



**MWH Americas, Inc.
Watana Hydroelectric Study
Transmission Connection to CVEA
Project # 11-0514**

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Summary of Changes

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1 Introduction

Development of the Watana Hydro Project will serve the energy needs of the six electric utilities along the Railbelt. Copper Valley Electric (CVEA) serves the communities of Glennallen and Valdez with a 138kV transmission line between them, but isolated from the Railbelt and provides a significant amount of its energy through diesel generation. This study is to provide a “high-level” assessment of possible transmission line routings to connect CVEA to the Railbelt Electrical Grid with the construction of the Watana hydroelectric project

This study consisted of an office review using aerial imagery, USGS maps, a review of previous interconnections studies and general knowledge of the area. Typical Alaskan transmission structures capable of either 115 or 138kV were assumed for routing and cost estimates. Four possible line routes were identified and designated as;

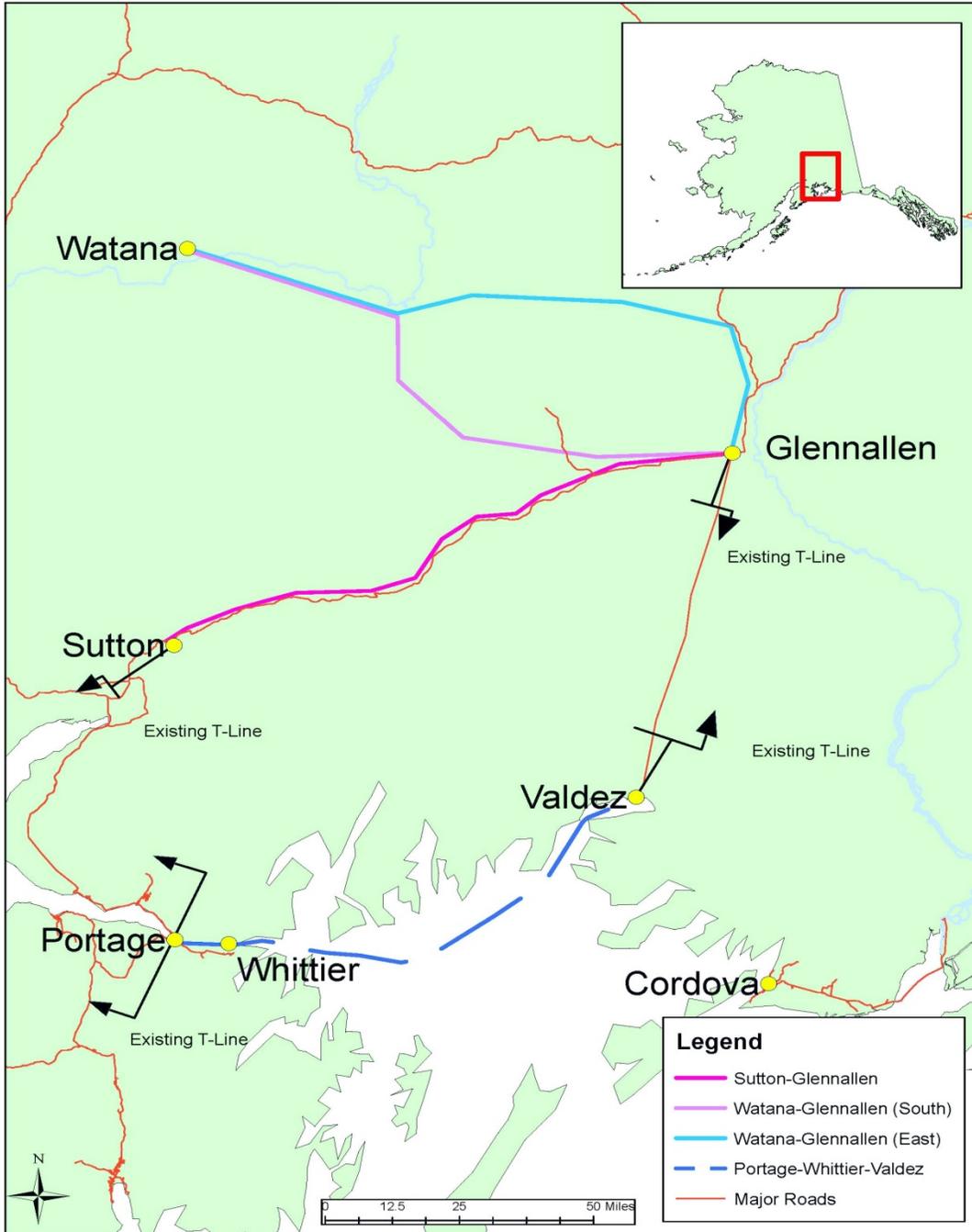
- Sutton- Glennallen (S-G)
- Watana - Glennallen East (W-G East)
- Watana - Glennallen South (W-G South)
- Portage - Whittier - Valdez (P-W-V)

Overhead lines are assumed for the Sutton and Watana lines and P-W-V is a DC submarine cable. Submarine cables are manufactured by a small number of companies around the world and their popularity has increased dramatically in the last decade. Consequently, cost estimates for submarine installations require a higher contingency for uncertainties. The S-G transmission line has been studied for over 20 years by various engineering firms and a synopsis of relevant sections from those studies is included. A transmission line directly from Watana to Glennallen has not been studied before and two possibilities are presented.

A brief description of each line route generally explains terrain to be crossed and some comments about land status and construction issues. Cost estimates are budgetary level only. They do show that a DC submarine cable is very expensive.

2 Overview Map

MWH 11-0229



Watana Hydro
Transmission Corridor Report
Connection to CVEA

Date: 5/14/12

3 Previous Studies

Several studies were completed in the late 1980's and early 1990's on various transmission lines around the state which included a connection of the CVEA system to the Railbelt. Following is a brief description of each study.

Power Engineers Inc. /Hart-Crower Inc. (June 1989).

Railbelt Intertie Reconnaissance Study/ Northeast Transmission Intertie Project, vol. 8, State of Alaska, Alaska Power Authority (RIR-89).

RIR-89 is part of an overall "Railbelt Intertie Reconnaissance Study" to create a second electric tie between the Anchorage and Fairbanks electrical systems. One possible route within this overall study, noted in volume 8A (346 pages) & 8B (384 pages), extends from the Matanuska Electric's service area at Sutton and essentially follows the Glenn Highway northeast to Glennallen and then north to the GVEA system at Delta. Only the line section between Sutton and Glennallen is considered in our review.

RIR-89 prepared two alternative routes along the Glenn Highway based on results of electrical studies, environmental, permitting requirements and cost estimates. These alternatives were presented to the public and incorporation of comments resulted in a "Suggested Route".

Volume 8B includes over 200 pages of collected public comments which are briefly summarized below.

Apparently there was confusion created when the report originally bore the name "feasibility" rather than "reconnaissance", which had very different connotations and was changed.

Consistently the concern was expressed about the line interfering with views of the natural beauty in the area especially if constructed on the south side of the highway, and specifically in the area of the Matanuska Glacier. In the Sheep Mountain area, neither side of the highway was acceptable, the line needed to be completely out of view from the highway.

There was another concern of having high voltage lines near residences or lines crossing directly over homes. Many property owners organized the NEICR (Northeast Intertie Concerned Residents) and worked with the report team to arrive at a more acceptable route.

CVEA went on record favoring the project feeling the report had overstated costs and understated benefits. More efficient water utilization of the Solomon Gulch hydroelectric project was anticipated with this interconnection.

Power Engineers/Hart Crowser (Jan. 1993),

Sutton to Glennallen 138KV Transmission Intertie Project, vol 2 Final Report, Copper Valley Electric Inc. (CIP-93).

Prior to this CIP-93 final report, CVEA had requested Power Engineers to prepare a "screening level cost estimate" which was completed on August 18,1992. The results of the 1992 cost

estimate were reviewed by CVEA, Alaska Energy Authority, Chugach Electric Association, Matanuska Electric Association, two construction contractors, and other interested parties. Based on the input received from the reviewers the project appeared feasible, however, it was generally agreed that a more detailed cost estimate be prepared for the project. As a result of these discussions, Power Engineers was requested by CVEA to prepare a detailed cost estimate. This document, CIP-93, was based on a single route. The route selected was slightly different than the “Suggested Route “identified in RIR-89. Power Engineers and CVEA understood that to follow Alaska Legislative procedure, Alaska Energy Authority would require a Feasibility Study be completed.

RW Beck (April 1994) Feasibility Study

Copper Valley Intertie, vols. 1-3, State of Alaska, Department of Community and Regional Affairs, Division of Energy (FS-94).

The FS-94 feasibility study presented minor variations of the “Suggested Route” from RIR-89 and CIP-93 between Sutton and Glennallen. Route alternatives within FS-94 were generally sited to minimize visual impacts. A set of evaluation criteria was established and applied with a route evaluation matrix procedure to determine the relative advantages and disadvantages of each alternative.

FS-94’s public process utilized significant involvement from not only residence along the route, but citizens from Anchorage to Glennallen. Three local citizen groups along the route; Sutton, Chickaloon, and Glacier View were generally opposed to the line. After discussions, some routing alternatives provided partial acceptance. As representative of their citizens, the MatSu Borough also passed a resolution against the line. Local utility managers also became involved and provided statements both for and against the line.

CH2MHILL (Nov. 1995). Feasibility Study Update

Copper Valley Intertie State of Alaska, Department of Community and Regional Affairs (FSU-95).

FSU-95 provided an updated cost of power analysis for various power supply alternatives to the Railbelt. Unlike FS-94 the cost of power analysis includes generation and purchased power costs. The study merely considered the CVEA Intertie as an alternate power supply. Intertie routing alternatives were not considered because there were not significant costs differential to the various routes in FS-94.

4 Routing Descriptions

Following are brief descriptions of each proposed route.

Sutton- Glennallen (S-G)

This route would connect to Matanuska Electric’s transmission facility in the Sutton area and generally parallel the Glenn Highway corridor to the terminus in Glennallen. For this report it is assumed “apparent preferred route, Route Alternative D” from (FS-94) is used. The route proceeds from Sutton to Boulder Creek, then along the southern flank of Anthracite Ridge to a

point west of the Victory Road area. The route turns north of Strelshla Mountain and continues up Hicks Creek, Alfred Creek and Crooked Creek before turning east into the Copper River Basin. The route continues in a general easterly direction from Crooked Creek remaining from two to six miles north of the Glenn Highway until it turns south and crosses the highway approximately 5 five miles west of Glennallen then east into the CVEA's substation. The highway provides a distinct advantage for this route and allows access for construction and future maintenance.

There were definite attempts to route north of the highway to reduce visibility. Because of the terrain, there are places where it is as much as 6 miles or more from the highway.

Watana-Glennallen East (W-G East)

This route is connected to the proposed Watana Hydro starting from the south side of the facility, then eastward above the reservoir and Susitna River on the south side. The route follows a bench at approximately 2000 foot elevation crossing Kosina Creek. Mid-way around Clarence Peak and in the next 12 miles there are some steep areas and it may be necessary to move up to 3000 feet to cross before dropping down into the Tyone Creek drainage. Elevation of this drainage area is also high, 2200 feet, with some contours at 2400 and 2600 feet across the area eastward. Higher elevations are subject to more severe climatological conditions and this first 48 miles will be potentially impacted by high altitude conditions and construction considerations

This route could proceed southeast directly to Glennallen, but it would cross the Lake Louise area. A more easterly route will avoid many wetland and recreational areas. From Tyone Creek drainage area, the route proceeds east toward the Richardson Highway corridor swinging south just west of Sourdough Lodge and staying west of the Gulkana River designated as part of the "National Wild and Scenic Rivers". W-G East is proposed to enter the Richardson Highway corridor just south of Sourdough and then generally parallel the Richardson Highway into Glennallen.

Access for construction will be via helicopter from the Watana end until within about 50 miles of the Richardson Highway where an ice road could be constructed. The highway will be used for access where parallel. Maintenance will be via helicopter and the Richardson Highway. Many miles of wetlands are expected with the associated more expensive foundations. Federal, Native, State and private lands are anticipated.

Watana-Glennallen West (W-G South)

This route is identical to the W-G East route described above for the first 50 miles before deviating to the south as opposed to the east to avoid the Lake Louise recreation area and large area of wetlands.

At the point of deviation with the W-G East route, this route could proceed southeast directly to Glennallen, but it would cross the Lake Louise recreational area. A more southerly route is recommended to avoid many wetland and recreational areas. From Tyone Creek drainage area, the route proceeds southward to an area west of Lake Louise then turning eastward at a point just south of Lake Louise staying north of Old Man Lake, north of Moose Lake and west of Mud Lake and east into Glennallen.

Access for construction will be via helicopter from the Watana end until within about 50 miles of the Glenn Highway or Lake Louise Road where an ice road can be constructed. The highway will be used for access where parallel. Maintenance will be via helicopter, the Glenn Highway and local roads. Many miles of wetlands are expected with the associated more expensive foundations. Federal, Native, State and private lands are anticipated.

Portage-Whittier-Valdez (P-W-V)

This route would connect to Chugach Electric’s transmission facilities at the junction of the Portage Road and the Seward Highway. The existing overhead distribution line from the Portage Substation into the Portage visitor’s center would be used by adding an overhead transmission line circuit. This would likely require a major expansion of the existing Portage substation to include three 115 kV breakers at the station. From the Visitor’s center into Whittier the distribution circuit is underground cable including several miles of cable within the tunnels into Whittier. The transmission line would follow the existing distribution line from Portage Substation to the Whittier tunnel. At Portage, the 115 kV line would terminate at a HVDC converter station. The HVDC cable would continue as a land cable to Whittier then as a submarine cable to a DC converter station and a submarine cable to Valdez. Due to the submarine cable distance, only a DC cable is feasible for this route alternative. This is a very well-used marine recreational area with many activities potentially damaging to a submarine cable. Burial and armoring will be required to minimize possible impacts.

5 Route Comparison Table

Following is a comparison table of the four alternative line routes.

Line Route	Miles	Estimated Cost	Line Description	Some Possible Issues
Sutton - Glennallen	134	\$101,000,000	Single 115 or 138kV overhead line parallel to Glenn Highway	Previous studies have shown this route to have considerable public opinion against the line. Construction and maintenance via the highway.
Watana-Glennallen (east)	151	\$153,000,000	Single 115 or 138kV overhead line east from the powerhouse to the Richardson Highway and then south into Glennallen	Line will traverse undisturbed land until parallel to Richardson Highway. Helicopter and Richardson Highway for construction and maintenance. Public concerns are unknown.
Watana-Glennallen (south)	139	\$141,000,000	Single 115 or 138kV overhead line southeast and south from the powerhouse to the Glenn Highway and then east into Glennallen	Line will traverse undisturbed land until parallel to Glenn Highway. Helicopter and Glenn Highway for construction and maintenance. Public concerns are unknown.
Portage-Whittier-Valdez	120	\$459,000,000	Single 115 or 138kV overhead line into Portage Visitors Center then HVDC land cable to Whittier and DC Submarine cable to	Line will follow existing distribution into Whittier and then buried through Prince William Sound. Marine activities in the sound are concern for submarine

			Valdez.	cable.
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6 Conclusions

Based on the previous studies from 1989, 1994 and 1995, the logical routing for a connection between the Railbelt and the CVEA system is along the Glenn Highway Corridor. This corridor is already disturbed by significant encroachment by mankind and a transmission line is one more piece of a typical development evolution. Unfortunately, new development always runs contrary to remote lifestyles and produces the NIMBY response. A new transmission line will have a significant construction impact on the developed area along the highway both good and bad. Public and especially governmental agencies objections to the line will be a major obstacle for this route. Once completed, the line should become a less significant to the public and the highway will allow much needed access for maintenance.

The two routes from the Watana Hydro facility are each similar in impacts and probable objections. These routes traverse essentially undeveloped lands with significant recreational use including a great deal of hunting. A transmission line, although not incompatible with recreational areas, will undoubtedly generate public issues. Climatological conditions will be more severe in the higher terrain and mountain passes. A significant amount of either route will require helicopter construction and maintenance.

A DC submarine cable appears, like all buried lines, to be the best solution to routes with visibility issues. However, submarine cables introduce other concerns such as; longevity, extreme costs and very long repair times if needed. With an estimated cost of three times remote and 4 times road access overhead line along with the other concerns, this alternative is probably not practical.