

T.W. Sullivan:

Power Station at the End of the Oregon Trail



In the early 1890s, the dust from wagon trains was barely settled in Oregon City, the terminus of the historic Oregon Trail, yet a new era was under way. Largely gone were self-sufficient farmers and independent craftsmen. In their place were factory workers and urban dwellers who required cheap, reliable, efficient energy from a central source of supply—i.e., electricity.

The time was ripe for the rise of a privately owned electric utility. In that part of the U.S., the successful firm proved to be the company that in 1948, following numerous name changes, was named Portland General Electric Company (PGE). At its founding in 1889, PGE—then known as Willamette Falls Electric Co.—owned several small power stations, one of which burned sawdust and “hog fuel,” and was in competition with several other small companies for the area’s electricity market. In 1893, the company leaped ahead of the pack by starting construction of the first major hydroelectric project in Oregon.

That plant was called Station B when it produced its first power in December 1895. In 1953, when it underwent substantial modernizing, it was renamed the



Thomas William Sullivan was Portland General Electric Company’s foremost hydraulic engineer from 1890 until his death in 1940. He designed and built PGE’s Station B, renamed the T.W. Sullivan plant in 1953.

Thomas W. Sullivan Plant in honor of its designer, builder, first superintendent, and PGE’s foremost hydraulic engineer.



Portland General Electric Company’s Station B hydroelectric plant, 1930

Completed in 1895, the plant assured PGE’s success in the highly competitive electricity market in the Pacific Northwest in the late nineteenth century.

The power station’s history reflects the transition of a region from the pioneer days of the 1800s to the electrical age of the twentieth century.

In 1889, PGE completed its first hydro plant, the much smaller Station A, on the east side of Willamette Falls, the only waterfall in Oregon with sufficient height and volume for power production. In 1889, Station A transmitted power 14 miles to downtown Portland, lighting the city’s street lights. With that, the station became one of the first facilities in the U.S. to transmit power over a long distance. Station A, however, was subject to mechanical breakdowns, and to floods. It was abandoned in 1897.

Construction began in 1893 on Station B on the west side of the falls, adjacent to navigation locks built by PGE. (PGE sold the locks to the federal government, and they are now operated by the U.S. Army Corps of Engineers.) PGE’s decision to expand was, largely, a response to the demand for electricity created by two of Portland’s electric railroad lines. Those “interurban” railroads, often called trolleys, provided transportation prior to the advent of paved roads and motor cars, and allowed for residential, commercial, and industrial development in what would come to be known as the suburbs.

From its first day of operation in December 1895, Station B helped to power expansion of the city, and was enlarged itself as the demands increased. Jack Phillips, now living in Ryderwood, Washington, was a longtime operator at T.W. Sullivan, and since his retirement in 1989 has become an unofficial PGE historian and collector of artifacts.

In those early days, Phillips said, engineers could not parallel two generators onto the same transmission line, and so power from each generator was transmitted directly to a certain customer.

In Station B’s first year of operation, two 500-volt direct current (DC) generators transmitted electricity to two rail lines, one an interurban between Oregon City and Portland and another serving a growing tourist and recreation development along the Willamette Valley as far south as Eugene. Three 6,000-volt revolving armature alternating current (AC) generators powered a flour mill, and provided electricity for commercial and residential needs.

Phillips said the design was unique in that two turbines of different head ratings were installed for each 450-kW AC generator. The turbine for low-head condi-

Technical Information

T.W. Sullivan Plant

General Information

Location: On the west side of Willamette Falls, across the Willamette River from Oregon City, Oregon

Owner: Portland General Electric Company, Portland, Oregon

FERC License: 2233

Capacity: 16 MW

Head: 50 feet

Average Streamflow: 5,000 cubic feet per second

Expected Annual Generation: 107,074 megawatt-hours

On-Line Date: December 1895

Equipment

Turbines (13 units)

12 adjustable pitch Kaplans manufactured by Pelton Water Wheel Co.

1 fixed-pitch Francis (manufacturer unknown)

242 rpm

1,800 horsepower

Generators (13 units)

12 Westinghouse induction motor-generators with gate shaft controllers

1 General Electric synchronous generator with governor

3 phase; 60 Hertz; 2400/4160V

Construction

Intake

Forebay pond; vertical slide gate for each turbine

Powerhouse

Concrete walls, 6 feet thick with minimum rebar

Steel truss gable-type roof

250 feet long; varies from 35 to 50 feet wide

Draft tubes

Welded steel pipe replaced riveted steel in 1987

Fish Protection

Fish screen diversion system designed by George Eicher, and fish evaluator system designed and installed by PGE

Transmission

57,000-volt lines to plant substation; two lines to Portland General Electric Company grid

nameplate from an original generator. His favorite, though, is the roll-top desk he sat at every day for ten years. He believes the desk belonged to Thomas W. Sullivan. "That was a real interesting job for me," he said. "I've always liked history, and there I was working right in the middle of it."

Many of those artifacts, including Sullivan's desk, are included in a large display housed in the Clackamas County Historical Society building in Oregon City, which traces the history of the T.W. Sullivan Plant.

In 1953, the plant was modernized with the installation of 12 propeller-type turbines, which tripled its power production capacity to the current level of 15 MW. One Francis-type turbine, installed as a replacement in 1924, was left in place. A 57,000-volt transmission line feeds into the Sullivan substation and to another substation in Oregon City.

The plant also was automated in 1953. Westinghouse supplied 12 induction motor-generators and designed a complex wiring and switching system that allowed the plant to be monitored at a central dispatch office.

In the early years, a staff of 22 men manned the plant 24 hours a day, seven days a week. After 1953, the staffing dropped to two, and then was cut to one man working on a day shift Monday through Friday, as is the case now.

"When the station was modernized, it was quite advanced for its time," Phillips said. "If a bearing overheated or something like that, Mercoid switches would automatically shut down the generator. That would light a signal at the dispatcher's office, and they'd call the operator out to go put it back on line."

Though the Sullivan plant is now the smallest plant in the PGE system, it has contributed significantly to the company's environmental studies in the past 15 years. In 1980, a highly efficient fish screen was installed, and in 1991 a fish "evaluator" was added.

Phillips said fish migrating downstream are directed by leaf gates into the penstock feeding the No. 13 generator. The screen diverts fish into a pipe that, until 1991, carried them to the tailrace. The pipe now carries fish directly into the "evaluator," where their physical status is assessed.

"Biologists are using the fish screen and evaluator system to gather a lot of data about migrating fish," said Don Miller, the plant's current manager. "Sullivan is still very important to us."

tions was larger physically, but slower in speed, and connected to the generator by a wide leather belt. Under high-head conditions, tension of the belt was reduced so it could "slip," allowing the higher speed turbine to drive the generator.

Over the next several years, more capacity was added. By 1903, Station B had 13 generators producing 5.73 MW, by far the most of any plant in Oregon.

Station B evolved during the next decades as electrical needs changed and advances in technology were made. For

example, cars and buses replaced the electric trolleys, and the DC generators that had served the trolleys were no longer needed. They were replaced with AC generators.

Among the memorabilia Phillips collected when he worked there are old photographs of the plant and locks, old billings from when Portland Railway, Light & Power—which was PGE's name from 1906 to 1924—sold water; antique tools made in a blacksmith shop that once stood next to the plant; and a



The turbine deck at Portland General Electric's 16-MW T.W. Sullivan hydroelectric plant, as it looks today. In addition to producing power, the plant's innovative fish screen and a new fish evaluator system are providing useful data for fisheries research and management.