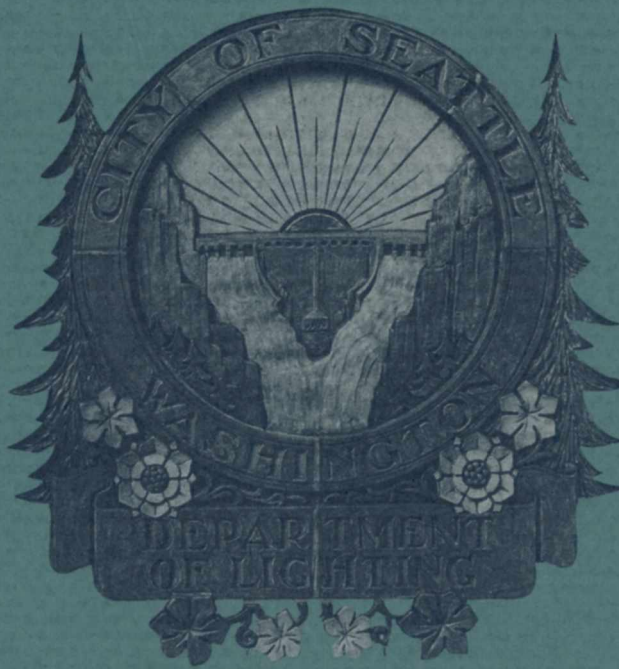


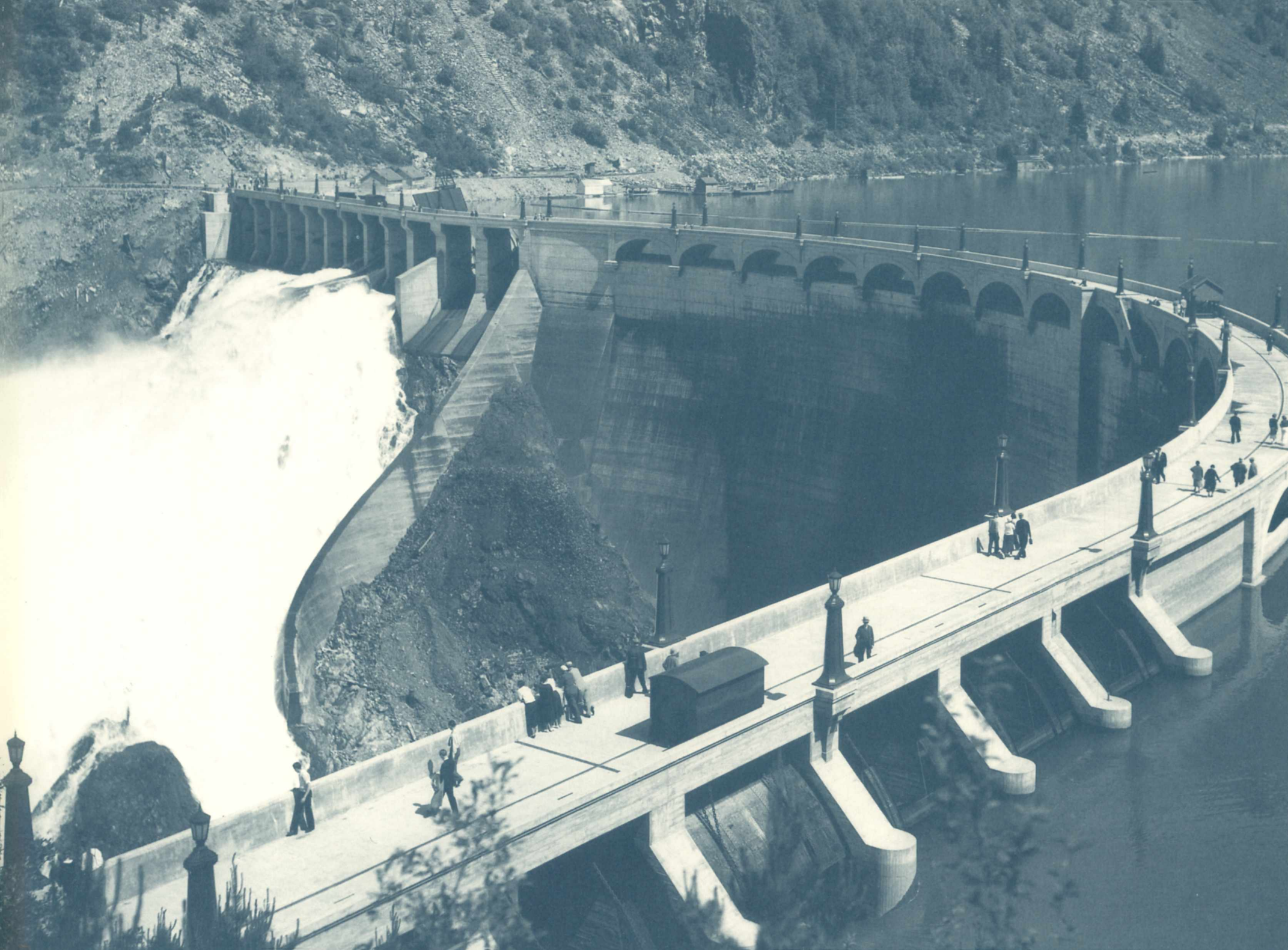


SKAGIT POWER

SKAGIT POWER DEVELOPMENT:
A RECORD OF THE SKAGIT RIVER
HYDROELECTRIC PROJECT

An aerial photograph of the Skagit River Hydroelectric Project. The image shows a large concrete dam with multiple spillways, a powerhouse, and a large reservoir. The surrounding area is forested. The text is overlaid on the right side of the image.

SKAGIT POWER DEVELOPMENT:
A RECORD OF THE SKAGIT RIVER
HYDROELECTRIC PROJECT





James Delmage Ross,
Seattle's Superintendent
of Lighting
(SCL).

The Skagit Project took shape in the context of a bitter struggle between public and private power advocates. At the center of the controversy was Seattle's Superintendent of Lighting, James Delmage ("J.D.") Ross. Ross tirelessly promoted citizen support for municipal hydroelectricity, in part through a program of public tours that combined visits to the dams and powerhouses with scenic grandeur, hearty meals, and overnight lodging. Today, the Skagit Tours live on, continuing to showcase the evolving trends in hydroelectric technology.

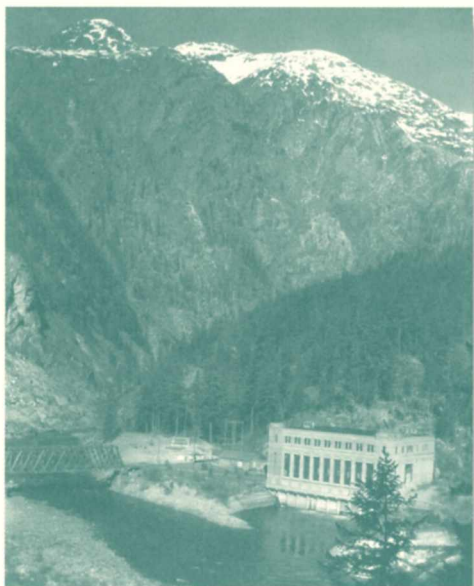
This booklet is a synopsis of technical documentation conducted for the Historic American Engineering Record (HAER). During the summers of 1989 and 1990, a team of architecture students, historians, and photographers prepared measured drawings and a historical report, and photographed the historic engineering facilities at Skagit. Their full report, Skagit Power Development: Skagit River and Newhalem Creek Hydroelectric Projects, HAER No. WA-24, is now on file in the Library of Congress. The work was sponsored and funded by Seattle City Light in conjunction with re-licensing of the Skagit Project by the Federal Energy Regulatory Commission, and co-sponsored by the Seattle Support Office, formerly the Pacific Northwest Regional Office (PNRO), of the National Park Service.

Headworks at Gorge
High Dam, completed
in 1961, and
transmission towers
seen from Highway 20
(WA-24-C-9).



View of the community
of Diablo from
Highway 20. Visible
features from left to
right are the water
tower, switchyard,
Diablo Powerhouse,
and the incline railway
(WA-24-D-1).





Gorge Powerhouse, the first of three phases of development on the Skagit, as it appeared in 1930 in its original size and configuration. Note the Howe Truss railroad bridge to the left, in place by 1921 (SCL-L-70).

Project Managers for the HAER documentation project included Eric Delony, Chief of HAER; Stephanie Toothman, Chief of Cultural Resources Division, PNRO; G. Gray Fitzsimons, Historian/Engineer, HAER; and Gretchen Luxenberg, Historian, PNRO.

The text which follows summarizes the written report compiled by team historians Nancy Mannikko and Patricia Erigero in 1990. Most of the photographs appearing in this booklet (captioned with the WA-24 prefix) were taken in 1987, 1989 and 1990 by HAER photographer Jet Lowe. They are a representative selection from the 165 images submitted to the Library of Congress. Historic photographs are presented courtesy of Seattle City Light's archival collection, and are given a SCL prefix in the captions. Reduced copies of the measured drawings produced by recording team members Rita Goodrich, Dione DeMartelaere, Orsolya Hofer, Douglas Pancoast, and Dale Waldron in 1990, appear as a group at the end of the booklet. This synopsis of the HAER technical report was prepared by Florence K. Lentz.



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Early Days

on the Upper Skagit

From its source in the Cascade Mountains of British Columbia, to its mouth at Puget Sound in western Washington, the Skagit River drains an area of 3,105 square miles. For over 8,000 years, the Skagit River drainage was extensively used by ancestors of today's Salish-speaking Indian people. The earliest Euro-Americans in the region attempted little exploration along the river. Settlers were discouraged by its marshy delta, its massive log jams and, on the upper reaches, its treacherous rapids and sheer canyon walls. By the late 1870s, however, citizen action had cleared the log jams and opened the lower Skagit for navigation, allowing gold prospectors to venture further upriver.

By the mid-1890s, these miners had fashioned a pack route known as the Goat Trail from the settlement of Marblemount to the upper reaches of the river. Portions of the trail were widened through blasting, and volunteers erected crude bridges to give pack trains access to the mines on Ruby and Thunder creeks.



John McMillan, panning for gold in the Upper Skagit River valley (NPS 19-A).



"Pansy House," a typical City Light bunkhouse for single men at Newhalem, later converted to family housing (WA-24-5).



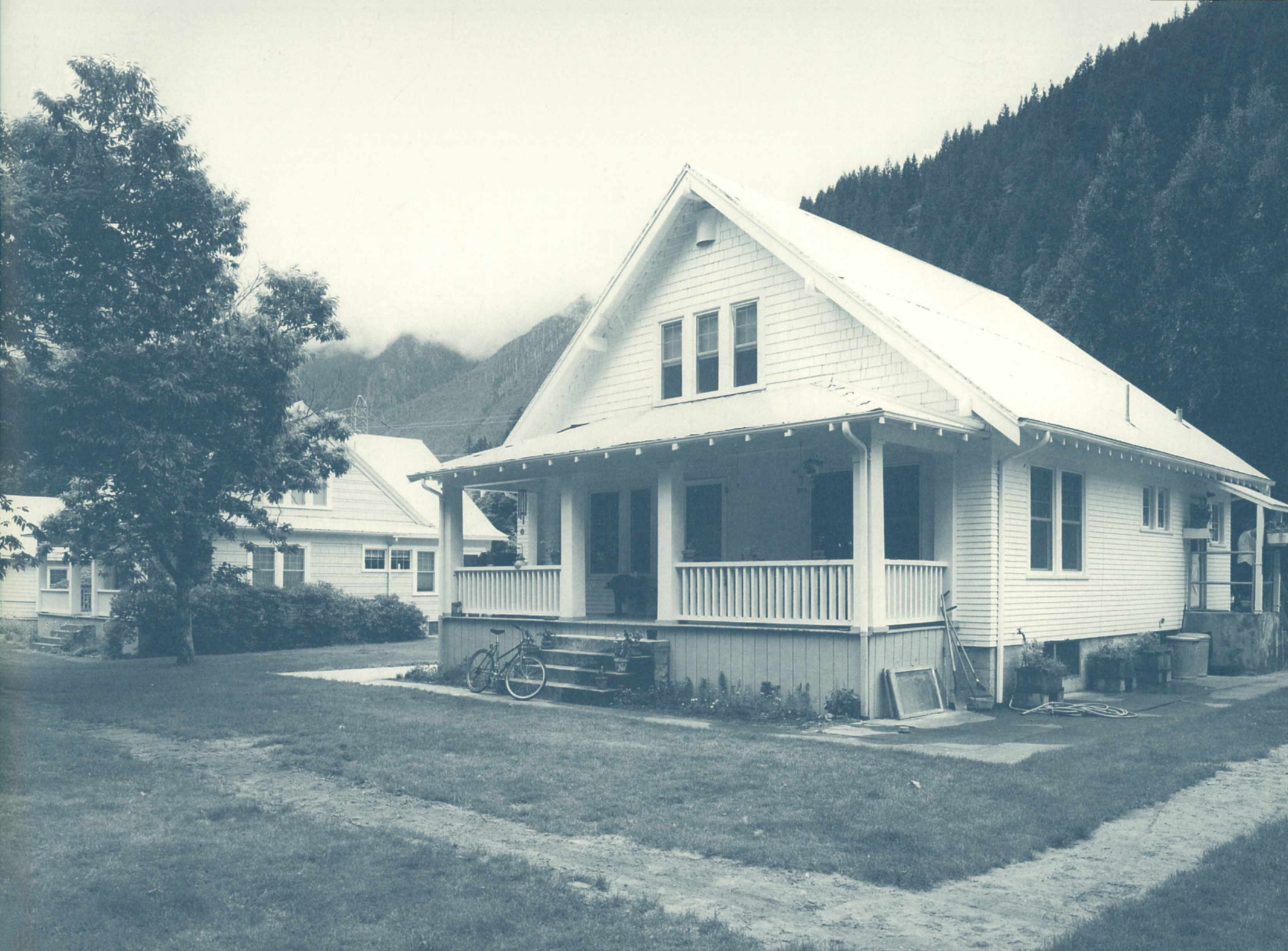
Gorge Inn, in Newhalem, built in 1920. For many years the main cookhouse and mess hall for City Light employees, construction workers, and tourists at the Skagit (WA-24-8).

1898

In 1898, the Davis family established a homestead at Cedar Bar (near present-day Diablo) that evolved into a hotel and guest ranch. The Davis Ranch catered to miners and pack trains en route to the claims. In 1907, much of the North Cascades became a national forest and some settlers' homestead claims were invalidated. The Davis family stayed on, however, providing lodging and meals for trout fishermen and outdoorsmen.

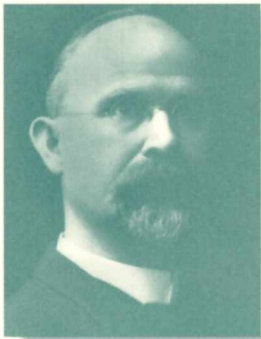
With the arrival of the United States Forest Service, the relative isolation of the Upper Skagit ended. The Forest Service constructed trails, bridges, fire lookouts and ranger stations, packing in hand tools and building materials on the backs of men and horses. Bridges and trails were widened and made more permanent. When engineers began surveying the Skagit for potential hydroelectric development, they traveled with relative ease and stayed at guest ranches and inns such as the Davis Ranch and the Ruby Inn. The rugged canyon now appeared promising for future hydroelectric development.

An operator's cottage on "Silk Stocking Row," the first permanent housing built at Newhalem, reserved for powerhouse operators, supervisors, and their families (WA-24-11).



Electricity

Comes West



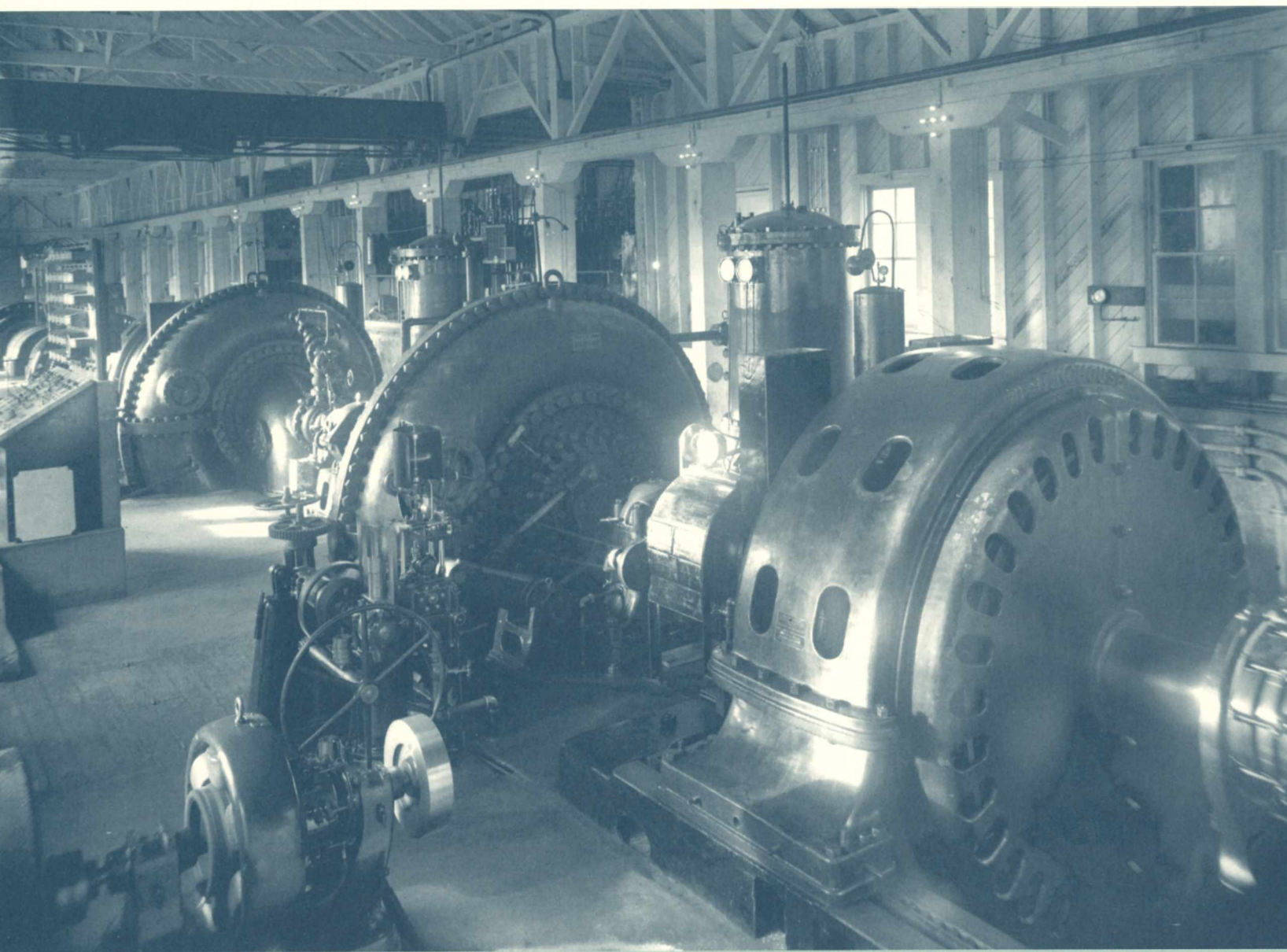
In 1893, an official report to the mayor of Seattle, James T. Ronald, recommended the formation of a municipal light company (Seattle-Archives).

The earliest commercial producers of electricity in Washington communities were the Washington Water Power Company in Spokane, and the Seattle Electric Light Company in Seattle. The latter was eventually acquired by a large “foreign” corporation, the Boston-based engineering and management consulting firm of Stone and Webster. In 1912, this growing business merged numerous small electric utilities in western Washington into the Puget Sound Traction, Light and Power Company.

In opposition, a movement advocating the municipal ownership of utilities gathered strength throughout the Northwest, fostered by a spirit of progressive reform. Promoters of municipal ownership believed that if cities took control of all phases of power production, from generation to distribution, they could produce electricity more efficiently and more cheaply than profit-seeking private enterprise. In 1893, an official report to the mayor of Seattle recommended the formation of a municipal light company. City charter amendments in 1896 authorized such municipal ownership and, in 1902, citizens approved a \$590,000 bond issue for construction of a generating plant on the Cedar River southeast of Seattle.

Downtown Seattle,
Second and Yesler,
Smith Tower in the
background.
Streetlights had three
globes on top of a
bronze pole
(SCL-Archives).





Cedar Falls Powerhouse began generating electricity for Seattle's streetlights in 1905, when it was under the control of the Water Department (SCL).

1902



Seattle's City Engineer R.H. Thomson hired J.D. Ross for the job of designing the power plant at Cedar Falls (SED-24226).

Among the most ardent supporters of municipal ownership was an individual who would play a pivotal role in the growth of Seattle City Light, the development of the Skagit, and the electric utility industry nationwide. Canadian by birth, James Delmage Ross was a young, self-trained electrical engineer when he walked into the office of Seattle's City Engineer R.H. Thomson and applied for the job of designing the power plant at Cedar Falls. Ross joined the Seattle Lighting and Water Department in 1902 and became its articulate spokesman and rising star. By 1911, one year after the formation of the new Seattle Lighting Department, J.D. Ross was appointed its Superintendent, and remained at the helm until his death in 1939.

Ross was a visionary with consummate political skills. He believed strongly in the right of every citizen to affordable electrical power. His commitment to this concept, and his dogged persistence in achieving his goals, kept his career afloat through changing administrations and periods of bitter opposition. It was largely Ross' flare for good public relations that won the support of the citizenry for public power and, ultimately, for the development of the Skagit River Hydroelectric Project.



Crypt of Seattle City Light Superintendent J.D. Ross (1872-1939) recessed into the base of Ross Mountain near Gorge Powerhouse. Ross was the driving force behind power development of the Skagit (WA-24-28).



Seattle streetlight
(SCL-L-30).

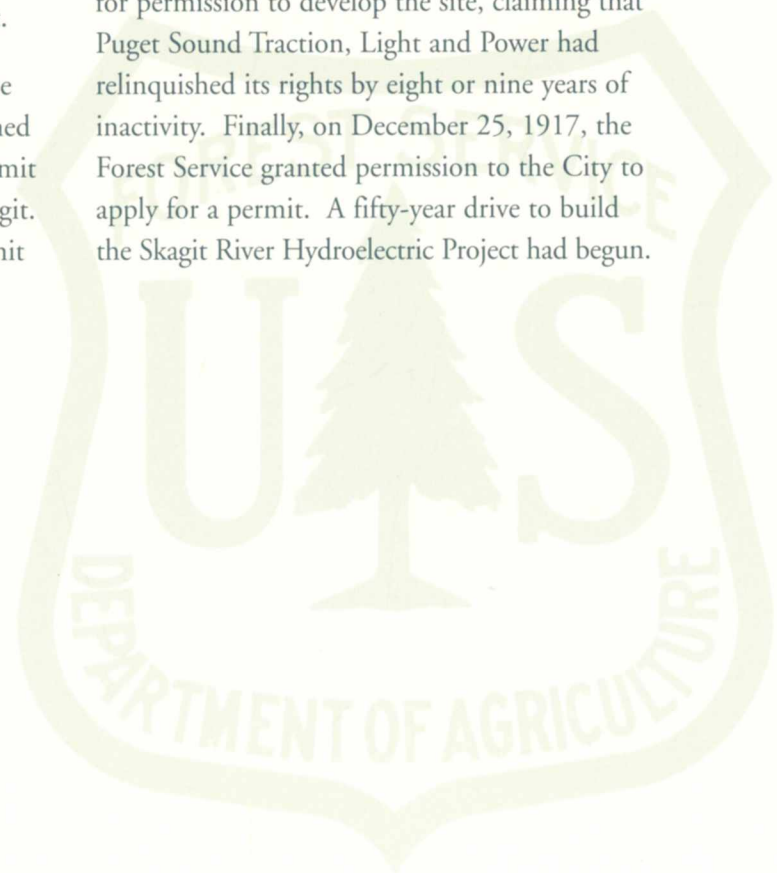
1915

The growing industrial and residential demand for electricity forced the City to look for new sources of energy. As early as 1915, Ross sent junior engineers in search of new sites. Their conclusion was that the Upper Skagit River, then the boundary between the Washington and the Snoqualmie national forests, offered the greatest potential for large-scale development.

An immediate obstacle stood in the way. The Skagit Power Company, a small investor-owned company, had already filed in 1908 for a permit to develop a hydroelectric project on the Skagit. The Forest Service had, in fact, issued a permit to Skagit Power based on the company's submitted surveys and plans for a massive

gravity dam. Unable to secure the necessary capital, Skagit Power soon abandoned its grand plans and was absorbed by Puget Sound Traction, Light and Power.

Determined to secure the Skagit for the City of Seattle, J.D. Ross petitioned the Forest Service for permission to develop the site, claiming that Puget Sound Traction, Light and Power had relinquished its rights by eight or nine years of inactivity. Finally, on December 25, 1917, the Forest Service granted permission to the City to apply for a permit. A fifty-year drive to build the Skagit River Hydroelectric Project had begun.



Early photograph of
the Skagit River from
bend below Ruby
(SCL-5027-628-19).



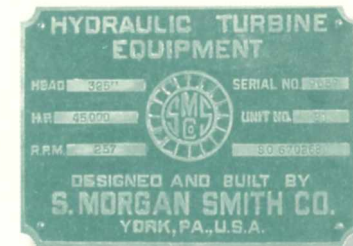
Harnessing *the Skagit at Gorge*



Nameplates on original generating unit 21, dating from 1925, in Gorge Powerhouse (WA-24-B-10).

The earliest plans for development on the Skagit centered on a dam at Ruby Creek, where Ross Dam now stands. The Ruby site was regarded as ideal because of its geophysical features and its large water storage potential. As planning progressed it became clear that, no matter how promising the Ruby site, logistical problems would prevent it from being the first step of the overall development.

Under a revised long-range plan, construction began at the mouth of Newhalem Creek in 1920. A 26-mile railroad was built from the downriver town of Rockport to bring supplies to the site, and a sawmill was constructed to supply lumber to the busy camp. At Newhalem Creek, a small 3000 horsepower power plant, equipped with a double-hung Pelton wheel and a 2000 kva horizontal shaft generator, began producing power for construction.



A 26-mile railroad
was built to bring
supplies to the site of
the work camp
at Newhalem
(SCL -L-965-955).





Looking south down
Newhalem's Main
Street, ornamental light
standards with 5-globe
clusters (SCL-L-122).

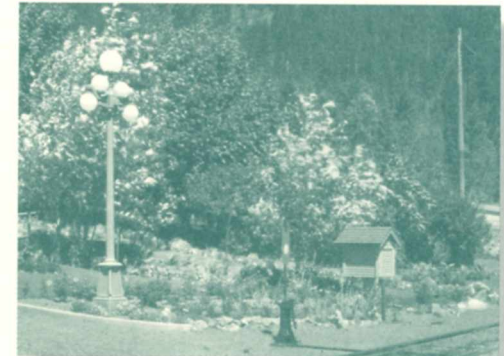
1920

In the years that followed, “City Camp” evolved into the substantial company town of Newhalem, with single family dwellings, bunkhouses for workers and tourists, community facilities, and extensive landscaping. Along either side of Main Street, the utility’s main office and warehouse, the commissary and mess hall, a hotel, a theater, and a community hall sprang up. Skagit managers and their families were housed on Silk Stocking Row in a block of sturdy bungalows facing the river. To the east and west were more modest cottages for construction workers, plant engineers, and maintenance crews.

During its heyday as a public showcase in the 1920s and 1930s, thousands of tourists visited the Skagit Project each summer, staying over in Newhalem bunkhouses and enjoying hearty meals in the Gorge Inn. Though its population is much reduced and much of its worker housing gone, Newhalem continues to operate as a rare example of a municipally-owned company town.



In 1934, tourists would arrive in Newhalem by train from Rockport (SCL-L-414).



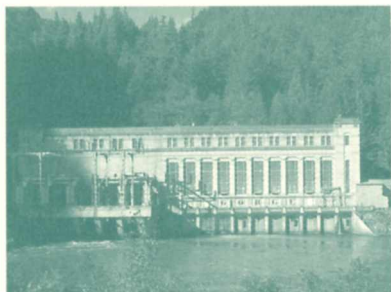
As tourists disembarked from the train, they marveled at the town’s elaborate landscaping (SCL-L-14).



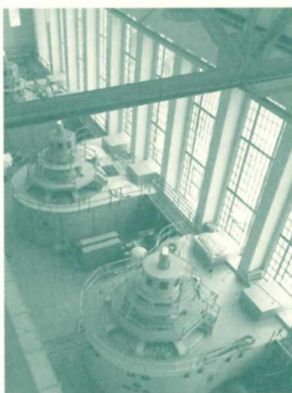
Tourists’ first stop would be the Commissary, where they received a schedule for their tour and lodging assignments (SCL-L-4).



Men and women were assigned to separate dorms. During the summer, more than 250 tourists could be housed each night (SCL-L-257).



Gorge Powerhouse today, with pedestrian suspension bridge to right. Left section of powerhouse added in 1949 (WA-24-B-1).



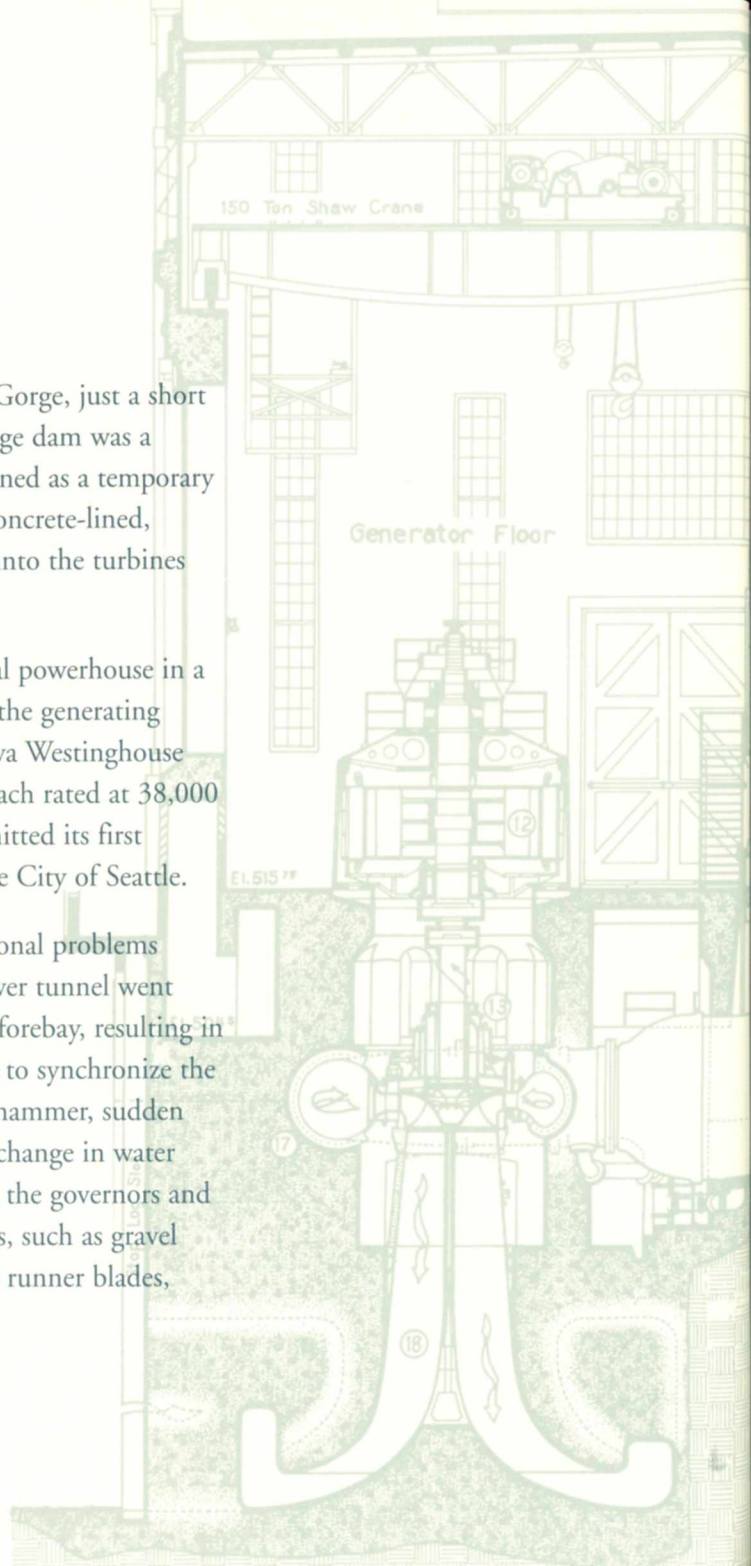
Interior of Gorge Powerhouse, looking southwest toward generating units 23, 22, and 21 (WA-24-B-7).

1924

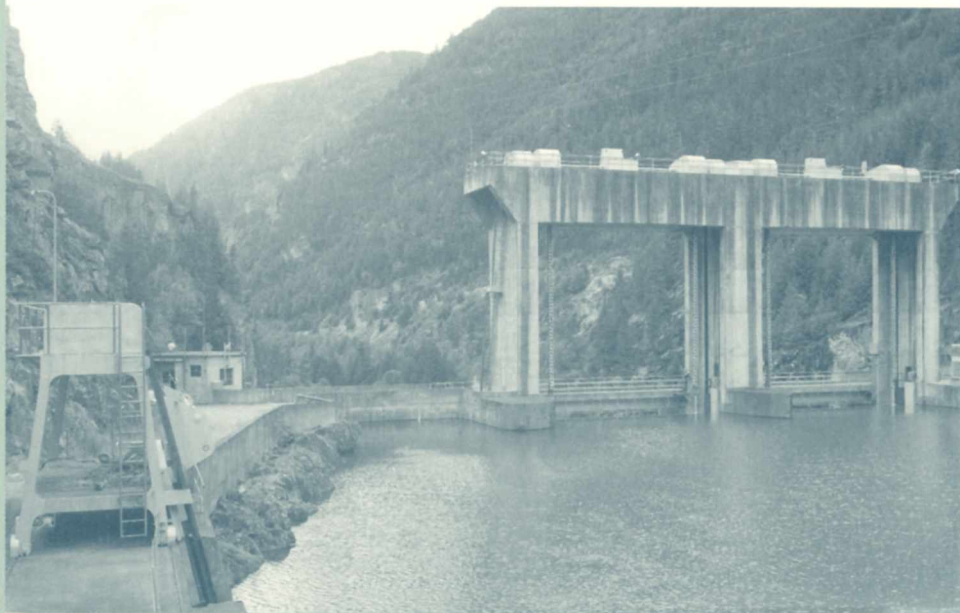
The first of the Skagit River developments was at Gorge, just a short stretch upriver from Newhalem. The original Gorge dam was a simple, rock-filled timber crib diversion dam, designed as a temporary structure due to time and money constraints. A concrete-lined, 11,000 foot-long power tunnel that guided water into the turbines took more than two years to build.

Near the mouth of Ladder Creek, a plain industrial powerhouse in a stripped-down Neoclassic style was built to house the generating equipment. Here the City installed two 30,000 kva Westinghouse generators, driven by S. Morgan Smith turbines, each rated at 38,000 hp. In the fall of 1924, Gorge Powerhouse transmitted its first impulses of Skagit River hydroelectric power to the City of Seattle.

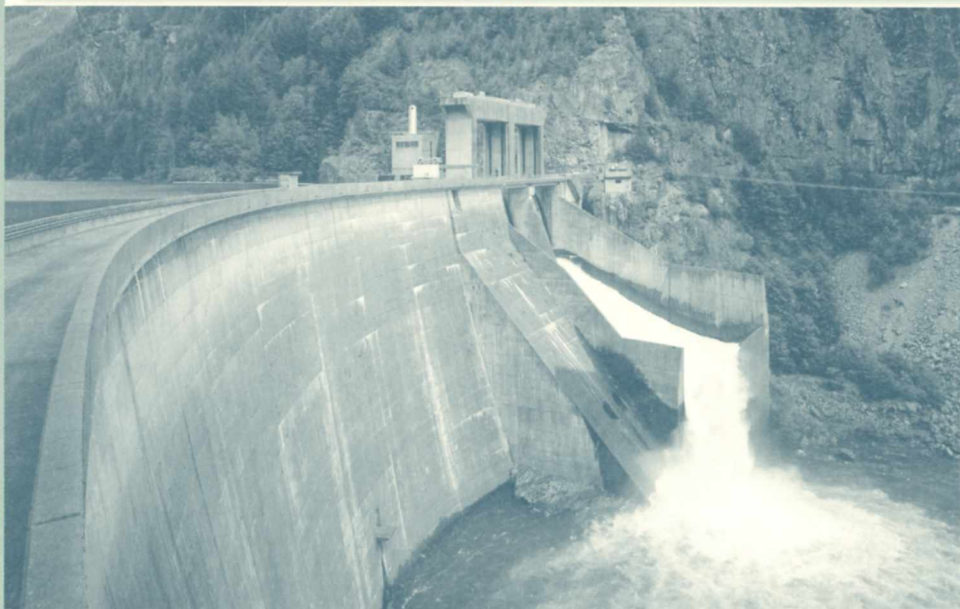
Gorge Powerhouse experienced some early operational problems because of its design features. Water from the power tunnel went directly into penstocks without passing through a forebay, resulting in a surging effect that made it difficult for operators to synchronize the generators. The plant faced problems with water hammer, sudden extreme high pressure in a pipe caused by a rapid change in water flow. Over time, plant operators learned to adjust the governors and the surging episodes decreased, but other problems, such as gravel washing into the intake and damaging the turbine runner blades, were to plague the Gorge plant for many years.



Spill gates at Gorge High Dam, with intake on left (WA-24-C-8).

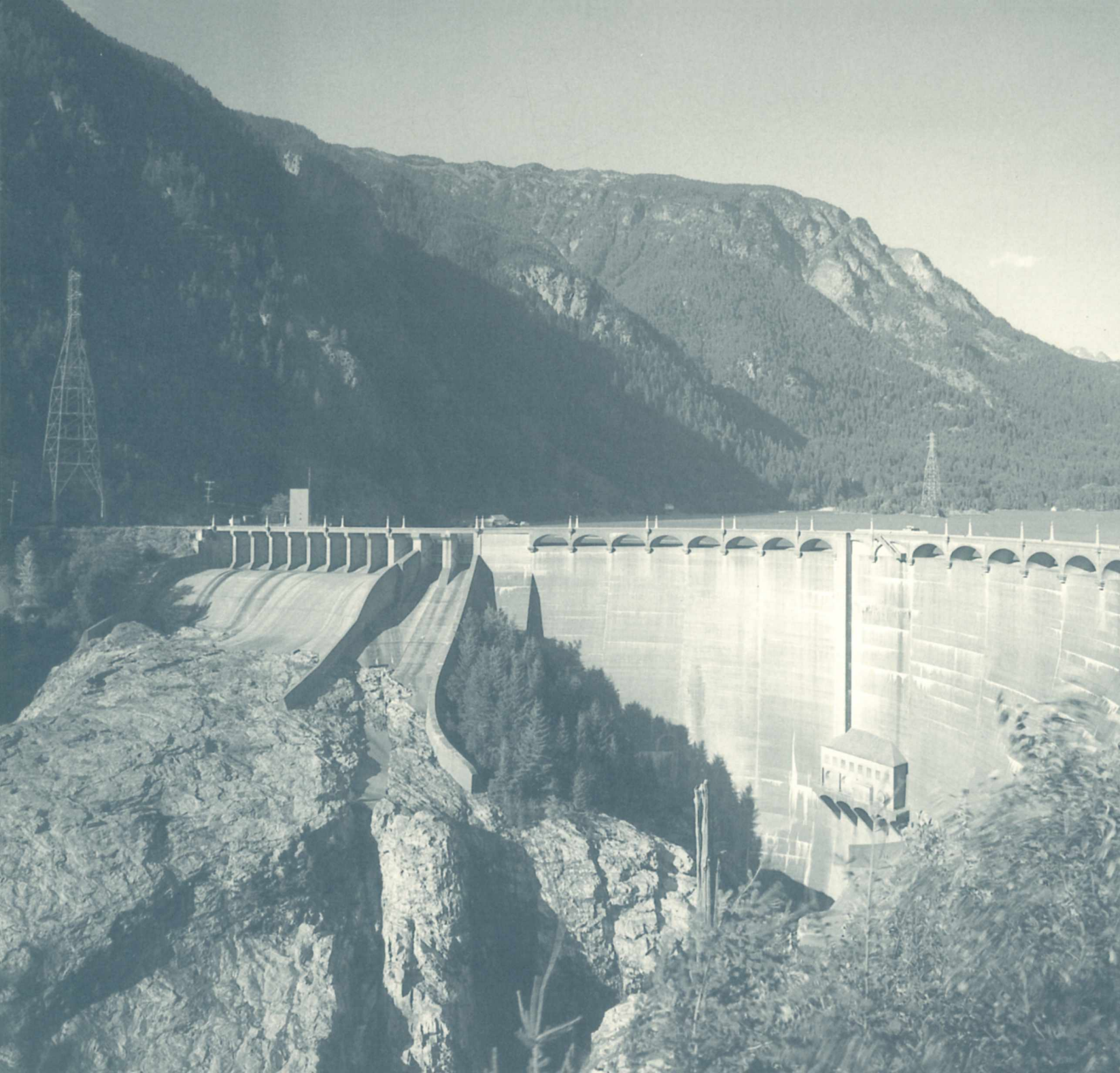


Gorge High Dam, completed in 1961, as seen from north end of crest looking south (WA-24-C-4).



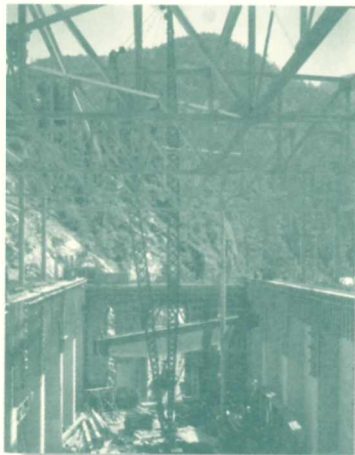
To alleviate this problem and stabilize the water supply, the crib dam at Gorge was raised by two feet in 1929, allowing the addition of a third generator unit at the powerhouse. By 1950, City Light had completely replaced the original crib dam with a diversion dam of concrete, and made a six-bay addition to the powerhouse, allowing for installation of a fourth unit.

Engineers had long envisioned a high masonry dam at Gorge but were stymied by layers of alluvial material at the site that prevented de-watering of the channel to bedrock. After years of analysis, they devised a way to temporarily freeze the river's flow with brine, and the construction of Gorge High Dam proceeded. The new dam was dedicated in 1961 and remains today.

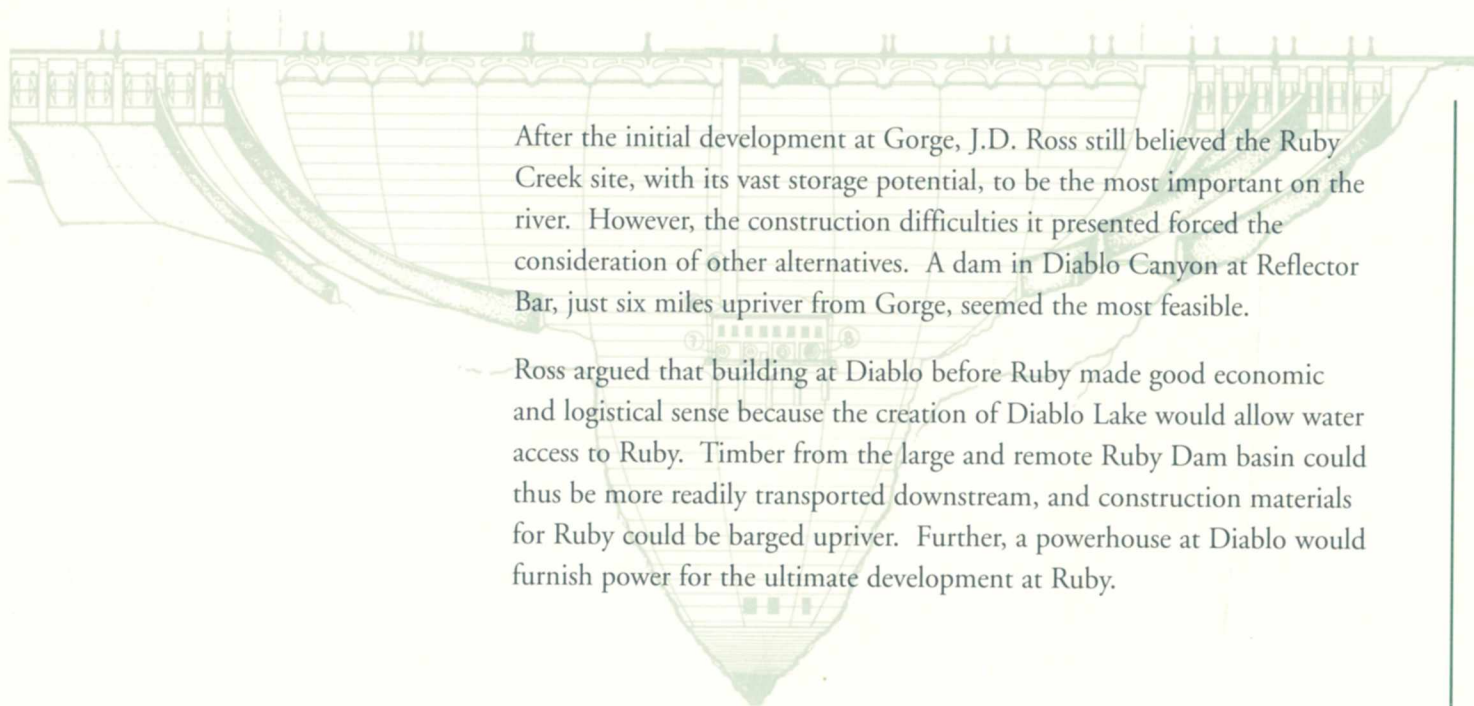


View of Diablo Dam
from southwest side
(WA-24-F-2).

Progress *at Diablo*

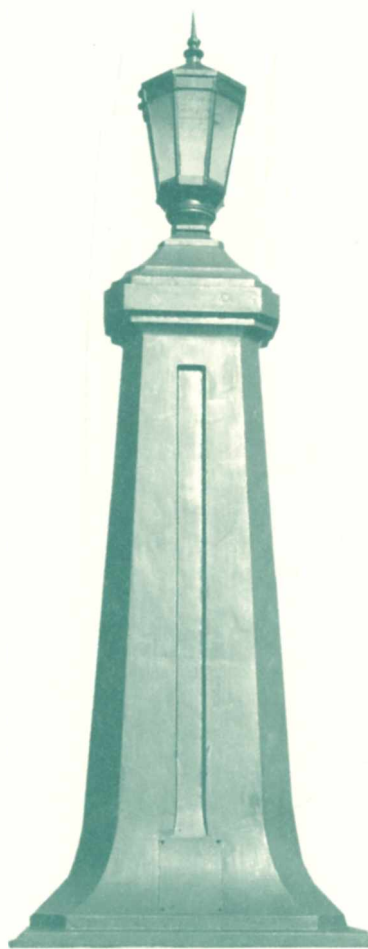


Harnischfeger power bridge crane, largest in the world at the time, being placed in position at Diablo Powerhouse in May, 1935 (SCL- LD-40).



After the initial development at Gorge, J.D. Ross still believed the Ruby Creek site, with its vast storage potential, to be the most important on the river. However, the construction difficulties it presented forced the consideration of other alternatives. A dam in Diablo Canyon at Reflector Bar, just six miles upriver from Gorge, seemed the most feasible.

Ross argued that building at Diablo before Ruby made good economic and logistical sense because the creation of Diablo Lake would allow water access to Ruby. Timber from the large and remote Ruby Dam basin could thus be more readily transported downstream, and construction materials for Ruby could be barged upriver. Further, a powerhouse at Diablo would furnish power for the ultimate development at Ruby.



Diablo Dam light standard
(SCL-D-(31-3-6)-6).

In addition to the issues of siting and funding, the design of the proposed high dam at Diablo was the subject of lively discussion in the mid-1920s. Two basic traditions of dam design were prevalent at the time: gravity dams of masonry that relied on their own dead weight for stability, and structural dams of thin, unreinforced concrete that resisted the hydrostatic pressure of impounded water through arch or buttress features. Single arch dams, involving far less material and cost, had proven successful in narrow canyons where the water pressure could be transferred from the arch to the abutments.

After much debate among City officials and the larger engineering community as to the safety of these seemingly fragile structures, in 1927, a contract for the design of Diablo Dam was awarded to Lars Jorgensen, principal of the Constant Angle Arch Dam Company. Jorgensen had designed a number

of successful dams of this type in the west since 1914, including the one at Lake Cushman for the City of Tacoma. Ross admired that dam, and in December of 1925, he wrote to Jorgensen saying, "I like the Cushman Dam and believe your type is the one to use at Diablo."

In October, 1927, the Federal Power Commission approved the use of a constant-angle single-arch dam design at Diablo. Wasting no time, the City immediately constructed an extension of the standard gauge railway from Gorge to Reflector Bar at Diablo. The construction contract for the dam was awarded to Winston Brothers of Minneapolis, and by January, 1928, excavation at the site began in earnest. Soon, the Forest Service ranger station at Reflector Bar was transformed into a busy construction camp.

Interior of power
tunnel during
construction of
Diablo Powerhouse,
July, 1936
(SCL-LD-566).





Incline railway at Diablo, used in construction of Diablo and Ross (originally Ruby Dam), designed as a permanent feature of the project (SCL-D-(28-4-14)-4).

Over time, the camp evolved into the company town of Diablo, boasting an office and warehouse, a commissary and mess hall, a hotel, and a hospital. Bunkhouses, worker cottages, and larger dwellings for engineers and managers spread over a 20-acre site. In 1935, as more employees brought their families to live at Diablo, a building was designated for use as a school. After World War II, the City constructed a large new school, which now serves as the community's dining hall and visitor center. The Forest Service provided design assistance in the late 1930s for the construction of permanent housing at Hollywood, downstream of Reflector Bar. Although greatly changed from its earliest construction camp days, Diablo, like Newhalem, remains as a rare example of a municipally-owned company town still in use.

One of the most interesting features of the Diablo construction site was an incline, or funicular railway, designed for lifting railway cars from the bar at river level to a higher elevation at the top of the dam. The incline survives as a feature of the historic district, as it was designed for use in future developments further up the Skagit at Ruby.

Construction at Diablo demanded great ingenuity. From the clearing of the canyon using power shovels and spring flood waters, to the conveyor system designed for transporting concrete to pour sites on the dam itself, Diablo's builders devised innovative approaches. Despite serious flooding and a month-long breakdown of the incline hoist gear, the dam was completed in less than three years' time, including construction of the power tunnel, surge tank, penstocks, and powerhouse foundations.

The City had finally achieved something monumental on the Skagit. Diablo Dam was, and still is, an astounding example of engineering, evidenced by the 1758 carloads of cement, 630,000 tons of gravel aggregate, and 350,000 cubic yards of concrete used in its construction; it was the highest thin arch dam in the world at the time of its dedication in August, 1930. Combining beauty with utility, the roadway above the crest of the dam was carried on arches, and included ornamental lighting standards still in place along the parapet walls.



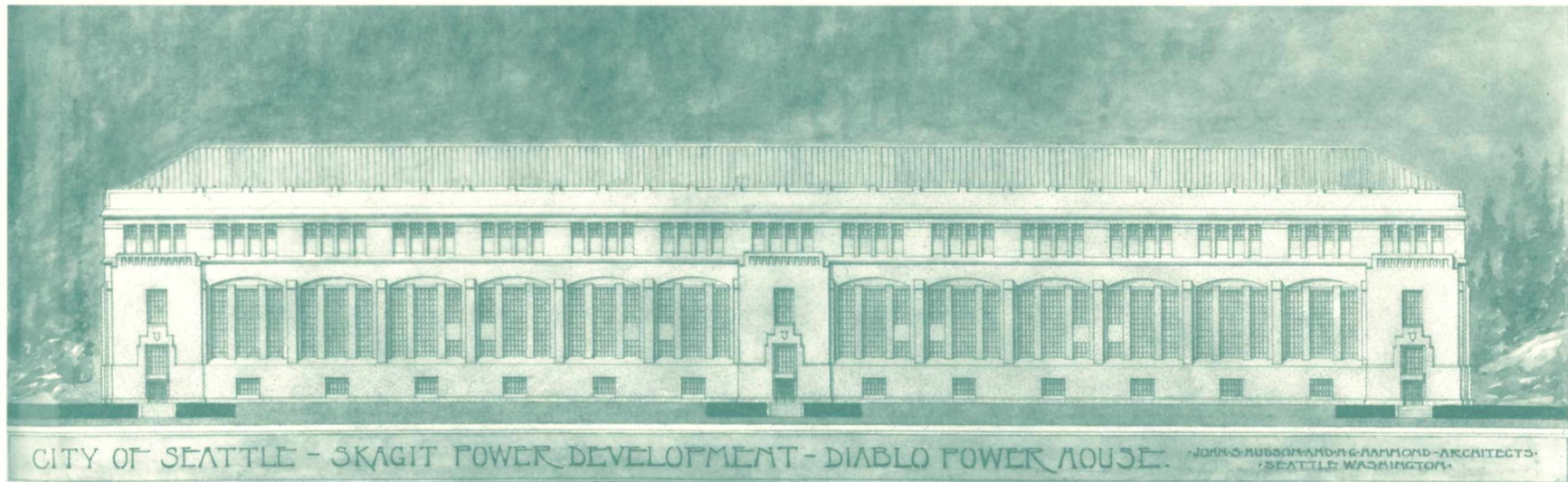
Detail of the tainter type spill gates, from the north end of Diablo Dam (WA-24-F-9).

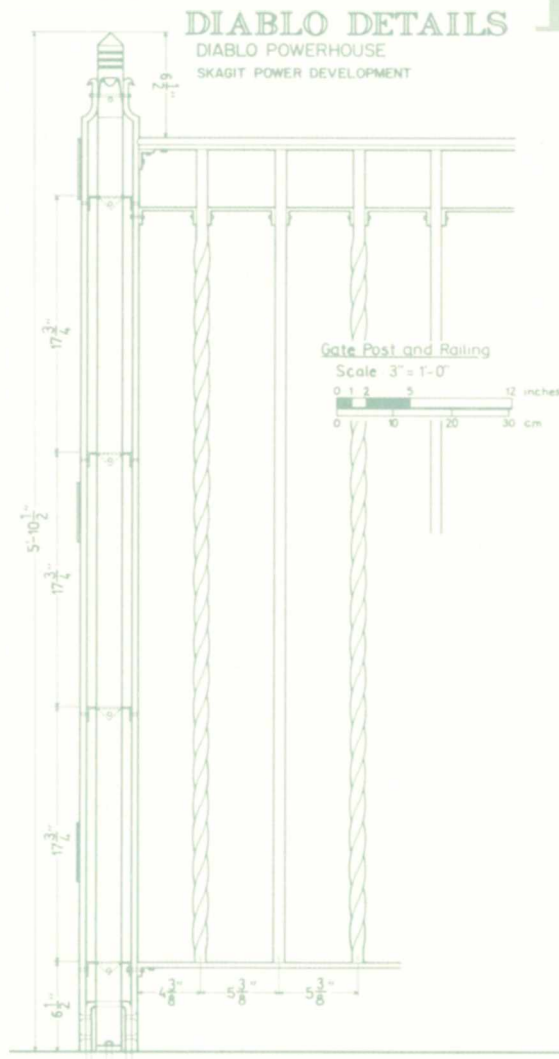
It was another six long years before Diablo Powerhouse would go on line. As the dam neared completion, J.D. Ross and R.H. Thomson, temporarily back in office as City Engineer, bickered over powerhouse design, delaying project start up. Then, with the onset of nationwide depression in the early 1930s, the City's bonds became unmarketable. Federal monies were lacking for City Light projects; Washington State had already garnered its share

of such funding with the Grand Coulee and Bonneville Dam projects on the Columbia. In the meantime, two state-of-the-art, 60,000 kva generators ordered in 1928 for Diablo Powerhouse, languished in storage in heated buildings at Reflector Bar.

Little by little, the powerhouse was completed. The size of the generators and turbines required the installation of an enormous overhead crane,

reportedly the largest ever built. Transported to Reflector Bar in 1932, the 300-ton two-trolley traveling crane weighed 392,800 pounds and had seven motors. Ross' dramatic design for generators on pedestals was carried out, as were other elegant interior refinements like terrazzo floors, an art deco water fountain, a tiled goldfish pool, and brass and anodized aluminum details.





1936

Diablo Powerhouse was dedicated in 1936, when President Roosevelt pressed a button at his home in Hyde Park, transmitting an electrical impulse across the continent to start the generators. Putting Diablo on line involved far fewer problems than had been the case with Gorge twelve years earlier. Now complete, Diablo Powerhouse epitomized the mature technology of hydroelectricity in the 1930s, and symbolized the best of an emerging aesthetic of Moderne design for large-scale public works. Clearly, the building's interior features, especially the visitor lobby and the raised generators, were intended to showcase the Skagit River Hydroelectric Project and garner additional public support for upcoming developments upriver.



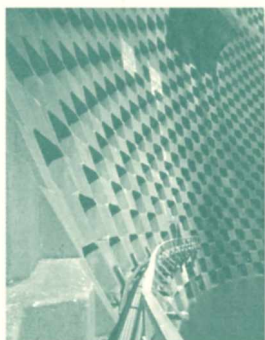
Diablo Powerhouse, dedicated in 1937. Aluminum-clad northern elevation designed as a temporary wall for possible future expansion (WA-24-D-2).



Visitor's lobby at Diablo Powerhouse, showing tiled goldfish pond, terrazzo floor, and raised generators (WA-24-D-3).

The Ultimate

Development at Ruby

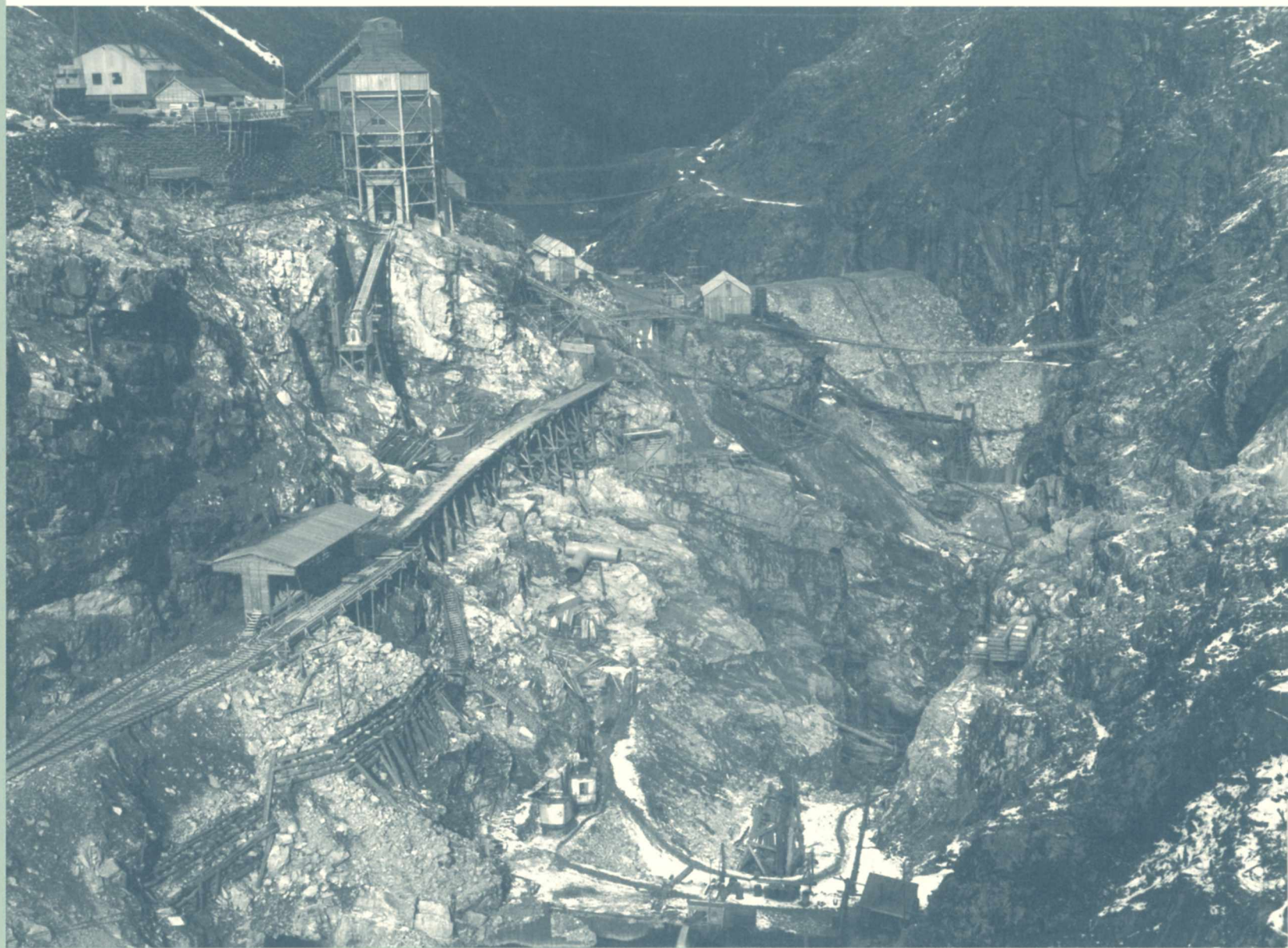


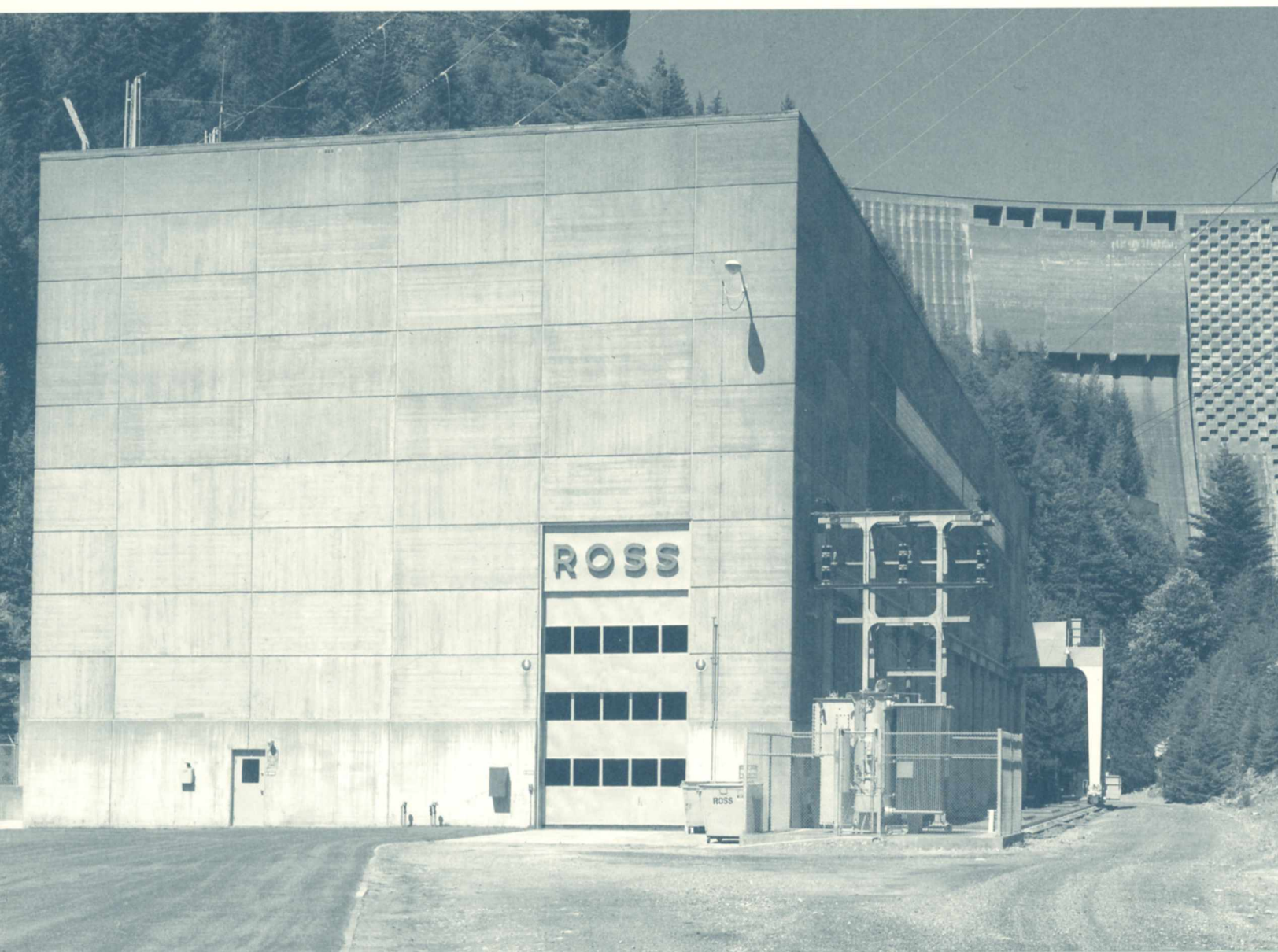
Coffered face of Ross Dam, designed to ensure good bonding of future additions. Valve house visible at upper right (WA-24-H-4).

Seattle City Light, and J.D. Ross in particular, had dreamed of Ruby Dam's development since first filing on the Skagit in 1917. Planning for Ruby had, in fact, picked up speed during the construction at Diablo. By the 1930s, the work at Ruby qualified for federal funding, because it offered flood control to communities and farms downstream. In 1936, the City received three million dollars from the Public Works Administration, enabling it to issue an additional four million dollars in bonds.

The planned reservoir would cover 20,000 acres and have the capacity to store 600 days' flow. Like Diablo, Ruby Dam's design was influenced by its remote location and cost considerations. In July, 1937, when the City awarded the contract for the first phase of Ruby Dam, it was a constant-angle thin arch dam that was specified. Lars Jorgensen's firm, the Constant Angle Arch Dam Company, provided preliminary design work, but additional designs were later prepared by the consulting firm of J.R. Savage, after Jorgensen's death later that same year.

View of the
construction site at
Ruby (Ross) Dam just
after the first concrete
was poured. Concrete
mixing plant on bluff
to left (SCL-RD-172).





West elevation of Ross
Powerhouse, with Ross
Dam in background
(WA-24-G-1).

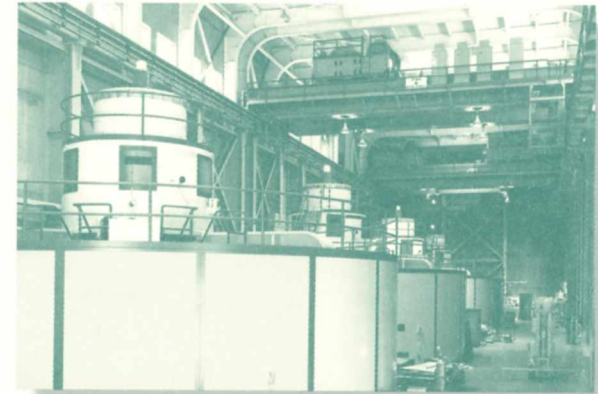
1939

Ruby was to be constructed in three phases. The first phase would bring the dam to elevation 1300 feet above sea level, the second to elevation 1515, and the final step to elevation 1728. When completed, the dam was to be 655 feet tall. City Light completed the first phase in 1940 and the second phase in 1949, to a structural height of 540 feet. Although Ross didn't live to witness completion of the dam, it was nevertheless dedicated to him, its greatest champion, upon his death in 1939.

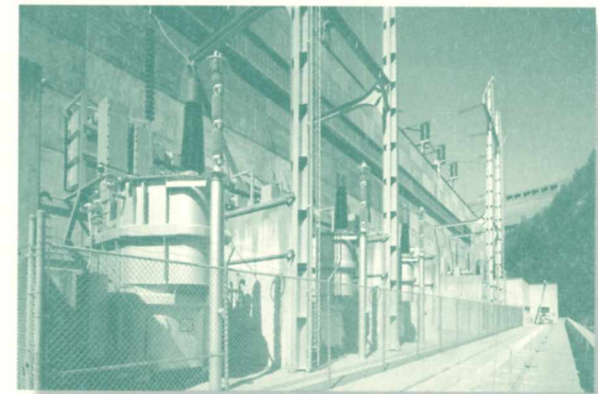
When the time came, thirty years later, to consider the third and final phase of development, great public resistance was met. Increasing the size of the reservoir meant inundating over 8,300 acres of wilderness, a prospect that led the City to explore sources of power other than Skagit. Today, Ross Dam remains "unfinished" and, given today's commitment to environmental protection, will likely remain so.

Work on the construction of Ross Powerhouse, the final major component in the Skagit system, began in 1951. The plant reached completion in 1957 with the installation of its fourth and final generator.

Ross Dam and Powerhouse are accessible only by trail or boat up beautiful Diablo Lake. These features are not only the final destination of visitors to the Skagit, but also the long-realized dream of J.D. Ross and many other forward-thinking public figures in Seattle's past. Together with the historic components at Gorge and Diablo, they are inextricably linked with the development of the Skagit River Hydroelectric Project.



Interior of Ross Powerhouse, looking east toward generating units 41, 42, 43, and 44 (WA-24-G-3).

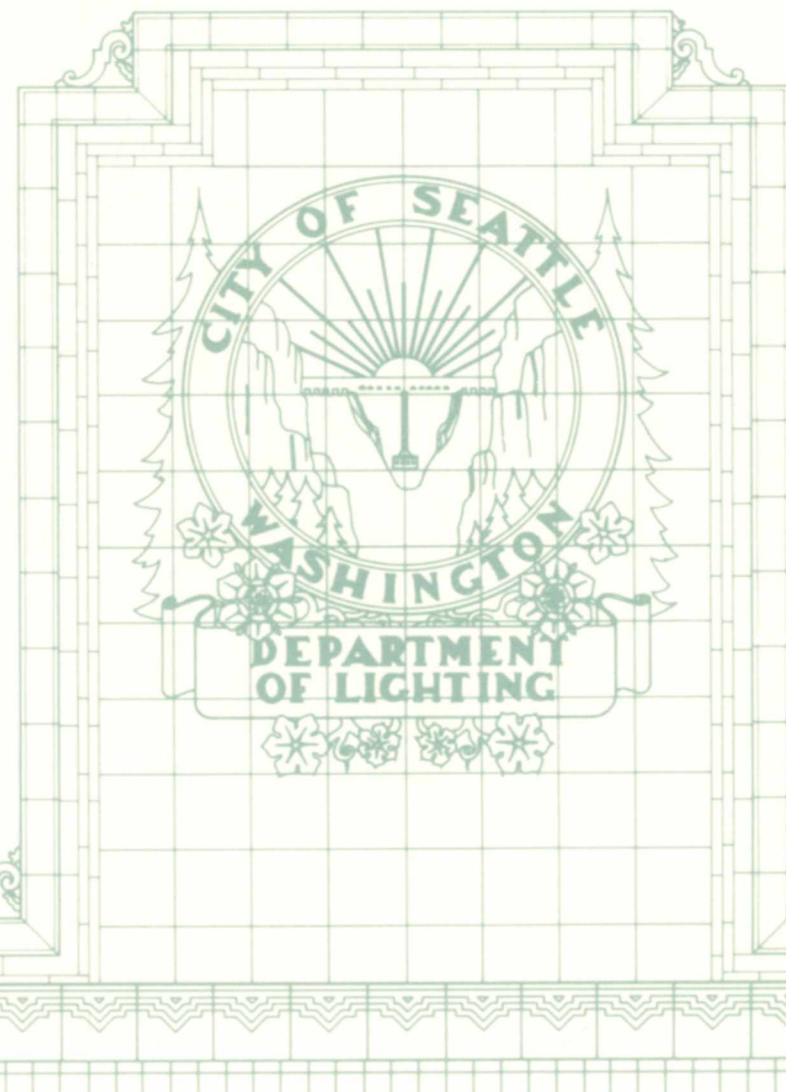


Transformer deck at Ross Powerhouse, looking east. Stop-log hoist house visible at far end (WA-24-G-22).

HISTORIC AMERICAN ENGINEERING RECORD DRAWINGS

This set of drawings was completed as part of a recording project for the Historic American Engineering Record (HAER), a long-range program to document historically significant engineering and industrial works in the United States. The HAER program is administered by the National Park Service, U.S. Department of the Interior; the original record set of drawings, photographs, and the historical narrative is located in the Library of Congress' HAER Collection under record number WA-24.

The record drawings for the Skagit Project document significant features of the complex of dams, powerhouses and transmission lines. They are interpretive documents, tracing the production of power from the intake of water at Ross Lake to the delivery of electricity to the citizens of Seattle. This record set complements the historic archives of Seattle City Light, which incorporates an extensive collection of engineering drawings, specifications, operating manuals and policies, and photographs, documenting the historical development of the Skagit Project.

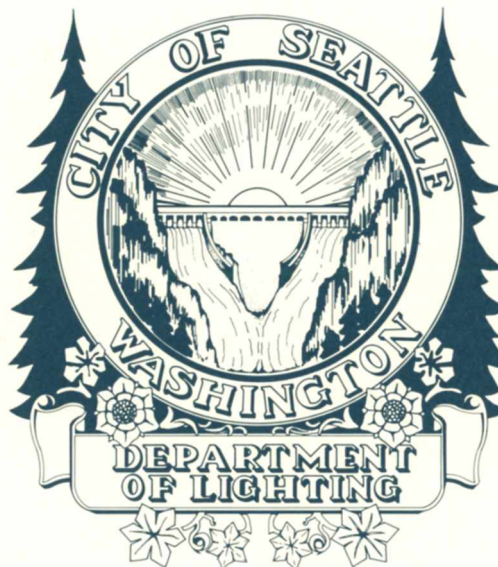


SKAGIT POWER DEVELOPMENT

The Skagit Power Development (SPD), owned and operated by the City of Seattle, is located in the Cascade Mountains of northern Washington State. The project consists of three dams and hydroelectric plants -- Gorge, Diablo, and Ross -- and one small plant, Newhalem, as well as two company towns, Newhalem and Diablo. The city first began developing the Skagit River in 1918, utilizing what the Superintendent of Lighting, James D. Ross, described as a "three stage" plan. Seattle City Light completed construction of the first powerhouse, Newhalem, in 1921 and the last one, Ross, in 1955. SPD illustrates the evolution of hydroelectric technology over a fifty-year period.

Seattle City Light's interest in promoting the benefits of hydroelectricity and municipal ownership is reflected in the project's design. The dams and powerplants are representative of hydroelectric principles developed in the western United States: the storage of water in isolated locations; utilization of the thin arch dam (to reduce the amount and cost of construction materials); high heads; and high voltage, point-to-point transmission over long distances.

The small Newhalem Powerplant (1921), on Newhalem Creek, provided power for construction of Gorge Dam and City Camp (now Newhalem). The Gorge Powerplant (1924) was the first of three built on the Skagit River. Forty years would pass before Gorge High Dam (1961) was completed as originally planned. Diablo Dam (1930) and Powerhouse (1936) were the second phase of the SPD. Their design symbolizes the era's faith in progress and technology. The potential of the "three phase" plan was reached upon completion of Ross Dam (1949) and Powerhouse (1955). The water of the Skagit River had been captured three times for the generation of hydroelectricity; moreover, the "River of a Million Horsepower" had been harnessed.



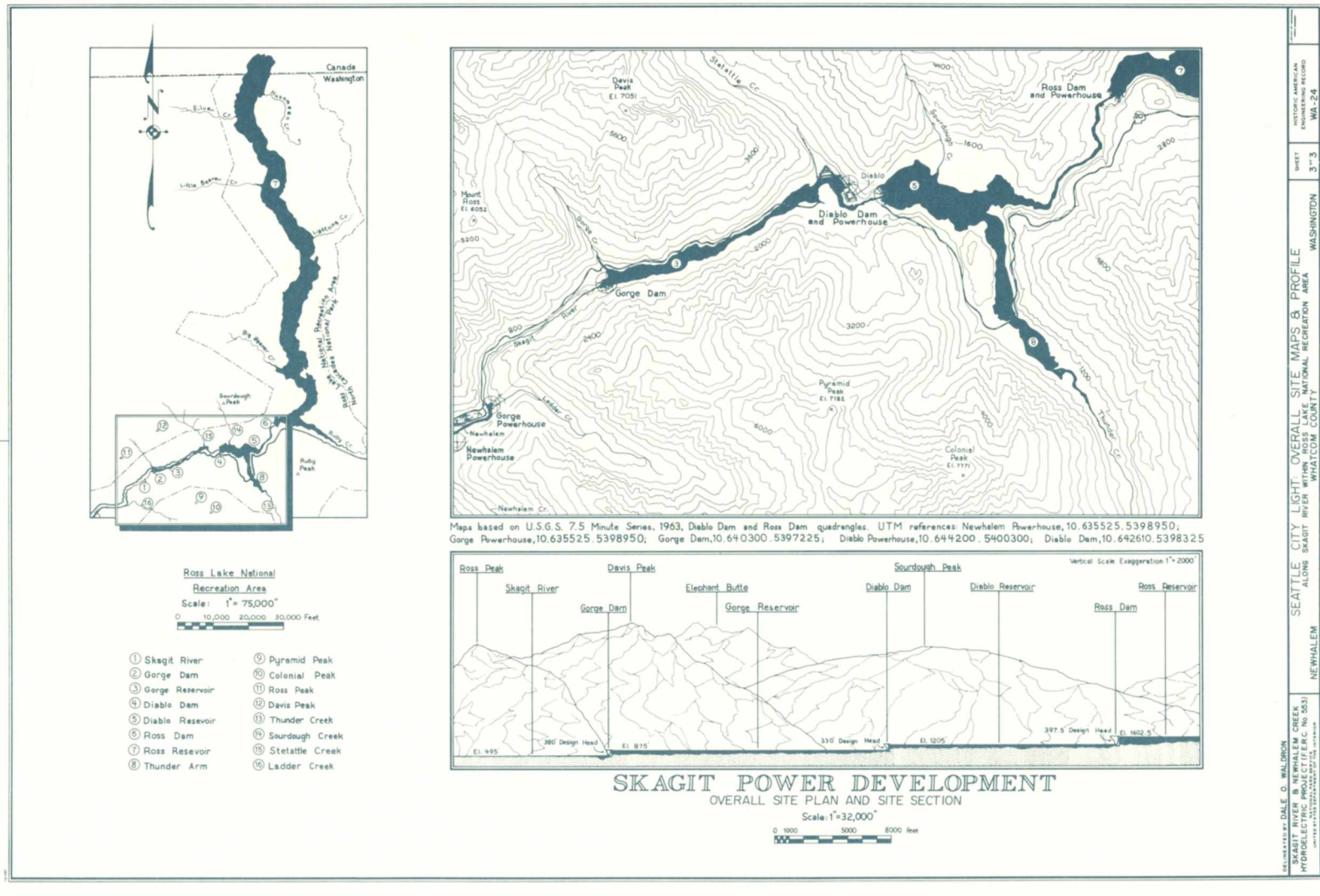
Logo & motif from Seattle City Light Office, Seattle, Washington (1935)

This recording project is part of the Historic American Engineering Record (HAER), a long range program to document historically significant engineering and industrial works in the United States. The HAER program is administered by the National Park Service, U.S. Department of the Interior. The Skagit Power Development Recording Project was cosponsored during the summers of 1989 and 1990 by: Seattle City Light, Randall Hardy, Superintendent; HAER, Dr. Robert J. Kapsch, Chief; and the Pacific Northwest Regional Office (PNRO), National Park Service, Charles H. Odegaard, Regional Director.

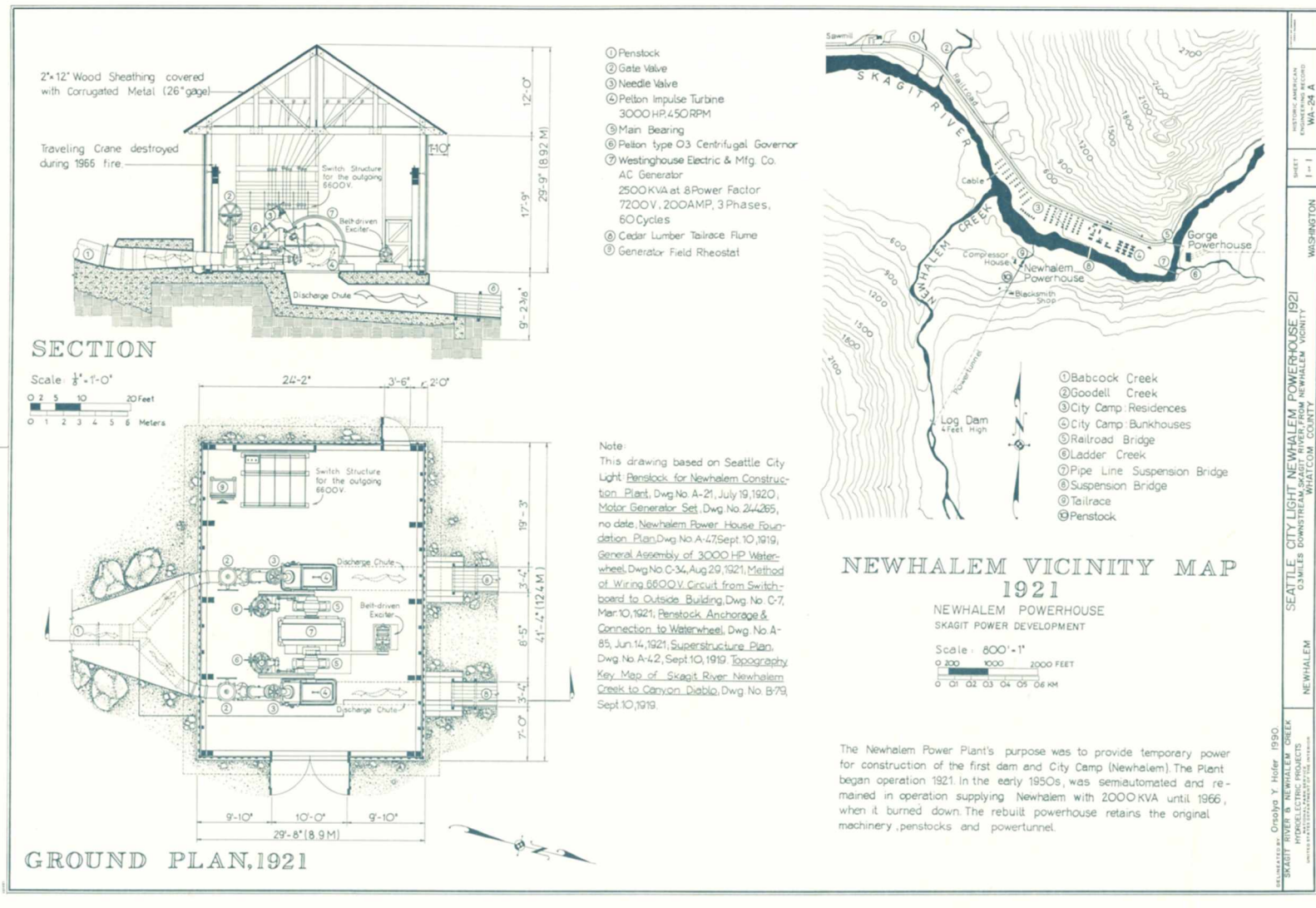
The field work, measured drawings, historical reports, and photographs were prepared under the direction of project managers: Eric N. DeLony, Chief of HAER; Stephanie S. Toothman, Chief of Cultural Resources Division (PNRO); G. Gray Fitzsimons, HAER, Historian/Engineer; and Gretchen Luxenberg, Historian (PNRO). The recording team consisted of Architectural Supervisor, Rita Goodrich (University of Minnesota, Minneapolis), and Architectural Technicians: Dione De Martelæere (North Dakota State University), Orsolya Hofer (Technical University of Budapest, Hungary, ICOMOS), Douglas Pancoast (Kansas University), and Dale Q. Waldron (Rhode Island School of Design). The formal photography was done by John "Jet" Lowe. The historians responsible for documenting the SPD were Nancy Mannikio (Virginia Polytechnic Institute and State University) and Patricia Erigero (University of Oregon).

The recording team received valuable assistance from Seattle City Light, both in Seattle and at the Skagit Power Development. Special thanks to Lane Dexter (Sr. Operator, Gorge Powerhouse), Lonnie Johnson (Sr. Operator, Diablo Powerhouse), and Phi Trinh (Supervisor, Diablo Powerhouse).

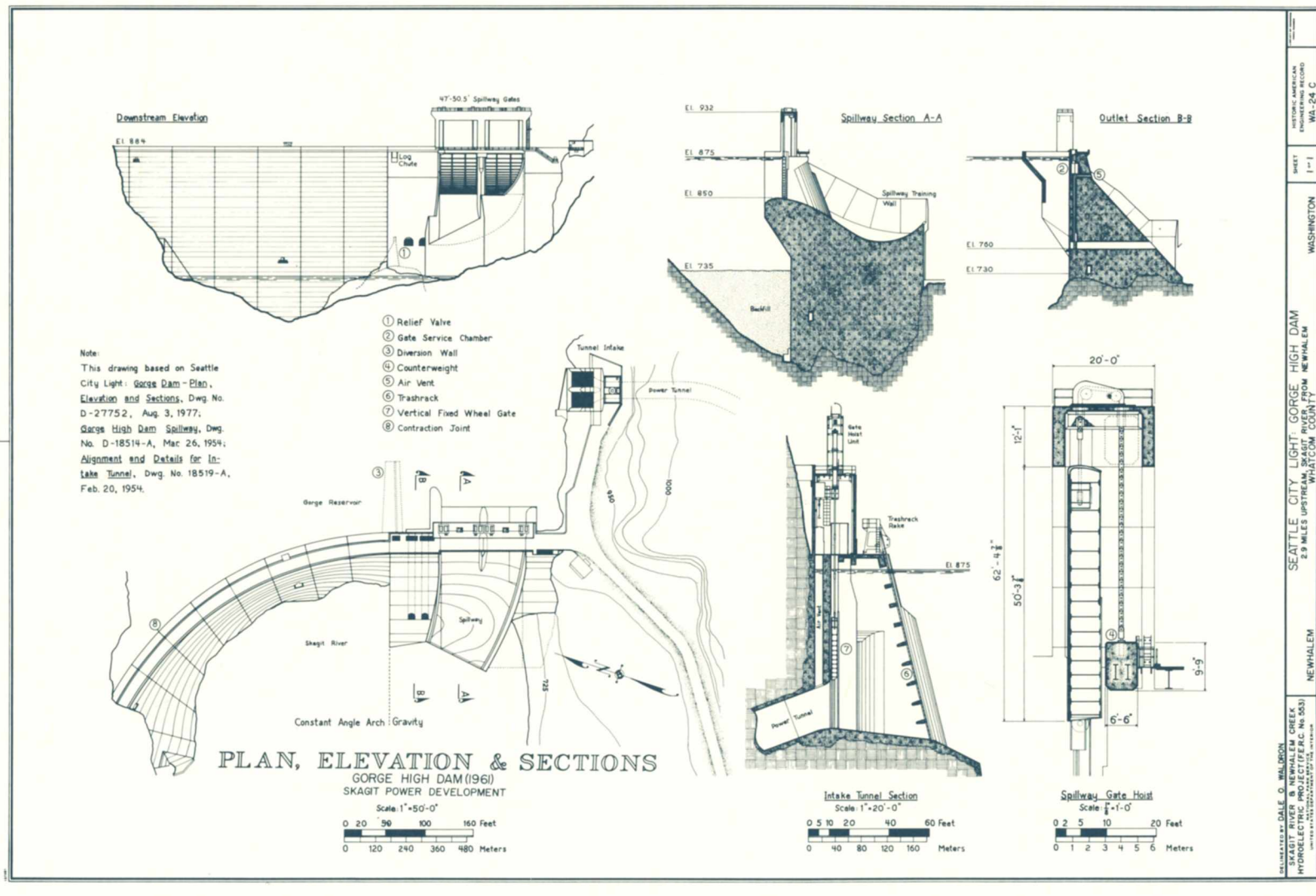
DRAWING		SHEET		WASHINGTON		SEATTLE CITY LIGHT: SKAGIT POWER DEVELOPMENT		WHATCOM COUNTY		NEWHALEM	
HISTORIC AMERICAN ENGINEERING RECORD		1-3		WA - 24							
IF REPRODUCED PLEASE CREDIT: HISTORIC AMERICAN ENGINEERING RECORD, NATIONAL PARK SERVICE, NAME OF DELINEATOR, DATE OF THE DRAWING											



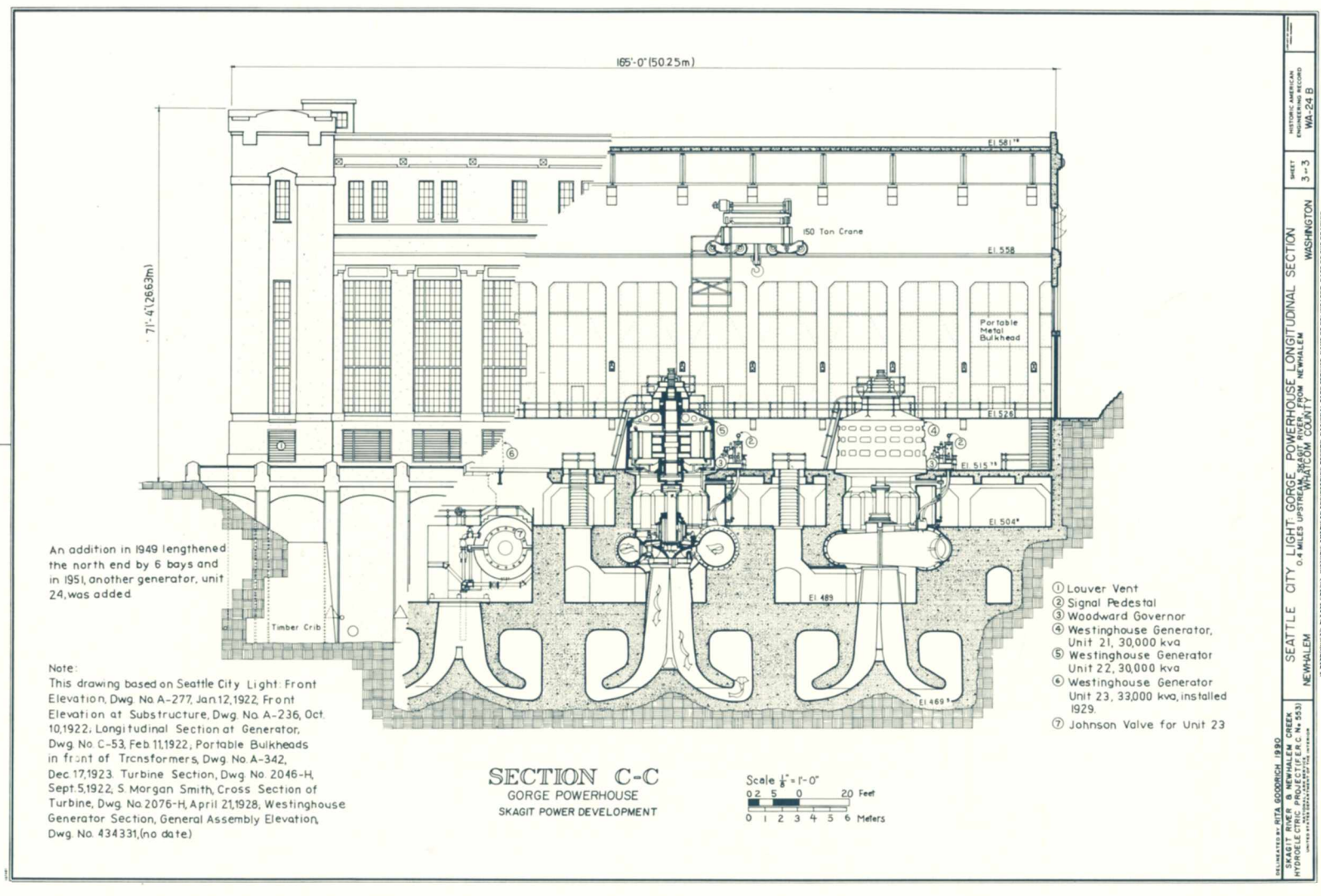
Seattle City Light: Skagit Power Development (WA - 24) Title Sheet (3 of 3)



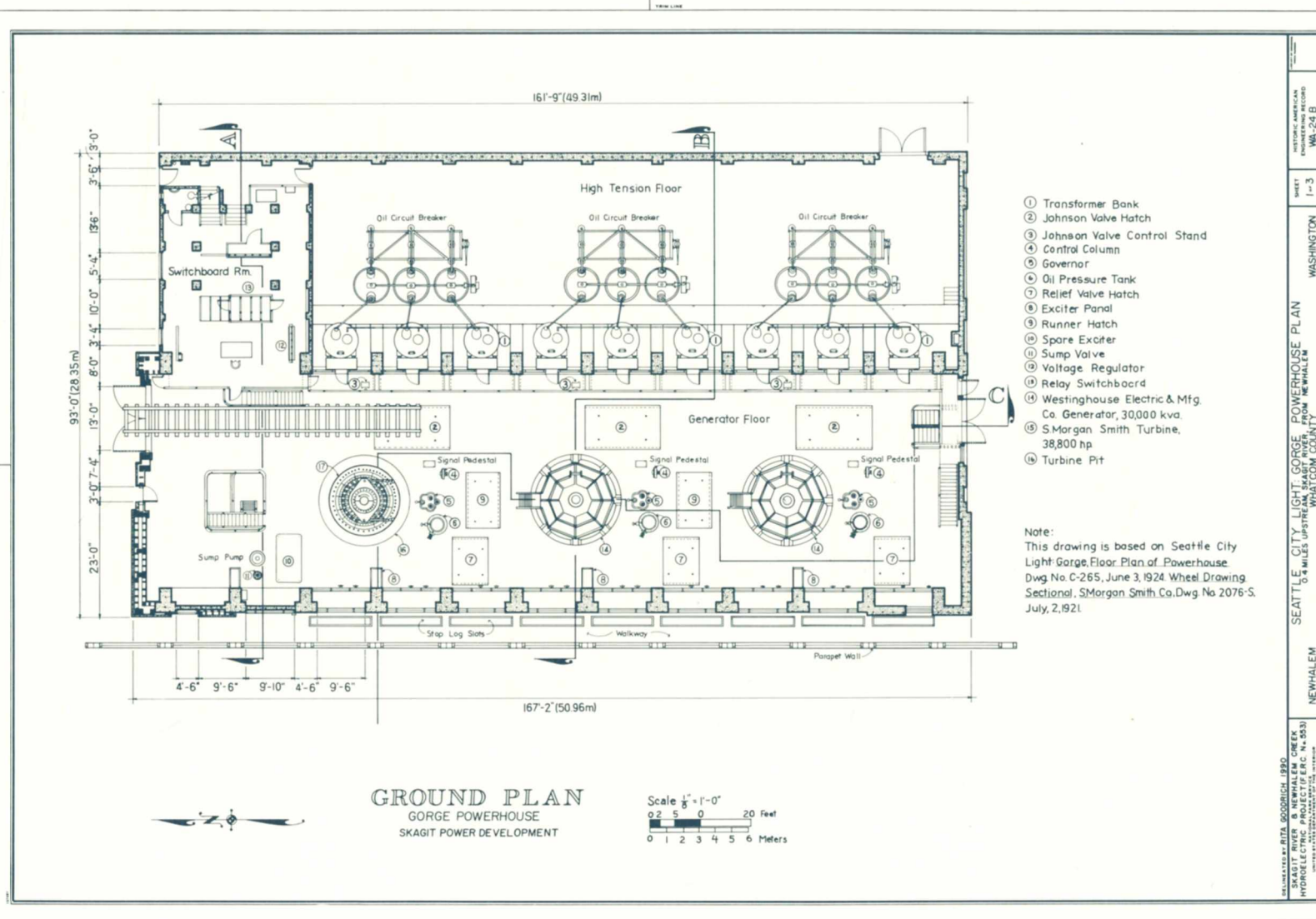
Seattle City Light: Skagit Power Development (WA - 24 A) Title Sheet (1 of 1)



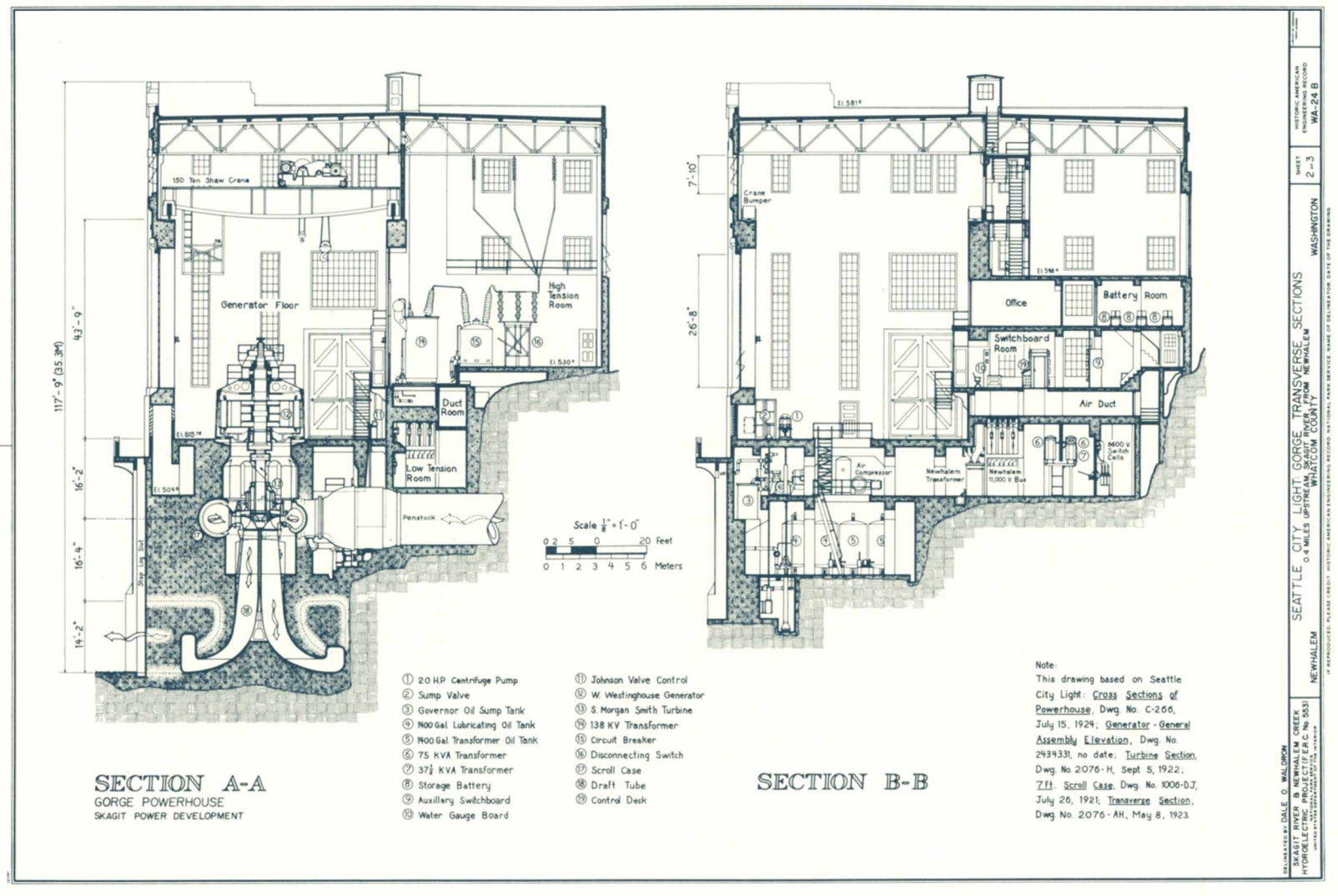
Seattle City Light: Skagit Power Development (WA - 24 C) Title Sheet (1 of 1)



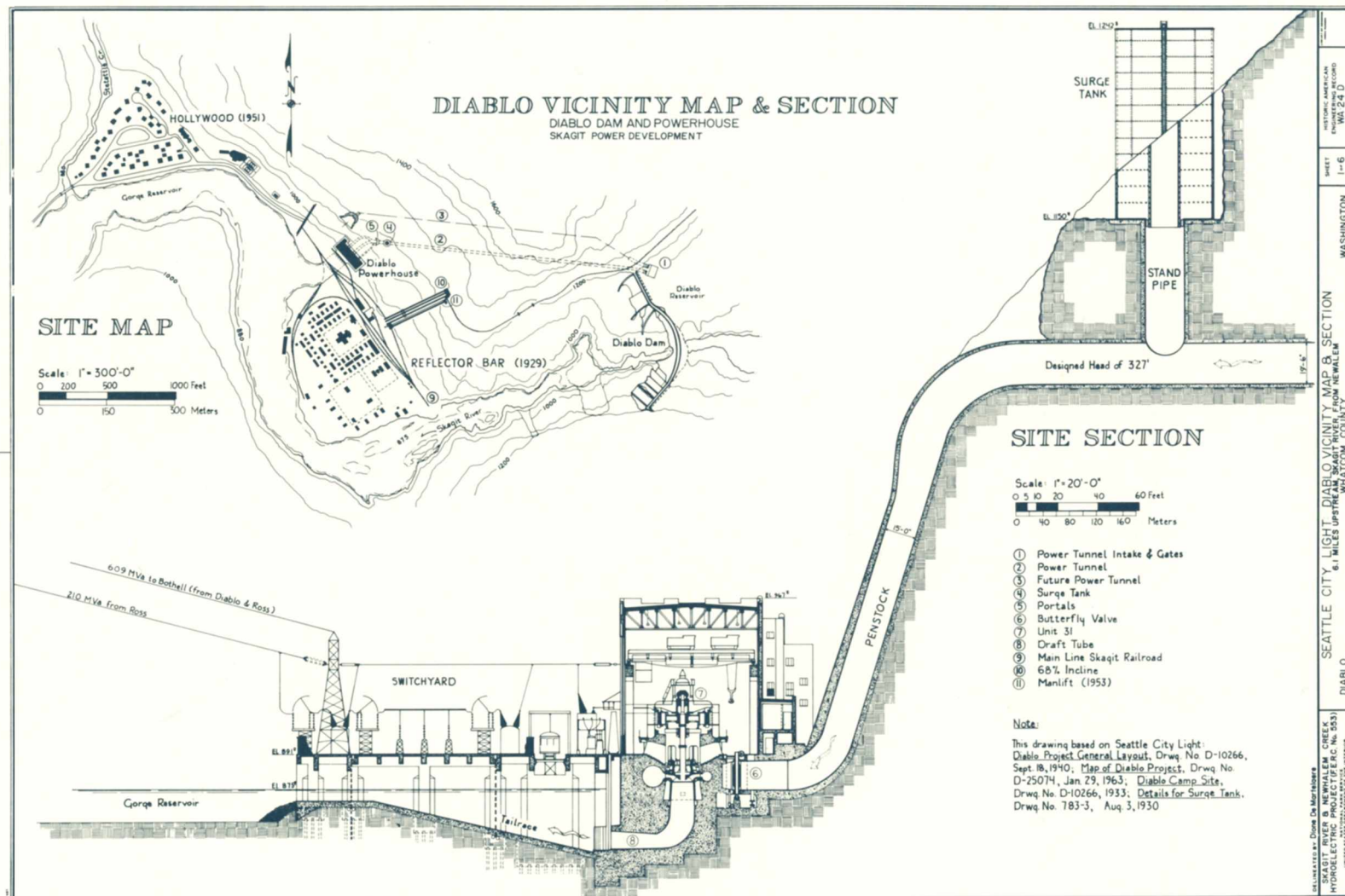
Seattle City Light: Skagit Power Development (WA - 24 B) Title Sheet (3 of 3)



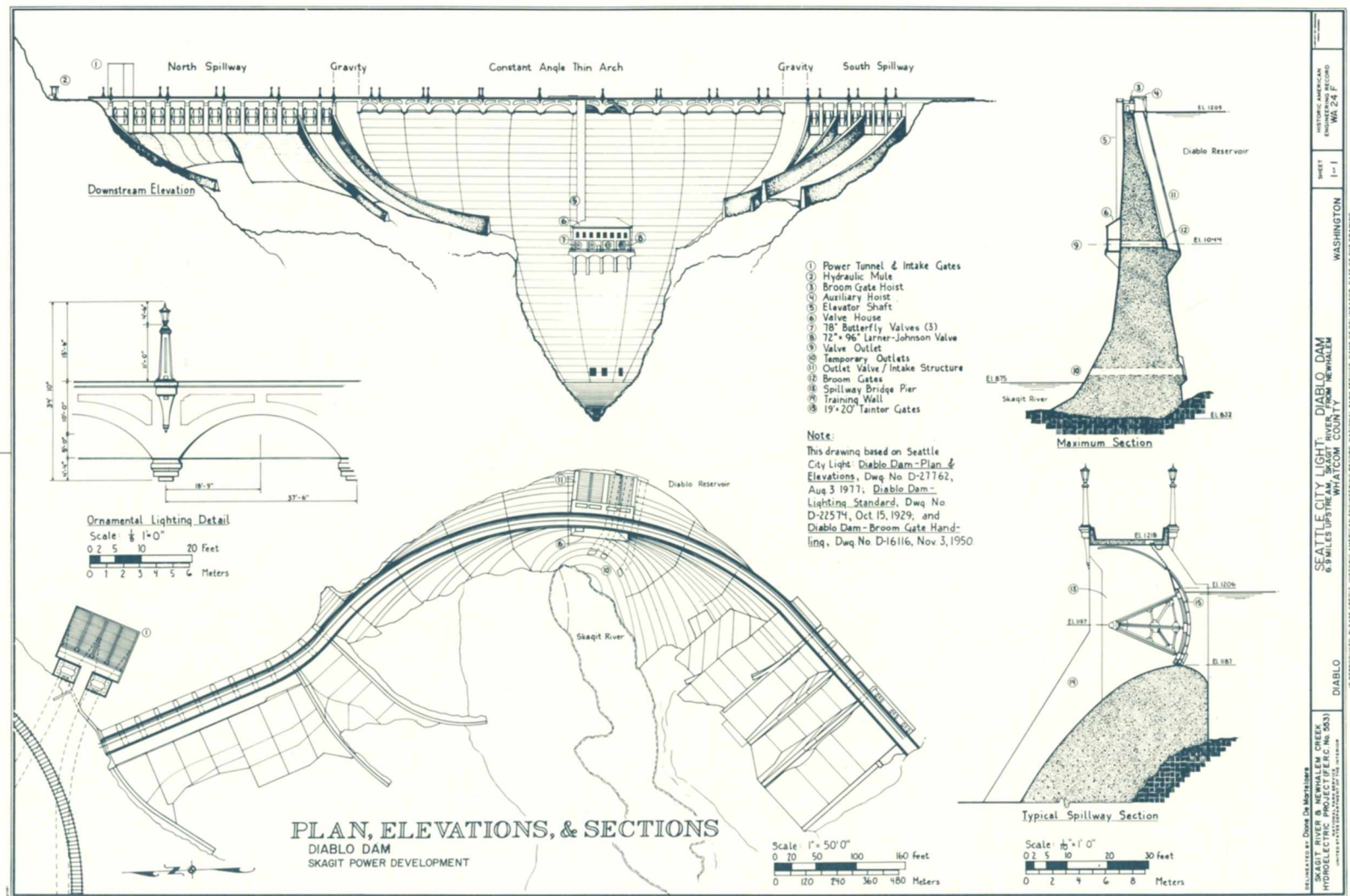
Seattle City Light: Skagit Power Development (WA - 24 B) Title Sheet (1 of 3)



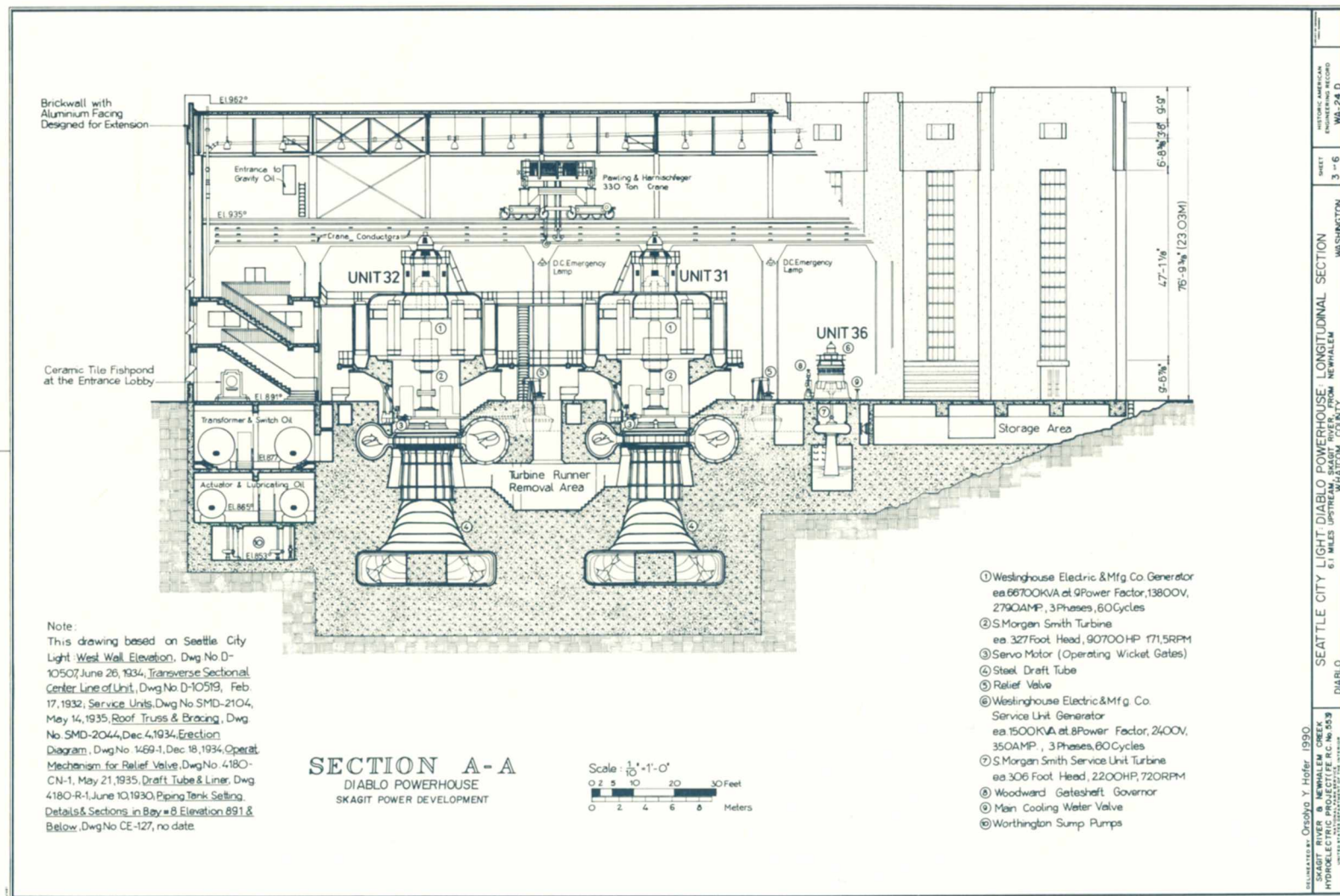
Seattle City Light: Skagit Power Development (WA - 24 B) Title Sheet (2 of 3)



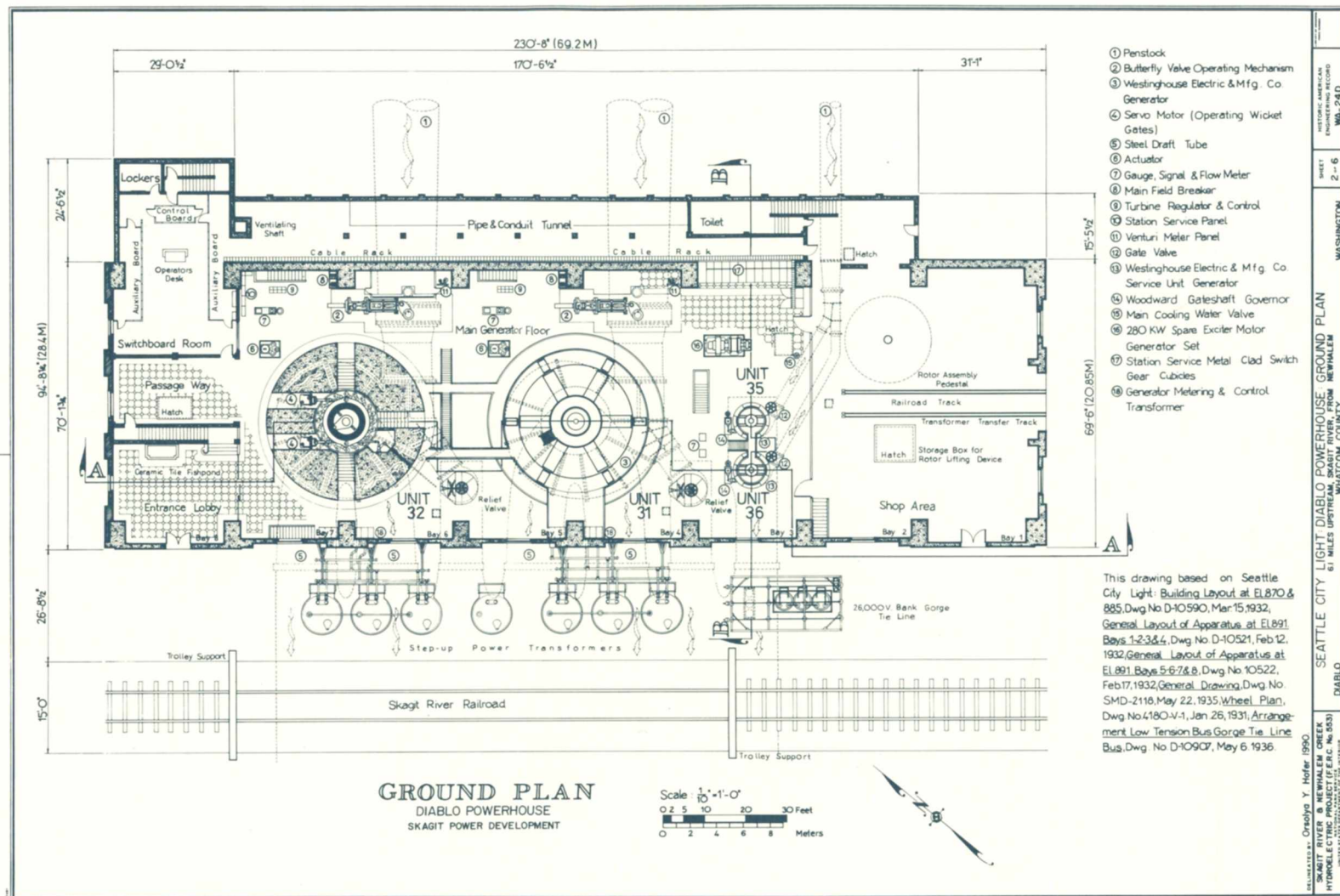
Seattle City Light: Skagit Power Development (WA - 24 D) Title Sheet (1 of 6)



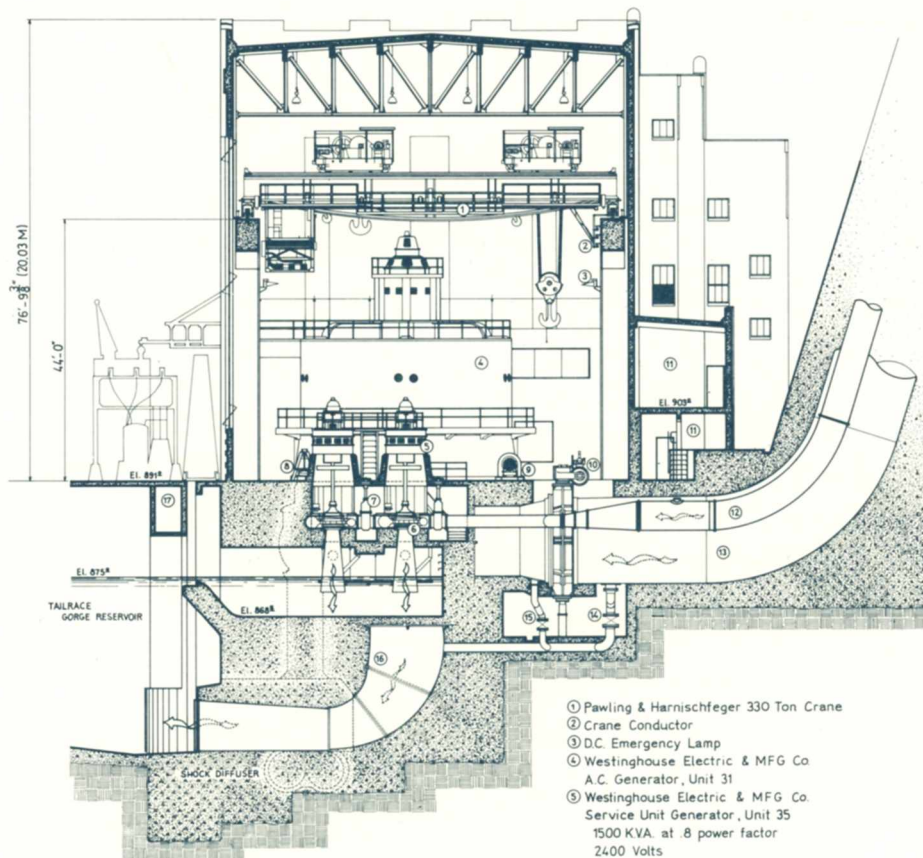
Seattle City Light: Skagit Power Development (WA - 24 F) Title Sheet (1 of 1)



Seattle City Light: Skagit Power Development (WA - 24 D) Title Sheet (3 of 6)



Seattle City Light: Skagit Power Development (WA - 24 D) Title Sheet (2 of 6)



Note:
 This drawing based on Seattle City Light:
 Roof Truss, Dwg. No. SMD-2044, Nov., 27, 1934
 General Dwg. Sections, Dwg. No. 4180-CK-1, May 5, 1935
 Box Girder, Dwg. No. SMD-2020, Apr., 4, 1931
 Penstock Connections, Dwg. No. 783-3, Mar., 25, 1931
 14' Butterfly Valve, Dwg. No. MD-1843, Dec., 4, 1930
 Service Units, Dwg. No. 4180-AB-1, May 13, 1935

- ① Pawling & Harnischfeger 330 Ton Crane
- ② Crane Conductor
- ③ D.C. Emergency Lamp
- ④ Westinghouse Electric & MFG Co.
A.C. Generator, Unit 31
- ⑤ Westinghouse Electric & MFG Co.
Service Unit Generator, Unit 35
1500 KVA at .8 power factor
2400 Volts
350 Amps
3 phase, 60 cycles
- ⑥ S. Morgan Smith
Service Unit Turbine, Unit 35
720 R.P.M.
2200 H.P.
306' designed head
- ⑦ Gate Valve, Service Unit
- ⑧ Relief Valve, Unit 31
- ⑨ Spare Exciter
- ⑩ Butterfly Valve Operating Mechanism
- ⑪ Storage Room
- ⑫ Penstock, Unit 35
- ⑬ Penstock, Unit 31
- ⑭ Penstock Drain Valve
- ⑮ Scroll Case Drain Valve
- ⑯ Steel Draft Tube, Unit 31
- ⑰ Transformer Cooling Water Duct

SECTION B-B

DIABLO POWERHOUSE
 SKAGIT POWER DEVELOPMENT

Scale $\frac{1}{8} = 1'-0"$
 0 2 5 10 20 Feet
 0 1 2 3 4 5 6 Meters

DELINEATED BY Douglas Pancoast
 SKAGIT RIVER & NEWHALEM CREEK
 HYDROELECTRIC PROJECT (F.E.C. No. 553)
 NATIONAL PARK SERVICE
 UNITED STATES DEPARTMENT OF THE INTERIOR

SEATTLE CITY LIGHT- DIABLO POWERHOUSE- TRANSVERSE SECTION
 6.1 MILES UPSTREAM, SKAGIT RIVER, FROM NEWHALEM
 DIABLO WHATCOM COUNTY WASHINGTON

SHEET
 4 - 6

HISTORIC AMERICAN
 ENGINEERING RECORD
 WA-24 D

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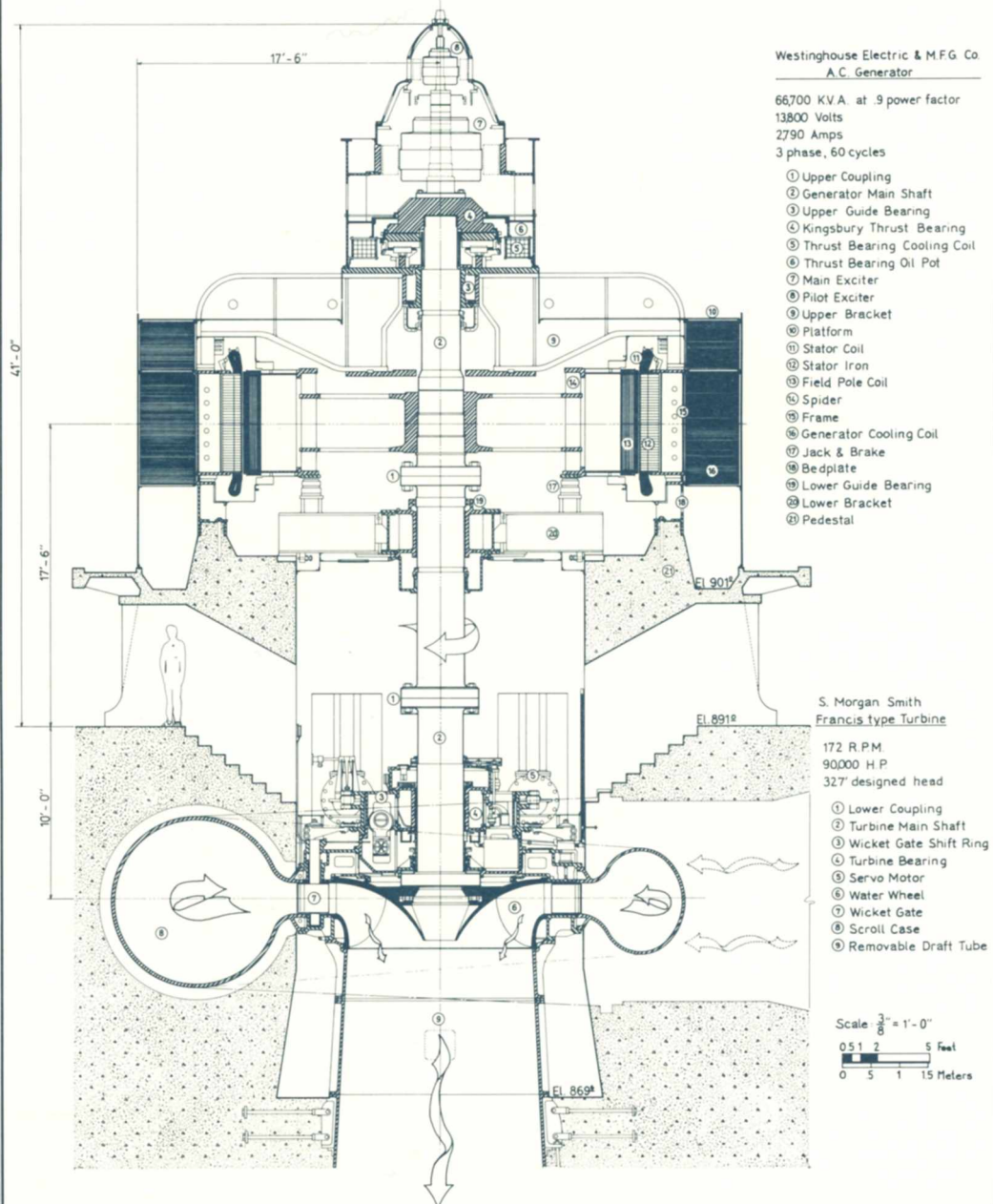
DIABLO UNIT 31

DIABLO POWERHOUSE
SKAGIT POWER DEVELOPMENT

Note:

Unit 31, Diablo Powerhouse: This unit was the largest of its kind when ordered in the early 1930's. The unit became operational on September 23, 1936.

This drawing based on Seattle City Light: General Assembly, Dwg No. SME-177, no date. Wheel Section, Dwg No. 4180-U-1, June 17, 1935.



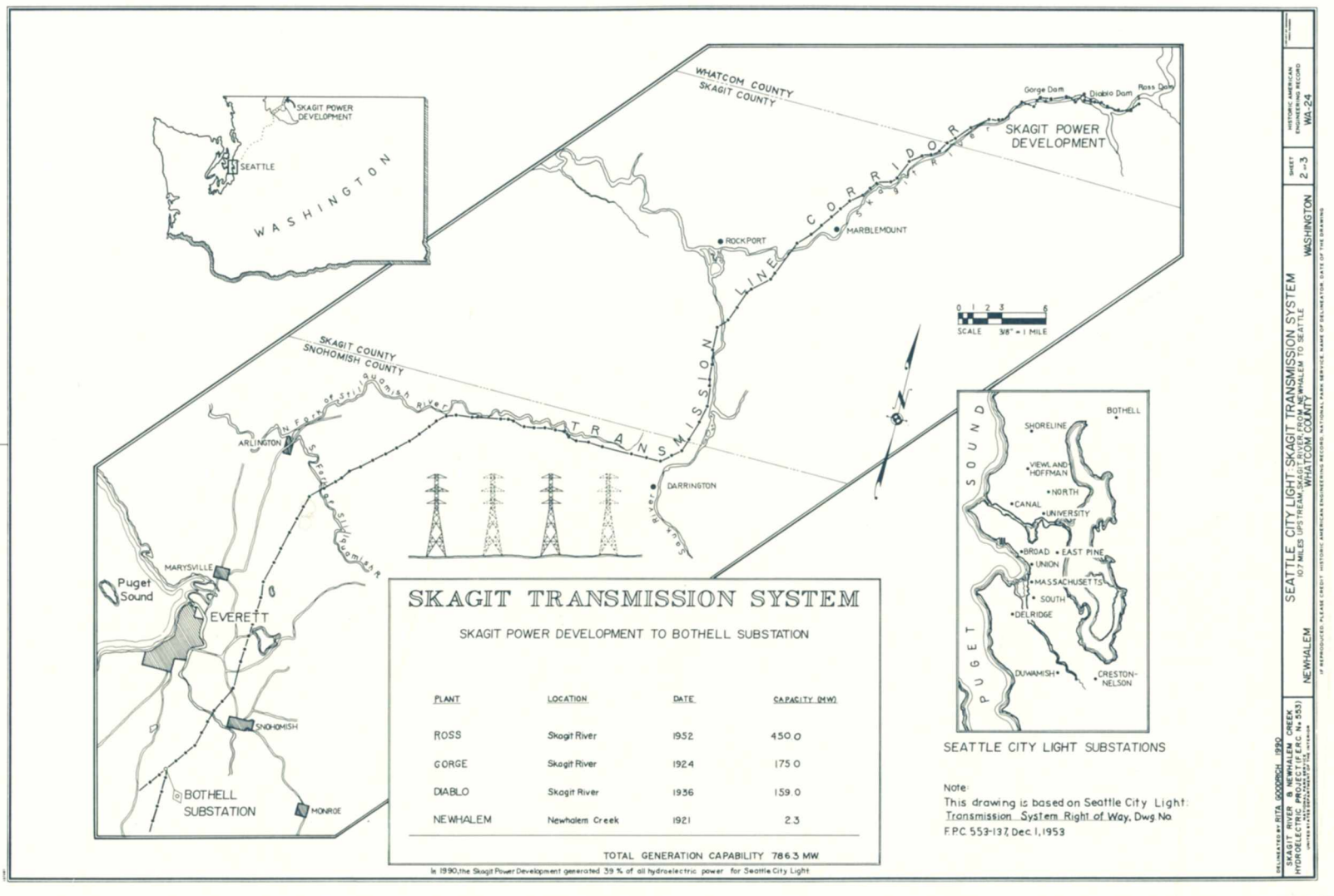
DELINATED BY: Douglas Pancoast
SKAGIT RIVER & NEWHALEM CREEK
HYDROELECTRIC PROJECT (FERC No. 553)
UNITED STATES DEPARTMENT OF THE INTERIOR

SEATTLE CITY LIGHT: DIABLO POWERHOUSE: SECTION: UNIT 31
6.1 MILES UPSTREAM, SKAGIT RIVER, FROM NEWHALEM
DIABLO WHATCOM COUNTY WASHINGTON

SHEET
5 - 6

HISTORIC AMERICAN
ENGINEERING RECORD
WA-24 D

IF REPRODUCED, PLEASE CREDIT: HISTORIC AMERICAN ENGINEERING RECORD, NATIONAL PARK SERVICE, NAME OF DELINEATOR, DATE OF THE DRAWING



Seattle City Light: Skagit Power Development (WA - 24) Title Sheet (2 of 3)

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The information presented in this summary is drawn from the written report component of *Skagit Power Development: Skagit River and Newhalem Creek Hydroelectric Projects*, Historic American Engineering Record (HAER) Report No. WA-24, on file in the Library of Congress.

That report includes a detailed, seven-page bibliography, selected entries of which are listed below.

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ACKNOWLEDGEMENTS

In addition to the members of the Historic American Engineering Record team and National Park Service staff previously acknowledged, the following individuals made significant contributions to this project:

Scott Cline, Seattle Municipal Archives, Seattle City Clerk's Office

Felix deMello, Generation Division, Seattle City Light

John Earnst, former Superintendent of North Cascades National Park

Michele Lynn, Environment and Safety Division, Seattle City Light

Jan Mulder, Environment and Safety Division, Seattle City Light

Bill Newby, former Director of Generation for Seattle City Light

NancyEllen Regier, Graphic Designer, Executive Services Department, City of Seattle

Rick Rutz, former employee of Seattle City Light

FUNDED BY



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