanges would be much higher today. Even at $35 per acre it would cost nearly $15 million to consolidate the 422,000 acres of BLM lands in the basin.

A major problem is the fact that most of the BLM land is heavily timbered while a majority of the intermingled private lands have been cut over.[24] Exchanges of timbered O&C lands for cut over private lands could necessitate a much greater acreage of private lands coming off the tax rolls into public ownership. This would have serious impact on the tax base of some school districts. Also it would sharply reduce the present geographical spread of the supply of public timber and create both a shortage and an imbalance of timber supply to dependent mills. Reciprocal road use agreements and road construction programs also present barriers to the exchange program. Costs of access roads are from $20,000 to $100,000 per mile. There would be an additional appraisal cost of at least $200 per mile of road chargeable to the exchange. Appraising and equitably assigning the values involved in the hundreds of reciprocal right-of-way and road use agreements would be a monumental task. It is difficult to evaluate the total problem in costs that might be involved in eliminating the Federal Government's current road responsibility in areas where O&C ownership would be eliminated. The access road program which has minimized capital investments in road construction for many timber owners is a major consideration in the economics of timber management on both private and public lands.

Blocking up the forest land ownership pattern will alter the present distribution of timber age classes, upsetting the long term allowable cut schedule to the distress of the timber industry.

On the other hand some of the benefits and objectives of a forest land exchange program are:

(1) Solid land ownership makes possible more complete and timely multiple resource use, development, and management. It reduces cost of coordination with other owners in transportation planning, road construction, timing of timber sales, establishment of property lines, sale layout, snag felling, slash burning, road use maintenance, and disease and insect control.

(2) Solid land ownership results in more economical and efficient protection, management, resource utilization and rehabilitation. Logging costs are higher on scattered tracts due to illogical cutting units fitted to ownership rather than topography. The checkerboard land pattern presents access problems involving many diverse ownerships.

24/ Memo of January 4, 1963 from Oregon State Director to Director, BLM, file #2244 L&M.

(3) An exchange program would eliminate hard to manage isolated tracts and scattered parcels where management decisions must be modified to fit actions on adjacent lands which may expose the BLM lands to windthrow or fire hazard from slash.

(4) Exchanges permit the acquisition of recreation lands.

(5) Consolidated holdings reduce administrative costs through decreased travel and reduction of access problems. Forest Service experience indicates that it costs $1,000 to obtain each road right-of-way.

There are advantages to the present checkerboard pattern of the O&C lands.

(1) Scattered ownership spreads the risk of fire, wind, and insect damage.

(2) It contributes to stability of timber supplies for industry over a larger area.

(3) It makes available for public and multiple use benefits lands dispersed over a wide area and provides public access to recreation, hunting and fishing areas.

(4) The scattered public lands provide a seed source for adjacent private cut over lands, contributing to their reforestation.

Despite the foregoing advantages, a wholesale exchange program with the objective of achieving solid blocks of O&C land appears impractical and not in the public interest. Limited exchanges in certain areas may be justified and should be programed where management benefits and public interest justifies the expense. To avoid high appraisal costs, exchanges become more practical and less apt to rouse opposition if they are limited to cut over lands, both offered and selected.

Problems to be anticipated in making exchanges are industry protests, substantiating appraisals, delays in processing resulting from appeals or protests, concern over effects on allowable cut, and public reaction.

District investigation and study is needed to determine opportunities to improve the Federal land management pattern through BLM - U. S. Forest Service exchanges. Review of land status maps indicates there may be some limited opportunity for such exchanges.

b. Cooperation

Implementation of a land classification program on the public lands is based on close cooperation with other local units of government, particularly the county, local planning and zoning authorities, as well as those resource groups actually using these lands. Public hearings are a prerequisite to land classification to alert the people and get their recom-

mendations for future use and ownership of designated land areas. Counties and municipalities can make BLM's classification responsibility easier by zoning lands for certain types of development or use. Applications coming to BLM not in conformity to the zoned use are summarily rejected.

Little of the commercial forest lands or other areas of BLM lands in the basin has been zoned or included in other types of land use control. The opportunity is wide open for the districts to work with the county officials to secure protective zoning for recreational or natural beauty areas on lands close to or adjacent to BLM acreages. Local zoning can facilitate BLM land management planning and disposal by guiding the types and direction of land use, as well as giving support to BLM programs. The first step in such a program is for BLM district people to identify private land areas where zoning is needed for protection of resource values on BLM lands. The need for remedial or protective zoning should then be made known to local officials for consideration and implementation. Planned or programed development or activities on the BLM lands of course must warrant the action requested of the county.

c. Withdrawals and Reservations

Withdrawals and reservations of the public lands limit their availability for public use and development. The records improvement program recently completed on the public land records for Oregon has identified all existing withdrawals and show their restriction on land use. Having this type of data readily available will simplify management decisions and make possible a review of all withdrawals as to their current need by the administering agency.

d. Other Land Segregation and Fractional Interests

Unpatented mining claim locations on public land segregate it from public use. Public Law 167 action on these lands determines whether the Federal government may manage non-mineral resources on the land but does not open the land to public use.

On the other hand lands patented under the Stock Raising Homestead Act, the Recreation and Public Purposes Act, the Small Tract Act, the Color of Title Act, and some land exchanges resulted in the mineral estate being reserved to the Federal government even though surface is deeded property. Some of the lands acquired by the Federal government under the Bankhead-Jones Act of the 1930s was subsequently disposed of with retention of all or fractional mineral estate being reserved to the Government. However, it is believed there will be found to be relatively few problems with fractional land interests in the Willamette Basin except for mining claim locations.

5. Summary

The Classification and Multiple Use Act (P.L. 88-607) directs the Secretary of the Interior to develop criteria by which he will determine which BLM lands shall be disposed of and which shall be retained and managed. It is expected that much of the needed land use programing and classification

will be accomplished in the Unit Resource Analysis work now being undertaken by the districts. Guidelines and goals for the classification program are well spelled out in BLM Manual Releases 1601 - 1608. In a comprehensive basin plan more emphasis is given to future economic and social needs because many times immediate action must be taken if the future demand is to be met. This is particularly important in the Willamette Basin where population growth will be much faster than the national average. Projections show a growth index of 307 for the basin by year 2020 compared to 259 for the Nation.

B BLM Lands Resource Management Responsibilities 1965-1980

1. The Need for Land Use Planning [25/]

a. Increasing numbers and concentrations of people point up the costs of a laissez-faire subjective, serendipity approach to land use. Costs are reflected not only in money but in lost opportunities for a better use.

b. Population pressure problems have now reached the point that there are finally financial benefits in environmental planning for man as there long have been for chickens, bees, and San Gertudis cattle.

c. Our affluent society has now moved environment into a priority political position.

2. Functions of an Environment

The basic functions of man's envoronment are (1) home life, (2) school, (3) shopping, (4) commuting, (5) work, (6) religion, (7) leisure and recreation, (8) scenic experience, (9) healing. BLM lands offer opportunity for satisfaction of several of these.

3. Variables of an Environment

Controllable variables in man's environment are: (1) climate, (2) air, (3) water, (4) solid wastes, (5) noise, (6) food, drugs, alcohol, etc., (7) safety, (8) privacy, (9) gross number, (10) density, (11) duration, (12) frequency. Management of BLM lands can have major impact on several of these.

4. Relationship between Functions and Variables

The resource manager's hardest job is to forecast which functions the public will wish to sacrifice to gain more of another. An example is the current trend to enchance transportation by trading land space for pavement to better serve the automobile. This trend was not foreseen by early city planners. The middle-class American sacrifices leisure time by adding time to the commuting function in order to enjoy the environmental benefits of a suburban home. In

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25/ "The Next 50 Years", 1967 - 2017" American Institute of Planners, Portland Conf. Paper, 1966.

will be accomplished in the Unit Resource Analysis work now being undertaken by the districts. Guidelines and goals for the classification program are well spelled out in BLM Manual Releases 1601 - 1608. In a comprehensive basin plan more emphasis is given to future economic and social needs because many times immediate action must be taken if the future demand is to be met. This is particularly important in the Willamette Basin where population growth will be much faster than the national average. Projections show a growth index of 307 for the basin by year 2020 compared to 259 for the Nation.

VIII. H. BLM Lands Resource Management Responsibilities 1965-1980

1. The Need for Land Use Planning 5/

a. Increasing numbers and concentrations of people point up the costs of a laissez-faire subjective, serendipity approach to land use. Costs are reflected not only in money but in lost opportunities for a better use.

b. Population pressure problems have now reached the point that there are finally financial benefits in environmental planning for man as there long have been for chickens, bees, and San Gertudis cattle.

c. Our affluent society has now moved environment into a priority political position.

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moving to a suburban site he changes the environmental variables of population density, noise, and privacy. Man's choice in trade-offs between environmental functions and variables governs his aspirations, life pattern, and mental well-being. In a depressed economic situation the choices are simple, being related to the basic needs for survival. In an opulent society the choices can be extremely complicated and frequently are enjoyed at the expense of future populations.

Scientists tell us that just about as important as food for maintaining human life is an environment in which it is possible to satisfy the human longing for quiet, privacy, independence, initiative, and open space.26/ These are not frills or luxuries but real biological necessities. They will be in short supply long before there is a critical shortage of other basic factors of life. The forest watersheds of the basin may soon be more valuable for their contribution to the social vitality of the people through recreation opportunity and open space than from their economic contribution of wood fibre. A meaningful analysis of needs must first link demands for resource utilization with general public goals. An accelerating urban population alerts us to an ever increasing need for meeting social as well as economic goals. Fortunately potential uses of forest land are more or less compatible, requiring decisions as to intensity of use more than choice of one use over another.

5. Willamette Basin Land Use Issues and Objectives.

The Willamette Basin Study identified the following list of land use issues and objectives:

Land Use Issues	Objective
Forest Land Policy:	1. More intensive management of public lands. a. Maintenance of timber producing land base. b. Maintain balance between water, timber, power, and other factors in watershed management.
Recreation Land & Open Space	1. Expansion of open space conservation areas. 2. Expansion of "close in" nonurban recreation areas. 3. Expansion of lower elevation scenic recreation areas. 4. Preservation of recreation and natural beauty areas.

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Scenic Highway Policy:	1.	Expansion of scenic highways.
	2.	Preservation of natural beauty.
Policy for Urbanization:	1.	Concentration and containment.
	2.	Preservation of open space.
Industrial Land Policy:	1.	Increased public control of industrial land use.
	2.	Pollution control.
Agricultural Land Policy:	1.	Increased productivity.
	2.	Increased efficiency.
	3.	Improved aesthetic quality of rural lands.
	4.	Preservation in agricultural use.
Water Pollution Control Policy:	1.	Stream specialization.
	2.	Treatment.
	3.	Incentives to protect water quality.
	4.	Dilution.
Air Pollution Control Policy:	1.	Prevention, i.e. disposal of logging slash.
	2.	Containment.
Flood Plain Management:	1.	Expansion of flood plain management controls.

6. Forest Land Use Problems in Willamette Basin

a. Land Use Conflicts

(1) Land for reservoirs v.s. scenic areas, forest production, wildlife and fishery habitat.

(2) Forest production v.s. recreation and natural beauty, highway and powerline land requirements.

(3) Wilderness recreation v.s. intensive recreational development, commercial development, summer homes, timber harvest.

b. Ecological imbalances

(1) Soil erosion problems i.e. timber harvest, road construction, agriculture.

(2) Forest conservation problems i.e. securing reforestation, protection from fire, insects, disease.

(3) Adverse effects of land use on fish and wildlife populations and distribution.

7. BLM Land Management Program 1965 - 1980

In the early part of the 1968-1980 period the Salem and Eugene BLM Districts will have completed their resource unit analysis and classification of the public lands as to those found suitable either for disposal or retention for long term management. This should be a period of stabilization of land tenure. This will permit intensification of resource management programs to meet the expanding needs of a spiraling population and economic growth. There will be strong pressures and increased emphasis for high quality water production and increased recreation use from the public lands at some expense to timber production. Sustained yield timber production objectives might be maintained or even increased through more intensive silvicultural practices. Topographic limitations of the forest lands effectively block urban development or other intensive use of most of the BLM lands of the basin.

This will be the time for the districts to consider needed land exchanges for the enhancement of timber management or recreation programs.

An accelerated lands program is needed in both the Salem and Eugene Districts. Major priority should be given to a study of the merits of a land exchange program with the Forest Service to block up ownership and reduce cost of administration. If found feasible, exchanges should be consummated with minimal requirements as to equal values of the lands to be exchanged.

8. Salem BLM District Land Management Opportunities

Urban expansion of the Portland and Salem areas will have to be considered in future programing for public land use in the Salem District. The scattered BLM lands in western Multnomah County should be examined for their recreational and watershed values. Isolated tracts in T. 2 S., R. 3 W. and T. 1 S., R. 4 W., might well be exchanged if they are found to have no important public use values. Increased staffing will be required to implement an effective land exchange program.

Most of the new water impoundments being proposed by the Willamette Basin Task Force for flood control, irrigation, recreation, etc., are in the Salem District. These will change the use of many acres of BLM land and greatly magnify BLM recreation responsibilities and needed financing for this activity.

9. Eugene BLM District Land Management Opportunities

The Eugene area is found to be the fastest growing part of the basin through the entire study period. Nearly 50% more people will require accommodations by 1980. This will be reflected not only in an increased demand for land but also for municipal water supplies, building materials, and recreation. The BLM lands can make their greatest contribution through clean water supplies, open spaces, outdoor recreation, and wood fibre to sustain the industry.

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Isolated tracts of BLM lands in sections 15 and 23, T. 18 S., R. 5 W.; sec. 33, 34, T. 18 S., R. 4 W.; sec. 20, T. 15 S., R. 3 W.; and sec. 15, T. 17 S., R. 3 W., W.M. should be examined for their recreational and watershed values. Exchange of these lands to block up ownership appears advantageous if they have no important public use values. It is obvious that the Eugene District must have increased staffing and funds for needed recreational developments as well as for an expanded lands program.

10. Conclusions:

The economic development and population growth of the Willamette Basin has resulted in a great many land use problems, many of which affect BLM lands. In some cases research is needed for developing guidelines for proper land and resource use. Primarily the need is for increased funding to accomplish the needed land use objectives and to cover the cost of more intensive resource management programs.

Accelerating urbanization of the farm lands of the basin will result in substantial acreages of small ownership forest lands being converted to agricultural use. On the other hand many acres of submarginal farm lands are reverting to forest cover. There seems as yet little incentive for the small forest land owner to manage his woodlands in an efficient manner. This throws a greater share of responsibility for continued wood fibre production on the large private and the public forest lands.

The number of cities, their population, and land area covered is expected to double by year 2000.27/ Urbanization of the western states is expected to continue at a faster rate than other regions of the United States through year 2000. An accelerating demand for land where supply is limited will be reflected in greatly increased land values, even on forest lands. BLM will have to maintain a strong yet responsive land management program to maintain its role as guardian over these public lands. The land use objectives indicate that forest resource planners should be giving major attention to preservation of open space and natural beauty areas, development of "close-in" non-urban recreation areas, expansion of lower elevation scenic roads and recreation areas, protection of water quality, and providing better access to forest lands.

C. Future Resource Situation to Year 2020

Lands

1. General

Populations in the basin are expected to nearly triple by 2020. Per capita personal income is expected to be 4 times the 1960 income. Economic projections indicate that import-competing industries will replace the "basic"

27/ "Land for Americans, Trends, Prospects, and Problems" Marian Clawson 1963.

forest and agricultural products processing as the primary labor market. Urban expansion will no doubt continue to follow main highway routes through the valley lands. Better flood control from construction of large impoundments will permit more intensive utilization of the flood plain. Accelerated air travel will expose forest management operations to massive critical scrutiny. Natural beauty will become a consideration in air travel as well as on highways. An affluent public may well demand that the public forest lands be given intensive park like management with little or no slash or debris being left on the ground, and clear cut timber harvest areas reduced in size or eliminated.

2. BLM Land Resource Management Opportunities 1980 - 2020

Need for some blocking of the public land ownership through land exchange will continue through this period. Increasing demands for wood fibre will preclude reduction of acreages in forest production. Most of the private forest lands may well be under the control of a few large combines by this date. The public lands will be required to meet intensive recreation use at the same time. Much more intensive land and resourse management and protection will be necessary plus high outlays for recreation facilities. Heavy demand for high quality water from the forest watersheds will necessitate extreme care in road construction, timber harvest, slash disposal, and control of recreational use to prevent siltation or biotic contamination.

3. Conclusions

The major management objective during this period will be achievement of a synthesis of the several land uses and resource demands on BLM lands. A static resource base will require much more intensive management in order to meet accelerating demands for many resources from the forest watershed. There will be need for expansion of "open space" conservation areas, lower elevation scenic recreation areas, and scenic highway areas, as well as continued production of an undiminished supply of wood fibre, fish and wildlife and high quality water. Increased funding for management and resource investment must take place of a diminishing acreage to meet production demands. Fortunately, most of the anticipated competing uses for forest land are more or less complementary and can be implemented without too great a sacrifice of other important resource values.

A second management objective is for flexibility of land management programs. As technology advances and resources grow or decline people and their aspirations change. Thus, the land manager must keep attuned to public, economic, and social needs as basis for modification of land management programs.

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XVI. Nature and Distribution of Forest Soils in the Willamette Basin

A. General

A meaningful watershed management program should be based on the soil characteristics of the area. Unfortunately the forest soils of the Willamette Basin had not been surveyed when this study was initiated. Early in the study need for soils data was identified and BLM was requested to provide soils data for its lands. Because BLM builds access roads across private land to reach the public land, soils data were also needed for the intermingled private lands. BLM agreed to furnish this information, and a contract was made with the soils department, Oregon State University to accomplish a soils "mantle stability" survey. This will be a guide to future engineering and land use planning. It covers the forest lands lying below the National Forest boundaries and is subsequently referred to as segment III of the basin area. The survey was not completed in time to be used to advantage in this study, but the data is submitted as a guide to future planning.

Soils management interpretations show that the type of soil can be more important than topography in forest management decisions. The wide range of moisture retention capacity of the various soils is a guide to effectiveness of revegetation programs and length of timber crop rotation periods. Soils data is also a guide to cost and method of road construction as well as to maintenance problems.

The Oregon State University Department of Soils is preparing a report on this survey together with maps which will be a supplement to this report.

Two soil problem areas were identified, unstable soils and high erosion hazard soils. The Soils Specialists making the survey rated the tendency of soils to slump or slide after being disturbed based on field observations. In making the determination they also correlated soil and bedrock characteristics with the stability of the disturbed regolith. High erosion hazard soils are related to topography, soil plasticity, clay content, depth to bedrock, and other soil and bedrock characteristics. Out of a total of 2,090,000 acres surveyed, 41% is found to have unstable or highly erodable soils. Table I-I describes the forest soils found.

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The following data is taken from the report prepared by Byron Thomas for the Willamette Basin Study.

B. Map Symbols

The general soil map now available to the Salem and Eugene Districts shows the location and and extent of many soil areas. Each delineated area is identified by a map symbol. Soil series or miscellaneous land types are represented by a number of a combination of numbers (14-20) or a combination of letters (Mp - Ab - Wa) occuring within each delineation. The map symbol identifies the one, two, or three dominant soil series, or miscellaneous land types, that occur separately or intermingled within the delineated area. The soil series are indicated in order of their dominance. For example, a delineation with the symbol, 14-20, has 14 (Honeygrove series) as the primary soil and 20 (Peavine series) as the secondary soil. The respective percentage of each soil is given in the mapping unit description which is listed under the primary soil description. Soil series that comprise less than 20 percent of a delineation are not listed.*

The mapping unit symbol contains a capital W, X, Y or Z at the end which designates the slope range. For example, the symbol 14-20 X indicates an area of Honeygrove and Peavine soils with slopes dominantly ranging from 10 to 35 percent. The symbol 14-20 Y indicates an area of Honeygrove and Peavine soils with slopes dominantly ranging from 35 to 60 percent. The symbol 14-20 XY indicates an area of Honey grove and Peavine soils with about seventy percent of the delineation having slopes in the X slope range (10 to 35 percent) and about thirty percent of the area in the Y slope range (35 to 60 percent). The range in slope for the delineation for 14-20 XY would be 10-60 percent. It should be noted that on a detailed soil map there would be a delineation for each significant slope range. The slope classes and their respective symbols are given in section IV, Use of the Map and Report. The slope classes also appear on the map legend, and in the Mapping Unit Descriptions.

C. Descriptions of Soil Series

Soil series are in the lowest category (most narrowly defined) of the natural system of soil classification. Each series consists of soils essentially uniform in differentiating characteristics, including texture, structure, arrangement of horizons, color, etc. A map area (delineation)

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* It is important to note that this percentage will allow a significant acreage within any delineation to be a contracting soil series which will have different management implications. For intensified management of any small area, it is appropriate to identify the soil on the ground or secure a detailed soil map.

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may include two or three soil series with contrasting properties; subsequently, they have contrasting suitabilities and management requirements. Therefore, meaningful interpretations of the soils information must be made for the individual soil series, or slope group subdivisions of them and not for the entire area within any delineation.

Appendix III contains a description for each soil series and miscellaneous land type. The soil series descriptions give a general description of the soil profile and a description for the modal setting.

Established, tentative, and proposed soil series may be clearly defined with definite limits relative to other soil series. They may cover a suitable and significant range in soil conditions. Such series are described in this report as having a clear concept.

In general, this report uses the working concepts of soil series as currently used in detailed mapping. In a few cases, one of a pair of strongly overlapping series has been eliminated.

Acreage Figures

The acreage of each delineation on the map was determined by means of a calibrated grid device. The acreage of each soil series was calculated on the basis of the average proportions of the components in the delineations as given in the Mapping Unit Descriptions. Areas mapped in terms of one series were credited entirely to that series.

The acreage for each series, subdivided by slope, is listed in Table 3 by county and subbasin for Segment III lands. Acreage figures in this report are only approximations because only the major soils in each delineation were accounted for. Inclusions of other soils amounting to less than 20 percent of a delineation were not recorded. Moreover, the proportions of the major soils used in calculation only approximate the real proportions.

Interpretations

The major interpretation for each soil series, and its slope phases, is the stability of the disturbed regolith. For irrigable lands, the interpretations given in Willamette Basin General Association Map and Report, Segment I, may be applied for any corresponding soil.

Additional interpretative data to be used with the Segment III map will be in a subsequent report.

D. Distribution of Forest Soils

Three soil moisture temperature zones are identified in the Willamette Basin forest area. They have a direct relationship to forest

management. These are classified as xeric-mesic, moist-mesic, and moist frigid. This zonal pattern is based on moisture and temperature variations.

1. Zeric-Mesic Zone

This is the warmest and driest of the 3 zones being considered. It is sometimes referred to as the "valley zone". Soils of the xeric-mesic zone generally occur in the foothills or valleys below 1000 feet elevation. These soils are subject to prolonged dry periods in summer. In at least 7 out of 10 years the moisture content is below the permanent wilting point for at least 60 consecutive days. In 4 to 5 years out of 10 this soil is an intergrade between xeric and moist. Usually these soils are found in areas receiving less than 55 inches rainfall per year. They may also be found on a few steep side slopes facing south or southwest at elevations in excess of 2000 feet. Douglas fir stands occupy much of the zeric-mesic zone. Poison oak is prevalant and serves as an indicator plant for this zone. In some areas Oregon white oak is found intermingled with Douglas fir.

2. Moist Mesic Zone

Most of the area covered by this survey is moist or non-xeric. The term "mesic" refers to soil temperatures, meaning temperate, neither hot nor cold. Quantitatively mesic means that the mean annual soil temperature is between 47° and 59° F and that the winter soil temperature is 9° F colder than the summer soil temperature. Its elevation range is from 600 to 4000 feet. In general, the elevation of both the upper and lower limits of the zone is lowest near the Columbia River, gradually increasing towards the south.

The mean annual precipitation is generally over 45 inches in the vicinity of the Tualatin Hills and over 55 inches in other parts of the Basin. With increasing elevation the annual rainfall goes up, approaching 200 inches in the Coast Range and 140 inches in the Western Cascade Mountains (1, 10). About 60 percent of the precipitation falls in the period between November and February, and 10 percent in the period between June and September. Less than 10 percent of the precipitation occurs as snow at the lower end of the elevation gradient, but nearly 50 percent falls as snow at elevations of 4,000 feet in the Cascade Mountains. Snow accumulations are small in the Coast Range (11).

Air temperatures also vary with the elevation gradient. In January, the temperature averages from 32 to 36° F and in July it averages 60 to 64° F. Mean annual air temperatures range from about 46 to 54° F, being warmer at lower elevations and cooler at higher elevations.

This area occurs in the Douglas-fir vegetation zone (1, 7). Douglas-fir is the most abundant single species and occurs in pure stands over wide areas. On the more moist sites or at higher elevations western redcedar, grand fir, and mountain hemlock are mixed with the Douglas-fir. The understory includes vine maple, alder, salal, red, huckleberry, salmon berry, sword fern, and bracken fern.

management. These are classified as xeric-mesic, moist-mesic, and moist frigid. This zonal pattern is based on moisture and temperature variations.

1. Xeric-Mesic Zone

This is the warmest and driest of the 3 zones being considered. It is sometimes referred to as the "valley zone". Soils of the xeric-mesic zone generally occur in the foothills or valleys below 1000 feet elevation. These soils are subject to prolonged dry periods in summer. In at least 7 out of 10 years the moisture content is below the permanent wilting point for at least 60 consecutive days. In 4 to 5 years out of 10 this soil is an intergrade between xeric and moist. Usually these soils are found in areas receiving less than 55 inches rainfall per year. They may also be found on a few steep side slopes facing south or southwest at elevations in excess of 2000 feet. Douglas fir stands occupy much of the xeric-mesic zone. Poison oak is prevalent and serves as an indicator plant for this zone. In some areas Oregon white oak is found intermingled with Douglas fir.

2. Moist Mesic Zone

Most of the area covered by this survey is moist or non-xeric. The term "mesic" refers to soil temperatures, meaning temperate, neither hot nor cold. Quantitatively mesic means that the mean annual soil temperature is between 47° and 59° F and that the winter soil temperature is 9° F colder than the summer soil temperature. Its elevation range is from 800 to 4000 feet. In general, the elevation of both the upper and lower limits of the zone is lowest near the Columbia River, gradually increasing towards the south.

The mean annual precipitation is generally 45 inches in the vicinity of the Tualatin Hills and over 55 inches in other parts of the Basin. With increasing elevation the annual rainfall goes up, approaching 200 inches in the Coast Range and 140 inches in the Western Cascade Mountains (1, 10). About 80 percent of the precipitation falls in the period between November and February, and 10 percent in the period between June and September. Less than 10 percent of the precipitation occurs as snow at the lower end of the elevation gradient, but nearly 50 percent falls as snow at elevations of 4,000 feet in the Cascade Mountains. Snow accumulations are small in the Coast Range (11).

Air temperatures also vary with the elevation gradient. In January, the temperature averages from 32 to 35° F and in July it averages 60 to 64° F. Mean annual air temperatures range from about 46 to 54° F, being warmer at lower elevations and cooler at higher elevations.

This area occurs in the Douglas-fir vegetation zone (1, 7). Douglas-fir is the most abundant single species and occurs in pure stands over wide areas. On the more moist sites or at higher elevations western redcedar, grand fir, and mountain hemlock are mixed with the Douglas-fir. The understory includes vine maple, alder, salal, red, huckleberry, salmon berry, sword fern, and bracken fern.

The topography is mountainous. Relief and length of steep or very steep side slopes on the irregular peaks and ridges is generally greater at higher elevations than at lower elevations (11). Broad ridges with moderate slopes and relief are common in Multnomah and Clackamas Counties.

Parent materials in the Western Cascade Mountains are dominantly from basic rocks of volcanic origin (11). These include basalt and andesite flow rocks and pyroclastic tuffs, breccias, and agglomerates all of the Miocene age. Aeolian silts cap the volcanic uplands in Multnomah and northern Clackamas Counties.

The Coast Range is composed largely of weakly consolidated sedimentary bedrock with lesser amounts of basic volcanic and intrusive rocks, mostly of Eocene age (3, 11). Slopes, especially in the areas with sedimentary rocks, are often unstable and mass movement is common. In the northern part of the Coast Range wind-blown silty deposits cap the ridges, spurs and side slopes.

The more stable landscape positions in the drier portions of this zone are occupied by strongly developed soils with a high degree of horizon differentiation. These include red, clayey soils of the deep Honeygrove series and of the moderately deep Peavine series. The brown clayey soils that are otherwise similar to the Honeygrove soils are of the apt series. Brown moderately fine textured soils with strong profile differentiation are of the Olyic series. Associated with the Honeygrove and Apt soils on the steeper side slopes are less strongly developed moderately deep soils of the Digger soils; which are brown and have light colored surfaces; the Bohannon soils, which are brown and have dark colored soils; the 69S soils which are brown and very gravelly or cobby; and the Klickitat soils, which are reddish and very gravelly or cobby.

The areas capped with loess in the Coast Range have soils of the moderately well drained Goble and Cascade series. Soils of the Cascade series have very firm brittle subsoils below 18 inches. Soils of the well drained Bull Run series occur in the portion of the moist-mesic zone covered with loess in the northern Cascade Mountains.

Areas receiving over 70 to 80 inches of precipitation, annually, and which commonly occur on landscapes that are steeper and less stable than those containing soils of the Honeygrove series, show less horizon differentiation than those of the Honeygrove and the other well developed soils. These areas are at elevations above those of the well developed soils.

In many parts of the moist-mesic zone deep, red, clayey soils without strong horizon differentiation occur on the moderately to strongly sloping ridges and sideslopes. The red soils with dark surface soils are of the McCully series in the Cascade Mountains and the Blachly series in the Coast Range. Deep, red soils that are less clayey than McCully or Blachly soils are of the Hembre series if the surface soils are dark, or of the Marty series if the surface soils are light. Those that are moderately deep and

only moderately fine textured are of the 21 (unnamed) series if light colored in the surface and a moderately deep variant of Hembre soils if dark colored.

Associated with the red soils on the steep to very steep side slopes and canyon walls are soils of the very gravelly or cobbly, moderately deep, Klickitat and shallow Kilches series.

Vast areas of brown or yellowish brown soils occur in the moist-mesic zone. These soils are commonly associated with sedimentary rocks in the Coast Range and with high rainfall in both mountain ranges.

Fine textured or clayey, brownish soils are included in the Astoria, Melby, and Ead soils. Astoria soils are deep and have a dark surface soil. Melby soils are deep and have a light surface. Ead soils are moderately deep and have a very thick dark surface.

Brownish or yellowish-brown soils with high coarse fragment content (skeletal soils) include soils of the Damsite, 69S, 175S, 53S and 70S series.

The skeletal soils with dark surfaces include the deep Damsite, the moderately deep 69S, and the shallow 175S series. Those with light colored surface soils are in the moderately deep 53S and the shallow 70S series. Generally, skeletal and shallow soils are found on very steep side slopes and canyon walls where the rate of geologic erosion is equal to or in excess of the rate of soil formation.

3. Moist-Frigid zone

The moist-frigid zone makes up a minor portion of this survey and is restricted to the higher ridges and peaks of the Cascade Mountains and Coast Range. The lower limit of the zone ranges from about 3,000 feet in the northern part of the Basin to nearly 4,000 feet at the Calapooya Divide. Most of the areas in this zone occur in the Cascade Mountains. Rocky Top Mountain, located in Marion County, is the highest point in the survey and has an elevation of 5015 feet. The tallest mountain in the Coast Range is Marys Peak with an elevation of 4097 feet.

Very little meteorlogical data is available for more mountainous parts of Oregon, but it is assumed that the mean air temperatures are about 32° F in January, 62° F in July, and 45° F for the year (10). The mean annual precipitation ranges from 80 to 140 inches in the Cascade Mountains and from 100 to nearly 200 inches in the Coast Range. Nearly half of the precipitation occurs as snow in the Cascade Mountains, but winter accumulations of snow are small in the Coast Range.

The dominant tree species in this zone is western hemlock. Mixed with the hemlock are noble fir, silver fir, Douglas-fir, western white pine and western redcedar. Understory vegetation includes rhododendron, beargrass and blue huckleberry (1,7).

Most areas of this zone are located on narrow, sharp ridges with very steep side slopes. Some saddles and ridges are only moderately sloping.

The soils are generally developed in materials derived from basic igneous rocks (11). In the Cascade Mountains the underlying rocks are mainly volcanic flow rocks and associated pyroclastics, whereas in the Coast Range the highest peaks are generally capped with intrusive medium to coarse grained basic igneous rocks.

Most soils of the moist-frigid zone are brownish or yellowish and skeletal soils are more common than nonskeletal soils. In the Cascade Mountains soils of the deep, loamy skeletal Goodfellow series, and of the moderately deep Henline series occupy most of the ridges and steep sideslopes. Associated with the Henline soils are smaller areas of the shallow 75S series. The craggy peaks and crests that are dominantly rock outcrop and barren were mapped as the miscellanous land type, Rockland. In Marion County, soils of the moderately coarse textured, highly leached Whetstone series are associated with soils of the Henline series. In Linn County, soils of the moderately deep, nonskeletal Keel series occupy some of the ridges. Oneonta soils are deep nonskeletal, brownish soils that occur as inclusions with Goodfellow soils.

A few soils of the frigid zone are reddish and these are included in the moderately fine textured, moderately deep Cruiser series.

E. Interpretations

1. Interpretative Groups for Selected Objectives

Interpretive groups comprise soils that are similar with respect to a set of properties or qualities that are important for some specific objective, usually some aspect of use and management. Properties not pertinent to the objective of the grouping are ignored and may deviate widely among the soils in any particular group.

Interpretive groupings are useful for the stated objective. They can be misleading if used for a different objective. It is advisable to consider the differences that exist between soils in each group as well as the similarities that are the basis for the groups.

Stability of the Disturbed Regolith - Cutbank Stability

Stability of the disturbed regolith is analogous to the United States Forest Service's Cutbank Stability ratings. ( ) ( ) There is a distinction between the Forest Service's stability classes and the stability classes for this report. The Forest Service defines each of the five stability classes as to the number of cutbank failures per mile for a geological unit. For this survey, the three stability classes were made by comparing the frequency of cutbank failures for each soil phase. The stability classes used in this report are somewhat less quantitative than those of the Forest Service although they were derived in essentially the same manner. That is,

the soils were rated by soils specialists who based their opinions on recorded and unrecorded field observations as to the tendency of the soils to slump or slide after being disturbed. The soils specialists also correlated soil and bedrock characteristics (such as soil texture, degree of rock weathering and degree of rock fracturing) with stability of the disturbed regolith.

The following guide can be used to correlate the two systems:

Forest Service Cutbank Stability Classes	Segment III Disturbed Regolith Stability Classes
Very Stable Stable	Stable
Moderately Stable	Moderately Stable
Unstable Very Unstable	Unstable

Table I-2 gives the stability ratings for each slope phase of each upland soil type. Table I-III shows soil hazard and use descriptions.

TABLE I-I

Characteristics - Willamette Basin Forest Soils

Symbol	Series	Base	Parent Material	Depth	Stickiness	Plasticity	Coarse Fragments	Elevation Feet	Distribution
10	Blachly	Clay loam	Sandstone	60" +	Slight	Slight	5%	250-3000	Moderate
11	Marty	silty clay lm.	quartz diorite	6'-8'	Slight	Slight	0-15%	500-4000	Limited
12	Jory	silty clay lm.	basalt	5'-20'	Sticky	Plastic	few	300-1000	Moderate
14	Honeygrove	clay loam	-	60-100	Slight	Slight	15-25%	500-1500	Moderate
16	Olyic	silt loam	basalt	20"-40"	Slight	Slight	few	500-2000	Extensive
20	Peavine	silty clay lm.	Siltstone Shale	20"-40"	Sticky	Plastic	few to many	400-1200	Extensive
23	Nekia	silty clay lm.	basalt	20"-48"	Sticky	Plastic	0-25%	300-1200	Extensive
27	Hembre	silty clay lm.	basalt	36"-48"	Slight	Slight	few	200-2800	Extensive
29	Klickitat	gravelly clay lm.	basalt	30"-48"	Slight	Slight	50% +	500-4000	Moderate
35_s	Kilchis 1/	stony loam	basalt	-	Slight	Non-plastic	Stony	500-3500	Moderate

1/ Inherent productivity is low

TABLE I-I

Symbol	Series	Base	Parent Material	Depth	Stickiness	Plasticity	Coarse Fragments	Elevation Feet	Distribution
50	Apt	Clay	Sandstone Colluviam	60"/	Slight	Slight	0-10%	500-1500	Limited
51	Astoria	silt loam	Siltstone or Shale	48"	Slight	Slight	few	100-2000	Extensive
54	Slickrock	gravelly loam	Sandstone	4'-6'	Slight	Slight	20-50%	250-2500	Moderate
55	Laurelwood	silty clay loam	Basalt	3'-10'	None	Slight	few to common	200-1500	Moderate
56	Cascade	silt loam	-	60"/	Slight	Slight	-	100-1400	Extensive
57	Preacher	clay loam	Sandstone	36"-48"	Slight	Slight	few	250-2500	Moderate
60	Melby	silt loam	Siltstone Shale Sandstone	20"-40"	Slight	Slight	few	500-2000	Extensive
65	Steiwer	silty clay loam	Sandstone	20"-40"	Sticky	Plastic	0-30%	250-650	Southwest Exposures
66	Digger	gravelly loam	Sandstone	20"-40"	Slight	Slight	20-50%	200-1800	Limited
67	Willakenzie	silty clay loam	Sand-Silt-Stone	20"-40"	Slight	Slight	few	250-800	Extensive

TABLE I-I

Symbol	Series	Parent Material Base	Parent Material	Depth	Stickiness	Plasticity	Coarse Fragments	Elevation Feet	Distribution
	Price	silty clay loam	basalt	40"-60"	Sticky	Plastic	0-20%	400-1300	Limited
	Hiyu	gravelly loam	-	20"-40"	Slight	Slight	35-80%	200-3000	Moderate
	Hatchery	gravelly clay loam	basalt	20"-48"	Slight	Slight	65%	250-1500	Limited
	Dumont	gravelly clay loam	-	5'-11'	Slight	Slight	15-20	1000-4000	Moderate
	Bohanon	gravelly loam	Sandstone	20"-48"	None	None	5-30	100-4000	Moderate
	Ritner	silty clay	basalt	40"-60"	Sticky	Plastic	10-30	500-1300	Limited

Table I-II

Soils Watershed Management Characteristics
Survey by Byron Thomas and J. A. Pomerening, O.S.U.

Symbol	Soil Series and Land Type	Slope %	Infiltration	Permeability	Water Holding Capacity	Effect. Root Zone Inches	Erosion Hazard	Disturbed Regolith Stability
10x	Blachly	20-35	Mod. Rapid	Moderate	High	60 +	Medium	Stable
10y	Blachly	35-60	Mod. Rapid	Moderate	High	60 +	High	Moderately Stable
11w	Marty	0-10	Mod. Rapid	Moderate	Mod.-High	40-60	Low	Stable
11x	Marty	10-35	Mod. Rapid	Moderate	Mod.-High	40-60	Low	Stable
11y	Marty	35-60	Mod. Rapid	Moderate	Mod.-High	40-60	Medium	Stable
11z	Marty	60 +	Mod. Rapid	Moderate	Mod.-High	40-60	High	Moderately Stable
12w	Jory	0-10	Moderate	Moderate	High	60 +	Low	Stable
12x	Jory	10-35	Moderate	Moderate	High	60 +	Medium	Stable
12y	Jory	35-60	Moderate	Moderate	High	60 +	High	Moderately Stable
12xw	Jory (Sed. rock phase)	0-10	Moderate	Mod. Slow	High	60 +	Low	Stable
12xx	Jory (Sed. rock phase)	10-35	Moderate	Mod. Slow	High	60 +	Medium	Moderately Stable
14w	Honeygrove	0-10	Moderate	Mod. Slow	Moderate	60 +	Low	Stable
14x	Honeygrove	10-35	Moderate	Mod. Slow	Moderate	60 +	Low	Stable
14y	Honeygrove	35-60	Moderate	Mod. Slow	Moderate	60 +	Medium	Moderately Stable
14xx	Honeygrove (Sed. rock phase)	10-35	Moderate	Mod. Slow	Moderate	60 +	Low	Moderately Stable
14xy	Honeygrove (Sed. rock phase)	35-60	Moderate	Mod. Slow	Moderate	60 +	Medium	Unstable
14xz	Honeygrove (Sed. rock phase)	60 +	Moderate	Mod. Slow	Moderate	60 +	High	Unstable
15y	Hullt	35-60	Moderate	Moderate	Moderate	60 +	Medium	Stable
15z	Hullt	60 +	Moderate	Moderate	Moderate	60 +	High	Moderately Stable
16x	Olyic	10-35	Mod. Rapid	Moderate	High	40-60	High	Stable
16y	Olyic	35-60	Mod. Rapid	Moderate	High	40-60	High	Moderately Stable
16z	Olyic	60 +	Mod. Rapid	Moderate	High	40-60	High	Unstable
19w	Cruiser	0-10	Mod. Rapid	Moderate	Moderate	40-60	Low	Stable
19x	Cruiser	10-35	Mod. Rapid	Moderate	Moderate	40-60	Low	Stable
19y	Cruiser	35-60	Mod. Rapid	Moderate	Moderate	40-60	Medium	Stable
20w	Peavine	0-10	Moderate	Mod. Slow	Moderate	20-40	Low	Stable

Table I-11

Soils Watershed Management Characteristics
Survey by Byron Thomas and J. A. Pomerening, O.S.U.

Symbol	Soil Series and Land Type	Slope %	Infiltration	Permeability	Water Holding Capacity	Effect. Root Zone Inches	Erosion Hazard	Disturbed Regolith Stability
20x	Peavine	10-35	Moderate	Mod. Slow	Moderate	20-40	Medium	Stable
20y	Peavine	35-60	Moderate	Mod. Slow	Moderate	20-40	High	Moderately Stable
20z	Peavine	60 +	Moderate	Mod. Slow	Moderate	20-40	High	Unstable
20xx	Peavine (Sed. rock phase)	10-35	Moderate	Mod. Slow	Moderate	20-40	Medium	Moderately Stable
20xy	Peavine (Sed. rock phase)	35-60	Moderate	Mod. Slow	Moderate	20-40	High	Unstable
21x	Unnamed	10-35	Moderate	Moderate	Moderate	20-40	Medium	Moderately Stable
21y	Unnamed	35-60	Moderate	Moderate	Moderate	20-40	Medium	Unstable
21z	Unnamed	60 +	Moderate	Moderate	Moderate	20-40	High	Unstable
23w	Nekia	0-10	Moderate	Moderate	Moderate	20-40	Low	Stable
23x	Nekia	10-35	Moderate	Moderate	Moderate	20-40	Medium	Stable
23y	Nekia	35-60	Moderate	Moderate	Moderate	20-40	High	Moderately Stable
23xx	Nekia (Sed. rock phase)	10-35	Moderate	Mod. Slow	Moderate	20-40	Medium	Moderately Stable
23xy	Nekia (Sed. rock phase)	35-60	Moderate	Mod. Slow	Moderate	20-40	High	Unstable
25x	Whetstone	10-35	Mod. Rapid	Moderate	Moderate	20-40	Low	Stable
25y	Whetstone	35-60	Mod. Rapid	Moderate	Moderate	20-40	Medium	Moderately Stable
25z	Whetstone	60 +	Mod. Rapid	Moderate	Moderate	20-40	Medium	Moderately Stable
27w	Hembre, ext. rock phase	0-10	Mod. Rapid	Moderate	Mod.-High	40-60	Low	Stable
27x	Hembre, ext. rock phase	10-35	Mod. Rapid	Moderate	Mod.-High	40-60	Low	Stable
27y	Hembre, ext. rock phase	35-60	Mod. Rapid	Moderate	Mod.-High	40-60	Medium	Stable
27z	Hembre, ext. rock phase	60 +	Mod. Rapid	Moderate	Mod.-High	40-60	High	Moderately Stable
27nx	Hembre, intrusive rock phase	10-35	Mod. Rapid	Mod. Rapid	Mod.-High	40-60	Low	Stable
27ny	Hembre, intrusive rock phase	35-60	Mod. Rapid	Mod. Rapid	Mod.-High	40-60	Medium	Stable

Table I-II

Soils Watershed Management Characteristics
Survey by Byron Thomas and J. A. Pomerening, O.S.U.

Symbol	Soil Series and Land Type	Slope %	Infiltration	Permeability	Water Holding Capacity	Effect. Root Zone Inches	Erosion Hazard	Disturbed Regolith Stability
27nz	Hembre, intrusive rock phase	60 +	Mod. Rapid	Mod. Rapid	Mod.-High	40-60	High	Moderately Stable
29sx	Klickitat	10-35	Mod. Rapid	Mod. Rapid	Low	20-40	Low	Stable
29sy	Klickitat	35-60	Mod. Rapid	Mod. Rapid	Low	20-40	Low	Stable
29sz	Klickitat	60 +	Mod. Rapid	Mod. Rapid	Low	20-40	High	Moderately Stable
35sx	Kilchis	10-35	Mod. Rapid	Rapid	Low	10-20	Low	Stable
35sy	Kilchis	35-60	Mod. Rapid	Rapid	Low	10-20	Low	Stable
35sz	Kilchis	60 +	Mod. Rapid	Rapid	Low	20-40	High	Moderately Stable
36sw	Witzel	0-10	Mod. Slow	Mod. Slow	Very Low	10-20	Low	Stable
36sx	Witzel	10-35	Mod. Slow	Mod. Slow	Very Low	10-20	Medium	Stable
36sy	Witzel	35-60	Mod. Slow	Mod. Slow	Very Low	10-20	High	Stable
36sz	Witzel	60 +	Mod. Slow	Mod. Slow	Very Low	10-20	High	Moderately Stable
50x	Apt	10-35	Moderate	Moderate	Moderate	60 +	Medium	Moderately Stable
50y	Apt	35-60	Moderate	Moderate	Moderate	60 +	High	Unstable
51x	Astoria	10-35	Moderate	Moderate	High	60 +	High	Moderately Stable
51y	Astoria	35-60	Moderate	Moderate	High	60 +	Very High	Unstable
53sd	Unnamed	60 +	Mod. Rapid	Rapid	Low	20-40	High	Unstable
54y	Slickrock	35-60	Moderate	Moderate	Moderate	40-60	Medium	Moderately Stable
55w	Laurelwood	0-10	Moderate	Moderate	High	60 +	Medium	Stable
55x	Laurelwood	10-35	Moderate	M derate	High	60 +	High	Stable
55y	Laurelwood	35-60	Moderate	Moderate	High	60 +	Very High	Moderately Stable
56w	Cascade	0-10	Moderate	Mod. Slow	High	60 +	Low	Stable
56x	Cascade	10-35	Moderate	Mod. Slow	High	60 +	Low	Stable
56y	Cascade	35-60	Moderate	Mod. Slow	High	60 +	Medium	Moderately Stable
57x	Preacher	10-35	Moderate	Moderate	Low	40-60	Low	Stable
57y	Preacher	35-60	Moderate	Moderate	Low	40-60	Medium	Moderately Stable
57z	Preacher	60 +	Moderate	Moderate	Low	40-60	High	Moderately Stable
58w	Kinton	0-10	M derate	Mod. Slow	High	40-60	Low	Stable
58x	Kinton	10-35	Moderate	Mod. Slow	High	40-60	Medium	Stable
58y	Kinton	35-60	Moderate	Mod. Slow	High	40-60	High	Moderately Stable
60w	Melby	0-10	Moderate	M derate	Moderate	40-60	Low	Stable
60x	Melby	10-35	Moderate	Moderate	Moderate	40-60	Medium	Moderately Stable

Table I-II

Soils Watershed Management Characteristics
Survey by Byron Thomas and J. A. Pomerening, O.S.U.

Symbol	Soil Series and Land Type	Slope %	Infiltration	Permeability	Water Holding Capacity	Effect. Root Zone Inches	Erosion Hazard	Disturbed Regolith Stability
61x	Ead	10-35	Moderate	Moderate	Moderate	20-40	High	Moderately Stable
61y	Ead	35-60	Moderate	Moderate	Moderate	20-40	Very High	Unstable
62x	Keel	10-35	Mod. Rapid	Mod. Rapid	Moderate	40-60	Medium	Stable
62y	Keel	35-60	Mod. Rapid	Mod. Rapid	Moderate	40-60	High	Moderately Stable
62r	Rockland	35 +	Rapid	Rapid	Very Low	0-20	Low-High	Stable
66x	Digger	10-35	Mod. Rapid	Mod. Rapid	Low	20-40	Low	Stable
66y	Digger	35-60	Mod. Rapid	Mod. Rapid	Low	20-40	Medium	Stable
66z	Digger	60 +	Mod. Rapid	Mod. Rapid	Low	20-40	High	Moderately Stable
67w	Willakenzie	0-10	Moderate	Mod. Slow	High	20-40	Med. High	Stable
67x	Willakenzie	10-35	Moderate	Mod. Slow	High	20-40	Very High	Stable
67y	Willakenzie	35-60	Moderate	Mod. Slow	High	20-40	Very High	Stable
67z	Willakenzie	60 +	M derate	Mod. Slow	High	20-40	Very High	Unstable
69sw	Unnamed	0-10	Mod. Rapid	Mod. Rapid	Low	20-40	Low	Stable
69sx	(Skeletal Bohanon)	10-35	Mod. Rapid	Mod. Rapid	Low	20-40	Low	Stable
69sy	(Skeletal Bohanon)	35-60	Mod. Rapid	Mod. Rapid	Low	20-40	Medium	Stable
69sz	(Skeletal Bohanon)	60 +	Mod. Rapid	Mod. Rapid	Low	20-40	High	Moderately Stable
70sz	Unnamed	60 +	Mod. Rapid	Mod. Rapid	Low	10-20	High	Unstable
75sy	Unnamed	35-60	Mod. Rapid	Mod. Rapid	Low	10-20	Medium	Stable
75sz	Unnamed	60 +	Mod. Rapid	Mod. Rapid	Low	10-20	High	Moderately Stable
111w	McCully	0-10	Moderateq	Moderate	Moderate	60 +	Medium	Stable
111x	McCully	10-35	Moderate	Moderate	Moderate	60 +	High	Stable
111y	McCully	35-60	Moderate	Moderate	Moderate	60 +	Very High	Moderately Stable
111z	McCully	60 +	Moderate	Moderate	Moderate	60 +	Very High	Unstable
156w	Horeb	0-10	Moderate	Moderate	Moderate	40-60	Low	Stable
156x	Horeb	10-35	Moderate	Moderate	Moderate	40-60	Medium	Stable
156y	Horeb	35-60	Moderate	Moderate	Moderate	40-60	Medium	Moderately Stable
156z	Horeb	60 +	Moderate	Moderate	Moderate	40-60	High	Moderately Stable
157w	Kinny	0-10	Moderate	Moderate	Low	40-60	Low	Stable
157x	Kinny	10-35	Moderate	Moderate	Low	40-60	Medium	Stable

Table I-II

Soils Watershed Management Characteristics
Survey by Byron Thomas and J. A. Pomerening, O.S.U.

Symbol	Soil Series and Land Type	Slope %	Infiltration	Permeability	Water Holding Capacity	Effect. Root Zone Inches	Erosion Hazard	Disturbed Regolith Stability
157y	Kinny	35-60	Moderate	Moderate	Low	40-60	High	Moderately Stable
157z	Kinny	60 +	Moderate	Moderate	Low	40-60	High	Moderately Stable
158w	Bull Run	0-10	Moderate	Moderate	High	60 +	Low	Stable
158x	Bull Run	10-35	Moderate	Moderate	High	60 +	Low	Stable
158y	Bull Run	35-60	Moderate	Moderate	High	60 +	Medium	Moderately Stable
159y	Damsite	35-60	Moderate	Mod. Rapid	Low	40-60	Medium	Stable
159sz	Damsite	60 +	Mod. Rapid	Mod. Rapid	Low	40-60	High	Moderately Stable
169sx	Henline	10-35	Mod. Rapid	Mod. Rapid	Low	20-40	Low	Stable
169sy	Henline	35-60	Mod. Rapid	Mod. Rapid	Low	20-40	Medium	Stable
169sz	Henline	60 +	Mod. Rapid	Mod. Rapid	Low	20-40	High	Moderately Stable
175sy	Unnamed	35-60	Mod. Rapid	Mod. Rapid	Low	10-20	Medium	Stable
175sz	Unnamed	60 +	Mod. Rapid	Mod. Rapid	Low	10-20	High	Moderately Stable
256w	Unnamed Xeric Cascade	0-10	Moderate	Mod. Slow	High	60 +	Low	Stable
256x	Unnamed Xeric Cascade	10-35	Moderate	Mod. Slow	High	60 +	Low	Stable
256y	Unnamed Xeric Cascade	35-60	Moderate	Mod. Slow	High	60 +	Medium	Moderately Stable
258w	Goble	0-10	Moderate	Mod. Slow	High	40-60	Low	Stable
258x	Goble	10-35	Moderate	Mod. Slow	High	40-60	Medium	Stable
258y	Goble	35-60	Moderate	Mod. Slow	High	40-60	High	Moderately Stable
259sw	Goodfellow	0-10	Moderate	Moderate	Low	40-60	Low	Stable
259sx	Goodfellow	10-35	Moderate	Moderate	Low	40-60	Low	Stable
Czw	Cazedero	0-10	Mod. Rapid	Moderate	High	60 +	Low	Stable
Czx	Cazedero	10-35	Mod. Rapid	Moderate	High	60 +	Medium	Stable

Table I-III

Willamette Basin Forest Soils

Soil Name	Hazard	Restrictions	Parent Material	Aggregate	Profile Depth
Peavine	Erosion Compaction	Restrict logging during prolonged wet period.	Sedimentary rock	None	20"-40"
Willakenzie	Erosion Compaction	Restrict logging during prolonged wet period.	Sedimentary rock	None	20"-40"
Hazelair	Erosion	Silty clay loam with clay subsoil	Sed. rock	None	20"-40"
Jory	Erosion on steep slopes	Silty clay loam with clay subsoil	Igneous rock	0-20%, gravel & cobbles	40"-60"
Nekia	Erosion on mod. to steep slopes	Silty clay loam with clay subsoil	Igneous rock	0-20%, gravel & cobbles	20"-40"
Witzel	Shallow - stony profile	Very stony silty clay loam	Igneous rock	Cobbles & stones 50-90%	10"-20"
Cazadero	Erosion	Silty loam	Old alluvium	Cobbles & gravel	60" +
Bornstedt	Erosion	Silt loam	Old alluvium	None	40"-60"
Kinton	Erosion	Silt loam	Loess-like	None	20"-40"
Cascade	Erosion	Silt loam	Loess-like	None	20"-40"
Laurelwood	Erosion	Silt loam	Loess-like	None	60" +
Melby	Erosion on steep slopes	Restrict logging during prolonged wet periods.	Sed. rock	None	30"-60"
Olyic	Erosion on steep slopes	Silt loam	Igneous rock	None	40"-60"

Table I-III

Willamette Basin Forest Soils

Soil Name	Hazard	Restrictions	Parent Material	Aggregate	Profile Depth
McCully	Erosion	Clay loam	Igneous rock	0-15%, cobbles & gravel	60" +
Kinney	Erosion	Cobbly profile, cobbly loam soil	Igneous rock	20-50% cobbles & gravel	36"-60"
Peavine	Erosion	Restrict logging during prolonged wet periods	Sed. rock, sand-stone & shale	None	20"-40"
Klickitat	Erosion - acid soil	Loamy surface soil	Igneous rock	20-50% cobbles below 10"	20"-40"
Honeygrove	Erosion - acid soil	Restrict logging during prolonged wet periods	Sedimentary - sandstone	None	40"-60"
Bohannon	Erosion - acid soil	Restrict logging during prolonged wet periods	Sedimentary - sandstone	20-50% gravel	20"-40"
Astoria	Erosion - acid soil	Restrict logging during prolonged wet periods.	Sedimentary - siltstone or shale	None	40"-100"
Hembre	Erosion - acid soil	Gravelly loam and silt loam	Igneous rock	20-50% gravel cobbles & stones	36"-60"
Kilchis	Shallow soil	Acid stony loam soil	Igneous rock	20-90% stones & cobbles	12"-20"
Bull Run	Erosion	Silt loam soil	Igneous rock	None	60" +
Aschoff	Erosion	Stony silt loam	glacial till of basalt & andesite	20-50% stones	60" +
Honeygrove	Erosion acid soil	Restrict logging during prolonged wet periods	Sed. sandstone	None	40"-60"

Table I-III

Willamette Basin Forest Soils

Soil Name	Hazard	Restrictions	Parent Material	Aggregate	Profile Depth
Bohannon	Erosion - acid soil	Restrict logging during prolonged wet periods.	Sedimentary	20-50% gravel	20"-40"
Whetstone	Erosion - acid soil	Stony sandy loam	Colluvium & till over basic igneous rock	20-50% stones	40"-60"
Henline	-	Very stony sandy loam	Colluvium & till over basic igneous rock	50-90% stones	30"
Sisi	Erosion	Gravelly loam	Igneous rock	50-90% stones & gravel	40"-100"
Hambone	Erosion	Gravelly fine sandy loam	Igneous rock	20-50% stones & gravel	40"-100"
Rockland	Shallow soil	Less than 10" soil over bedrock	Igneous rock	-	0-10"
Timberline	Acid soil	Sandy loam soil	Igneous rock	None	20"-40"

XVII. Proposed Water Developments - Impact Studies

A. General

Three Federal agencies construct large reservoirs affecting BLM lands. These are Corps of Engineers, Bureau of Reclamation, and Soil Conservation Service. The latter has two types of programs in the basin. The south half of the basin is embraced in a Soil Conservation Service Resource Conservation and Development project. A high proportion of the project area is timber land, including substantial acreages of BLM land. Proposed programs include reservoir construction as well as improvement in timber management, recreation development, and other conservation practices.

The other Soil Conservation Service reservoir construction program is that under P. L. 566, and tentative sites for development have been identified throughout the basin.

B. Proposed Reservoirs

Seven of the proposed reservoirs are on BLM lands in the Eugene District. See Table XI-1. They will have major impact on 862 acres of BLM land, reducing timber production by 448.5 M. board feet per year. Opportunity cost due to lost production equals $747,870. Only three of the reservoirs enhance the recreation potential of the BLM lands.

Ten proposed reservoirs affect BLM lands in the Salem District. They have major impact on 3,073 acres. Timber production will be reduced 1,415 M. board feet per year. BLM improvements worth $1,229,000 will be inundated. Opportunity cost from loss of timber production equals $2,857,817. Only three of the reservoirs will enhance recreation opportunities on the BLM lands. All will increase BLM's management responsibilities due to increasing public use. Fire protection will be one of the major problems.

Preliminary impact reports have been sent to the construction agencies on all except McKay Creek reservoir. Lack of planning data precludes preparation of an impact report on the latter.

The high opportunity cost from construction of the Lyons project on the Little North Santiam may result in selection of an alternative site which will have less adverse impact on BLM's programs.

The greatest impact on BLM of these reservoirs will be the tremendous surge of recreation use. Funds must somehow be found to provide facilities needed to protect the site and water resource values.

The reservoir sites listed are only a few of the total number of projects being built into the basin study program. Most do not directly affect BLM lands and are not discussed in this report.

Table A-1

Proposed Reservoirs Affecting BLM Lands
in Willamette Basin

Reservoir Name	Stream	Reservoir Surface Acres	BLM District	BLM Acres Affec.	BLM Improv. Affec.	BLM Recr. Enhan.	BLM Annual Timber Produc. Loss (bd.ft.)	Opportunity Cost
Abrams	Mosby Cr.	1,050	Eugene	95	-	Fair	51M	$85,000
Thurston	McKenzie River	8,100	Eugene	140	-	Minor	70M	116,700
Diston	Row River	1,315	Eugene	200	-	Fair	100M	167,000
Shotgun	Shotgun Creek	275	Eugene	275	$25,000	Good	137.5M	229,170
Bear Cr.	Bear Cr.	107	Eugene	40	-	Good	24M	40,000
Ferguson Creek	Ferguson Creek	154	Eugene	100	-	Good	60M	100,000
Ferguson	Ferguson Creek	133	Eugene	12	$68,000 1/	Poor	6M	10,000
Total Eugene District				862	$93,000		448.5M	$747,870
Coal Cr.	Butte Cr.	695	Salem	147	-	Good	74M	$122,500
Clear Cr.	Clear Cr.	1,710	Salem	75	-	Limited	37.5M	62,500
Grange	Silver Cr.	620	Salem	40	-	Minor	24M	40,000
Pike	N.Yamhill River	1,460	Salem	23	-	Good	11.5	19,150
Lyons	Lit.North Fk.Santiam	2,100	Salem	2,000	$361,000	Fair	1,200M	2,000,000
Buck Hollow	Willamina	1,435	Salem	200	$842,000	Poor	40M	567,000
Dairy Cr.	East Fork Dairy Cr.	322	Salem	28	$26,000	Good	28M	46,667
Holley	Calapooya	3,080	Salem	200	-	Poor	-	-
Cascadia	S.Santiam	1,700	Salem	160	-	None	-	-
McKay	McKay Cr.	310	Salem	200	-	Fair	-	-
Total Salem District				3,073	$1,229,000		1,415M	$2,857,817
Basin Total				3,935	$1,322,000		1,863.5M	$3,605,687

1/ Replacement cost

Some of the criteria for evaluating proposed reservoirs are as follows:

1. The dam and reservoir should blend well with the forest environment and provide good opportunity for recreational development and enjoyment.

2. The dam and reservoir should not threaten or destroy basic forest watershed resources, jeopardizing the performance of the drainage as an efficient watershed.

3. The reservoir should not destroy an existing resource complex already producing clearly significant economic or social benefits, including existing recreation, fisheries, wildlife, timber, water quality, etc.

4. The impact on the lumber industry and timber stumpage values due to increased log transportation distances and adverse grades which result either in increased log costs or decreased stumpage values.

Twelve of the listed projects are proposed for construction by 1980. Correlation of these projects with district programs imposes costs on the districts which must be programed and budgeted. These costs include preparation of formal impact reports as soon as preliminary project plans are completed. The Forest Service programs project imposed costs per project as follows:

Item	Costs: Initial Investment	Costs: Annual
1. Planning - Impact Studies	$5,000	
2. Administration		
During construction		$10,000
After construction		$1,000
3. Recreation		
New facilities	$100,000 - $300,000	
Maintenance facilities		$5,000 - $15,000
4. Reservoir Debris		
Disposal facilities	$15,000	
Annual sweeping		$10,000
5. Protection		
Fire - during construction		$3,000
Fire - after construction		$1,000

Inadequacies in past BLM impact reports resulted from lack of manpower and funding to handle this type of work. Table A-1 shows the necessity for BLM being involved in water project site determinations and correlation of programs with construction agencies.

C. Summary

Twelve of the reservoirs proposed for construction by 1980 have impact on BLM operations. This averages at least one new project start per year. These are only the projects proposed for construction in the Willamette Basin. Many more will be proposed throughout the rest of the State. In view of the sizeable impact of some of these reservoirs on BLM programs, this work should be well identified in future BLM programs.

TABLE A-2

RESERVOIR STORAGE DEPLETION LOSS DUE TO SILTATION FROM WATERSHED EROSION IN WILLAMETTE BASIN

bbasin Reservoir	Constr. Date	Constr. Cost	Cost Adjusted to 1966 Dollars 2/	Drainage Area sq. Miles	Gross Storage Acre feet	Project Cost per A.Ft. 1966 Dollars	Av. Annual Siltation Acre Feet 4/	Siltation Cos Per Year
pper Willamette Sub-area								
./ Cottage Grove	1942	$ 3,137,294	$ 6,337,334	104	33,060	$191	26	$ 4,966
./ Dorena	1949	14,563,473	20,097,593	265	77,500	259	66	17,094
btotal		$ 17,700,767	$ 26,434,927	369	110,560		92	$ 22,060
2 Hills Creek	1961	45,700,619	50,270,681	389	356,000	141	97	13,677
2 Lookout Point	1953)	89,051,783	109,533,693	991	483,500	227	248	56,296
Dexter	1955)							
2 Fall Creek	1965	21,087,000	21,930,480	184	125,000	176	57 46	$ 8,096
btotal		$155,839,402	181,734,854	1,564	964,500		391	78,069
3 Cougar	1963	54,700,000	58,529,000	208	219,000	267	52	13,884
3 Blue River 1/		31,400,000	3/ 31,400,000	88	89,000	354	22	7,788 250
btotal		$ 86,100,000	$ 89,929,000	296	308,000		74	$ 21,672
4 Fern Ridge	1941	6,484,967	14,461,476	275	116,200	125	92	11,500
btotal Upper Willamette		$266,125,136	$312,560,257	2,504	1,499,260		649	$133,301
m								
iddle Willamette Sub-area								
5 Detroit	1953)	62,729,698	77,157,728	438	460,930	167	109	18,203
Big Cliff	1954)							
5 Green Peter	1966)	82,300,000	82,300,000	771	491,000	167	193	32,231
Foster	1966)							
btotal Middle Willamette		$145,029,698	$159,457,728	1,209	951,930		302	$ 50,434
Total Basin Wide		$411,154,834	$472,017,985	3,713	2,451,190	$193	951	$183,735

150 ton per acre = 1" soil loss

1/ Under construction
2/ Purchasing power of dollar from "Business Statistics" U.S. Dept. Commerce
3/ Estimate by Corps of Engineers
4/ Corps Engineers House Doc. 531, Vol V "Columbia River & Tributaries in N.W. United States" 1950

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Definition of Terms Used in Economic Profiles

1. Demand - refers to the impact of national, state or local consumption or use of resources on the resources in a specified area.

2. User Influence Areas - refers to the marketing area of a resource or the source of demand. They vary by type of resource. Recreation user influence areas may be quite large while that for livestock forage may be quite small.

3. District Statistical Areas - refer to a resource processing or distribution center together with its surrounding area of influence. It may include one or more counties. Ordinarily boundaries are correlated with county lines since statistical data is generally available on a county basis.

4. Local Economy - refers to the local system for producing, distribution, and consumption of wealth, including goods and services.

5. Economic Dependency - as related to BLM resources is the proportionate share of the BLM resource used or needed to sustain an industry on a yearlong basis.

6. Economic Benefits - includes providing employment, increasing gross or personal income, or contributing to the supply of "new" money brought into an area by making resources available to local industries.

7. Export - refers to sales of locally produced goods or services to non-local industries or people.

8. Personal Income - includes income from labor, property, dividends, interest, proprietor's income, and transfer payments to individuals by government for social security, retirement, unemployment compensation, direct relief, etc. minus personal contributions for social insurance.

9. User Benefit - equals the market value of the resource used or purchased except for recreation on which the values are set by Senate Doc. 97.

10. Net Effective Buying Income - is the spendable income available to a family or person over and above taxes or other expense over which he has no control.

Definitions of Terms Used in Economic Profiles

1. Demand - refers to the amount of national, state or local consumption at prices of resources of the commodity in a specified area.

2. Total Sufficiency Ratio - refers to the marketing area of a resource or commodity of supply. These vary by type of resource. Recreation area sufficiency ratios may be rather large, while that for livestock feed may be quite small.

3. Population Distribution Area - refers to a resource permitting or facilitating further progress into the corresponding area of influence. It may include all or part counties. Sufficiently boundaries are coordinated with census lines since statistical data is generally available on a county basis.

4. Local Economy - refers to the local system for production, distribution and consumption of wealth, including goods and services.

5. Economic Development - an enterprise and resources in its program which starts on the unit resource-based or needed to sustain an industry on a yearly basis.

6. Economic Expansion - business providing employment, broadening areas or personal income, or contributing to the supply of needed service locally and can be done by making resources available in local production.

7. Export - refers to sales of locally produced goods or services to non-local industries or people.

8. Personal Income - includes income from labor, property, dividends, interest, proprietor's income, and transfer payments to individuals by government (old-age security, retirement, unemployment compensation, direct relief, etc. minus personal contributions for social insurance.

9. Site Benefits - equals the market value of the resources used or purchased goods for recreation to which the values are set by travel time, etc.

10. Net Disposable Family Income - is the available income available to a family or person after all state taxes or other expense over which he has no control.

11. Poverty Classification, Poor Families - are generally considered in this category where annual income is less than $3000. However, a rural family with a $3000 income is much better off than a family in Portland with the same income. For this reason, the Office of Economic Opportunity has rated each Oregon County for its poverty level cut-off. In 1966, families with less than $2450 in Baker County were in the "poor" category whereas in Lane County the cut-off was $2578.

12. Unsound Housing - is an indication of poverty, referring to housing which is substandard in plumbing, wiring, or other category, or is delapidated or deteriorated. Nationwide 26% of the housing is in this category.

13. Recreation day - is synonymous with recreation visit as used in State Highway Department "Oregon Outdoor Recreation" survey. It is a unit of measurement consisting of a visit by one individual to an area for recreation purposes during a reasonable portion or all of a 24 hour period. Driving for pleasure may be included.

14. Benchmark Projections to 1980 - indicate what BLM resource production would be in 1980 if the present proportion of BLM resource production to total resource production remained unchanged.

15. Economic Multipliers - are the factors derived by quantifying the relationship between "new" money brought into an area through export of products or services and the total amount of personal income this "new" money will generate in the community. The relative size of the multiplier is determined by the amount of local labor input into the resource, the intensity of processing prior to export, and the amount of locally produced goods used in the processing.

16. Business Income Multipliers* - are factors showing total change in business output in the area per $1.00 change in the output of a specific industry sector. Business income multipliers developed for Oregon industries are as follows:

Livestock industry	1.56
Lumber	1.28
Mining	1.15
Recreation - lodging, cafes, taverns	1.56

an increase or decrease in New Capital Formation causes cumulative effects in ~~new~~ income thro' consumer expenditure

17. Household Income Multipliers* - are factors showing total change in the quantity of labor and management services demanded in an area per $1.00 change in output of a specific industry. The fractional portion of the household income multiplier used by each industrial sector is taken from direct and indirect trade coefficient tables. The industry portion of the household income multiplier is added to the business income multiplier to get the total economic multiplier factor. The proportionate household multiplier by industry are as follows:

Livestock	18 cents
wood products	35 cents
mining	22 cents
recreation, lodging, cafes, taverns	32 cents

18. Conservation lands - are private lands taken out of crop production for conservation reasons.

* "Effects of Selected Changes in Federal Land Use on a Rural Economy" OSU 1968. Bul. 604.

TABLE III A

Willamette River Basin Comprehensive Study

County Lane Subbasin Coast Fork Tributary

DATA CONFIRMATION

Ownership BLM & Private Date 4-10-67

Land 1/ Measure Problem	Name (Local) of Project	Type of Project & Location 2/	Existing water stor. Development	Priority	Benefits	Amount No.	Amount Unit	Costs Total $
5	Clark Creek	5 - 1	Dorena Res.	20	Water quality	0.50	miles	$1,500
13	Big River	13 - 1 3 none	Cottage Grove Res.	1	Water quality site protection prot. fisheries	200	acres	16,500
17	Big River	17 - 1	Cottage Grove Res.	16	Flood damage control	7.0	miles	5,600
17	Sharps Creek	17 - 2	Dorena Res.	15	Flood Dam. contr.	10.0	miles	8,000
17	Mosby Creek	17 - 3	None	18	Flood Dam. contr. site protection Prot. Improv.	2.0	miles	1,600
1	Mosby Creek	1 - 1	None					
	Need maintenance on 8 miles temporary road for recreational use.							6,900
16	Sharps Creek	16 - 1	Dorena Res.		Site protection water quality Enhance Fisher.			
		7 - 0	None					
		8 - 0	None					
5	Sharps Creek	5 - 2	Dorena Res.	22	Site protection	0.25	miles	500
17	Rat Creek	17 - 4	Dorena Res.	23	Flood dam.contr. site protection protect improv.	0.25	miles	300
5	Cerro Gordo	5 - 3	Dorena Res.	21	Site protection	1.0	acre	200
2	Cerro Gordo	2 - 1	Dorena Res.	5	Water quality	50.0	acres	15,000
11	" "	11 - 1	Dorena Res.	14	Protect fisher.	1.0	acre	300
2	Cobblestone Rd.	2 - 2	Dorena Res.	10	Site protection protect fisher.	20.0	acres	6,000
11	Cobblestone Rd.	11 - 2	Dorena Res.	17	Water quality	5.0	acres	1,500
11	Harms Creek	11 - 3	Dorena Res.	7	Water quality	40.0	acres	12,000
2	Harms Creek	2 - 3	Dorena Res.	8	Site protect. fisheries Prot. improve.	40.0	acres	12,000

1/ See Land Measure Problem code 2/ Consult map

TABLE III A

Willamette River Basin Comprehensive Study

County Lane Subbasin Coast Fork Tributary ________

DATA CONFIRMATION:

Ownership BLM Date 4-10-67

Land 1/ Measure Problem	Name (Local) of Project	Type of Project & Location 2/	Existing water stor. Development	Priority	Benefits	Amount No.	Amount Unit	Costs Total $
5	Harms Creek	5 - 4	Dorena Res.	19	Site Protec. fisheries	1.0	mile	$3,000
2	Harms Creek	2 - 4	Dorena Res.	6	Site Protec. fisheries water quality	40.0	acres	12,000
11	Smith Creek	11 - 4	Dorena Res.	13	Water quality fisheries, site protec., prot. improvements	15.0	acres	4,500
2	Dorena South	2 - 5	Dorena Res.	2	Water quality, fisheries Protect improv.	75.0	acres	22,500
11	Dorena South	11 - 5	Dorena Res.	3	Site prot. fisheries	50.0	acres	15,000
11	London West	11 - 6	Cottage Grove Res.	4	Site protec. fisheries, water quality, improvements	50.0	acres	15,000
2	London West	2 - 6	Cottage Grove Res.	11	Site protec. fisheries, water quality, prot. improv.	20.0	acres	6,000
2	Hoodoo Mtn.	2 - 7	Cottage Grove Res.	12	Site protec. fisheries, water quality, improvements	15.0	acres	4,700
11	Jasper Creek	11 - 7	Cottage Grove Res.	9	Site protec. fisheries, water quality, improvements.	40.0	acres	12,000
	TOTAL							$182,600

1/ See Land Measure Problem code

2/ Consult map

TABLE III B

Willamette River Basin Comprehensive Study

County Lane Subbasin Middle Fork Tributary

DATA CONFIRMATION:

Ownership BLM Date 4-12-67

Land 1/ Measure Problem	Name (Local) of Project	Type of Project & Location 2/	Priority	Benefits	Amount No.	Amount Unit	Costs Total $
5	Lost Creek	5 - 1	11	Site protec. fisheries prot. improv. water quality	1.0	miles	$3,000
15	Lost Creek	5 - 2	10	Site protec. fisheries, prot. improv.	1.0	miles	1,000
15	Hills Creek	5 - 3	6	Site protec. fisheries prot. improv.	6.0	miles	6,000
15	Winberry Creek	5 - 4	8	Site protec. fisheries, prot. impr	2.0	miles	2,000
2	Lost Creek	2 - 1	1	Water quality, site protec., fisheries prot. improv.	125	acres	37,500
13	Lost Creek	13 - 1	7	Prot. improv. site protec. water quality.	3.0	miles	4,860
13	Hills Creek	13 - 2	9	Prot. improv. water quality.	1.0	miles	1,620
2	Hills Creek	2 - 2	3	Fisheries, site protec., water quality.	50.0	acres	15,000
7	Lost Creek	7 - 1	12	Fisheries, flood damage reduc., site improv.	1.0	mile	5,000

1/ See Land Measure Problem code

2/ Consult map

TABLE III B

Willamette River Basin Comprehensive Study

County Lane Subbasin Middle Fork Tributary

DATA CONFIRMATION:

Ownership BLM Date 4-12-67

Land 1/ Measure Problem	Name (Local) of Project	Type of Project & Location 2/	Priority	Benefits	Amount No.	Amount Unit	Costs Total $
11	Lost Creek	11 - 1	2	Site improv, site prot. & prot. improv.	20	acres	$6,000
11	Fall Creek	11 - 2	4	Site protec. & improv., prot. improv.	10	acres	3,000
11	Hills Creek	11 - 3	5	Prot. site & improv.	10	acres	3,000
	TOTAL COST						$87,980

1/ See Land Measure Problem code

2/ Consult map