

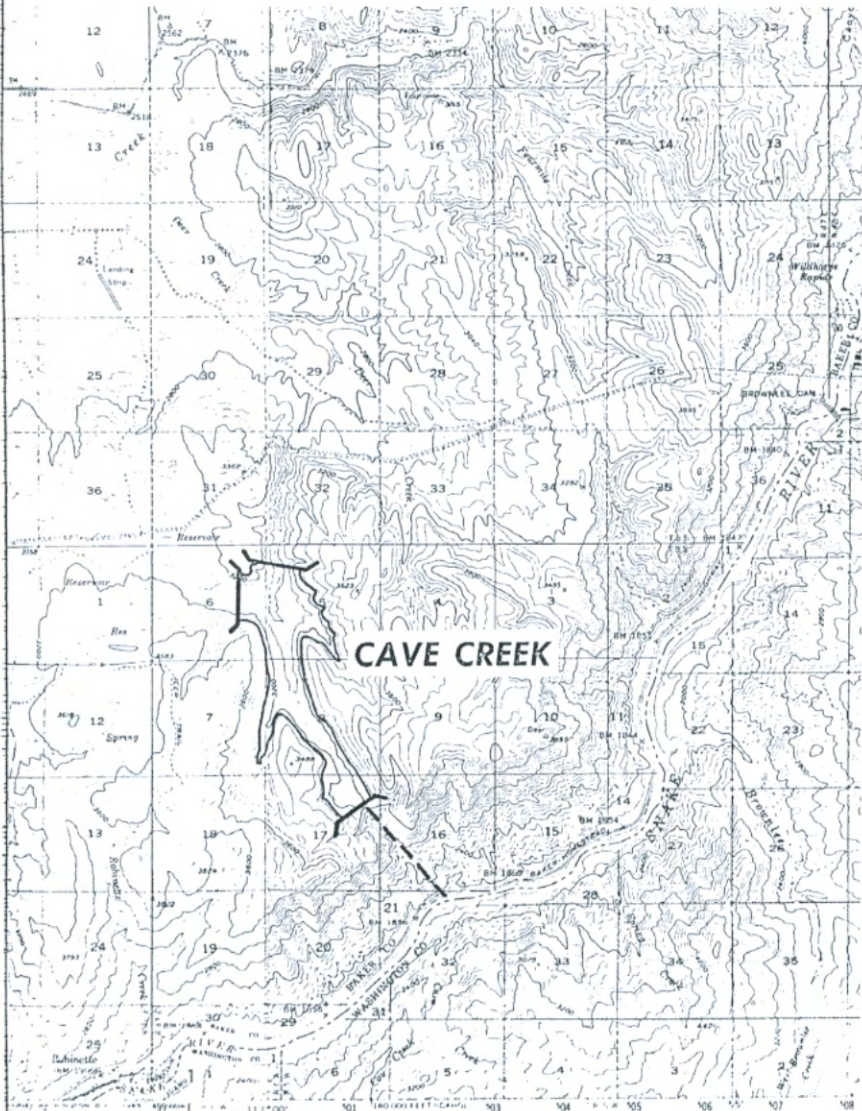
Social Factors.

- a. Displacement. There do not appear to be any residences in the area that would be impacted.
- b. Land Ownership. The region is controlled by the Bureau of Land Management.
- c. Public Attitudes. Local citizens may oppose the loss of the grazing land; however, the lack of development and the remoteness of the site would tend to reduce the likelihood of opposition to a pumped storage project in this area.
- d. Public Safety. Public access to the upper reservoir and the inlet/outlet area of Brownlee pool should be restricted.

Geology. Structure here is thick granite-derived interbeds separated by thin basalt flows. This is on the flank of a gentle anticline with the bedding dipping to the west. There are several thicker basalt flows near the tailrace area which have the appearance of forming the base of the interbedded sequence. Construction materials should be available nearby.

Environmental Considerations. The outlet is situated in a nongame bird and shorebird area. The Snake River region still contains enough riparian habitat to be of significant environmental concern. The upper reservoir would reduce the amount of rangeland in the area. This area is also big game winter range. The region is excellent chukar habitat. The upper reservoir through increased water availability may actually increase chukar populations in the region.

Location Data. The upper reservoir site is located 10 miles NE of Richland, Oregon, in Sec 5, 8 and 17 of T9S, R5W. Coordinates are N44-59.0, W116-42.0. Reference USGS quad is Copperfield, 1:62,500.



Mapped, edited, and published by the Geological Survey
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 Aerial photographs taken 1951 - February & 1957

A-9



SITE - JUNIPER CANYON #80

LOWER RESERVOIR - McNARY RESERVOIR (LAKE WALLULA) COLUMBIA RIVER

Physical Factors

a. 1,000 MW Plant Size

Head - 1,020 Ft.

Storage - 16,200 Ac. Ft. Discharge - 13,400 cfs

Drawdown Upper - 55 Ft. Lower - 1 Ft.

Size Upper - 390 Acres Lower - 38,800 Acres

Penstock Length - 6,300 Ft.

b. 3,000 MW Plant Size

Head - 1,020 Ft.

Storage - 45,900 Ac. Ft. Discharge - 38,100 cfs

Drawdown - 110 Ft. Lower - 2 Ft.

Size Upper - 670 Acres Lower - 38,800 Acres

Penstock Length - 6,300 Ft.

c. Hydrology. The effect of drawdown from the larger installations on operation of McNary project should be studied.

d. Proximity to Load Center. Site is located 195 airline miles from Portland load center.

e. Access. Access to tailrace area is by good roads and railroad. Upper reservoir area is accessible by gravel and dirt roads; however, some of these upper access roads are now blocked by adjacent landowners. Transmission line adjacent to upper reservoir (500 KV).

f. Land Use. The upper reservoir main land use is agricultural. There is much wheat grown in this area. Steep areas are in native rangeland used mostly for wildlife habitat. There is some recreation use in this area. The lower reservoir land use is wildlife habitat. There is a U.S. highway and a railroad that run through this area.

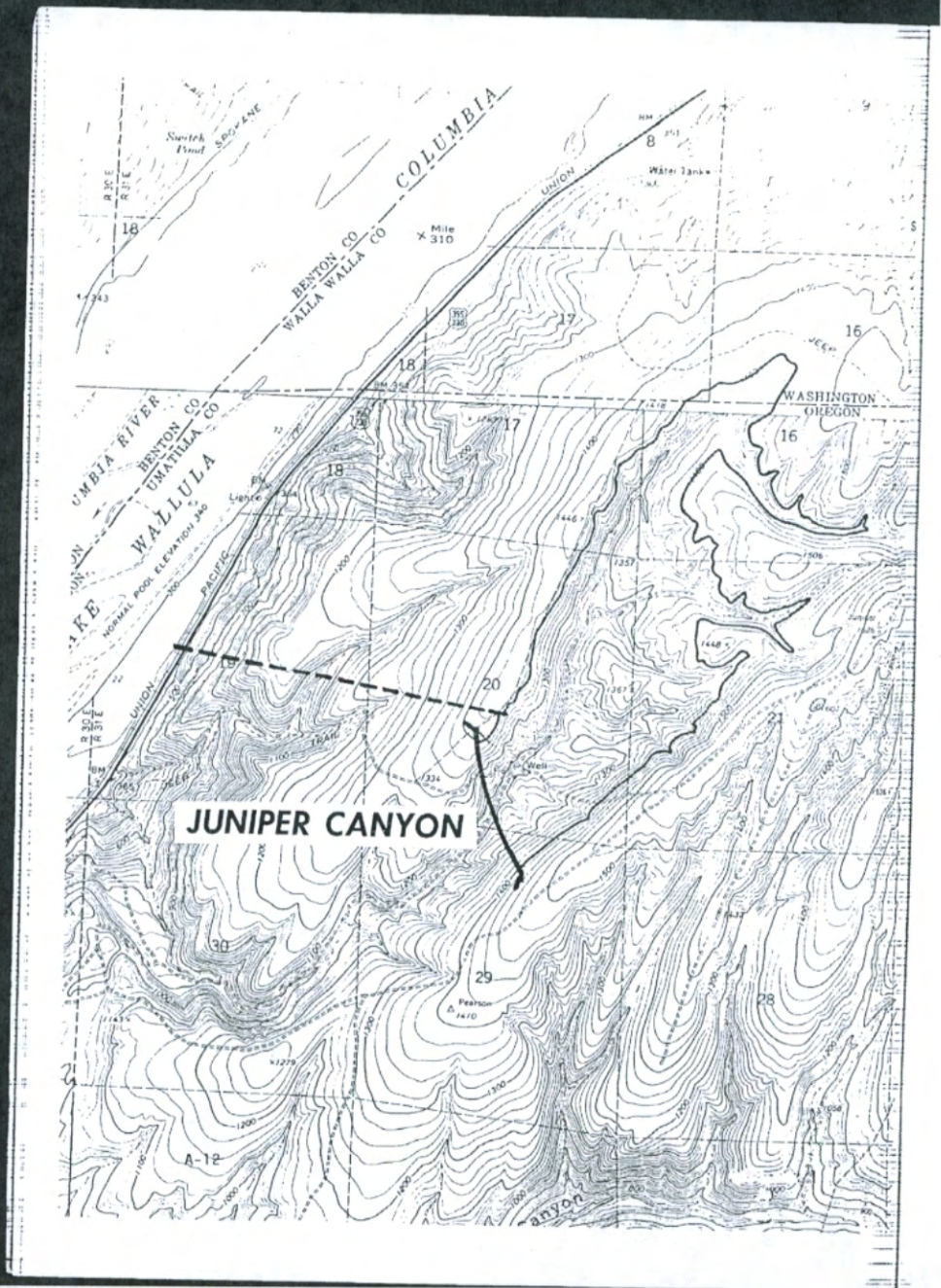
Social Factors

- a. Displacement. There is one structure in the upper reservoir. It appears to be an abandoned cabin. The U.S. highway would be disrupted during inlet/outlet construction.
- b. Land Ownership. The upper reservoir is in private ownership. The lower reservoir is controlled by the Corps of Engineers, but there may be leases involved with the highway and railroad.
- c. Public Attitudes. The regional citizens are opposed to additional losses of agricultural land for any purpose. Opposition to the upper reservoir would be expected. Wildlife agencies' concerns over the effects of pumped storage operations on anadromous fish runs could result in litigation.
- d. Public Safety. Public access to the upper reservoir and the inlet/outlet area of Lake Wallula should be restricted.

Geology. The geology is a series of basalt flows with some flow breccia units. The basalts range from some rather massive columnar units to closely fractured, hackly ones. These are overlain by windblown silts, and in some local outcrops in the near vicinity are found basaltic sands and gravels. The silts, however, obscure the upper limits and areal extent of the sands and gravels.

Environmental Considerations. The upper reservoir development would alter the area's agricultural productivity. The areas affected do not appear to contain unique animal or plant species, nor do they contain unique habitat regimes. The lower reservoir is, however, excellent chukar habitat. The major concern at this site involves the anadromous fish runs of the Columbia River. Many wildlife agencies believe that pump storage operations may adversely impact fish runs through water quality alterations and/or fish migration pattern disruptions. Pump storage development at this site could require massive environmental investigations and possible mitigation before pump storage operation would occur.

Location Data. The upper reservoir site is located in Oregon about 8 miles SW of Wallula, Washington in Sec. 16, 17, 20 and 21, T6N, R31E. Coordinates are N45-59.0, W118-58.0. Reference USGS quad is Juniper Canyon, Oregon-Washington, 1:24,000.



SITE - TUMBLE LAKE #34

LOWER RESERVOIR - DETROIT LAKE (NORTH FORK SANTIAM RIVER)

Physical Factorsa. 1,000 MW Plant Size

Head - 2,180 Ft.

Storage - 7,300 Ac. Ft.

Discharge - 6,300 c.f.s.

Drawdown Upper - 60 Ft.

Lower - 2 Ft.

Size Upper - 130 Acres

Lower - 3,430 Acres

Penstock length - 10,700 Ft.

b. 4,000 MW Plant Size

Head - 2,180 Ft.

Storage - 29,000 Ac. Ft.

Discharge - 23,700 c.f.s.

Drawdown - 195 Ft.

Lower - 15 Ft.

Size Upper - 190 Acres

Lower - 3,450 Acres

Penstock length - 10,700 Ft.

- c. Hydrology. The project would use the Corps' existing reservoir, Detroit Lake, as the lower reservoir. Studies are needed to determine the effect of pumped storage operation on the existing project.
- d. Proximity to Load Center. The project is located approximately 50 miles east of Salem, Oregon. Power transmission facilities are available at the Detroit Lake project.
- e. Access. The lower reservoir site is accessible by paved highway. Logging roads extend to within 1 mile of the upper reservoir area.
- f. Land Use. The lower reservoir would be an existing multiple-purpose reservoir, which provides flood control, irrigation, downstream navigation improvement, power generation, and recreation. The upper reservoir site is located in a basin,

which has retained its natural character in spite of intensive logging in surrounding basins. Tumble Lake is a popular hiking destination for fishermen and other recreationists.

Social Factors

- a. Displacement. The pumped storage project would not displace any human habitation. Depending upon the extent of lower reservoir pool fluctuations, some impact on Detroit reservoir recreation use could be expected.
- b. Land Ownership. Lower reservoir lands are owned or managed by the Corps of Engineers, Oregon State Parks, and Recreation and Willamette National Forest. Upper reservoir lands are administered by the Willamette National Forest.
- c. Public Attitudes. Public concern could result from changes in existing recreation activities at Detroit Lake and the loss of the natural attractiveness of Tumble Lake. Informal contacts suggest that there may be considerable public support for preserving Tumble Lake in its present form.
- d. Public Safety. Public access would be restricted at the upper reservoir site and in the area near the powerhouse intake/outlet structure.

Geological Considerations

The existing Detroit Lake project is the lower reservoir for the site. The upper reservoir is an enlargement of the existing Tumble Lake, a small alpine lake located within a glacial cirque. The Tumble Lake outlet is a waterfall that drains southeast along the youthful v-notched valley formed by Tumble Creek and empties into Detroit reservoir. Slopes within the area are mostly steep and heavily timbered.

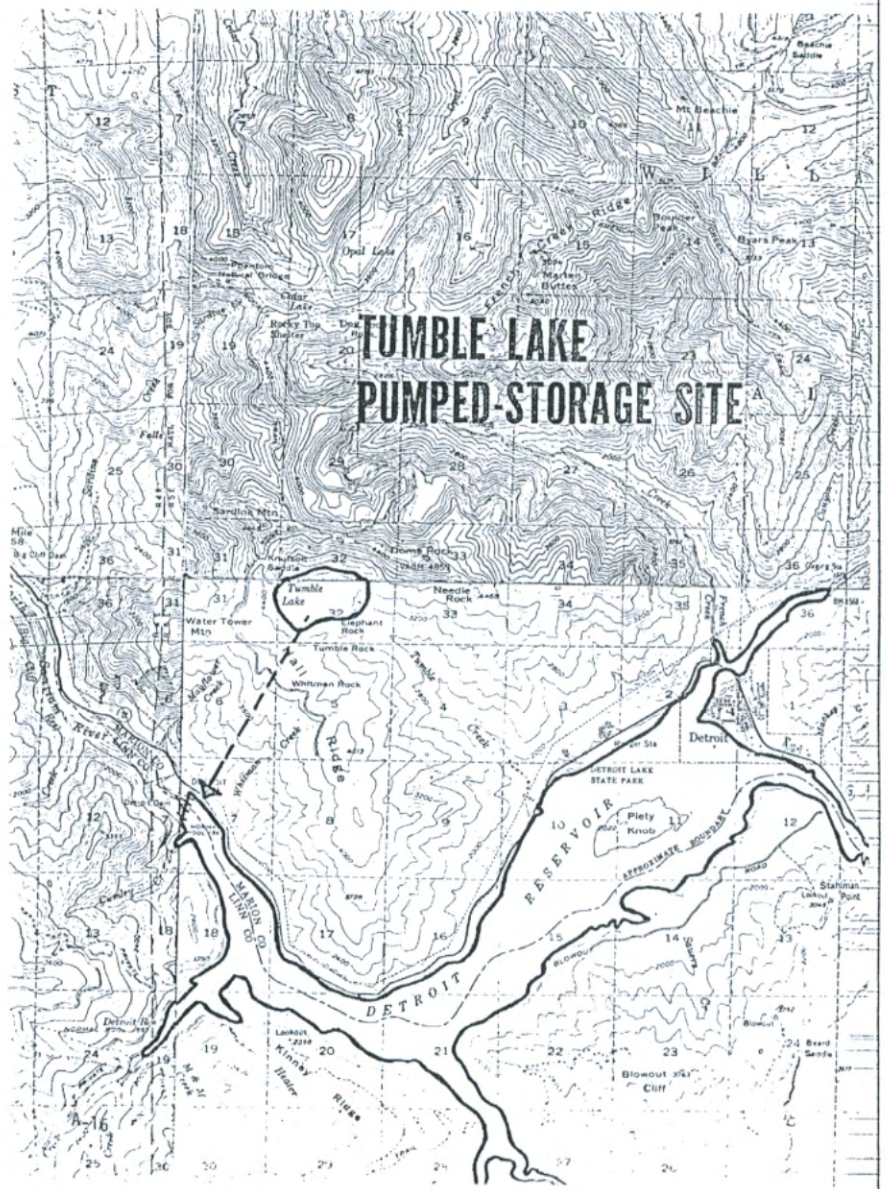
Abundant rock outcrops, cliffs and talus slopes occur throughout the region. These are formed primarily by andesite flows and flow breccias with interbedded tuffs. Diorite intrusives are also common within the area and form part of the walls around Tumble Lake.

Engineering geologic conditions appear to be excellent for construction of a pumped storage facility at the Tumble Lake site.

Environmental Considerations

Detroit Lake is stocked annually by the Oregon Department of Fish and Wildlife with fingerling kokanee salmon and rainbow trout and legal-sized rainbow trout. Anadromous fish runs are blocked downstream by Detroit Lake project. Vegetation in the area is predominantly Douglas fir, western hemlock and red cedar. Big game species reported in the area include blacktail deer, Roosevelt elk, bear, and some cougar. Upland game birds occurring within the project area include blue grouse and mountain quail. Rare and threatened species in the area include the bald eagle, the spotted owl and the Oregon slender salamander.

Tumble Lake was stocked by the Oregon Department of Fish and Wildlife with brook trout and it now supports a self-maintaining population. The very scenic lake receives moderate recreational use. Vegetation in the Tumble Lake area is primarily dense stands of Douglas fir and western hemlock. Clearcut areas are found in the high elevations. The Tumble Lake area provides good summer habitat for deer and elk and supports a number of fur bearers. Tumble Lake has no apparent lacustrine edge and is clear. Snags are visible at the northeast end of the lake.



SITE - JORDAN CREEK #406

LOWER RESERVOIR - RUFUS WOODS LAKE

Physical Factors

a. 1,000 mW

Head 1,160 ft.	
Storage 14,300 ac. ft.	Discharge 12,000 c.f.s.
Drawdown Upper 50 ft.	Lower 2 ft.
Size Upper 390 ac.	Lower 8,400 ac.
Penstock length 12,000 ft.	

b. 5,000 mW

Head 1,160 ft.	
Storage 68,500 ac. ft.	Discharge 52,700 c.f.s.
Drawdown Upper 130 ft.	Lower 8 ft.
Size Upper 900 ac.	Lower 8,400 ac.
Penstock length 12,000 ft.	

c. Hydrology. Effects of operation of pumped storage site on Chief Joseph Dam project should be studied.

d. Proximity to Load Center. Estimate to tie into regional power net will be made.

e. Access. Good access to upper and lower reservoir areas.

f. Land Use. Upper reservoir - private ownership used for farming - lower reservoir USCE.

Social Factors

a. Displacement. Farm in area of upper reservoir damsite - lower reservoir - none.

b. Land Ownership. Upper reservoir - private ownership - lower reservoir USCE.

c. Public Attitude. Inundation of 400-800 acres of productive farmland would cause some conflict.

d. Public Safety. During operation access to upper reservoir would be restricted.

Geologic Considerations

Reservoir is broad, shallow basin where fairly impervious glacial till mantles flat-lying Columbia River basalt. South abutment in basalt, north abutment and foundation in till. Conduit and powerhouse can be mostly in granite underlying basalt. Serious leakage from reservoir probably not a problem due to apparent completeness of glacial till mantle. Requires confirmation. Construction materials available from above reservoir area, tunnel muck and waste area at Foster Creek. Concrete aggregate available from Chief Joseph Dam source, 10 miles downstream.

Environmental Considerations

a. Fisheries. Based on the assumption that all penstocks will be screened, impacts to fishery resources will be minimal. Rufus Woods Lake is above all anadromous fish runs.

b. Wildlife. General wildlife habitat value of area to be destroyed by upper reservoir is rated poor to fair for all seasons. It is unlikely that rare and endangered species would be impacted by a project at this site. Further studies would be required to confirm this.

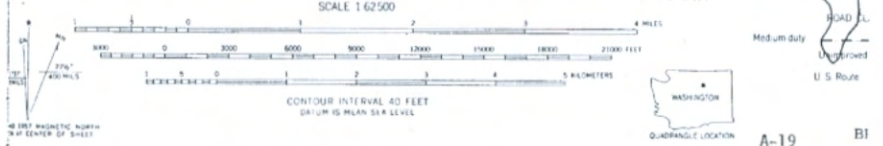
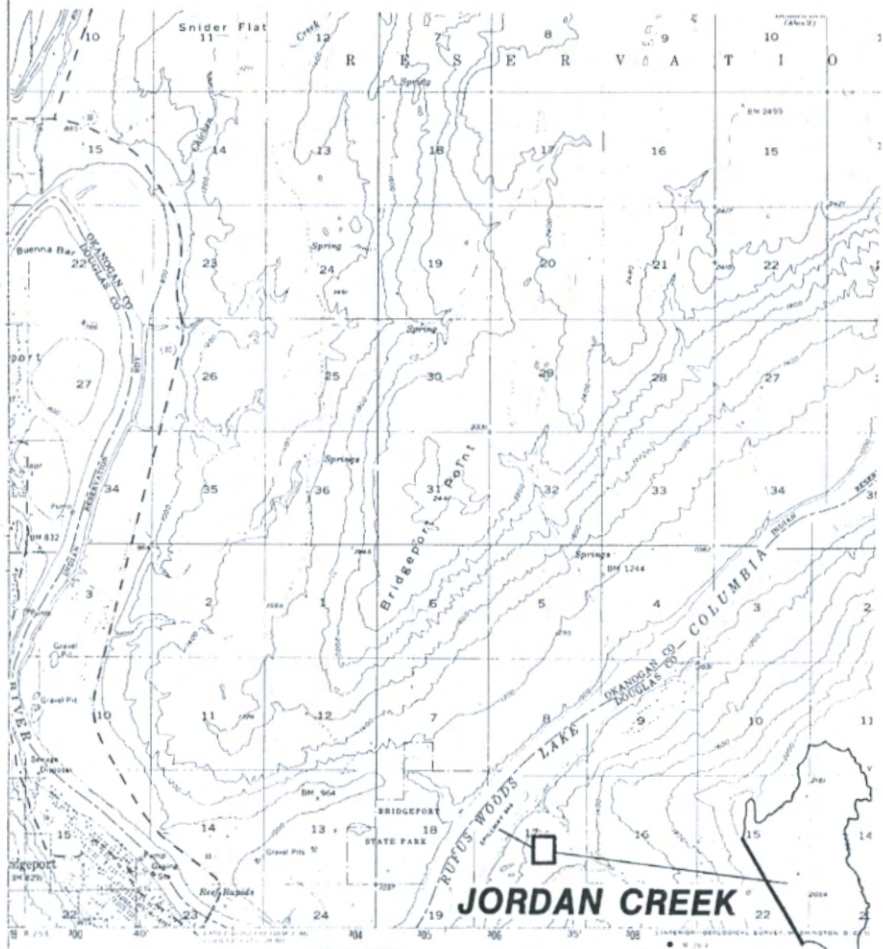
c. Esthetics/Recreation. Impacts on esthetics and recreation would be minimal.

d. Cultural Resources. The project site is within the historical territory of the southern Okanogan Indians. The proposed site is an area with high potential for significant cultural resources.

Preauthorization studies connected with the project would include cultural resources reconnaissance. If significant cultural resources within the project were identified, advance planning would take these into account in consideration of project alternatives. If adverse effects on them were unavoidable, funds could be programmed to assure their preservation.

e. Water Quality. Increased turbidity, dissolved solids loading, and water temperature changes would be expected to have little effect on the lower reservoir. Further studies would be required to confirm this.

f. Major or unique factors which may be expected to influence further studies at Jordan Creek include the almost total lack of wildlife habitat and existing roads and transmission corridors in the vicinity of the upper reservoir. An offsetting factor, however, is the loss of very productive agricultural lands to inundation.



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 A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

A-19 BI

SITE - SILVER CREEK #263

LOWER RESERVOIR - KACHESS LAKE

Physical Factors

a. 1,000 mW plant size

Head 1,610 ft.	
Storage 9,500 ac. ft.	Discharge 8,500 c.f.s.
Drawdown Upper 60 ft.	Lower 2 ft.
Size Upper 140 ac.	Lower 4,300 ac.
Penstock length 7,500 ft.	

b. 3,000 mW plant size

Head 1,610 ft.	
Storage 28,400 ac. ft.	Discharge 23,800 c.f.s.
Drawdown Upper 150 ft.	Lower 7 ft.
Size Upper 300 ac.	Lower 4,300 ac.
Penstock length 7,500 ft.	

c. Hydrology. Sufficient water should be available even during low-pool periods. Water-use conflicts could arise between irrigation and power needs.

d. Proximity to Load Center. Site is within 45 miles of Seattle-Tacoma area.

e. Access. Access to lower reservoir is good.

f. Land Use. Upper reservoir is used for hiking and probably some backpack camping - lies within Wenatchee National Forest - Upper reservoir is in fairly natural condition - Lower Reservoir used for recreation, 30 to 50 recreation cabins along shoreline.

Social Factors

a. Displacement. None necessary if operation is done during mid-winter period - otherwise would affect recreation cabins along reservoir.

b. Land Ownership. Wenatchee National Forest and USBR. Private ownership of some lakefront recreation lots.

c. Public Attitudes. Road construction and inundation of natural mountain valley might be opposed by environmental groups. Some opposition would probably come from owners of lakefront property on lower reservoir.

d. Public Safety. Access would be restricted to upper reservoir and inlet/outlet, on lower reservoir during operation.

Geologic Considerations

Damsite and reservoir in broad, locally steep-sided, glaciated, subalpine valley. Damsite and reservoir mostly underlain by basalt flows which dip moderately NE. East abutment is exposed bedrock, west abutment then colluvium mantling bedrock. Valley floor overburden, probably not too thick. Reservoir area mantled by glacial deposits which may be subject to some sloughing and sliding during rapid drawdown. Conduit and powerhouse may be underground in competent volcanic rocks and intake to lower reservoir in sandstone and conglomerate. Construction materials may be obtained from glacial deposits and rock in the reservoir area. Concrete aggregate may be hauled from commercial gravel deposits in Yakima Valley to the south. Serious reservoir leakage is not anticipated.

Environmental Considerations

a. Fisheries. Flows greater than normal high water might be expected because spillway at Lake Kachess might need to be enlarged. If overbank flooding occurs, it will impact fish spawning in river downstream of lake outlet as well as present possible safety hazard.

b. Wildlife. Undisturbed general wildlife habitat, rated very good to excellent in warmer seasons, would be destroyed by inundation of upper reservoir. No rare and endangered species are currently known to inhabit the project area and it is unlikely that construction would critically impact the species.

c. Recreation/Esthetics. An attractive setting would be severely altered by construction of the upper reservoir.

d. Cultural Resources. The project is within the historical territory of the Kittatas Indians. The proposed site is in an area with low potential for significant cultural resources.

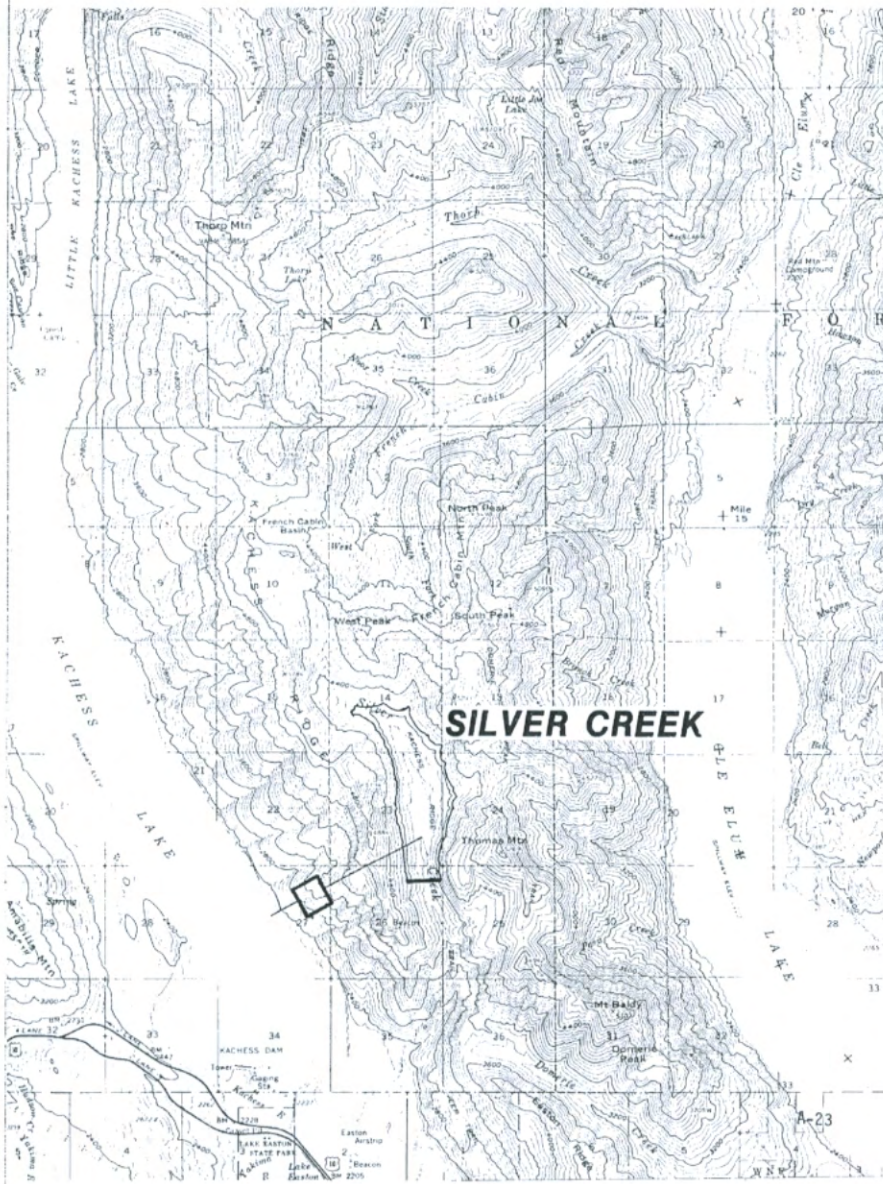
Preauthorization studies connected with the project would include cultural resources reconnaissance. If significant cultural resources within the project were identified, advance planning would take these into account in consideration of project alternatives. If adverse effects on them were unavoidable, funds could be programmed to assure their preservation.

e. Water Quality. The Yakima River system would be relatively sensitive to increased turbidity, dissolved solids loading,

and water temperature changes due to project operation. Further water quality studies are particularly important at this site.

f. Major or unique factors which may be expected to influence further studies at Silver Creek include the complete natural setting of the upper reservoir. Neither roads nor logging intrude on the area. The area is esthetically pleasing and offers good wildlife habitat. On the other hand, the site is very close to existing transmission line corridors.





February 1977

SITE - WAKEAWASIS #570

LOWER RESERVOIR - RIFFE LAKE

Physical Factors

a. 1,000 MW Plant Size

Head - 1,370 Ft.

Storage - 12,100 Ac. Ft.

Discharge - 10,000 c.f.s.

Drawdown Upper - 80 Ft.

Lower - 2 Ft.

Size Upper - 230 Acres

Lower - Riffe Lake

Penstock length - 7,700 Ft.

b. 3,000 MW Plant Size

Head - 1,370 Ft.

Storage - 34,200 Ac. Ft.

Discharge - 28,500 c.f.s.

Drawdown - 155 Ft.

Lower - 5 Ft.

Size Upper - 410 Acres

Lower - Riffe Lake

Penstock length - 7,700 Ft.

- c. Hydrology. The lower reservoir site would be the existing Riffe Lake formed by Tacoma Power and Light Company's Mossyrock Dam on Cowlitz River. Studies are necessary to determine the effects of pumped storage operation on the existing reservoir.
- d. Proximity to Load Center. The site is within 70 miles of either Tacoma, Washington, or Portland, Oregon. Power transmission facilities are present at Mossyrock Dam.
- e. Access. Unpaved logging roads are found throughout the upper reservoir area.
- f. Land Use. The existing lower reservoir is used for power production and recreation. The upper reservoir area has been extensively clearcut.

Social Factors

- a. Displacement. There are no homes or major improvements which would be affected.
- b. Land Ownership. Land is in private ownership.
- c. Public Attitudes. The upper reservoir is not heavily used by the public. Increased fluctuation of the lower reservoir might affect some shoreline recreational activities.
- d. Public Safety. Access to the upper reservoir and the lower reservoir outlet/inlet area would be restricted.

Geological Considerations

The south Cowlitz valley slopes are steep and the north valley slopes are moderately steep. Both slopes are partially timbered. The valley floor averages about 4,000 feet in width and is relatively flat. The upper reservoir area to the south is a poorly-defined low located at the headward end of Elk Creek. Local side slopes are low to moderate. A small swampy area occurs near the middle of the upper proposed reservoir.

A rock ledge caps the low butte to the east of the upper reservoir and a rock quarry is found to the northwest of the site. Upper Eocene volcanics of the Cowlitz Formation that underlie the area are predominantly basalt and andesite flows and flow breccias with some interbedded pyroclastics. Overburden includes fluvial-glacial debris and residual soils.

Environmental Considerations

Anadromous fish runs into the lower reservoir area are blocked by downstream dams. Riffe Lake is currently maintained as a high use boating and fishing area. The Department of Game annually stocks the reservoir with rainbow trout. Vegetation in the area is primarily Douglas fir intermixed with western red cedar and hemlock. Clearcut areas are apparent in the higher elevations and around the lake. There should be no major impact on the fishing and boating use of the reservoir.

The upper site is largely clearcut and crossed with logging roads. Vegetation in the area is scattered, mixed-age Douglas fir. A small spring is present in the basin and the area may have limited wildlife value.

