CUSHMAN NO. 1 HYDROELECTRIC POWER PLANT, WATER CONVENANCE SYSTEM
Spanning the North Fork of Skokomish River
Hoodsport vicinity
Mason County
Washington

HAER WA-26-E
HAER WA-26-E

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
PACIFIC WEST REGIONAL OFFICE
National Park Service
U.S. Department of the Interior
333 Bush Street
San Francisco, CA 94104

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HAER No. WA-26-E

Location:	Spanning the North Fork of the Skokomish River, Mason County, Washington USGS Topographic Quad: Hoodsport Township 22 North, Range 4 West, Section 5
GPS Coordinates:	Latitude: 47° 25'389 N, Longitude: 123° 13'353 W This coordinate represents the center of the Cushman No. 1 intake house building. Obtained October 17, 2012, using Google Earth (© 2012). The coordinate's datum is North American Datum 1983.
Present Owner:	City of Tacoma, Department of Public Utilities, Light Division (doing business as Tacoma Power)
Present Use:	Hydroelectric Power Production
Significance:	Cushman No. 1 Hydroelectric Power Plant powerhouse represents a significant achievement in power production for the City of Tacoma. Constructed in response to unprecedented increases in power demands in the city, the Cushman No. 1 Development led to further industrial and commercial expansion. Cushman No. 1 dam is a notable example of medium-head hydroelectric technology from the mid-1920s. Moreover, its construction was an engineering feat, located in steep, nearly inaccessible terrain prone to flooding.
Date:	Constructed 1923–1925
Builder:	Tacoma City Light
Report prepared by:	Natalie K. Perrin, M.S., and Heather Lee Miller, Ph.D. Historical Research Associates, Inc. 1904 Third Avenue, Suite 240 Seattle, WA, 98101 and John Stamets, Photographer 493 14th Avenue East Seattle, WA 98112
Submittal Date:	July 17, 2014

I. PROJECT DESCRIPTION

The City of Tacoma, Department of Public Utilities, Light Division (doing business as Tacoma Power) owns and operates the Cushman Hydroelectric Project (the Project). The Project is operated under a 50-year Federal Energy Regulatory Commission (FERC) license (FERC Project No. 460), which was granted on July 15, 2010, following over 20 years of negotiations with federal, state, local, and tribal entities. The Cushman Hydroelectric Project comprises two historic districts listed in the National Register of Historic Places (NRHP) in 1988, specifically the Cushman No. 1 Hydroelectric Plant Historic District and the Cushman No. 2 Hydroelectric Plant Historic District. At the time of this writing, the two districts are being combined into one historic district known as the Cushman Hydroelectric Project Historic District; the district, as revised, encompasses the Cushman Nos. 1 and 2 Developments and a segment of the Potlatch (Cushman) Transmission Line.

The Cushman Hydroelectric Project plays an integral role in the City of Tacoma's infrastructure and economic development. The Cushman No. 1 Hydroelectric Power Plant or, more accurately, the Cushman No. 1 Development, includes buildings and structures from the initial building campaign of the Project, 1923–1925. The Cushman No. 1 Development impounds Lake Cushman, and includes the Cushman No. 1 dam and valve house (HAER No. WA-26-B), the Cushman No. 1 powerhouse (HAER No. WA-26-C), the inclined tram and tram house (HAER No. WA-26-D), the water conveyance system (HAER No. WA-26-E), and the Potlatch (Cushman) transmission line (HAER No. WA-26-F). The original spillway (HAER No. WA-26-A) was removed and replaced with a modern spillway in 1991.

As part of FERC relicensing, Article 414 requires a floating surface collector (FSC) and net transition structure (NTS) be installed at the Cushman No. 1 Development, to facilitate downstream fish passage. Construction of the FSC and NTS is considered an undertaking under Section 106 of the National Historic Preservation Act of 1966 (as amended), and constituted an unavoidable adverse effect on a historic property. To minimize the adverse effect, Tacoma Power consulted with an architectural historian during project design phases; combined the Cushman Nos. 1 and 2 Hydroelectric Power Plant historic districts into one Cushman Hydroelectric Project historic district via a NRHP nomination update; and completed this Historic American Engineering Record (HAER) documentation to addend the 1989 recordation of the Cushman No. 1 spillway.

Aside from minor alterations to the Cushman No. 1 dam deck and parapet to accommodate minimal attachment of the FSC, limited character-defining features and/or historic fabric will be altered or removed for construction of the FSC. As indicated, modifications to original materials, design, and workmanship were reviewed and revised with the aid of an architectural historian, to ensure compliance with the Secretary of the Interior's *Standards for Rehabilitation*.

II. HISTORIC CONTEXT

On February 28, 1926, the *Tacoma Sunday Ledger* produced a special edition detailing every aspect of the Cushman Project. One headline, "Tubes That Get Little Attention By Visitors Play Important Role," chronicled the remarkable engineering feat that is the Cushman No. 1 water

conveyance system. Begun May 1, 1924, the design of the tunnel was the work of hydraulic engineer Benjamin E. Torpen. Torpen completed the hydraulic studies and plans of the Cushman Project, after which he was promoted to resident engineer. Along with E. A. Prokop, tunnel engineer, and Henry Norby, a civil engineer, the hidden marvel of the Cushman power tunnel "was neither very long nor very difficult in its nature, yet it has nevertheless come in for a generous degree of praise whenever engineers have gone over the plant. This is due to the refinements of workmanship which distinguish it."[1]

III. PHYSICAL DESCRIPTION

The Cushman No. 1 water conveyance system comprises the diversion intake, intake gate house (and platform), and the power tunnel (including the diversion tunnel and penstocks). Constructed on the upstream face of the dam, the diversion intake is a reinforced-concrete structure with two intake gates. The gates divert water, used to power the turbines, from the Cushman reservoir into a tunnel that leads to the powerhouse. The gates operate through a vertical well just behind the intake and at the head of the power tunnel. The intake is protected by a trash rack of ½ by 4-inch steel bars, which is fitted with a power-operated trash rake to remove debris.

Operating equipment for the gates and the trash rake occupies the intake house, located immediately above the gate well and trash rake on a raised platform. This building carries the tunnel vent and the bypass valve to a point above high water. The bypass valve is used to fill the tunnel and equalize the pressure before the main gates are opened. The building and platform are accessible via a short bridge from the top of the dam. The intake house is rectangular in plan with a gable roof of standing-seam metal. The building is clad in prefabricated metal panels and features four three-light metal-sash windows, one in each gable end on the north and south elevations and two flanking the central steel entry door on the west elevation.

The circular, concrete-lined power tunnel is 540 feet long and 17 feet in diameter. The maximum water velocity in the tunnel is 12 feet per second. (Portions of the tunnel built for diversion and drainage only are 10 feet in diameter and unlined.) Water is conveyed from the tunnel through two 12-foot diameter lateral branches to two riveted steel penstocks, each 150 feet long and 10 feet in diameter. In her original NRHP nomination for the Cushman No. 1 Hydroelectric Power Plant Historic District, historian Lisa Soderberg noted that "the low water velocity and the short length of the conduit between the intake and the water wheels obviated the use of relief valves and surge chamber."[2]

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[1] "Tubes That Get Little Attention by Visitors Play Important Role," *Tacoma Sunday Ledger,* February 28, 1926, 10.

[2] Lisa Soderberg, "Cushman No. 1 Hydroelectric Power Plant," National Register of Historic Places Nomination Form, 1988, 8-1, on file at the Washington Department of Archaeology and Historic Preservation, Olympia (hereafter DAHP).

IV. CONSTRUCTON AND MAINTENANCE

"Such records as having made the two ends of the bore meet within three-sixteenths of an inch . . . of having only one round of shots break out rock deeper than needed . . . and of obtaining a lining of the tunnel so perfect that the graining of the lumber in the forms was frequently left in the concrete" were just some of the "refinements of workmanship" noted of the Cushman water conveyance system.[3]

The "exactness" with which the tunnel was built translated to a great cost savings for the City of Tacoma. The internal pressure of the tunnel, once filled, was likened to that of a steam boiler; reinforcing steel was essential in locations where the "depth of rock was not such as to insure a counter pressure at least as great as the internal pressure of the tunnel." The perfection of the lining reduced friction to ensure minimal amount of power loss in carrying water to the turbines. Further, the intake and gates were designed "to conserve the effective head of the water," gradually increasing the velocity from 2 feet per second to 12 feet per second.[4]

Since initial construction, the power tunnel has seen no major alterations and limited maintenance; fortunate, as the tunnel and penstocks are almost completely inaccessible when the project is functioning. The diversion intake, intake gate and platform have also remained largely intact to their original form, with only minimal maintenance.

V. REFERENCES

Soderberg, Lisa. "Cushman No. 1 Hydroelectric Power Plant." National Register of Historic Places Nomination Form. 1988. On file at the Washington Department of Archaeology and Historic Preservation, Olympia.

"Tubes That Get Little Attention by Visitors Play Important Role," *Tacoma Sunday Ledger*. February 28, 1926. Washington State Library, Olympia, WA.

[3] "Tubes That Get Little Attention by Visitors Play Important Role," 10.

[4] "Tubes That Get Little Attention by Visitors Play Important Role," 10.