Oregon Historic Site Record

LOCATION AND PROPERTY NAME

address:	30878 NW Evergreen Wy Estacada vcty, Clackamas County (97023)	**historic name:**	River Mill Hydroelectric Project
		current/other names:	River Mill Dam; Station M; PGE; Portland General Electric
assoc addresses:		**block/lot/tax lot:**	/ 01900
location descr:	Less Than 1 Mile E Of Estacada On The Clackamas River	**twnshp/rng/sect/qtr sect:**	3S 4E 20

PROPERTY CHARACTERISTICS

resource type:	Site	**height (stories):**		**total elig resources:**	5	**total inelig resources:**	1
elig evaluation:	eligible/significant			**NR Status:**	Individually Listed		
prim constr date:	1911	**second date:**		**date indiv listed:**	05/10/2001		

primary orig use:	Energy Facility	**orig use comments:**	
second orig use:			
primary style:	Utilitarian	**prim style comments:**	
secondary style:		**sec style comments:**	
primary siding:	Concrete: Other/Undefined	**siding comments:**	
secondary siding:			
plan type:		**architect:**	Ambursen, Nils F
		builder:	Puget Sound Bridge & Dredging

comments/notes:

Less Than 1 Mile E Of Estacada On The Clackamas River; 34E19 00100-23.7 acre TBR; 34E20 02000-47.89 acre TBR, 12.18 acre OS; 34E20 01900-34.1 acre TBR, 26.9 acre RRFF5 River Mill Hydroelectric Project includes Timber Park, River Mill Powerhouse Dam, River Mill Powerhouse, River Mill Gate House/Unloading House, River Mill Fish Ladder, River Mill Spillway Dam, River Mill Park Structures, River Mill Substation, and River Mill Reservoir (Estacada Lake). *****NOTE: Not all of these are contributing to the NR-listed resource (River Mill Hydroelectric Project).***** All on Clackamas River. FERC studies on shelves. River Mill NR-listed. To view resources within the River River Hydroelectric Project, enter "River Mill Hydroelectric Project" into the "Cluster Name" searchbox.

GROUPINGS / ASSOCIATIONS

Survey/Grouping Included In:	Type of Grouping	Date Listed	Date Compiled
Clackamas County Historic Landmarks	Survey & Inventory Project		2008
Clackamas River Hydroelectric Project	Survey & Inventory Project		2003

Farmstead/Cluster Name: River Mill Hydroelectric Project

SHPO INFORMATION FOR THIS PROPERTY

NR date listed:	05/10/2001	**106 Project(s):**	None
ILS survey date:	07/15/2008	**Special Assess Project(s):**	None
RLS survey date:			

Federal Tax Program

Status	Start	Compl
Complete		

ARCHITECTURAL / PROPERTY DESCRIPTION

(Includes expanded description of the building/property, setting, significant landscape features, outbuildings and alterations)

PHYSICAL DESCRIPTION AS DESCRIBED IN NR NOMINATION: The River Mill Hydroelectric Project is located on the Clackamas River, slightly less than a mile east of the city of Estacada, in Clackamas County, Oregon. Estacada, the sole incorporated city in the so-called "Upper Clackamas Valley," was established in 1905. The development is located at 30878 NW Evergreen Way off River Mill Road, east of State Highway 211, and primarily located within the channel of the Clackamas River, a year-round river that begins in the mountainous area to the southeast and drains into the Willamette River near West Linn. The River Mill Hydroelectric Project consists of several related components, including the powerhouse, powerhouse dam, spillway dam, fish ladder and various in-stream features. A non-historic but associated recreational area is located on the eastern bank of the river, adjacent to the generation plant. River Mill was built between 1910 and 1911 at a cost of just over one million dollars. Puget Sound Bridge and Dredging Company, of Seattle, Washington, served as the general contractor and Sellers and Rippey, consulting engineers of Philadelphia, were in charge of the overall design. The spillway and powerhouse dams were designed by Nils Ambursen, of the Ambursen Hydraulic Construction Company of Boston, Massachusetts. Portland Railway Light & Power Company [PRL&P], the project developer, served as its own contractor for the installation of the generation equipment and through its various successors continues to own and operate the project today. The individual resources within the River Mill Hydroelectric Development, all built in 1910- 1911 unless otherwise noted, are: Powerhouse Dam: Located on the east bank of the Clackamas River, the powerhouse dam is an Ambursen-type structure approximately 173 feet in length, supporting the power and gate houses. Overall height at the downstream face is approximately 86 feet. The hollow interior of the structure is composed of a series of poured-in-place buttresses spaced on 14 to 18-foot intervals, with horizontal supporting members and concrete slabs forming the up- and downstream faces. Interior finishes include the rough form marks and put-log holes remaining from the false work of construction and the interior is accessed via a narrow suspended walkway that runs the length of the dam. Two basic internal-bay variants exist, those with and those without penstocks, the massive 9-foot diameter, riveted-steel pipes that channel water from the forebay into the turbines. At the direction of the Federal Energy Regulatory commission [FERC], the Powerhouse Dam is undergoing structural remediation to provide sufficient seismic capacity during a Maximum Credit Event. The Powerhouse Dam is counted as a contributing structure in Section 5. Powerhouse: The powerhouse is a large cast-concrete structure built above the powerhouse dam. A three-story, rectilinear-volume set perpendicularly across the river channel, the powerhouse is simply detailed with engaged, cast-stringcourse lines, sills, and cornice. Engaged columns and other architectural elements accent the design. The flat roof of the powerhouse is augmented by twin hipped skylights, re-roofed in non¬historic standing-seam steel, cl970s. The interior power floor, holding the generation equipment, is lit by two banks of original, industrial-steel fixed and pivot-sash multi¬-pane windows. River Mill was designed for five turbines; Units 1, 2 and 3 were installed during initial construction and remain. Unit 4 was added in December 1927 and the fifth and final Unit, 5, was installed in 1952, yielding a total peak capacity of 23,000 kw. All units remain in operation. The interior of the powerhouse remains largely intact, with concrete flooring, walls, and similar industrial finishes. Two upper bays are created by the continuation of the dam buttresses, with lateral walkways providing access. An original-appearing wrought-steel gate with arrow-tipped verticals guards access to this area. The Powerhouse is counted as a contributing structure in Section 5. Gate House/Unloading House: Extending to the east and south of the powerhouse, and built above the powerhouse dam, the Gate House/Unloading House is a multi-story concrete structure comprised of two basic parts. The Unloading House, a two-story poured concrete volume, is located at the extreme east, providing access for equipment delivery via a large non-historic roll-up door. Windows are original, industrial-steel fixed and pivot-sash with multi-pane windows. Engaged columns and a finely detailed cornice line, with arched parapet on the east, cap the volume. On the east elevation, facing the parking-access area, a bowed parapet is highlighted by an incised "1911" date block. The roof, hidden behind the parapet, is a shallow gable. Interior character is largely intact, with open steel trusses and a large gantry crane, concrete flooring, painted steel railings and similar industrial features. A spiral stairwell and open-screen elevator remain, providing access between levels. The Gate House, located upstream, behind the powerhouse and to the west and continuing from the Unloading House, is a multi-story, cast-concrete structure with simple detailing, including the same metal windows and modest cast decoration of the remainder of the project. The interior is dominated by the five large steel rack and pinion-head gate assemblies, below an open steel truss roofing system. An outside deck provides access and operation of the trash racks and removal system, to clean the upriver forebay. The Gate House/Unloading House is counted as a single contributing structure in Section 5. Fish Ladder: The Fish Ladder is a square-sided concrete structure that rises from the downstream elevation through a series of elevated "switchback" turns to allow upstream migrants to bypass the River Mill Dam. The ladder is box-shaped in section with an open, wire-mesh-protected top. The ladder was originally built in 1911-13 as an element of the original development. It has been serially modified to improve its function, the most recent major repair occurred in 1971, but retains high integrity to its historic appearance and character. The Fish Ladder is counted as a contributing structure in Section 5. Spillwav Dam: Along with the powerhouse, the River Mill spillway dam forms the dominant visual elements of the development. Located between the powerhouse dam and the west bank of the Clackamas River, the spillway dam is 406 feet long and approximately 73 feet in height. A 54-foot wide non-overflow section divides the spillway dam from the powerhouse dam. Designed by Nils F. Ambursen, of the Ambursen Hydraulic Construction Company, the inventor of the slab and buttress or "Ambursen" dam, the River Mill dam consists of twenty-two cast concrete buttresses (varying in width from 15 inches to 72 inches, depending on location) set parallel to the river channel at intervals of 18 feet center-to-center, except for the 10-foot spacing between Buttresses A and B. Cast-concrete slab sections form both faces of the spillway, with interior cast-concrete corbels and lateral cast-concrete struts providing additional support. A narrow cast-concrete walkway, with steel guard rails, runs longitudinally the entire width of the dam, piercing each buttress via a chamfer-edged opening. The walkway terminates at the west bank, where a small ladder rises to an access tower. Spaces between the buttresses (bays) are essentially open to bedrock, above and below the suspended walkway, creating an essentially open interior core, the key characteristic and advantage of the Ambursen design. Various repairs and modest alteration of the spillway dam modify the original "as built" construction. These include a major resurfacing of the up and downstream faces of the dam with an additional layer of concrete. In 1967, the abutment height was raised 8 feet with cast concrete walls, increasing overall capacity of the reservoir and providing additional flood protection. Neither change deviates in any significant way from the historic character. Like the Powerhouse Dam, the Spillway is being structurally strengthened at the direction of the Federal Energy Regulatory Commission [FERC], to provide sufficient seismic capacity during a Maximum Credit Event. The Spillway Dam is counted as a contributing structure in Section 5. River Mill Park Structures: River Mill Park is a small company-owned day use area on the Clackamas River on the east bank, adjacent to the hydroelectric development. A number of small wood-frame structures provide support and storage services, the largest of which is a 20-foot by 10-foot gable structure that serves as restroom. The restroom, wood frame with board and batten siding was apparently built in the 1960s as part of Portland General Electric's system-wide expansion of recreational opportunities. Other structures within River Mill Park include picnic benches, rock fireplaces, and similar recreational facilities. Although located within the River Mill Project as generally defined, none of the park area structures share associations with the original development period and the park is counted as a single non-contributing site in Section 5. ALTERATIONS AS DESCRIBED IN NR NOMINATION: The River Mill Powerhouse is built in-line with the dam and spillway, jutting out into the main channel of the Clackamas River. A massive, multi-story, concrete volume, the modest classical detailing of the powerhouse is virtually unchanged from its original construction more than 80 years ago. Designed for five generation units, only three were installed at River Mill by the end of 1911. The fourth unit was added in December 1927 and the fifth and final unit was not installed until 1952. This completed the generation facilities and raised the total peak capability at River Mill to 23,000 kw. Various other equipment improvements in the mid-1950s slightly modified the plant as well. (Greisser, 1972:38) Identified changes to the powerhouse are limited to the painting from the original raw concrete to the present beige in October 1972 and the installation of a new aluminum-coated roof in May 1974. (PGE, River Mill VF). The exterior painting also resulted in the loss of the painted plant identification sign, similar to that at Oak Grove, that was located on the parking lot facade (below the incised "1911" block). Various system alterations, particularly the concrete addition to the flood wall, were also constructed in 1966 as part of the spillway upgrade described below. (Greisser, 1982:39) The concrete fish ladder at River Mill, stepping up the face of the dam in a series of right ¬angle turns, was completed in 1913 and considered a model design for its day. In 1970, Harza Engineering assisted PG E in a major modification of the fish ladder at River Mill and Parker Northwest, of Oregon City, served as the contractor for the $580K project. (PGE Bullseye, Oct 1970:5 and Oct 1971:5) "Its entrance has been modified several times in order to improve fish attraction; the most recent upgrades of the ladder were done in the mid-1980s." (PGE, Hydroelectric System, c199S:11) The Ambursen-type Spillway Dam has been periodically repaired since its original 1911 construction, most notably in 1939 when it was "re-faced" with an additional layer of concrete. (PGE Files, River Mill Photo Binder) The only other identified change to the River Mill Dam is the 1966-67 increase to its spillway capacity, via the construction of 8' extensions to the abutments and wing walls on the upriver side so that the older structure could match the capacity of the North Fork Spillway. This work was designed internally by PGE's own Construction-Coordinating Department. (PCE Bullseye, May 1967:4) SEISMIC REMEDIATION PROJECT The River Mill Hydroelectric Project is operated by Portland General Electric and continues its historic use as an electrical generation facility as a part of Federal Energy Regulatory Commission [FERC] Project License No. 2195. Well-maintained and generally unmodified in any significant way since its construction, correction of structural deficiencies inherent in the Ambursen design of River Mill's powerhouse and spillway dams have been mandated by FERC to assure integrity and public safety during a Maximum Credible Earthquake. These deficiencies were first reported by Raytheon, working under contract to PGE, in 1996. Primary deficiencies were the bending capacity of the buttresses against lateral loads and the shear strength of the corbels that tie the upstream "slabs" of the dam face to the interior buttress system. Additional study of the buttress concrete in 1997 found its strength and elasticity to be less than previously thought, adding to the need for remediation. Raytheon published its report "Feasibility Study for Structural Remediation of the River Mill Development" in June 1998. Several options to strengthen the capacity of the powerhouse and spillway dams at River Mill were evaluated from structural and economic standpoints, as well as for impact on the character-defining features of the historic design and the final design as been previously documented both as part of Section 106 review and under the Historic Preservation Certification process as part of PGE's on-going application for Certified Rehabilitation. Required remediation will correct the structural deficiencies of the powerhouse and spillway dams at River Mill using a combination of techniques. The powerhouse dam, where issues are compounded by the design of the powerhouse and related facilities, will be solidified using a modified concrete infill strategy that will largely reduce the present open character of the Ambursen design. On the spillway dam, however, a diaphragm wall and reinforced concrete pilaster system has been designed that will correct the present structural issues while retaining to the greatest degree feasible the open interior character of the Ambursen form, including the longitudinal walkway, and open bays. As a part of the overall rehabilitation program, in conjunction with the seismic correction to the dams themselves, the historic River Mill Powerhouse will be substantially renovated and restored as detailed below, including a return to the historic exterior gray tones, window and glazing restoration, and exterior masonry repair. Completion of the proposed rehabilitation of the River Mill Hydroelectric Project will result in a thoroughly renovated facility that both meets current functional and safety requirements while clearly relating its original design character and the associations which make it a significant resource in the Clackamas region.

HISTORY

(Chronological, descriptive history of the property from its construction through at least the historic period - preferably to the present)

AS DESCRIBED IN THE NATIONAL REGISTER NOMINATION: The River Mill Hydroelectric Project, built in 1911 by the Portland Railway Light and Power Company, consists of an assemblage of concrete industrial structures spanning the channel of the Clackamas River in the vicinity of Estacada, Oregon. In continuous operation as a hydroelectric generation facility since construction, the River Mill Hydroelectric Project retains high integrity and effectively relates its original construction and the associations for which it is significant. The River Mill Hydroelectric Project, built in 1911 by the Portland Railway Light and Power Company and operated by its successor Portland General Electric, consists of an assemblage of concrete industrial structures spanning the channel of the Clackamas River in the vicinity of Estacada, Oregon. In continuous use for its original function as a hydroelectric generation facility since construction, the River Mill Hydroelectric Project has experienced modest alteration and improvement related to improved safety and operational requirements. The project retains very high integrity in use of materials, workmanship, feeling, location, setting, and effectively relates the associations for which it is significant under Criterion "A." The design of the facility, including the earliest known Ambursen-designed hydroelectric dam in the west, although modified to improve seismic performance, nevertheless retains the open interior character that defines the type. As such, the River Mill Hydroelectric Project, including the modified Spillway and Powerhouse dams, retains sufficient integrity to relate the original project design and the associations for which it is significant under Criteria "A" and "C" for listing in the National Register of Historic Places. The River Mill Hydroelectric Project, completed in 1911 and used continuously as a hydroelectric generation facility for nearly nine decades, is significant for its role in the development of the Clackamas River Valley and the expansion of the early electric trolleys that provided improved access, sett1ement and economic development to this region during the first quarter of the 20th-century. Designed by noted hydroelectric engineer, the hollow slab and buttress dams at the River Mill Hydroelectric Project are additionally significant as the oldest hydroelectric-related examples of the Ambursen type on the Pacific Coast and the best known examples in the region to have been designed by the inventor of the form, Nils F. Ambursen. CONTEXT: The Rise of Electrification Throughout the first three-quarters of the 19th century industrial development, and to a large extent community building, was substantially the result of proximity to water. Rivers, lakes, and ocean ports provided towns with ready access to goods by providing economical water-based transportation. Flowing water, long a source of motive power for small industrial uses such as water-driven mills, reached a pinnacle of functionality in the 1840s with the development of large-scale systems such as that at Lowell, Massachusetts. In the post-Civil War era, as the Industrial Revolution firmly took hold in the United States, major improvements in transportation and power-generation technologies brought sweeping change to the character of American cities and how they developed. Key among these "modern" improvements was the early-1880s invention and construction of entirely new systems for the generation and distribution of electrical power. Once established, the ready availability of electricity freed American industry from the limited water-based sites then available and greatly expanded the economic base of the nation. Beginning in the late 1880s and early 1890s, the development of electrified interurban transportation systems, coupled with the widespread adoption of home lighting and new labor-saving electric appliances, changed the daily life of the typical American as has little before or since. In the year following Thomas Edison's 1879 demonstration of an incandescent lamp at his Menlo Park laboratory, a series of rapid advances led to the development of commercially viable electrical generation and distribution systems that could be constructed around the nation and dozens of entrepreneurs entered sought to capitalize on the birth of a new and promising industry. In 1880, one of the earliest hydro-electric turbines was installed in Grand Rapids, Michigan, soon followed by a system at Niagara Falls, New York. Electric Generation and the Development of the Clackamas River Area Settlement in the Clackamas River valley, often called the "Estacada County," was limited throughout Oregon's pioneer period, with sparse homesteads along the Barlow Trail and scattered attempts at agriculture in the narrow creek valleys that feed the river. In the 1840s, the Currin brothers built a cabin south of Eagle Creek and established a store near what eventually became known as Currinsville, marking the first permanent settlement in the area. In 1859, a bridge across the Clackamas River was established near the mouth of Eagle Creek, "...where an island with riffles made shallower water," (Dillon: cl936). Cyclically replaced and improved following flooding and increasing use, this bridge crossing remained a focal point for transportation across the river through the remainder of the 19th century and ultimately served as the focus for the establishment of the town of Estacada. (Lynch, 1973:271) The development of the City of Estacada, even today the sole incorporated community in the upper Clackamas region, is integrally linked to the generation of hydroelectric power on the Clackamas River. In the latter years of the 19th century, Portland grew increasingly reliant upon an extensive network of trolleys for transportation and, predominately running upon electricity, this network spurred intensive needs for increasing electrical capacity in the region. As the output of smaller plants was over-extended, new sources on the Clackamas came to the fore and in 1901, George W. Brown, chief engineer of the Oregon Water Power Railroad Company, set out to explore the upper Clackamas River country for potential water power sites. On the homestead of John Zobrist, whom Brown had conveniently employed as a guide, he ". . . found a spot where the current was swift and the location looked ideal for a dam." (Lynch 1973:356) Brown enticed Frederick Morris, of Morris Brothers Investment Bankers, a prominent Portland firm with previous experience in financing railway development, into financially supporting the concept, and plans were made for the construction of a dam and hydroelectric facility. First, Oregon Water Power hired L. R. Meyers to build a railroad line to the dam site, to be known as "Cazadero," that would allow for both the transport of construction materials in and shipment of locally milled timber goods from a mill the Morris established in the area. O. B. Coldwell, then a vice-president of the Oregon Water Power Railroad Company, named the new dam "Faraday" after the famed scientist. In 1903, the power company filed a plat for a new townsite near its development, built a hotel at the end of the railroad line, and encouraged "excursion" use to promote development in the Upper Clackamas area. The City of Estacada was incorporated in 1905. Various stories documenting the origin of the name of "Estacada" cloud its true origin. "Estacada is a Spanish word and means “staked out, or marked with stakes” and the principal use in the United States is in northwestern Texas. The Spanish name refers to the trunks of an upright desert plant that remain standing like stakes or poles. The name was used in Oregon because it had a pleasing sound with no thought of its original significance." (McArthur, 1982:260) The most reliable account of the city's moniker credits its origin to George J. Kelly, an employee of Mr. W. P. Keady, the right-of-way and land agent for the Oregon Water Power Townsite Company, an element of the power concern. In December 1903, at a meeting in Keady's office, Kelly suggested naming the town Estacado. Some versions claim that an error in the engineering department when drafting the town plat, resulted in the change to a terminal "a' while other sources claim that Kelly himself was responsible for the change. While the initial hydroelectric development on the Clackamas was begun by the Oregon Water Power Railroad Company, it was a larger firm, formed by the merger of OWPRC and the Portland General Electric Company, among others, that would actually see the first transmission of hydropower from the Upper Clackamas, beginning with the construction of the Faraday or "Cazadero" plant in 1907. Four years later, again faced with increasing demand the second plant on the Clackamas, at River Mill, was completed. PCE & Predecessor Corporate Context Portland had early shown an interest in the generation of electric power and its potential uses. Entrepreneur Henry Villard (principal of the Oregon Navigation and Railroad Company, for a time the owner of the canal at the Willamette Falls) had traveled to Edison’s workshop in 1880 and witnessed the inventor's first public demonstration of the incandescent lamp. Villard saw the potential of electricity as a spur for massive economic development in Oregon and determined to promote its use. For his return to Portland, Villard had Edison outfit his ship, the Columbia, with a dynamo and a series of brush arc electric light, Edison's first commercial order for electric generation equipment. (Tollefson, 1987:20) Docking the Columbia near downtown Portland, Villard had wires run from the ship to the Claredon Hotel and advertised the "blazing" new lights to an enchanted city. “The powerful rays lighted up the whole neighborhood to the brightness of day. Thousands visited the light and the vessel.” (Oregonian, 4¬September-1880) Demand for electric power, almost exclusively for lighting, swept Portland. Soon various industrialists hooked generators to their internal power plants and offered limited power to light offices and homes in the downtown. Most of these early attempts at electrical generation used steam and the power served only a limited area and was usually available only in the evening. In 1888, two early area-power providers, the Oregon City Electric Company and the United States Electric Lighting and Power Company, joined forces, merging the teeming customer base of the Portland area with the seemingly inexhaustible supply of power available at the Willamette Falls. “A very important step in the entire future of the electrical industry was taken when in November, 1888, Oregon City and Portland capitalists united in the organization of the Willamette Falls Electric Company, with [E. L.] Eastham as president and Parker Morey as superintendent.” (Coldwell, 1941:289-90) The pioneering efforts of the Willamette Falls Electric Company between 1889 and 1890 firmly established the potential of the Willamette Falls as the major source of electricity for the city of Portland. Beginning in 1893 and 1895, the reorganized and expanded company (now known as the Portland General Electric Company) built a second, significantly larger plant, known as Station B. By 1903, Station B provided Portland General Electric with the vast majority of its power, and boasted a capacity of 5,730 kW. (Greisser, 1982:6-7) By the early 1900s, the role of electric-powered trolleys became increasing significant in the development of Portland and its surrounding communities. New organizations sought permits to operate such networks within the city and Portland General Electric, which provided power not only for its own trolleys but also sold electricity to its competitors, faced ever increasing demands on its generating capacity. This was exacerbated by the crowning success of the 1905 Lewis and Clark Exposition, overseen in large part by Henry W. Goode, President of Portland General Electric after Parker Morey's retirement in 1902. Goode's involvement and the demonstrations of electrical appliances and lighting at the fair brought additional respectability to the company and increased ownership of the new "labor-saving devices" of the era. Portland's population also boomed following the Exposition, as area visitors chose to relocate and invest in the rapidly advancing community. “Not only did [the Exposition] 'place Portland on the map,' so to speak, but it achieved the greatest financial success of anything of the sort ever held in Oregon…over 2,500,000 visitors passed through the portals, including 135,000 from east of the Mississippi River.” (MacColl, 1976:261) Against the backdrop of the rapid growth of Portland and the Willamette Valley, an area increasingly reliant on its extensive network of interurban railroads, the need for additional generation capacity in the early years of the 20th century created a serious competition among varying interests. One of the largest of these was the Oregon Water Power & Railway Company. “The potential for power development on the Clackamas River was recognized at the turn of the century. [Its] power sites were in relatively close proximity to Portland and to projected electric interurban lines. Thus, surveys were started in June 1901.. .and in 1902 property acquisition began for the hydroelectric generating project then named Cazadero. (Greisser, 1982-35) As already noted, the Oregon Water Power Railroad Company established the new city of Estacada as the terminus of its wood-burning steam railway line running east from Portland and was offering low-cost excursion and tourist fares to the community as early as 1902, building ridership and freight traffic in anticipation of the construction of its power plant. In the early years of the 20th century, Parker Morey and Portland General Electric Company, still the largest of the area's electrical providers, did not stand idly by while its competitors explored new sources of generation. Between 1900 and 1910, Portland's population grew over 100%, from 90,426 to 207,214 with similar rates of growth throughout much of its surrounding area. (State of Oregon, 1914: 147) Uneasy with his company's complete reliance on the Willamette Falls plant, Morey had begun development of "Station C," a steam plant in northwest Portland, in 1901, and Stations "D" and “E," also Portland steam plants, between 1904 and 1905. Morey's successor Henry Goode, perhaps sensing the potential growth to be brought about by the Lewis and Clark Exposition, set in motion of series of events that would greatly expand the company's generation capacity. Chief among these would be the creation of the Portland Railway Light & Power Company, formed in 1906. The Portland Railway Light & Power Company was a truly massive enterprise for its day. Capitalized with substantial eastern monies, the new utility company combined the assets and operations of Portland General Electric with the Oregon Water and Power Company, the Portland Railway Company, and a number of other firms that in total represented the combined interests of more than thirty-six earlier railway operations, power providers, and related entities. Essentially, the formation of the Portland Railway Light & Power Company established a complete monopoly on such services in the greater Portland area. “Every electrical light, power and traction company in the lower Willamette Valley has been merged into one vast consolidation of interests. Every mile of electric railway, every horsepower of electric energy generated within a 5O-mile radius of Portland, have been brought under the same ownership and will be operated by one management." (Oregonian, 4-May-1906) By joining with the Oregon Water Power Railroad, the former Portland General Electric Company fell heir to the potential of the Clackamas River and immediately took over the on-going hydroelectric development at Estacada, rushing to complete a plant to augment its overburdened Station B at Willamette Falls. Once Station "G", the Faraday plant, was completed in 1907, the railway line to Cazadero was electrified and service to the Clackamas Valley area was dramatically improved, spurring increased development. (This initial generation facility on the Clackamas was first known as "Cazadero," then re-designated Station "G" and finally termed "Faraday," the name by which it is currently known.) Increased settlement and commercial development in the Estacada area during the first two decades of the 20th century was aided, in large part, by the efforts of the Portland Railway, Light & Power Company itself. (The corporate identity created by the 1906 Portland Railway, Light & Power Company name is fairly indicative of the company's priorities and self-image. This was largely a transportation company, that providing lighting and generated power solely as a means toward efficiently providing those services to its riders and customers.) The company, which owned substantial lands in the region, sought to increase settlement and commercial use both to sell property and create a steady commuter volume that would help offset its own use of the line for freight and service. Toward that end, Portland Railway Light & Power offered special weekend fishing and recreational packages on its Estacada line and published promotional leaflets throughout the first decade of the century. One, titled Health: Wealth & Happiness on Ten Acres, was published in 1908, only a short time after the completion of the Faraday plant, to encourage residential development. “The building of this railroad throws open to the homeseeker a veritable paradise of opportunity where he may realize the fondest hopes of his dreams - whether it be a cosy (sic) home on a ten-acre tract within a few minutes ride from the heart of this big city, or a more extensive farm, or a dairy ranch, ora fruit orchard, or a poultry ranch, or land for any other purpose...” (PRL&P Co., 1908) In the years before Henry Ford's production of the Model "T," the first truly affordable automobile for the average American, electric trolleys and railroads formed the backbone of the nation's transportation system. This was especially true in the far-flung, young, cities of the western United States and Portland was a classic example of the phenomena. One of the major entities that joined to form Portland Railway Light & Power, was the Portland Railway Company, a concern that in 1906 included the assets of twenty-eight separate predecessor lines dating back to 1882. (Wollner, 1990:69) In its heyday, Portland's railway system was a major element of the city's character and daily life. “The presence of the trolleys on city streets, and in the countryside, at least for the first fifteen years of the new century, represented convenience, adventure, and freedom. Trolleys did what machines should do - they made life easier and better. They were quick, clean, and cheap. By all accounts, Portland Railway Light and Power owned one of the best, most complete railway systems in the country.” (Wollner, 1990:80) By 1922, in the twilight years of Portland's electric railway period, the Portland Railway Light & Power Company boasted that its trolleys served an area of over 800 square miles, with 32 separate city street car lines and four interurban lines, offering a combined 341 miles of track. “In 1922 [Portland Railway Light & Power Company] carried 90,156,701 revenue, transfer and free passengers on its city lines and 3,474,013 [passengers] on its interurban lines for a total of 93,900,714 passengers.” (PRL&P, 1922) THE RIVER MILL DEVELOPMENT In December 1909, the Portland Railway Light & Power Company acquired from the Portland Water Power and Electric Transmission Company and the Morris Brothers some 1642 acres of property and the development rights near Estacada that would eventually become the River Mill Hydroelectric Development. The construction of this facility, to be the company's second on the Clackamas River, would augment the Faraday development at Cazadero and help meet the ever-increasing demand for power being placed on the company's system. “The railway company will proceed at once with the development of the water power plant on the property acquired near its Cazadero plant and expects to have it in operation by September 1, 1911. [According to B. F. Joselyn, President of the Portland Railway Light & Power Company], "It is possible that the dam to be erected at the Estacada, or Morris site, will be of hollow concrete construction, a departure in dam building. On my trip East, I went to Ellsworth, Maine and inspected a hollow concrete dam in use at that point and found it to be giving perfect satisfaction and its cost materially less than that of a solid concrete dam." (Oregonian,3-December-1909)(Nils F. Ambursen design for a slab and buttress or "hollow" dam at Ellsworth, Maine for the Bar Harbor Power Company was completed in 1907. (National Dam Inventory, 10 #ME00026) Built as Joselyn anticipated of hollow "flat slab and buttress," construction, the River Mill Dam is more correctly termed an "Ambursen" dam after Nils. F. Ambursen, the engineer who patented this influential design. Puget Sound Bridge and Dredging Company of Seattle, Washington served as the general contractor and Sellers and Rippey, consulting engineers of Philadelphia were responsible for the design of the project. The spillway and powerhouse dams themselves were designed and licensed by the Ambursen Hydraulic Construction Company of Boston, Massachusetts. The Portland Railway Light and Power Company served as its own contractor for the installation of mechanical and electrical equipment. The River Mill Dam is 936 feet long spanning the Clackamas, and stands 85 feet high. The spillway section is 405 feet wide, including splashboards. Construction of the River Mill dam was begun in June 1910 and completed eighteen months later in November 1911. (Greisser, 1982:38) The total cost of the dam was $1,011,746.29. (PG E Files, 5-23-1912). “Upon its completion, the River Mill project gained immediate notoriety for its design "...for the rapidity of its construction, considering the exceedingly substantial manner in which its is built, and for the fact that it employs the first Ambursen type of dam for power plant work on the Pacific Coast." (Journal of Electricity, Power and Gas, 4-January¬1913, as cited in Greisser, 1982:38) NILS F. AMBURSEN AND THE "HOLLOW' DAM During the 1895-1915 period of hydroelectric expansion in the United States, dubbed "Innovation and Experimentation" by historian Duncan Hay, a variety of attempts were made to both increase capacity of hydroelectric facilities while lowering costs and shortening times in the construction of badly needed new plants. One innovation of lasting impact was the invention of the hollow-core slab and buttress dam by engineer Nils F. Ambursen. Born in Frederickstad on 6-February-1876 and educated at the Civil Engineering College at Skien, Norway, Ambursen migrated to the United States by 1896 and became a naturalized citizen in March 1902. Gaining experience in dam construction as an employee of the B. F. Sturtevant Company, in 1903 Ambursen designed the Theresa dam, the first concrete slab and buttress dam ever, for Snell and Makepeace at Theresa, New York. (AJI information on Ambursen and the Ambursen Construction Company, unless otherwise noted. is to.ken from N. F. Ambursen, Condensed Record of Education, Training, and Experience, 1934, as supplied by Ambursen's daughter, Mrs. Frances A. Ambursen, of Mitchellsville, Maryland.) “.. . buttress dams act as gravity structures but are designed to take advantage of the vertical component of water to achieve structural stability. The amount of material in the dam is reduced by building a series of discrete buttresses spaced from 15 to 70 feet apart. The inclined upstream face is then built across the front of these buttresses . . .As a result, buttress dams are often referred to as hollow dams because of the hollow spaces between the buttresses. . . The earliest flat-slab buttress dams were designed by Nils F. Ambursen and his company, the Ambursen Hydraulic Construction Company, hence they are often called Ambursen dams. (Jackson, 1988:50-51) Following the completion of the Theresa Dam, a description of the new design was published in the November 1903 Engineering News Record. "The article created such widespread interest amongst engineers and others hat I found it necessary to organize the Ambursen Construction Company." (Ambursen, 1934) Joining forces with William L. Church, a Professor of Civil Engineering at LeHigh University and formerly a partner in Westinghouse, Church, Kerr and Company, Ambursen filed a patent on the new dam that bears his name. "While with the Ambursen Company, I held the position of vice-president and Chief Engineer, and was in full charge of all engineering and construction...No plans nor contracts could be executed without my approval." During its existence under the original partners from late 1903 through 1917, the Ambursen company built more than 100 dams in North America and the design gained a substantial reputation. In 1917, following his invention of a system of steel forms for building construction, Ambursen left the firm and established the Uni-Form Company, soon purchased by Blaw Knox of Pittsburgh, Pennsylvania. In 1922, Ambursen returned to private practice, consulting on the design of hydroelectric facilities for a wide variety of clients. These included the Ambursen Hydraulic Construction Company although he retained no formal association with the firm after 1917. (See S. W. Stewart, President, Ambursen Hydraulic Construction Company, "Copy of Recommendation" 12-August-1 933. Nils F.) Ambursen died in Washington D.C. at 81 years of age in January 1958. According to information compiled by Mr. Amburs.en in 1934 under the heading "Partial List of Construction Projects with which N. F. Ambursen has been identified," he was involved with projects ranging from a storage lake in British Columbia to a hydroelectric facility for the Puerto Rico Light and Power Company. The bulk of Ambursen's work, however, was located in the eastern Untied States, particularly in the Northeastern states of Maine, New York and New Hampshire. The River Mill Dam is the oldest, and apparently sole surviving, of the three identified Ambursen projects in the United States built west of the Rocky Mountains. (The others are a hydro-electric facility for the Big Horn Power Company in Shoshone, Wyoming and an irrigation dam for the La Prelle Reservoir and Ditch Company in Douglas Wyoming. Neither appear to survive. It should be noted that while not directly identified with Ambursen, at least one "slab and buttress" hydroelectric dam in the western United States is identified in FEMA's National Dam Inventory is listed as pre-dating River Mill; the low-head 1907 Shoshone Falls Dam in Jerome County, Idaho. (See National Dam Inventory, NID #ID00050) There are a total of 79 slab and buttress hydroelectric dams, or less than one-half of one percent, within the 75,000+ identified dams in the United States.)

RESEARCH INFORMATION

Title Records	Census Records	Property Tax Records	Local Histories
Sanborn Maps	Biographical Sources	✔ SHPO Files	Interviews
Obituaries	Newspapers	State Archives	Historic Photographs
City Directories	Building Permits	State Library	

Local Library:		**University Library:**	
Historical Society:		**Other Respository:**	National Register nomination

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