

PACKWOOD LAKE HYDROELECTRIC PROJECT



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The Packwood Lake Hydroelectric Project occupies lands of the Gifford Pinchot National Forest, and is authorized by the Federal Power Commission License No. 2244. From the initial consideration of the project development and throughout its planning, design and construction, it has been the objective of Washington Public Power Supply System to provide the optimum amount of power at the lowest possible cost while protecting the forestry resources and enhancing the recreational opportunities. Preservation of these values continues to be a constant watchword of WPPSS during operation of the Packwood Project.

The Project consists of a diversion structure a short distance downstream from the discharge of Packwood Lake, an intake structure and 22,000-foot pipeline to convey the water through two tunnels and around the mountain to a surge tank and penstock a short distance southeast of the town of Packwood. The powerhouse site is located at the base of the mountain adjacent to the town of Packwood with a tailrace channel discharging into the Cowlitz River. Cost of the Project has been privately financed by a \$12,500,000 revenue bond issue, to be repaid by power purchases as part of the power cost. The Project will produce approximately 101 million kilowatt hours of electric energy annually, (for purposes of comparison Lewis County PUD in 1963 purchased 177 million kilowatt hours).

Power from the Packwood Project is delivered to the Bonneville Power Administration for use by Public Utility Districts in Benton, Clallam, Clark, Franklin, Ferry, Kittitas, Klickitat, Lewis, Mason, Snohomish and Wahkiakum Counties in Washington. An allotment of power from the Headworks of the Project is reserved for use by the Forest Service at the Packwood Lake Guard Station. A source of power is available, at prevailing rates, to the small resort presently located on the lake.

The Supply System has also cooperated with the community of Packwood to provide a source of power at the upper portions of the Project to allow a community television installation for receiving Seattle telecasts in the area for the first time.

The combined Lewis County payroll of the general contractor, subcontractors, consulting engineer and Supply System amounted to approximately \$2,150,000 during the two-year period of construction. The Supply System paid approximately \$320,000 in Washington State taxes during the construction of the Project. The value of the power to the region over the life of the Project is conservatively estimated in excess of \$60 million.

Escapement of fingerling fish from the Packwood Lake has been reduced by the installation of a fish screen at the Lake outlet. The Lake is not accessible to anadromous fish and the spawning areas of the Cowlitz River will not be adversely affected. The Project water is returned to the Cowlitz River through an outlet structure in the tailrace channel. Fish screens in the outlet structure prevent fish from entering the tailrace channel.

Under terms of the Project license, a minimum release of Lake water in Lake Creek is made to preserve resident stream fish. The license also provides for maintenance of the Lake water above an elevation of 2857 feet, the approximately normal Lake level, during the recreation season from May 1 to September 15.

RECREATION: Recreational features of the Packwood Lake and the precipitous Cascade Mountain section of the Goat Rocks area have in no respect been adversely affected. Public access to the recreation area has been greatly improved by the extension of the present Forest Service road from the existing parking lot, at elevation 1400 feet, approximately 3½ miles to a new parking lot at elevation 2800 feet. The improved parking area includes a loading ramp for horses or "tote goats," space for 50 cars and five trailers, a turn-around area and an excellent view of the valley with Mount Rainier in the background.

The original five-mile trail from the old parking lot to the Lake has been replaced by a new four-mile trail which will furnish improved and easier access to the Lake for hikers, campers, and fishermen. In accordance with terms of the agreement between the Washington Public Power Supply System and the U.S. Forest Service, the construction road to the Lake has been closed and revegetated. Although the temporary bridges will be removed as a requirement of the Forest Service the construction road does provide an attractive potential future alternate access to the Lake for recreationists, when permitted by the Forest Service.

STATISTICAL DATA

PACKWOOD LAKE: The natural Lake elevation of 2857 feet lies approximately 1,800 feet above the Powerhouse. Packwood Lake and Lake Creek are bounded on the Southwest by Snyder Mountain, elevation 5,030 feet, and on the Northwest by a mountain ridge, elevation 5,300 feet.

Packwood Lake will furnish approximately 3,500 acre feet of storage when the Lake Level is lowered from 2,858.5 to 2,850.5 feet mean sea level. Area of the Lake is approximately 450 acres.

LAKE CREEK: has an average flow of 100 cfs; a medium flow of 92 cfs, and a maximum flood of record of 1,400 cfs.

INTAKE STRUCTURE: Water enters the project facilities through the Intake Structure which is located approximately 360 feet downstream from the Lake outlet. The Intake Structure houses trash racks, stop logs, traveling fish screens and a fixed wheel gate to control the water where it enters the 72" Pretensioned concrete Pipeline. The Intake Structure rises 42 feet from the foundation and 22 feet above the maximum Lake water elevation.

An automatic fish water release maintains a constant flow of water downstream from the structure for the protection of the fish. All metering and control system data measured at the headworks is transmitted directly to the Powerhouse for recording and remote control.

DROP STRUCTURE: The concrete drop structure extends the full 90-foot width of the stream bed and ties into the cutoff walls of impervious material. The knap of the drop structure at elevation 2,858.5 will allow water to spill only by over-topping the structure at times when the seasonal high flows exceed the capacity of the turbine generator. The drop structure has a design capability of 3,000 cfs, more than twice the maximum flow of record.

During the periods of average flow, the Lake Level is controlled remotely from the Powerhouse by a pre-set program of plant operation conforming to system load requirements and the FPC license.

TUNNEL #1	
Length	1,730 Feet
Configuration of Lining	Circular
Diameter	6'-0"
Number of angles	One
Concrete required	3,700 cu. yds.

TUNNEL #2	
Length	3,200 Feet
Width—concrete lined section	6'-6"
Height—concrete lined section	8'-6"
Width—unlined section	8'-0"
Height—unlined section	9'-3"
Number of angles	Two
Concrete required	4,400 cu. yds.

72" PRETENSIONED CONCRETE PIPELINE	
Length, approx.	17,000 Feet
Inside diameter	72 Inches
Outside diameter	77 Inches
Standard lengths	20 Feet and 32 Feet
Weight per sections	7 Tons and 11 Tons
Joint sealing material	Rubber gasket and cement grout
Design pressure	100 psi
Nominal differential in elevation between Lake and Surge Tank	119 Feet

SURGE TANK:	
Height above pipeline	191 Feet
Diameter of Surge Tank	
outer	14 Feet
inner	5 feet 6 Inches
Length of adit	80 Feet
Length of shaft	56 Feet
Diameter of adit and shaft lining	6 Feet
Concrete required	550 Cubic Yards
Weight of steel	148 Tons

PENSTOCK	
Total length	5,600 Feet
Maximum design pressure	970 psi
Section Length	39 Feet
Section couplings	Pressure or welded
Maximum test pressure	1,570 psi
Number of concrete anchors	12
Volume of anchor concrete	915 Cubic Yards
Weight of anchor re-steel	102,500 Lbs.
Weight of Penstock Pipe	2,530,000 Lbs.
Number of man-holes	9

POWERHOUSE AND CONTROL BUILDING:

Turbine Type	Impulse
Turbine Generator Manufacturer	Allis Chalmers
Turbine capacity rated full load	36,700 hp
Maximum Turbine capacity overload	41,400 hp
Speed	360 rpm
Maximum Turbine efficiency design	90 pct.
Weight of Turbine	204,000 Lbs.
Net effective head	1598-1803.5 Feet
Jet diameter (Two)	8¼ Inches
Diameter of runner	121 Inches
Generator capacity—100 pct. (0.95pf)	27,500 KVA
Maximum generator capacity—115 pct. (0.95pf)	31,625 KVA
Maximum generator efficiency	97.65 pct.
Voltage	13,800 Volts
Total structure concrete	2,670 Cu. Yards
Total weight re-steel	250,000 Lbs.
Powerhouse depth below ground	43 Feet

TAILRACE CHANNEL

Length	8100
Width at top of asphalt lining	29 Feet
Width at base of asphalt lining	9 Feet
Depth	5 Feet 9 Inches
Length of Highway Culvert	200 Feet
Length of Hall Creek Flume	356 Feet

ROADS AND TRAILS

Total New Public Road constructed	3.5 Miles
Capacity of new parking lot	50 Cars, 5 Trailers
Total New Forest Service Trail constructed	4 Miles
Temporary roads and benches constructed, approx.	6.5 Miles

TOTAL PROJECT AREA

TOTAL PROJECT CLEARING	70 Acres
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WASHINGTON PUBLIC POWER SUPPLY SYSTEM

WPPSS is a municipal corporation and operating agency of the State of Washington. It was organized in January 1957. It is empowered to acquire, construct and operate plants, works and facilities for the generation and/or transmission of electric power and energy.

WPPSS has its principal office in Kennewick, Washington. The management and control of WPPSS is vested in a Board of Directors made up of one representative from each of the 16 public utility districts which are members.

Public Utility District	Representative on the Board of Directors
Benton County No. 1	Robert Johanson*
Chelan County No. 1	L. J. Richardson
Clallam County No. 1	Alvin E. Fletcher
Clark County No. 1	Edward F. Evans*
Cowlitz County No. 1	W. E. Sailors
Douglas County No. 1	Lloyd McLean
Ferry County No. 1	Oliver R. Pooler
Franklin County No. 1	Glenn C. Walkley*
Grant County No. 2	George Schuster
Grays Harbor County No. 1	Harry S. Swenson*
Kittitas County No. 1	Laurence Møllergaard
Klickitat County No. 1	L. E. Darland*
Lewis County No. 1	T. R. Teitzel*
Mason County No. 3	Edwin W. Taylor
Snohomish County No. 1	W. G. Hulbert, Jr.*
Wahkiakum County No. 1	John King

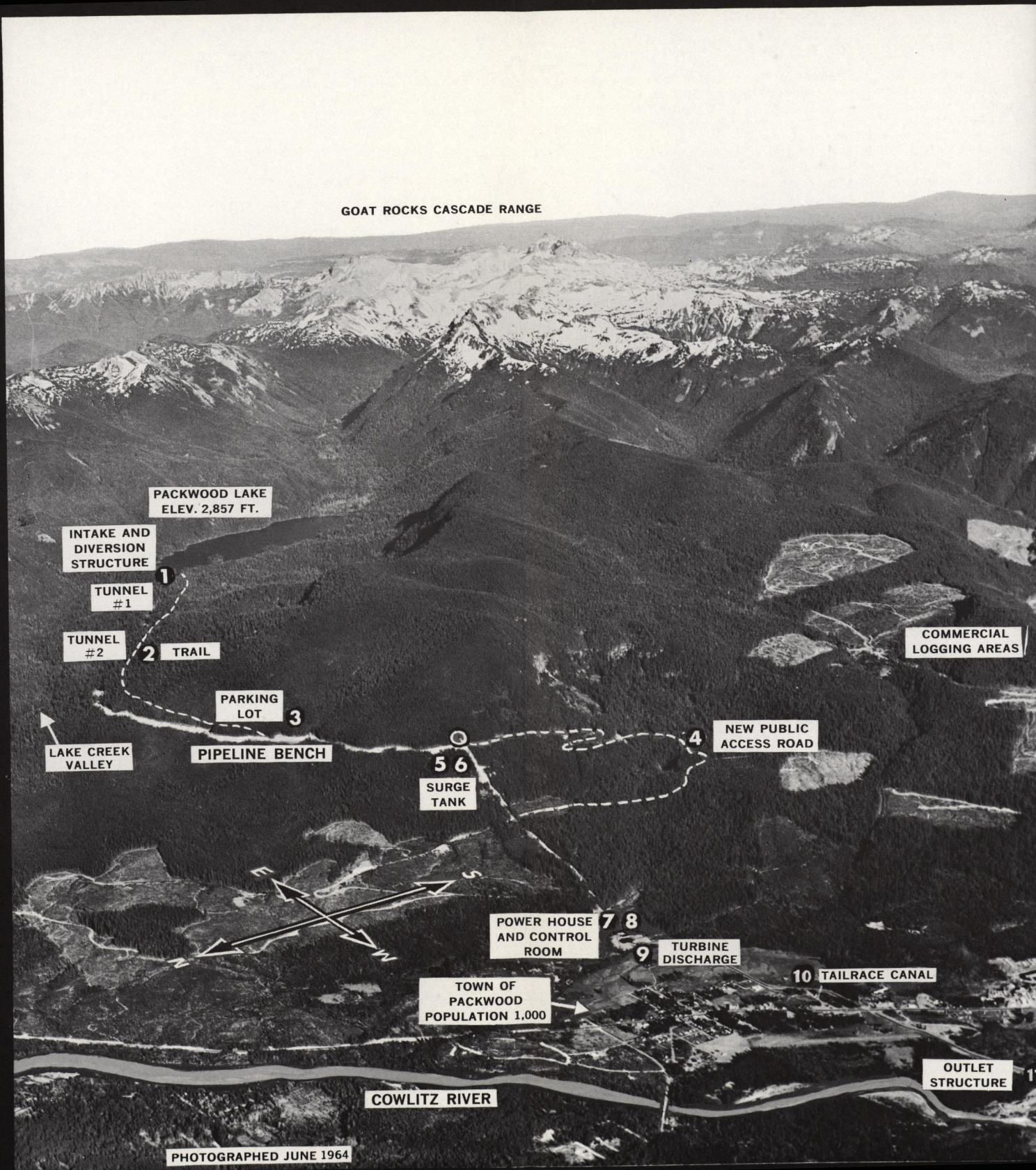
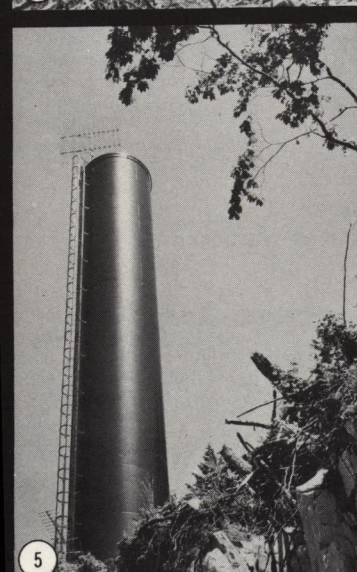
*Members of the Executive Committee

OFFICERS ELECTED BY THE BOARD

President	Glenn C. Walkley
Vice-President	T. R. Teitzel
Secretary	Edward F. Evans
Managing Director	Owen W. Hurd
Treasurer	Elmer A. Landin, Jr.
Auditor	Ronald E. Warden

Washington Public Power Supply System

P.O. Box 166 • 130 Vista Way • Kennewick, Washington
Phone: Area Code 509/582-3137



GOAT ROCKS CASCADE RANGE

PACKWOOD LAKE
ELEV. 2,857 FT.

INTAKE AND
DIVERSION
STRUCTURE

TUNNEL
#1

TUNNEL
#2

2 TRAIL

PARKING
LOT

PIPELINE BENCH

5 6
SURGE
TANK

POWER HOUSE
AND CONTROL
ROOM

TOWN OF
PACKWOOD
POPULATION 1,000

COWLITZ RIVER

COMMERCIAL
LOGGING AREAS

NEW PUBLIC
ACCESS ROAD

9 TURBINE
DISCHARGE

10 TAILRACE CANAL

OUTLET
STRUCTURE

PHOTOGRAPHED JUNE 1964

