WATANA HYDRO TRANSMISSION CORRIDOR REPORT

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Prepared for:

MWH Americas

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1. EXECUTIVE SUMMARY

Electric Power Systems, Inc. (EPS) was contracted to develop a line corridor report that would identify possible line routings from the Watana Hydroelectric project to interconnection with the Railbelt electrical grid. The Railbelt electrical grid is currently a single-circuit transmission system with limited transfer capacity and single-contingency reliability. The Railbelt grid has expansion plans as defined in the 2010 Railbelt Integrated Resource Plan to increase the reliability and transfer capacity between major load and generation load centers.

The Watana Hydroelectric Project can interconnect with the Railbelt grid in three different locations along separate line routings. The selection of the Watana line routing impacts the construction of the Railbelt infrastructure between the Anchorage and Fairbanks areas. Although this infrastructure is not part of the Watana project, the consideration of the interconnection of the Watana project into the Railbelt can influence decisions in the development of the Railbelt transmission system.

Preliminary studies indicate that to transmit a peak generation capability of 600 MW from the Watana project, three 230 kV transmission lines will be required from the Watana project to the Railbelt interconnected system. The Watana project will provide power to the Fairbanks area north of Watana and to the Anchorage/Mat-Su/Kenai areas south of the project. For purposes of this routing report, it is assumed 200 MW of capacity will be supplied north and 400 MW will be shipped south from the project. A line optimization study to further define the interconnection requirements of the Watana project is not part of this report.

Three general alignments, both sides of the Susitna River to the west and a northern route to Cantwell, were provided as starting points for our report. Possible access road alignments were also provided. Road access is very important to construction of a transmission line and therefore our corridors attempted to follow the access road where reasonable. Roads require a continuous linear corridor that fits with the terrain. Transmission lines have the ability to step-over some terrain features and are not as restricted. However, transmission lines are vulnerable to climatic conditions and higher elevations produce more severe loadings. The corridors noted are a compilation of all these considerations.

One corridor is located on the south side of the Susitna River and would terminate at the proposed Gold Creek Substation (Susitna South Corridor). A second corridor is located on the north side of the river and would terminate at the proposed Chulitna Substation (Susitna North Corridor). The third corridor runs north from the dam site to the Denali Highway, then along the Denali Highway to the existing Cantwell Substation (Denali Corridor). The three potential transmission line corridors are shown on the Overview Map, Figure 1 on the next page. Detail corridor maps can be found in Appendix A.

Connection of the Watana Hydro Facility to the existing Railbelt electrical grid will be highly influenced by decisions of necessary changes to the existing grid. Even though these changes are not part of this report, selection of the final Watana transmission corridor will be impacted.

All of the tangible criteria are included in Table 2 and offer the following observations. Three circuits in Susitna North Corridor is the least cost to the Watana project if the road is nearby. Susitna South is slightly higher for the Road Nearby case because the road routing selected for the south only coincides 50% with the transmission routing. Susitna South is slightly less for the No Road case because of the shorter length. The Denali Corridor is considerably longer and thereby carries the highest single corridor cost. The combination of Susitna and Denali Corridors (Alternatives 4 & 5) reflect the miles of construction and fall between Alternatives 1, 2 & 3. At this point all three corridors are feasible and should be included in the PAD due to alternative line studies that will be required during the permitting process.

The impact of winter construction generally increases the estimated cost by about 16% and road access varies from about a 4% to 21% increase.

Acquisition of a permanent right-of-way will require significant land negotiations and at least some public participation. This process is best worked when there are multiple corridors. Therefore, it seems reasonable to maintain at least one corridor west (Susitna North or South) along with the Denali corridor at this level of review.

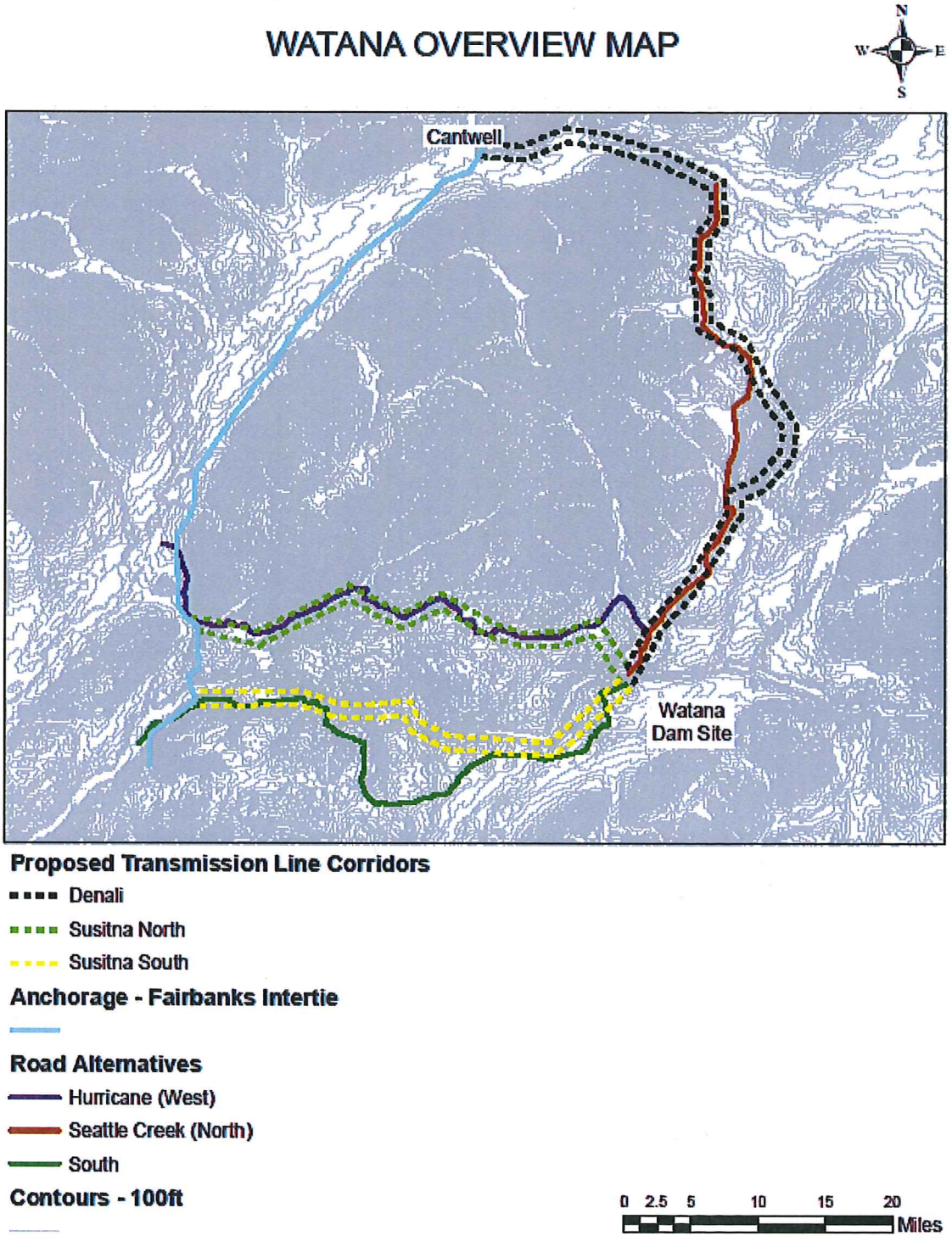


FIGURE 1 – OVERVIEW MAP

2. INTRODUCTION AND PURPOSE

The purpose of this report is to develop sufficient project definition to file a Pre-Application Document (PAD) with the Federal Energy Regulatory Authority (FERC) for the Watana Hydroelectric Project (Project). The assessment will focus on identification of transmission corridors, together with enough preliminary design information so that necessary environmental studies can be scoped following the PAD publication. The Project, as defined by FERC, extends only to the connections with the existing Anchorage-Fairbanks Intertie transmission system in the vicinity of Gold Creek and Cantwell. This assessment assumes that power will be delivered to the vicinity of Gold Creek and/or to Cantwell.

At this level of review, one mile wide corridors have been identified using topographical maps and judgment of reasonable routings that could be constructed to connect the Watana Dam site with the Railbelt transmission system. Final alignments will be part of the design phase.

It is anticipated that three transmission lines (circuits) will be needed with two circuits for loads south and one circuit north. These circuits could be constructed in one corridor or in combination with a second corridor. The three possible corridors are identified as Susitna North or South and Denali.

Two sets of cost estimates were developed as part of the assessment effort. One set assumes that a road is constructed in the vicinity of the transmission corridor and available for use by the transmission line construction contractor. The second set assumes no road is constructed.

3. LINE ROUTING

Three, one-mile wide corridors have been identified in which the new transmission lines could be constructed to connect the Watana Dam site with the Railbelt transmission system. Table 1 summarizes the five alternatives that are considered. Development of corridors and comparisons requires the application of consistent criteria. Following is an explanation of the criteria used for routing and comparison.

3.1 Evaluative Criteria

Evaluative criteria describe the differences between routes and the level of suitability to meet the project purpose and needs. These criteria are not used to eliminate routes, but are used in development of the routes. The following describes the evaluative criteria, and how it applies to this report.

- **Adjacent to an Access Road** - This criterion is significant to the construction cost of the line and routings are as close as practical to the road.
- **Avoid Land Use Conflicts** - This criterion is used to exclude areas that could provoke major conflicts in land use (i.e., airports, dedicated recreation areas, and densely populated areas).

- **Avoid Major Terrain Obstacles** - This criterion is used to exclude areas that could cause significant construction and/or major difficulty in construction or maintenance (i.e., large rivers, mountains, high value wetlands, ponds, and lakes).
- **Minimize Climatological Conditions** - Alaskan climatological conditions are highly influenced by elevation and the higher elevations produce more severe conditions such as; snow accretion, icing, and wind. As a result, routes are selected that primarily avoids higher elevations. Maximum corridor elevations are approximately; North = 3,400', South = 2,400' and Denali = 3,800'. As a comparison, the Anchorage/Fairbanks Intertie in this area reaches about 3,000' elevation and has had a good performance record.
- **Minimize Route Distance** - This criterion is used to minimize the route distance and decrease the total cost of the project.
- **Minimize Environmental Impacts** - This criterion is complex with many attributes. For the level of this report, the avoidance of obvious wetlands is the only criterion used.

3.2 *Intangible Criteria*

Evaluation of intangible criteria such as: visual impacts, public safety, existing facilities, construction impacts and land use are subjective and primarily deal with impacts to the public. These criteria require a reasonably detailed design before evaluation and are beyond the scope of this report

3.3 *Tangible Criteria*

The tangible criteria used in this report for route comparison are: construction cost, engineering, management costs, permitting, contingency, and summer or winter construction. The following describes the tangibles criteria and how they are applied in this report.

- **Construction Costs** – This criterion estimates the cost of the construction based on conceptual towers and typical line costs expected in the area. Access via a road is the single greatest impact to construction cost. Without an access road, line construction requires all-terrain equipment and significant helicopter costs. Construction cost estimates for both road and no road conditions are included in this report.

- **Engineering, Management Costs** - This criterion estimates the cost of design, and project management as a percentage of construction cost.
- **Permitting** – This criterion estimates the cost of acquiring land use and environmental permits from the regulatory agencies. It does not include any protracted public involvement process. This effort is highly variable and for this report has been included as a percentage of construction costs.
- **Contingency Cost** – This criterion provides a buffer for this level of report.

- **Summer or Winter Construction Costs** – It is anticipated that some agency stipulations will require that at least portions of the construction will be required to be completed in the winter when ground conditions reduce impacts.

3.4 Routing Alternatives

Table 1 is a tabulation of Route Miles (length of the corridor) and Circuit Miles (total miles of circuits within the corridor).

TABLE 1 – ALTERNATIVE SUMMARIES

Corridor	Description	Route Miles	Circuit Miles
Susitna North	3 Circuits Watana to Chulitna Substation via Susitna North Corridor	37	111
Susitna South	3 Circuits Watana to Gold Creek Substation via Susitna South Corridor	35	105
Denali	3 Circuits Watana to Cantwell Substation via Denali Corridor	62	186
Susitna North and Denali	2 Circuits Watana to Chulitna Substation via Susitna North Corridor; 1 Circuit Watana to Cantwell Substation via Denali Corridor	99	136
Susitna South and Denali	2 Circuits Watana to Gold Creek Substation via Susitna South Corridor; 1 Circuit Watana to Cantwell Substation via Denali Corridor	97	132

3.5 Permitting

Agency permits can be a significant part of acquiring permission to construct a new transmission line. Table 2 presents a list of potential permits for this transmission line.

TABLE 2 - POTENTIAL PERMITS AND APPROVALS

Agency Name	Type of Permit/Approval	Reason for Permit/Approval
Federal Agencies		
U.S. Army Corps of Engineers (COE)	Section 404 Permit	A Section 404 permit is required for authorization of wetland fills.
State Agencies		
Alaska Department of Environmental Conservation (ADEC)	Certificate of Reasonable Assurance (401 Certificate)	ADEC must issue a 401 Certificate to accompany any federal permit issued under the Federal Clean Water Act. For example, a COE Section 404 permit would trigger the need for a state certificate.
Alaska Department of Natural Resources (ADNR)	Fish Habitat Permit (AS Title 41.05.870)	A General Waterway/Waterbody Application must be submitted if heavy equipment usage or construction activities disturb the natural flow or bed of any stream, river, or lake. These permits also stipulate how stream water withdrawals may be conducted.
ADNR, Division of Mining and Water Management		
ADNR, Division of Land	Temporary Water Use Permit	This permit is required if water withdrawals will occur during construction. The permit lasts for the length of a temporary project.
ADNR, Division of Land ADNR, State Historic Preservation Office (SHPO)	Land Use Permit	A land use permit is required for use of state lands along the proposed ROW.
	Right of Way (ROW) Permit	A ROW is required for construction of transmission lines or other improvements that cross state lands.
Alaska Department of Transportation and Public Facilities (ADOT&PF)	Cultural Resource Concurrence Section 106 Review	For any federally permitted, licensed, or funded project, the SHPO must concur that cultural resources would not be adversely impacted, or that proper methods would be used to minimize or mitigate impacts that would take place.
National Parks Service (NPS)	Utility Permit on State ROW	Required before construction on ADOT&PF managed state lands or for structures crossing ADOT&PF ROWs.
Alaska Railroad Corp (ARRC)	Section 6(F)-approval to use lands purchased by the Land Water Conservation Fund.	Nancy Lake State Recreation Area
	Crossing Permit	Required before construction on ARRC property.

The following section briefly describes federal and state agency jurisdiction and their permit requirements.

- ***COE*** - The Army Corps of Engineers (COE) regulates impacts to wetlands. The COE enforces Section 404 of the Clean Water Act by issuing individual or nationwide permits for wetlands impacts.
- ***ADEC*** - The Alaska Department of Environmental Conservation (ADEC), in conjunction with the COE 404 permitting, will analyze projects for impacts to water quality and recommend mitigation measures to prevent water pollution. ADEC will issue a Certificate of Assurance in accordance with Section 401 of the Clean Water Act.
- ***ADNR*** - The Alaska Department of Natural Resources (ADNR) regulates temporary withdrawals of water from state-owned sources and issues a water use permit. ADNR coordinates this permit application with all state agencies.

  The ADNR Division of Mining, Land and Water also issues right-of-way permits for crossing state lands. The exception is when a project crosses a state highway. If a state highway is crossed, the Department of Transportation & Public Facilities (DOT&PF) regulates the crossing.

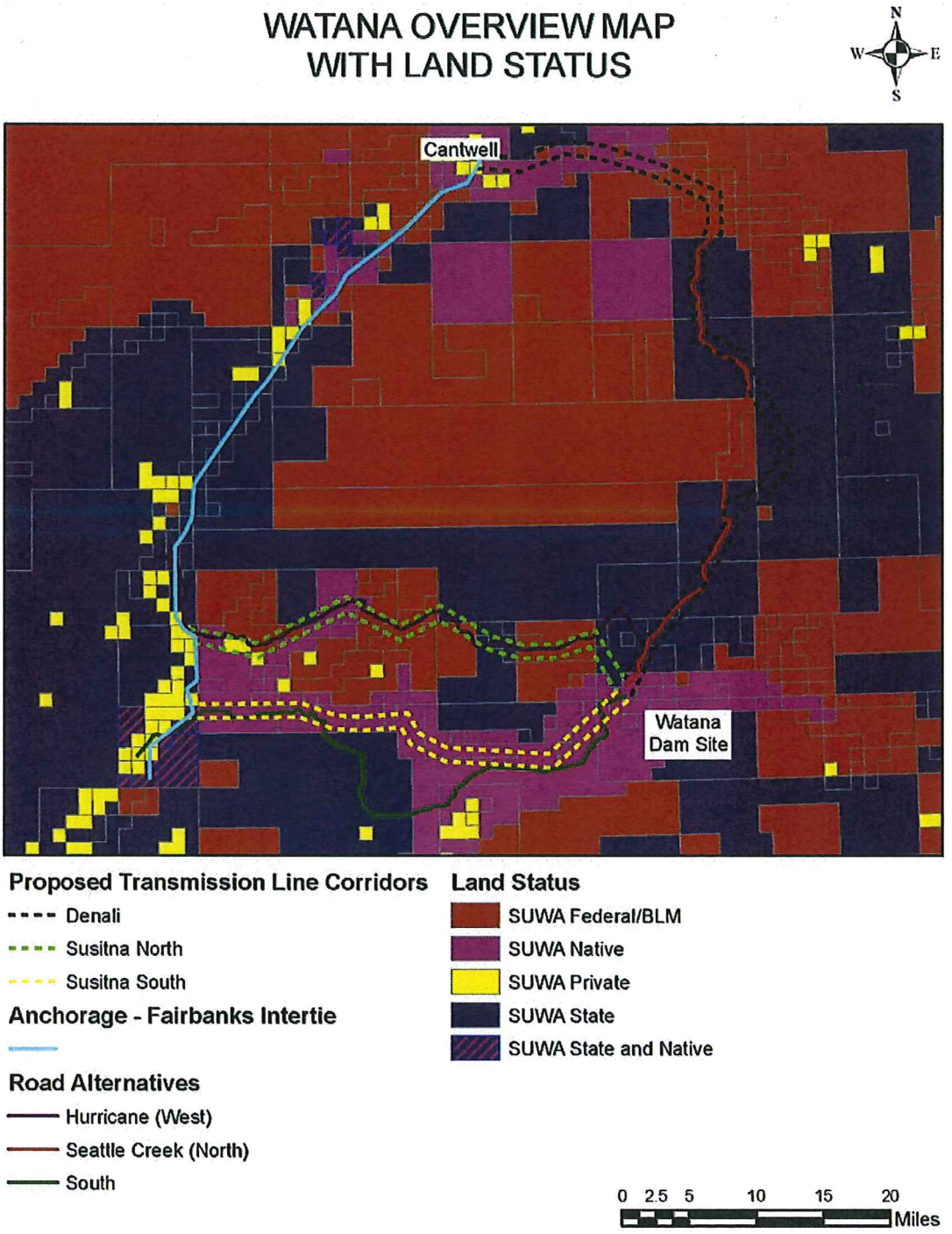
  The State Historic Preservation Office (SHPO) is a division of ADNR and it regulates impacts to historic, cultural, and archeological resources. According to the 1966 Historic Preservation Act, all projects must be submitted to the SHPO for their analysis and approval.

  ADNR regulates specific rivers, lakes, and streams or parts of them that are important for the spawning, rearing, or migration of anadromous fish. According to Alaska Statute 16.05.870, ADF&G must issue a permit for any activity occurring in habitat important to anadromous fish.
- ***ADOT&PF*** - The ADOT&PF regulates state-owned roads. A new transmission line along or crossing a state-owned road would require a utility permit from ADOT&PF.
- ***ARRC*** - If a route uses the Alaska Railroad Corporation (ARRC) corridor or crosses the Alaska Railroad, a Right of Way Permit will be required.

3.6 *Land Classification/Ownership*

The following map generally shows the land status in the area of the corridors.

FIGURE 2 – LAND STATUS



3.7 Limitations

The transmission corridors identified in this report are consistent with a reconnaissance effort using office resources. To the extent practical, corridors were selected that avoided higher terrain, wetlands and steep slopes and were adjacent to proposed access roads. Any of the corridors will cross various landowners including the State, BLM, and Native. No environmental issues were considered except to try and avoid probable and obvious wetlands.

In recent years, permitting and Right-of-Way procurement has become a significant cost of an Alaskan transmission line. Agency and Public concerns, along with the amount of time to complete this effort, can only be determined during the process. For this report, the costs for these items are lumped into a general percentage adder to the construction cost estimate. Once the project is better defined, these portions of the costs should be revisited.

4. TECHNICAL CONSIDERATIONS

4.1 Typical Design Criteria

For the purpose of this assessment typical design parameters used to construct transmission lines in mountainous terrain are assumed. Climatological conditions are expected to be similar to the existing Anchorage/Fairbanks Intertie in this area which has experienced few issues.

4.2 Typical Structure Types

Previous power flow studies have identified the need to use twin bundled 954 kcmil conductors on all transmission lines to achieve satisfactory electrical performance. A single overhead fiber optic ground wire (OPGW) and a single overhead ground wire (OHGW) are also assumed to be attached to each structure. Typical transmission line tangent structures used in Alaska that would be suitable to support three twin bundles of 954 kcmil conductor and two ground wires are the steel H-frame structure and the steel X-tower. For this report, the cost of constructing with either structure type is considered the same and an H-frame construction is selected.

4.3 Required Transmission System Additions

EPS previously completed a high-level screening study to determine what modifications and additions must be made to the Railbelt utility system to accommodate the construction of either the 420 MW or 600 MW Watana Hydroelectric Project. The Study indicated that numerous transmission system additions are required to support the proposed generation. The additions relevant to the PAD are listed to below:

- Construct either the Gold Creek or Chulitna 230 kV Substation along the existing Anchorage-Fairbanks Intertie route.
- Construct three new 230 kV transmission lines between either Gold Creek or Chulitna Substations and the Watana Hydroelectric site and a new 230 kV line between either Gold Creek or Chulitna Substation and Cantwell Substation; or in the alternative, construct two new transmission lines between either Gold Creek or Chulitna Substation

and the Watana site and a third transmission line between the Cantwell Substation and the Watana site.

5. TRANSMISSION COST ESTIMATES

The following cost estimates are primarily for construction of the transmission line with percentage multipliers for other related costs. Previously constructed Alaskan transmission lines actual costs along with our judgment are the basis of these estimates. Estimates are in 2011 dollars with the following assumptions:

- A contingency of 20% is assumed.
- Owner, engineering, and permitting are estimated as a % of construction cost.
- Agencies may require the line be constructed in the winter rather than the more favorable summer; this is estimated as a % adder.

Two scenarios for preparing cost estimates have been assumed. Scenario 1 assumes an all-weather road is constructed nearby and can be used to access the transmission corridor for construction. Scenario 2 assumes a road is not constructed and construction access is via all-terrain equipment and helicopters. Table 2 compares the cost of these two scenarios for the five alternatives described in Table 1. Cost estimates were prepared using a series of spreadsheets, which can be found in Appendix B and C.

TABLE 2 - ESTIMATED TRANSMISSION LINE COST IN $1,000.

		Road Nearby		No Road	
Alternative	Description	Low ($1,000)	High ($1,000)	Low ($1,000)	High ($1,000)
1	3 Circuits Susitna North 37 ± miles	$147,174	$171,703	$178,518	$208,271
2	3 Circuits Susitna South 35 ± miles	$163,856	$190,114	$170,021	$198,357
3	3 Circuits Denali Corridor 62± miles	$246,484	$287,565	$298,946	$348,771
4	2 Circuits Susitna North 37± miles and 1 circuit Denali Corridor 62± miles	$196,692	$229,474	$238,569	$278,330
5	2 Circuits Susitna South 35± miles and 1 circuit Denali Corridor 62± miles	$208,240	$242,220	$232,150	$270,842

*All costs include a 20% reduction for construction of a second or third circuit within the same corridor.

6. CONCLUSION

Connection of the Watana Hydro Facility to the existing Railbelt electrical grid will be highly influenced by decisions of necessary changes to the existing grid. Even though these changes are not part of this report, selection of the final Watana transmission corridor will be impacted.

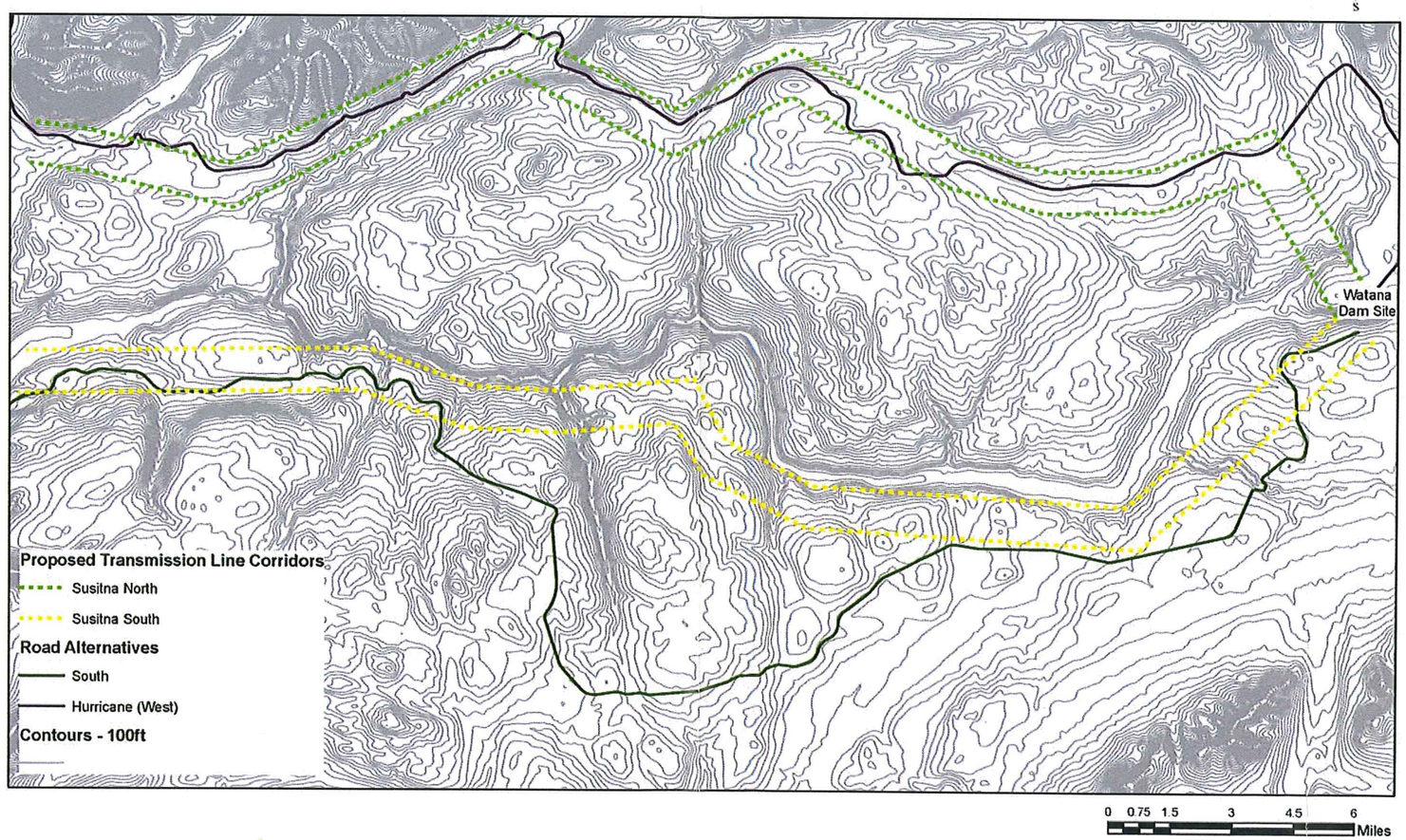
All of the tangible criteria are included in Table 2 above and offer the following observations. Three circuits in Susitna North Corridor is the least cost if the road is nearby. Susitna South is slightly higher for the Road Nearby case because the road routing selected for the south only coincides 50% with the transmission routing. Susitna South is slightly less for the No Road case because of the shorter length. The Denali Corridor is considerably longer and thereby carries the highest single corridor cost. The combination of Susitna and Denali Corridors (Alternatives 4 & 5) reflect the miles of construction and fall between Alternatives 1, 2 & 3.

The impact of winter construction generally increases the estimated cost by about 16% and road access varies from about a 4% to 21% increase.

Acquisition of a permanent right-of-way will require significant land negotiations and at least some public participation. This process is best worked when there are multiple corridors. Therefore, it seems reasonable to maintain at least one corridor west (Susitna North or South) along with the Denali corridor at this level of review.

APPENDIX A – CORRIDOR MAPS

SUSITNA NORTH AND SUSITNA SOUTH CORRIDORS



COST ESTIMATE SUMMARY

Susitna South 35± miles with no Road

Description	Quantity	Unit	Material Cost ($1,000)	Labor Cost ($1,000)	Material & Labor Cost ($1,000)	Total Cost ($1,000)
Structures	185	ea	$47.5	$40.5	$87.9	$16,252
Foundations	400	ea	$6.1	$25.9	$32.1	$12,810
Conductor	35	mi crkt	$105.0	$205.3	$310.3	$10,861
Other*	35	mi	$20.3	$79.0	$99.3	$3,673
Subtotal						$43,595
Mob/Demob @10%						$4,360
Engineering, Management, Permitting @15% Subtotal						$6,539
Estimated Construction Cost						$54,494
Contingency @20% Total						$10,899
Estimated Summer Construction Cost						**$65,393**
Winter Construction Cost adder @ 25% of Subtotal						$10,899
Estimated Winter Construction Cost						**$76,291**

* Includes: OH ground and fiber, ground, dampers, aerial balls, bird diverters, signs, clearing

COST ESTIMATE SUMMARY

Denali 62± miles No Road

Description	Quantity	Unit	Material Cost ($1,000)	Labor Cost ($1,000)	Material & Labor Cost ($1,000)	Total Cost ($1,000)
Structures	327	ea	$47.3	$39.2	$86.5	$28,318
Foundations	705	ea	$6.1	$25.9	$32.1	$22,591
Conductor	62	crktmi	$105.0	$205.3	$310.3	$19,239
Other*	62	crktmi	$21.4	$83.5	$104.9	$6,506
Subtotal						$76,653
Mob/Demob @10%						$7,665
Engineering, Management, Permitting @15% Subtotal						$11,498
Estimated Construction Cost						$95,816
Contingency @20% Total						$19,163
Estimated Summer Construction Cost						**$114,979**
Winter Construction Cost adder @ 25% of Subtotal						$19,163
Estimated Winter Construction Cost						**$134,143**

* Includes: OH ground and fiber, ground, dampers, aerial balls, bird diverters, signs, clearing