DESIGN MEMORANDUM NO. 1D

DRAFT MUD MOUNTAIN DAM MASTER PLAN

US Army Corps
of Engineers®
Seattle District

January 1997

VALIDATION

The Mud Mountain Dam Master Plan, Design Memorandum 1D, prepared by Engineering Division, has been coordinated with all pertinent elements of Seattle District, Including Operations Division and Real Estate Division.

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EXECUTIVE SUMMARY

This January 1997 Mud Mountain Dam Master Plan (Design Memorandum 1D) has been prepared in accordance with ER 1130-2-435 to guide the use and development of the natural and manmade resources at the project. The Mud Mountain Dam project is operated and maintained by the Seattle District, U.S. Army Corps of Engineers.

Project resource development and management actions are measured against a management framework which includes resource objectives and concise land management measures for individual project sites and features. The master plan will serve to increase resource management effectiveness and provide the basis for the preparation of operational management plans (OMP), prescribed by ER 1130-2-435, and feature design memorandums (FDM).

The Mud Mountain Dam project is the primary component of a comprehensive flood control plan for the Puyallup River, providing protection to agricultural, industrial, commercial and residential properties, and more than 220,000 residents. The dam was authorized by the Flood Control Act of 1936 and became operational 1948. Construction and O&M of recreational facilities were authorized by the Flood Control Act of 1944. In 1988 dam safety modifications were initiated to control seepage through the structure and provide earthquake protection of the inlet works. These modifications were completed in early 1996.

The Mud Mountain Dam project consists of the dam and appurtenant structures, a project operations area, a day use recreation area, and the reservoir lands. Mud Mountain Dam is normally operated without a reservoir, passing the normal flow of the White River through a 9-foot-diameter tunnel. A 23-foot-diameter tunnel provides additional capacity to pass high flows. Reservoir lands are used for low-density recreation, contain diverse vegetation, and provide a home for up to 116 species of wildlife including resident herds of Rocky Mountain elk and black tailed deer. The project provides fish transport for spawning salmon and steelhead trout to replace the natural passage lost due to construction of the dam.

Project lands were acquired in accordance with the authorizing documents for operation of the project for flood control. The master plan presents various project land classifications and gives specific recommendations for development and resource management consistent with the authorized project purpose.

Resource objectives for the Mud Mountain Dam project fall into one of five broad headings: project operations, recreation management, wildlife management, habitat management, coordination, and public education.

- Project Operations. Resource objectives in this category are to maintain and operate the project to provide flood control for the lower White and Puyallup Rivers.

- Recreation Management. Resource objectives in this category are to manage existing developed day use recreation facilities and to develop additional facilities to help meet current and future recreational needs such as picnicking, sightseeing, hiking, camping, river rafting and horseback riding. Recreation is classified as “high density” for intensive use such as picnicking,

playgrounds and sports activities, and “low density” for hiking, sightseeing, camping, etc.

- Habitat Management. Resource objectives in this category are to preserve significant wildlife habitat on project lands, including forests, wetlands, and meadows, in an undisturbed condition and to continue assisting anadromous fish with upstream migration by collecting fish below the dam and transporting them to a release site above the dam.

- Coordination. Resource objectives in this category are to maintain close, ongoing coordination with interested federal, Tribal, state and local agencies, and citizen groups and organizations in managing the natural and manmade resources associated with Mud Mountain.

- Public Education. Resource objectives in this category are to enhance the public’s recreational experience and to increase the visitor’s knowledge of the Corps of Engineers’ role in flood control and environmental management by providing context-sensitive information.

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SECTION 1

Introduction

1. INTRODUCTION

1.1. Purpose. Master plans for Corps of Engineers Civil Works projects are planning documents, conceptual in scope, which provide a framework for the orderly, coordinated development and management of all natural and manmade project resources. This master plan does not evaluate operational aspects of the project for flood control, nor is it within the scope of a master plan to do so. All Corps of Engineers Civil Works projects and other fee owned lands are required by Engineer Regulation (ER) 1130-2-435, Project Operations - Preparation of Master Plans, to have master plans. The ER also provides for periodic review and update. The original master plan for the Mud Mountain Dam project (Design Memorandum (DM) 1B) was issued in March 1964 and was updated in April 1976 (DM 1C). This master plan (DM 1D) reflects new guidance for preparation of project master plans issued in December 1989 and incorporates interim Provisional Resource Objectives prepared in 1989, as modified by the results of the current analysis.

1.2. Scope. The master plan assesses project resources to develop guidelines that provide for their best and highest use, development, and management. Evaluation is focused specifically on project lands administered by the Corps and includes consideration of scenic, cultural, historic, recreational, and biological values. The primary goals of the master plan are to prescribe an overall land and water management plan, resource objectives, and associated design and management concepts. The master plan provides a guide for the best possible combination of responses to regional needs, resource capabilities and suitability, and expressed public interests and desires consistent with authorized project purposes, historic designation, and other institutional policies and directives. The master plan is based on a thorough understanding of the operation of the project and of project operations land and facility requirements. Land classifications and resource management prescriptions are formulated to be in harmony with these requirements.

1.3. Plan Formulation. The master plan has been formulated utilizing the study framework depicted in Figure 1.1. The plan formulation process was developed as a means to improve the quality and usefulness of Corps master plans and to reduce the long-term cost of the master plan program. Major outputs of the plan formulation process include the following:

a. Establish projectwide resource objectives, Sections I and 4.

b. Assign land classification and restricted water use zones to project areas, Section 4.

c. Establish resource objectives for specific management areas for which land classification has been assigned, Sections 5 through 11.

d. Identify land management measures which will contribute to achievement of site-specific resource objectives, Sections 5 through 11.

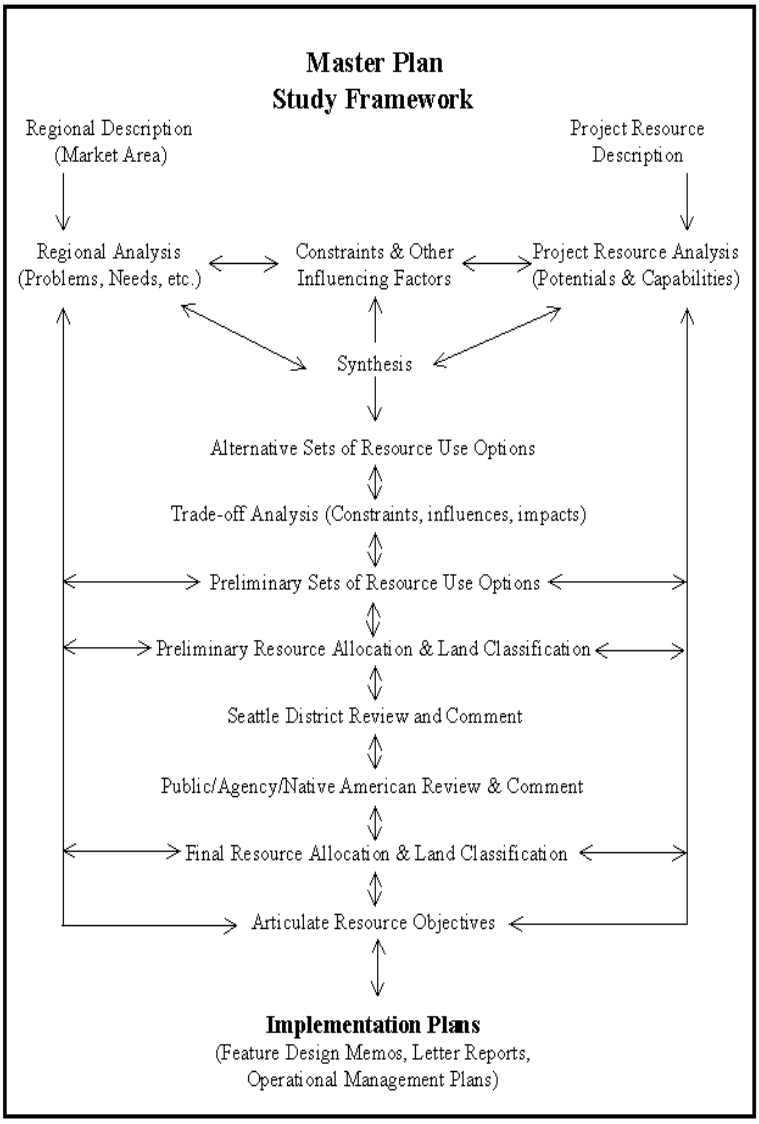


Figure 1.1
Master Plan Framework

e. Recommend development to be considered in subsequent design phases to achieve desired project utilization at site-specific locations, Sections 5 through 11.

f. Identify major constraints to future project resource use, development, and management, Sections 5 through 11.

g. Specify design criteria to be considered in subsequent design phases of plan implementation, Section 12.

h. Recommend subsequent aspects of planning for use, development, and management of project resources, Section 13.

1.4. Resource Objectives. This master plan contains resource objectives that are specific to the Mud Mountain Dam project and establishes guidelines for future development and management of the natural and manmade resources at the project. The resource objectives are consistent with the project purposes and applicable federal laws and directives. They are designed to obtain the greatest possible benefit while meeting the needs of the public and protecting and enhancing environmental quality. These resource objectives were formulated through study and analyses focusing on the three broad components of regional needs, public desires, and resource capabilities and potential, as illustrated in Figure 1.2.

Figure 1.2
Resource Objectives

SECTION 2

Project Description

2. PROJECT DESCRIPTION

2.1. Project Authorization. Construction of Mud Mountain Darn was authorized by the Flood Control Act of 22 June 1936 (PL 74-738), enacted by the 74th Congress, 2nd Session, as the main unit of the comprehensive Puyallup River flood control project. Construction and O&M of recreational facilities were authorized by the Flood Control Act of 1944 (PL 78-534).

2.2. Project Purpose. Mud Mountain Dam is a flood control facility providing flood protection to the lower White and Puyallup River valleys. In conjunction with channel improvements and a levee system at the mouth of the Puyallup River, the dam protects the Tacoma industrial district against floods as much as 50 percent greater than the 1933 maximum flood of record. The reservoir behind the dam is normally kept empty to provide storage of floodwaters which cannot be carried by the Puyallup River without flooding. The reservoir is designed to store 106,000 acre-feet of water, which would form a lake 5 1/2 miles long with an area of about 1,200 acres. Excessive discharge from the upper White River drainage area is impounded in the reservoir and released under controlled conditions to limit flow in the lower Puyallup River channel to 45,000 cubic feet per second (cfs) and flow in the lower White River to about 19,000 cfs.

Photograph 2.1
Upstream face of Mud Mountain Dam

2.3. Project Location. The Mud Mountain Dam project is located on the White River 8 miles southeast of Enumclaw, 30 miles east of Tacoma, and 45 miles southeast of Seattle. The project location is shown on Figure 2. 1, Vicinity Map.

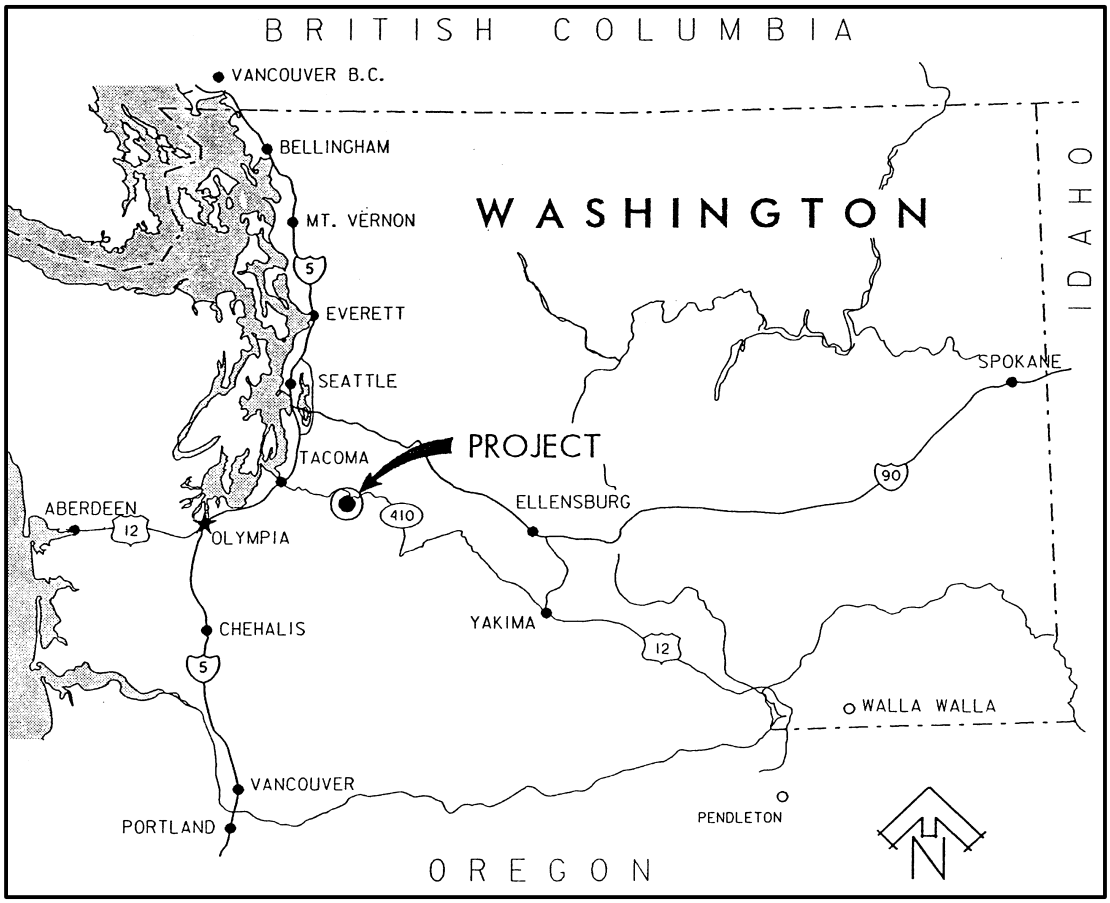


Figure 2.1
Vicinity Map

2.4. Project History. Residents of the White and Puyallup River valleys experienced devastating floods in 1892, 1917, 1921, and 1933.[1/] The Inter-County River Improvement Commission was formed in the early 1900s to deal with the problem of controlling the floods. Several revetments, diversion dams, and trash barriers were constructed. Never-the-less, the flood of 1933 resulted in nearly $ 1,000,000 damage. In that same year, the Commission suggested construction of a concrete

[1/] Hoyt, William G. and Largbein, Walter B.; Floods. Princeton University Press: Princeton, NJ, 1955, pg. 425

arch dam on the White River. The U.S. Congress concurred and authorized construction of the dam in the Flood Control Act of 1936. Three years of design study by the Corps of Engineers, Seattle District, determined that the dam would be a compacted earth-core and graded gravel structure instead of the concrete arch-type dam design initially proposed.[1/] A cross-section of Mud Mountain Dam is shown in Figure 2.2.

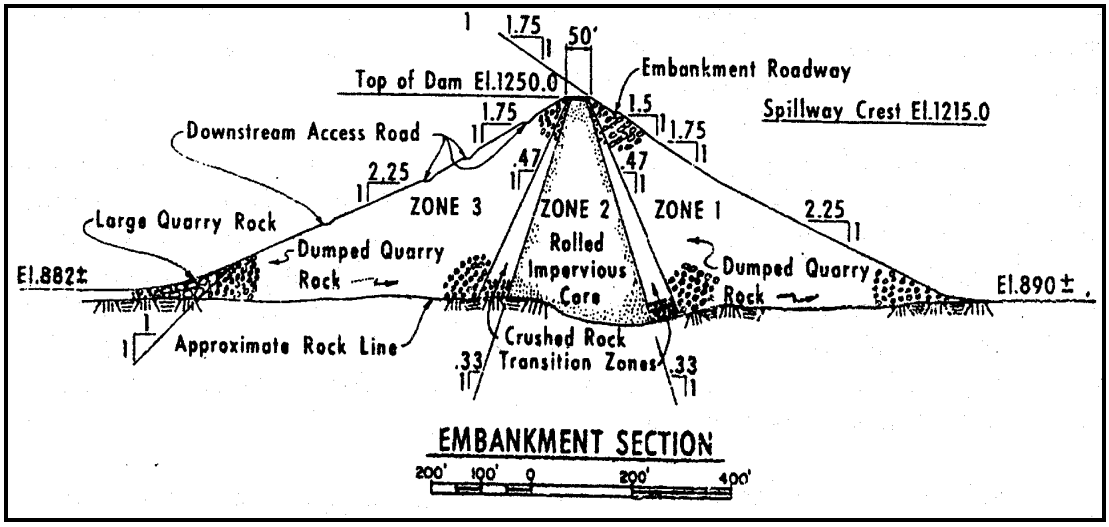


Figure 2.2

In 1937, a camp was built in the approximate location of the present day project facilities to provide surveyors, geologists, and engineers with a base of operation. The construction camp was completed in 1939 and consisted of an office building, repair shop, mess hall, hospital, bunkhouses for 400 men, a few family houses, and the original upper vista building. Construction on the dam itself began August 1939. Work progressed until July 1942 when construction was halted because steel was needed for war materials. Work resumed in 1947 and within a year, the tunnels, regulating valves, and valve house were completed, marking the end of major construction. Installation of a fishway structure and the establishment of the hydrologic radio network was completed in 1949.[2/] Mud Mountain Dam was dedicated in 1953, and, at that time, the 425-foot-tall structure was the highest earth construction darn in the world.[3/] Since then, various access road improvements, bridge replacement, and visitor facilities have been constructed. Plate 1 shows the current project condition

[1/] Corps of Engineers, Seattle District; Survey Report, 1939, pg. 6

[2/] Corps of Engineers, Seattle District; Mud Mountain Dam, Public Brochure, 1966

[3/] "Footloose", Tacoma News Tribune, 30 July 1978

and Plate 2 provides a detailed layout of the project operations and damsite area. Pertinent project data is contained in Appendix A, Section 1.

2.5. Project Modifications. In the late 1980s, geotechnical investigations verified concerns that fine material was being washed out of the core of the dam. Design studies determined a concrete cutoff wall to be the best solution to control water seepage and to prevent deterioration. Soon after, initial work was begun on a concrete cutoff wall which would extend 808 feet across the crest of the dam. The cutoff wall, 402.6-foot-deep and varying from 36- to 42-inch-thick, was built using a "hydrofraise," a specialized excavator which excavated 36- to 42-inch by 12-foot rectangular sections.[1/] Construction was completed in November of l990.

In addition to dam reconditioning, further studies indicated the need to modify the spillway walls, raise the crest of the dam, replace the two existing intake towers, and remove the outlet works water control valves. Studies determined that the original spillway for the dam was inadequate to contain a spillway design flood (SDF) of 245,000 cfs, and, in a SDF event, the dam would be overtopped and could fail, inundating the White and Puyallup River valleys below. Earthquake analyses found that the intake towers for both the 9-foot and 23-foot-diameter tunnels would fail during a major earthquake, blocking the tunnels and causing the pool to rise uncontrollably. Based on these studies, structural modifications to the dam included:

- Raising the dam height to prevent overtopping. Work completed November 1990.

- Raising the spillway walls to contain the SDF. Work completed November 1991.

- Removing the existing water valves at the 23-foot tunnel outlet works. Completed September 1994.

- Removing the two existing intake towers and replacing them with a single new tower capable of remaining operational during a design earthquake or flood. Operational November 1994.

The final construction contract, intake tower and the outlet works, was completed in early 1996.[2/]

2.6. Project Setting. Mud Mountain Dam is located at river mile 29.6 on the White River. The dam is constructed in a 150-foot-wide canyon where rock cliffs on either side of the gorge rise almost vertically to a height of nearly 230 feet above the river channel. Downstream, the channel widens to a width of about 700 feet, and the cliffs rise to a height of 425 feet. The lands surrounding

[1/]Ems, Larry D., Resident Engineer, Mud Mountain Darn, telephone conversation, 11 May 1995.

[2/]ibid

Mud Mountain Dam belong to forest resource companies, and, as such, nearly all have been clear-cut within the past 40 years. Project lands are primarily second growth forest, averaging about 60 years of age, and provide a protected forest ecosystem. The White River, with headwaters high on Mount Rainier, is the major tributary of the Puyallup River basin. The drainage area above the dam is about 402 square miles (see Figure 2.3). The watershed topography upstream of the dam ranges from foothills to mountainous terrain (see Plate 3). Major watershed landowners include the U.S. Forest Service (USFS), National Park Service (NPS), and private timber companies. The watershed is used primarily for timber production; fish production, supporting an important commercial, Native American, and sport fishery; recreation; and some residential use. Downstream topography ranges from timber covered foothills at the dam to tidal flatland near the mouth of the Puyallup River. Land uses downstream from the dam include: agriculture, industry, commerce, and residential development for more than 200,000 people.

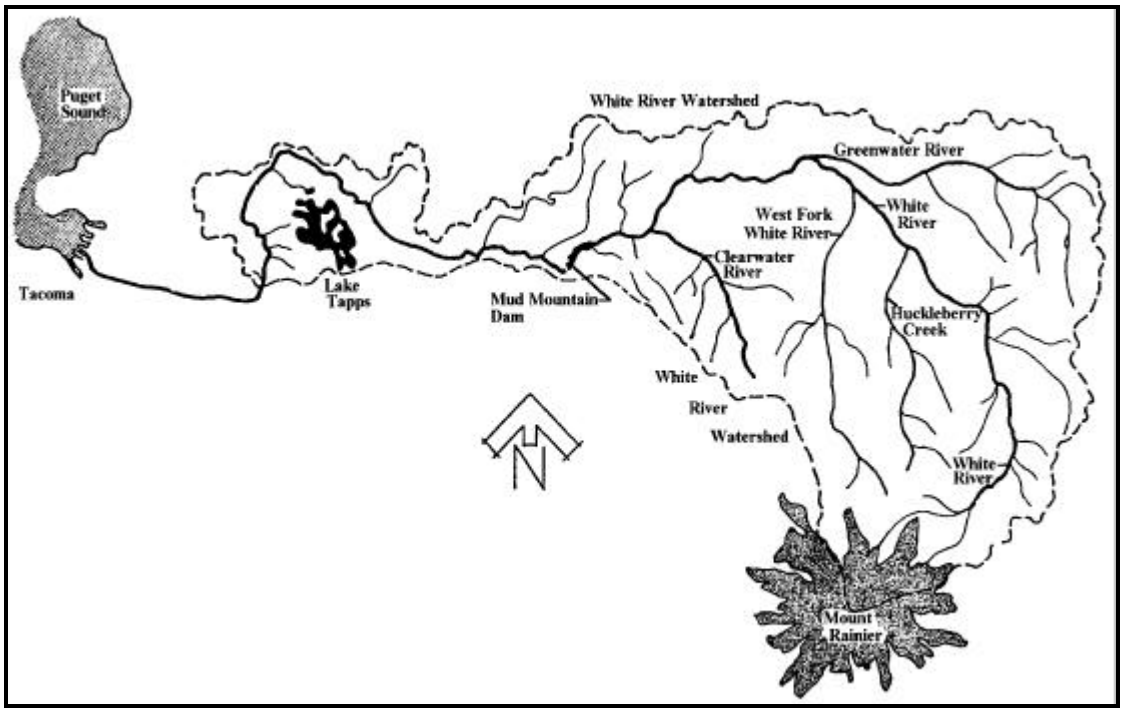


Figure 2.3
White River Watershed

2.7. Project Lands Administered by the Corps of Engineers. A total real estate interest of 2,439.98 acres was originally held by the Corps of Engineers for the construction, operation and maintenance of the Mud Mountain Dam project. Of that acreage, 2,359.94 acres were owned in fee with the remaining 80.04 acres held in lease, license, permit or easement.

In 1950, a 2.15-acre perpetual easement was obtained from Puget Sound Power and Light Company (Puget Power) at the Buckley diversion dam site, and a fish collection facility was constructed at this location. In the early 1960s, 694.24 acres of fee-owned land were reported as excess to project requirements and transferred to GSA. An interest in 33.66 acres held in lease, license, permit or easement was terminated. In 1977 the project reacquired 197.53 acres previously transferred to GSA, and, in 1989, an additional 11.75 acres were acquired in support of the dam modification work, and 2.10 acres of lease were acquired in 1990. Currently, the total project real estate interest is 1,923.46 acres, of which 1,863.23 acres are owned in fee, 3.48 acres are leased, 0.05 acres are held by permit, 0.01 acres are held by license, and 56.69 acres are held by easement. An additional 27.54 acres of leased joint use road right-of-way is held but not included in the real estate interest reported above.

The dam site and facilities occupy about 265 acres. The remaining fee-owned acreage was acquired as reservoir lands and for erosion control. Easements are held for road and utility right-of-way, the radio transmitter site and as storage area. Leased acreage is held for the fish collection site, piezometer sites, and radio relay sites.

Classification of project lands (see Paragraph 4.3) only account for approximately 1,700 of the project's 1,863 acres owned in fee. Of the remaining acreage, most is riverbed, however, the lack of an accurate boundary survey makes exact classification impossible.

2.8. Related Lands Administered by Others. The Mud Mountain Dam project is surrounded by land belonging to Weyerhaeuser Timber Company, generally on the north side of the White River, and Champion Timber Company, generally on the south side of the river. Green River College also owns a small parcel of land on the north side of the river upstream of the fish release facility (see Plate 1).

2.9. Project Access. Access to the project is from State Route (SR) 410 which runs parallel to the right bank of the White River for the entire length of the project. This highway connects with Interstate 5 to the west via SR 167 and SR 18, and continues east through Mount Rainier National Park to the city of Yakima. This highway is a major scenic cross-state tourist route (see Figure 2.4). A project owned, two lane paved road leads from SR 410 directly to the project operations area. This, and a connecting county road, are the only public access routes to the project operations area. A private log-haul road belonging to the Weyerhaeuser Timber Company extends the fall length of the project on the right bank between the access road and the project boundary. The Government has access across the haul road at specific locations for project purposes, but it is closed to the public. Public access to the upper reaches of the project is restricted to foot travel across private land. No public access roads are on the left bank of the project. Present access to the left bank is via the road across the dam crest. Recreational development in the upper river areas would necessitate acquiring public access to the area. Entry to these areas could utilize existing project easement across the private log-haul road. In 1996, when this report

was being prepared, both Weyerhaeuser and Champion were discouraging public access to their property and were charging access fees.

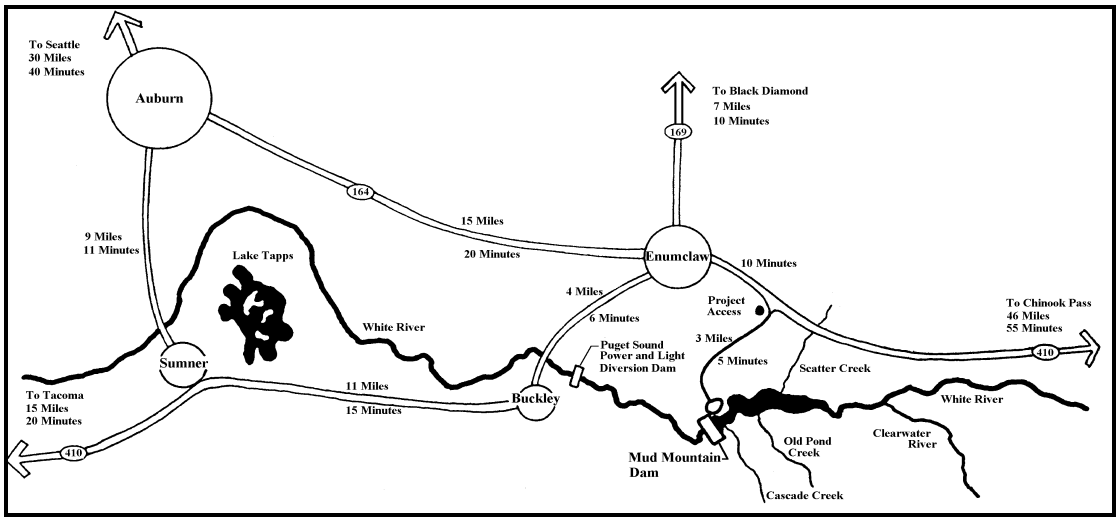


Figure 2.4
Project Access

Photograph 2.2
Project Entry Sign

2.10. Project Operations. The project provides flood protection to the lower White and Puyallup River valleys in conjunction with channel improvements and levee systems at the mouth of the Puyallup River. The project normally operates in a modified run-of-the-river mode. During flood events, White River runoff is impounded to limit the flow in the lower Puyallup River to a maximum of 45,000 cfs. Pool drawdown is started as soon as possible after the flood event has passed and is emptied as quickly as downstream flow constraints allow. During the fall, winter, and spring, the reservoir elevation fluctuates widely, making the reservoir unsafe for public use. A pool is formed for short periods during the summer as needed to accumulate floatable debris for disposal and to facilitate routine maintenance on the discharge tunnels.

The operational pool elevation frequency curve shown in Figure 2.5 is based on a 53-year period of record from 1944-1996. The annual pool elevations have fluctuated from a low of 965 in water year[1/] (WY) 1966 to a high of 1,196.1 in WY 1996. Pool elevation fluctuations are a result of flood control and maintenance operations required for debris removal.

Maximum pool elevations are usually the result of flood events which generally occur during winter. These data exclude a temporary pool held at an average elevation of 1,130 feet in 1974 to test water seepage through the dam.

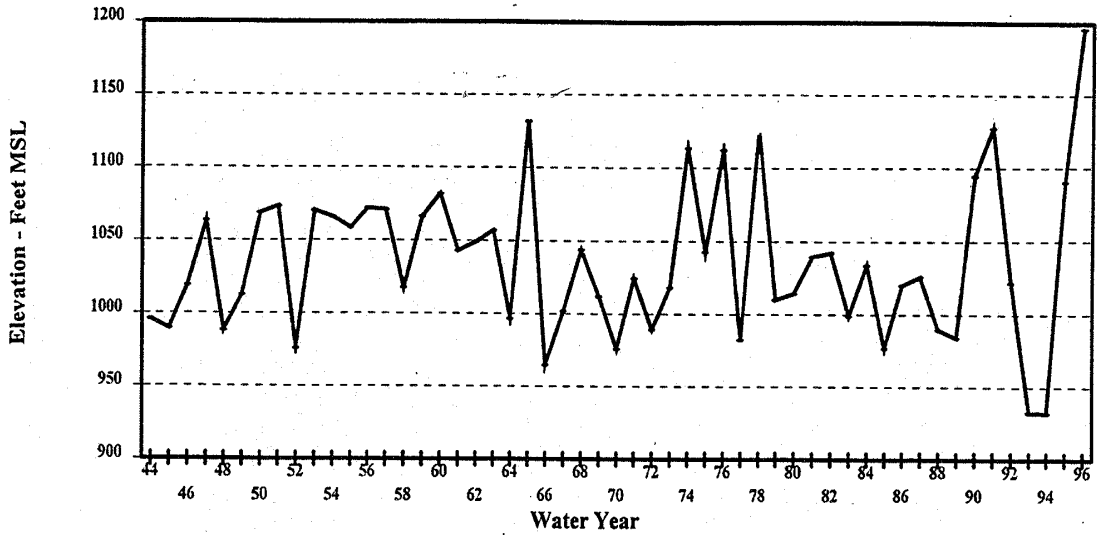


Figure 2.5
Maximum Annual Pool Elevations

[1/]Water year runs concurrent to fiscal year.

Debris collection was originally performed using an overhead cableway. This cableway was made inoperable during the winter of 1974 by a slide on the left bank which snapped the haul cable and buried the cableway anchor. Since then, debris has been removed through the use of a barge mounted crane and work boats. A pool is established and floating debris is collected and stored at either the upper or lower debris basin upland site, then burned when conditions permit. Debris is removed from the trash racks by a barge-mounted crane. Plate 4 shows the locations of the upper and lower debris basins and illustrates the extent of pool elevations that are likely to occur during 1-, 5-, 10-, 20-, 50-, 100-, and 500-year floods.

Maintenance of the intake tunnel is not limited to debris removal. The White River carries a large bedload of silt, sand, gravel, cobbles, and boulders due to its glacial origin (estimated to be ½ million cubic yards annually). Until the construction of the new intake as part of the dam modification project, this material passed through the 9-foot tunnel. As a result of the constant flow and the abrasiveness of the bedload, the tunnel floor was subject to extensive damage and required major rehabilitation on the average of every 2 years. The new tunnel with its steel liner is expected to require much lower maintenance.

Photograph 2.3
Debris Collection

2.11. Scenic Visual Qualities. The project area has a large variety of natural and cultural features which contribute to the scenic visual qualities. These features are scattered throughout the project, however, each is quite distinct in character and is described in the following paragraphs.

a. The River. The most dominant feature, the White River, varies in character from braided in the east, to meandering, and finally to a channelized river at the western edge of the project. Several areas have rapids which are audibly as well as visually appealing. Due to the White River's glacial origin it changes color from crystal clear in the early spring to milky white in summer as suspended fine sediment is carried off Mt. Rainier. A major factor affecting the visual quality of the river is whether or not a pool is held. A pool is held only during flood events (generally, early winter), and briefly during debris removal operations. When a pool is not held, the lower basin just upstream of the dam is in a silty condition and presents a stark contrast to the adjacent vegetation as shown in photographs 2.4 and 2.5. The visual quality of the river also varies depending on the amount of sedimentation in the water. The period of greatest sedimentation, and lowest visual quality, occurs during the summer because of glacial melt on Mount Rainier. At that time of year the river appears very muddy and dirty. The Clearwater and Greenwater Rivers, five creeks (Old Pond, Cascade, Upper Cascade, Canyon, and Scatter), and four unnamed drainages feed into the White River on project lands. Vegetation is lush along these water courses. A major visual asset within the project lands is the undisturbed second-growth forest.

Photograph 2.4
Lower Debris Basin with Pool

b. West of Scatter Creek. Visual appeal of project lands somewhat deteriorates west of Scatter Creek (see Plate 2) to the dam. Within this reach, annual inundation needed for flood control operations destroys much of the river's natural character. At lower pool, the edge condition of the river is indistinct and poorly defined. Colors within the landscape are uniform, debris is scattered, and the banks are silty. Unobstructed views within this reach vary from ¼ to 1½ miles in distance.

c. Lower Basin. When a pool is held at an elevation between 1070 feet and 1130 feet, the poor visual quality of the lower basin is masked. The edge condition of the river is crisp and well defined, the colors are diverse, and the pool has a high reflective quality. The scale of open space created varies from intimate to monumental, with vistas up to 2½ miles. Open spaces within the lower basin are warm and quiet with an abundance of light.

The lower basin is typically bordered by heavily vegetated steep slopes, providing a setting within the slopes that is quiet, damp, and cool for the viewer. Colors are diverse and odors are varied and pleasant. Access is limited. The steep slopes define the spaces created by the river and unvegetated areas are either exposed cliffs or slide areas.

Photograph 2.5
Lower Debris Basin without Pool

d. Upper Plateau. Hemlock and mixed hardwoods are typically found in the upper plateau areas, often bordering steep slopes. The visual quality can best be described by a screened edge condition, with semi-open to canopied over-story, filtered light, diverse and pleasant odors, diverse colors year-round, and a setting that is cool and quiet. Vistas range up to 3 miles.

e. Damsite. The damsite area incorporates all roads, buildings, vista structures, picnic areas, children play areas, and project operation structures on project lands. Many of these developments were designed to meet functional requirements. As a result, to a visitor, their original layout is perceived as being somewhat visually chaotic with poorly defined edges and lack of visual separation between operational and recreational activities. Recent construction for the Intake Works Project has resulted in improving the functional requirements of the project by rerouting and thus minimizing the visitor traffic into and through the operations area, therefore, visual improvements may follow. Many visitors are unaware the river canyon exists below, due to limited views from the day use area. Generally this zone is open, flat, and abundant with light. The visual features within the damsite are more developed than other parts of the project, however, the natural setting of which they are a part, creates a popular day use area visited by school groups and families throughout the open season.

Initial landscaping and development of the visitor day use area, including viewing, picnic and play facilities, were completed in the late 1960s. Existing vegetation consists of a combination of evergreen and deciduous trees, as well as native and ornamental shrubs and ground covers. The higher-maintenance landscaping at the day use area provides the visitor an urban park-like setting not found throughout the rest of the project. Large lawn areas are Ranked by curvilinear plant beds of thick ground covers and shrubs. Many of the plant beds are located on 3-foot-high earth mounds. A list generally describing the major plantings within the landscaped day use area by common and botanical names is found in Appendix B, Section 1, Day Use Area Vegetation. Unobstructed view within the damsite area vary up to 1 mile.

f. Trails. The Vista Trail, a 0.3-mile nature trail, begins behind the upper vista deck and winds down the canyon wall to a lower vista deck. The dam and intake tower structure can be viewed and photographed from the trail and the lower vista deck. The 3.5-mile-long Rim Trail starts from the main visitor parking lot and follows the north rim of the White River canyon ending at the upper debris basin access road. The Rim Trail is restricted to pedestrian traffic and provides excellent views of the river's more primitive south shore and its tributaries. The 6.0-mile River Trail starts at the lower end of the upper debris basin access road, meandering up the White River and generally following the river bank. The River Trail offers uninterrupted views of the river, valley walls, meadows and abundant wildlife. Vistas along project trails vary up to 1 mile.

2.12. Climate. The western Washington area in the vicinity of Mud Mountain Dam

has a typical west coast maritime climate characterized by mild winters and cool summers. Weather in the project area is influenced by the nearby Cascade mountain range, Mount Rainier, and Puget Sound.

Photograph 2.6
Day Use Area

Average daily maximum and minimum temperatures for July are 720 F and 5 l' F, respectively, and the mean annual temperature is 48'F. The first fall frost can occur in early October and the last spring frost can occur as late as June. Under normal conditions, however, the growing season lasts between 150 and 180 days. Average annual precipitation is 54 inches with annual snowfall averaging 15 inches. There are an average of 162 days per year with .01 inches or more of precipitation, and ¾ of the annual precipitation occurs between October and March. December is typically the wettest month of the year with an average of 6.8 inches of precipitation, while July is the driest month with an average rainfall of 1.6 inches. Prevailing winds are from the southwest bringing moist air into the area, while winds from the north and northwest generally bring clearer weather.

2.13. Geologic Setting. Mud Mountain Dam occupies a portion of the White River Valley just inside the western mountain front of the Cascade Range. This portion of the range is characterized generally by smoothly rounded mountain ridges with a thick mantle of colluvium and residuum covered with brush and timber. In the vicinity of the project sharp rock cliffs or peaks protrude through the mantle.

The area has a relief of little more than 3,000 feet. The valley of the White River in the project area is cut mainly in a series of Pleistocene materials, which include glacial outwash, lake deposits and ancient volcanic-generated ash beds, mudflows, and related fluvial deposits from Mount Rainier. Locally, the river has cut narrow gorges into the underlying volcanic bedrock.

Rock underlying the area includes volcanic agglomerate, breccia, tuff, and andesitic lava belonging to the Enumclaw Formation of the Keechelus Andesitic Group. Rock was deposited late in the Eocene during the early stages of a period of vulcanism which extended through much of Tertiary time. The rock is highly variable in character and competence, is commonly weathered or altered, and seldom exposed within the project area. Exposures are limited to the gorge in which the dam is situated, a small canyon in the vicinity of Old Pond Creek, and along the south side of the valley between Canyon Creek and the Clearwater River.

Bedrock sides of the White River valley are 1 to 3 miles apart in the project area and delineate an "outer," older and broader valley of the ancestral White River. The configuration of the bedrock surface beneath the older valley is not well known but appears to be at an elevation of about 900 feet national geodetic vertical datum (NGVD), with at least one channel cut as much as 150 feet deeper. This valley developed during uplift of the Cascade Range late in the Tertiary Period. The outer valley was filled to an elevation of about 1,600 feet NGVD by a series of Pleistocene mudflows, fluvial sand and gravel, ash beds, lake beds, glacial outwash deposits, and fills. Much of this fill was removed down to an elevation of about 1,100 feet NGVD by erosion prior to the last continental glaciation, but terrace remnants corroborate the former extent of the fill.

Between 15,000 and 13,500 years ago, glacial ice moving south from Canada, the Vashon Glaciation, invaded the Puget Sound lowland. At its maximum extent the glacier occupied a position adjacent to the northwest Rank of Mud Mountain, initially impounding a lake in the older, broader White River Valley into which silts and very fine sands were deposited. Glacial streams deposited a thick fill of sand, gravel and boulders in the valley, shifting drainage against the south valley wall. The top of the outwash fill attained an elevation of about 1,350 feet NGVD and extended 4 to 5 miles upstream. The White River cut an "inner" valley into this fill of glacial outwash and lake beds. The portion of the stream against the south valley wall cut a steep-sided, 2-mile-long, canyon partly into the underlying bedrock. About 5,700 years ago, a major mudflow off Mount Rainier, the Osceola Mudflow, -discharged down the partly cut valley, flooding over the top of the outwash surface and down the northwest flank of Mud Mountain, and leaving a mantle of boulder, sand and clay over the entire Mud Mountain-Scatter Creek upland area. Final cutting of the "inner" valley then continued to its present stage, though interrupted by short periods of aggradation. At least one of these appears to have been caused by a major landslide from the north side of the valley, ½ mile above the dam. Remnants of fill terraces of recent White River alluvium along the lower flanks of the "inner" valley substantiate these events.

2.14. Geology of Project Lands. (See Plate 5.) Project lands may be divided into five general areas on the basis of topography, geomorphology, and geology: (1) inner valley floor, (2) rock canyons, (3) south valley slope, (4) north valley slope, and (5) Mud Mountain-Scatter Creek upland.

The inner valley floor is mantled by gravel, boulders, and sand deposited by the present stage of the White River. Being a braided stream, the channel or branching channels of the river can quickly change positions on the lower valley floor. A low valley terrace about 20 feet above the river forms much of the valley floor in the wider segments of the inner valley. This feature is commonly mantled by reservoir or flood-related silt and sand and is not subject to the changing channel except where the present braided channel is eroding the low terrace margin.

The south valley wall consists of slopes steeper than 30 percent and commonly 50 percent or more mantled by sandy, silty colluvium. Beneath the colluvium is a sequence of gravel, boulders, sand, lakebed clays and silts, and mudflows which characterize much of the pre-Vashon valley fill. Locally, sand and gravel terrace remnants from the Vashon outwash and/or White River valley fill are evident below elevation 1,350 feet. The slope rises to a broad terrace between elevations 1,500 feet and 1,600 feet on the outer valley side. Upstream from the mouth of Canyon Creek the south valley wall is mostly bedrock with a variable mantle of colluvium. Even though the in situ materials composing the south valley wall are mostly stable, the presence of lakebed clays and the colluvial mantle cause portions of the slope to be subject to landslides under conditions of prolonged heavy rainfall and reservoir drawdown.

On 31 January 1974 a slide involving both the colluvial mantle and older lakebed clays occurred above the south bank of the reservoir adjacent to the dam. The slide permanently damaged the project cableway system and several thousand cubic yards of earth and debris were dumped into the reservoir. The slide occasionally continues to creep after prolonged rainfall and snowmelt and is a prominent feature from viewpoints in the dam area.

The north valley slope is composed mostly of Vashon outwash, sand and gravel, together with related lake deposits, and is capped by the Osceola Mudflow. These materials are commonly mantled by several feet of colluvium derived from them. The slope is usually greater than 50 percent. Locally, where colluvium has sloughed away, these materials stand at slopes of 70 percent or greater. Springs are common along the north valley wall, generally a function of perched water tables on the lakebeds. In the vicinity of the dam and between the lower and upper debris basins, the north valley wall is composed of materials from the pre-Vashon valley fill. These materials stand at slopes of 50 to 90 percent and, while inherently stable, may locally be subject to landslides under conditions of undercutting, prolonged precipitation, or rapid reservoir drawdown. The colluvial mantle is less developed in these materials owing to their inherent stability, resistance to erosion, and the freshness of the valley wall. A large prehistoric landslide in these older materials just north of the upper vista point blocked the White River for a time. Wood from the base of this slide suggests that it

occurred about 1,800 years ago. In 1974 a small slide of older valley fill materials briefly diverted the White River about ½ mile upstream from Canyon Creek.

The Mud Mountain-Scatter Creek upland and similar upland areas upstream are mantled nearly everywhere by the Osceola mudflow, consisting of gravel and boulders in a matrix of sandy clay. The mudflow has a thickness of 2 to 30 feet, providing an effective seal which prevents the downward percolation of surface water. As the mudflow reflects the undulating surface topography which existed prior to its deposition, the commonly flat ground of the upland gives way locally to slopes of up to 15 percent, and minor depressions tend to collect and hold water for long periods.

2.15. Vegetation. (See Plate 6.) The project is located within the "humid transition" zone, an area which receives a relatively high amount of precipitation as weather systems move from the Puget Sound area east toward the Cascade mountains. The weather systems are delayed by the barrier posed by the mountain range, causing precipitation to fall at an accelerated rate. Forests in this zone are characterized by coniferous (evergreen) trees, including western hemlock, western red cedar, and Douglas fir**.** Deciduous (leaf bearing) trees such as red alder and black cottonwood, along with various species of willows, are the principal tree species in riparian woodlands, i.e., vegetation zones along streams and lakes that are adapted to elevated amounts of soil moisture (i.e., flooding) at certain times of the year.

All project lands at Mud Mountain Dam have been logged at some point in the past, with most areas having been logged over 50 years ago prior to construction of the project. This history of logging contributes to the current pattern of succession on project lands. Although an occasional older tree exists, the present forests are mainly second growth, varying in age from roughly 15 to 90 years. Table 2.1 shows the diversity of conditions that may be found on project lands for second growth in this age span. The primary lesson to be learned from this table is that the successional age of 40-99 years, i.e., the most abundant age class at Mud Mountain Dam, has the lowest plant and animal diversity, as well as biomass production and structural diversity, of any successional stage. 'therefore, it is prudent to allow the forests to continue to mature as this will allow greater diversity of plants and animals on project lands.

The successional stage of the majority of project lands is that of a young to mature forest, and comprised of roughly equal amounts of evergreen and deciduous trees, either intermixed or in solid stands of one type or another. The mix and distribution of tree species is dependent on several factors including age of stand, soils, moisture gradients, and exposure. In addition to forests, project lands also have meadows, interspersed with willows and alders, and beaver ponds, with associated wetland vegetation such as cattail, bulrush, and spirea. Many animals freely move from one vegetation type to another, while other animals are restricted to a single habitat type and seldom use other habitats. The categories of vegetation found on project lands are discussed in detail in the following paragraphs. Only a partial inventory of native plants on Mud Mountain Dam project lands has been conducted. As a result, the plant

listing contained within this report is incomplete, and a thorough plant inventory is recommended.

CONDITIONS	SUCCESSIONAL STAGES					
	Grass-forb	Shrub-seedling	Pole-sapling	Young Forest	Mature Forest	Old Growth
Time Interval (Years)	0-4	5-10	11-39	40-99	100-224	>225
Canopy Closure		xx	xxxx	xxxxx	xxxx	xxx
Herbage Production	xxxxx	xxx	xx	x	xx	xxx
Shrub Production	x	xxxxx	xx	x	xx	xxx
Canopy Volume		x	xx	xxx	xxxxx	xxxx
Plant Diversity	xxxx	xxxxx	xxx	x	xx	xxxxx
Structural Diversity	x	xxx	xx	x	xx	xxxxx
Animal Diversity	xxx	xxxx	x	xx	xxxxx	xxxx

Table 2.1

Generalized western hemlock successional stages and relative environmental characteristics. (The number of "x's" indicate the relative magnitude)

a. Evergreen Forest. Douglas fir *(Pseudotsuga menziesii),* western hemlock *(Tsuga heterophylla),* and western red cedar *(Thuja plicata)* are the dominant evergreen trees throughout most of the project lands, particularly downstream from the Clearwater River. Upstream from the Clearwater River, Sitka spruce *(Picea sitchensis)* becomes a dominant species. On most dry soils in western Washington, forests succeed into a climax forest dominated by western hemlock. This species begins to dominate at around 100 years, becoming old growth at about 250 years, and climax at about 400 years of age. Evergreen forests in wetter soils tend to be dominated by western red cedar and Sitka spruce. Douglas fir, which can grow in most any soil, does best in drier soils in western Washington and is often the most abundant tree in managed forests. It is not, however, a true climax species, despite its longevity.

b. Deciduous Forest. Deciduous forests tend to be much brighter than coniferous forests, due to the better light passage of the leaves and absence of foliage during the winter months. As a result, the understory vegetation is generally more diverse and much denser in a deciduous forest than in a coniferous forest.

Dominant trees include red alder *(Alnus rubra),* black cottonwood *(Populus trichocarpa),* vine maple *(Acer circinatum),* and big-leaf maple *(Acer macropkvllum).* Under story trees and shrubs include

cascara *(Rhamnus purshiana),* Pacific willow *(Salix lasiandra),* bitter cherry *(Prunus emarginata),* Pacific dogwood *(Cornus nuttallii),* madrona *(Arbutus menziesii),* red elderberry *(Sambucus callicarpa),* hazelnut *(Corylus cornuta),* ocean spray *(Holodiscus discolor),* salmonberry *(Rubus spectabilis),* thimbleberry *(R. parviflorus),* red huckleberry *(Vaccinium parviflorum),* evergreen huckleberry *(V ovatum),* devil's club *(Oploplanax horridus),* and Indian plum *(Oemleria cerasiformis).*

c. Mixed Evergreen and Deciduous Forest. As the name suggests, this forest is a mix of the evergreen and deciduous tree species described above. The mixed forest is generally an intermediate transition stage that, if left to succeed, will eventually become a mature coniferous forest.

d. Alder/Willow/Cottonwood. These deciduous trees warrant special commentary because of their tendency to form monotypic stands in various locations on project lands. Alder tends to be one of the pioneer species (first to colonize) following clear cutting or fire. They form nearly monotypic stands for a few years until shade-tolerant trees (such as western hemlock) outgrow the alders or the alders die off (alder is a short-lived species, usually living less than 100 years). On Mud Mountain Dam project lands, a unique situation has developed along the lower slopes, just above the meadows. A band of alders rings the project in a vertical zone roughly 50 feet in extent. This may be a result of the temporary pool held at approximate elevation 1,130 feet in 1974 which killed trees and other vegetation below that elevation. Thus, the band of alders represents the pioneering efforts of this species in that band. On the meadows below the band, grasses and other herbaceous plants apparently were not killed by the pool raise, and thus have withstood invasion by the alders (in addition, annual inundation of the meadows likely prevents establishment of seedlings). Alders and willows are, however, numerous on the meadows, and near Scatter Creek they form a dense shrubland. The origin of these stands is unclear, though it may be a result of local disturbances allowing these species to gain a foothold. Cottonwoods commonly grow alongside rivers, occasionally forming dense stands called overflow forests. These forests are excellent riparian habitat for numerous species of animals. In the project area, however, such stands are rare, occurring primarily near the mouth of the Clearwater River.

e. Grassland/Meadow. These terms are used interchangeably in this master plan, although in typical usage "grassland" is an upland (dry soil) vegetation type, and "meadow" is a wetlands Grasslands on the project have not been delineated for wetland identification and exhibit characteristics of both upland and wetland conditions, thus it is difficult to select one term over the other. Though wetlands are regulated under Section 404 of the Clean Water Act, delineation between wetlands and grasslands is not a primary concern at the Mud Mountain Dam Project because there is no intention to alter the current classification and management of these lands. If, and when, alteration of the classification or management of these lands becomes desirable, delineation would be undertaken as part of the master plan update. Project

grasslands are characteristically flat or low gradient benches just above the river which are annually inundated through project operations. This inundation is probably responsible for retaining the open grassland condition of the meadows because it retards the establishment and growth of trees and shrubs. Plant species include several types of grasses, Indian thistle *(Cirsium edule),* tansy *(Tanacetum vulgare),* cat's ear *(Hypochaeris* spp.), groundsel *(Senecio* spp.), yarrow *(Achillea millefolium),* field chickweed *(Cerastium arvense),* and Himalayan blackberry *(Rubus discolor).* Most of these plants are exotica which escaped from pasture grass mixes or were in other ways accidentally introduced. Grassland locations are shown on Plate 6, while Plate 7 shows the location of wetland and snag habitat, including meadows, within the project boundaries.

f. Herbaceous Fringe. Another unique feature of the Mud Mountain Dam project lands is an herbaceous fringe ringing the meadows adjacent to the forested areas. This fringe is about 10 to 20 feet in width and is composed of various species, mainly Himalayan blackberry, Indian thistle and tansy. It is mentioned only because it is evident on aerial photos as a unique feature. It has no special merit and requires no special attention, although it may serve as a transition or buffer for wildlife between the forests and the meadows. Animal species found in this area are much the same as those for the meadow.

g. Open Water/Stream. There are five small ponds on project lands. At least one was created by beaver dams and two of the others may have been as well. Open water provides habitat for a variety of animals, even with the nearby presence of the river. All animals need water, but because the river has little riparian vegetation, any animal that attempts to drink from the river is exposed to potential predation. Three of the ponds are surrounded by dense vegetation, allowing animals to quietly drink and bathe without making themselves vulnerable to predation. In addition, such ponds provide food in the form of aquatic plants and insects to other forms of wildlife, such as waterfowl, mink, river otters, swallows, flycatchers, and others. Finally, amphibians find homes in such protected environments.

h. Snags. Snags are a result of water levels being too high for too long during a particular growing season, killing trees, leaving the dead wood behind to provide home and food for a wide variety of animals. Snags are found throughout the project in areas where historic flooding has caused the death of many trees, and, in particular, are found in abundance in the Scatter Creek area. Approximately 458 acres of snags were created by the temporary pool raise in 1974, which went as high as elevation 1,150 feet and was held at elevation 1,130 feet (equivalent to a 50-year flood pool elevation) for at least two months.[1/] As a result of this pool elevation, a vertical distance of at least 50 feet was flooded long enough to kill all trees growing in that elevation range. Twenty years later most of the snags resulting from that pool raise are gone or have fallen to become decaying logs. Many of these have been removed

[1/]Brewer, Chris Boyd, Mud Mountain Wildlife Inventory and Habitat Analysis, 1979, pg. 4

during debris removal operations. Many snags still remain, most of them near Scatter Creek. Snags provide valuable, and difficult to replace, habitat for many species of animals that live in cavities. (Cavities are almost never made in live trees because the wood is harder to excavate and because sap will flow into the cavity, gumming feathers and fur.) A few species of birds can excavate cavities, e.g., woodpeckers and nuthatches; other animals will then use these cavities in future years after the excavators have vacated. A listing of birds and animals that utilize snags is contained in Appendix B, Section 2.

i. Gravel Bars. Exposed gravel bars are an important habitat for several species of wildlife, primarily as feeding habitat. Species such as spotted sandpiper and killdeer will nest on gravel bars. Many insects and other invertebrate animals live in gravel bars, providing a food source for spotted sandpipers, killdeer, American pipits, American crows, harlequin ducks, dippers, savannah sparrows, and small mammals such as shrews, voles, and mice. In addition, some birds aerial feed over gravel bars on flying insects that hatch from eggs deposited on the gravel bars.

j. Wetlands. Wetlands can occur in nearly any situation or vegetation type; most of the vegetation types described above contain wetlands. The main characteristic that sets them apart from "uplands" is the presence of water, especially during the growing season. The water does not have to be on the surface; a consistently high water table will produce a boggy soil that will predominantly support plants that are adapted to wet soils. Thus, wetlands will often be recognized by a different mix and character of vegetation than that found in adjacent uplands. As an example, a wooded swamp in an alder forest may still contain alders, but the alders may be noticeably stunted and even twisted and bent; under story plants might consist of buttercups and skunk cabbage instead of red huckleberry and violets. In an evergreen forest, a predominance of western red cedar and Sitka spruce are often tell-tale signs that a wetland is present. Plate 7 shows the distribution of various wetland habitats in the project area. The areas identified are only keyed to surface water (ponds, marshes, swamps versus meadows), and to woody versus herbaceous vegetation (swamps and snags versus marshes and meadows, respectively). Swamps usually have areas of open water at some time during late winter and early spring (sometimes year round), frequently have moist, spongy soil, and are dominated by woody plants such as alders, cottonwoods and western red cedar, as well as willows, twinberry *(Lonicera involucrata),* ninebark *(Physocarpus capitatus),* and other shrubs. Most of the swamps on project lands are east of Scatter Creek. Meadows, though predominantly herbaceous, and often characterized by pasture grasses, can also include depressed patches of wetland shrubs, such as willows and scrub alders. Marshes usually have surface water throughout the year and are often dominated by cattails *(Typha* spp.) and bulrushes *(Scirpus spp.).* Ponds usually contain water that is too deep for trees and semi-aquatic plants. However, under some conditions, ponds may support aquatic plants such as pondweeds *(Potamogeton* spp.), knotweeds *(Polygonum* spp.), water lilies *(Nymphaea* spp.), and others. A large cattail-dominated pond east of Scatter Creek was created by extensive beaver activity.

2.16. Fisheries. According to state of Washington Department of Fish and Wildlife records, and confirmed by Seattle District's trap and haul operations, the White River drainage provides migration, spawning and rearing habitat for several anadromous species of fish, including chinook *(Oncorhynchus tshauytscha),* coho *(0. kisutch),* pink *(0. gorbuscha),* and chum (0. *keta)* salmon, and sea-run cutthroat (0. *clarki)* and steelhead *(0. mykiss)* trout. Resident trout include rainbow and cutthroat. In addition, two resident species of char are present: Dolly Varden *(Salvelinus malma)* and bull trout *(S. confluentus).* Other native resident species include whitefish *(Prosopium* spp.), suckers *(Catostomus* spp.) and sculpins *(Cottus spp).*

a. Fish Passage. Mud Mountain Dam was constructed without upstream fish passage facilities. To provide for fish passage around the project, the Corps of Engineers constructed, and continues to operate, a fish collection facility at Puget Power's diversion dam near Buckley. Fish are collected and hauled by tanker-truck to the release site approximately 4½ miles above Mud Mountain Dam (see Figure 2.6). Once released, the fish continue migration to upstream spawning grounds. Some fish that return to the collection facility are hatchery fish released from the Muckleshoot Tribe's White River hatchery directly across the river. The hatchery fish are separated from the wild fish and are returned to the hatchery. No adult anadromous fish currently spawn in the reach between Mud Mountain Dam and the Puget Power diversion. Juveniles (fry and smolts) of the anadromous species pass downstream through the dam, as do adult spawned-out steelhead (kelts). Other species may also pass downstream through the project. Dam safety modifications are expected to substantially improve fish survival during downstream passage through the 23-foot tunnel.

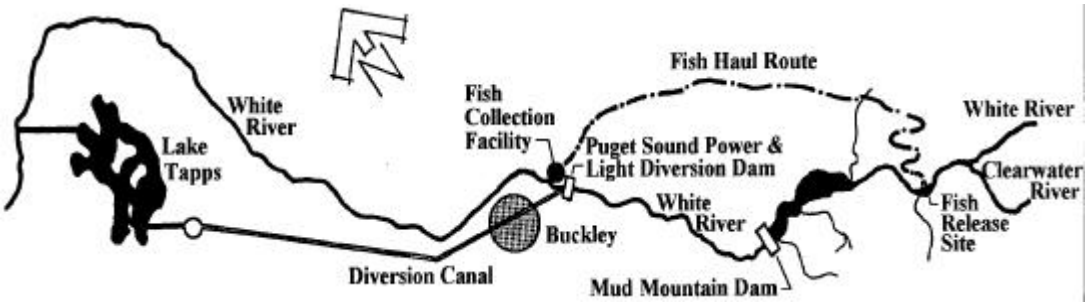


Figure 2.6
Fish Transport Route

Downstream fish passage problems were anticipated to occur during the construction period (1989-1996) of the dam safety modifications as a result of the construction activities. A mitigation plan was developed to mitigate for loss of the spring chinook outmigration during the construction period. This plan provided for rehabilitation of a spring chinook rearing pond on Forest Service land upstream of the project, and funding of operation of the pond during modification of the 9-foot tunnel. Corps funding of the rearing pond operation was concluded at the end of the 1994 rearing season. The Puyallup and Muckleshoot Tribes assumed funding of rearing pond operations beginning in 1995 to promote restoration of the spring chinook run.

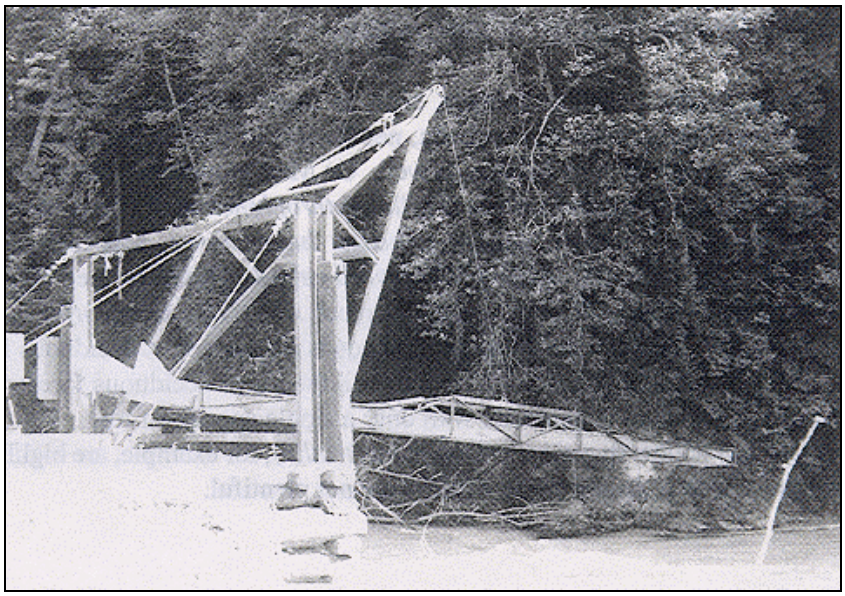
b. Spawning. The main stem of the White River is not thought to be heavily used for spawning due to its high bedload content. Much of the main stem in the project area consists of boulders, large cobble, and fines which is poor spawning substrate. However, certain tributaries, such as the Clearwater and Greenwater, do support spawning by anadromous fish. Scatter Creek is apparently used by coho, at least for rearing, if not for spawning. The main stem is used for transport and rearing of juveniles; young-of-the-year Chinook and subyearling coho and steelhead/rainbow have been found in the main channel and in side channels above Mud Mountain Dam. These species use this habitat for rearing, and later, migration. Pink and chum fry, which migrate to Puget Sound soon after emerging from the gravel, use the main stem White as a migration route. Fluvial bull trout likely use the main stem for migration and feeding, but they favor cold headwater streams for spawning and early rearing. It is likely that some rearing occurs off the main channel in the case of coho. There is little specific information on the use of the project area by resident fish species, but some resident fish are caught at the Buckley collection facility. Efforts are underway to determine whether or not some of the fish identified as Dolly Varden at the Buckley facility are actually bull trout. If they are, this would indicate juveniles and possibly adults migrate downstream through the Mud Mountain Dam.

c. Operational Issues. Under operations prior to the dam safety modifications, use of the 23-foot tunnel was avoided during the spring-summer salmonid outmigration season because of its inherent problems with fish passage. Construction of the new intake and outlet system is expected to provide safer fish passage, and it is anticipated that the 23-foot tunnel will be operable during the outmigration season. Seattle District made a commitment to the state and federal resource agencies to study fish passage through the new tunnel configuration in order to verify anticipated reduction of fish mortality. Sediment transport is expected to approach a more natural regimen with the new tunnel configurations. This should reduce previous concerns about sudden releases of large amounts of bedload, and better protection of downstream spawning and rearing areas is anticipated.

Impoundment of water for a large flood, i.e., greater than a 50-year event, may cause newly transported adult salmonids to be flooded out of the river channel when the backwater approaches the elevation of the fish release site.

Above Photograph 2.7
Fish Collection Facility

Below Photograph 2.8
Fish Release Chute



2.17. Wildlife. As described in the vegetation section, the project lands are a mosaic of various forested and grassland habitats. Most of the animals that utilize project lands are generalists that use a wide range of habitat types. Animals found on project lands that have a broad ecological niche and utilize several vegetation types include song sparrow *(Melospiza melodia),* dark-eyed junco *(Junco hyemalis),* yellow-rumped warbler *(Dendroica coronata),* black-capped chickadee *(Parus atricapillus),* Bewick's wren *(Thryomanes bewickii),* Steller's jay *(Cyanocitta stelleri),* Pacific slope flycatcher *(Empidonax difficilis),* western wood pewee *(Contopus sordidulus),* great horned owl *(Bubo virginianus),* red-tailed hawk *(Buteo jamaicensis),* Columbia blacktail deer *(Odocoileus hemaonus),* Rocky Mountain elk *(Cervus canadensis),* black bear *(Euarctos americanus),* snowshoe hare *(Lepus americanus),* deer mouse *(Peromyscus maniculatus),* raccoon *(Procyon lotor),* mountain beaver *(Aplodontia rufa)* (especially in moist banks), coyote *(Canis latrans),* and mink *(Mustela vison)* (especially along stream courses). A complete list of wildlife species is found in Appendix B, Section 3.

a. Evergreen Forest. Evergreen forests are home to a set of animals adapted to the needle leaves, cones, deep shade, moss, and litter-covered forest floor unique to these forests. Though better adapted to life in evergreen forests, most animal species are not restricted to evergreen forests and will use adjacent habitats as well. Representative species found in evergreen forests on project lands include (but are not limited to) red crossbill *(Loxia curvirostra),* chestnut-backed chickadee *(Parus rufescens),* red-breasted nuthatch *(Sitta canadensis),* golden-crowned kinglet *(Regulus satrapa),* winter wren *(Troglodytes troglodytes),* Townsend's warbler *(Dendroica townsendi),* blackthroated gray warbler *(D. nigrescens),* varied thrush *(Ixoreus naevis),* Swainson's thrush *(Catharus ustulatus),* olive-sided flycatcher *(Nuttallornis borealis),* Vaux's swift *(Chaetura vauxi),* pygmy owl *(Glaucidium gnoma),* and goshawk *(Accipiter gentilis).* Mammals include Boreal red-backed vole *(Clethrionomys gapperi),* eastem gray squirrel *(Sciurus carolinensis),* Douglas squirrel *(Tamiasciurus douglasi),* Townsend's chipmunk *(Eutamias townsendi),* pine marten *(Martes americans),* and Trowbridge's shrew *(Sorex trowbridgei).*

b. Deciduous Forest. Certain animals, such as many warblers, are better adapted to deciduous, broad-leaved forests than to evergreen, needle-leaved forests, but, as with evergreen forests, most overlap in the use of other habitats as well. On Mud Mountain Dam project lands, the characteristic birds include rufous-sided towhee *(Pipilo erythrophthalmus),* black-headed grosbeak *(Pheucticus melanocephalus),* western tanager *(Piranga ludoviciana),* MacGillivray's warbler *(Oporornis tolmiei),* orange-crowned warbler *(Vermivora celata),* Hutton's vireo *(Vireo huttoni),* hairy woodpecker *(Dendrocopos villosus),* western screech owl *(Otus kennicottii),* and Cooper's hawk *(Accipiter cooperii).* Alders, willows, and cottonwoods are subsets of deciduous forests, and, as such, tend to show the same associations of animals as the set of deciduous forests. However, there are a few animals that tend to associate with only a single species of tree. Yellow warblers *(Dendroicapetechia)* and willow flycatchers *(Empidonax traillii),* for example, are

highly associated with willows and are scarce or absent when willows are not plentiful.

c. Mixed Forest. Mixed forests are simply a mix of evergreen and deciduous trees and tend to have a mix of animal species listed in the three previous paragraphs.

d. Meadows. Certain animals find food and shelter on these grassland and shrub habitats. American goldfinch *(Carduelis tristis)*, savannah sparrow *(Passerculus sandwichensis)*, whitecrowned sparrow *(Zonotrichia leucophrys)*, common yellowthroat *(Geothlypis trichas)*, yellow warbler, Wilson's warbler *(Wilsonia pusilla)*, American pipit *(Anthus spinoletta)* (migration and winter only), willow flycatcher, rufous hummingbird *(Selasphorus rufus)*, California quail *(Callipepla californica)*, Townsend vole *(Microtus townsendi)*, striped skunk *(Mephitis mephitis)*, longtail weasel *(Mustelaftenata)*, Townsend mole *(Scapanus townsendi)*, and Virginia opossum *(Didelphis virginiana)* are representative of animals found on this habitat type in the project area.

e. Snags. A short list of species that are found on project lands that nest in cavities, but don't excavate them, includes wood duck *(Aix sponsa)*, screech owl, tree swallow *(Tachycineta bicolor)*, black-capped chickadee, Vaux's swift, eastern gray squirrel, and pine marten. A more complete list of cavity nesters is provided in Appendix B, Section 2. Snags also provide an abundant source of insects which become prey for numerous species, both cavity nesters and non-cavity nesters. Users of snags for feeding and/or perching include sharp-shinned hawk *(Accipiter striatus)*, osprey *(Pandion haliaetus)*, woodpeckers, western screech owl, brown creeper *(Certhia americans)*, belted kingfisher *(Ceryle alcyon)*, Douglas squirrel, and deer mouse.

2.18. Hunting and Fishing. Hunting and fishing in accordance with local and state regulations are allowed on project lands. Hunting is not allowed in areas zoned for project operations or recreation (see Plate 8). Signs advising the public of potential hazard will be posted at access points to low density recreation areas and at the beginning of the Rim Trail during hunting season. Hunting and fishing is severely limited by the restricted access to project lands as discussed in Paragraph 2.9, Project Access.

2.19. Protected/Endangered Species.

a. Bull Trout. In June 1994, the U.S. Fish and Wildlife Service (Service) listed the bull trout as a category 1 ("warranted but precluded") species in the Federal Register. This classification means there is enough information available to warrant listing the species as threatened or endangered, but limited Service resources preclude developing a recovery plan. The bull trout received a moderate threat-to-extinction rating range wide in the United States. The Service will review this classification annually to determine if the condition of the bull trout warrants reclassification. The

bull trout should be treated just as if it were listed as endangered for any proposed work that would have an impact on fish and marine habitat.

b. Spring Chinook. Spring Chinook have been in decline for several years in southern Puget Sound drainage. A committee of several resource agencies and tribes has been working to restore them. The White River spring chinook was the subject of a February 1994 petition to the National Marine Fisheries Service (NMFS) for listing under the Endangered Species Act (ESA).

c. Coho. A petition to list coho range wide in the continental U.S. was submitted to NMFS in 1993. No rule to list has been proposed.

d. Steelhead. A petition to list steelhead range wide in the continental U.S. was submitted to NMFS in 1994. Steelhead were proposed for listing in drainage outside of Puget Sound in July 1996, however, this does not affect White River steelhead at this time.

e. Bald Eagle. Bald eagles *(Haliaeetus lencocephalus)* occasionally forage along the White River both above and below Mud Mountain Dam during the winter season, but have not been observed to nest in the project area. Presence of the bald eagle should have no adverse impact on operation of Mud Mountain Dam for its authorized purposes.

2.20. Cultural/Historic Resources.

a. General Background. Cultural resources include existing archeological or historical objects, buildings, structures, or sites related to the history of past human land use on project lands. This includes the activities of prehistoric Native American peoples as well as early historic European and American settlers. During late prehistoric times the White River valley was occupied and used by a number of culturally similar but socially independent Salish-speaking Native American tribes (Smalh-Kamish, Skope-ahmish, St-Kah-mish). During the first half of the 19th century, Hudson's Bay Company trading activities were established in the region out of Fort Nisqually. Following the boundary settlement with Great Britain in 1847, an influx of American settlers began. The U.S. Army established a post at Fort Steilacoom and conducted numerous mapping reconnaissance studies in the region. After the Medicine Creek Treaty of 1854, conducted by Territorial Governor Isaac Stevens, a number of the previously independent Native American groups were reorganized by the Government and became confederated on a reservation as the Muckleshoot Indian Tribe. Homesteaders began moving into the project locality by the late 19th century.

b. Archeological Resources. The Seattle District conducted an archeological reconnaissance on project fee-owned lands in 1975. No archeological sites were observed or recorded, and the reconnaissance concluded that no prehistoric cultural

resources eligible for the National Register were known to exist on project lands.

c. Historical Resources. A major east-west Native American trail passed through the northeastern part of the project, known historically as the Naches Trail. This was the major horse trail used by Native Americans of southern Puget Sound for travel over the Cascade mountains to eastern Washington, and was later used by one of the first immigrant wagon trains (the Longmire Party) over the Oregon Trail (1853) to come to the Washington coast. It was also used by the U.S. military and volunteer militia out of Fort Steilacoom during the Indian War of 1855. During the late 19th century and early 20th century Euro-American homesteads began to emerge in the area. These have not survived intact on project lands.

The White River and the Naches Trail are included on King County's list of heritage sites on and adjacent to the project lands. In 1976, the National Park Service recommended evaluation of the Naches Trail as a possible National Register nomination. Seattle District has not participated in this evaluation because so little of the trail is located on project lands. However, the District has made an effort to record where the Naches Trail passes through project lands and to preserve the original road bed where possible.

In 1990, the Washington State Office of Archeology and Historic Preservation (WSOAHP) determined that Mud Mountain Dam itself is not eligible for the National Register because it is less than 50 years of age. WSOAHP may reevaluate the project's eligibility for the National Register when the dam is 50 years old in 1998. Such a determination could result in restrictions on operation and maintenance of the project and/or individual project facilities.

d. Native American Cultural Resources. The Native American peoples that comprise the Muckleshoot Indian Tribe traditionally occupied and used parts of the Mud Mountain Dam project lands. Ethno-historic research and direct coordination meetings with the Muckleshoot Tribe in 1975 revealed that the project area was used by the Native Americans on a seasonal basis to gather berries, medicinal herbs, and tree bark for basketry. Since this initial coordination, new federal legislation has been passed requiring federal agencies to consult with tribes concerning potential impacts on traditional Native American religious practices and/or effects upon traditional cultural properties. These consultations have not yet taken place with the Muckleshoot Tribe with respect to Mud Mountain Dam project lands.

SECTION 3

Factors Influencing Resource Use, Development, and Management

3. FACTORS INFLUENCING RESOURCE USE, DEVELOPMENT, AND MANAGEMENT

3.1. General. A variety of physical, social, economic, and institutional factors have been identified as influencing selection and implementation of options for future use, development, and management of project resources. These factors include project access, topography and hydrology of project lands, area of influence, socioeconomic characteristics, recreation trends and needs, project visitation trends, views of the public and coordination with Native American tribes, historical significance, and current policy on recreational development.

3.2. Access to Project Lands. As discussed in Paragraph 2.9, Project Access, public ingress to project lands, other than the project office and adjacent day use area, is severely limited. The River Trail provides access on the north side of the river from the day use area. Public access is very limited on the south side of the river, and there are no developed trails. It has been District policy to restrict access across the top of the dam structure in the interest of public safety because there is no safe walkway on top of the structure, and the public would have to transit the operations area. Both Weyerhaeuser and Champion Timber Company were discouraging public access through their property at the time that this report was prepared. Development of access is key to development of further public use of the project lands on both the north and south sides of the river.

3.3. Topography of Project Lands. (See Plate 9.) Use of project lands is restricted by geologic and topographic features. Although the dam was completed in 1948, the reservoir has never been full. As a consequence, the landslide hazard from reservoir operation has not been fully tested. However, by recognizing potential hazards and topographic (slope and elevation) factors, construction and use of project maintenance roads, trails, and recreation facilities may be permitted with little danger. Use of project lands on the upland surface is geologically restricted only by proximity to the edge of the valley. In the project operations and day use areas, permanent structures may be sited as close as 20 or 30 feet from the edge. Design of any new permanent structure on project lands should include geo-technical investigations to assure foundational stability. The mudflow-derived soils on the upland surface are poorly drained and have a high clay content, therefore, adequate surface drainage will be required in developed or landscaped areas. A gravel base will be necessary for all roads, paths, and trails. Table 3.1 lists slope criteria and Table 3.2 lists elevation criteria used in determining land-use suitability.

In addition to the topographic considerations discussed above, restrictions on recreational uses must be imposed for public safety. Beginning approximately 2,000 feet upstream of the intake works, the White River valley narrows into a 150-foot-wide canyon with near vertical rock cliffs rising up to 230 feet high on either side. As the channel constricts, the velocity of the river increases. This combination of rapidly

moving water and shear cliffs creates a condition from which escape would be difficult.

Table 3.1
SLOPE CONSTRAINTS

0% -10% Slopes - High-Use Potential - areas of high-use potential on valley floor adjacent to the river and on Mud Mountain-Scatter Creek uplands. These areas are most conducive to development, can accommodate a greater span of activities, and are subject to the least impact of any of the slope categories. Subject to elevation constraints.

10% - 20% Slopes - Moderate-Use Potential - lower valley walls that can accommodate, for the most part, only low-intensity use. Carefully sited road cuts and trails are permissible but development on 10% to 20% slopes requires extreme caution.

20% - 30% Slopes - Low-Use Potential - valley walls and low-use potential slopes vulnerable to major slope activity. Many areas are actively eroding and unstable and their use potential is extremely limited.

Over 30% - Minimal-Use Potential - valley walls and cliffs, for all practical purposes, unusable. These are major slide areas.

Table 3.2
ELEVATION CONSTRAINTS[1/]

Elevation 1,116 feet and Below - Low-Development Potential - no facility should be sited below elevation 1,116 because of frequent inundation.

Elevation 1,116 feet – 1,215 feet - Moderate-Development Potential - valley floor terrace above the river channel. Development should be limited to trails and unimproved camp areas because of reservoir operations.

Elevation 1,215 feet and Above - High-Development Potential - suitable for permanent structures where geologic safeguards are met.

[1/] All elevations in NGVD

3.4. Area of Influence. Visitors are attracted to the Mud Mountain Dam project from three defined market areas—primary, secondary, and tertiary—based on travel time and distance from the project. The primary market area, a 25- to 30-mile radius (½- to ¾-hour travel) from the dam, includes the towns of Enumclaw, Buckley, Sumner, Bonney Lake, Edgewood, Puyallup, Kent, Auburn, and Renton. Approximately 158,000 persons live in the primary area (1993 data). The majority of the 2,492,000 people in the secondary area (30- to 50-mile radius, or 1- to 2-hour travel) live in the Tacoma-Seattle corridor. Other population centers in this area are the municipalities of Bremerton, Bellevue, Olympia, and Edmonds. The tertiary market includes all areas outside the primary and secondary market areas, i.e., the rest of Washington State, northern Oregon and southern British Columbia. Historically, visitor surveys at state parks and reservoirs show that the majority of the visitors originate from an area within 1½ hours travel time from the facility. The Mud Mountain Dam project has easy access via SR 410 and, based upon empirical data, the project is, and will continue to be, within the recreational travel distance of more than one-half of Washington's population.

3.5. Socioeconomic Characteristics. The combined primary and secondary market areas (Puget Sound lowlands) have experienced fluctuating but continual growth over the past 50 years, typically growing at a rate exceeding that of the rest of Washington State. The area's population doubled between 1940 and the mid 1960s, a growth rate twice the national rate. The growth trend subsided to a rate which equaled the national average (1.49 percent annually) until the 1970s, then dropped for several years to a rate which fluctuated around 0.4 percent when the Boeing Corporation, the area's primary employer, restructured. Beginning in the 1980s the local economy began to diversify and export trade, forest products, and computer software industries became increasingly more important. During the decade between 1980 and 1990 the growth rate has averaged in excess of 2.0 percent annually. Since 1950 the population of the Puget Sound lowlands has constituted approximately 50 percent of the total state population, exceeding 50 percent in the last decade. Regional population has grown from slightly more than 770,000 in 1940 to almost 2,650,000 in 1993, the latest date for which data exist. In 1994 the Census Bureau projected a 50 percent population growth for the state over the next twenty years, and if historical trends continue, the population in the Puget Sound lowlands will reach nearly 4,000,000 by the year 2014.

3.6. Recreation Trends and Needs Population growth in both the primary and secondary markets has exceeded the growth predicted in the 1976 analyses and will continue to grow according to predictions of the Census Bureau (Paragraph 3.5). Increasing population generates increased demand on recreational facilities of all types, including those available at the Mud Mountain Darn project. Review of visitation records from nearby recreation sites[1/] along the S.R. 410 corridor confirms that recreational needs in the Puget Sound area are increasing. At a 1994 public meeting, significant interest was expressed for the use of project lands for primitive camping, horseback riding, and use of the river for rafting and canoeing (Paragraph 3.9b), in addition to the picnic and playground facilities in the day use area.

[1/]Federation Forest and Mount Rainier National Park

3.7. Recreational Analysis. No formal recreational analysis was performed as part of this update due to limited budget and in-house resources. A Comprehensive Recreation Study and Project Utilization Projection (CRSUP) was performed in 1976, as part of the previous update. The CRSUP used data from the 1973 Washington State "Statewide Comprehensive Outdoor Recreation and Open Spaces Plan" (SCORP) and the 1970 "Puget Sound and Adjacent Waters" study prepared by the Puget Sound Taskforce of the Pacific Northwest River Basins Committee. The 1976 study was performed by a consultant and the basic data and detailed computations are not available, however, the analysis was reviewed and determined to be adequate for incorporation into this update. Pertinent portions of the 1976 analysis are reprinted in Appendix A, Section 3.

The CRSUP calculated the project's proportion of facilities, for identified activities, as a percentage of the regional supply of facilities, and compared the calculated percentage against activity participation projections to derive predicted attendance as shown on Figure 3.1. The analysis predicted that under unrestricted development conditions, i.e., local cost-sharing partners, the recreational potential of the project would be fully developed, and utilization would increase to the project's maximum annual capacity of 153,000 visitors by the mid 1990s. Under restricted development conditions, i.e., no cost-sharing agreements, predicted visitation would reach 135,000 visitors by 1990 at which point utilization would stabilize.

Expansion in 1995 of the day use area to include approximately 5.5 acres on the west side of the project access road (baseball playing field excluded) increases the maximum annual capacity of the project to 205,200 (see Table 3.3). Without cost-sharing sponsors, the predicted utilization is limited to 88 percent of the maximum, or about 180,600 visitors annually. In the decade and a half since the recreational usage analysis, federal funding has been limited, and development has proceeded at a slower pace than anticipated. However, if recreational additions are provided to meet public demands, the projected capacity could be reached by 2020, based on the rate of growth predicted in the CRSUP. Since the population growth has exceeded the growth predicted in the previous study resulting in greater demand for recreational facilities, these growth rates are conservative.

3.8. Project Visitation Trends. Recorded annual visitation[1/] at the project is shown in Figure 3.1. Between 1955 and 1973 project visitation grew at a mean average annual rate of 4.4 percent. Project visitation increased in 1974 with completion of the day use area which provided picnic facilities, a restroom, playground equipment, a wading pool and parking. Mean average annual visitation at the project has exhibited an average growth rate of approximately 0.2 percent since 1974 as shown in Figure 3.l. During the period from 1987-1994, an average of 94,587 people visited the project annually. This excludes dispersed recreation which could add a significant amount to the project's total visitation.[2/]

[1/]Visitation is an estimate of the use at the main park area at the dam and does not reflect any of the dispersed recreation that is occurring on the trials upstream from the dam site.

[2/]Dispersed use data has not been collected via a formal survey. Estimates are available in visitor hours beginning with the 1989 Natural Resource Management System (NRMS) report.

Table 3.3
MAXIMUM ANNUAL CAPACITY

Area	BOR Class[1/]	Avail. Acres	Percent Developed	Annual Capacity Per Developed Acre	Maximum Annual Capacity
Damsite/Day Use	IIA	19.5	80	12,000	187,200
Overnight Camping	IIB	60.0	25	1,200	18,000
Total Maximum Annual Capacity					205,200

The bulk of the project's visitation occurs in the day use area during the relative dry summer months. Even though the day use area is open daily year-round, visitation has not been significant from October through March, typically the wetter months. Dam safety modification construction had some impact on visitation during 1988 and 1989 because public access to the day use area was restricted by construction traffic. In 1992 new monthly visitation load factors resulting from a 1990 visitation survey were implemented, and in 1994, day use area improvements consisting of new state-of-the-art playground equipment, wading pool rehabilitation, and replacement of the upper vista deck were completed. 1996 improvements to expand the day use area (see Paragraph 12.3) include replacement of a restroom lost to construction of the upper vista platform and paving and striping of the west side parking area.

Low public awareness of Mud Mountain Dam project and its recreational features has probably contributed to lower than anticipated usage over the years. This effect was suggested by the 1990 visitor survey which disclosed that some visitors had been unaware of the recreational opportunities available at the project, and confirmed in 1994 with the increase in visitation following an increase in local publicity. There are no highway signs directing visitors to the project, and the Mud Mountain Darn entrance sign is visible only within 0.2 miles of the turnoff. The large redwood project entrance sign does not include recreation activity symbols as seen on newer reflective Department of Transportation highway signs. In 1996, the District ordered direction signs for installation on SR 41 0 outside of Buckley northbound and in Enumclaw at the intersection of SR 164 and SR 410. Information signs advising motorists of available recreation will also be installed on eastbound and westbound SR 410 within a mile of the Mud Mountain Dam turnoff. Additional advertisement of the project could be negotiated with the U.S. Forest Service to include Mud Mountain Dam activities in their radio broadcasts (AM 650), and to include project literature in their brochure racks. Project brochures could also be made available to other state, federal and private agencies for distribution.

[1/]Bureau of Outdoor Recreation density standards. Class "A" is high density (i.e., picnic area); class "B" is low density (i.e., camp site).

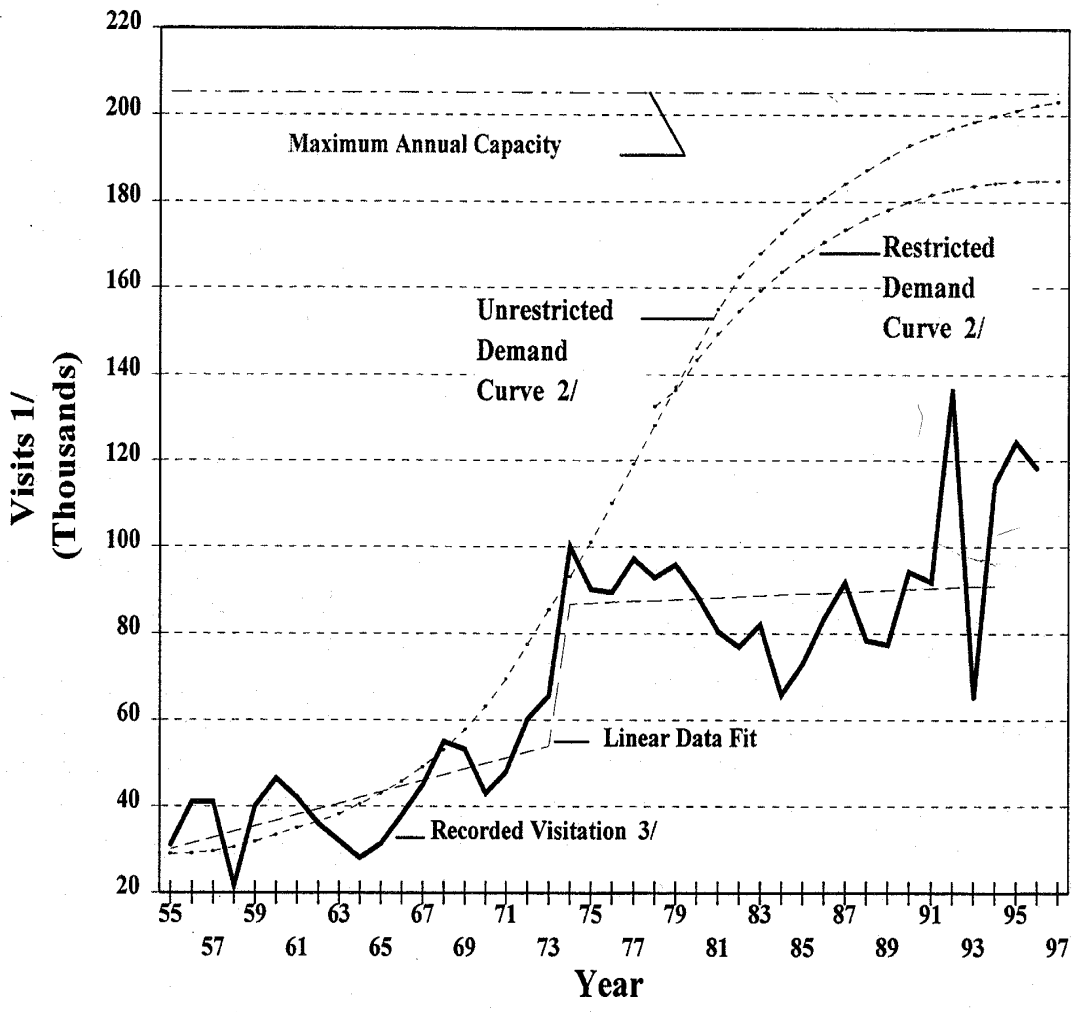


Figure 3.1
Mud Mountain Dam Visitation

NOTES:

1/ A visit represents one person participating in one or more recreational activities during his/her visit to the project. Visits are equivalent to the number of visitors. Visitation counts do not include visitors using the upstream area unless they parked in the day use parking area. Demand curves include low density utilization.

2/ Demand curves were graphically generated from 1976 Master Plan recreational analysis. Supporting calculations are not available.

3/ New monthly visitation load factors implemented in 1992 based upon results of 1990 visitor survey.

3.9. Views of the Public.

a. Project Visitation Data. A traffic-stop visitor survey was conducted in 1990 to gather volume and visitor composition data and the public's impressions of the project. Of the 393 vehicles that visited the project while the survey was in progress, occupants of 304 (77 percent) vehicles responded to the interview. The response was overwhelmingly positive. Many visitors commented on the scenic beauty of the area and were impressed with the facilities available. Quite a few respondents commented on the cleanliness of the day use area and mentioned the restrooms in particular. A dozen or so respondents said that they use the project facilities frequently and felt that the setting and playground facilities were good for children. There were no negative comments, though one hiker requested a better map at the trail head and a second visitor felt that a handrail was needed on the trail stairs.

b. Public Meeting Input. On 17 March 1994 over thirty people attended a public meeting at the Enumclaw Public Library to discuss public usage of project facilities. The majority of the attendees were from the primary market area. Six attendees were from the secondary market area (Paragraph 3.4). More than 50 percent of those attending were associated with equestrian clubs. Also represented were river rafting associations and the Boy Scouts of America.

One of the primary issues raised by both the equestrian and rafting groups was the lack of vehicle access to trail heads and the river. Both groups desire to bring in trailers, either to convey horses or to retrieve rafts. These groups often participate in organized events which could utilize parking for up to 50 vehicles per event.

Both the riding associations and the people interested in hiking see the need for improved trail surfaces and extension of the trail system to the south side of the river. Several people requested consideration of primitive toilet facilities at selected locations along the trails and at locations where river craft could be landed. A representative for the Boy Scouts advised that there is limited availability of winter hiking and camping areas and felt that these type of facilities would receive significant usage if available at the project. Hikers identified the failed bridge over Scatter Creek as a major impediment and asked the Corps to consider replacing it. This group is also interested in more interpretive signing along the trails, possibly even organized walks conducted by the project ranger. Finally, all the organizations represented at the public meeting expressed Interest in being involved in future planning and development processes for recreational features at the Mud Mountain Dam project.

c. Public and Agency Coordination. The Mud Mountain Darn Master Plan was distributed for public and agency review in March 1997. Reviewers included federal, state, and county resource agencies, environmental groups, the Puyallup and Muckleshoot Indian Tribes, equestrian and rafting recreational organizations, the cities of Enumclaw and Buckley, and the public. A distribution list, and comment

letters received, are contained in Appendix B, Section 4, Public and Agency Coordination. Comments were received from the Interagency Committee for Outdoor Recreation (IAC), Washington Department of Ecology, and the state Office of Archaeology and Historic Preservation, and were all supportive of the recommended actions. The IAC noted that their research shows that the fastest growing form of recreational activity is associated with trails in natural settings, particularly near bodies of water. The IAC endorses the proposed expansion of the trail system and upgrade of existing trails.

d. Native American Concerns. The Muckleshoot Tribe have expressed concerns about fish passage and habitat restoration, cultural resource preservation, recreation, and employment. Progress has been made towards reducing these concerns since 1975 when they were initially expressed. The Corps of Engineers has worked in cooperation with the Muckleshoot Tribe to improve fish passage for wild and hatchery fish through the project intake and outlet works., and with the U.S. Forest Service to provide rehabilitation of a rearing pond for spring chinook. While ' some issues of fish passage remain, Corps fisheries biologists believe that the modified intake works will significantly reduce fish mortality as they migrate through the project.

3.10. Coordination With Native American Tribes. The Medicine Creek Treaty of 1854 recognized the rights of the Muckleshoot Indian Tribe along the upper White River in an area that now includes Mud Mountain Dam project land. The Muckleshoot Indian reservation is located along the White River 12 miles downstream from the dam. The reservation was officially established in 1857 by Executive Order pursuant to the Medicine Creek Treaty of 1854. The Muckleshoot Tribe is a federally recognized treaty tribe with important off-reservation treaty fishing rights sustained by the Boldt Decision of 1972.

On 15 April 1994, North Pacific Division issued a Native American Policy as guidance for tribal consultations. The policy is to ensure consultation with Native American tribes, recognize tribal sovereignty through a government-to-government relationship, and to honor treaty rights. To date, (1996) an informal on-going dialogue exists among, technical fisheries staff members and Corps technical staff working at Mud Mountain. No government-to-government meetings with elected tribal officials. and the District Engineer have yet taken place regarding project operations at Mud Mountain Dam.

3.11. Historical Significance. There are no known prehistoric or historic sites on project lands, nor are there any buildings or sites listed on the National Register of Historic Places. Nevertheless, a portion of the Naches Trail (Paragraph 2.20c) does cross through the project, and this historic thoroughfare has been suggested for listing in the National Register. Project operation and development of project resources should be accomplished in such a manner to avoid impact on the Naches Trail to the maximum extent possible. The cableway and tower (see Photograph 3. 1) have been

identified as features of engineering interest. The tower is in poor condition and may pose a danger to the public. If removal is necessary, the District's Technical Center of Expertise for Preservation of Buildings and Structures should be consulted to determine what steps should be taken to preserve a record of the structure.

3.12. Policy on New Recreational Developments. Current Administration policy (1995) on recreation is to encourage non-federal participation in the development and administration of existing Corps recreation areas. Present policy governing new recreation developments at completed projects stipulates that "development to meet increased demands for recreation facilities should be pursued with local funds, through lease agreements with local governments, or other means. Operation, maintenance and replacement costs are the responsibility of the local sponsor." However, the Corps will participate in cost-shared projects with local interests providing federal funds are 'Table. Refer to ER 1165-2-400, Recreation Planning, Development and Management Policies, and related guidance for further discussion of Administration policy on recreational development.

Photograph 3.1
Cableway Tower

SECTION 4

Land Allocation, Land Classification, and Projectwide Resource Objectives

4. LAND ALLOCATION, LAND CLASSIFICATION AND PROJECTWIDE RESOURCE OBJECTIVES

4.1. General. The purpose of this section is to define and prescribe project land allocations and land classifications, to define and describe land management areas, and to present projectwide resource objectives. Resource objectives specific to land management areas are discussed in Sections 5 through 11.

4.2. Land Allocation. Project lands now owned in fee by the United States and managed by the Corps of Engineers are allocated to any of four categories depending upon the purpose for which they were acquired. ER 1130-2-435 defines these categories as: Operations, Recreation, Fish and Wildlife, and Mitigation. All lands for the Mud Mountain Dam project were acquired in accordance with the Flood Control Act of 1936 for construction and operation of a dam to control floods in the lower White and Puyallup River valleys, and are therefore allocated to Operations. Recreation was added as a project purpose by the Flood Control Act of 1944, but no lands are allocated to this category.

4.3. Land Classification. Allocated project lands are classified to provide for development and resource management consistent with authorized project purposes. The land classification process is designed to fully utilize project lands and considers public desires, legislative authority, regional and project-specific resource requirements and suitability. Project lands as defined in ER 1130-2-550 are classified into any of six subcategories: Project Operations, Recreation, Multiple Resource Management, Easement Lands, Mitigation, and Environmentally Sensitive Areas. These classifications are discussed in the following paragraphs and are shown on Plate 10. Flood control is the primary purpose of the Mud Mountain Dam project and flood control operations take precedence over all other land use classification categories. Project acreage by land classification is shown in Table 4.1. Acreage was determined from graphical information system (GIS) mapping which excluded the White River channel, and is only approximate due to the lack of accurate boundary surveys.

a. Project Operations. This classification category includes those project lands required for the flood control structure, operations center, office, maintenance compound, and other areas that are used solely for project operations. At many Corps flood control projects the majority of land is classified as Project Operations. At the Mud Mountain Dam project, however, only 378 of the project's total ~~1,923.46~~ 1,863.23 acres are included in this classification. This situation occurs because the Mud Mountain Dam project does not normally maintain a flood control pool. Therefore lands which are infrequently inundated may be designated for other purposes such as recreation or multiple resource management.

b. Recreation. Project lands in this category are managed for intensive recreational activities by the visiting public, including developed recreation areas and

areas for concessions, resorts and quasi-public development. Recreational facilities at the Mud Mountain Dam project were authorized and developed under the authority of Section 4 of the Flood Control Act of 1944, as amended, and consist of about 21 acres. Low density recreational activities such as hiking and sightseeing are classified under Recreation - Low Density, and, at the Mud Mountain Dam project, all such lands are classified for multiple uses (see next paragraph).

Mud Mountain Dam Project Acreage	
Land Classification	**Acreage**
Project Operations	**378.00**
Recreation	**21.00**
Multiple Resource Management (MRM)	**984.10**
MRM - Recreation - Low Density	*593.00*
MRM - Wildlife Management General	*0.10*
MRM - Vegetative Management	*0*
MRM - Inactive and/or Future Rec.	*391.00*
Mitigation	**0**
Environmentally Sensitive	**316.00**
Easements	~~**60.00**~~ **56.69**
River channel & correction for boundary	~~**164.00**~~ **107.44**
TOTAL ACREAGE	~~**1,923.46**~~ **1,863.23**

[Rev. 2/14/2000 by B. Ecker]

Table 4.1

c. Multiple Resource Management. Project lands in this category are managed for one or more uses to the extent that they are compatible with the primary allocation. Land uses in this category are:

1) Recreation - Low Density. This category represents lands on which their primary use is for activities such as hiking, primitive camping, wildlife observation, hunting, fishing and other similar pastimes. 593 acres of project lands are classified as recreation - low density.

2) Wildlife Management General. This category represents lands which are designated for fish and wildlife management. Lands in this category should be evaluated for lease to the U.S. Department of the Interior or to the state Department of Fish and Wildlife. The fish release facility, sited on less than 0.1 acre and located about 4 miles upstream of the dam, is classified as Wildlife Management General.

3) Vegetative Management. This category represents lands whose primary use is for management activities to protect and develop forest and vegetative cover. Mud Mountain Dam has no project lands in this category.

4) Inactive and/or Future Recreation Areas. This category represents lands which are set aside for future recreational development and/or areas not currently open to the public. There are about 391 acres in this category at the Mud Mountain Dam project.

d. Easement Lands. This category contains lands in which the Corps holds an easement interest but not fee title. Use and management of easement lands will be in strict accordance with the terms and conditions of the easement estate acquired for the project. The project has ~~56.7~~ 56.69 acres of easement lands, which are held for road and utility right-of-way, the radio transmitter site and as storage. The fish collection facility (see Paragraph 2.16a) is sited on 2.15 acres of perpetual easement at the Puget Power's diversion dam near Buckley, Washington.

e. Mitigation Lands. Lands in this category are acquired or designated specifically for mitigation purposes. **No Mud Mountain Dam project lands are classified as mitigation lands.**

f. Environmentally Sensitive Areas. Project lands in this category are of ecological, scientific, cultural and/or aesthetic significance. These lands are environmentally fragile and public use is restricted to those activities that do not conflict with preserving them. The Mud Mountain Dam project has about 316 acres classified as environmentally sensitive.

4.4. Land Management Areas Mud Mountain Dam project lands have diverse management needs which are dependent upon the usage of a given area. The project is divided into 7 land management areas, shown on Plate ~~11~~ 10, which are discussed in detail in Sections 5 through 11. These management areas are:

- Project Operations Management Area.
- Day Use Recreation Management Area
- Left Bank Multiple Purpose Management Area
- Left Bank Riparian Management Area
- Right Bank Multiple Purpose Management Area
- Right Bank Riparian Management Area
- Fish Release Management Area

4.5. Restricted Water Use Zone. The hazardous nature of some river reaches on project lands requires that they be restricted from public use. At the Mud Mountain Dam project, the White River is restricted in the interest of public safety beginning 2,000 feet upstream of the intake works to 500 feet below the outlet works as shown on Plate 10. Above the dam, the White River narrows to a 150-foot-wide canyon with sheer walls up to 230 feet high. As the channel narrows the velocity increases and the river flows directly to the intake works. Below the dam, water exits at high velocity, carrying with it floating debris and a rocky bedload which could damage property and severely injure anyone approaching too close to the outlet works. The restricted water use zone is approximately 8 acres.

4.6. Projectwide Resource Objectives. The following objectives are applicable to all project lands to a greater or lesser extent. For example, management of the wildlife habitat is of higher priority on lands classified as Multiple Resource Management. However, the objectives are still valid to a lesser extent to lands classified as Project Operation and Recreation and should be considered when improvements or changes are being contemplated for these areas. Coordination with other agencies is certainly applicable to all project lands, as is public education, particularly with respect to the project purpose and the general mission of the Corps of Engineers.

a. Project Operation. To maintain and operate the project to provide flood control for the lower White and Puyallup Rivers.

b. Recreational Management. To manage existing developed day use recreation facilities and to develop additional facilities to help meet current and future recreational needs such as picnicking, sightseeing, hiking, camping, river rafting and horseback riding. Recreation is classified as “high density” for intensive use such as picnicking, playgrounds and sports activities, and “low density” for hiking, sightseeing, camping, etc

c. Habitat Management.

1) To preserve, protect and enhance existing fish and wildlife habitat on project lands, including wetlands and water areas, through a cooperative effort involving federal, Tribal, state, local, and citizen interests.

2) To manage project lands that provide critical winter habitat for resident Columbia blacktail deer and resident and migratory Rocky Mountain elk to preserve self-sustaining populations.

3) To permit timber harvest only when required to improve forest wildlife habitat or on an individual tree basis to remove diseased or other trees which may pose a safety hazard.

4) To maintain a sustaining level of snags and logs for cavity nesters.

d. Coordination. To maintain close, ongoing coordination with interested federal, Native American tribes, state and local agencies, and citizen groups and organizations in managing the natural and manmade resources associated with Mud Mountain Dam project lands.

e. Public Education. To broaden public understanding and appreciation of the mission of the Corps, its role in project development and operation, and the management of natural and manmade project resources through the use of interpretive programming and facilities.

4.7. Rationale.

a. Project Operations. The Mud Mountain Dam was authorized and constructed to provide flood control for the lower White River. This is the primary purpose of the project.

b. Recreational Management. Recreation was added as a project purpose by the Flood Control Act of 1944 and is the secondary project purpose.

c. Habitat Management. Lands surrounding the project are managed extensively for timber harvest. Continued management of project lands as a natural ecosystem benefits local wildlife. Forest wildlife habitat on project lands is inherently diverse due to the mixture of forested, riparian and wetland communities, and will most likely maintain and increase in diversity if not disturbed. An inventory of wildlife at Mud Mountain Dam indicates utilization of the area by a large number of diverse animal species. There are 187 species of birds, 54 species of mammals, 7 species of amphibians, and 4 species of reptiles which are known to inhabit western Washington in habitats similar to those found on project lands. Of these 252 species, 116 have been positively identified as inhabitants of project lands. Prominent wildlife species include Rocky Mountain elk, Columbia blacktail deer, black bear, bobcat, mountain lion (cougar), beaver, great blue heron, and bald eagle. In the wetland and snag areas, numerous species of waterfowl find suitable nesting conditions. Snags provide cavities for a number of birds and small mammals, including wood ducks, goldeneyes, mergansers, woodpeckers, and northern flying squirrels. Appendix B Section 3 lists wildlife species found on Mud Mountain Dam project lands.

Forest management practices at the project must consider aesthetics, recreational uses, wildlife habitat, slope stability, and watershed protection. Project lands exist as a relatively undisturbed habitat area within an intensive timber harvest region. In addition to its significant value as wildlife habitat, timber on project lands is generally located in areas where harvesting would create severe erosion detrimental to slope stability, soil conservation and water quality. Timber harvesting is not recommended in these areas. If harvesting is deemed necessary for any reason, cutting should be done in small patches, leaving as wide a buffer strip for streams and rivers as possible. Snags and logs in forested areas should be retained undisturbed as they increase the diversity of habitats and provide critical habitat needs for a wide variety of animals. Snags that pose a safety hazard and logs that would contribute to drift should be moved, with the logs being relocated within the vegetated areas.

Effective resource stewardship requires an understanding of project plant communities, a knowledge of the critical features of each wildlife management unit, and an inventory of wildlife species utilizing and/or dependent upon project habitats. Resource management practices must be based on an accurate inventory of project plant communities and understanding of wildlife/vegetation relationships on project lands. General plant community descriptions prepared in 1978-1979 are only broad representations of the general project area, with many actual variations from the described characteristics.

Rocky Mountain elk utilizing project land are descendants of an elk herd introduced in 1913 on Grass Mountain located to the north of Mud Mountain Dam. Though not an indigenous species of Washington, Rocky Mountain elk are today commonly found within the state, including a population of 120-130 elk within the Three Sisters-Grass Mountain area that includes Mud Mountain Dam project lands. Included within this population is a herd estimated at 20 animals that reside year-round on project lands. Elk are migratory in their habits, with primary winter ranges located along the Clearwater and White River bottom lands and lower forested south-facing mountain slopes. Mud Mountain Dam project lands serve as essential winter range for a portion of the Three Sisters-Grass Mountain elk herd (see Figure 4.1).

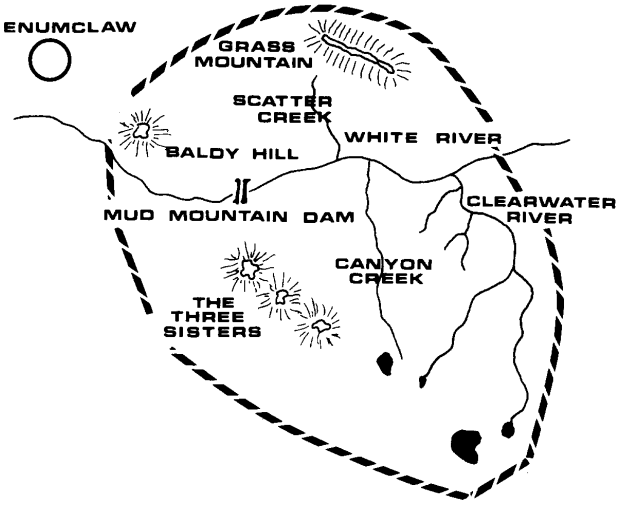


Figure 4.1
Three Sisters - Grass Mountain Elk Range

The riparian, sedge meadow, marsh, and intermittent pond habitats and forested south-facing slopes on project lands are important to the elk winter range and are utilized as well by the resident population. The resident elk population feeds and beds in open areas along the White River in the warmer summer months. A healthy resident population of approximately 50-75 Columbia blacktail deer also inhabit project lands. Animal trails are prevalent throughout the area and deer use appears to be evenly distributed. Loss or degradation of winter habitat, where the animals find suitable food and protection from harsh winter weather, would be detrimental to both elk and deer. However, because elk can out-compete deer for food, the resident deer herd would be most affected by further habitat loss or degradation.

d. Coordination. Project resources are rich and varied, benefiting the large number of diverse animal species in the project area and serving as a valuable outdoor recreation resource for the Puget Sound region. Proper resource stewardship, by

definition, requires that the Corps establish and maintain close, effective coordination with interested agencies, groups, and individuals. Project lands are extensively utilized by at least 116 species of birds mammals, amphibians, and reptiles. Coordination with the U.S. Forest Service and Washington Department of Fish and Wildlife in the management of wildlife species, such as the Rocky Mountain elk population, is essential. Coordination with the U.S. Fish and Wildlife Service under the North American Waterfowl Management Plan, relating to opportunities for actions to improve and preserve wetland habitats on project lands, would be very desirable. The project's fisheries protection program, which includes collection and transport of anadromous fish, requires ongoing coordination with the Washington Department of Fish and Wildlife, the Service, NMFS, and the Muckleshoot and Puyallup Indian Tribes. Increasing recreational use of project lands for such activities as hiking, picnicking, playground use, sightseeing, mountain biking, horseback riding, rafting, canoeing and kayaking, hunting, and fishing, requires that the Corps obtain input and assistance from citizen groups when developing management plans for these and related uses.

e. Public Education. The interpretive potential at Mud Mountain Dam has not been fully explored. There is a legitimate need for an integrated interpretive program which better relates the project, the Puyallup/White River basins, and the Corps of Engineers to the visitor. Enhanced interpretive programming and facilities would increase visitor awareness of the purpose and function of Mud Mountain Dam while simultaneously cultivating visitor understanding and appreciation of the relationship between the project's resources and the dynamics of the Puyallup and White River basins.

4.8. Management Actions.

a. Wildlife Habitat. Currently, no active measures are taken to meet the wildlife habitat management objectives. The following actions are recommended to guide future wildlife habitat management:

1) Update the plant community inventory and conduct a detailed inventory of the wildlife resource for the project as a means to more clearly define management units and establish sound resource management practices.

2) Establish a forest management policy by which to evaluate any proposed timber harvest on project land.

3) Establish a snag management policy to prevent unnecessary removal of snags.

b. Coordination. Currently, no active measures are taken to meet coordination objectives. The following actions are recommended to improve coordination:

1) Establish formal coordination program with state and federal agencies to review management issues of mutual interest on a 5-year cycle.

2) Establish procedures with Champion and Weyerhaeuser Timber companies to advise project of changes in timber management practices on lands adjacent to Mud Mountain Dam. Set up an emergency coordination list.

3) Maintain contact with local groups such as the horseback riders and white water rafters associations and the Boy Scouts. Establish methods to allow these groups, and the general public, to make comments and suggestions on recreational management of project lands.

c. Public Education. Continue current practices such as updating and refurbishing public information displays and lectures by project ranger. Expansion of the public education program by adding photographic and video displays, trail signs, and brochures on project operation/mission of the Corps of Engineers, project recreational features, and project plant and wildlife is recommended.

4.9. Major Constraints. Funding for inventory of plant community and expansion of public education program has lower priority for than funding of operation orientated projects and maintenance, and will be hard to implement until priority of recreation is increased or higher funding levels are established. An alternate funding source would be to implement user fees for the project's recreational features.

SECTION 5

Project Operations Management Area

5. PROJECT OPERATIONS MANAGEMENT AREA

5.1. General. Section 5 describes and analyzes lands and associated facilities and structures required for operation and maintenance in accordance with the authorized project purpose of providing flood control to the Puyallup River floodplain area downstream of the project. The project operations management area consists of those lands on which activities directly related to the project's primary purpose of flood control occurs. As such, it includes the dam and appurtenant structures, the project office and maintenance facilities, and the upstream debris storage areas. The project operations management area consists of all lands west of the project entry road and day use recreation area, and the dam and project office area. The project operations management area continues upstream of the dam along the river approximately 2 miles to the east end of the upper debris basin area, and is bounded on the north and south sides approximately by the 1096 contour. The area occupies approximately 378 acres (see Plate 11). The project operations management area is divided into four sub areas for management flexibility (see Figure 5.1). These sub-areas are the dam and project office area, the construction staging area, the lower debris basin storage area, and the upper debris basin storage area.

5.2. Dam and Project Office Area.

a. Dam and Spillway Section. The concrete spillway is located on the north side of the dam, and is 1,200 feet long by 315 feet wide. In 1992 the side walls were raised **7** feet as part of the dam safety improvements because studies in the late 1980s indicated that the existing structure would be overtopped by a maximum probable flood event.

b. Tower. The new intake tower, completed in 1995, replaced two existing towers with a single tower capable of remaining operational during a maximum credible earthquake or spillway design flood (see general design memorandum 26 dated July 1986 for design details).

c. Project Office and Shops. This area contains the project administration office, storage facilities, emergency power generation, carpenter shop and vehicle maintenance facilities including gas station and wash rack (see Figure 5.2). The Resident Engineer's office is scheduled to be removed and a new wash facility is proposed.

d. Project Water Supply System. The existing water system uses two sources which can supply a total of approximately 2,120 gallons per hour (gph). The first source, a spring located on the north side of the dam, provides 120 gph year-round. The other source, a shallow well at the toe of the dam, provides approximately 2,000 gph, but is unreliable during the summer months when it has occasionally run dry. Water is stored in two 30,000-gallon tanks adjacent to the project office. The wading pool in the day use area holds an additional 1,160 gallons which can be used as an emergency backup supply in a fire control situation. Due to the undependable nature of the well supply during high demand periods, the existing system is inadequate for current and future project requirements.

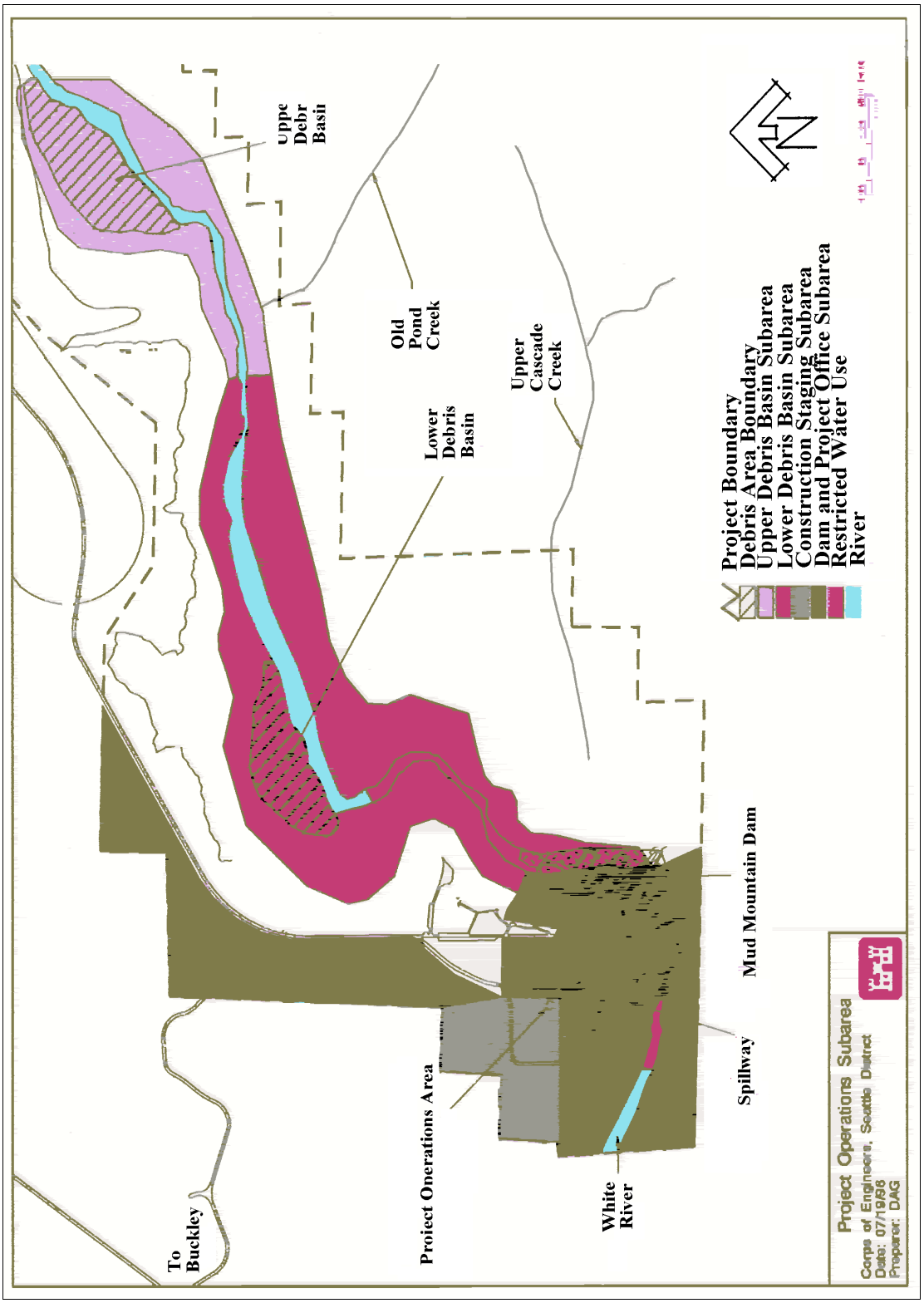


Figure 5-1
Project Operations Management Area

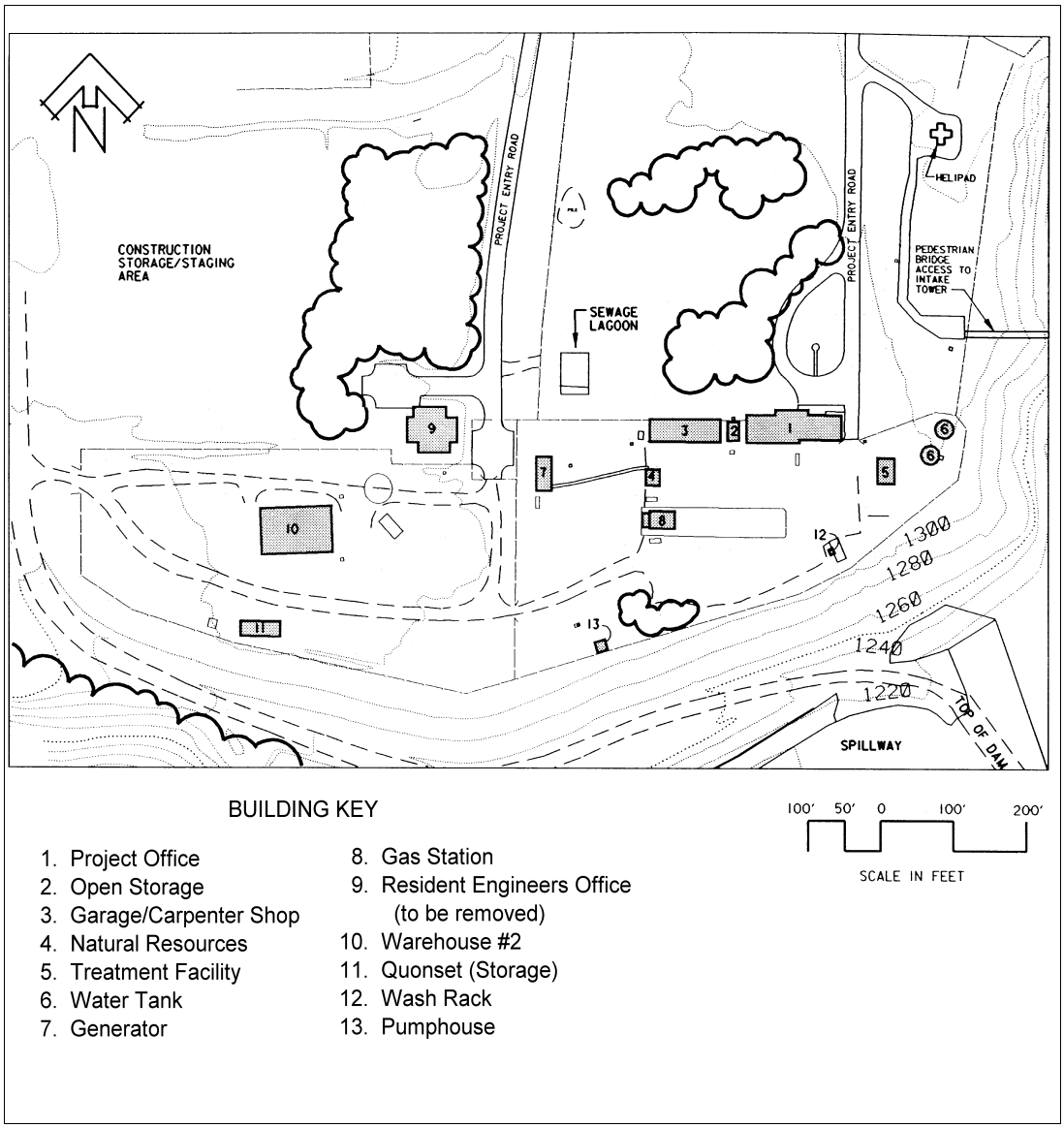


Figure 5.2
Project Office and Shops

5.3. Construction Staging Area. This 26 acres was acquired in 1987 as support lands for the dam safety modifications project. The land was stripped of all vegetation and used as a construction staging and storage area. It was also a disposal site for slurry extracted from the center of the earthen dam during the cut-off wall construction. Minimal site restoration, i.e., regrade, topsoil, seed and plant evergreen seedlings, was accomplished upon completion of the final construction contract. A ponding area for wash rack effluent is planned for a portion of the area.

5.4. Lower and Upper Debris Basin. Two debris basins are located approximately ½ mile and 1½ miles respectively upstream from the dam site. The lower debris basin (approximately 20 acres) and the upper debris basin (approximately 60 acres) function as holding areas for log debris that is floated upstream and deposited when the pool elevation is up. When all of the debris is collected the pool is lowered to normal river level leaving the logs on dry ground. At a later time the salvageable wood is removed and remaining logs are burned. Floods in December 1995 and February 1996 resulted in a record pool elevation of 1196.1, and damaged the access road to the lower debris basin. This area can not be used as described above until access is reestablished. The lower debris area is roughly defined by the annual pool, elevation 1030, while the upper debris area is approximately defined by the 5-year pool, elevation 1070. Both debris basins are utilized by elk and deer for critical winter forage, although the vegetation has low nutritional value. Active cultivation of a more nutritional food crop such as timothy, wheatgrass or white clover should be considered.

5.5. Land Classification. Project Operations

5.6. Resource Objectives.

a. To conduct operation and maintenance functions necessary to insure continued operation of Mud Mountain Dam and appurtenant structures.

b. To provide a better understanding of the Corps' mission to visitors through interpretation of project purposes, concept of operations, and natural and manmade features of the area.

c. To restore staging areas to native vegetation to improve wildlife habitat and low-density recreation use.

d. To provide winter forage for resident herds of Rocky Mountain elk and Columbia blacktail deer.

5.7. Rationale.

a. The dam and appurtenant structures are required for project operation and maintenance purposes.

b. Providing a better understanding to the public through interpretation of project purposes, concepts of project operation, and the natural and manmade features of the area is a means to enhance public appreciation of the project mission and the surrounding project areas.

c. Restoration of staging areas to previous condition is necessary to control erosion and is reasonable and prudent. Public use as low density recreation provides additional opportunity for public education and provides additional area for public use on busy weekends.

5.8. Management Actions.

a. Maintain the physical security at the project as specified in North Pacific Division Regulation (NPDR) 90-1-1, Military Police - Physical Security.

b. Continue to provide guided group tours of the dam upon request and allow controlled public access so long as it does not interfere with project operations purposes.

c. Manage visitor access to public areas of the project during periods of potentially hazardous operations or construction.

d. Revegetate areas with native trees and shrubs.

5.9. Recommended Development.

a. Update boundary surveys and install boundary markers. Lack of boundary monuments has already resulted in at least one occurrence of unauthorized construction on Corps land, and several occurrences of commercial logging on project lands is suspected.

b. Locate and develop additional water source or sources to meet current and proposed project needs. Current water demand during high use periods is about 1,000 gph, excluding irrigation needs. Firefighting requirement is 12,000 gph. High use occurs during the summer months coinciding with the period during which the well is most likely to go dry resulting in insufficient water supply. The on-site storage is sufficient for existing and proposed potable and firefighting requirements provided a new source is developed. The distribution system will need to be expanded to meet requirements in the expanded day use area and in the staging area. New water supply may require additional treatment depending upon source. Irrigation for the project operating and day use areas would require approximately 30,000 gallons per hour (gph). This water does not require treatment and could be pumped directly from the White River.

c. Develop recreation use plan for construction staging area. At a minimum, this plan should consider:

1) Landscape architectural plantings to provide visual variety and screening.
2) Provision of 50 individual and two group camp sites.
3) Provision of a shower facility to accommodate three bathers of each sex centrally located to the camping sites.
4) Construction of a trail system to provide hiking and interpretive nature walks, screening and access to individual camp sites. Trails should be paved due to close proximity to day use area.

5.10. Major Constraints. Operation and maintenance items may have higher priority than water supply improvement and boundary delineation. Improvements and development of new facilities are subject to funding constraints and prevailing Corps policies for new recreation development as discussed in Paragraph 3.12.

SECTION 6

Day Use Recreation Management Area

6. DAY USE RECREATION MANAGEMENT AREA

6.1. General. Section 6 describes lands included in the day use recreation management area, and prescribes criteria for their future development and management. The day use recreation management area is a 21-acre site bounded on the west and south by the project operations area, on the east by the edge of the White River Canyon, and on the north by the project fence (see Plate 11). Recreation lands and facilities include the day use area, the upper and lower project overlook platforms and the connecting trail (see Plate 10).

6.2. Recreation Facilities.

a. Day Use Area. The developed portion of the day use area, located on the east side of the project entry road, is approximately 14 acres, and provides picnic facilities, restrooms, and playground equipment (see Figure 6.1 and Photographs 6.1 through 6.3). The day use area has direct access via the project entry road which is used by both public and project traffic.

Photograph 6.1
Project Entry Road

The picnic area has 20 picnic table sites with covered picnic tables, 3 of which are double table units; a group picnic shelter with 4 tables; and a cooking shelter with electrical outlets and 3 fire pits. Each pair of picnic table sites is served by a barbecue grill. The children's play area is equipped with swings, slides, "jungle gym" type

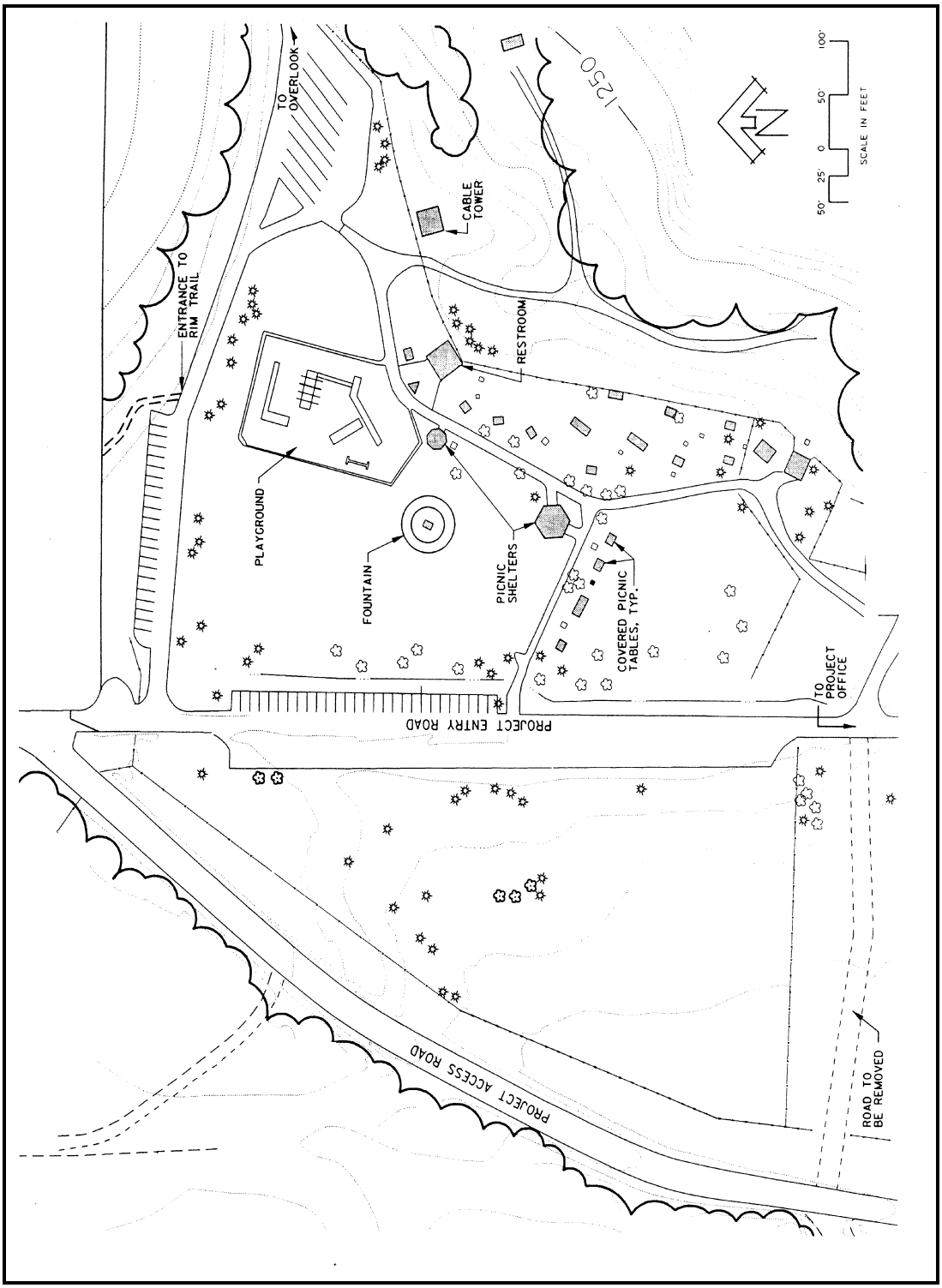
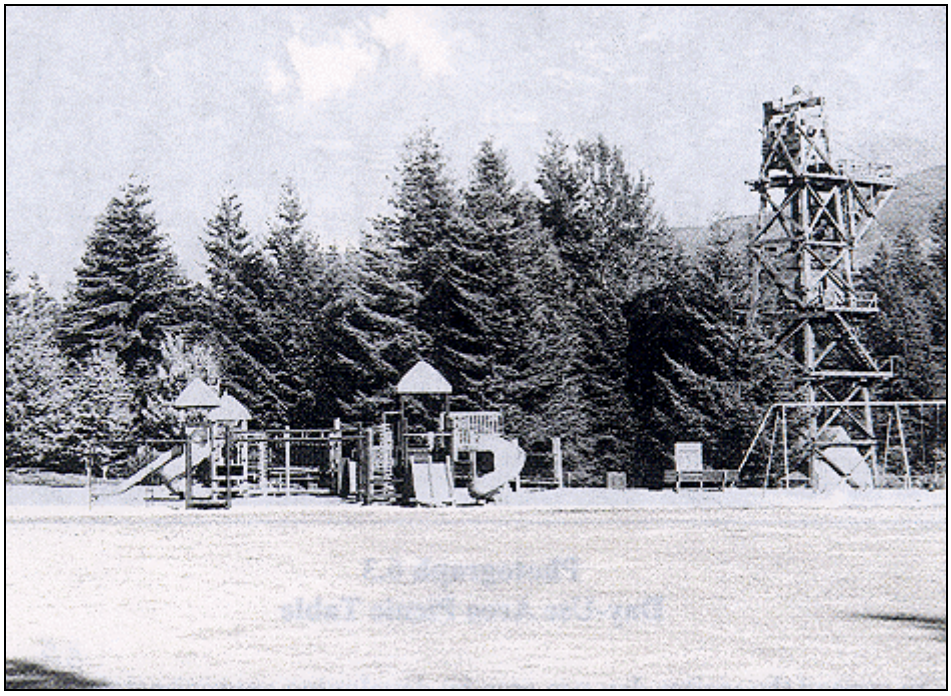


Figure 6.1
Day Use Area

equipment, and a wading pool, and is located adjacent to the picnic area. The playground area was upgraded in 1993 when all of the old equipment was removed and new play equipment meeting current safety codes was installed.



Photograph 6.2
Playground Area

Restroom facilities accessible by visitors with disabilities are centrally located to the day use area. The men's restroom provides a toilet and a urinal while the women's restroom provides two toilets, one of which has been retrofitted for visitors with disabilities. Both restrooms are lighted and are equipped with a sink with hot and cold water and an electric hand drying unit. These facilities do not fully meet the dimensional criteria of the Americans with Disabilities Act (ADA) of 1990.

Parking is available on the north, ~~and~~ east and west sides of the day use area. Parking on the north and immediately adjacent to the day use area consists of a paved area striped for 31 spaces, two of which are handicapped parking spaces. Across the access road is paved parking for an additional 50 vehicles, but there is no handicapped parking. An additional 49 paved parking spaces are available east of the day use area and adjacent to the upper vista platform. Of these, 3 spaces meet dimensional criteria for handicapped parking in accordance with the ADA. Current layout of project parking does not meet handicapped parking availability criteria specified in the ADA which requires 6 spaces for the current amount of parking.

Photograph 6.3
Day Use Area Picnic Table

Improvements to expand the visitor day use area by developing approximately ~~7~~ 5.5 acres on the west side of the project entry road were begun during the summer of 1993. Many of the large black cottonwood trees were removed to reduce potential hazards and to open up the area for proposed improvements. Paving and striping for additional head-in parking along the west and east side of the project entry road were also accomplished. Construction of a picnic shelter structure including a restroom is currently under contract (FY96) and is expected to be completed in June 1997. Landscaping, however, was not included in this contract.

b. Project Overlooks. Upper and lower vista platforms are located on a prominent peninsula that overlooks the upstream side of Mud Mountain Dam, the White River and the lower debris basin. The entire upper vista platform was rebuilt in 1992 because of deterioration and safety concerns for the old structure. The new, larger platform consists of an upper and lower deck and was constructed using low maintenance materials. Access by people with disabilities is provided only to the upper deck. New interpretive exhibits were installed, but restroom facilities were removed from this location. The lower vista platform is approximately 125 feet below the upper platform and is reached by a 1,600-foot-long dirt trail with grades up to 25 percent winding down through a densely tree-covered slope (see Photograph 6.4). Because of the surface material and steep grades of the access trail, wheelchair bound visitors are unable to reach this lower viewing platform.

Photograph 6.4
Lower Vista Platform

6.3. Interpretive Opportunities. Several interpretive opportunities are currently available at the project. A video tape discussing the need and purpose of Mud Mountain Dam and containing historic photos of the project construction is available for viewing upon request at the project office. Also available are slide presentations on project wildlife, vegetation and the current dam safety modifications. Outdoor interpretive signs are strategically placed to provide information on project features. A ranger is available upon request to give talks on natural and manmade features at Mud Mountain Dam.

6.4. Land Classification. Recreation

6.5. Resource Objectives.

a. To provide a clean, safe and enjoyable recreational experience to the visiting public.

b. To manage existing developed day use recreation facilities and to develop additional facilities to help meet current and future needs for day use recreation, such as picnicking, sightseeing and hiking.

c. To provide an educational experience for the public through formal and informal interpretation of project purposes, concept of operations, and natural and manmade features of the area.

6.6. Rationale. Management of existing day use recreation facilities and possible development of new facilities to help meet current and future needs is in the overall public interest and is consistent with existing federal law, Administration policy and Corps of Engineers' regulations and guidelines. An interpretative program increases the visitor's understanding of the surrounding environment, project purposes and concepts of project operation, and enhances visitor appreciation of the area as well as the project mission and the Corps' role in providing flood control.

6.7. Management Actions.

a. Continue to provide and maintain public convenience facilities such as toilets, shelters, drinking fountains or other services designed to provide a clean, safe and enjoyable recreational experience at the project. Enhance interpretive measures and improve public access to project lands and facilities. Manage visitor access to public areas of the project during periods of potentially hazardous operation or construction.

b. Monitor and study increasing recreational use on project lands to identify the types and extent of use and to determine if resource damage or user conflicts are occurring. If damage and/or conflicts are found, to develop management programs to address these problems.

c. Improve public awareness of recreational facilities and opportunities available at Mud Mountain Dam project.

6.8. Recommended Development

a. Upgrade restroom facility on east side of the project entry road to meet ADA standards.

b. Provide additional day use facilities on west side of project access road (see Figure 6.2). Recommended facilities:

- 7 picnic table units.
- Playing fields for baseball, volleyball and horseshoes.
- Landscaping with predominantly low-maintenance grasses, deciduous trees to provide shade, native trees blending with existing trees, and minimal native shrubs and ground covers as needed to define spaces and create privacy.
- An underground irrigation system (installed at the same time as the landscaping).
- Interpretive center

c. Provide a minimum of 2 additional parking spaces at day use area on west side of project entry road in accordance with ADA guidelines.

d. Develop alternate route for main project operations personnel traffic to bypass the day use area, minimizing potential conflicts between visitor use and activities of project personnel.

6.9. Major Constraints. Improvements and development of new facilities are subject to funding constraints and prevailing Corps policies for new recreation development as discussed in Paragraph 3.12.

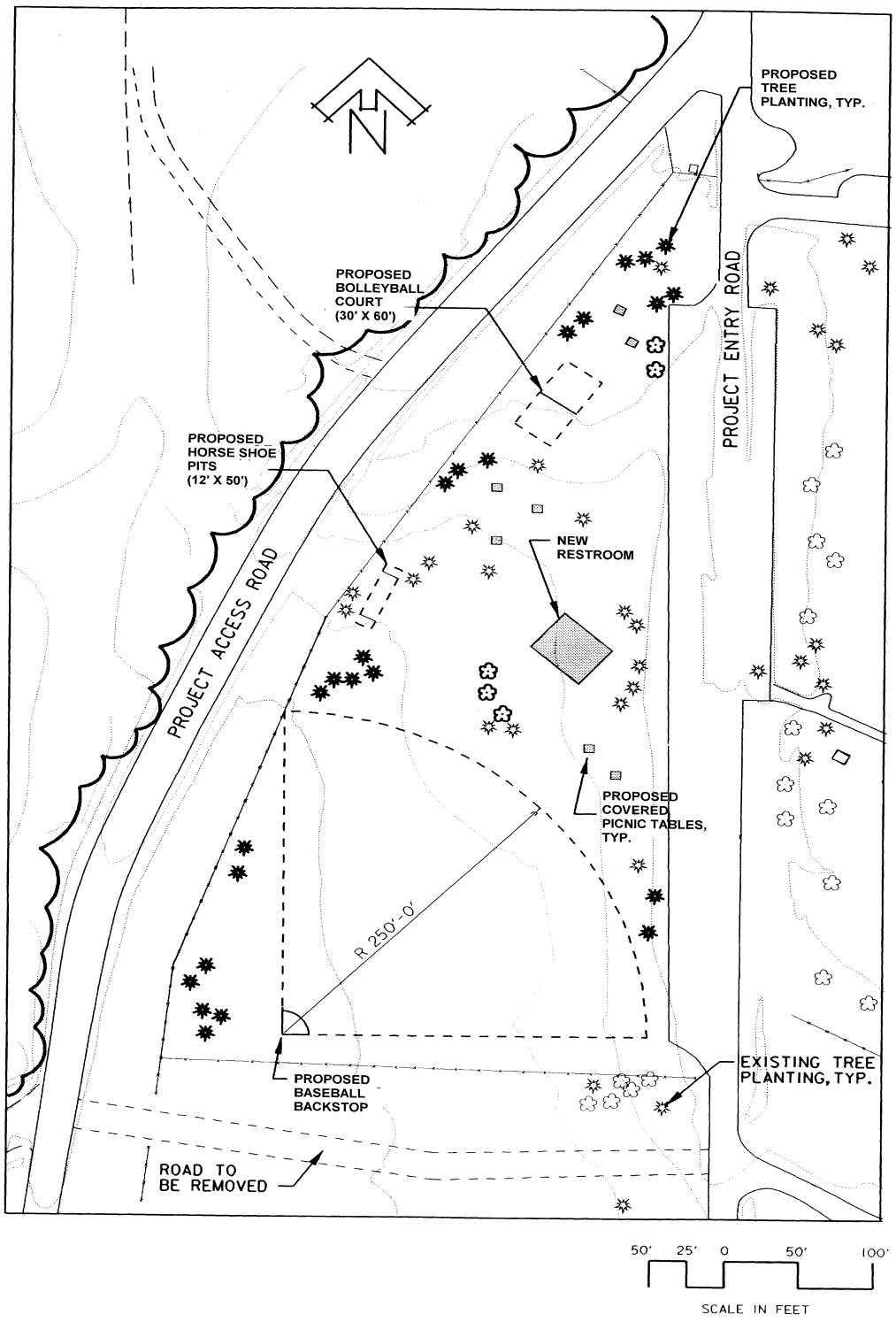


Figure 6.2
Expanded Day Use Area

SECTION 7

Right Bank Multiple Purpose Management Area

7. RIGHT BANK MULTIPLE PURPOSE MANAGEMENT AREA

7.1. General. Project lands included in the right bank multiple purpose management area lie between the project boundary on the north side, the project entry road on the west, and the White River, project operations management area, or right bank riparian management area on the south (see Plate 11). The right bank multiple purpose management area is an area of 593 acres which comprise the majority of land on the right bank (north side) of the White River. The area is almost entirely forested with a small portion of meadow, and includes many areas of steep slopes. Included are the Rim and River Trails and the project roads that lead to the debris basins. In addition to the Clearwater River and Scatter Creek there are at least three unnamed streams flowing through this area, draining the higher elevations and flowing into the White River (see Plate 10).

7.2. Recreational Opportunities.

Photograph 7.1
Typical Project Trail

a. Rim Trail. The Rim Trail is a 3.5-mile trail that originates at the Mud Mountain day use area (see Photograph 7.1). The trailhead facilities include a paved 9-car parking area located just outside the fence at the entrance to the day use area. The trail leaves the parking area and proceeds through a grove of vine maples to the edge of the river canyon and then continues along the north canyon rim upstream from the dam. Views include the White River and surrounding river canyon and neighboring mountains. This is an excellent hike since it is very accessible and the terrain is gentle to slightly sloping. It is also unique in that the surrounding privately held forest land, which is intensively managed, is rarely visible giving the sense of a real woodland environment. Equestrian use of the Rim Trail is prohibited.

b. River Trail. The River Trail is a 6-mile-long trail originating about 2 miles north of

the day use area at the upper debris basin and proceeding upstream along the right bank of the White River. The trail winds down through mature and transitional stands of forest, gradually opening up into meadows along the banks of the river. Unobstructed scenic views, abundant wildlife and river access are provided the visitor. This is an excellent equestrian, hiking and mountain biking area. Motorcycles and other motorized vehicles are not allowed to use this trail. The River Trail is not accessible when the flood pool is above the 1,050 foot elevation.

7.3. Land Classification. Multiple Resource Management: Low Density Recreation

7.4. Resource Objectives.

a. To allow low density dispersed recreation use, such as hiking, sightseeing, horseback riding, river access and hunting (in season) on project lands not developed for recreational use, where public access is not otherwise restricted due to public safety, operational or environmental considerations.

b. To retain forests for wildlife habitat as well as for aesthetic enjoyment, and to protect steep slopes and riverbanks from erosion.

c. To improve trail-heads and maintain all project roads and trails.

7.5. Rationale. The Mud Mountain Dam project lands have become increasingly important as a regional low-density day use area. Maintaining roads, trails, and, above all, the forested condition of the project area is important in retaining the values visitors seek when visiting the project. The Rim and River Trails are used frequently by fishermen, sightseers, walkers, hikers, mountain bikers and equestrians for general relaxation. Interpretive signing can be used to educate the public on a range of topics including project purposes, environmental protection measures and species of vegetation. Forests and other vegetation on project lands provide bank stability and erosion protection and habitat for migratory herds of Columbia black-tailed deer and Rocky Mountain elk as well as numerous other resident and transitory species.

7.6. Management Actions.

a. Continue road and trail and forest maintenance as needed. Improve trail surfaces as resources become available.

b. Actively pursue solutions to project access with adjacent landowners.

c. Identify potential sponsors and seek to enter into agreements with them for new recreational development.

7.7. Recommended Development.

a. Extend Rim Trail from the point where it joins the upper debris basin road, so that it remains on top of the ridge and follows close to the project boundary, crossing Scatter Creek in its upper reach, and staying close to the project boundary to the east end of the project. Pave Rim Trail in accordance with ADA standards for use by elderly and wheelchair bound visitors.

b. Provide signs at trail-heads to enable hikers to clearly understand beginning, terminus, length, focal points, and terrain of project trails.

c. Provide interpretative signs along project trails to improve public awareness and understanding of project purpose, natural features, and forest ecosystems. Develop and provide brochures at trail-heads which identify flora and fauna encountered along trail system, discuss ecological issues such as forest successional stages, erosion control, importance and management practices of various forest and meadow areas, including environmentally sensitive areas, etc. Post signs on trails where equestrian use is prohibited.

d. Develop additional low density recreation opportunities such as primitive camping sites, primitive picnic area sites and river craft take-out sites.

e. Provide take-out sites for white water recreationists to pull equipment out of the river and obtain access to project entry road/SR 410 by crossing project lands. Use may need to be controlled by issue of permits. Users would also have to obtain permission and coordinate access across Weyerhaeuser property.

7.8. Major Constraints. Improvements and development of new facilities are subject to funding constraint and prevailing Corps policies for new recreation development, discussed in Paragraph 3.12.

SECTION 8

Right Bank Riparian Management Area

8. RIGHT BANK RIPARIAN MANAGEMENT AREAS

8.1. General. The right bank riparian management area is a 252-acre site surrounding Scatter Creek which consists of two discrete types of vegetation: wetland areas, approximately 89 acres, and riparian areas, approximately 163 acres (see Plate 11). Lands in this area are environmentally fragile and require special management techniques to protect them.

a. Wetland Areas. The right bank riparian management area contains approximately 64 acres of swamp and approximately 25 acres of marsh area, and includes all of the area surrounding Scatter Creek and the adjoining beaver-dammed wetlands. This classification comprises the majority of the wetlands found on project lands. Wetlands provide several functions, including fish and wildlife habitat, sediment and nutrient retention (i.e., protects downstream fish habitat), shoreline protection from erosion, food chain support, low density recreation, and education. Wetlands are sensitive to disturbance. Any removal of vegetation, draining, filling, or other disturbance will reduce their ability to provide any of these functions. Wetlands are the only type of wildlife habitat that provides all three of the basic life requirements of animals: cover, food, and water. Water is the key ingredient: the ready availability of water means that animals need not range far to drink or bathe.

b. Riparian Areas. Riparian areas are zones of vegetation found along rivers, streams, and water bodies. The vegetation types found in riparian areas are strongly influenced by the presence of the adjacent water bodies and may include areas also defined as wetlands in addition to more mesic vegetation communities. Typical plants include willows, cottonwoods and alders with an under story of red-osier dogwood, salmonberry, snowberry, and ninebark. Sedges and rushes can also be found in wetlands in the riparian zone. Functions commonly attributed to riparian habitat include flood storage, water quality improvement, bank erosion protection, and fish and wildlife habitat.

In the White River, riparian areas provide shade to maintain lower water temperatures, provide micro habitat for fish through downed woody debris, help to stabilize stream channel, act as habitat for a variety of resident and migratory birds, provide a source of terrestrial insects which are a food for fish, and add nutrients through leaves and large organic debris which provide a food source for aquatic insects and fish.

8.2. Land Classification. Environmentally Sensitive Area

8.3. Resource Objectives.

a. To retain all wetlands in existing conditions, with the following exceptions:

1) Removal of individual trees which pose a safety hazard, and

2) Modify habitat when such action will improve it for target species.

b. To protect environmentally fragile areas by restricting public access to well defined locations and trails.

c. To increase public awareness of the importance and value of these areas while permitting controlled access and educational opportunities.

8.4. Rationale. The Mud Mountain Dam project lands have become increasingly important as a regional low density day use area, however, environmentally sensitive areas are easily damaged by unrestricted use by the public. In addition, poor land management practices can result in severe erosion problems, especially on steep slopes and along river banks. For example, removal of trees, shrubs, and herbaceous vegetation exposes the soils to the ravages of freely running water, which otherwise is held in check by the dense network of roots. Roots not only bind the soil, but also soak up enormous quantities of water. Thus it is quite important that vegetation is never removed from wet hillsides in the project area; such management will invite severe erosion problems that may not be possible to correct once they are established. Retaining the wetland habitats in their present state and providing controlled public access and enjoyment of project lands are important values visitors seek when visiting the project. Educating the public in the functional and fragile nature of these areas is in the best interest of the Nation.

8.5. Management Actions. Restrict public access in wetland areas to well defined trails and areas set aside for picnicking, river access, etc.

8.6. Recommended Development.

a. Delineate environmentally sensitive areas (e.g., wetlands) and advise public of use restrictions in this area.

b. Provide new trails and upgrade the existing trail near the beaver-dammed wetlands and Scatter Creek to restrict visitors to trails only.

c. Provide interpretive signing to improve public enjoyment of project lands and educate the public concerning the fragile nature of the project wetlands and riparian areas.

8.7. Major Constraints. Improvements and development of new facilities are subject to funding constraints and prevailing Corps policies for new recreation development as discussed in Paragraph 3.12.

SECTION 9

Left Bank Multiple Purpose Management Area

9. LEFT BANK MULTIPLE PURPOSE MANAGEMENT AREA

9.1. General. The left bank multiple purpose management area includes all project lands between the left bank of the White River and the south project boundary, and upstream of the project operation management area, excluding the two left bank riparian management areas as shown on Plate 11. The area is characterized by very steep slopes, with mature or nearly mature forests on the slopes. At the toe of the slopes are benches that lie slightly above the White River and are vegetated by grasses and willows. With the exception of a logging road owned by Champion Timber Company, and which traverses about ½ mile of project lands near the dam, the left bank area is currently inaccessible except by boat or raft launched several miles upstream. The project boundary is approximately at the top of the slope.

9.2. Land Classification. Multiple Resource Management: Inactive, Future Low-Density Recreation

9.3. Resource Objectives.

a. To retain forest and meadow habitats in existing condition (i.e., allow to grow through successional stages).

b. To provide public access for low-density recreation as public need grows.

9.4. Rationale. The Mud Mountain Dam project lands have become increasingly important as a regional low density recreational area. Retaining the forest and meadow habitats in their present state and providing improved public access and enjoyment of project lands are important values visitors seek when visiting the project.

9.5. Management Actions. Actively pursue solutions to project access with adjacent landowners and, in keeping with project operations requirements, pursue enhancement of safety of access across the dam.

9.6 Recommended Development.

a. Provide access to south side of the White River, either by allowing access across the dam, or by footbridge across the White River at, or near, the fish release site, or both.

b. Construct a system of trails and low density, primitive camp sites.

9.7. Major Constraints.

a. Improvements and development of new facilities are subject to funding constraints and prevailing Corps policies for new recreation development as discussed in Paragraph 3.12.

b. Lack of access to the south side of the White River prevents utilization of the area.

c. Development of a loop trail system would require upstream bridging of the White River and/or access across the dam.

SECTION 10

Left Bank Riparian Management Areas

10. LEFT BANK RIPARIAN MANAGEMENT AREAS

10.1. General. The left bank riparian management area consists of two sites on the left bank of the White River surrounding Clearwater River and in the vicinity of Canyon Creek as shown on Plate 10. These two sites are combined into one management area because the management requirements are the same and, although not contiguous, they are geographically close to one another. The Canyon Creek subarea contains about 50 acres while the Clearwater River subarea consists of approximately 15 acres for a total of 65 acres. Two discrete types of vegetation are found in the left bank riparian management area: approximately 36 acres of wetland areas and about 29 acres of riparian areas (see Plate 10). There are two distinct marsh areas: a forested swamp across the White River from the fish release site; and forested swamps on either side of the Clearwater River. Riparian areas are found along the streambank. Refer to Section 8.1 for a discussion of wetland and riparian classifications. Lands in this area are environmentally fragile and require special management techniques to protect them.

10.2. Land Classification. Environmentally Sensitive Area

10.3. Resource Objectives. See Section 8.3

10.4. Rationale. See Section 8.4

10.5. Management Actions. See Section 8.5

10.6. Recommended Development. See Section 8.6

10.7. Major Constraints. See Section 8.7

SECTION 11

Fish Release Management Area

11. FISH RELEASE MANAGEMENT AREA

11.1. General. The fish release management area consists of two sites, the Buckley collection facility, and the upstream release site. The Buckley collection facility is a 2.15-acre site located adjacent to the Puget Power diversion dam near Buckley, Washington (see Figure 2.7), at which the anadromous fish are trapped for transport around Mud Mountain Dam. The upstream release site is a small area of about 0.1 acre located on the right bank of the White River approximately as shown on Plate 11. The site comprises the upstream end of the fish bypass operation and contains a chute by which anadromous fish are returned to the White River.

11.2. Land Classification. Multiple Resource Management - Wildlife Management General

11.3. Resource Objective.

a. To continue assisting anadromous fish with upstream migration by collecting fish below the dam and transporting them to the release site above the dam.

b. To implement improved methods of fish bypass if such methods can be identified and are scientifically, technologically and economically justified.

11.4. Rationale. The Corps has a continuing program at the project based on an agreement among the U.S. Government, the state of Washington, and the Puget Sound Power and Light Company to assure upstream fish passage around Mud Mountain Dam. A high environmental and economic value is placed on these fish by all concerned agencies and Native American tribes. The fish bypass program is in the overall public interest and should be maintained. Continuing efforts of federal, state, and local agencies and the Puyallup and Muckleshoot Indian Tribes to improve the White River fisheries program should be supported and encouraged by the Corps.

11.5. Management Actions. Continue operation and maintenance activities at existing facilities.

11.6. Major Constraints. None

SECTION 12

Design Criteria

12. DESIGN CRITERIA

12.1. General. This section provides design criteria for recommended development as discussed in sections 4 through 11. Applicable policy and design manuals are as follows:

- Americans with Disabilities Act (ADA), Public Law (PL) 101-336, 26 July 1990.

- Department of Defense (DOD) Policy on Handicapped Access dated 20 October 1993

- ADA Accessibility Guidelines for Buildings and Facilities (ADAAG)

- Engineering Manual (EM) 1110-1-400, Recreation Planning and Design Criteria

- EM 1110-2-410, Design of Recreation Areas and Facilities, Access and Circulation

- Technical Manual (TM) 5-803-10, Planning and Design of Outdoor Sports Facilities

- TM 5-813-5, Water Supply, Water Distribution

12.2. Department of Defense Policy. DOD policy requires all DOD facilities, which includes Corps of Engineers water resources projects such as Mud Mountain Dam, to be at least as accessible as state and local government facilities and public accommodations in the private sector that are subject to the ADA. It is the Corps' policy to incorporate accessibility considerations in all outdoor recreation planning, design, new construction, and renovation activity at water resources projects. Design and construction standards are defined in the ADAAG, which was developed by the United States Architectural and Transportation Barriers Compliance Board, of which DOD is a member. ADA requirements may be summarized as follows:

a. Remove architectural and structural barriers in existing facilities where readily achievable. "Readily achievable" means easily accomplishable and able to be carried out without undue difficulty or expense.

b. Provide readily achievable alternative measures when removal of physical barriers is not readily achievable. Legitimate safety requirements may be considered in determining what is readily achievable so long as they are based on actual risks and are necessary for safe operation.

c. Maintain accessible features and equipment.

d. Design and construct new facilities and, when undertaking alterations, alter existing facilities in accordance with ADAAG.

12.3. Water Supply. Install additional water supply in accordance with TM 5-813-5, and the following:

- Potable requirements - 1,000 gph[1/]
- Firefighting requirements - 12,000 gph
- Irrigation requirements - 8,640 gph per acre[2/]

12.4. Recreational Facilities. Outdoor recreational facilities will be constructed in accordance with referenced design guidance, and the following:

- Picnic areas - Individual covered tables will be provided on concrete pads. Provide one barbecue grill unit, garbage can, and potable water faucet for every two picnic tables. Tables will match existing units in design and color.

- Playing fields - Baseball and volleyball will be grass surface, regulation sized fields.

- Landscaping - Plants will be low-maintenance, trees, shrubs and grasses. (See Appendix B, Section I for existing vegetation types in the day use area.) New landscaping should blend with existing plants, and native plants will be selected when possible. Irrigation system will be low-maintenance with large radius pop-up heads in lawn areas and drip or low-water use micro-sprays in shrub areas.

- Interpretive center - Center to match existing recreational facilities in architectural style, building materials and color. Interpretive center will contain wall-mounted display cases, brochure racks and a visitor-operated video tape and slide show.

- Parking areas - Parking areas shall be designed in accordance with EM 1110-241-0 and shall be 2-inch class "b" asphaltic concrete over 6-inch crushed gravel base. Parking stalls will be 10 feet wide by 20 feet deep, except for parking for visitors with disabilities (see ADAAG for parking stall dimensions).

[1/] includes recreational use

[2/] Irrigation of cultivated project lands in the day use and project operation areas is assumed to be 2 hours of watering per day.

- Trails - Trail system in high use areas should be designed for accessibility by disabled visitors (see ADAAG for slope criteria). Trails should be 4 feet wide and be constructed of 2-inch asphaltic concrete over suitable base. Overhead clearance should be 8 feet minimum. Where restoration is required, planting of native vegetation in the staging area should be emphasized. Interpretive signs for vegetation should be installed along trails. Brochures keyed to the trail interpretive signs and providing details of the vegetation should be available at the interpretive center and at the beginning of the trail system.

Trail surfaces in moderate use areas should be 4-inch-thick -inch crushed gravel. Trails exclusively for equestrian use should not be surfaced.

Trails should be built-up instead of dug-in and grades should not exceed 10 percent. Where grades greater than 10 percent are necessary, steep grades should be broken by short flat or near flat segments.

Ditches should be constructed along uphill side of trail where ground runoff is anticipated. Cross ditching or culverts should be installed as necessary to prevent erosion of trail.

- Individual camping sites. Individual sites should have a picnic table and barbecue unit. Potable water should be provided for every four individual sites and a garbage can should be placed for every six sites. Single stall, handicapped visitor accessible restroom facilities similar in construction to those in the day use areas should be available for every eight sites.

- Group camping site. Group camping site should accommodate six to eight tent sites and contain four barbecue grill units, a fire pit, four picnic tables, two garbage cans, potable water, and restroom facilities.

- Shower facility should be similar in construction and architectural design to restroom facilities. Shower facility should provide two toilets (men's - one toilet and one urinal) in addition to three shower stalls.

- Rafting take-out sites should be 20 feet by 30 feet, graded to not greater than 20 percent grade and surfaced with 8-inch-deep sandy material. Notification signs should be installed not less than ½ mile and 500 feet upstream of the take-out site.

12.5. Project Signs. Project signs should be constructed in accordance with the Uniform Traffic Control Devices published by the Federal Highway Administration and Engineer Pamphlet (EP) 310-1-6a, 6b., the Corps of Engineers Sign Standards Manual.

SECTION 13

Conclusions and Recommendations

13. CONCLUSIONS AND RECOMMENDATIONS

13.1. Conclusions. The Mud Mountain Dam project master plan has been prepared to provide guidance for the preservation, conservation, restoration, maintenance, management and development of all natural and manmade resources on project lands. Project lands were acquired in accordance with the authorizing documents for the operation of the project for flood control on the White and Puyallup Rivers. The master plan presents specific recommendations for both short- and long-term development and management actions consistent with the authorized project purpose. Project resource development and management actions shall be measured against a management framework which includes resource objectives and concise management actions for individual project sites and features. This master plan will serve to increase resource management effectiveness and provide the basis for the preparation of follow-up Operational Management Plans (OMP) as prescribed by Engineer Regulation (ER) 1130-2-435.

13.2. Recommendations. Recommend that the Mud Mountain Dam project master plan be adopted as a guide to the orderly use, development and management of the natural and manmade resources of the Mud Mountain Dam project administered by the Seattle District. Land classifications and resource objectives formalized by the master plan provide a balanced plan for sound resource use, development and management consistent with the authorized project purpose and are based on determination of highest and best use.

Approved:

Donald T. Wynn
Colonel, Corps of Engineers
District Engineer

Plates (not available in this electronic document)

Appendices

Appendix A

Supplemental Project Information

Section 1 - Pertinent Data

Section 2 - Previously Issued Reports and References

Section 3 - ~~Reprint~~ Excerpt of Recreational Analysis from Mud Mountain Dam Master Plan Design Memorandum 1C

Appendix A

Supplemental Project Information

SECTION 1

PERTINENT DATA

1. General

Federal Identification Number	WA00300
Owner/Operator	U.S. Army Corps of Engineers, Seattle District
Date Constructed	1939-1942 and 1947-1948
Dam Safety Modification	
Cutoff Wall	1988-1990
Spillway Walls	199x-1991
Intake Towers	1992-1995
Purpose	Flood Control
Downstream Hazard Potential	Category 1 (high)
Size Classification	Large

2. Location

County, State	King/Pierce, Washington
GLO Location	Sec 17, T19N, R7E, W.M.
USGS quadrangle	Enumclaw
Latitude	47° - 8.4'
Longitude	121° - 55.9'
Upstream from Mouth of White River	28 miles
Upstream from Mouth of Puyallup River	38 miles

3. Reservoir Data

Watershed	Upper White River
Drainage Area	402 square miles
Probable Maximum Flood (PMF) Outflow	245,000 cfs
Capacity at Spillway Crest	106,000 acre-feet
Capacity at Pool Elevation of 1,252 feet msl	147,500 acre-feet
Pool Elevation at PMF	1,252.2 feet msl
Max Pool Acreage (elv. 1,215' - spillway crest)	970 acres
Fee Acres Above Average Pool (elv. ')	1,760 acres?
Max spillway design pool (elv. 1,241')	1,200 acres

4. Dam

Type	Rockfill (Concrete cutoff wall in earth core)
Structural Height	427 feet
Hydraulic Height	360 feet
Crest Elevation	1,257 feet msl
Crest Length	810 feet
Width	
at Base	1,600 feet

at Crest	25.5 feet
Volume of Fill	2,300,000 cubic yards
Concrete in Project	87,000 cubic yards
Concrete in Cutoff Wall	18,277 cubic yards
Maximum Credible Earthquake (MCE)	0.35 g
Operating Basis Earthquake	0.24 g
Design Freeboard	4.8 feet

5. Spillway

Location	Right Abutment
Type	Concrete Free-Overflow Chute
Crest	
Elevation	1,215 feet msl
Width	315 feet
Length	1,200 feet
Capacity at Pool Elevation 1,252.2 feet msl	245,000 cfs (Spillway Design Flood)

7. Intake Structure

Type	Single, cylindrical trashrack
Location	Right bank, adjacent to Upstream face of dam
Diameter	50 feet
Intake Access	Single entrance to 9-ft tunnel
	Dual entrance to 23-ft tunnel
Elevation to 23-foot tunnel intakes	
Intake 1	910 feet msl
Intake 2	925 feet msl
Elevation top of Intake Structure	1,100 feet msl
Elevation Reservoir Floor	895 feet msl

8. Intake Structure Access Bridge

Type	Steel Plate Girder
Span	227 feet
Roadway Width	18 feet

9. Outlet Works

Authorized flood control discharge (total)	17,600 cfs
Maximum discharge	24,150 cfs

9-foot tunnel

Type	Concrete, Horseshoe
Location	Right bank
Control	Radial Gate in Intake Structure
Length	1,521.2 feet
Discharge at Pool Elev. 1,215 feet msl	4,600 cfs

23-foot tunnel

Type	Concrete, Circular
Location	Right Bank
Control	Radial Gates in Intake Structure
Length	1,656.5 feet
Discharge at Pool Elev. 1,215 feet msl	13,000 cfs
Maximum discharge	19,550 cfs

Appendix A

Supplemental Project Information

SECTION 2

PREVIOUSLY ISSUED REPORTS AND REFERENCES

Previously Issued Reports and References

	Title	Date
1.	Construction Plans	--
2.	Geological Report, Edwin T. Hodge	18 Jul 1938
3.	Analysis of Design, Mud Mountain Dam	03 Dec 1938
4.	Design of Mud Mountain Dam & Appurtenances	30 Dec 1938
5.	Report on Soil Tests for Mud Mountain Dam	11 May 1939
6.	TM 164-1, WES, Results of Soil Test on Materials from Proposed Mud Mountain Dam	20 Dec 1939
7.	Contract Specifications for the Dam	1939
8.	Test Fill Report for Mud Mountain Dam	--
9.	Bonneville Hydraulic Laboratory, Model Study of the Spillway for Mud Mountain Dam	1942
10.	WES Bulletin No. 14, Permeability Characteristics of Mud Mountain Impervious Clay Materials	20 Feb 1942
11.	Foundation Report	21 Mar 1942
12.	Bonneville Hydraulic Laboratory, Model Study of the 23-Foot Outlet Tunnel for Mud Mountain Dam	15 Jul 1942
13.	Prototype Testing	Jan 1945
14.	Agenda for Consulting Board Meeting	28-29 Jul l945
15.	Analysis of Design -- Embankment Design	1946
16.	Analysis of Design -- Design Other than Embankment	1946
17.	Analysis of Design -- Original 9-Foot Gate, Modified 9-Foot Gate and Cableway	1946
18.	Master Recreation Plan	1946
19.	Real Estate, Preliminary Planning Report Civil Project -- Tracts 14 and 15	04 Mar 1948
20.	Supplement to Agenda for Consulting Board Meeting	28-29 Jul 1948

Previously Issued Reports and References

	Title	Date
21.	Proceedings of Consulting Board Meeting	28-29 Jul 1948
22.	Real Estate, Preliminary Planning Report Civil Project -- Easements for Radio Reporting Network, Puyallup River Basin, Mud Mountain Dam	04 May 1949
23.	Proposed Improvements -- Right Bank	Jan 1950
24.	Proposed Revisions -- Outlet Works	Jan 1950
25.	Real Estate Supplement to Preliminary Planning Rept -- Easements for Radio Reporting Network, Puyallup River Basin, Mud Mountain Dam	13 Feb 1950
26.	Real Estate Supplement to Supplement dated 13 Feb 1950 (same title)	06 Mar 1952
27.	Reservoir Regulation Manual	Aug 1954
28.	Real Estate Planning Report -- Civil Project -- Mud Mountain Dam, Piezometer Stations	26 Aug 1954
29.	Real Estate -- Design Memorandum No. 1 -- Access Road and Bridge	11 Feb 1958
30.	Design Memorandum (unnumbered) -- Improved Access Upstream and Downstream Outlet Works Structures	Dec 1960
31.	Design Memorandum Supplement No. 1 -- Improved Access to Upstream and Downstream Outlet Works Structures	Dec 1962
32.	Design Memorandum No. 1B -- Reservoir Management and Public Use Development (Master Plan)	Mar 1964
33.	Report of Earthquake Damage	1965
34.	Periodic Inspection and Continued Evaluation Report No. 1-- Inspection of:	20 Jul 1967
35.	Design Memorandum No. 1B Revised Master Plan	Dec 1968
36.	Periodic Inspection and Continuing Evaluation Report No. 2 -- Inspection of:	29 Apr 1969
37.	Periodic Inspection and Continuing Evaluation Report No. 3 -- Inspection of:	07 Oct 1971

Previously Issued Reports and References

	Title	Date
38.	Environmental Impact Statement -- Mud Mountain Dam and Reservoir, White River, Washington	Apr 1972
39.	Cableway Replacement Planning Report	May 1973
40.	Periodic Inspection and Continuing Evaluation Report No. 4 -- Inspection of:	23 May 1973
41.	Feasibility of Forest Management Determination Report	Dec 1973
42.	Mud Mountain Dam, Interpretive Concept Plan	Apr 1974
43.	USGS Water Resources Investigation 78-113 Sediment Transportation by the White River into Mud Mountain Reservoir	Jun 1974-Jun 1976
44.	Design Memorandum No. 20B -- The Mud Mountain Dam Master Plans, Phase III	Sep 1974
45.	Period Inspection and Continuing Evaluation Report No. 5 -- Inspection of:	22 Apr 1975
46.	Design Memorandum No. 1C -- Mud Mountain Master Plan	Apr 1976
47.	Design Memorandum No. 2 -- Visitors Center	May 1976
48.	Design Memorandum No. 3 -- Water Treatment Plant	Sep 1976
49.	Real Estate -- Design Memorandum No. 8 -- Revised Guide Taking Line	Sep 1976
50.	Means of Improving the Capability and Quality of the Water System -- Harstad Accounts, Inc.	Mar 1977
51.	Periodic Inspection Report No. 6 -- Inspection of:	Apr 1977
52.	Design Memorandum No. 4 -- Stabilizing Right Downstream Bank	Sep 1977
53.	Design Memorandum No. 5 -- Construction of Road on Upstream Face of Dam	Sep 1977
54.	Design Memorandum No. 6 -- Stop Log Hoist for 9-Foot Tunnel	Sep 1978
55.	Report on Right Rim Reservoir Leakage	Dec 1978
56.	Design Memorandum No. 7 -- Rehabilitation of Apron Structure for 9-Foot Tunnel	Aug 1979

Previously Issued Reports and References

	Title	Date
57.	Supplement No. 1 to Design Memorandum 1C -- Landscaping and Parking Improvements	Oct 1979
58.	Design Memorandum No. 12 -- Supplement No. 9, Rockfill Dam, Spillway Outlet Works and Related Project Facilities	--
59.	Operational and Maintenance Manual	Jun 1981
60.	Emergency Preparedness Brief with Dam Break Flood Inundation Maps	Apr 1982
61.	Periodic Inspection Report No. 7 -- Inspection of:	May 1982
62.	Effect of Mud Mountain Dam Regulation on Sediment Movement in the White River, Northwest Hydraulic Consultants, Inc.	Jul 1983
63.	Design Memorandum No. 25 -- Earthquake Analysis of Mud Mountain Dam	Sep 1983
64.	Reconnaissance Report for Mud Mountain Dam, Dam Safety Assurance Program	Apr 1984
65.	Preliminary Reconnaissance Report on Seepage Studies at Mud Mountain Dam	20 Aug 1985
66.	Reconnaissance Report on Seepage Control, Mud Mountain Dam	13 Dec 1985
67.	Real Estate-Design Memorandum No. 27 -- Contractor Staging Area Dam Safety Assurance Program, Mud Mountain Dam	Jan 1986
68.	Letter Supplement No. 1 to Real Estate Design Memorandum No. 27 -- Boundary Change	Feb 1986
69.	General Design Memorandum No. 26 -- Dam Safety Assurance Program, Mud Mountain Dam	Jul 1986
70.	Supplement No. 1 to General Design Memorandum No. 26 -- Mud Mountain Dam Seepage Control Measures	Nov 1986
71.	Feature Design Memorandum No. 28 -- Intake Tower, Mud Mountain Dam	1988
72.	Dam Seepage Control Cutoff Wall -- Report on Construction of Test Section Between Sta 15+84 and 16+37	Oct 1987

Previously Issued Reports and References

	Title	Date
73.	Letter Supplement No. 2 to GDM No. 26 -- Spillway Bridge Construction	Aug 1990
74.	Periodic Inspection Report No. 8 -- Inspection of:	May 1991
75.	Seepage Control Cutoff Wall - Construction Foundation Report	Aug 1991
76.	Letter Supplement No. 3 to GDM No. 26 -- Construction Related Fishery Mitigation	Apr 1992
77.	Period Inspection Report No. 9 -- Inspection of:	Jun 1993

Appendix A

Supplemental Project Information

SECTION 3

Excerpt of Recreational Analysis from Mud Mountain Dam Master Plan Design Memorandum 1C

TABLE 7*

PUBLICLY ADMINISTERED RECREATION FACILITIES
PRIMARY MARKET AREA

Administrator	Total Acres	Camp Units	Shelters	Picnic Units	Boat Launch	Swimming Beach	Nature Area	Nature Trail	Winter Sports	Public Hunting	Public Fishing	Organ. Camp
Federal	2,965	326	2	180					1			4
State	2,606	198		644	26	3	2					
County	1,460			506	3	9						
City-Local	1,978			138	3	4						
Totals	**9,009**	**524**	**2**	**1,468**	**32**	**16**	**2**	**0**	**1**	**0**	**0**	**4**

TABLE 8*

PUBLICLY ADMINISTERED RECREATION FACILITIES
SECONDARY MARKET AREA

Administrator	Total Acres	Camp Units	Shelters	Picnic Units	Boat Launch	Swimming Beach	Nature Area	Nature Trail	Winter Sports	Public Hunting	Public Fishing	Organ. Camp
Federal	595	511	6	285								
State	1,886	11		30	33					1		
County	878					1						
City-Local	3,751	61		337	6	5	1	1				1
Totals	**7,110**	**583**	**6**	**652**	**39**	**6**	**1**	**1**	**0**	**1**	**0**	**1**

*Source: Comprehensive Study of Water and Related Land Resources, Puget Sound and Adjacent Waters, March 1970.

TABLE 9

PRIVATELY ADMINISTERED RECREATION FACILITIES

PRIMARY MARKET AREA

Activity	No. Facilities	Activity	No. Facilities
Scenic Sites	1	Golf Course, 18-hole	3
Nature Observation Sites	1	Putt Golfing Course	1
Hiking Trails	1	Fishing Ponds	3
Tent Camping Sites	2	Lake, River Fishing Facilities	1
Trailer Camping Sites	1	Saltwater Fishing Facilities	10
Picnicking Sites	4	Horseback Riding Stables	5
Archery Ranges	1	Swimming Beaches	4
Target Shooting Ranges	3	Boating Water	5
Go-Cart Racing Tracks	2	Snow Skiing Areas	1
Children's Play Grounds	1	Motorcycling Tracks	1
Golf Course, 9-hole	6	Drag Racing Tracks	2

SECONDARY MARKET AREA

Activity	No. Facilities	Activity	No. Facilities
Rural Living	1	Golfing, 18-hole	5
Scenic Enjoyment	5	Putt Golfing	2
Nature Observation	11	Pond Fishing	3
Hiking	10	Lake, Rive fishing	4
Tent Camping	9	Hunting Waterfowl	1
Picnicking	21	Horseback Riding	12
Field Games	8	Pony riding	1
Archery	1	Swimming	22
Target Shooting	5	Boating	1
Children's Play	4	Water Skiing	1
Golfing, 9-hole	7	Ice Skating	1

*Source: Comprehensive Study of Water and Related Land Resources, Puget Sound and Adjacent Waters, March 1970.

ANTICIPATED ATTENDANCE.

ER 1120-2-403, "Estimating Initial Reservoir Recreation Use" is not considered appropriate for predicting future attendance for the following reasons: (1) the project has been completed for over 20 years; (2) public use facilities, as well as attendance records, already exist; and (3) because the project operates without a pool or reservoir, ER 1120-2-403 provides no comparable project for user rate projections.

Without dependable user rates, projections are based on project records, modified by data included in the state of Washington's "Statewide Comprehensive Outdoor Recreation and Open Space Plan" (SCORP) prepared by the Interagency Committee for Outdoor Recreation in 1973 and the earlier (1970) "Puget Sound and Adjacent Waters" study compiled by the Puget Sound Task Force of the Pacific Northwest River Basins Committee.

Two projections were calculated: (1) unrestricted growth, comparable to projections for the region as a whole; and (2) visitation based on minimum additional facility development due to lack of necessary cost-sharing agreements at this time.

The estimates were developed in the following manner:

Existing and suggested future activities at the project were identified; participation projections for those act ivies were compiled, using appendix 4 (pages 23-28) of SCORP for the market area; and project facilities (by activity) were compared with the regional supply, using the Puget Sound and Adjacent Waters Study (appendix X) as a data base. The project's proportion of facilities was calculated; comparing this percentage against participation projections, anticipated attendance was derived. As a test of this methodology, past picnic visitation using the above procedure was computed. SCORP noted 2.2 million picnic occasions for 1970 in the area; project records attribute 18,000 picnic occasions, or the equivalent of 1 percent of the total activity; project facilities also represented 1 percent of the regional supply. In 1974, there were an estimated 2.4 million picnic occasions in the area, with the project accounting for approximately 2 percent, or 46,000 picnic occasions.

Attendance at Mud Mountain experienced erratic but positive growth between 1955 and 1970. At that time major improvements and expansion of project visitor facilities changed the attendance pattern to one of steady growth. For this reason figure 9*(3.1)*, Project attendance, has a demand curve using 1970 as a base point. Under restricted development conditions (no cost-sharing agreement) attendance is anticipated to reach 135,000 by 1990, and stabilize at that level; with cost sharing, and associated development, a maximum practical use level of 153,000 could be reached around 1995.

Because of site constraints, and to insure a quality recreation experience, a "maximum practical use" method was used to aid in future attendance projections. A system combining a modified Bureau of Outdoor Recreation density classification and Washington State Interagency Committee for Outdoor Recreation Standards was used to determine this use level (Table 10). ~~indicates recommended ll~; P level.~.~~

Class II areas, according to BOR Standards, are categories of medium to low intensity development. The natural setting plays an important role in the recreation experience. The subcategories "A" and "B" indicate relative density of recreationists-"A", a picnic area (high), and "B", a camp area (low).

TABLE 10
MAXIMUM PRACTICAL USE

Area	BOR Class[1/]	Avail. Acres	Percent Developed	Annual Attendance per Developed Acre	Ultimate Annual Attendance
Damsite/Day Use	IIA	14	80	12,000	135,000
Overnight Camping	IIB	60	25	1,200	18,000
Total Annual Attendance					**153,000**

DESIGN LOAD.

General. Recreation facility requirements for Corps recreation sites are calculated based on projected demand. For the purposes of this plan, assuming eventual cost-sharing co-sponsors, facility requirements are based on 153,000 annual visitor attendance.

The kinds and amounts of facilities to be provided are determined on estimated attendance and anticipated use of several recreation facilities. The calculations for design load on an average weekend day in the peak month of August include:

DL - Design Load
AA - Annual Attendance
M - Percent of annual attendance expected during peak month of August (33 percent)
N - Number of weekend days
W - Percent of peak month attendance expected on weekend days (55 percent)

$$DL = \frac{AA \times M \times W}{N}$$

The design load of 153,000 annual recreation visitors is 3,100 persons on a weekend day

in August;

AA = 153,000
M = 33 percent
W = 55 percent
N = 9

$$DL = \frac{153{,}000 \times .33 \times .55}{9} = 3{,}100$$

for 135,000 the design load is 2,700.

AA = 135,000
M = 33 percent
W = 55 percent
N = 9

$$DL = \frac{135{,}000 \times .33 \times .55}{9} = 2{,}700$$

FACILITY REQUIREMENTS.

General. The activity participation is based on an analysis of the type of facilities provided by the Corps. The estimated percentage distribution is based on experience in Corps and other recreation areas in the state of Washington (Table 11).

The number of persons in a family or in a group using recreation facilities is based on standards developed by the state of Washington Interagency Committee for Outdoor Recreation.

The turnover, or number of times per day that a recreation facility may be used by persons or groups, is also based on Interagency Committee standards.

The number of visitors on a weekend day in the peak month of August (design load) is translated into numbers of facilities required based on distribution of activities, average number using a facility at one time, average number of times a facility is used in a day, and standard number of facilities required per group.

TABLE 11
ESTIMATED ACTIVITY PARTICIPATION

Activity	Percent
Camping	10
Picnicking	20*

Sightseeing	73*
Hiking	10
Nature Study	8
Fishing/Hunting	0
TOTAL	**122**

Totals are more than 100 percent (and rounded) because an individual may be engaged in more than one activity per day.
*Based on project records.

Facility Requirements. The projected annual visitation of 153,000, assuming a design load of 3,100 visitors on a weekend day in August, indicate a demand for 77 campsites as follows:

F = Number of facilities
DL = Design load
P = Percent of visitors engaged in recreation activity
N = Average number in group
T = Turnover (average number of times facility is used in a day)
FS = Standard number of facilities required per group

$$F = \frac{DL \times P \times FS}{N \times T}$$

$DL_{153,000} = 3,100$ $DL_{135,000}=2,700$
P = 10 percent
N = 4
T = 1
FS = 1

$$F = \frac{3,100 \times .10 \times 1}{4 \times 1} = 77$$

$$F = \frac{2,700 \times .10 \times 1}{4 \times 1} = 68$$

Picnic facility requirements, calculated under the same formula, indicate a need for 52 picnic units under a maximum practical use level of development and 45 picnic units for the anticipated attendance of 135,000.

$DL_{153,000} = 3,100$ $DL_{135,000}=2,700$
P = 20 percent
N = 4
T = 3
FS = 1

$$F = \frac{3,100 \times .20 \times 1}{4 \times 3} = 52$$

$$F = \frac{2{,}700 \times .20 \times 1}{4 \times 3} = 45$$

Appendix B

Environmental Appendix

Section 1 - Day Use Area Vegetation

Section 2 - Cavity Utilizing Species

Section 3 - Wildlife Species Listing

Section 4 - Public and Agency Coordination

Appendix B

Environmental Appendix

SECTION 1

DAY USE AREA VEGETATION

DAY USE AREA VEGETATION

COMMON NAME	SCIENTIFIC NAME
Evergreen Trees	
American arborvitae	*Thuja occidentalis*
Austrian pine	*Pinus nigra*
Douglas fir	*Pseudotsuga menziesii**
scotch pine	*Pinus sylvestris*
Sitka spruce	*Picea sitchensis**
western red cedar	*Thuja plicata**
western hemlock	*Tsuga heterophylla**
Shrubs	
David viburnum	*Viburnum davidii*
devil's club	*Oplopanax horridum**
dwarf-winged euonymus	*Euonymus alatus*
evergreen azalea	*Rhododendron (Kurume)* spp. (Kurume group)
Indian plum	Osmaronia cerasiformis*
mountain balm	Ceanothus velutinus*
Oregon boxwood	Pachystima myrsinites*
Oregon grape	Mahonia aquifolium*
ocean spray	Holodiscus discolor*
red elderberry	Sambucus callicarpa*
red huckleberry	Vaccinium parvifolium*
red-osier dogwood	Cornus stolonifera*
salmonberry	Rubus spectablis*
snowberry	Symphoricarpos albus*
thimbleberry	Rubus parviflorus*

***Native species**

COMMON NAME	SCIENTIFIC NAME
Deciduous Trees	
big-leaf maple	Acer macrophyllum*
black cottonwood	Populus trichocarpa*
black locust	Robinia pseudoacacia
Norway maple	Acer platanoides
Pacific dogwood	Cornus nuttallii*
red alder	Alnus rubra*
scarlet oak	Quercus coccinea
thornless honeylocust	Gleditsia triacanthos
vine maple	Acer circinatum*
Ground Covers	
coltsfoot	Petasites speciosa*
Japanese spurge	Pachysandra terminalis
kinnikinnick	Arctostaphylos uvaursi*
lady fern	Athyrium filix-femina*
licorice fern	Polypodium spp*
salal	Gaultheria shallon*
St. John's-wort	Hypericum calycinum
sword fern	Polystichum munitum*
trailing yellow violets	Viola sempervirens*

Appendix B

Environmental Appendix

SECTION 2

CAVITY UTILIZING SPECIES

CAVITY-UTILIZING SPECIES

ANIMALS

COMMON NAME	SCIENTIFIC NAME
Uses Snags for Feeding Sites	
chickaree	
deer mouse	*Peromyscus maniculatus*
northern flying squirrel	*Glaucomys sabrinus*
raccoon	*Procyon lotor*
marten	*Martes sp.*

BIRDS

COMMON NAME	SCIENTIFIC NAME
Use Snags for Feeding Sites	
bald eagle	*Haliaeetus leucocephalus*
American kestrel	*Falco sparverius*
Cooper's hawk	*Accipiter cooperi*
red-tailed hawk	*Buteo jamaicensis*
sharp-shinned hawk	*Accipiter striatus*
osprey	*Pandion haliaetus*
goshawk	*Accipiter gentilis*
belted kingfisher	*Ceryle alcyon*
western kingbird	*Tyrannus verticalis*
black-capped chickadee	*Poecile atricapillus*
brown creeper	*Certhia americana*
flicker	
Hammond's flycatcher	*Empidonax hammondi*
house wren	*Troglodytes aedon*
nuthatch	
downy woodpecker	*Picoides pubescens*
hairy woodpecker	*Picoides villosus*
Lewis' woodpecker	*Melanerpes lewis*
pileated woodpecker	*Dryocopus pileatus*
great horned owl	*Bubo virginianus*
pygmy owl	
screech owl	

Cavity Excavators

red-breasted nuthatch	*Sitta canadensis*
common flicker	
yellow-bellied sapsucker	
downy woodpecker	*Picoides pubescens*
hairy woodpecker	*Picoides villosus*
Lewis' woodpecker	*Melanerpes lewis*
pileated woodpecker	*Dryocopus pileatus*

Cavity Nesters

big brown bat	
brown creeper (nests behind bark)	*Certhia americana*
California myotis	
long-eared myotis	
Bewicks' wren	*Thryomanes bewicki*
house finch	*Carpodacus mexicanus*
house sparrow	*Passer domesticus*
house wren	*Troglodytes aedon*
starling	

Exclusively Cavity Nesters

bufflehead	*Bucephala albeola*
harlequin duck	*Histrionicus histrionicus*
wood duck	*Aix sponsa*
black-capped chickadee	*Poecile atricapillus*
chestnut-backed chickadee	*Parus rufescens*
Barrow's goldeneye	*Bucephala islandica*
common goldeneye	
common merganser	*Mergus merganser*
hooded merganser	*Lophodytes cucullatus*
sparrow hawk	
pygmy owl	
saw-whet owl	
screech owl	
spotted owl	*Strix occidentalis*
purple martin	*Progne subis*
tree swallow	*Tachycineta bicolor*
Vaux's swift	*Chaetura vauxi*

Appendix B

Environmental Appendix

SECTION 3

WILDLIFE SPECIES LISTING

COMMON NAME	SCIENTIFIC NAME	COMMON NAME	SCIENTIFIC NAME
AMPHIBIANS			
AMBYSTOMIDAE		**HYLINIDAE**	
long-toed salamander*	*Ambystoma macrodactylum*	Pacific treefrog*	*Hyla regilla*
northwestern salamander*	*Ambystoma gracile*		
Oregon salamander*	*Ensatina eschscholtzii*	**RANIDAE**	
		bullfrog*	*Rana catesbeiana*
BUFONIDAE		red-legged frog*	*Rana aurora*
western toad*	*Bufo boreas*		
		SALMANDRIDAE	
		rough-skinned newt*	*Taricha granulosa*
REPTILES			
ANGUIDAE		**COLUBRIDAE**	
northern alligator lizard*	*Gerrhonotus coeruleus*	common garter snake*	*Thamnophis sirtalis*
		northwestern garter snake*	*Thamnophis ordinoides*
		western garter snake*	*Thamnophis elegans*
MAMMALS			
APLODONTIDAE (RODENTIA)		**FELIDAE**	
mountain beaver*	*Aplodontia rufa*	bobcat*	*Lynx rufus*
		mountain lion*	*Felis concolor*
CANEDAE			
common red fox	*Vulpes vulpesfulva*	**LEPORIDAE (LAGOMORPHA)**	
coyote*	*Canis latrans*	eastern cottontail*	*Sylvilagus floridanus*
		snowshoe hare*	*Lepus americanus*
CASTORIDAE			
beaver*	*Castor canadensis*	**MUSTELTDAE**	
		longtail weasel*	*Mustela frenata*
CERVIDAE		mink*	*Mustela vison*
Rocky Mountain elk*	*Cervus canadensis nelsoni*	pine marten*	*Martes americans*
Columbia blacktail deer*	*Odocoileus hemionus columbianus*	river otter* Shorttail weasel*	*Lutra canadensis* *Mustela ermines*
		spotted skunk*	*Spilogale putorius*
CRICETIDAE		striped skunk*	*Mephitis mephitis*
boreal red-backed vole	*Clethrionomys gapperi*		
bushytail woodrat*	*Neotoma cinerea*	**PROCYONIDAE**	
deer mouse*	*Peromyscus maniculatusr*	raccoon*	*Procyon lotor*
heather vole	*Phenacomys intermediusr*		
longtail vole	*Microtus longicaudus*	**SCIURIDAE**	
muskrat*	*Ondatra zibethica*	Douglas squirrel	*Tamiasciurus douglasi*
Oregon vole	*Microtus oregoni*	eastern gray squirrel*	*Sciurus carolinensis*
Townsend's vole	*Microtus townsendi*	northern flying squirrel*	*Glaucomys sabrinus*
DIDELPHIDAE		Townsend's chipmunk*	*Eutamias townsendi*
Virginia opossum*	*Didelphis virginiana*		
		SORICIDAE	
ERETHIZONTIDAE		dusky shrew	*Sorex obscurus*
porcupine*	*Erethizon dorsatum*	marsh shrew	*Sorex bendirei*
		masked shrew*	*Sorex cinereus*
		northern water shrew	*Sorex palustris*

COMMON NAME	SCIENTIFIC NAME	COMMON NAME	SCIENTIFIC NAME
SORICIDAE, con't.		**VESPERTILIONIDAE (CHIROPTERA)**	
Trowbridge's shrew*	*Sorex trowbridgei*	big brown bat	*Eptesicus fuscus*
vagrant shrew*	*Sorex vagrans*	California myotis	*Myotis californicus*
		fringed myotis	*Myotis thysanodes*
TALPTDAE		hoary bat	*Lasiurus cinereus*
coast mole*	*Scapanus orarius*	keen myotis	*Myotis keeni*
shrew-mole*	*Neurotrichus gibbsi*	little brown bat	*Myotis lucifugus*
Townsend's mole*	*Scapanus townsendi*	long-legged myotis	*Myotis volans*
		long-eared myotis	*Myotis evotis*
URSIDAE		silver-haired bat	*Lasionycteris noctivagans*
black bear*	*Ursus americanus*	Townsend's big-eared bat	*Plecotus townsendi*
		Yuma myotis	*Myotis yumanensis*
		ZAPODEDAE	
		Pacific jumping mouse*	*Zapus trinotatus*
BIRDS			
ACCIPITRIDAE		**ANATIDAE, con't.**	
bald eagle*	*Haliaeetus leucocephalus*	northern shoveler	*Anas clypeata*
Cooper's hawk*	*Accipiter cooperii*	pintail	*Anas acuta*
golden eagle*	*Aquila chrysaetos*	red-breasted merganser	*Mergus serrator*
goshawk*	*Accipiter gentiles*	redhead	*Aythya americans*
marsh hawk	*Circus cyaneus*	ring-necked duck	*Aythya collaris*
red-tailed hawk*	*Buteo jamaicensis*	ruddy duck	*Oxyura jamaicensis*
sharp-shinned hawk*	*Accipiter striatus*	trumpeter swan	*Olor buccinator*
		whistling swan	*Olor columbianus*
ALAUDIDAE		white-winged scoter	*Melanitta deglandi*
horned lark	*Eremophila alpestris*	wood duck*	*Aix sponsa*
ALCEDINIDAE		**APODIDAE**	
belted kingfisher*	*Megaceryle alcyon*	black swift	*Cypseloides niger*
		Vaux's swift*	*Chaetura vauxi*
ANATIDAE			
American wigeon	*Anas americans*	**ARDEIDAE**	
Barrow's goldeneye	*Bucephala islandica*	American bittern	*Botaurus lentiginosus*
blue-winged teal	*Anas discors*	great blue heron*	*Ardea herodias*
bufflehead	*Bucephala albeola*	green heron	*Butorides virescens anthonyi*
Canada goose	*Branta canadensis*		
canvasback	*Aythya valisineria*		
common goldeneye	*Bucephala clangula*	**BOMBYCILLIDAE**	
common merganser	*Mergus merganser*	Bohemian waxwing	*Bombycilla garrulus*
gadwall	*Anas strepera*	cedar waxwing*	*Bombycilla cedrorum*
greater scaup	*Aythya marila*		
green-winged teal	*Anas crecca*	**CAPRIMULGIDAE**	
harlequin duck	*Histrionicus histrionicus*	Common nighthawk*	*Chordeiles minor*
hooded merganser	*Lophodytes cucatus*		
lesser scaup	*Aythya affinis*		
mallard*	*Anas platyrhynchos*		

COMMON NAME	SCIENTIFIC NAME	COMMON NAME	SCIENTIFIC NAME
CATHARTIDAE		**GAVIIDAE**	
turkey vulture*	*Cathartes aura*	common loon	*Gavia immer*
CERTHIIDAE		**GRUIDAE**	
brown creeper*	*Certhia americans*	sandhill crane	*Grus canadensis*
CHARADRIIDAE		**HIRUNDINIDAE**	
black-bellied plover	*Pluvialis squatarola*	bank swallow*	*Riparia riparia*
killdeer*	*Charadrius vociferus*	barn swallow*	*Hirundo rustica*
CINCLIDAE		cliff swallow	*Petrochelidon pyrrhonota*
dipper*	*Cinclus mexicanus*	purple martin*	*Progne subis subis*
		rough-winged swallow*	*Stelgidopteryx ruficollis*
COLUMBIDAE		tree swallow*	*Iridoprocne bicolor*
band-tailed pigeon	*Columba fasciata*	violet-green swallow*	*Tachycineta thalassina*
mourning dove	*Zenaida macroura*		
rock dove	*Columba livia*	**ICTERIDAE**	
CORVIDAE		Brewer's blackbird	*Euphagus cyanocephalus*
common raven*	*Corvus corax*	brown-headed cowbird	*Molothrus ater*
common crow*	*Corvus brachyrhynchos*	northern oriole	*Icterus galbula bullockii*
gray jay*	*Perisoreus canadensis*		
Steller's jay*	*Cyanocitta stelleri*	red-winged blackbird*	*Agelaius phoeniceus*
		western meadowlark	*Sturnella neglecta*
FALCONIDAE		yellow-headed blackbird	*Xanthocephalus xanthocephalus*
American kestrel	*Falco sparverius*		
merlin	*Falco columbarius*		
peregrine falcon	*Falco peregrinus*	**LANIIDAE**	
		northern shrike	*Lanius excubitor*
FRINGILLIDAE			
black-headed grosbeak*	*Pheucticus melanocephalus*	**LARIDAE**	
American goldfinch*	*Carduelis tristis*	black tern	*Chlidonias niger*
chipping sparrow	*Spizella passerina*	Bonaparte's gull	*Larus philadelphia*
common redpoll	*Acanthis flammea*	California gull	*Larus californicus*
dark-eyed junco*	*Junco hyemalis*	common tern	*Sterna hirundo*
evening grosbeak*	*Hesperiphona vespertina*	glaucous-winged gull	*Laris glaucescens*
fox sparrow*	*Passerella iliaca*	herring gull	*Larus argentatus*
golden-crowned sparrow	*Zonotrichia atricapilla*	mew gull	*Larus canus*
house finch	*Carpodacus mexicanus*	ring-billed gull	*Larus delawarensis*
lazuli bunting	*Passerina amoena*		
Lincoln's sparrow	*Melospiza lincolnii*	**PANDIONIDAE**	
pine siskin*	*Carduelis pinus*	osprey*	*Pandion haliaetus*
purple finch	*Carpodacus purpureus*		
red crossbill*	*Loxia curvirostra*	**PARIDAE**	
rufous-sided towhee*	*Pipilo erythrophthalmus*	black-capped chickadee*	*Parus atricapillus*
savannah sparrow*	*Passerculus sandwichensis*		
song sparrow*	*Melospiza melodia*	bushtit	*Psaltriparus minimum*
vesper sparrow	*Pooecetes gramineus*	Chestnut-backed chickadee*	*Parus rufescens*
white-crowned sparrow	*Zonotrichia leucophrys*		
white-throated sparrow	*Zonotrichia albicollis*		
white-winged crossbill	*Loxia leucoptera*		

COMMON NAME	SCIENTIFIC NAME	COMMON NAME	SCIENTIFIC NAME
PARULIDAE		**SCOLOPACIDAE, con't.**	
black-throated gray warbler*	*Dendroica nigrescens*	least sandpiper	*Tringa melanoleuca* *Calidris minutilla*
common yellowthroat*	*Geothlypis trichas*	lesser yellowlegs*	*Tringa flavipes*
hermit warbler MacGillivray's warbler*	*Dendroica occidentalis* *Oporornis tolmiei*	long-billed dowitcher	*Limnodromus scolopaceus*
Nashville warbler	*Vermivora ruficapilla*	solitary sandpiper	*Tringa solitaria*
orange-crowned warbler*	*Vermivora celata*	spotted sandpiper*	*Actitis macularia*
Townsend's warbler*	*Dendroica townsendi*	western sandpiper	*Calidris mauri*
Wilson's warbler* yellow warbler*	*Wilsonia pusilla* *Dendroica petechia*	white-rumped sandpiper	*Calidris fuscicollis*
yellow-rumped warbler*	*Dendroica coronata*		
		SITTIDAE	
PHALAROPODIDAE		red-breasted nuthatch*	*Sitta canadensis*
Wilson's phalarope	*Phalaropus tricolor*		
red-necked phalarope	*Phalaropus lobatus*	**STRIGIDAE**	
		great gray owl	*Strix nebulosa*
PHASIANIDAE		great-horned owl*	*Bubo virginianus*
bobwhite	*Colinus virginianus virginianus*	long-eared owl pygmy owl*	*Asio otus* *Glaucidium gnoma*
California quail*	*Callipepla californica*	saw-whet owl*	*Aegolius acadicus*
mountain quail	*Oreotyx pictus*	short-eared owl	*Asio flammeus*
ring-necked pheasant	*Phasianus colchicus*	snowy owl	*Nyctea scandiaca*
PICIDAE		spotted owl	*Strix occidentalis caurina*
common flicker*	*Colaptes auratus*	western screech owl*	*Otus kennicottii*
downy woodpecker*	*Dendrocopos pubescens*		
hairy woodpecker*	*Dendrocopos villosus*	**STURNIDAE**	
Lewis' woodpecker	*Asyndesmus lewis*	starling*	*Sturnus vulgaris*
pileated woodpecker*	*Dryocopus pileatus*		
red-breasted sapsucker*	*Sphyrapicus ruber*	**SYLVIIDAE**	
PLOCEIDAE		golden-crowned kinglet*	*Regulus satrapa*
house sparrow	*Passer domesticus*	ruby-crowned kinglet*	*Regulus calendula*
PODICIPEDIDAE		**TETRAONIDAE**	
eared grebe	*Podiceps nigricollis*	blue grouse*	*Dendragapus obscurus*
horned grebe	*Podiceps auritus*	ruffed grouse*	*Bonasa umbellus*
pied-billed grebe	*Podilymbus podiceps*		
western grebe	*Aechmophorus occidentalis*	**THAUPIDAE**	
		western tanager*	*Piranga ludoviciana*
RALLIDAE			
American coot*	*Fulica americans*	**TROCHILIDAE**	
sora	*Porzana carolina*	Anna's hummingbird	*Calypte anna*
Virginia rail	*Rallus limicola*	rufous hummingbird*	*Selasphorus rufus*
Yellow rail	*Coturnicops noveboracensis*		
		TROGLODYTIDAE	
SCOLOPACIDAE		Bewick's wren	*Thryomanes bewickii*
Common snipe	*Capella gallinago delicate*	House wren	*Troglodytes aedon*
Dunlin*	*Calidris alpina*	Marsh wren*	*Cistothorus palustris*

COMMON NAME	SCIENTIFIC NAME	COMMON NAME	SCIENTIFIC NAME
TROGLODYTIDAE, con't.		**TYTONIDAE**	
winter wren*	*Troglodytes troglodytes*	barn owl	*Tyto alba*
TURDIDAE		**VIREONIDAE**	
American robin*	*Turdus migratorius*	Hutton's vireo*	*Vireo huttoni*
hermit thrush	*Catharus guttatus*	red-eyed vireo	*Vireo olivaceus*
Swainson's thrush*	*Catharus ustulatus*	solitary vireo*	*Vireo solitarius*
Townsend's solitaire*	*Myadestes townsendi*	warbling vireo*	*Vireo gilvus*
varied thrush*	*Ixoreus niveus*		
western bluebird*	*Sialia mexicana*		
TYRANNIDAE			
eastern kingbird	*Tyrannus tyrannus*		
Hammond's flycatcher	*Empidonax hammondii*		
olive-sided flycatcher*	*Nuttallornis borealis*		
Pacific slope flycatcher*	*Empidonax difficilis*		
western kingbird*	*Tyrannus verticalis*		
western wood pewee*	*Contopus sordidulus*		
willow flycatcher*	*Empidonax traillii*		

*Species observed at Mud Mountain Dam and inhabiting western Washington in habitats found on project lands.

Appendix B

Environmental Appendix

SECTION 4

PUBLIC AND AGENCY COORDINATION, DISTRIBUTION AND COMMENTS

Public Meeting 3/17/94 Mud Mountain Dam Master Plan

	Attendance
Enumclaw Trail Riders	6
Washington Recreational River Runners	4
Meridian Riding Club	3
BCH	15
BSA	1
Others	4
Enumclaw	18
Hobart	1
North Bend	1
Tacoma	2
Buckley	1
Auburn	1
Sumner	2
Tukwila	1
Seattle	1
Meridian	2
Maple Valley	

MUD MOUNTAIN DAM MASTER PLAN DISTRIBUTION LIST

U. S. Fish and Wildlife Service
3704 Griffin SE
Olympia, WA 98501

Boy Scouts of America
Chief Seattle Council Troop 398
Mr. Douglas Hans
16037 45th Ave. So.
Tukwila, WA 98188

Washington Kayak Club Inc
P.O. Box 24264
Seattle, WA 98124-0264

Sierra Club - Cascade Chapter
8511 15th NE
Seattle, WA 98115

Audubon Society - Tahoma Chapter
2601 70th Ave. W, Suite E
University Place, WA 98466-5430

Ms. Patricia Sumption
10510 11th Ave NE
Seattle, WA 98125

Mr. Bob Bartlett
17325 431st SE
North Bend, WA 98045

Enumclaw Trail Riders
P.O. Box 411
Enumclaw, WA 98022

Washington Recreational River Runners
P.O. Box 25048
Seattle, WA 98125

Back Country Horsemen
P.O. Box 411
Enumclaw, WA 98022

Meridian Riding Club
11202 119th St
Puyallup, WA 98374

National Park Service
Outdoor Recreation Information Center
915 2nd Ave, Suite 442
Seattle, WA 98174

National Park Service
Mount Rainier National Park
Ashford, WA 98304

Environmental Protection Agency
Region 10
1200 6th Ave
Seattle, WA 98101

Parks and Recreation Commission
Attn: Resources
7150 Clean Water Lane
Olympia, WA 98504

Interagency Committee for Outdoor Recreation
1111 Wash SE
Olympia, WA 98501

Washington Department of Fish and Wildlife
16018 Mill Creek Boulevard
Mill Creek, WA 98012

Washington Department of Ecology
3190 160th Ave SE
Bellevue, WA 98008-5452

Washington Department of Community Development
Attn: Office of Archaeology and Historic Preservation
111 W. 21st
Olympia, WA 98501

Washington Department of Natural Resources
South Sound Regional Office
P.O. Box 68
Enumclaw, WA 98022-0068

King County Department of Natural Resources
Attn: Parks Division
2040 84th Ave SE
Mercer Island, WA 98040

King County Department of Development and
Environmental Services
Attn: Land Use Services Division
3600 136th PI SE
Bellevue, WA 98006-1400

Pierce County Department of Parks and Recreation
9112 Lakewood Dr. SW
Tacoma, WA 98499

Pierce County Department of Planning and Land Services
Attn: Advance Planning
24011 S. 35th
Tacoma, WA 98409

Pierce County Department of Planning and Land Services
Attn: Historic Preservation
24011 S. 35th
Tacoma, WA 98409

City of Buckley
Attn: Planning Department
811 Main
Buckley, WA 98321

City of Enumclaw
Attn: Planning Department
1309 Myrtle
Enumclaw, WA 98022

City of Enumclaw
Attn: Department of Parks and Recreation
1339 Griffin
Enumclaw, WA 98022

Puyallup Indian Tribe
Mr. Bill Sullivan
2002 E. 28th St.
Tacoma, WA. 98404

Public Library
809 Ninth SE
Auburn, WA 98002

Public Library
1111 - 110th Ave NE
Bellevue, WA 98004

Public Library
24301 Roberts Dr
Black Diamond, WA 98010

Public Library
14700 - Sixth SW
Burien, WA 98166

Public Library
21620 - 11th S
Des Moines, WA 98198

Public Library
1700 - 1st
Enumclaw, WA 98022

Public Library
34200 - lst Wy S
Federal Way, WA 98003

Public Library
120 E Sunset Way
Issaquah, WA 98027

Public Library
2120 Second Ave N
Kent, WA 98032

Public Library
255 Ellingson Rd
Pacific, WA 98047

Public Library
15810 NE 85th
Redmond, WA 98052

Public Library
100 Mill S
Renton, WA 98055

Public Library
1000 Fourth Ave
Seattle, WA 98104-1193

Public Library
14475 - 59th S
Tukwila, WA 98168

Public Library
18501 - 90th E
Bonney Lake, WA 98390

Public Library
123 S River
Buckley, WA 98321

Public Library
Multi Purpose Center
Orting, WA 98360

Public Library
324 S Meridian
Puyallup, WA 98371

Public Library
1102 Tacoma Ave S
Tacoma, WA 98402

Public Library
540 Church
Wilkeson, WA 98306

STATE OF WASHINGTON
INTERAGENCY COMMITTEE FOR OUTDOOR RECREATION
P.O. Box 40917 • Olympia, Washington 98504-0917 • (360) 902-3000 • FAX (360) 902-3026

March 20, 1997

US Army Corps of Engineers
Seattle District
Attention: Larry Scudder
Mail Stop EN-TL-CP
PO Box 3755
Seattle, WA 98124-3755

Subject: Design Memorandum 1D, Mud Mountain Dam Master Plan

The Interagency Committee for Outdoor Recreation (IAC) is a State of Washington agency responsible for statewide outdoor recreation assessment and policy development. As part of this work, we develop and update Statewide Comprehensive Outdoor Recreation Planning (SCORP) processes and its various documents. In addition, IAC manages certain competitive grant programs to help fund outdoor recreation facility development.

The Design memorandum references the 1973 Washington State SCORP document. IAC has, of course, issued updated versions of SCORP since then. We have enclosed *Washington Outdoors (Assessment and Policy Plan 1990-1995)* and *Assessment and Policy Plan 1995-2001* for your review.

We agree that demand for outdoor recreation is growing at a rate greater than that predicted in 1973. Our more recent research indicates that the fastest-growing recreation activities are those that take advantage of trail opportunities, such as walking, hiking, and bicycle riding. In 1990, we projected hiking and mountain bicycling to grow 37 percent by the year 2000, and horseback riding to grow 17 percent in the same period.

The public has told us that it seeks settings that are predominantly natural and feature a water body of some kind. The Mud Mountain site offers important opportunities addressing all of these needs: trails, a managed landscape that appears predominantly natural, and the river corridor.

The project's trail system is unusual and valuable in several respects. First, it is at relatively low elevations, making it accessible for a good part of the year. Second, it takes the user through predominantly natural settings, with particularly good views of the river. Third, it is relatively close to populated areas, less than an hour from Tacoma.

We support the Corps' intent to expand the trail system to the south side of the river (pages 9-1 and 9-2). IAC suggests the Corps consider a loop trail system that crosses the White River at the fish release site and across the dam. A similar loop system at Lake Wynoochee is proving to be increasingly popular, especially with mountain bicyclists. Public use can be reasonably compatible with dam management if appropriate directional signing and other management techniques are utilized.

The Corps might consider adopting trail construction standards developed by the USDA Forest Service if it has not already done so. The Rim Trail, for example, offers a delightful user experience but does not appear to have been constructed to a particular standard.

IAC is aware that the Corps policy is to seek partnership for recreation facility improvement. To that end, the Corps may wish to consider application to our agency's Nonhighway and Off-Road Vehicle Activities (NOVA) grant program. NOVA funds have been used to fund trail and trail-related projects on federal lands including National Forest and National Parks. An informational brochure is enclosed.

Dispersed camping may be a lower priority than a day-use trail system. Two nearby State Parks, Nolte and Kanaskat-Palmer, currently offer public camping, though with limited trail opportunity.

Concerning the day use area, IAC's projected picnicking to grow 40 percent between 1991 and 2000. With this in mind, expansion of the day use area is appropriate.

Thank you for the opportunity to comment. If you have any questions or need further information, please contact me at (360)-902-3011.

Sincerely,

Jim Eychaner
Assistant Manager, Planning Services

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
P.O. Box 47600 • Olympia, Washington 98504-7600
(360) 407-6000 • TDD Only (Hearing Impaired) (360) 407-6006

March 19, 1997

Mr. Donald T. Wynn, Colonel, District Engineer
Department of the Army
Seattle District, Corps of Engineers
P.O. Box 3755
Seattle WA 98124-2255

Re: Design Memorandum No. 1D, Mud Mountain Dam Master Plan

Dear Colonel Wynn:

Thank you for the opportunity to review the proposed Master Plan for the management of the habitat and recreation potential associated with Mud Mountain Dam. In short, we in Dam Safety have no comments on the proposed plan.

Good luck in pursuing the matter.

Sincerely,

Jerald M LaVassar

Jerald LaVassar, M.S., P.E.
Shorelands & Water Resources Program
Dam Safety

JL:jl

Rec'd 3/

STATE OF WASHINGTON
DEPARTMENT OF COMMUNITY, TRADE AND ECONOMIC DEVELOPMENT
OFFICE OF ARCHAEOLOGY AND HISTORIC PRESERVATION
111 21st Avenue S.W. • P.O. Box 48343 • Olympia, Washington 98504-8343 • (206) 753-4011 • SCAN 234-4011

March 18, 1997

Mr. J. Larry Scudder
Seattle District, Corps of Engineers
P.O. Box 3755
Seattle, Washington 98124-2255

In future correspondence refer to:
Log: 031097-21-COE-S
Re: Draft Mud Mountain Dam Master Plan

Dear Mr. Scudder:

Thank you for sending to the Washington State Office of Archaeology and Historic Preservation (OAHP) a copy of the draft of Design Memorandum of the Mud Mountain Dam Master Plan. From your letter, I understand the Master Plan will provide the Corps of Engineers, Seattle District with a framework for the orderly, coordinated development and management of natural and manmade resources within the project area.

In response, I concur with statements in the draft Plan regarding pre-historic and historic properties at Mud Mountain Dam. As the Plan notes, I would like to reiterate that in 1998, the facility should be re-evaluated for eligibility for listing in the National Register of Historic Places. This evaluation process should include a comprehensive survey and inventory of the project area including structures such as the Cable Way Tower. In the intervening period, I recommend that properties such as the tower be maintained to protect character defining features and materials.

Again, thank you for the opportunity to review the draft Plan. Should you have any questions, please feel free to contact me at (360) 753-9116.

Sincerely,

Greg Griffith

Gregory Griffith
Comprehensive Planning Specialist

GAG:tjt