# CHAPTER V

# CLACKAMAS RIVER BASIN DEVELOPMENT

A period of significant Company growth occurred in the decade from 1902 to 1912. This was evidenced both in electric service load growth and in exploitation of generation resources to meet the needs of an expanding population. As electric requirements increased at a rapid rate, low-cost hydroelectric generation became ever more attractive for bulk power supply.

The potential for power development on the Clackamas River was recognized at the turn of the century. Power sites were in relatively close proximity to Portland and to projected electric interurban lines. Thus, surveys were started in June 1901 on the John Zobrist donation land claim, and in 1902 property acquisition began for a hydroelectric generating project then named Cazadero (later, Station G, and now, Faraday). In 1908, lands were purchased for a power site a short distance west of Estacada for the River Mill hydroelectric development.

Investments and payrolls for power site investigation, as well as plant and railroad construction and operation, contributed to the stable economy and growth of the Estacada area. The Company built a hotel and picnic park, and excursion trains on an electrified railroad brought crowds of Portlanders to Estacada on weekends for summer enjoyment. The public recreational facility was further enhanced by completion of River Mill dam in 1911, creating Estacada Lake and slack water to the Faraday powerhouse. With excellent hotel meals at reasonable prices as an additional draw, as many as seven extra trains were scheduled on Sundays for the pleasure seekers. The interurban lines were advertised as "The Trout Route", in angler's guides issued by the Company to the public.

A railroad from Portland through Gresham and Boring to Estacada, terminating at Cazadero, had been completed in 1903 by the Oregon Water Power & Railway Company, a predecessor company of PGE. The railroad was built primarily for hauling workmen, equipment and supplies for the construction of the Cazadero hydroelectric plant.

The decision to construct a railroad was made after estimating the cost of an alternative horse and heavy-wagon transportation system. The latter would have required planking a 22-mile roadway from S.P.R.R. Co.'s Clackamas station and upgrading the bridges all along the route.

Benefits from some investor-owned electric interurban railway lines in that period of undependable automobiles and muddy or dusty dirt roads were realized at Estacada and along the route from Portland. According to the *Street Railway Journal* of October 29, 1904: "Estacada is a town of 300 or 400 people . . . where six months ago there was nothing but a small farm and standing timber . . . The Hotel Estacada . . . is owned by the O.W.P. & R.R. Co. and has been constructed with a view of providing accommodations for those desiring short and inexpensive outings. . . . As a special inducement for Sunday traffic, a rate of 50 cents is given for the round trip from Portland to Estacada, instead of the week-day fare of $1.35. A rate of $1.50 is offered for the round-trip including dinner at the hotel". The original plat for the "Town of Estacada" was filed in Oregon City on January 9, 1904. In 1905 Estacada was incorporated as a city.

The ultimate projected usage of the interurban railroad to Cazadero, according to the *Street Railway Journal,* was for "tapping of the large and excellent yellow fir region on the Upper Clackamas River. By reason of natural obstructions in the river channel below Cazadero, it has been impossible to float logs down the stream to the Willamette; and as the country is too steep and rugged for logging roads . . . this large timber section . . . has lain dormant for years. This country is settled largely by the pioneers of Oregon who crossed the mountains

(on the Barlow Toll Road) and settled in this section some 50 years ago. Without transportation facilities and a 25 to 30 mile wagon haul, the advancement of these sturdy settlers has been slow as compared to that noticed in other parts of the West".

Anticipating a delay of some years in harvesting timber in the upper Clackamas River basin, the company conducted an aggressive campaign to develop freight business along the line. As the 1904 *Street Railway Journal* article noted: "Portland burns wood almost exclusively for fuel, and uses from 200,000 to 300,000 cords annually". For the calendar year 1904, more than 100,000 cords were hauled by the Estacada line. A flatcar could carry 16 cords, and the freight rate for the full trip was 85 cents per cord. At the time, there were 37 sawmills along the railway or tributary to it. Farmers also benefited. They were able to raise potatoes and other valuable cash crops for shipment to market, instead of having to raise hay and grain for fattening hogs and cattle, and then face the drive "on the hoof" the long distance to Portland.

At the beginning, practically the only town on the Cazadero interurban line was Gresham, with a population of about 150. The railroad management anticipated the need for only one combination freight and passenger train each day. However, within a year, seven passenger trains were required every weekday, and a freight train every night. On Sundays, the passenger schedules increased from 50 to 100 percent during the fishing and picnicking season.

Three wood-burning steam locomotives were first operated on the railroad section from Boring to Estacada. In 1907, the line was electrified upon completion of the Faraday hydroelectric development, providing direct current for the trolley wires at the terminal at Cazadero and through a substation constructed at Eagle Creek. E. L. (Roy) Meyers, the first station agent at Estacada, was later a longtime lobbyist for Portland General Electric and its predecessor companies. Until 1967, he resided at Eagle Creek on the pioneer Philip Foster donation land claim.

In 1843, Philip Foster, in partnership with Francis W. Pettygrove, operated a store in Oregon City. Soon afterwards, Foster located a homestead at Eagle Creek. In June 1844, he moved into a newly built log house on those fertile farm lands. The following year, Samuel K. Barlow reached the Foster place in the course of his attempts to locate a trail to Oregon City for a pioneer covered wagon train.[10]

In 1846, Foster and Barlow formed a partnership to construct an 80-mile-long toll road from Maupin, south of Mt. Hood, to Foster's farm, where fresh fruit and vegetables could be obtained by the pioneer migrants. A toll gate was built near Zig Zag where, by action of the Provisional Legislature, a charge of $5 per wagon and 10 cents for each loose animal was authorized for collection. The toll road was not a financial success, but it apparently operated until 1919, when it was deeded to the State of Oregon.

Prior to 1922, the Clackamas River basin east of Estacada was a 650-square-mile area of timbered wilderness, with no roads and few trails. Steep cliffs ran to the edge of the river at many places, forcing trails to climb up and down the side of the canyon and making a trip to the upper country an arduous task. There was only one homestead in the area. A U.S. Forest Service ranger station at Oak Grove, built about 1908, was for many years manned only in the summer fire season because of its isolated location. All supplies and equipment were transported into the area by pack train until 1923, when the Company — in preparation for the Oak Grove hydroelectric project construction — built a wagon road, immediately followed by a railroad into the area.

**Faraday Development (Originally Cazadero, subsequently Station G, then Faraday.)**

Construction work on the dam for this hydroelectric project was started in 1902 by the Oregon Water Power & Railway Company (O.W.P.& R. Co.), in accordance with plans for a five-unit plant prepared by the line's Chief Engineer, George I. Brown. On February 24, 1904, PGE contracted for the purchase of a portion of subsequent generation, but the O.W.P.& R. Co. was merged into the Portland Railway, Light & Power

Company (successor to the original PGE) on January 1, 1907, before the plant was completed. Before and after the merger, the same financial interests — Clark and Seligman* — controlled the two companies.

At the time of the consolidation, T. W. Sullivan, Hydraulic Engineer for PGE and P.R.L.&P., was placed in charge of the Faraday hydraulic installation. The mechanical and electrical installation was supervised by O. B. Coldwell, then Operating Engineer. The transmission line was built under the direction of H. S. Sladen, Transmission Engineer, general construction was supervised by Alf Drill, and R. R. Robley was in charge of electrical equipment installation.

The O.W.P.& R. Co., originally incorporated on December 7, 1901 as Oregon General Electric Company, represented the consolidation of four city and interurban electric railway properties owned and operated from May 1892 by eight corporations, individuals, and receivers.[2]

Initial operation of the Faraday plant was in February 1907. Three hydroturbine generating units totaling 7500-kW rated capacity were placed in service, together with a 400-kW rotary converter for 550-V direct-current railway supply. Generation was at 11,000 V, 33 cycle, with power stepped up to 33,000 V for transmission to Portland over two wood pole transmission lines. The 33-cycle frequency was selected because of its economic advantage in the conversion to direct current for electric street railway and interurban transportation, as well as to satisfy the requirements of the downtown area of Portland, where 120-240-V direct-current service was used by all stores and office buildings.

On Sunday morning June 21, 1908, all three generators were wrecked by the overspeed of one unit which caused it to fly apart and successively shatter governors on the other two generators. But for bent shafts and the loss of governor equipment, the water turbines were virtually uninjured. By July 10 that year, one of the generators had been replaced with a 60-cycle machine that the General Electric Company had had on hand for delivery to another company. It was the first 60-cycle generator on the P.R.L.&P. system. Two new replacement generators for the No. 1 and 2 water turbines were quickly supplied by Allis Chalmers Manufacturing Company. They were placed in service the following November.

A fourth generating unit of 3000-kW rating was added to the Faraday station in October 1909; a fifth unit rated at 3,750 kW began operation in August 1910. Generators for the No. 4 turbine unit consisted of three 1000-kW, 60-cycle, 2300-V frequency changer units salvaged from other locations on the system.

The Faraday development continued to operate virtually unchanged (except for substantial repairs and improvements to the right abutment and other portions of the timber crib dam) until August 1921, when the No. 1 generating unit was rewound for 60 cycles and the capacity increased by 500 kW. In August 1922, a similar improvement was made to the No. 2 generator, because of the prospect of reduced railway load and increases in the system's 60-cycle, alternating-current sales.

On June 15, 1953, disaster struck the Faraday powerhouse a second time. A surge of water pressure ruptured the cast iron turbine casing and draft tube elbow on the No. 3 generating unit. Within a few minutes, the powerhouse main floor was flooded to a depth of 6 feet. The chief operator, Harold Hoygaard, bravely stayed at the switchboard, managing to cut the plant free from the remainder of the PGE system and thus preventing more serious damage. Nevertheless, the No. 5 generator was burned out and the stator required a complete rewind.

Work on dry-out, repair and replacement of equipment was expedited, because an area power shortage was anticipated for the 1953-54 winter season. New welded steel turbine casings and draft tube elbows were ordered for all five turbines, and new cast steel runners were purchased for three. All governors were replaced with hydraulic controllers, in order to permit remote control by supervisory circuits. The total estimated cost of the

*E. W. Clark and Co., Philadelphia; and J. W. Seligman of New York.

repairs and improvements was $689,000, of which $162,000 was recovered from insurance. One unit was restored to service late in August 1953. Three more were available in September and October; and, the fifth unit became available before March 1954. Turbine reconstruction at the Pelton Water Wheel Company shop in San Francisco was scheduled for one unit at a time throughout 1954. None of the five units was available for maximum peaking service until February 1955.

A third complete outage of the Faraday plant occurred in January 1965 because of major flood damage. This event is covered in the Chapter on "Floods, Ice, and Windstorms".

On January 21, 1972, a major Clackamas River flood occurred. The peak flow of 64,200 cfs was reached near midnight, inundating the original Faraday powerhouse and the project office and shop facilities. Cost of cleanup and repairs totaled over $100,000, including $14,340 net cost for salable timber and flood trash removed from the North Fork reservoir, and new windings for the No. 3 generator. By May 1, four of the old generating units had been restored to service. No. 3 was repaired by May 31.

**River Mill Development (Formerly Station M)**

Property acquisitions for the River Mill hydroelectric development were started in 1908. In 1909, preliminary surveys and designs were made by the Portland Water Power & Electric Transmission Company which was incorporated December 22, 1908, by the former major property owner of record, W. H. Hurlburt. Late in 1908, the Portland Railway, Light & Power Company secured control of the property, immediately assuming responsibility for the project. Sellers and Rippey, consulting engineers of Philadelphia, were engaged to assist with design and construction.

The January 4, 1913 issue of the *Journal of Electricity, Power and Gas* noted that the project was unusual from the start: ". . . for the rapidity of its construction, considering the exceedingly substantial manner in which it is built, and for the fact it employs the first Ambursen type of dam for power plant work on the Pacific Coast. All available power in the river below the Cazadero plant is here developed under a head of 83 feet".

Construction contractor was the Puget Sound Bridge and Dredging Company, which started the work on June 1, 1910, and completed it November 15, 1911. The P.R.L.&P. Co. procured and installed the mechanical and electrical equipment. Turbines, penstocks, draft tubes, gates and other hydraulic necessities were ordered on June 29, 1910. Generators, transformers and other electrical equipment were not on order until December 10. Nevertheless, the first unit went into service 11 months later, on November 11, 1911, the second in 2 weeks, and the third just 1 month later. Under the most favorable head conditions (in January 1924), peak capability of the three generating units was 13,800 kW.

As the River Mill powerhouse was designed for five main generating units, the original construction included five sets of intake racks and gates and draft tubes. Penstock sections for the fourth and fifth units were initially installed extending to the powerhouse wall. The fourth generating unit, rated at 4150 kW, was added in December 1927 — increasing the plant output to a maximum peak capability of between 18,000 and 19,000 kW, depending on head and river discharge conditions. With this additional capacity, the plant investment averaged less than $117 per kW of maximum output. On May 19, 1952, the fifth unit, rated at 5000 kW, was operating in commercial service, raising the plant's peak capability to 23,000 kW.

A significant improvement made at River Mill in 1954 was the modernization of control of the generating units, making the plant semiautomatic. The original governors on the No. 1, 2 and 3 turbines were replaced with Pelton Water Wheel Company "hydraulic controllers". The governors on the other two units were to provide for similar electrical control of each generating unit, in the event of excessive temperatures or speed or other malfunction. This installation, with a book value of $167,961, permitted safe plant operation with one operator for each of two shifts per day instead of the formerly-required two operators round the clock 7 days per week.

In 1966, spillway capacity of the River Mill dam was increased 50 percent (to 150,000 cfs) to match that of the North Fork spillway. The December 1964 flood had pointed to the need for provision to pass floods of greater magnitude. Due to the excellence of the construction methods and materials originally used in the dam, the reinforced concrete and the strength of the sections were found to be adequate to withstand the additional pressure of an even greater flood. Because of higher flood elevations, abutments and wing walls were topped with 8 feet of concrete and a compacted-earth dike was built across the lowlands at the south end of the dam. On the upstream side, powerhouse walls were reinforced and openings were closed up to maximum flood elevation. The entire job was accomplished at a book cost of $161,719 — far less than the cost of a new gated, concrete, side spillway had such an addition been needed to pass an extra 50,000 cfs of flood water without raising the forebay water level.

**The "Second Clackamas" Project**

Investigation of a power site above the backwater of Cazadero dam for a project named Second Clackamas, then Upper Dam, and, ultimately, North Fork, was started on December 14, 1906, with the posting of a water right notice for the appropriation of 5000 second-feet. The *Engineering News* of June 27, 1907 stated: "Early this year work was started by the Company (P.R.L.&P. Co.) on a second power plant on the river .... The new plant will have a higher dam than the lower one, but the head secured will be about the same ... The estimated cost will be about $750,000 as against $1,000,000 for the Cazadero plant .... Time for completion is estimated at about four years". In 1907, the dam site and forebay were surveyed and mapped and work was started on clearing and excavation of test pits.

In 1908, extensive core drilling of the dam foundation was begun. It continued intermittently into 1910, when the area was cleared of topsoil by sluicing with high pressure "giants", and exploratory tunnels and trenches were dug along the dam axis. By that time, the site had been deemed suitable for development, so the railroad was extended from Cazadero to that point.

On January 21, 1911, contractors visited the work, anticipating bidding on the construction. The following month, however, C. M. Clark* wired from his office in Philadelphia to stop work on the excavation. In May, he further ordered that expenditures be reduced to less than $1000 per month. By that time, total investment in the project had reached nearly $194,000. Suspension of work other than stream gaging and minor activity to preserve the water right was ordered by Clark, as negotiations were in progress to purchase the Bull Run project from the Mt. Hood Railway and Power Company (The Bull Run project was acquired by P.R.L.&P. Co. on March 12, 1912.).

Various engineering studies for the development of power at the North Fork site were undertaken in 1912. On September 11 of that year, a permit for a 15,000-hp project using 1000 second-feet was obtained from the State Engineer. The plan was to construct a low diversion dam at a location about a mile below the South Fork of the Clackamas, conducting the water to a power plant by either a canal or a flume 4 miles in length. The cost estimate was $750,000, with completion scheduled for September 1917. Although the annual water power fees were paid, no actual work was accomplished other than to continue operation of the river discharge recorder.

In 1918, plans were revised for a diversion at the same location for a smaller conduit with a capacity of 667 second-feet and a plant capacity of 10,000 hp. For this project, the State Engineer issued Permit No. 3802 on May 31, 1918 with a 5-year completion date. Annual fees of $555 were paid to the state until 1938 when the project was abandoned. Ultimate development of the North Fork project did not occur until the power shortage period of the 1950s.

*Clark was a partner of E. W. Clark and Company, investment bankers of Philadelphia, and Chairman of the Executive Board of P.R.L.&P. Co.

**The Oak Grove Project**

In 1907, electrification of the Southern Pacific railroad lines in the lower Willamette Valley was contemplated. In order to secure a power source, the S.P. Co. filed notices of water appropriation on the Oak Grove Fork in 1907 and on Three Lynx Creek in 1908. It also applied to the U.S. Department of Agriculture on November 4, 1907 for permission to occupy and use National Forest lands for what was to become the Oak Grove hydroelectric development. A 50-year federal permit was granted on October 6, 1909. Special Use Permits were issued in March and May 1909 by the Forest Service to the S.P. Co. for a construction camp on Three Lynx Creek and use of a right-of-way for a "wagon" road up to and inside the project area. From 1908 through June 1911, the S.P. Co., surveyed and mapped the project, including reservoir sites at Timothy Meadows and Clackamas Lake. The Big Bottom storage site was also investigated. On March 29, 1911, the State Engineer issued permits for reservoir construction at Timothy Meadows and Clackamas Lake.

Fearing competitive aspects of the development, the Portland Railway, Light & Power Company closely watched the progress of the S.P. Co.'s work on the project. Negotiations with the S.P. accordingly culminated in the signing of a contract, on May 3, 1911, under which the P.R.L.&P. Co. would supply all the electric energy required to power the S.P. Co.'s projected 340-mile Oregon electrified railroad system. Under provisions in the contract, P.R.L.&P. Co. assumed all legal liabilities and assets of the Oak Grove development and agreed to pay $125,000 for all S.P. Co.'s rights and interests in the project. They were deeded to the Company on June 29, 1911. Application was later made to the Secretary of Agriculture for a "Preliminary Water-Power Permit" for the Oak Grove project "Dams, Conduits, Reservoirs, Forebay and Power House Site". On May 10, 1912 that permit was issued to the Company, requiring the payment of $2,135 per year for project use of federal lands.

The P.R.L.&P. Co., continued engineering studies for the Oak Grove hydroelectric development. It also maintained stream discharge recording stations from the time of the purchase of the project. Beginning December 27, 1915 and each year thereafter, annual statements of "Water Power Claimant" together with the statutory fee for "Power Claim No. 122" were filed with the State Engineer to preserve the water rights originally acquired by the S.P. Co. (reduced to 600 cfs for the combined diversion from the Oak Grove Fork and Three Lynx Creek). In 1913, a gasoline engine-driven core drilling outfit and supplies were packed into Timothy Meadows from Maupin, and five holes were drilled into the bedrock at the S.P. Co.'s dam site for a storage reservoir. A continuous water stage recorder was installed nearby, and serviced each month thereafter until World War I.

On July 2, 1914, a State Reservoir Permit was issued to the Company by the State Engineer for 40,000 acre-foot storage at Timothy. This was allowed to lapse.

The P.R.L.&P. Co. did not accomplish much work on the project until June 1920, when a survey party was sent into the field to survey an access road alignment following the S.P. Co.'s original plan, starting from a point opposite the North Fork dam site to Three Lynx. The crew was then moved to Big Bottom to make a topographical survey of the reservoir site. A log cabin was subsequently built and a stream gauging station was installed with a continuous recording unit.

Early in 1921, the bold decision was made to proceed with the construction of the Oak Grove project. This involved penetrating a vast, heavily timbered forest area, roadless above the North Fork branch of the Clackamas River. The problem of access alone was costly and time consuming, due to the narrow steep-walled Clackamas River canyon. About 30 miles of new road, followed by a railroad at an investment cost of $1,776,778, was needed for transporting men, equipment and supplies from the end of the electric interurban line at Cazadero into the project area. Nearly 900 acres of timber land had to be cleared and "fireproofed". In 1921, it was probably not realized that the total project cost for the first generating unit of 25,000-kW rated capacity, together with the steel tower, double-circuit 57-kV transmission line to Cazadero, would amount to $9,371,354 by December 31, 1925.

To illustrate the pioneering difficulties in the construction of a project in the Upper Clackamas basin, some construction progress reports will be briefed later.

On July 9, 1921, a crew established a survey camp about 9 miles upriver from Estacada, for construction of the project access road. On the same date, the Forest Service granted a permit for a "wagon" road over lands under their jurisdiction. Application had been made to the Federal Power Commission on June 30, 1921 for a preliminary permit to construct the Oak Grove Fork diversion structures, the Timothy Meadows reservoir, and the Big Bottom storage and diversion from the Clackamas River. The FPC license for Project No. 135 was issued September 22, 1922 for a 50-year period, covering the hydro generating project, but not including storage at Timothy Meadows or Big Bottom. Appropriate applications were also made to the State Engineer for the water diversions and storage. An ultimate development of over 100,000 hp in three generating units was planned, with the first of the units to be in operation by July 1924.

Progress on road construction was very slow: numerous steep rock cliffs and rock slides extended to the river's edge; in one location soft ground required planking on 9,000 feet of roadway; heavy rains fell, accompanied by freezing and thawing conditions; and there was considerable difficulty and delay in transporting supplies and equipment for the work. Narrow-gauge wagons had to be used for moving supplies to the advance camps. By September 1922, nine construction camps were in operation. Two more had been added by January 1923, bringing total housing capacity in the 11 camps to 1,300 men. Many of the camps had sawmills producing lumber and railroad ties. One fortunate development that assisted solution of the project access problem was an agreement with the Union Lumber Company, made November 15, 1921, to build a joint-user railroad extension from Cazadero to the North Fork branch. In December 1922, that electrified extension of the standard gauge railroad line was complete. Subsequently, P.R.L.&P. Co. constructed a steel bridge across North Fork Creek, extending the railroad to the area that is now Promontory Park.

On January 6th and 7th of 1923, high water washed out much of the road grade and two bridges. That misfortune, combined with construction difficulties, resulted in a decision later in January to build a standard-gauge logging-type railroad that would be usable during the winter months. Some 1,900 tons of 45-lb. rail and 10,000 ties were purchased. Another sawmill was installed to produce the many additional ties needed. By May the rail laying was completed to Davis Ranch. Four 50-ton, geared-type Shay locomotives and a number of gasoline-engine-powered speeders were purchased for the railroad operation, which began hauling approximately 132,000 ton-miles per month. Thus, the upper Clackamas River basin was penetrated with the first rapid and convenient means of access upstream from the North Fork.

While the railroad greatly facilitated construction of the Oak Grove hydroelectric project, it also necessitated a costly additional clearing operation. A project construction report of May 1923 stated: "In connection with the railroad, considerable force was expended in complying with the U.S. Forest Service requirements in the nature of clearing along the railroad right-of-way. The U.S. Forest Service regulations were made rather severe and it was necessary to make a clean-sweep of all down logs and debris within certain areas of the right-of-way. The same was also true of the transmission line clearing. On May 25th, two locomotive cranes (rented) and a donkey engine rigged up on a flat car, were put into service pulling logs up into piles. Some 450 men were engaged in this clean-up which included burning all debris". For June, the report was: "Special clearing along the railroad continued . . . This clearing is termed 'Special' as the right-of-way had been gone over once. To satisfy requirements of the Forest Service, it was necessary to go over some of the right-of-way as many as five times". Throughout each fire season, a Shay locomotive, coupled to a tank car of water with steam-driven pumps and long lengths of hoses, was maintained with steam up to operating pressure.

One aspect of the project construction that was not unusual in the 1920s, but would not have been permissible in later years, was the use of "hydraulic giants" to sluice the overburden from the bedrock along the penstock line. For this operation, following removal of trees, Cripple Creek was diverted at about the 2,000-foot elevation into 3,450 linear feet of wood flume and 2,000 linear feet of 14-inch-diameter wood stave pipe. Nearly 100,000 cubic yards of material were removed by the sluicing operation.

In June 1923, at the peak of construction, 1,757 men were on the job, including those engaged in erecting a 9-foot-diameter steel conduit line, under contract with Willamette Iron & Steel Company. Clearing of 285.9 acres for the conduit was completed that August. The Forest Service required that an additional 5 acres outside the project be cleared to replace pasture lands occupied by the line in the Oak Grove Ranger Station area.

A concrete diversion dam on the Oak Grove Fork created Lake Harriet. Although the dam was completed in November 1923, the bypass through it was not closed until June 12, 1924 when the lake could be filled. Fish passage facilities were not required, as two natural 24-foot falls about a mile downstream from the dam blocked fish migration.

Installation of the Pelton Water Wheel Company hydraulic turbine and related valves was started in February 1924, at which time conductors on the transmission line were installed as far as Cazadero and the line was operated at 11,000-V to supply construction power. Prior to that time, from November 1922, the Three Lynx area electric service had been supplied by a 75-kW hydro generator on Three Lynx Creek.

First operation of the Oak Grove 25,500-kW-rated hydro turbine generator was on August 4, 1924. The initial turbine runner, rated at 35,000 hp, soon was replaced with a runner rated 40,000 hp. In 1924, the turbine manufacturer claimed that the Oak Grove plant utilized a Francis-type reaction runner in what: "So far as known, is the highest-head plant in existence . . . ."

A two-room grade school with a second-floor apartment for a teacher was constructed in the Three Lynx village area in 1927 by the grade school district. However, at that time, the only taxable property in the district was owned by the Company which, in effect, provided the school facility and paid all expenses until logging companies moved operations into the area in the early 1940s. For many years, the Company's share of taxes was more than 95 percent until the Estacada Telephone Company began service in the area, reducing the Company share to about 90 percent.

Under a 1929 amendment to the Federal Power Commission license for the Oak Grove project, a diversion was authorized at Big Bottom on the main stem of the Clackamas River. A low dam, to be replaced later with a high dam for seasonal storage of 120,000 acre-feet, would divert the river through a 3-mile-long tunnel and discharge the flow into the head of Lake Harriet. The lake outlet structure for the diversion to the Oak Grove plant was designed to handle the additional water, and provisions were made for a second steel conduit line, 11 feet in diameter, extending to the surge tank. As part of the Big Bottom development, two additional generating units at the Oak Grove powerhouse were planned; also, the project railroad was extended to the tunnel mouth.

Application to the Federal Power Commission for an amendment to the Oak Grove license covering the Big Bottom diversion was made on April 15, 1926. At the same time, application for a water right was submitted to the State Engineer, superseding one dated July 1, 1921. The 3-year delay in obtaining an FPC amendment to license was due to a conflict in water right claims for power and other uses at Austin Hot Springs, downstream from Big Bottom. The owner of this 152-acre property, R. W. Cary, protested plans of the Company for the diversion. The area, in the heart of the Mt. Hood National Forest, had been purchased from the United States by Seth Austen (sic) on May 2, 1903 under a patent deed signed by President Theodore Roosevelt. Cary acquired the property, advertising it in 1914 as "Cary's Hot Springs". In a brochure, Cary referred to the area as "Queen of the Cascades" and claimed that it was "a place of such primeval and unsurpassed beauty that . . . it would become one of the scenic magnets of the Northwest".

In 1914, to reach Cary's development on the upper Clackamas River, one boarded the electric interurban in Portland at 6:45 a.m., arriving in Estacada at 8:30. An 8-mile auto-stage trip to the North Fork area was followed by a 12-mile ride with pack horses to Davis Ranch (then called "Kill Kare Kamp") for an overnight stay. By noon the next day, the hot springs were reached. There, tents were available with cooking facilities.

In July 1928, Cary sold his one-half interest in Austin Hot Springs to the Company. The following month the Company purchased for $10,000 the one-half interest of E. C. Hunt that had been bought from Cary on November 28, 1917.

A second generating unit of 25,500-kW rating, with a 40,000-hp turbine was installed in 1930-31. It was placed in service on March 5, 1931, the Oak Grove powerhouse having been extended to accommodate the installation. A new penstock was built from the three-way branch at the surge tank outlet to the turbine, and two 10,000-kVA transformers were installed for the second generating unit. In the Three Lynx village, ten new cottages to house employee families were constructed. Married men had replaced some of the bachelors in the operating crew. Therefore, because of the remote location of the project, Company housing was needed.

Limitations in the flow capacity of the 9-foot-diameter conduit line from Lake Harriet to the surge tank resulted in a maximum peak capability of 35,000-kW for the two generating units, until the Frog Lake forebay was constructed in 1953.

During 1931 and 1932, construction work proceeded on the Big Bottom tunnel at the discharge end. Some 3,600 lineal feet of tunnel was driven before the work was terminated early in 1932. The Big Bottom Diversion development was maintained in suspense by paying annual fees to the Federal Power Commission and the State of Oregon for a 400 cubic-feet-per-second diversion, until June 26, 1970, when FPC authorization was received to abandon the development as of January 1, 1970. This reduced the Oak Grove project area on Federal lands by 600 acres. The power capacity of the licensed project was reduced by 16,500 hp.

In July 1933, at the request of the Forest Service, the Company agreed* to abandon the project railroad from the Oak Grove Ranger Station to the head of Lake Harriet. A road constructed by the Forest Service followed the grade of this 3-mile-long section, except where wood trestles crossed deep canyons. In 1937, the balance of the railroad was replaced by a PGE-constructed truck road. However, the road around the north side of the surge tank knoll was not built until 1939. Maintenance of a railroad for the light traffic of that period was too costly.

On December 30, 1942, PGE and the Forest Service agreed to a "Memorandum of Understanding" (PGE Audit No. 8711) under which the Forest Service assumed the maintenance and improvement expenses for 19.5 miles of the Oak Grove project road from Cazadero to Whitewater at the junction with the Three Lynx access road. The steadily increasing volume of logs being sold by the Forest Service after 1942 were hauled out over this road, with the result that it was improved substantially at government expense. In the 1960s, the Oregon State Highway Department included the Clackamas River road in its system for maintenance and improvement. PGE was thus left with responsibility for maintaining the Three Lynx-to-Lake Harriet road only.

In 1948, area shortages of peak and energy encouraged the Company to study developments that would increase the systems' generation capability. The first step was the installation of a fifth unit of 5000-kW rating in the River Mill plant. On May 19, 1952 the unit was first operated in commercial service.

In 1952, studies were initiated for the development of additional peak capability for the two Oak Grove generating units. In spite of an aggregate rating of 51,000 kW, they were capable of only 35,000 kW, due to conduit line flow limitations. First considered, was building a 230-foot-high rock-filled dam in the Cripple Creek Canyon, to be used as a regulating reservoir. A more economical solution was the creation of a 430-acre-feet capacity forebay at Frog Lake — a high-elevation location on the 9-foot-diameter conduit line from Lake Harriet — about 11,800 feet upstream from the surge tank. On May 17, 1953, excavation of the forebay began in a valley area enclosed by two homogeneous rolled-earth dikes between two hills. When full, the forebay surface area is 17 acres.

*PGE Audit No. 5396.

Downstream from Frog Lake, 1,160 lineal feet of conduit line were relocated at a lower elevation, permitting an increase in the flow to the surge tank. That increase raised the plant's capability for peaking service to 49,000 kW, although the effective head and efficiency of water utilization was reduced. A portion of the energy loss under peaking operations was offset by the installation of semi-permanent and higher flashboards on the crest of the Lake Harriet diversion dam. To avoid excessive transmission line losses under peak generation conditions, the two circuits from Oak Grove to Faraday were cut over to 110 kV and a third 10,000 kVA transformer was added to the bank that had been provided for the second unit in 1931.

On November 16, 1953, the Frog Lake forebay was placed in service. Ebasco Services, Inc. (EBASCO), was retained as design engineer and construction supervisor of the development. Morrison Knudsen Company was the general contractor.

To increase the energy generation capabilities of the hydro plants on the Clackamas River during low river flow periods from September to April, a seasonal storage reservoir at Timothy Meadows was investigated in the summer of 1952. The dam site selected was about 1,000 feet downstream from the site investigated in 1910 by the Southern Pacific Railroad Company. On September 14, 1953, the Federal Power Commission amended the Oak Grove project license, authorizing the Timothy Meadows storage and the Frog Lake forebay developments. The storage reservoir was renamed Timothy Lake because meadow lands were completely inundated by the project.

In 1953-54, an access road up the Oak Grove Fork canyon from Lake Harriet to Clackamas Lake (about 13 miles) was constructed by PGE under an agreement with the Forest Service and in conformity with their specifications. Clearing of over 60 million board-feet of merchantable timber on the 1,600 acres of timberland included in the reservoir area was started by a contractor on July 20, 1954. It was completed by January 20, 1956 — the completion date of all construction work on the project. A usable storage of 61,740 acre-feet in 65 feet of draft was provided behind a compacted-earth dam 110 feet in maximum height, top width of 40 feet, and crest length of 740 feet. When full, Timothy Lake has a 1,430-acre surface area. It consequently became a very popular recreation lake soon after it was created. Engineering design of the storage reservoir was by Ebasco Services, Inc., which also served as construction supervisor. General contractor on the dam and related structures, the Morrison Knudsen Company, was awarded the contract on May 19, 1954.

**North Fork Project**

In the winter of 1954, nearly half a century after initial investigations of a power site upriver from the Faraday diversion pond, new studies were started for a hydroelectric development named North Fork. The dam site and the surrounding area had been the subject of extensive foundation exploration and preparation in 1911. After an 18-month review of previous investigations and new and comprehensive geologic reconnaissance and topographic mapping, PGE engaged Ebasco Services (EBASCO), on January 27, 1956, to provide engineering design and construction management services. EBASCO was also to provide similar services for the addition of a generating unit at the Faraday plant and for construction of a tunnel and related facilities to provide additional water diversion to the Faraday forebay.

Late in June 1956, applications for state and federal licenses were made; but licensing was held up, pending a solution for anticipated problems with fish. Agreement between PGE and the Oregon Fish and Game Commission as to the scope of facilities for handling migratory fish was reached on August 21, 1956. On September 13, 1956, the Federal Power Commission gave pre-license consent for the project work at North Fork and Faraday. Formalizing that consent, License Number 2195 was issued on January 18, 1957, covering a 50-year period from September 1, 1956. On September 13, the State Hydroelectric Commission issued License Number 202 for the North Fork Project and License Number 203 for the Faraday Addition. Both have the termination date of December 31, 2005.

On September 14, 1956, a general contract for the construction of projects was awarded to the Guy F. Atkinson Company. Excavation for the concrete arch dam and spillway block at North Fork was started in the first week of October.

The excavation revealed a deep gorge in the old river channel at elevation 463, necessitating a 17-foot increase in the height of the dam, to a maximum of 207 feet above bedrock. The arch dam is a thin shell, variable radius concrete structure with a total crest length of 676 feet. The maximum bottom thickness of 32 feet diminishes to a minimum top thickness of 8 feet. At the right, or north, abutment a massive concrete gravity thrust block provides a spillway with a capacity of 150,000 cubic feet, controlled with three large Tainter-type gates. Progress on the project construction was relatively rapid. First placement for concrete for the arch dam was made on April 29, 1957. The final concrete work was done exactly one year later.

Creation of the project reservoir (named North Fork Lake), with a surface area of 350 acres, required the relocation at a higher elevation for 14,700 linear feet of the Oregon City-West Linn domestic war supply line. That conduit for diversion from the South Fork of the Clackamas River, had been installed in 1916 under a perpetual easement (PGE Audit No. 1764) granted November 16, 1915, without charge, by the Portland Railway, Light & Power Company. As part of the North Fork project, nearly 1.5 miles of the forest access road in the vicinity of the North Fork River was relocated by PGE to follow the grade of the Oak Grove project railroad. On May 13, 1936, the U.S. Forest Service had obtained an easement from the Company (Audit No. 3268) granting the right to construct a road downgrade into the reservoir area to a good bridge site over the North Fork, and uphill to the railroad grade in the vicinity of Promontory Park, where the Forest Service installed a "guard station".

A semioutdoor-type powerhouse was constructed to accommodate two 34,500-hp hydraulic turbine generators, designed for 130 feet of net head. On November 24, 1958, the first generating unit was placed in commercial service. The second unit went into service on December 23. Maximum peak capability for the plant is 54,000 kW.

Extensive fish passage facilities, bypassing both the Cazadero (later named Faraday) and North Fork dams, were incorporated in the project.

On April 23, 1965, the FPC license for the North Fork was amended to include the Faraday and River Mill hydroelectric developments, under FPC Project No. 2195.

**Faraday Addition**

Modifications of the Faraday project were necessary to handle the water discharged by two units operating on peaking loads at North Fork. This entailed the construction of a new intake above the original Cazadero dam and a ½-mile-long concrete lined tunnel 23 feet in diameter. The tunnel, replacing an old wooden flume, accommodated approximately twice the original flow. Below the tunnel outlet, the original canal was widened to match the flow capacity of the tunnel. First tunneling operations started May 28, 1957. By August 29, 1958, the last placement of concrete was made.

Adjacent to the original Faraday powerhouse, a structure was provided for a 34,500-hp turbine generator, identical to the North Fork units. A new penstock gate and intake structure was constructed at the forebay, and a 14-foot-diameter welded steel penstock was erected to serve the turbine. On November 3, 1958, the generating unit installation was completed and placed in commercial service. Its peak capability is 25,000 kW.

During the third week of December 1964, a major flood on the Clackamas River severely damaged the timber-crib, rock-filled Cazadero dam.* Another flood, on January 29, 1965, caused its complete failure. A

*See Chapter on "Floods, Ice, and Windstorms".

new arch dam at the site was designed by EBASCO, but in May 1965 plans were changed in favor of a gated gravity structure to be named Faraday Dam. Contractor on the dam construction was C. J. Montag & Sons, Inc. EBASCO supervised the contractor's work.

The job was expedited in order to complete basic construction by October 15, 1965. However, a trench in the river bed some 12 to 15 feet lower than expected caused some delay in placement of the concrete, so the end piers and abutments were not completed until October 28. On November 12, 1965, cofferdam removal was complete. As the drum gates were not available during the 1965 season, a steel stanchion, timber flashboard arrangement was erected on the spillway crest to control the river surface at an elevation permitting diversion to the Faraday forebay. The drum gates were installed during the 1966 low water season. In 1907, the Cazadero dam had been considered "temporary". Over the years numerous new dam sites were studied. The 1964 flood finally settled the issue by scouring part of the foundation area.

In 1971, hydroelectric development of the power potential of the Clackamas River appeared to be concluded. Applying for a new FPC license for the Oak Grove project, the Company stated: "Potential sites on the Clackamas River and its tributaries have been studied; but with present development costs, none of the sites will produce power at a price competitive with nuclear plants. It is further considered that the unique recreational aspects of the Clackamas River basin do not create a favorable situation for additional hydroelectric developments, except for possible pumped storage".

# HISTORY OF

# PORTLAND GENERAL ELECTRIC COMPANY

## 1889-1981

# HISTORY OF
# PORTLAND GENERAL ELECTRIC COMPANY

## 1889-1981

This historical summary of Portland General Electric Company operations during 92 years of public service was compiled by Arthur H. Greisser following his retirement in 1971 as Superintendent of Production for the Company.

Newer history of the Company since 1935 has been combined with information contained in the previously published "Portland Electric Power Company with its Predecessor and Subsidiary Companies 1860-1935" by R. R. Robley.

With a primary objective of providing a convenient reference work, this information has been organized by subject matter. We hope you find it useful and enjoyable.

Published March 1982.