Appendix II: Reports and Publications

II-A. January 2008 NANA Region Wind Resource Assessment Status and Recommendations Report, V3 Energy

II-B. March 2008 Preliminary Wind Energy RETScreen Economic Analysis, NANA Pacific

II-C. June 2008 Letter Report on NANA Villages Overflight Reconnaissance Trip, V3 Energy

II-D. October 2008 Proposal for Alaska Energy Authority grant, Northwest Arctic Borough

II-E. July 2009 Red Dog Port Preliminary Wind Energy Assessment, WHPacific

Appendix II-A:

January 2008 NANA Region Wind Resource Assessment Status and Recommendations Report, V3 Energy

NANA Region Wind Resource Assessment Status and Recommendations

This report was prepared by Douglas Vaught, P.E. of V3 Energy, LLC for NANA Pacific, LLC in support of its work with NANA Regional Corporation, Inc. on a U.S. Department of Energy, Tribal Energy Program grant for a wind power feasibility study in the NANA Region of Alaska.

PRESENT STATUS OF WIND RESOURCE ASSESSMENTS IN REGION

For ease of organization, I've segregated the NANA region villages by geographic groupings: a northern group of Noatak, Kivalina, and Port of Red Dog Mine/Red Dog Mine; a southern group of Deering and Buckland; a central group of Selawik, Noorvik and Kiana; and an eastern group of Kobuk, Shungnak and Ambler. I've addressed the NANA villages by this geographic grouping as I think this helps assess issues common to sister villages. For instance, with respect to wind power issues, Deering and Buckland have much more in common than would, say, Deering and Ambler. Note that Kotzebue is a hub community, not a village, and won't be addressed in this report.

Northern Group of NANA Villages

<u>Noatak</u>

A 30 meter NRG meteorological (met) tower is presently installed at a site near the airport. From a recent telephone conversation with Ed Ward of Maniilaq Association in Kotzebue, the met tower that had been in Noorvik for the 2001/2001 wind resource study was moved to Noatak, presumably in late 2002 or early 2003, and erected at its present location. Unfortunately, as I learned through my conversation with Ed Ward and an earlier email exchange with Nina Shestakovich at Maniilaq, there is no indication that data was ever collected from the met tower in Noatak.

Although data recovery from Noatak was a failure, photographs of the met tower indicate that it appears intact and presumably is still usable. The tower may require new guy wires however if they have rusted or otherwise degraded over time and the tower will certainly need new sensors and a new data logger to put it back in service. Because the present met tower location near the airport is inappropriate for future wind power development, it is advisable to lower the tower, repair and/or replace components as needed and then re-erect in elsewhere in Noatak. Finding a good wind resource location accessible to Noatak may be a challenge though as the road network in Noatak is extremely limited and the predicted higher wind resources are in the hills and mountains west of the village which are not presently accessible by road. If a near-village site is selected for re-installation of the met tower, a site further away from the airport and perpendicular to the runway alignment should be considered.

I might add that normally I would not recommend siting a met tower in predicted Class 1 or 2 wind resource terrain, such as very near Noatak, as this is unlikely to yield satisfactory results for wind power development. The issue to consider in Noatak, though, is that a met tower has been in the village for several years but has not yielded in any data. Moving the met tower to a more promising village (for wind power development) is entirely rational, but that decision would leave Noatak with no wind data to rely on for planning its future energy needs and may be opposed by the residents of Noatak.

For further information, attached to this document is an Airport Station Summary Report prepared by Alaska Energy Authority (AEA) in 2005. This report predicts the wind resource in Noatak using Automated Surface Observing System (ASOS) data from National Oceanic and Atmospheric Administration (NOAA) sensors at the airport. In summary, this report predicts a Class 1 wind resource, which correlates to the AEA wind resource map.

<u>Kivalina</u>

Kivalina has Class 4 wind resource potential, but because the village has become highly vulnerable to erosion from autumn storm waves, the village leadership is actively seeking a new home for their community, possibly further southeast along the coast and closer to the Port of Red Dog Mine. If a definitive new village site is identified, a met tower could be erected at the new location to collect the data needed to support wind power when the new village is constructed.

<u>Port of Red Dog Mine</u>

Another option for Kivalina is to erect a met tower at or near the Port of Red Dog Mine with the thought that wind power produced in the port area could be sold to the mine through a power purchase agreement and also sold or supplied to the new Kivalina via an electrical intertie that could be constructed. In its present location, Kivalina is about 16 miles (straight line) from the port complex, but presumably the new village location will be closer, perhaps substantially so.

If NANA pursues the idea of wind resource study at the port, I recommend installation of a 50 or 60 meter met tower. Because the port would be a substantial load center, it might be possible to install larger, utility-scale turbines with much higher hub heights than the typical village-scale turbine. If this is a future consideration, this argues for a taller met tower as the data will be extrapolated a shorter distance (from the highest met tower sensor to the turbine hub height), resulting in a more accurate wind resource assessment.

Red Dog Mine

It is not certain to me if power for Red Dog Mine itself is a possible consideration for this grant funding. If so, there are possibilities of wind power on the ridges surrounding the mine, but met tower siting in this area would take considerable thought given mine operations issues, access constraints, and the possibility of rime icing at higher elevations.

Southern Group of NANA Villages

Deering

Deering was a candidate village about thirteen years ago for the wind project that was installed in Wales. Although one might have thought perhaps that a met tower would have been erected for this effort, this does not appear to be the case. But, wind resource analyses were completed for Deering at that time. I have received two sets of data for Deering: one from Kotzebue and scaled to Deering using Wind Atlas information (this is according to the text file header information) and the other apparently from Deering itself. The Kotzebue data is labeled as 1997 and the Deering data is labeled as 1998 through 2002. Both appear to be airport ASOS data as both are single anemometer, 10 meter data heights.

It is uncertain just how much faith one should put in these studies as they do not provide the degree of information one can obtain from a wind resource assessment from a met tower, specifically shear information that comes from having two anemometers at different elevations above ground level. Also, turbulence information is not obtainable as the data source does not include standard deviation data. Wind rose information is available, however, and that is likely reasonably accurate.

In running a quick analysis of both data sets, one can see that the Kotzebue data predicts a Class 6 (outstanding) wind resource and the Deering data predicts a high Class 3 (fair) to low Class 4 (good) resource. In reviewing the wind resource map for Deering, one can see that the airport is predicted to be in a Class 2 to Class 3 area, so the Deering data appears to correlate. The scaled-to-Deering Kotzebue airport data should probably be ignored at this point as the Deering airport data is likely more accurate.

Complicating my understanding of past wind studies in Deering are reports that Deering has, or once had, a met tower. Sonny Adams of NANA Regional Corporation recently visited Deering and was told that a met tower had been installed near the airport, but was taken down before data was collected, apparently due to a concern that the tower presented a hazard to aircraft. It is not known at this point the size of this met tower, its ownership, or its fate. If indeed it was a 30 meter tower and it is still in

Deering, then presumably it can be re-instrumented and re-erected at a suitable site in Deering for a true wind resource assessment.

Past wind analysis effort aside, Deering does possess very promising potential for wind power development, both at Cape Deceit to the northwest of the village and closer in, on a broad, sloping ridge immediately east of the village. Although the winds are predicted to be stronger at Cape Deceit, it is further away and would also likely generate concern with USFWS regarding possible negative impacts to the endangered eider ducks that inhabit this area. A better choice may be the ridge, but it is separated from Deering by the Inmachuk River, which could present an access challenge depending on the depth and swiftness of the river. For either location, a 30 meter tower should be installed in early summer to begin collecting solid wind data to support wind power development.

For further information, attached to this document is an Airport Station Summary Report prepared by AEA in 2005. This report predicts the wind resource in Deering using ASOS data from NOAA sensors at the airport. In summary, this report predicts a low Class 3 wind resource, which correlates to the AEA wind resource map and correlates with the Deering-specific wind data used in the wind power study effort a decade ago. Note again, however, that better winds are predicted at Cape Deceit and on the ridge east of the village.

<u>Buckland</u>

AEA installed a met tower in Buckland in September, 2005 at a location near the village. Apparently Kotzebue Electric Association (KEA) was to collect the wind data and forward it to AEA, although it appears that that arrangement did not work as well as had been hoped. I have not been able to determine how many times this process (data card removal, download, and transmittal) occurred, but at present AEA has only two months of Buckland data in its electronic files, from Sept. 1 to Oct. 25, 2005. More data may be stored on a computer at KEA but that has yet to be verified.

From conversations with Brad Reeve of KEA and Matt Bergen of Maniilaq, it seems that although more than two months of data was collected, there has not been a continuous collection of data due to data collection lapses and also datalogger battery failure from extreme cold temperatures. Until all collected data is recovered and analyzed, it is not possible to determine whether or not the met tower site is viable for wind power development. If a year's worth of data is recovered and the data looks promising, then it may be advisable to remove the met tower and transport it for use elsewhere. However, if the data does not look promising, then perhaps a better location can be selected in Buckland and the met tower moved to the new spot. Of course, a third possibility is that a year's worth of data at the present met tower location has not been collected. If that is the case, depending on the amount of data recovered and its promise for wind power development, a decision will have to be made whether to continue collecting data at the current location or move the tower to a more promising location.

If the data indicates that the wind resource is less than hoped, and this might be expected as the wind resource map predicts just a Class 1 wind resource in Buckland itself, and a decision is made to look elsewhere in Buckland for a better location, a promising site might be the first ridgeline directly west of what appears to be a gravel borrow pit west of Buckland. The wind resource map predicts a Class 3 to

Class 5 wind resource on this ridge and an even greater wind resource (up to Class 7) on the summit of Clem Mountain a bit further west. The advantage of the first ridge though is that it is near an existing road and hence should be relatively easy to access.

Central Group of NANA Villages

Selawik

Selawik has four AOC 15/50 wind turbines integrated into its power system and presumably will not see future wind resource assessment work. There may be, though, a desire at some point to replace the AOC turbines with higher capacity models or augment the four AOC turbines with additional wind turbines.

For further information, attached to this document is an Airport Station Summary Report prepared by AEA in 2005. This report predicts the wind resource in Selawik using ASOS data from NOAA sensors at the airport. In summary, this report predicts a Class 2 wind resource. Based on Alaska Village Electric Cooperative's (AVEC's) experience with wind power generation in Selawik, however, this may be low.

Noorvik

A wind resource assessment was conducted in Noorvik from September 2001 to September 2002 with grant funding from the Administration for American Natives (ANA) grant no. 90NK0108/01. A 30 meter NRG tower was erected, according to the project final report, about four miles east of Noorvik along the road to the gravel pit. The final report describes the measured wind resource as "good" with an average annual wind speed at 30 meters elevation of 5.7 m/s, likely equating to a Class 3 (fair) wind resource depending on other wind characteristics still not evaluated. The report also recommends installation of Bergey 10 kW wind turbines with a predicted capacity factor of about 22 percent at a 30 meter hub height.

Some or all of the raw data from this project is stored at the Maniilaq offices in Kotzebue. From a telephone conversation with Ed Ward, I was able to obtain about 5½ months of the original 12 months of data, but I have not yet been able to obtain the rest. It is not clear if the missing data is elsewhere in Maniilaq electronic files or is lost. It is not strictly necessary to obtain this data in order to characterize the wind resource of Noorvik, but the original report to ANA was deficient in many respects with respect to the analysis of the wind resource and it would be highly desirable to work up a new analysis from the original data.

The geography surrounding Noorvik is relatively flat and such that the wind data from the test site near the gravel pit should be usable for the AVEC-preferred wind turbine site on the old airstrip near the power plant. Again, it should not be necessary to erect a new met tower in Noorvik if the missing wind data files can be located. If the missing data cannot be recovered, then installation of a new met tower is a judgment call. A complete, one year plus data set would be analyzed more comprehensively than was done for the 2002 ANA report and it could also be used to more easily model various candidate wind turbines for installation in Noorvik. If a new met tower is installed, the preferred location by AVEC, Noorvik's utility company, is on the old airstrip near the power plant.

Kiana

Kiana is likely similar to Noorvik with respect to wind energy potential or perhaps slightly less given its location further inland. The village itself is probably Class 3, although the wind resource map predicts a Class 2 wind resource. One thought for wind power in this area is to build an electrical intertie between Noorvik and Kiana with wind turbines likely sited in Noorvik. Straight line distance from Noorvik to Kian is 19 miles, although actual intertied routing would likely be longer. An intertie would likely gain the interest and support of AVEC, the utility for both Noorvik and Kiana, as they have found substantial cost savings from electrically connecting villages and hence creating a larger, more efficient power system. Interties also are advantageous for wind power development as wind turbines work better in power systems with higher loads.

But, an electrical intertie may not be constructible or desired by AVEC and/or the villages for any number of reasons. If an intertie is not considered possible, then it would be desirable to install a met tower in Kiana. The logical choice will be to locate it as near to the village as possible as this will be relatively easy to accomplish and of course should wind turbines be installed, relatively inexpensive to develop. Better wind sites, however, are predicted to be in the higher elevation terrain east and south of Kiana. Locating a met tower in these hills will undoubtedly reveal a superior wind resource for wind power development than could be found nearer the village, but the potential cost of future development with a road and electrical connection, not to mention a bridge to cross the Kobuk or Squirrel River, could be prohibitively expensive.

Eastern Group of NANA Villages

Kobuk and Shungnak

Kobuk and Shungnak are considered together as they are at present electrically intertied, with the primary power generation plant in Shungnak. The immediate vicinities of Shungnak and Kobuk are both predicted to have poor wind resource potential for power development, but the hills north of Kobuk do have very good potential as indicated in the wind resource map. Coincidentally, a prospective gold mine north of Kobuk has resulted in consulting studies looking at the potential power sources for a mine in this area. This is a particularly difficult area as the rivers are not large enough to float fuel barges so far inland, hence fuel for a potential gold mine, as well as fuel used at present in the villages of Shungnak, Kobuk and Ambler, must arrive by aircraft at great expense

The consulting study I reviewed (*Mine Power Study, Arctic Project – Ambler Mining District*, Stone & Webster Management Consultants, Inc., Feb. 2006) predicts confirms what the AEA wind resource map predicts – potentially developable wind resources exist in the hills north of Kobuk. One or more met towers, preferably at least 40 meters high, could be sited in these hills as apparently a number of jeep and/or ATV trails traverse the area. Installation of met towers during the summer months would be relatively straightforward, but winter access for data card retrieval may be impossible give the region's harsh weather conditions. Should one or more met towers be installed in the hills north of Kobuk, it might be advisable to include satellite modem iPack transmitters to automatically transmit data to Anchorage.

For further information, attached to this document is an Airport Station Summary Report prepared by AEA in 2005. This report predicts the wind resource in Shungnak using ASOS data from NOAA sensors at the airport. In summary, this report predicts a Class 1 wind resource, which correlates to the AEA wind resource map.

Note again that wind resource studies conducted in the hills north of Kobuk may be of interest to Alaska Gold Company, Nova Gold, or others associated with mining exploration in this region. This may be an opportunity for discussion and a possible cost sharing arrangement for a wind resource study.

<u>Ambler</u>

Ambler shares with Shungnak and Kobuk the challenge of very high fuel and electricity prices due to lack of barge access and general remoteness and also a low predicted wind resource, just Class 1. As with Kobuk, potentially developable wind resources are predicated in surrounding hills, but these are a fair distance away. An electrical intertie, however, could be constructed to link to the Shungnak-Kobuk power system. Straight line distance from Ambler to Shungnak is about 24 miles and from Ambler to Kobuk is about 28 miles; actual intertie routing would likely be longer. If all three villages were intertied, then the benefits and cost savings of wind power or any other renewable energy development in the area could be shared.

For further information, attached to this document is an Airport Station Summary Report prepared by AEA in 2005. This report predicts the wind resource in Ambler using ASOS data from NOAA sensors at the airport. In summary, this report predicts a Class 1 wind resource, which correlates to the AEA wind resource map.

Although not within the scope of this study, I should note that AVEC has briefly explored the possibility of solar power for these villages. Although solar power equipment is expensive per installed kilowatt capacity, it requires relatively little maintenance compared to wind turbines and does not depend on sophisticated control devices and software. Of course, given Ambler's location (and also that of Shungnak and Kobuk) at just north of the Arctic Circle, one could expect a low capacity factor for solar power generation (high in the summer; none in mid-winter, but a fair recovery in late winter with both direct light and light reflected off snow).

GENERAL RECOMMENDATIONS

The most promising villages in the NANA Region for wind power development are those nearest the coast – Deering, Buckland, and Kivalina – as one would expect. Although Deering was considered ten or so years ago for a wind power project, its wind resource study was deficient at best. Buckland is another good candidate and at present has a met tower, but data recovery from this tower has not been consistent since its installation in autumn, 2005. Kivalina has excellent potential for wind power, but because the village will likely move to a new, less erosion-prone location within a decade, a wind resource study in the present village location may not make sense. However, a wind resource study at the Port of Red Dog Mine may be an excellent substitute location for ease of met tower installation and also for consideration of intertie possibilities to Kivalina, at its present location or its to-be-determined new location.

The second tier of promising villages for wind development are those immediately east of Kotzebue – Selawik, which already has four wind turbines, Noorvik and Kiana. Because Noorvik had a wind resource study conducted in 2001/2002, finding the missing original data files is a high priority. Because Noorvik is closer to the coast than Kiana, it would be the preferred location for wind turbines should the two villages be connected by an intertie. If an intertie is unlikely, then Kiana could be considered for a wind resource assessment.

The third tier of villages in the NANA Region, with respect to the potential for wind power development, is the far eastern group of Ambler, Shungnak and Kobuk, as well as Noatak in the north. All four villages have predicted Class 1 wind resources. But, higher terrain surrounding these villages does have higher predicted wind resources and hence would be the logical focus of met tower work. The problem, again, is access and the related cost to develop.

RECOMMENDATIONS FOR 2008 WORK

Wind resource data follow-up needs:

1. Obtain and analyze remaining KEA-collected data from Buckland; possibly also establish better collection procedures for the Buckland met tower to ensure the collection of one year of continuous data
2. Obtain from Maniilaq, if they have it, the missing data from Noorvik
3. Determine if Deering has a meter tower; if yes, determine is suitability for re-use
4. Obtain, if it was ever collected, met tower data from Noatak
5. Research intertie possibilities for Noorvik-Kiana, Ambler-Shungnak/Kobuk, and Kivalina-Port of Red Dog Mine

Met tower recommendations for field season, 2008, in order of priority:

1. Deering, install a 30 meter met tower (use existing tower in Deering if it exists and is suitable; otherwise obtain met tower from AEA)
2. Buckland, move the 30 meter met tower to a better location in Buckland if data indicates the present location is not viable for wind power development
3. Noatak, move the 30 meter met tower to a location in Noatak away from the airport
4. Noorvik, possibly install a 30 meter met tower on the old airstrip if 2002 ANA project data cannot be located (obtain met tower from AEA)
5. Port of Red Dog Mine/Kivaline intertie, install a 50 or 60 meter met tower (purchase new tower)
6. Kiana, perhaps install a 30 meter met tower (depends on discussions regarding intertie potential to Noorvik) (if installed, obtain met tower from AEA)

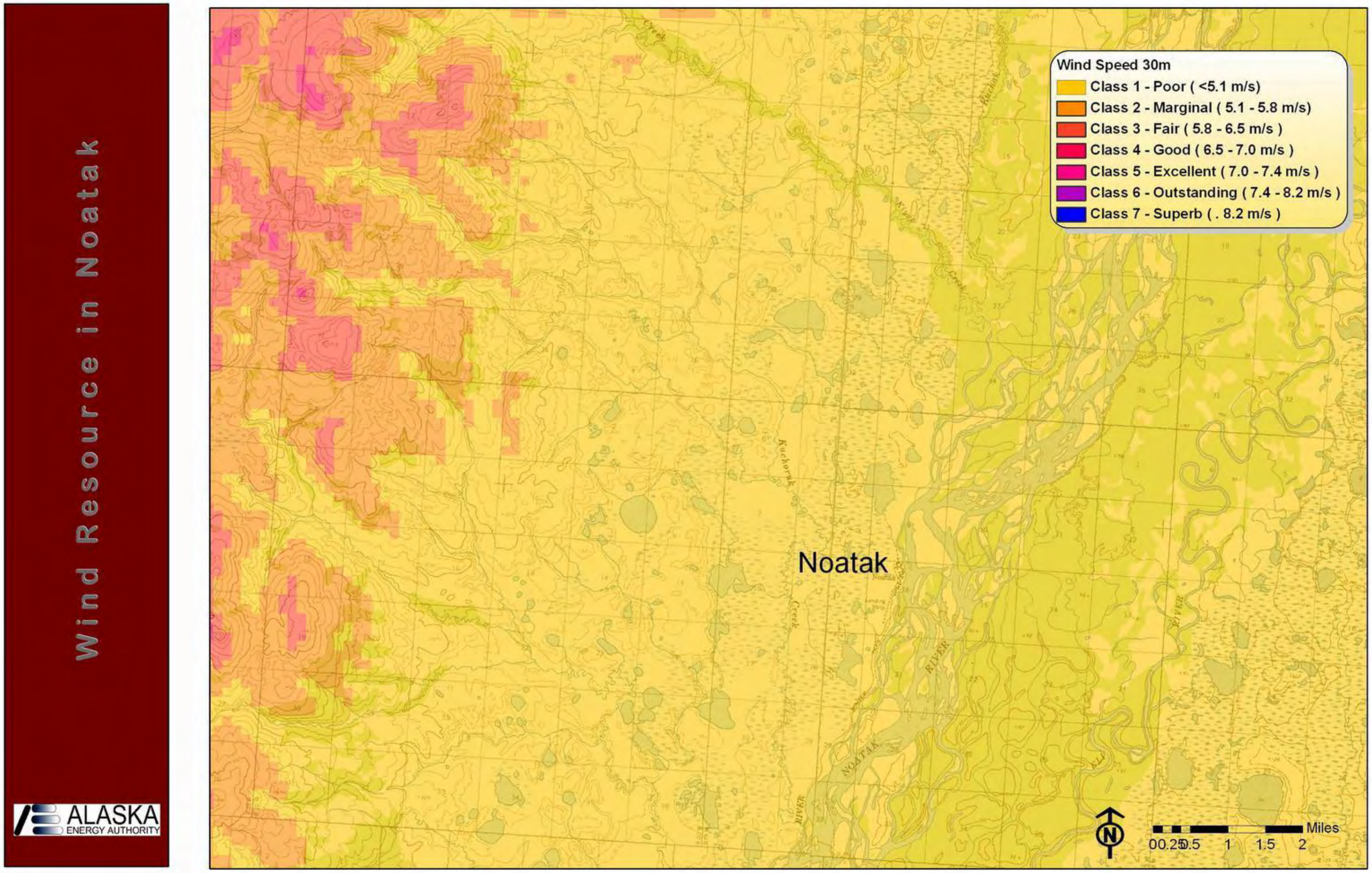
7. Kobuk, install one or two 40 to 60 meter met towers in the hills north of Kobuk (should first consult with interested gold mining companies regarding possible development plans for a gold mine in the area) (purchase new towers)

Steps needed to site and install a met tower in a village:

1. Identify a site on paper that has a potentially good wind resource, is relatively near roads, powerlines, or other village infrastructure, has land ownership access/ availability, not an airport concern, not a avian/wildlife concern
2. Travel to the village for a reconnaissance visit to meet with village or power utility leaders, verify site viability, adjust siting if necessary, survey soil for anchoring requirements, and identify equipment availability and labor help in the village for subsequent installation effort
3. Obtain FAA's "Determination of no hazard to air navigation" for the proposed site of a met tower placement
4. Initiate a consultation with USFWS for possible impacts to endangered species (prinicipal concern will be spectacled and king eiders; best to avoid being directly on the coast)
5. Obtain oral or written permission from the land owner to install a met tower
6. Purchase or otherwise secure a met tower and associated equipment and ship directly to the village or to Kotzebue for interim storage
7. Arrange labor and equipment support and schedule a trip to install the met tower
8. Install the met tower and train a local person(s) to swap out data cards, replace datalogger batteries, and inspect the tower for damage and other problems
9. Make an arrangement with the powerplant operator or other responsible party to periodically recover data from the datalogger

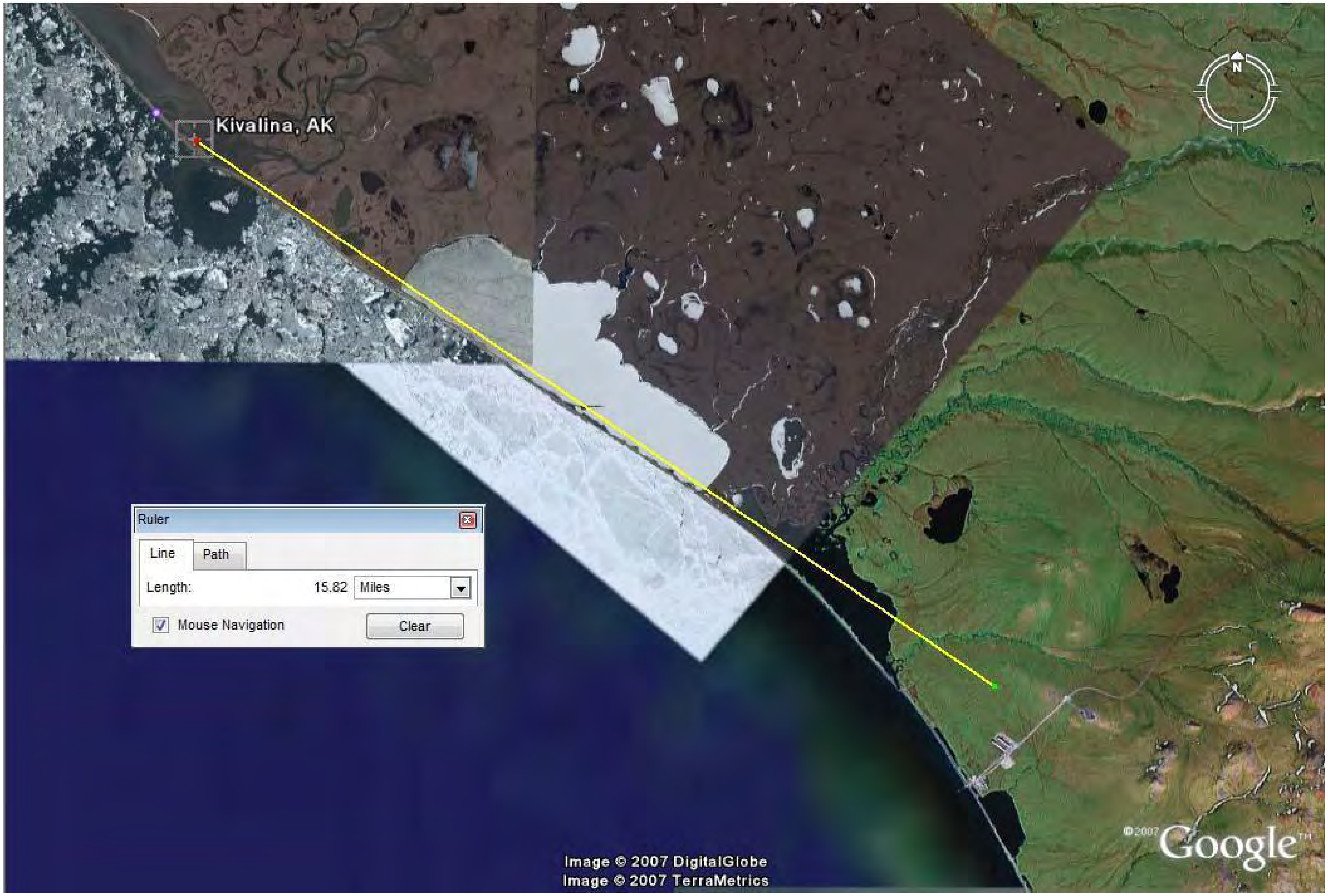
Noatak Google Earth Image

Noatak Wind Resource Map

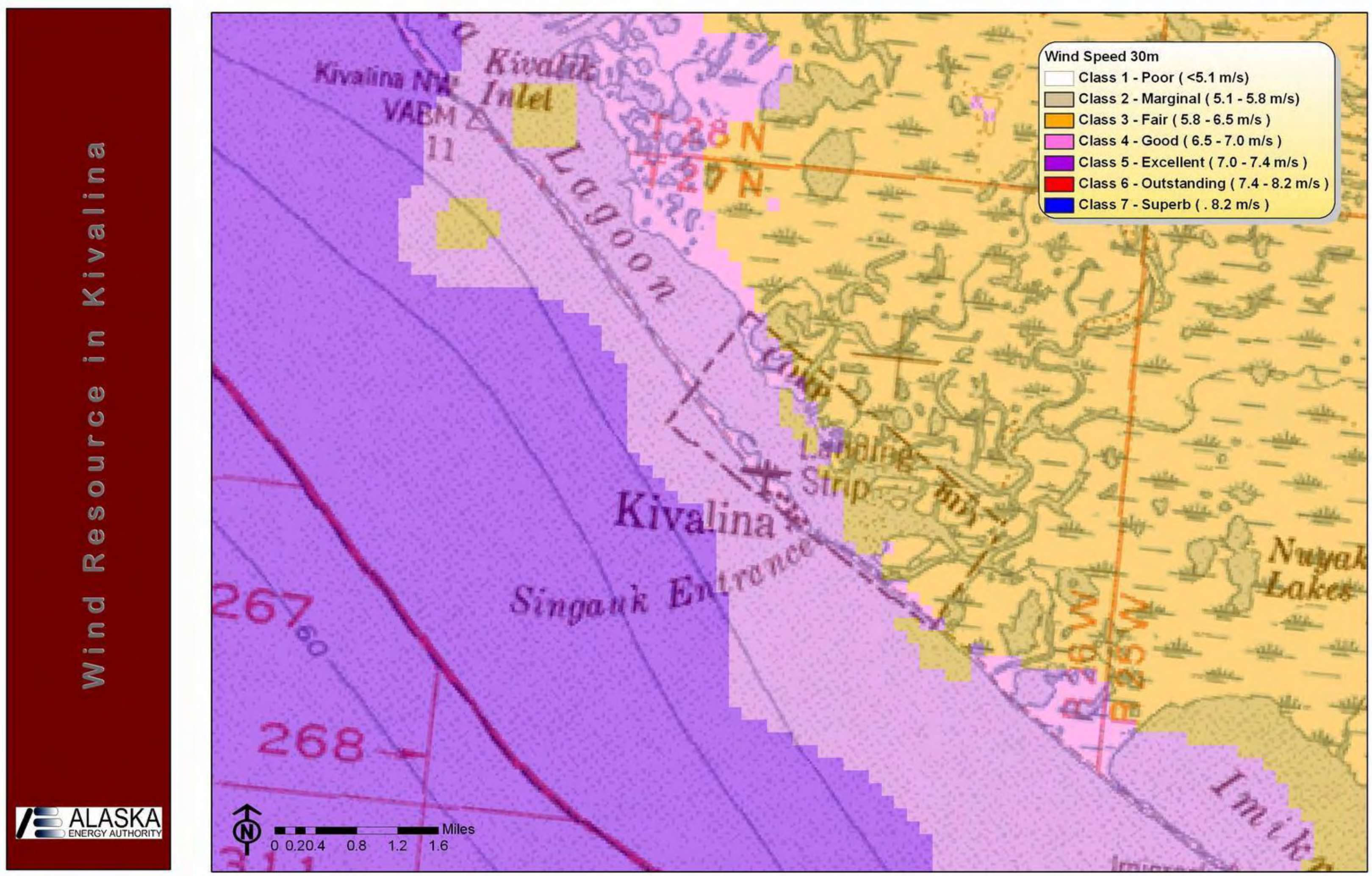


Port of Red Dog Mine Google Earth Image

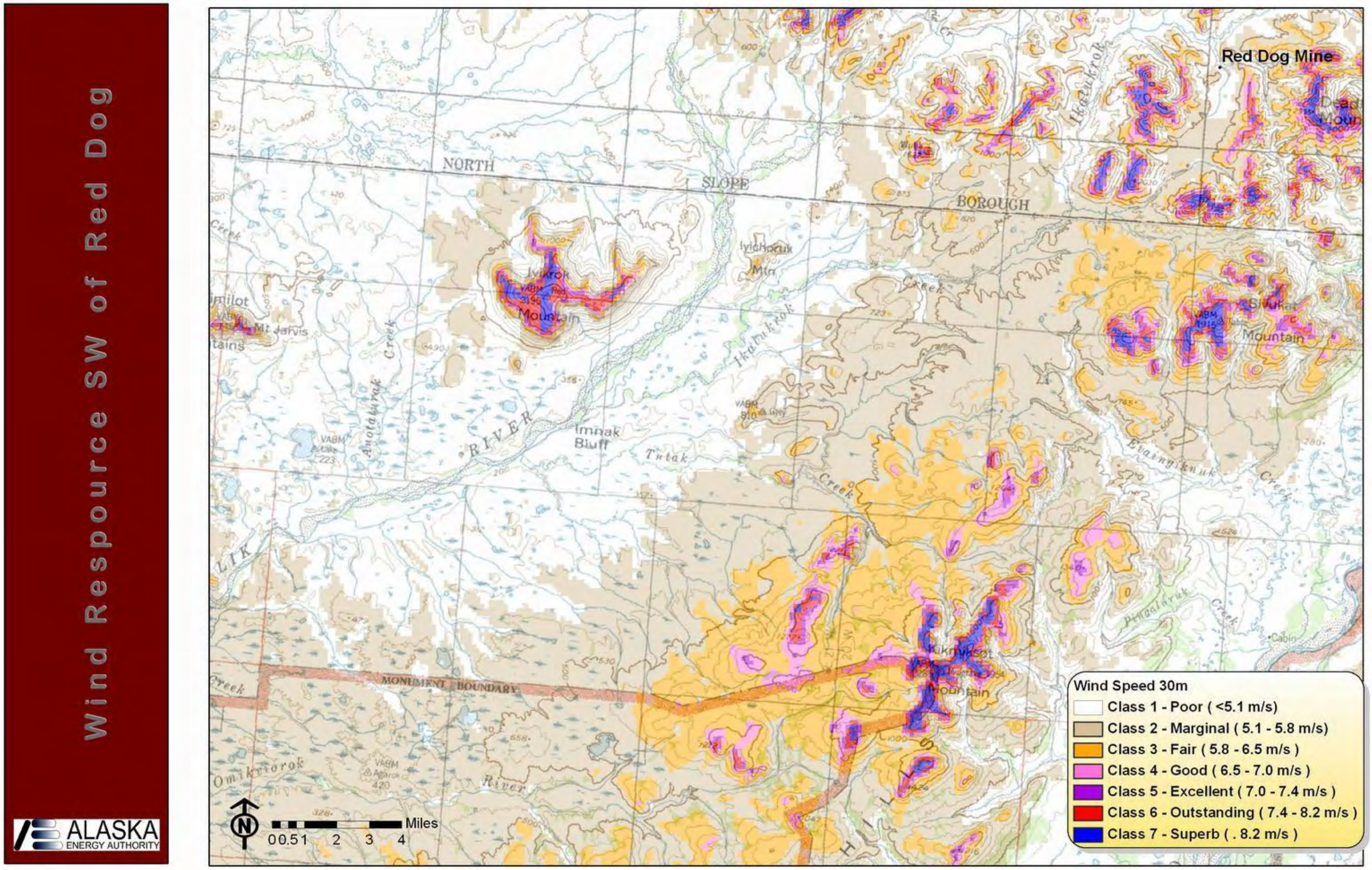
Red Dog Port to Kivalina Tie-line Distance Google Earth Image



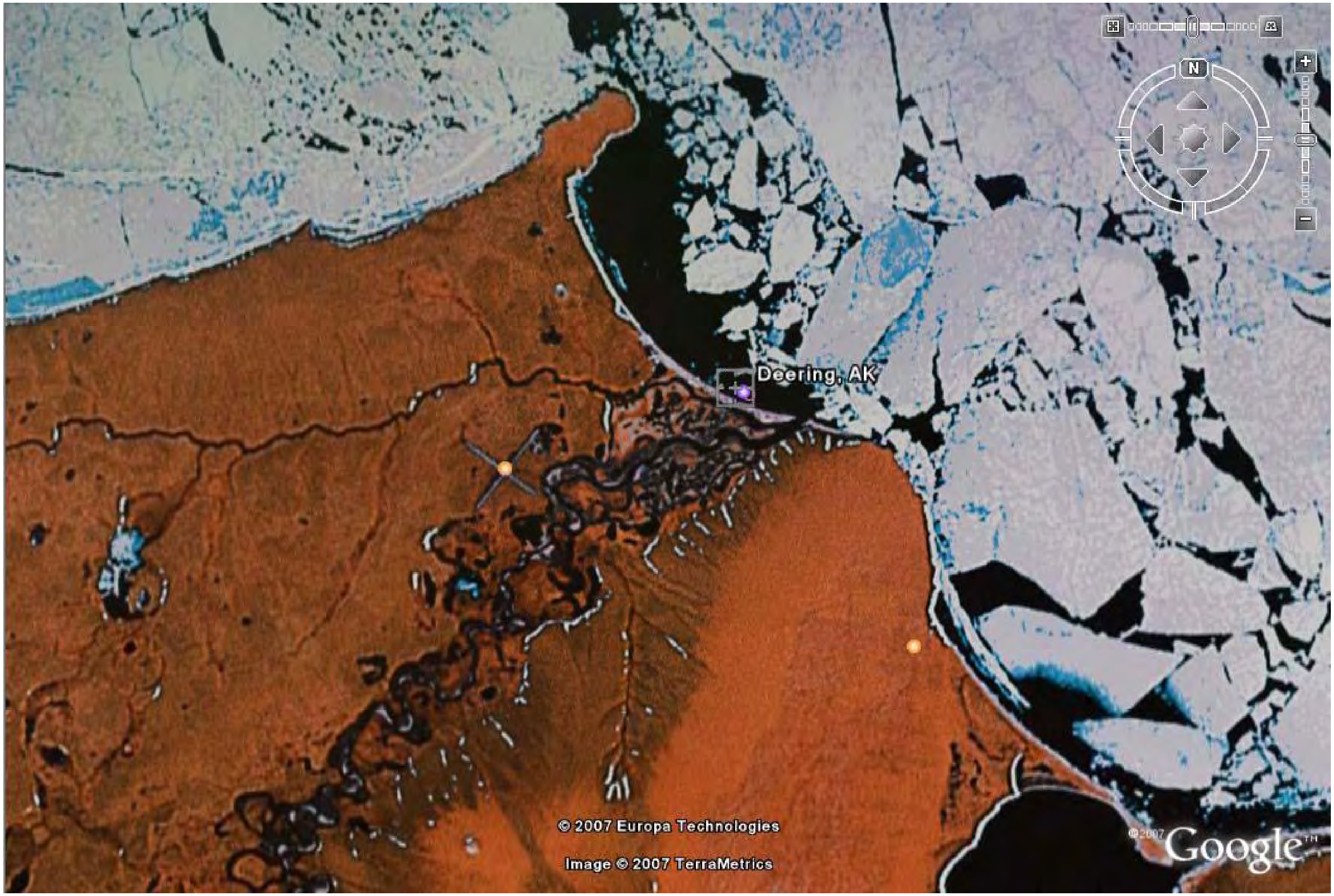
Kivalina Wind Resource Map



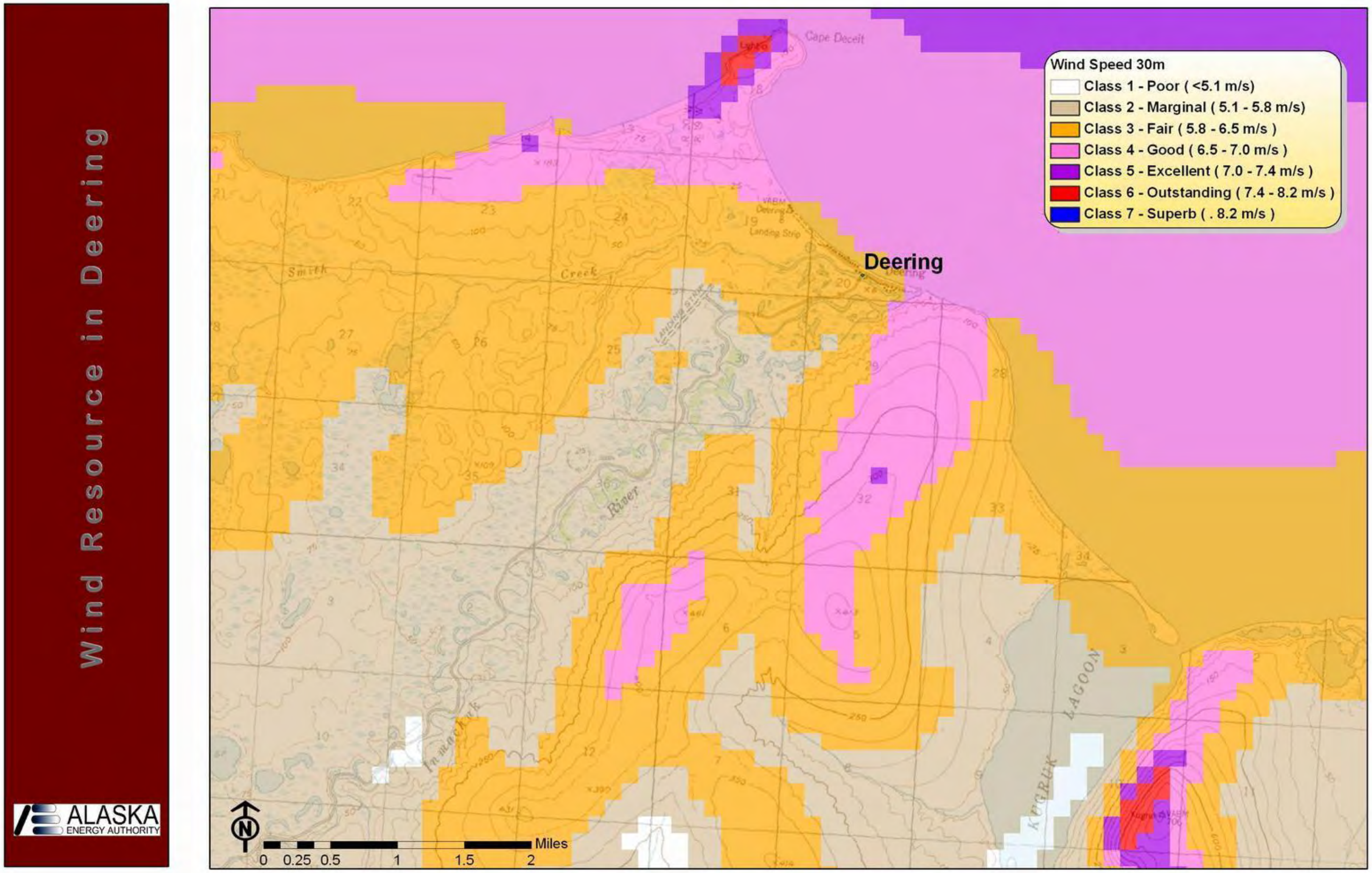
Red Dog Mine Wind Resource Map



Deering Google Earth Image

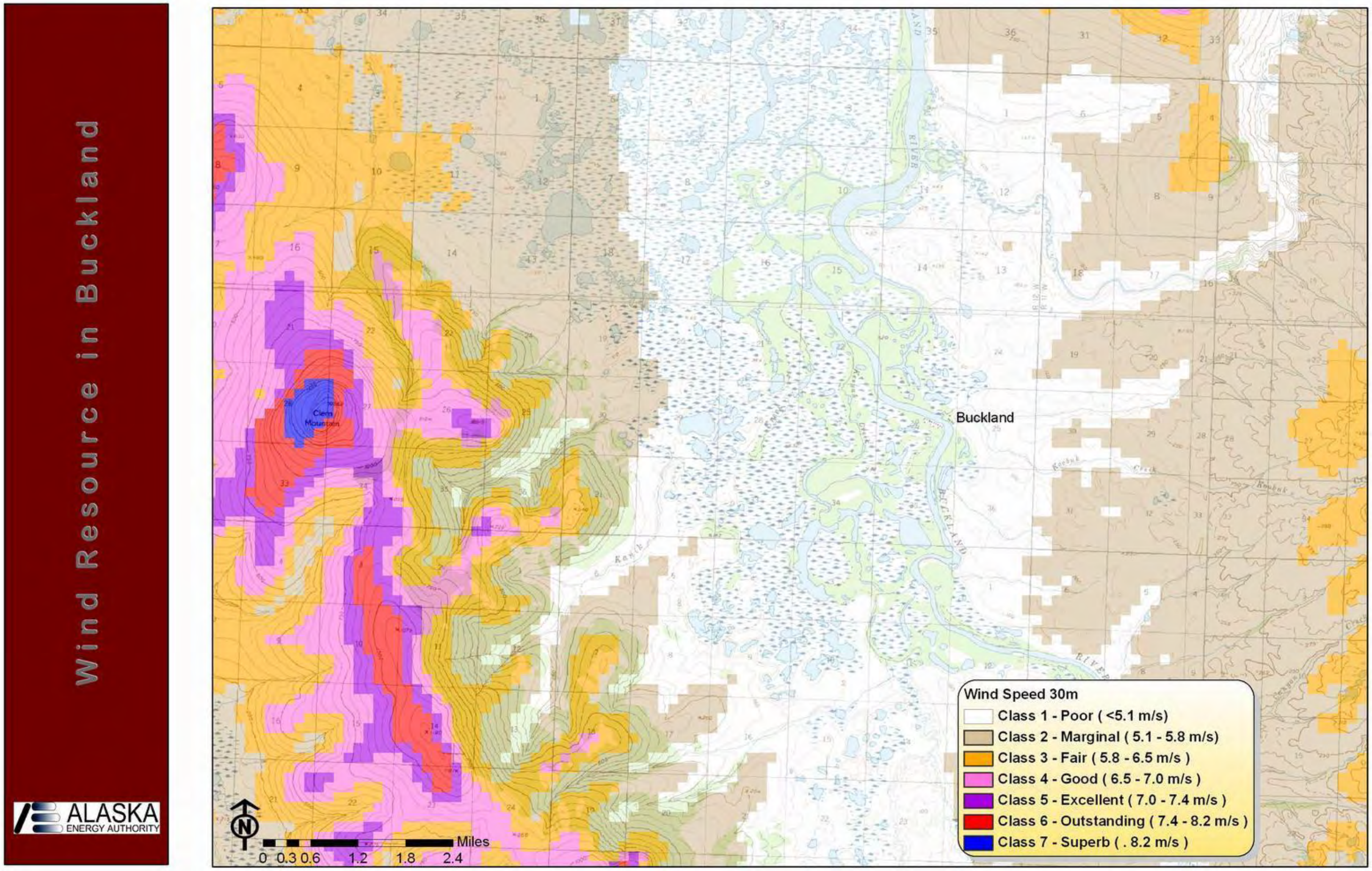


Deering Wind Resource Map

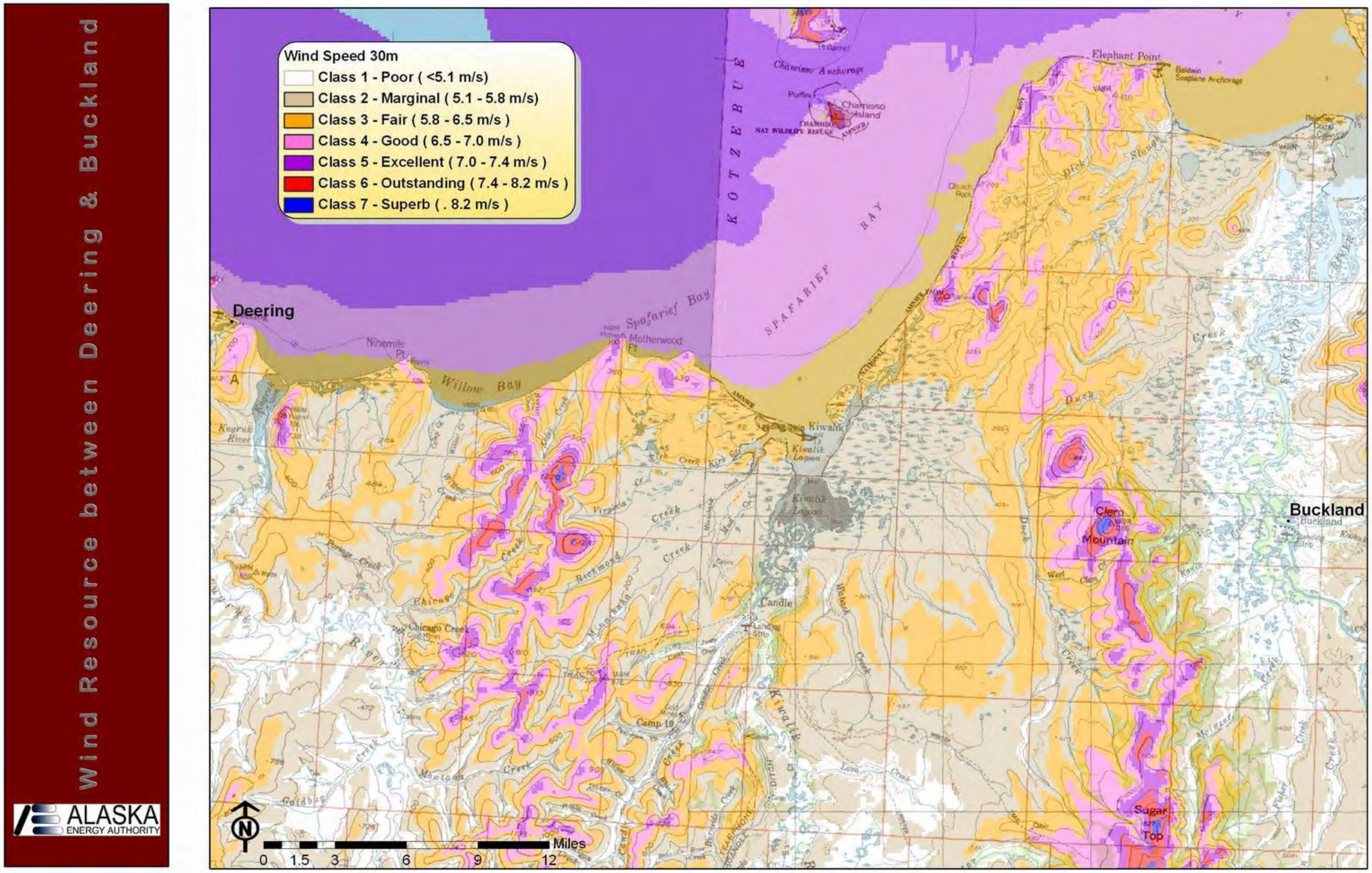


Buckland Google Earth Image

Buckland Wind Resource Map

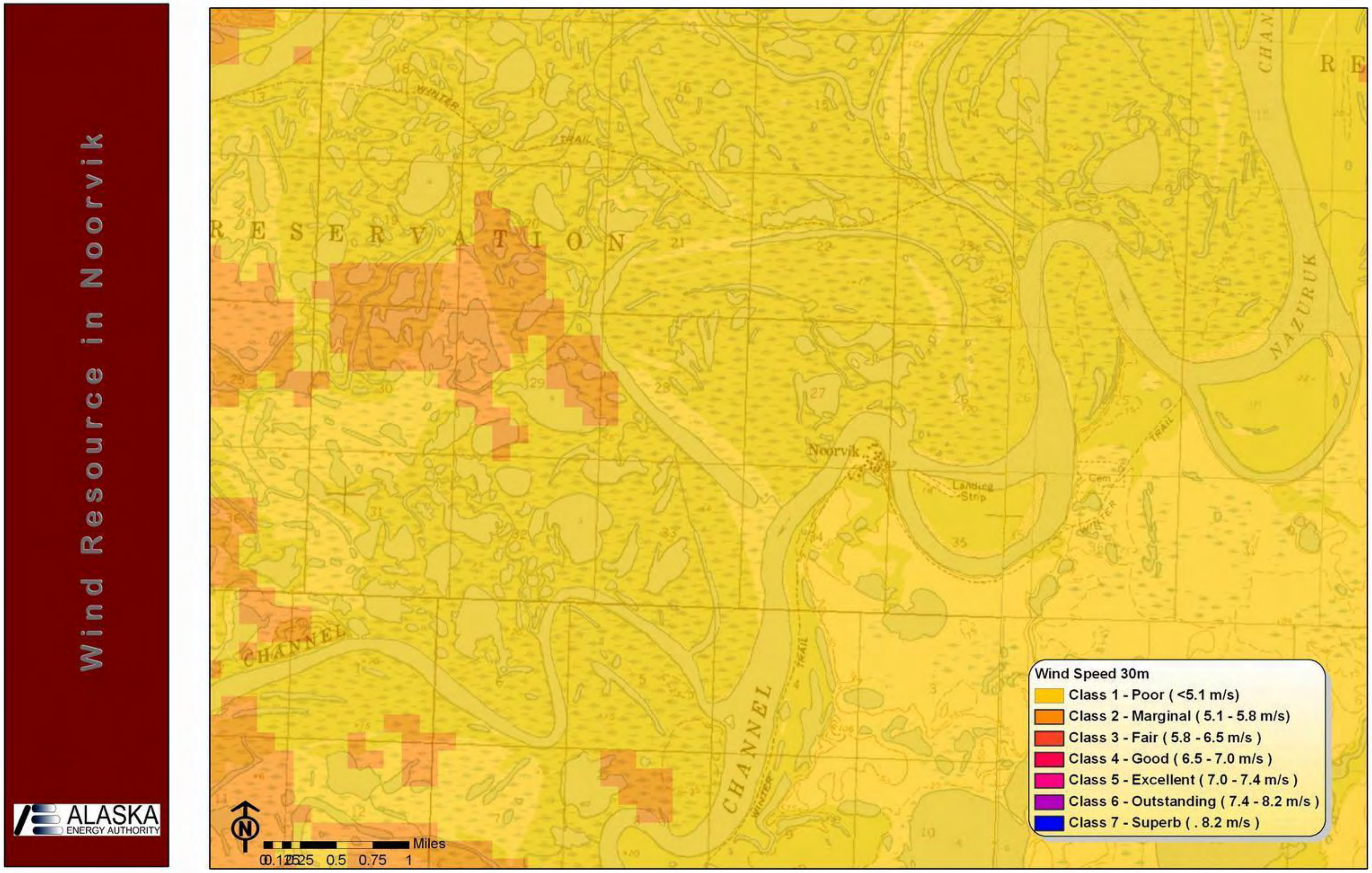


Deering and Buckland Regional Wind Resource Map



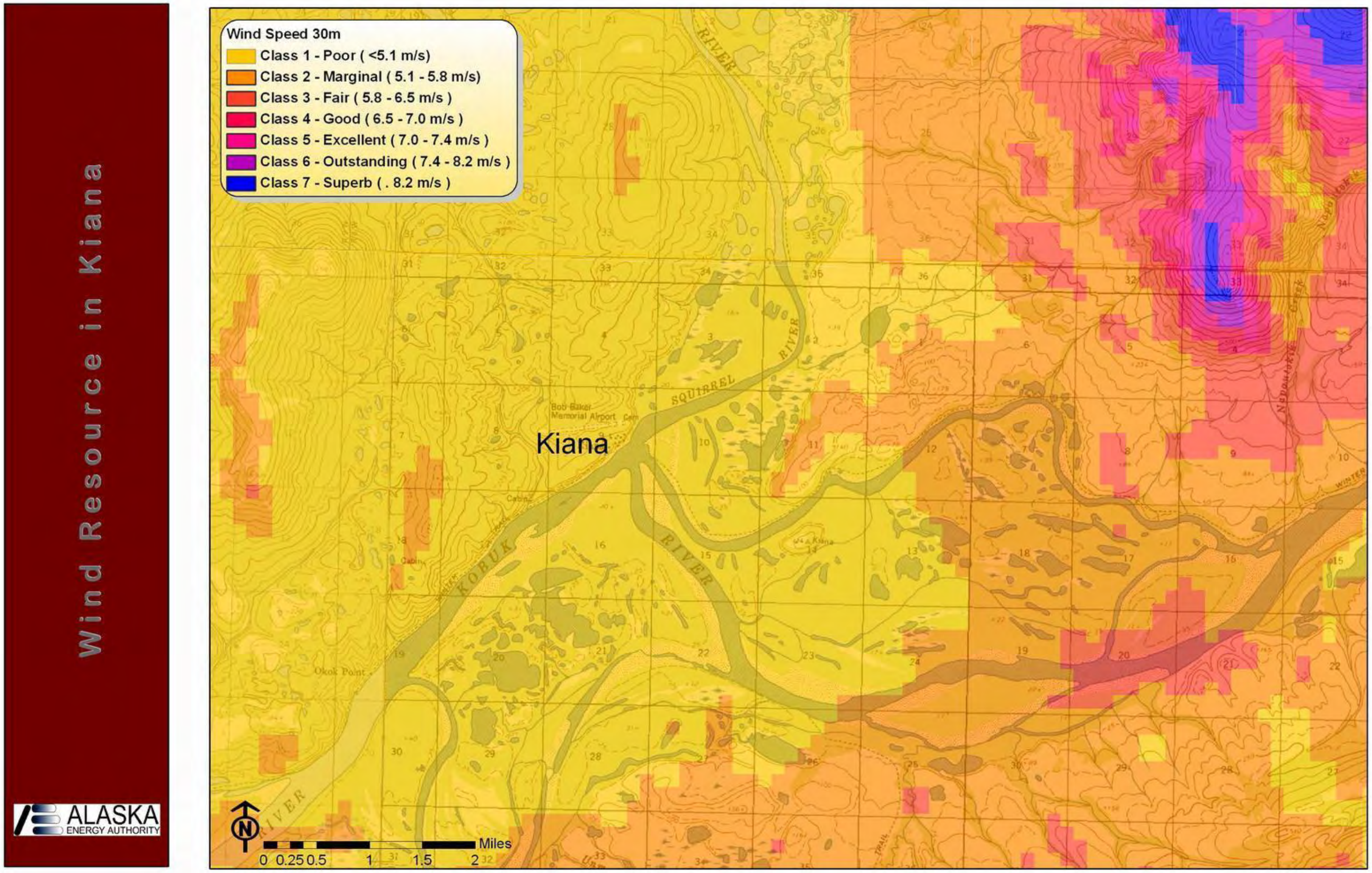
Noorvik Google Earth Image

Noorvik Wind Resource Map

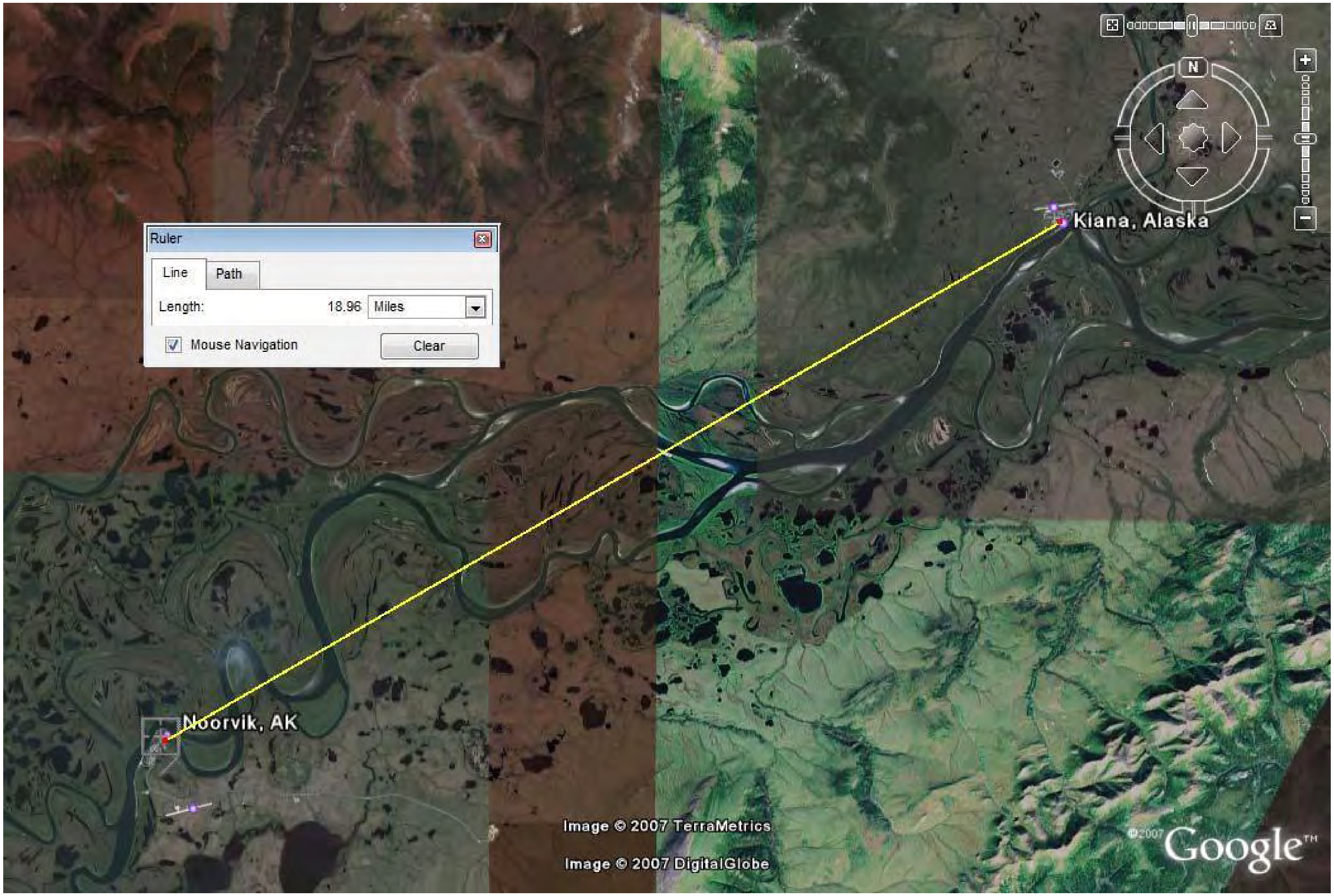


Kiana Google Earth Image

Kiana Wind Resource Map



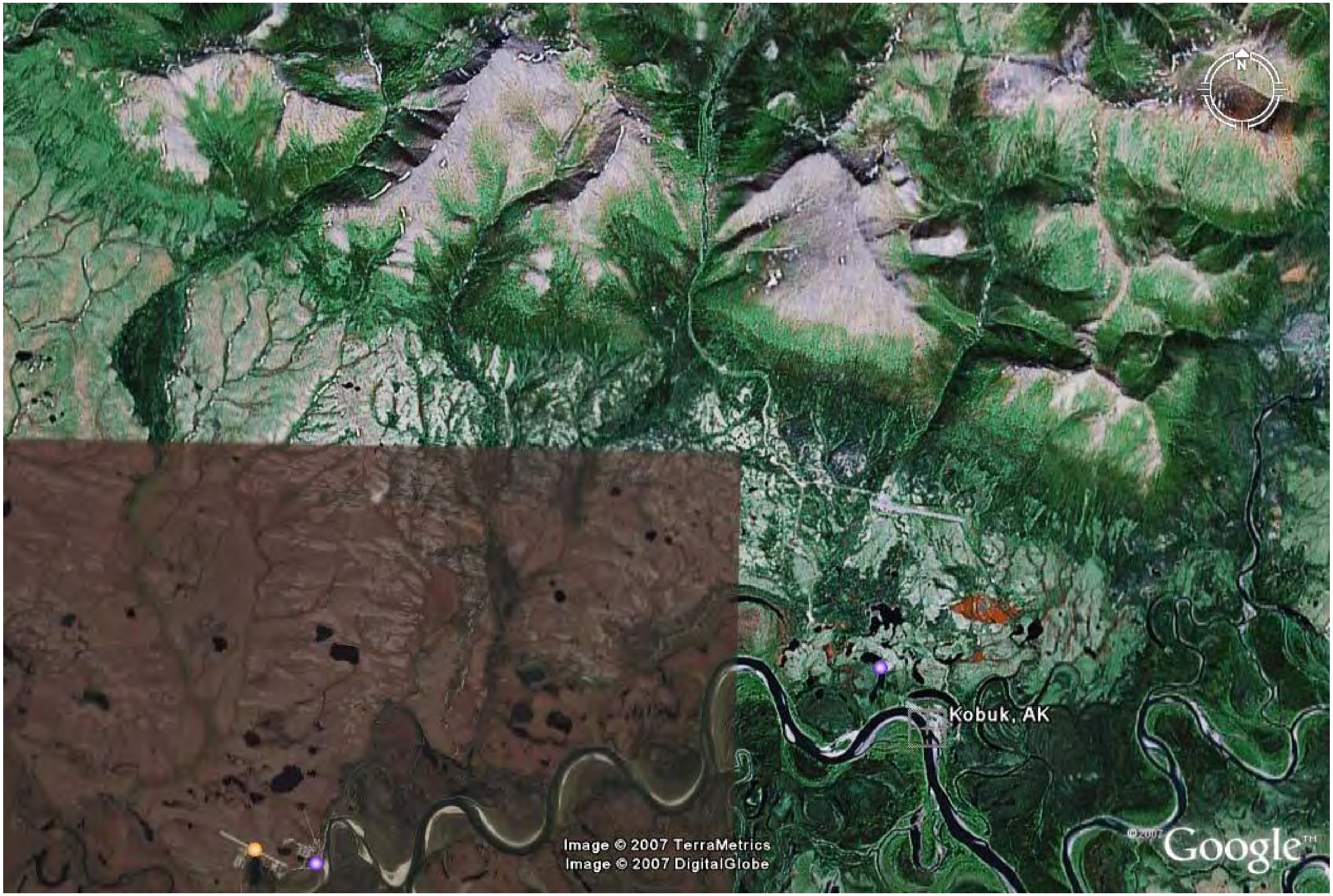
Noorvik to Kiana Tie-line Distance Google Earth Image



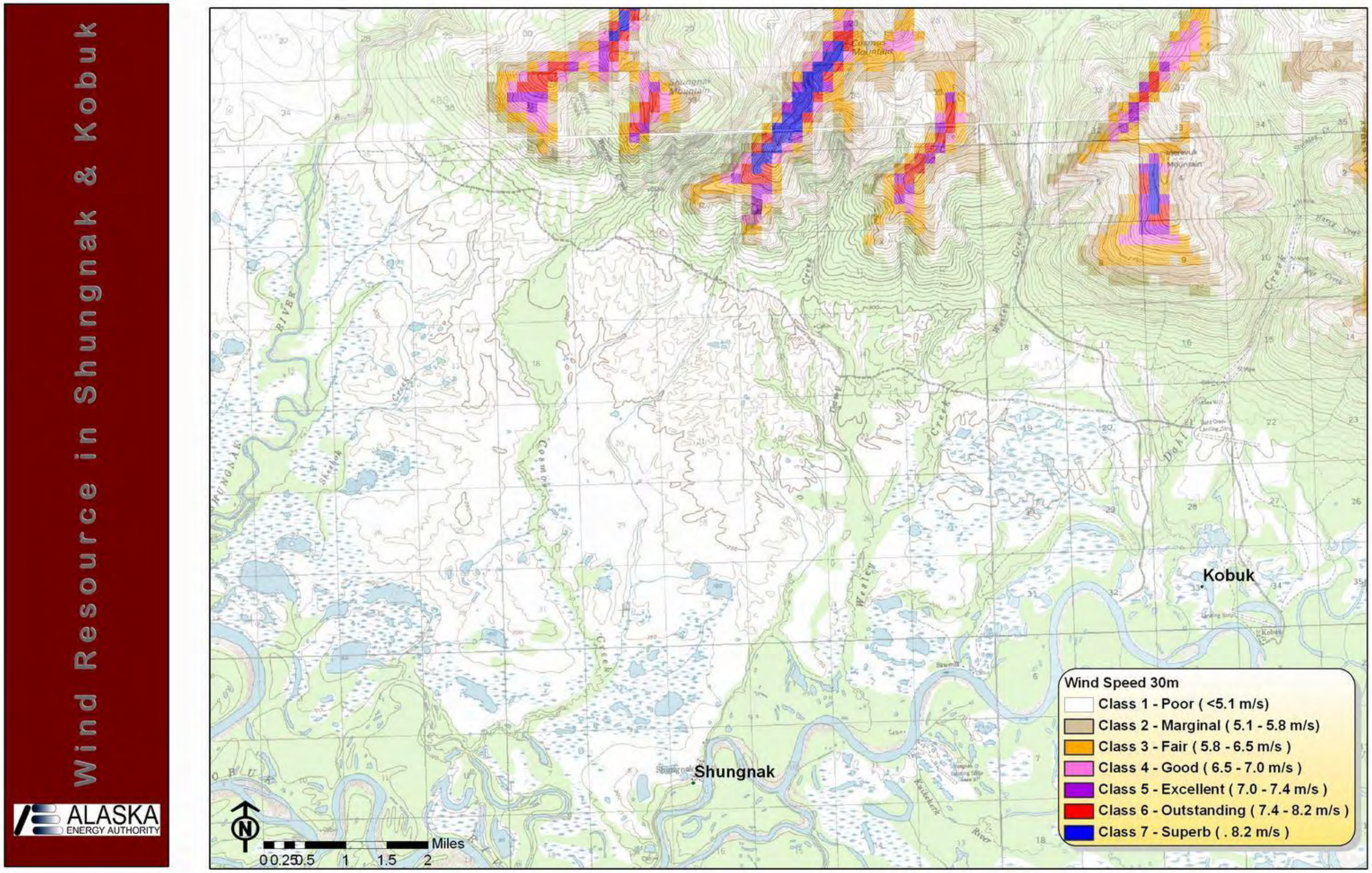
Selawik Google Earth Image

Shungnak and Kobuk Google Earth Image

Kobuk Area Google Earth Image

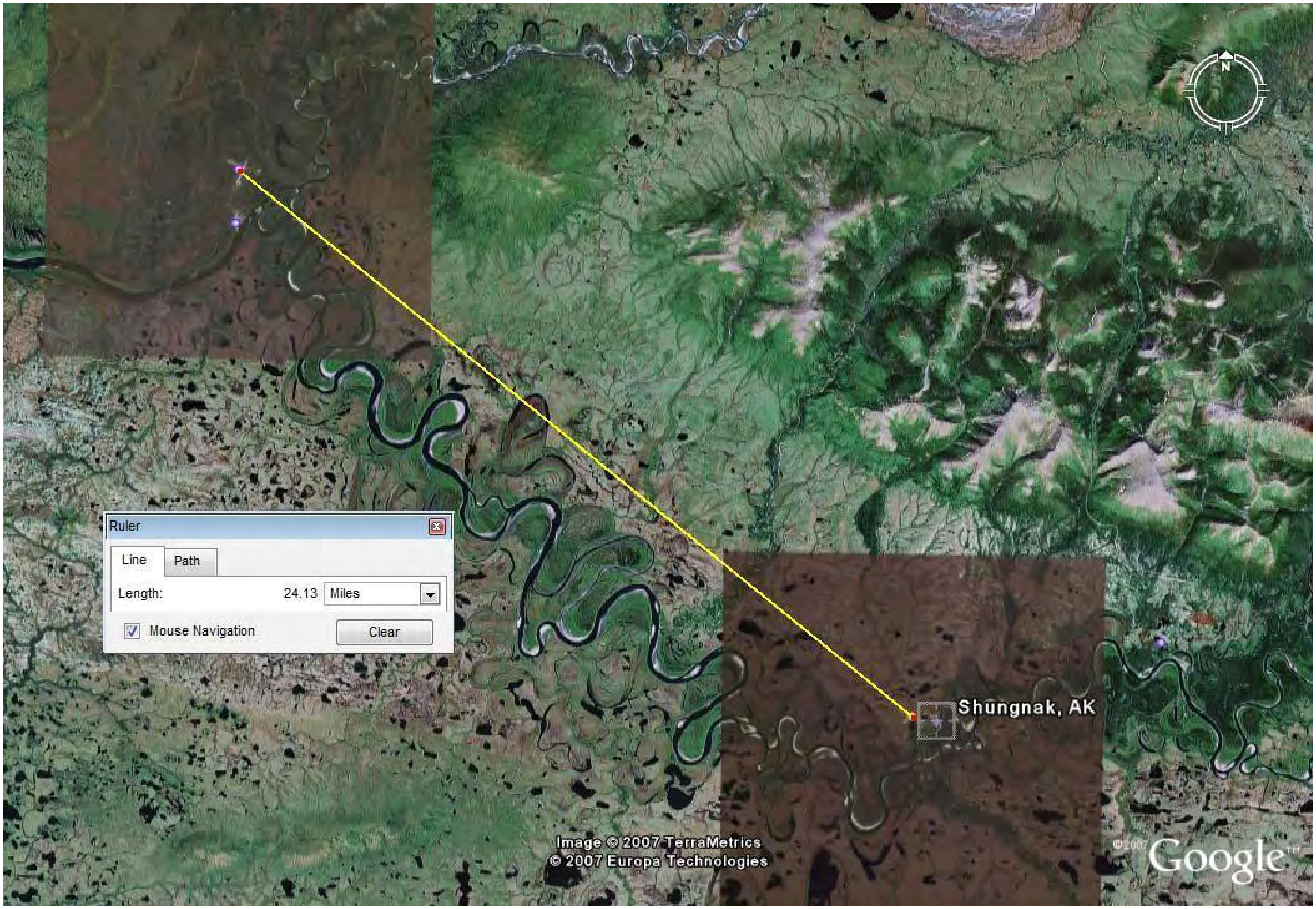


Shungnak and Kobuk Wind Resource Map

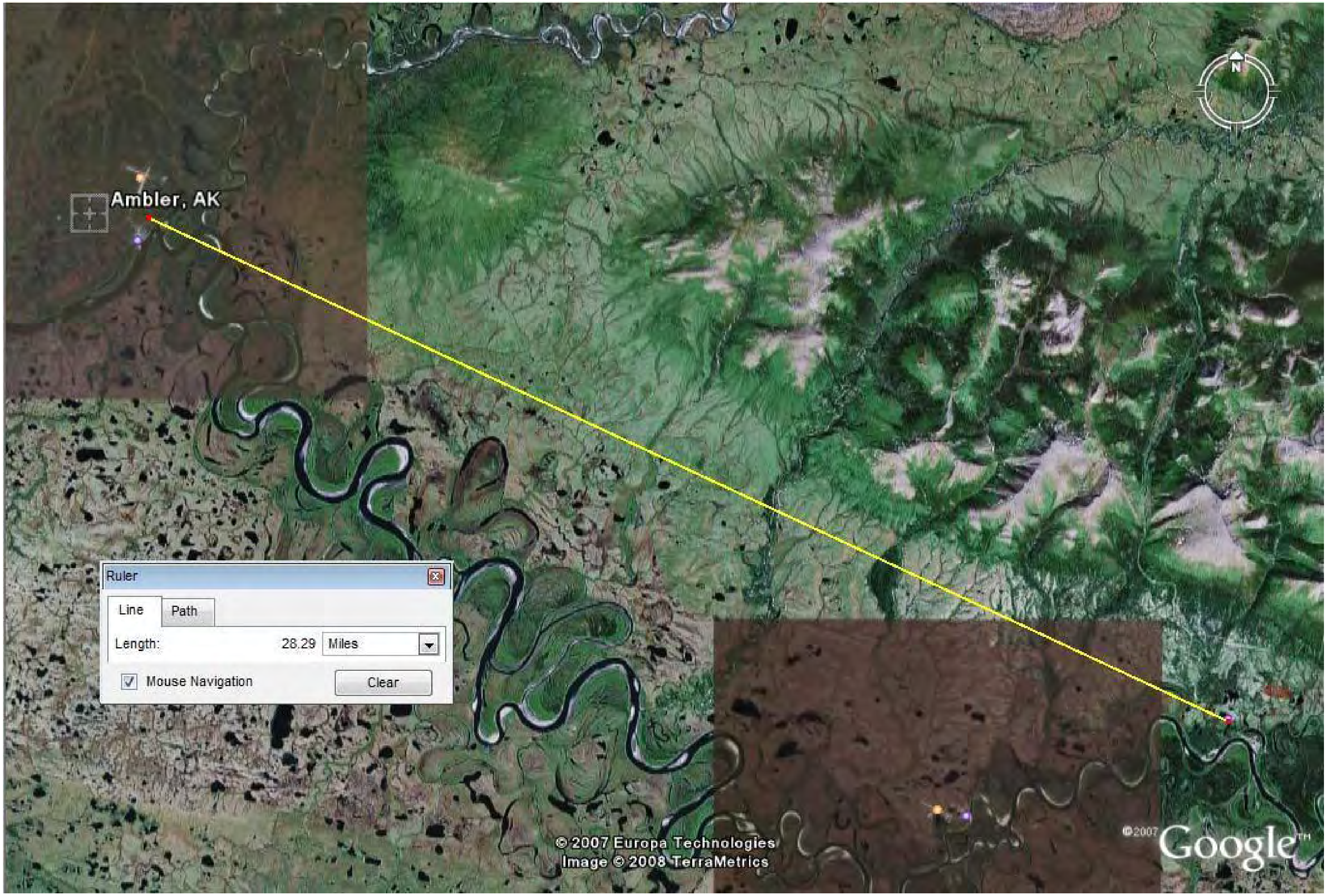


Ambler Google Earth Image

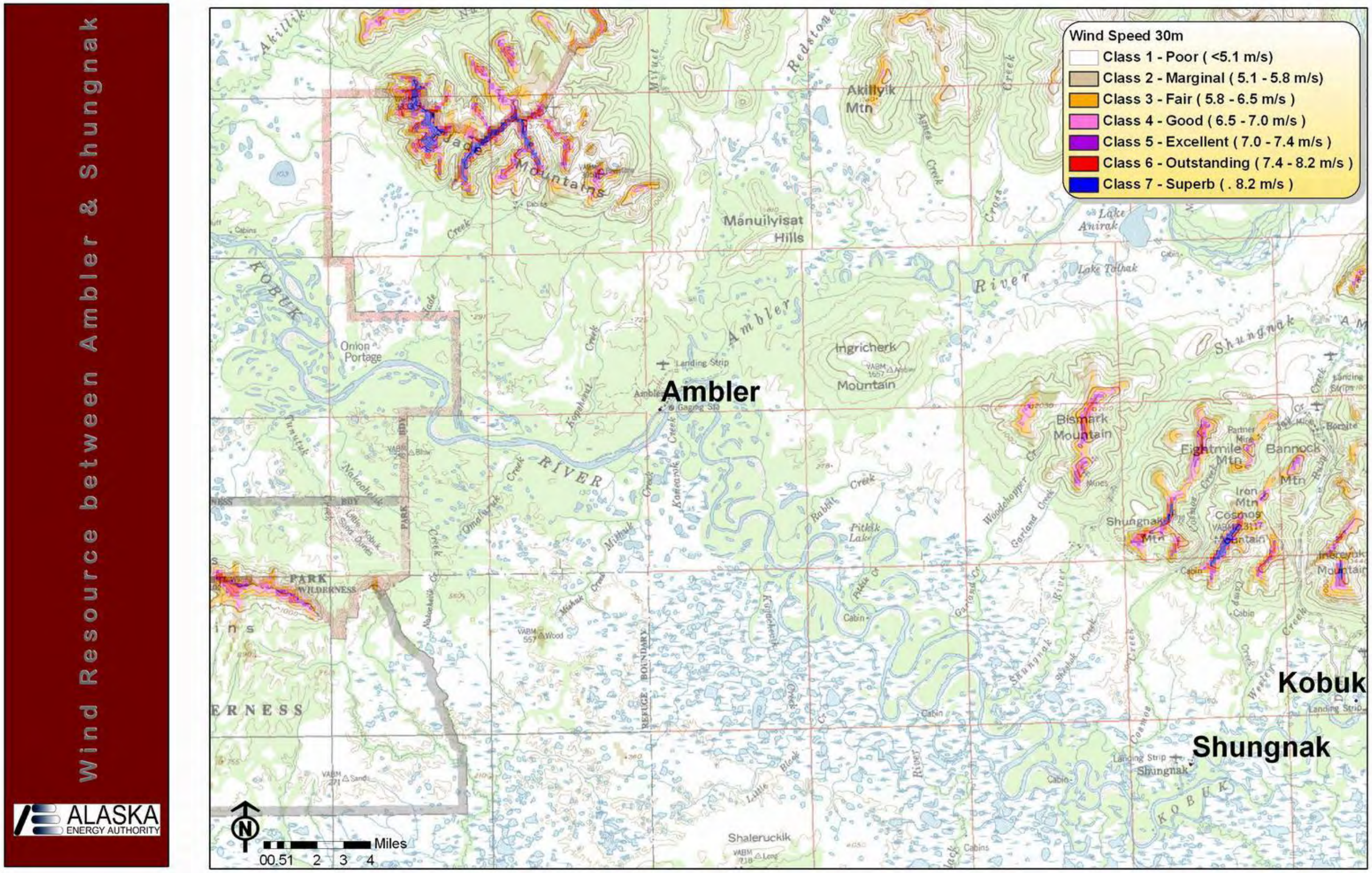
Ambler to Shungnak Tie-line Distance Google Earth Image



Amber to Kobuk Tie-line Distance Google Earth Image



Ambler to Shungnak Area Wind Resource Map



Appendix II-B:

March 2008 Preliminary Wind Energy RETScreen Economic Analysis, NANA Pacific

Wind Energy Financial Analysis: Buckland, Deering, and Buckland

Based the assumptions listed below, a pre-feasibility financial analysis of a small wind farm installation for the communities of Deering, Buckland and Noorvik was conducted using the software program RETScreen.

Wind turbine installation characteristics:

- Wind turbines used are 100-kW Northwind100 machines with a 30 m hub-height
- Two turbines installed in Deering (200-kW total wind capacity)
- Three turbines installed in Buckland and Noorvik (300-kW total wind capacity)

Installation cost assumptions (for all three communities):

- Feasibility, development and engineering costs- $100,000
- Wind turbines- $250,000/turbine
- Substation- $150,000
- Installation labor costs- $150,000
- Foundation- $200,000
- Misc./contingencies- $301,100 to 497,275
- Transmission line cost- $350,000/mile
- Annual operations and maintenance (O&M) costs- $22,000
- Drive train replacement- $30,000 every 10 years
- Blade replacement $80,000 every 15 years

Financial assumptions-

- Electricity avoided cost (compared to diesel)- $0.20/kWh
- Annual electricity cost escalation rate- 10%
- Inflation rate- 2.5%
- Discount rate- 7%
- Project life- 25 years

	Deering	**Buckland**	**Noorvik**
Average annual wind speed	7.2 m/s	6.8 m/s	5.8 m/s
Wind plant capacity factor	29.1%	25.9%	18.0 %
Total installed wind capacity	200-kW	300-kW	300-kW
Annual wind energy generated	510 MWh	682 MWh	473 MWh
Total generated in FY2007[6]	710 MWh	1423 MWh	1992 MWh
Transmission line length	1.5 miles	5 miles	0.5 mile
Transmission line cost	$525,000	$1,750,000	$175,000
Total installation cost	$1,926,100	$3,597,275	$1,812,800
Equity payback	11.6 years	13.6 years	11.8 years
Benefit-cost (B-C) ratio	**1.72**	**1.27**	**1.68**

[6] *Statistical Report of the Power Cost Equalization (PCE) Program*, Fiscal Year 2007, Alaska Energy Authority

Appendix II-C:

June 2008 Letter Report on NANA Villages Overflight Reconnaissance Trip, V3 Energy

APPENDIX 11-C

Douglas Vaught, P.E.
V3 Energy, LLC
19211 Babrof Drive
Eagle River, AK 99577

June 17, 2008

Jay Hermanson
NANA Pacific, LLC
3150 C Street, Suite 250
Anchorage, Alaska 99503

Subject: Letter Report on NANA Villages Overflight Reconnaissance Trip

This report documents observations from an overflight of several NANA Region villages accomplished on June 9, 2008 by Doug Vaught, V3 Energy, LLC and Sonny Adams, NANA Regional Corporation. Sonny and I flew via charter aircraft from Kotzebue to Nova Gold's Dahl Creek camp site near the village of Kobuk and the village overflights were incident to that effort. We flew over the villages of Kiana, Ambler, Shungnak, Kobuk, and Noorvik, in that order. Included below are brief discussions of the wind potential in each village. Also included are photographs, topographic maps and wind resource maps for each village (as needed to describe the wind power possibilities).

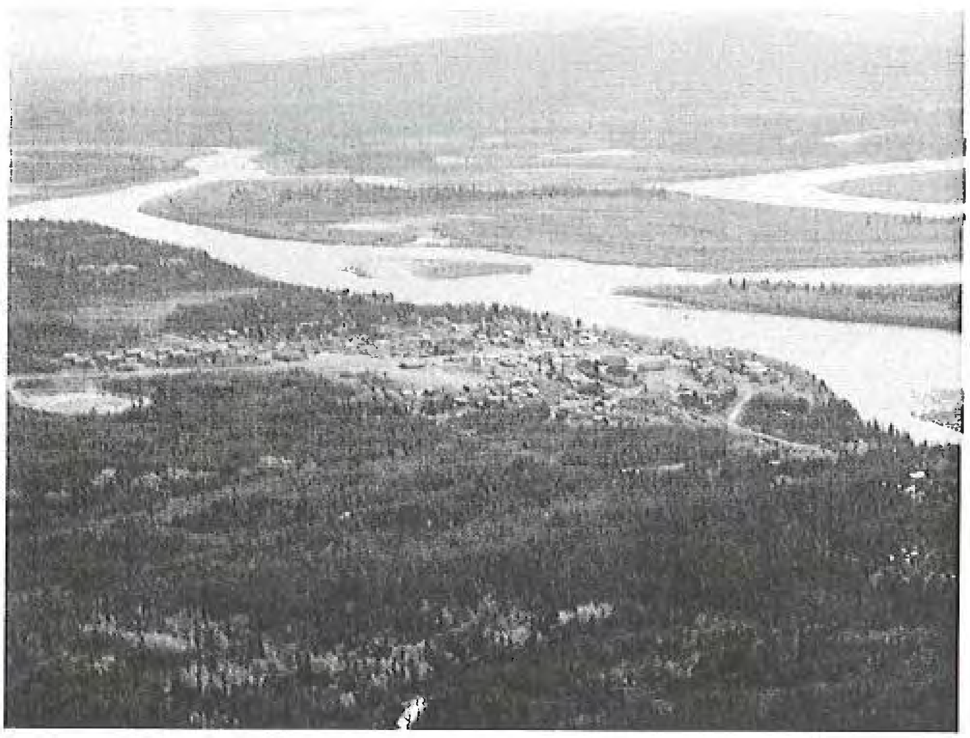
Kiana

Past thoughts with Kiana had been to look northwest, between Noorvik and Kiana, for wind power sites in the Kiana Hills which lie north of the Kobuk River. This had been considered a difficult prospect however given the distances involved from the village. However, during our flight we noticed a lower series of hills trending immediately north of Kiana that are of interest. The village airport and wastewater treatment lagoon are sited immediately north of Kiana on the lower section of these hills/ridge, but continuing up the ridgeline one finds Hill 396 (feet) and then beyond that Hill 440. The attached wind resource map indicates possible Class 4 to Class 6 winds at the marked locations, making this area a prime spot for further investigation.

Ambler

Prior to the reconnaissance trip, the prevailing thought had been that Ambler had no nearby wind resources close enough worth investigating. But, as in Kiana, a ridge trending north from the village presents a possibility and may be worth a met tower wind resource assessment. The particular site in question is labeled Hill 725 and is about 3.5 miles NNW of the village center. The new runway, however, considerably shortens the distance by trail one must travel to access the site. The attached wind resource map does not indicate particularly promising winds at this location, but this is odd as the map

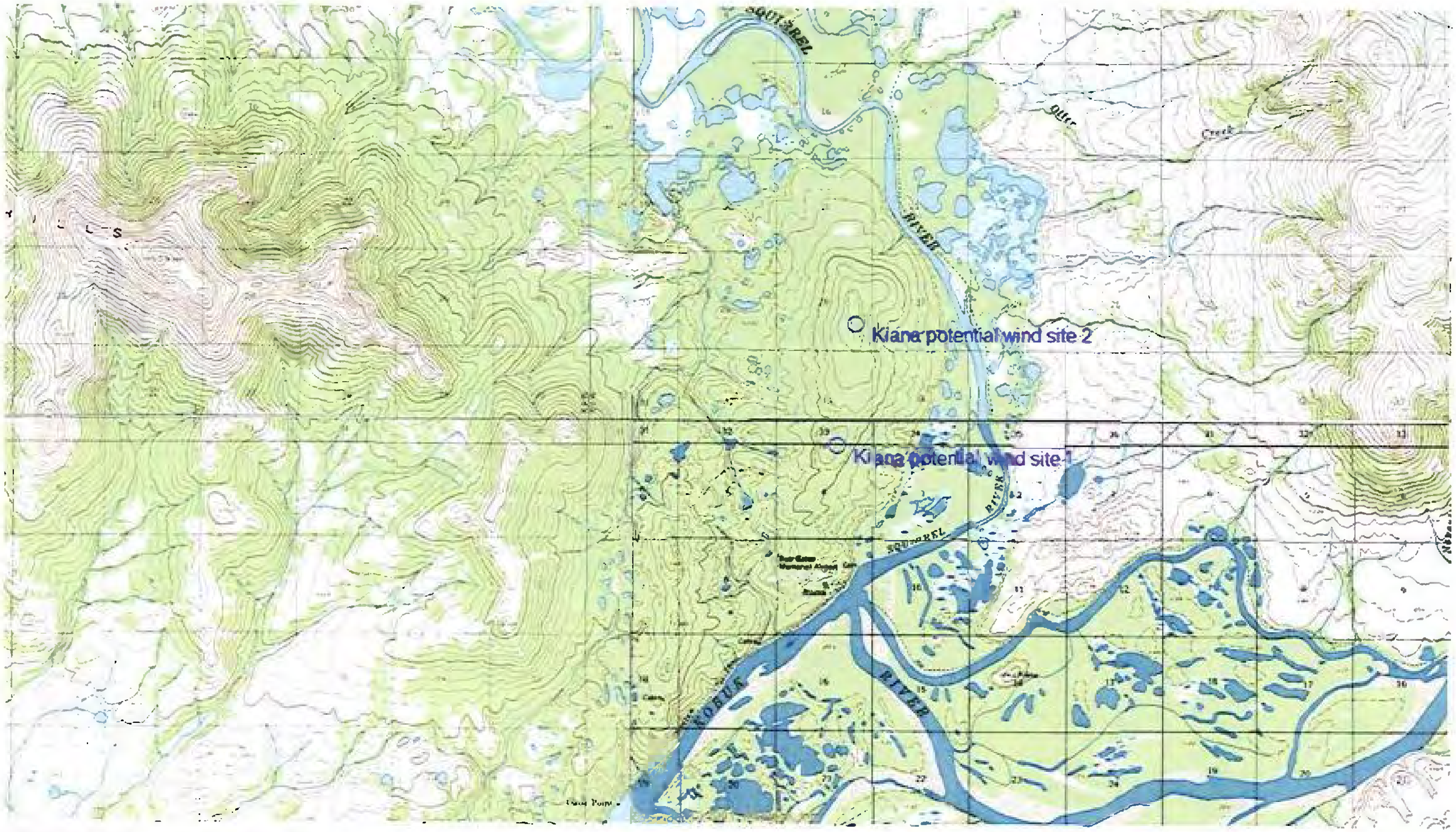
Kiana and the Kobuk River, view north, possible wind sites on higher terrain center right of photo



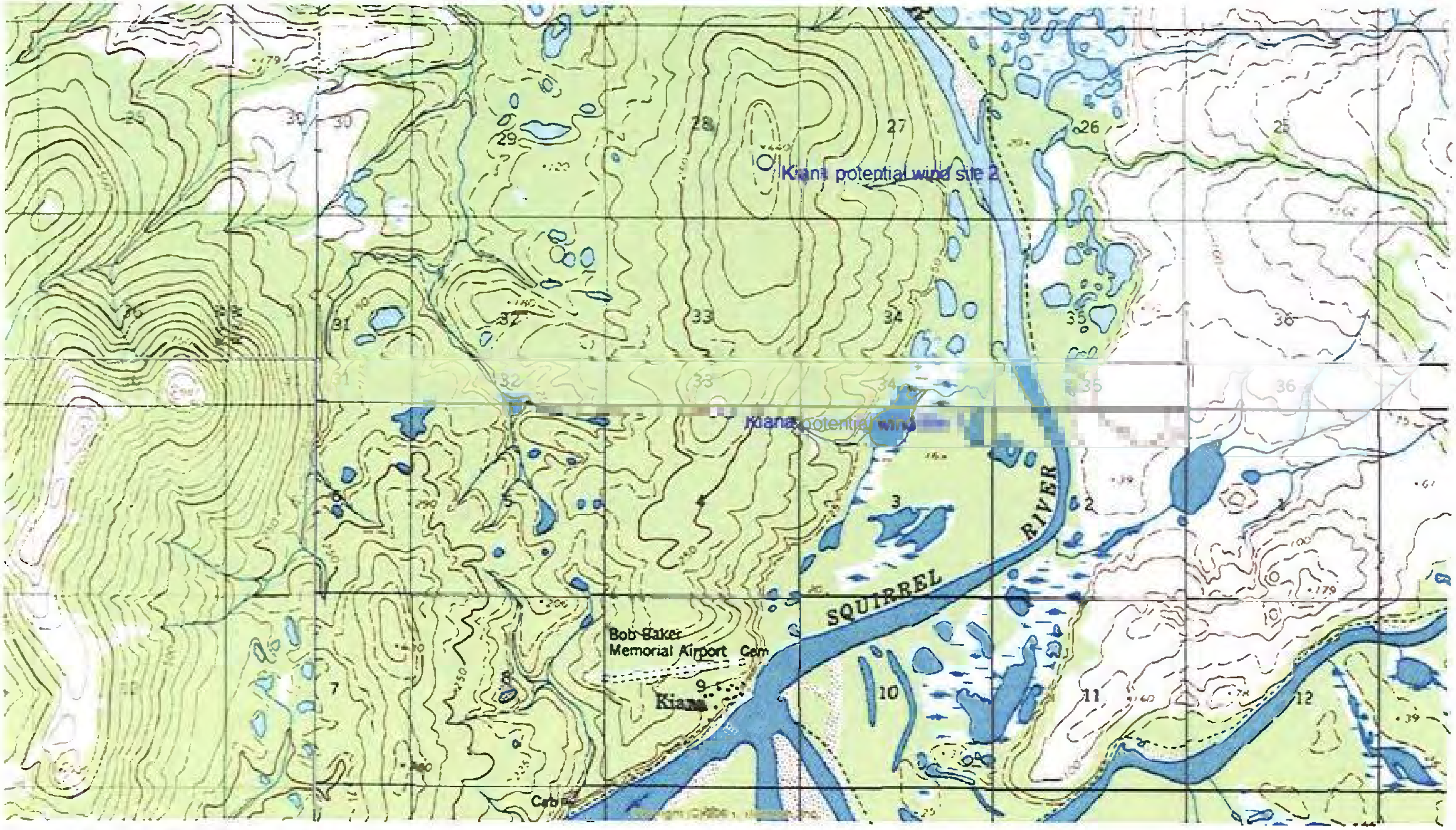
Ambler and the Kobuk River, view to the east

Kogoluktuk River possible hydropower site north of Kobuk

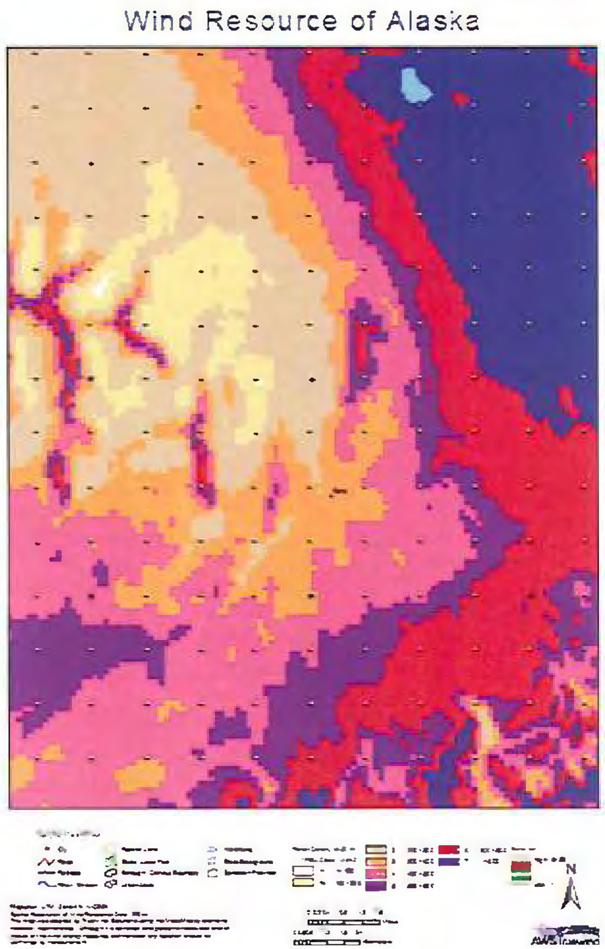
Kogoluktuk River possible hydro site near Kobuk



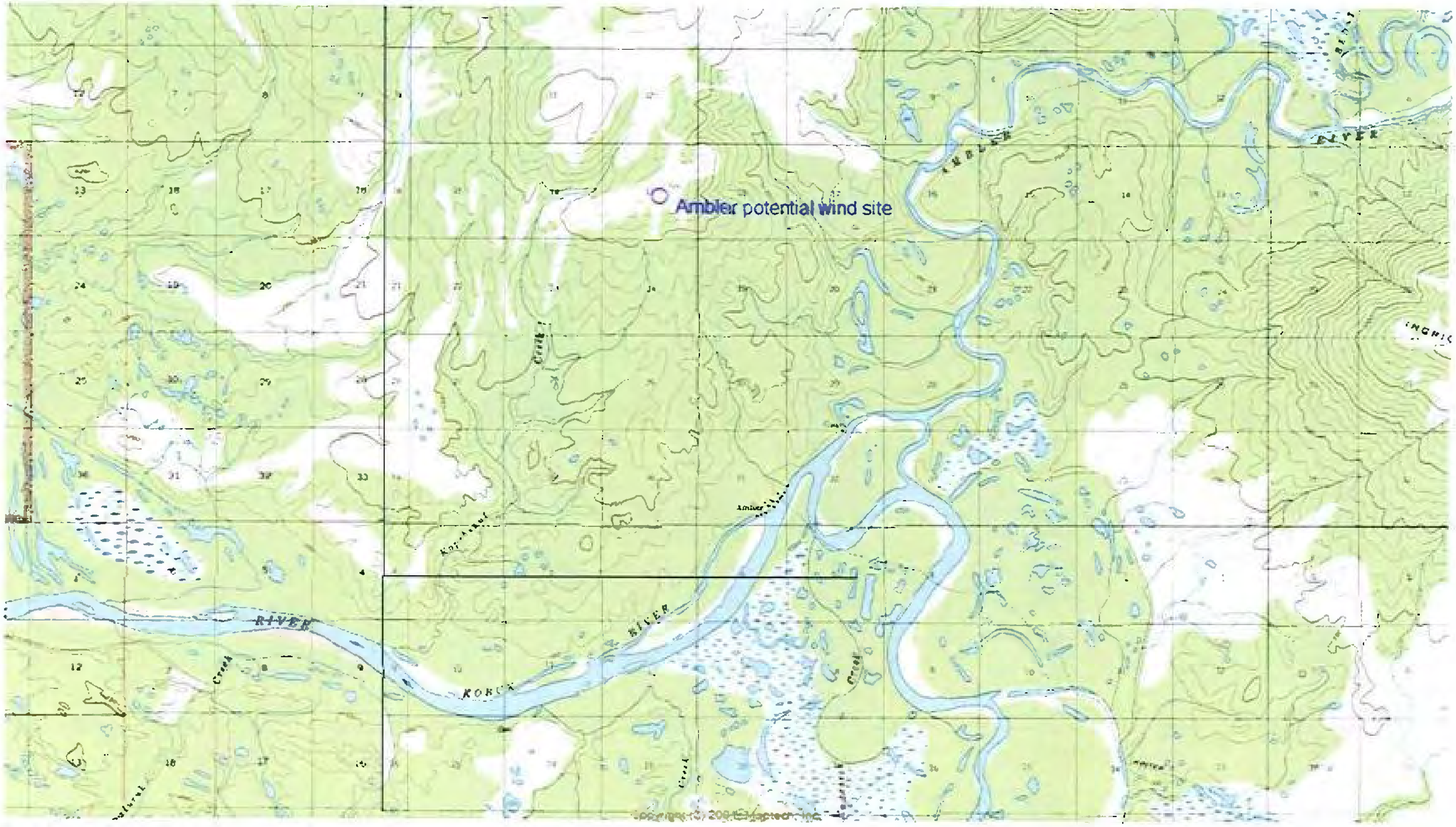
Kiana potential wind power sites



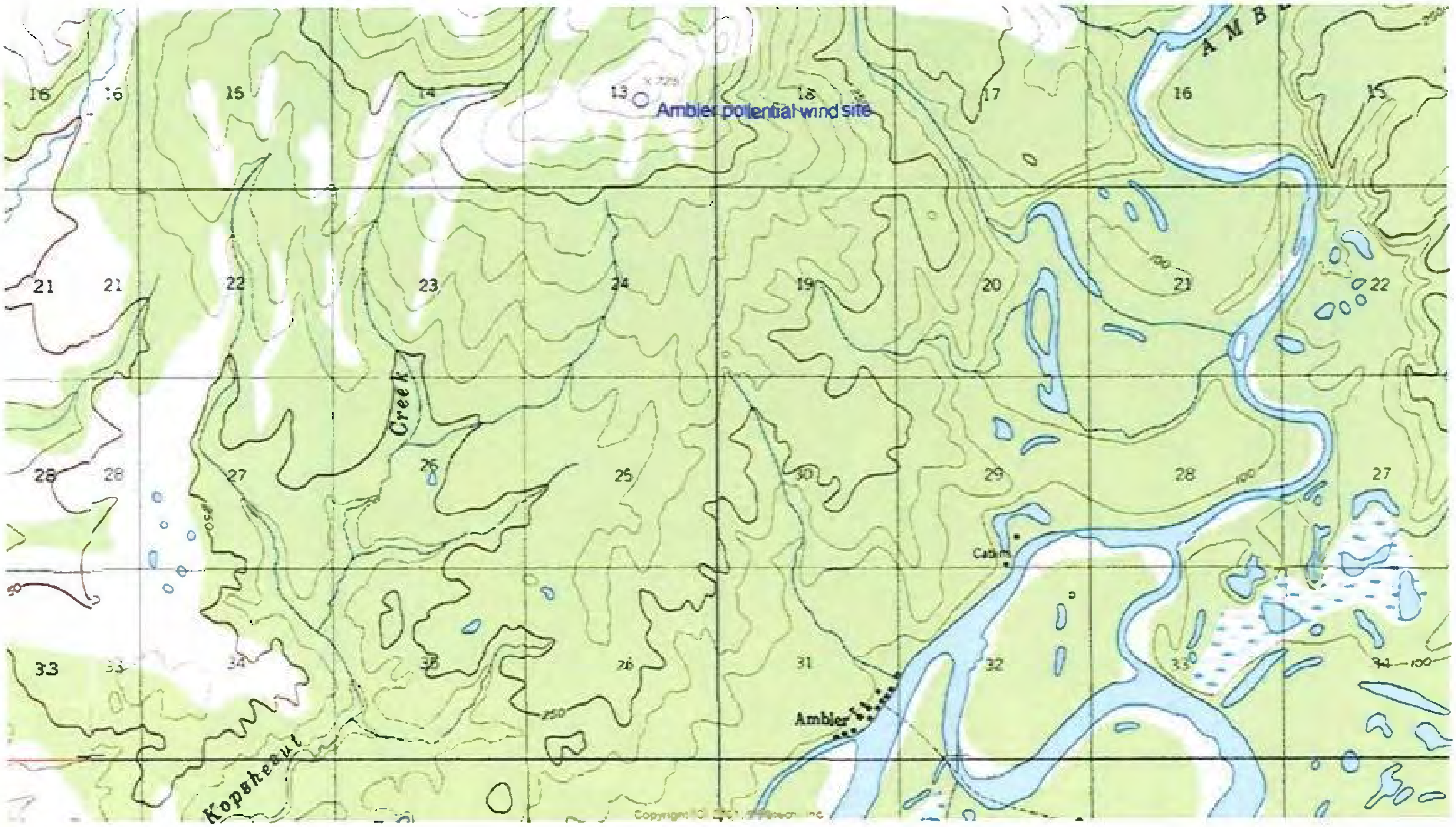
Kiana potential wind sites, close-up view



Kiana wind power density map, potential wind sites are in center of image

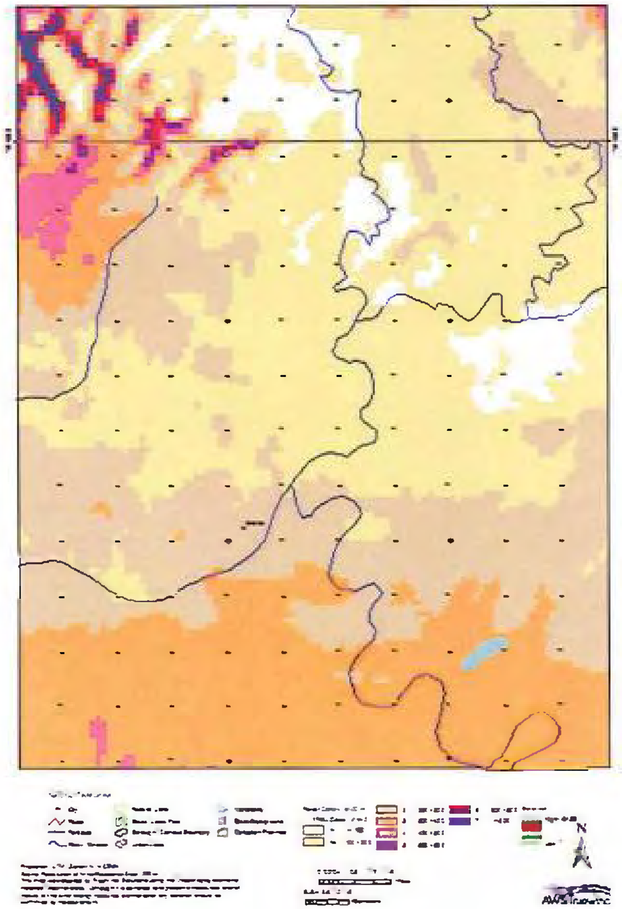


Ambler potential wind power site



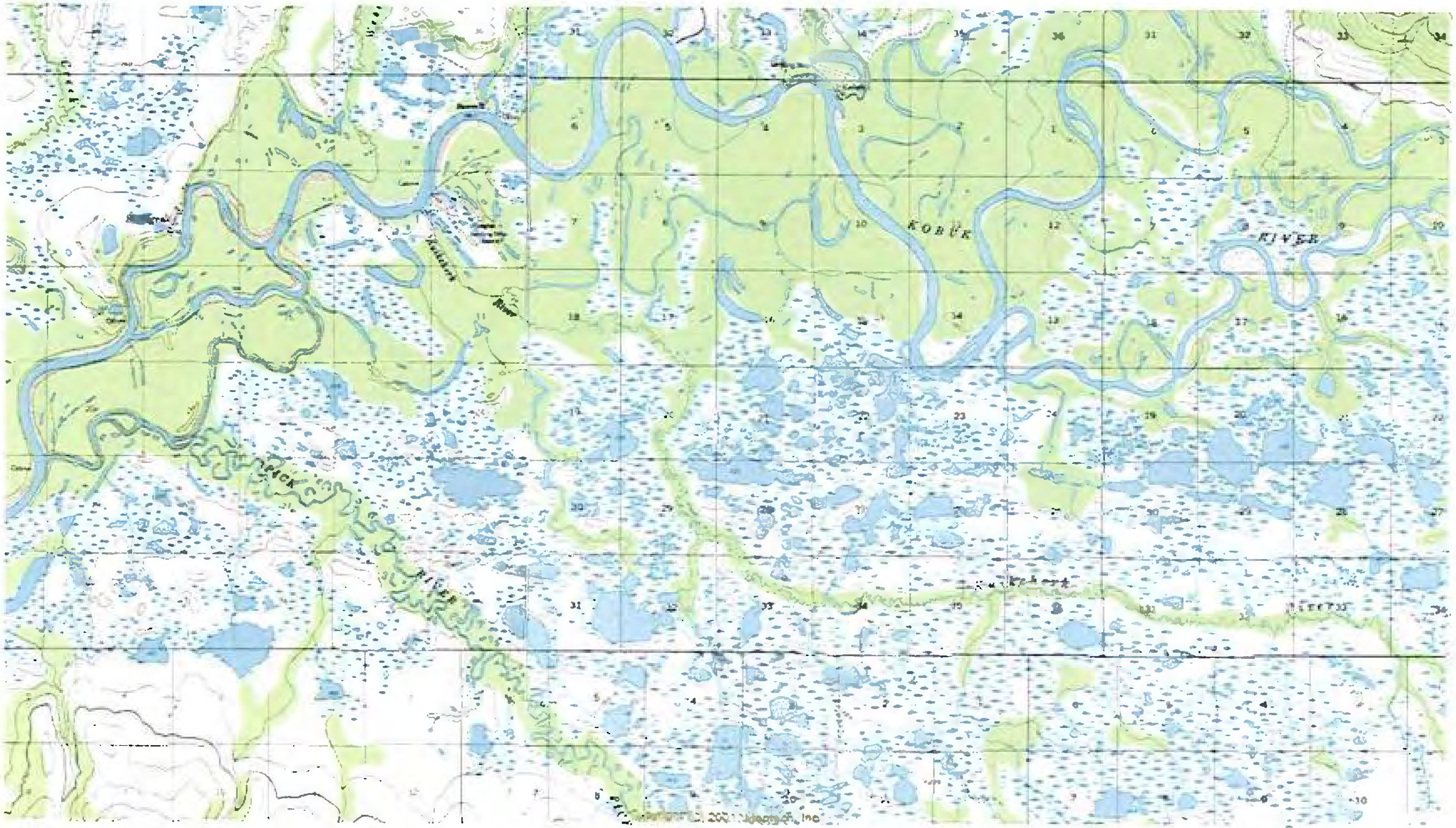
Ambler potential wind site, close-up view

Wind Resource of Alaska



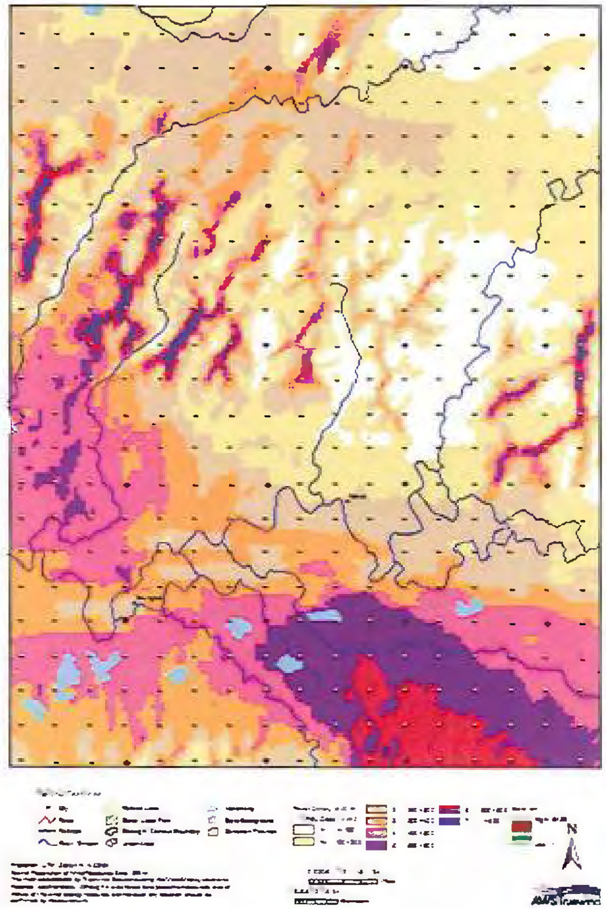
Ambler wind resource map, Ambler located lower center of image

Kobuk and Shungnak potential hydropower site



Kobuk and Shungnak, terrain south of the villages

Wind Resource of Alaska



Kobuk and Shungnak wind resource map, Kobuk is lower center in image

Appendix II-D:

October 2008 Proposal for Alaska Energy Authority grant, Northwest Arctic Borough

Northwest Arctic Borough
October 7th 2008

Proposal for

Renewable Energy Fund
Alaska Energy Authority Grant

Wind-Diesel Project for Buckland, Deering, and Noorvik

Rural Alaskans in the Northwest Arctic Borough, NWAB, are facing some of the highest costs anywhere in the nation. In order to proactively address the region's Energy Crisis, declared by the NWAB in September 2008, the NWAB is working to implement long term energy options. While there are a variety of alternative energy options available in NW Alaska, such as wind, solar, geothermal, and biomass; wind energy has a proven track record of success in our communities. Installing and integrating wind turbines in three NW Alaska villages is a big step toward securing the future of rural Alaska.

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1. Applicant Information

Northwest Arctic Borough

Po Box 110

Kotzebue, Alaska 99752

Phone: (907) 442-2500

Fax: (907) 442-2930

1.1. Applicant Point of Contact

Katherine Keith

Kotzebue Electric Association

Po Box 44

Kotzebue, Alaska 99752

k_keith@kea.coop

Work: (907) 442-3491

Cell: (651) 332-0584

Fax: (907) 442-2482

1.2. Applicant Minimum Requirement

1.2.1. As an Applicant, we are a government entity.

1.2.2. Attached to this application is formal approval and endorsement for its project by its board of directors, executive management, or other governing authority. If a collaborative grouping, a formal approval from each participants governing authority is necessary.

1.2.3. As an applicant, we have administrative and financial management systems and follow procurement standards that comply with the standards set forth in the grant agreement.

1.2.4. If awarded the grant, we can comply with all terms and conditions of the attached grant form. (Any exceptions should be clearly noted and submitted with the application.)

2. Project Summary

2.1. Project Type

This is a construction project which will generate electricity using the locally available wind resource.

2.2. Project Description

Rural Alaskans in the Northwest Arctic Borough, NWAB, are facing some of the highest costs anywhere in the nation. In order to proactively address the region's Energy Crisis, declared by the NWAB in September 2008, the NWAB is working to implement long term energy options. While there are a variety of alternative energy options available in NW Alaska, such as wind, solar, geothermal, and biomass; wind energy has a proven track record of success in our communities. Installing and integrating wind turbines in three villages is a big step toward securing the future of rural Alaska.

The goals of the proposed project are:

- To develop the wind energy potential in the communities of Buckland, Deering, and Noorvik,
- To develop appropriate wind generation engineering plans and designs, and
- To construct the necessary wind generation facilities (fully integrated with diesel power systems).

This is a two year project. Year one involves performing both pre-construction and construction tasks in Deering and Noorvik as well as pre-construction tasks in Buckland. Year two involves construction tasks in Buckland.

2.3. Project Budget Overview

As detailed in Figure 1 and Figure 2 below, the total project cost is $9,792,710. Currently, agencies within the Northwest Arctic Borough (NWAB) have contributed match funds in the amount of $162,800. The match funding was obtained from the NANA Regional Corporation, NRC, who fully endorses this project. NRC is donating gravel for foundation work and three acres of land at each wind site. NRC is also contributing $150,000 for pre-construction work which was obtained through a Department of Energy grant for wind resource development.

The project costs include the material and shipping costs of seven Northwind 100 Nacelle Turbines and the standard 37 foot tower; the foundation costs, transmissions lines, and associated administration, engineering, construction management, and contracting fees. The NWAB will continue to seek funding on behalf of the villages.

Northwest Arctic Borough Wind Development in Buckland, Deering, and Noorvik Cost Estimate 10/2/08				
	Item	Cost	Freight	Total
Northwind 100 Nacelle Turbines and 30 meter tower				
	Deering	$620,000	$193,600	$813,600
	Buckland	$930,000	$290,400	$1,220,400
	Noorvik	$930,000	$290,400	$1,220,400
	SUBTOTAL	$2,480,000	$774,400	$3,254,400
Foundation Costs (Freezeback pilings;fabricated base; shipping)				
	Deering	$622,000	$0	$622,000
	Buckland	$933,000	$0	$933,000
	Noorvik	$933,000	$0	$933,000
	SUBTOTAL	$2,488,000	$0	$2,488,000
Functional Checkout and Commissioning				
	Deering	$5,500	$0	$5,500
	Buckland	$8,250	$0	$8,250
	Noorvik	$8,250	$0	$8,250
	SUBTOTAL	$22,000	$0	$22,000
Spare Parts Set				
	Deering	$2,400	$0	$2,400
	Buckland	$3,600	$0	$3,600
	Noorvik	$3,600	$0	$3,600
	SUBTOTAL	$9,600	$0	$9,600
Erected cost of 13.8 Kva transmission lines (wood poles) roadway				
	Deering	$525,000	$0	$525,000
	Buckland	$1,750,000	$0	$1,750,000
	Noorvik	$0	$0	$0
	SUBTOTAL	$2,275,000	$0	$2,275,000
Preliminary Construction				
	Deering	$54,200	$0	$54,200
	Buckland	$54,200	$0	$54,200
	Noorvik	$54,200	$0	$54,200
	SUBTOTAL	$162,600	$0	$162,600
Direct Costs Subtotals				
	Deering	**$1,829,100**	**$193,600**	**$2,022,700**
	Buckland	**$3,679,050**	**$290,400**	**$3,969,450**
	Noorvik	**$1,929,050**	**$290,400**	**$2,219,450**
Direct Cost Total				**$8,211,600**
	Engineering & Administration @ 15%			**$1,231,740**
	Construction Management @ 8%			**$656,928**
	Contractor Overhead and Fee @10%			**$821,160**
TOTAL COST WITH OVERHEAD AND ENGINEERING				**$10,921,428**

Figure 1: Project Cost Estimate

Northwest Arctic Borough Wind Development in Buckland, Deering, and Noorvik Cost Share 10/2/08			
Organization	Cost Share Item	Type	Amount
NANA Regional Corporation	NRC was awarded $150,000 from DOE for prelimary feasibility studies and renewable energy assessments.	Cash	$150,000
NANA Regional Corporation	NANA Regional Corporation will provide gravel as a portion of its cost share match. Deering/Noorvik in year 1 and Buckland year 2.	Material	$7,500
NANA Regional Corporation	9 acre of NRC land for construction of wind turbines. The value of this is currently unconfirmed at this point.	Land	$0
City of Buckland	The City of Buckland will be requested to contribute $5,000 in uncollected professional staff time.	In Kind	$0
AVEC	AVEC will be asked to contribute up to $15,000 as part of its contribution to oversight on Noorvik.	In Kind	$0
Ipnatchiaq Electric Company	The Ipnatchiaq Electric Utility is contributing $5000 in uncollected professional staff time for the proposed effort.	In Kind	$5,000
COST SHARE TOTAL			**$162,500**
Total Project Cost: $10,921,428	**Cost Share Total: $162,500**	**Percentage Cost Share: 1.5%**	

Figure 2: Project Cost Share

A letter indicating the above cost share funding is provided below.

To whom it may concern:

NANA Regional Corporation (NRC) is taking an aggressive move in pursuing renewable energy via the "*Renewable Energy Deployment in Alaska Native Villages*" proposal for the Department of Energy. Recent surveys has shown that the NANA Region residents are supportive of renewable energies and are willing to participate in bringing forth renewable energy projects. High energy costs are motivating NANA Region residents to look for alternative energies and identifying ways to capture energy for their communities.

NRC is committed to developing wind energies for the communities of Deering, Buckland, and Noorvik. NRC will help develop these projects by providing services of Projects Manager Sonny Adams, Lands Director Abraham Snyder and Assistant Director Jeff Nelson. The Wind-Diesel Development Team will be supported by senior management; the President's office and Vice President Walter Sampson.

NRC will be working with village residents on installations of the wind-diesel turbines in each of villages. NRC also plans on working with some of the NANA Strategic Energy Plan members. These participants include: Kotzebue Electric Association (KEA), Alaska Village Electric Cooperative (AVEC), City of Buckland Electric Company, and Ipnatchiaq Electric Company. NRC will also continue to employ our Wind Energy Consultant, Doug Vaught of V3 Energy, to provide expertise in the site location of the wind-diesel turbines.

As an in-kind contribution, NRC will provide land, gravel, and a non-collection of indirect rates to help subsidize the Wind-Diesel Projects. These contributions are listed below:

- The land provision will equate to approximately 9 acres; three acres per project.
- Gravel provision has yet to be determined due to site locations of the wind turbines.
- The "non-collection of indirect rates" will equate to NRC absorbing 68.9% of indirect costs to the Wind-Diesel Projects.

Finally, NANA Pacific, an affiliate of NANA Regional Corporation, will be providing support services; such as project/construction management, technical and planning services, and procurement, as the prime subcontractor.

Sincerely,

Marie N. Greene, President
NANA Regional Corporation

Figure 3: Letter of NANA Regional Corporation's Contributions

2.4. Project Benefit

As in other parts of the country, energy costs in Alaska continue to rise at an alarming rate. In our remote corner of the state, electricity can exceed $.60/kWh and fuel costs are often upwards of $9.00/gallon. Many of the borough's disadvantaged residents are forced to choose between heating their homes and buying groceries. The high cost of energy negatively impacts community members, local government, and agencies providing services to the area. The Northwest Arctic Borough (NWAB) is working to address this energy crisis in Northwest Alaska.

The proposed wind generation infrastructure will help stabilize energy costs, providing long-term socio-economic benefits to villages. The NWAB is confronted by the reality that plagues much of rural Alaska: extremely limited economic opportunity combined with an almost astronomical cost of living. Faced with the challenges of high costs, limited local employment options and the need to support their families, rural Alaskans are forced with the choice of leaving village life behind in order to relocate to larger cities in search of employment and affordable living. In such small communities, each household is important to the well-being of the entire community. With more affordable energy available in the villages, more of our region's households will be able to afford to stay in their communities, promoting community stability and wellness and helping to stem the tide of rural migration.

NW Alaska suffers greatly from the high cost of electricity. 2008 residential power rates in the region varied from $.48/kWh in Kotzebue (up from $.39/kWh in 2007) to $.71/kWh in Noatak. The anticipated benefits of this project are many; primary among these is reducing the negative impact of the cost of energy in these communities by providing a renewable energy alternative. This alternative could help stabilize energy costs and provide long-term socio-economic benefits to village households. Locally produced affordable energy will empower our community residents and will help avert rural to urban migration.

2.5. Project Cost & Benefit Summary

2.5.1. Total Project Cost: $10,921,428

2.5.2. Grant Funds Requested in this Application: $10,758,928

2.5.3. Other Funds To Be Provided: $162,500

2.5.4. Total Grant Costs (Sum of 2.5.2 and 2.5.3): $10,921,428

2.5.5. Estimated Benefit (Savings):

2.5.5.1. $650,166/yr (Based on 2008 fuel prices)

3. Project Management Plan

3.1. Project Manager

The Northwest Arctic Borough will have executive oversight of this project and will provide the administrative and financial management systems which comply with the standards set forth in the grant applications.

The major participants in this project include the NWAB, the tribal villages of Buckland, Deering, and Noorvik, and the entities responsible for operating the electric utilities in each of these communities (Kotzebue Electric Association, Ipnatchiaq Electric Company, Alaska Village Electric Corporation). Each of these entities has actively participated in the development of this proposal, and each is fully committed to the project's success.

	Contact	Title	Add-ress	City/State	E-mail	Phone	Fax
City of Buckland	Darlene Hadley	City Administrator	PO Box 49	Buckland, AK 99727	city_of_buckland@yahoo.com	907-494-2121	907-494-2138
Ipnatchiaq Electric Company	Ruth Moto-Hingsbergen	Electric Utility Manager	PO Box 36021	Deering, AK 99736	ipnatchiaqec@msn.com	907-363-2157	907-363-2307
Alaska Village Electric Cooperative	Brent Petrie	Manager, Community Dev. & Key Accounts	4831 Eagle Street	Anchorage AK 99503	bpetrie@avec.org	907-561-1818	907-561-2388
Northwest Arctic Borough	Annabelle Alvite	Grants & Community Development Administrator	Po Box 1110	Kotzebue, AK 99752	aalvite@nwabor.org	907-442-2500	907-442-2930
Kotzebue Electric Association	Brad Reeve	General Manager	Po Box 44	Kotzebue, AK 99752	b_reeve@kea.coop	907-442-3491	907-442-2482

3.2. Project Milestones

3.2.1. Pre-Construction Program Activities

Project Start-Up and Additional Data Analysis:
Following a Notice to Proceed (NTP), the project team will meet to establish project guidelines, assign responsibilities, develop an appropriate communication plan, and identify information gaps. The group will confirm which site or combination of sites are most favorable and conduct any required additional inspection, evaluation, and analysis for the pre-construction activities.

Redeployment of the Met Tower and Wind Resource Assessment Program:
A 30 meter tower has been deployed at the Deering site, and an existing met tower in Buckland will be re-deployed to a new site. The re-deployment is an in-kind contribution to this proposed project by NRC.

Preliminary Site Planning:
NANA Pacific, NP, shall prepare a Preliminary Site Plan (PSP) utilizing aerial photos of the target area. It will show proposed locations of wind turbine(s), access roads, temporary material lay down sites, existing transmission and distribution power lines, and other details. Observations will be noted about suitable foundation and construction conditions, including topography, soil types, flooding and erosion potential, sensitive habitats, and existing man-made structures.

Geotechnical Review:
The NWAB will sub-contract with a qualified geotechnical engineering company for preliminary geotechnical review of the sites, site characterization, and review of aggregate supply.

Environmental, Antiquities Analysis (EAA) & Permit Review:
The project team shall coordinate an EAA assessment for the project, identifying any potential environmental and cultural impacts as well as prevention or mitigation strategies for these impacts.

Design and Planning:
The project team and project stakeholders will present the results from the previous steps during a Project and Design Development meeting.

Wind-diesel Integration Study & Design:
The project team will coordinate a wind-diesel integration study; including assessments of dynamic load control, balance of system electrical interconnect assessment, SCADA systems, heat recovery analysis, and conceptual system design.

Civil/Structural Engineering on Wind Turbine Tower Foundation:
The project team will evaluate the geotechnical report and recommend, design, and engineer a foundation appropriate to each individual site.

Electrical Interconnect Design:
Design will include conceptual electrical one-line diagram, conceptual distribution routing, and conceptual load study. Existing and additional arctic grounding requirements will be evaluated to meet State of Alaska requirements. The wind turbine – diesel generation facility control integration is outside the scope of this project and will be done by others.

Heat recovery and distributive heating systems:
The project team will evaluate feasibility of heat recovery systems in the village and provide drawings drawing of feasible distributive heating system. Control of these systems is to be done by the wind turbine–diesel integration contractor.

Business and Operations Plan:
The project team will assess and clarify issues related to ensuring efficiency in the ongoing operations of the utility such as technician training, ongoing O&M integration, and impacts on rate payers.

Final Design, Construction/Installation Plan, O&M Plan, and Business Plan submittal:
This final step will ensure efficient execution of the proposed plan and assure that roles and responsibilities are executed during the operation's phase.

3.2.2. Construction Program Activities

*Equipment Procurement***:**
Procure wind turbines and equipment for power system control and energy utilization, diesel automation and modification, towers and foundation, and communications.

Installation:
Upgrade diesel gen-set controls and install wind tower foundations and towers, wind turbines, power line from wind turbines to power plant, system controllers, power converter and battery storage, resistance heaters in power plant and school, and a communications network linking all system nodes.

Commissioning:
Write O&M manuals, make system modifications, monitor and report on system performance, and provide local operator training, system maintenance, and technical support services

3.3. Project Schedule

The installation of wind diesel hybrid power systems in Deering, Noorvik, and Buckland will occur over a 24-month period, starting October 1, 2008. The project period is divided into eight quarters, in both Year 1 (Q1-Q4) and Year 2 (Q5-Q8). The wind turbine installations in Deering and Noorvik (D/N) are planned for Year 1, and the wind turbine installation in Buckland (B) is planned for Year 2. However, if all technical, design, and financing issues are resolved during the summer 2009, then Buckland could mobilize concurrently with Noorvik and Deering. The project schedule is detailed in the following table.

Project Stage and Task	Start	End
	Lead Partner	
Pre-Construction Phase		
Project Initiation	Q1	Q2
• Identify project partners	NWAB	
• Develop project plan	NWAB,NP, KEA, AVEC, NRC	
Data Collection	Q1	Q8
• Compile historical data on Buckland/Deering/Noorvik facility energy demand, electricity, fuel expenses, and thermal load	NP, D, B, N, AVEC, KEA, NRC	
• Collect initial wind data from Buckland, Noorvik and Deering, and produce summary reports*	NP, AEA, D, B, N, AVEC, KEA, NRC	
• Continue collecting wind data from B, N, D for a year after system installation and produce summary reports*	NP, AEA, D, B, N, AVEC, KEA, NRC	
**Note: The budget for these tasks comes under a parallel project.*		
Environmental Impact Assessment	Q1	Q4
• Avian habitat and endangered species review	NP, AVEC, KEA	
• Flood plain/wetlands/hydrology and fisheries review	NP, AVEC, KEA	
• Historical and archeological review	NP, AVEC, KEA	
• Permit review	NP, AVEC, KEA	
Design & Testing	Q1	Q3
• Assess B/N/D electric load, thermal load, and wind resource	NP, AVEC, D, B, N, AEA	
• Develop preliminary system design	NP	
• Conduct preliminary system design review	NP	

Figure 4: Project Schedule and Milestones

Project Stage and Task (Page 2)	Start	End
	Lead Partner	
Pre-Construction Phase		
Design & Testing (continued)	Q1	Q3
• Specify major system components incl. wind turbines, wind-diesel system supervisory controller, heating load controller, dedicated power metering, and heating system retrofit.	NP	
• Site wind turbines	NP, AVEC, KEA	
• Develop final system design incl. feeder line from turbines to power plant and communications network linking all nodes	NP	
• Conduct final system design review	NP	
Construction Phase		
Equipment Procurement	Q1 (D/N) Q5 (B)	Q2 (D/N) Q6 (B)
• Procure power system control and energy utilization equip.	NP	
• Procure diesel automation and modification equipment	NP	
• Procure wind towers and foundation equipment	NP	
• Procure wind turbines	NP	
• Procure communications equipment	NP	
Buckland-Deering-Norvik Installation	Q2 (D/N) Q6 (B)	Q4 (D/N) Q8 (B)
• Install wind tower foundations and towers	NP, AVEC, KEA	
• Upgrade diesel gen-set controls	NP, AVEC, KEA	
• Install system controller	NP, AVEC, KEA	
• Install resistance heaters in power plant and school	NP, AVEC, KEA	
• Install wind turbines	NP, AVEC, KEA	
• Install power converter and battery storage	NP, AVEC, KEA	
• Install feeder line from wind turbines to power plant	NP, AVEC, KEA	
• Install communications network linking all system nodes	NP, AVEC, KEA	
Commissioning	Q3 (D/N) Q7 (B)	Q4 (D/N) Q8 (B)
• Write O&M manuals	NP, AVEC, KEA	
• Provide local operator training, system maintenance, and technical support services	NP, AVEC, KEA	
• Make system modifications	NP, AVEC, KEA	
• Monitor and report on system performance	NP, AVEC, KEA	
Post-Construction Phase		
System Assessment	Q2 (D/N) Q6 (B)	Q4 (D/N) Q8 (B)
• Prepare economic analysis of project from NANA/IEC/Buckland/AVEC perspective	NP, AVEC, KEA, NRC	
• Prepare prelim. economic analysis from regional perspective	NP, NRC	
• Prepare final economic analysis of project from the NANA/IEC/Buckland/AVEC perspective using wind data	NP, AVEC, KEA, NRC	
• Develop project plan for replication in other community	NP, AVEC, KEA	

3.4. Project Resources

3.4.1. Personnel/Partners

NANA Pacific

NANA Pacific will assist the NWAB by performing management functions for the project. NANA Pacific is a project management, engineering, and consulting company, with a specialty in energy. Providing energy related services, including energy planning, bulk fuel conceptual design, power distribution/design, wind resource assessments, financial and economic modeling, diesel power generation/distribution, rural infrastructure development, and facilitation. NANA Pacific's project/program management projects are handled by professionals with industry experience in construction, engineering, consulting, and development. NANA Pacific key personnel include:

Jay Hermanson has managed multiple renewable energy studies in Alaska and elsewhere, and holds an MBA from the University of Alaska, Anchorage. Technical expertise will be provided by Brian Yanity, he holds a BS in Electrical Engineering from Columbia University and an MS in Arctic Engineering from the University of Alaska, Anchorage. The project will also benefit from the provision of additional technical expertise by Douglas Vaught with V3 Energy and Stuart Parks with NANA-Colt. Both Mr. Vaught and Mr. Parks have extensive experience with rural Alaskan wind energy projects, and both are state-certified Professional Engineers.

NANA Regional Corporation

Sonny Adams, NRC Project Manager, will assist the NWAB in taking responsibility for building regional and community support for the project, and help to serve as the project's community liaison, and will conduct site visits to ensure satisfactory project progress. Mr. Adams brings extensive experience working on a variety of projects throughout the NWAB. Jeff Nelson, NRC's Assistant Director of Lands, will provide additional project support. Mr. Nelson has extensive knowledge of applicable state and federal laws, and a history of working successfully with the NRC Board of Directors on leases, easements, and permits

Kotzebue Electric Association

Kotzebue Electric Association, KEA, is a nonprofit Rural Utility Systems cooperative that serves the residents of Kotzebue, Alaska. KEA owns a wind-diesel power plant which has six engine/generator sets and 17 wind turbines (with a total installed wind capacity of 1.14 MW). KEA has demonstrated successful leadership and innovation in remote wind-diesel applications and will be a valuable partner for this project.

Kotzebue Electric Association, KEA, and Alaska Village Electric Cooperative, AVEC, have agreed to assist the Northwest Arctic Borough in whatever capacity is necessary. This could include, but is not limited to, project management, engineering, construction, project advice, and operations and maintenance training.

The NWAB will coordinate the following technical participants for implementation of the project.

Participant	Description and Capabilities	Designee
NANA Pacific	NANA Pacific is a project management, engineering, and consulting company, with a specialty in energy.	Jay Hermanson
Kotzebue Electric Association (KEA)	Non-profit electrical utility provider for Kotzebue and contractual manager of Buckland's utility. Expertise includes wind-diesel systems in arctic environments. KEA will play a critical role in the operations and maintenance plan.	Brad Reeve
City of Buckland Electric Utility	Electrical utility provider for Buckland. Expertise includes diesel systems and understanding of Buckland's energy needs.	Darlene Hadley
Ipnatchiaq Electric Company	Electrical utility provider for Deering. Expertise includes diesel systems and understanding of Deering's energy needs.	Ruth Moto-Hingsbergen
NANA Regional Corporation	NRC is one of 12 Alaska Native Regional Corporations, serving over 11,400 shareholders in the NANA region and its traditional communities. Expertise in project management	Sonny Adams
Northern Power Systems	Provider of Northwind100 turbine system. Expertise includes nearly 30 years of experience developing and installing wind power technology and partnering with government and commercial entities including DOE, NASA and NREL.	Brett Pingree
V3 Energy, LLC	Consulting firm with expertise in Alaskan wind energy projects: site selection, installation, training and data analysis.	Douglas Vaught, P.E.
NANA/Colt Engineering, LLC	Multidisciplinary engineering firm focusing on engineering, procurement and construction management services in rural Alaska and beyond. Expertise in project management in Alaska's utility, petroleum, mining and government industries.	Stuart Parks, P.E.
Alaska Village Electric Cooperative (AVEC)	Non-profit electric utility that provides power generation services to Noorvik. Expertise includes engineering, community development, O&M, and distribution.	Brent Petrie

Figure 5: Technical Participants

NANAPacific

3150 C Street, Ste 250
Anchorage, AK 99503
(907) 257-1742 T | (907) 257-1795 F
www.nanapacific.com
info@nanapacific.com

May 5, 2008

RE: Letter of Commitment- Wind Diesel Involvement for Noorvik, Deering, and Buckland

To Whom It May Concern:

NANA Pacific is a 100% NANA-owned, full-service engineering, construction, project management and consulting firm, with a specialty in the energy services sector. Our clients include: federal, state and local government agencies; tribal organizations; and oil and gas industry corporations. By offering a solid list of energy design-build capabilities, we are ideally suited to providing the needed *Project Management, Technical and Planning Services* to the NANA Regional Corporation for development of wind-diesel hybrid systems.

Energy Overview

NANA Pacific brings company and employee experience to support the NANA Regional Corporation in their desire to develop Wind Diesel Projects in Deering, Buckland, and Noorvik. Our experience is applicable to overall project development – beginning in the early planning stages, progressing to the engineering and construction phases, and finishing with commissioning and project turnover.

NANA Pacific energy experiences include a current master services agreement for the design/build on an 80 mw, Power Generation and distribution services to a variety of rural Alaskan communities, Bulk Fuel and Power System Upgrades for various parts of Alaska, and electrical distribution assessments and rehabilitation for industrial projects.

Engineering
NANA Pacific will utilize NANA-Colt as our design engineer. Their engineering experience includes design for the power generation and distribution industry, specifically in the areas of wind, diesel and natural gas. Additional engineering strengths focus on supporting the oil and gas industry. The NANA-Colt team of engineers base their solutions on established best practices with an eye on sustainability, innovation and value engineering.

Construction
NANA Pacific can provide Owner Representation and Construction Management services for multi-phase energy-related infrastructure development.

Support Services
Our team offers engineering and construction support services. These services include, but are not limited to: project management, estimating, scheduling, logistics planning and procurement. Additionally, we provide consulting services for feasibility studies, cost containment studies and constructability reviews.

With an excellent understanding of the NANA Region energy needs, combined with technical competencies in renewable and fossil fuel technology, we are ideally positioned to support wind-diesel development in the communities of Noorvik, Deering, and Buckland.

If we can be of any assistance to you, please contact myself or Jay Hermanson.

Sincerely,

Joe Mathis
Vice President
NANA Pacific
907-257-1750

Figure 6: NANA Pacific Letter of Commitment

Person	**Al "Sonny" Adams, Jr.**
Current Employer	*NANA Regional Corporation, Inc.*
Position	*Projects Manager*
Project Role	*NANA Regional Corporation Projects Manager and Community Liaison*
Duties and Responsibilities	Provide project information to villages and NANA Regional Corporation Senior Management. Gather Regional Community Support for renewable energy projects through Strategic Energy Plan. Facilitate site visits to ensure project progress. Coordinated team meetings to ensure good project communication.
Specific Qualifications	• Familiar with NANA Region. • Familiar with Inupiaq Culture, Subsistence and Traditional Activities.
Relevant Experience	Current position: Projects Manager September 2007 to present • Assists with oversight of the Red Dog Mine. • Assists with gravel sales in the NANA Region. • Assists with NANA's Energy Grants. Past Position: Metallurgical Engineer Dec 2004 to Sept 2007 • Trained flotation operators. • Worked with flotation and grinding operators to optimize zinc and lead circuits. • Responsible for clean water discharge into the environment. Past Position: Training Supervisor 1997 to 1999 • Responsible for updating training manuals and safety procedures Past Position: Mill Operator 1989-1997 • Flotation – Responsible for maximizing Lead and Zinc grades and recoveries. • Grinding – Responsible for liberation of sphalerite and galena from gangue particles. • Water Treatment – Responsible for clean water discharge. • Dewatering - Responsible for minimizing water content in zinc and lead concentrates. • Reagents – Responsible for mixing reagents to adequate strengths. • Shiploader and Truck Dump – Responsible for storage and shiploading zinc and lead concentrates. Past Position: Commercial Fisherman 1977 to 1987 • Worked as Captain and helper in the Kotzebue Sound.
Certifications/Registrations/ Professional Organizations	Bachelor of Science in Metallurgical and Materials Engineering
Education	Montana Tech, University of Montana - Butte, Montana *Area of Study: Metallurgical Engineering – Mineral Processing*
State of Residency	*Alaska (Anchorage)*

3.5. Project Communications

The NWAB will schedule monthly meetings between project partners to ensure proper communication. These partners will include NANA Regional Corporation, NANA Pacific, NANA Colt Engineering, Kotzebue Electric Association, Alaska Village Electric Cooperative, City of Buckland, Ipnatchiaq Electric Company, City of Noorvik, Northern Power Systems, and V3 Energy, LLC.

The NWAB will work closely with all subcontractors to ensure that the project schedule is followed and high quality products are delivered. The NWAB will provide quarterly reports to the Alaska Energy Authority (AEA). Project collaborators will provide additional reports to NWAB as required by AEA. The NWAB will submit reports directly to AEA. In addition, public presentations on project progress will be given at community meetings and possibly conferences. Informational brochures and other publications will be produced for the general public.

3.6. Project Risk

Logistical challenges and delays associated with construction in our remote rural Alaskan communities represent potential barriers to the success of the proposed project. The three villages proposed as sites for this project are remotely located from the nearest hub airport, and are reachable only by small airplane, snowmachine (snow mobile/skidoo), or seasonally available barges which travel on local waterways to bring supplies, fuel and other goods to the villages. Because of changeable weather conditions and the complex logistics involved in transporting materials to such remote locations, the season for barge transport is extremely limited, and shipping delays are quite common.

However, the NWAB is accustomed to dealing with such limitations, and its proposed partners also have extensive experience in addressing the difficulties associated with conducting business in such challenging conditions. Shipping arrangements for construction equipment and supplies will be made with ample allowance for possible delays, and sufficient flexibility will be included in construction schedules to ensure on-time and successful completion of all project phases. Finally, limited match funds may impede the project in the short term. At this time, the 20% match requirement is not in place. The NWAB will coordinate a capital campaign for the project and will pursue funding through USDA's High Cost of Energy Grant, develop local financing plans based on cost savings, and pursue various funding and financing opportunities. During April 2008, a delegation from the NANA/NWAB traveled to Washington, DC, to learn more about funding for renewable energy projects for the region. These leads will also be pursued.

4. Project Description and Tasks

4.1. Proposed Energy Resource

The following table highlights the areas to be targeted and provides evidence of the available energy resource.

	Description	Evidence
Buckland	AEA and KEA installed a met tower in Buckland in 2005; approx. 16 months of data have been recovered. The present met tower site is in a Class 2 wind regime, but the proposed project will continue with the already installed anemometer and wind data in a different location with predicted Class 4 to 5 winds. The accuracy of the state of Alaska's high resolution wind map has been confirmed with the collection of the anemometery study. A Class 4 or 5 wind resource is a reasonable assumption for the proposed site.	Wind Resource Map of Alaska. Met Tower results. AEA wind resource assessment website.
Deering	The NREL average Wind Power Class Category is 5. The proposed project will continue with KEAs existing installed anemometer. The Wind Resource Map of Alaska suggests a class 5 wind regime, with an assumed average wind speed of 7.2 m/s. The available data shows 1 year of wind data.	Alaska Rural Energy Plan[1]: NREL Reconnaissance. AEA wind resource assessment website.
Noorvik	The Wind Resource Map of Alaska suggests a Class 2 or 3 wind regime, with an assumed average wind speed of 5.8 m/s. Through a 2002 study commissioned by Maniilaq Association, there are 12 months of available data.	AEA wind resource assessment website. 2002 Maniilaq Association Report

Figure 7: Description and Evidence of Wind Energy in Project Communities

4.1.1. Buckland

The Alaska Energy Authority, assisted by Kotzebue Electric Association and village labor support, installed a 30 meter met tower just south of Buckland Village Center in September 2005. While data collection is ongoing, a 15 month gap in data exists from October 2005 to January 2007.

At the present met tower location, Buckland exhibits a marginal wind resource for wind power development, with an annual average wind speed at 30 meters elevation of 4.6 m/s and Wind Power Class 2. While this class is generally not adequate for wind development, more promising locations (Class 4) exist in the hills approximately five miles west of Buckland.

[1] Foster, Mark. Alaska Rural Energy Plan. Initiatives for Improving Energy Efficiency and Reliability. April 2004.

NANA Region Wind Resource Status Report

Buckland Wind Resource Map

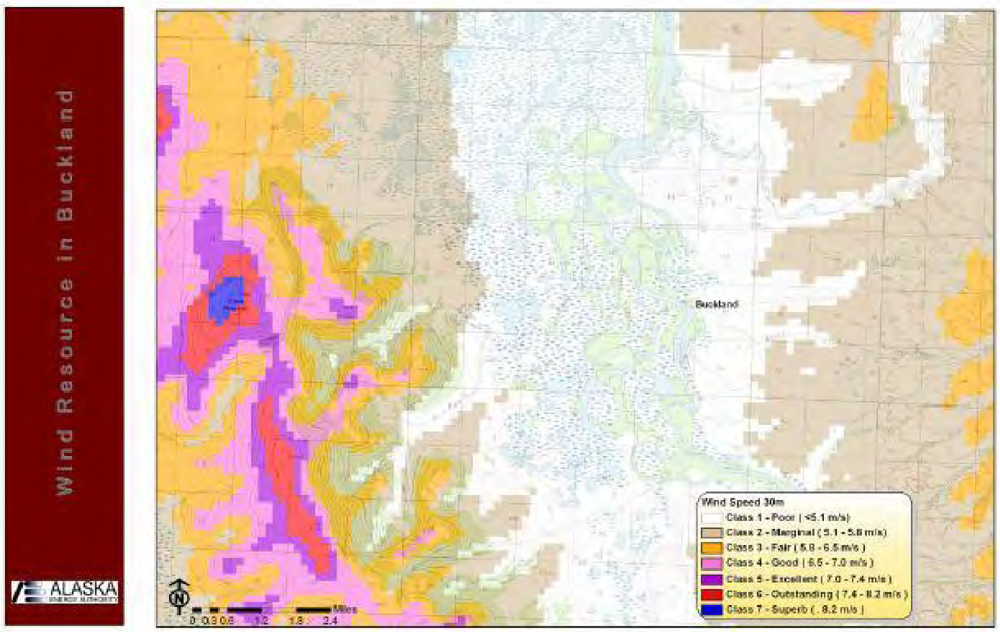
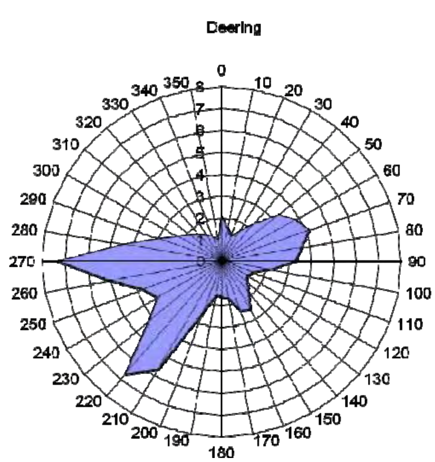


Figure 8: Wind Resource in Buckland

4.1.2. Deering

Deering was a candidate village about thirteen years ago for an innovative REL/AEA/AVEC/Kotzebue Electric Association wind-diesel project that was installed in the village of Wales and wind studies were conducted to generate data needed to support the project. The primary sources of data were the NOAA National Weather Service Automated Surface Observing System (ASOS) data from the Deering airport and five months of met tower data from a 30 meter NREL met tower that apparently was located near the airport. Although it is likely that more than five months of data was collected from the met tower, it appears that this is all that has survived.

Ian Baring-Gould of NREL sent a summary spreadsheet of the ASOS data to NANA Pacific, LLC; data range is January 1998 to September 2002. In examining this spreadsheet, it is apparent that this data was used for an analysis of a wind-diesel system for Deering as the ASOS data summary tables had been re-summarized into a HOMER inputs worksheet that contained the information needed to create a



HOMER file for wind-diesel analysis. The summary data inputs were monthly average wind speeds at the ASOS 10 meter AGL anemometer level, Weibull k coefficient, autocorrelation factor, diurnal pattern strength, and hour of peak wind speed. Also included in this spreadsheet was a wind frequency rose (shown here). Although Mr. Baring-Gould did not forward to us the original HOMER file used to evaluate Deering (it may have been lost), with this information a new HOMER file was created for the wind resource. With the statistical wind information inputs, HOMER employs a mathematical algorithm to generate a virtual wind resource with hourly wind speeds for an entire year. For further analysis, an output file from HOMER was generated and used as data input into the Windographer wind analysis software to better examine the wind characteristics in Deering (note that Windographer's wind-specific graphics capabilities are superior to those in HOMER).

The ASOS data, run through the Windographer software, indicates that the Deering airport classifies as a low Class 4 (good) wind resource with a calculated 10 meter mean annual wind speed of 4.97 m/s, a 10 meter elevation wind power density of 208 W/m^2 and a predicted 50 meter wind power density of 409 W/m^2. The 50 meter wind power density prediction is less certain because with only one anemometer level, Windographer assumes a power law exponent of 0.14 for wind shear. A met tower would collect data that would enable one to calculate a precise power law exponent value, but 0.14 is a reasonable estimate. Note that on the AEA wind resource assessment website (http://www.akenergyauthority.org/programwindresourcedata.html), a similar wind analysis is posted for Deering using the same data source, the airport ASOS station. With a longer data collection period, AEA calculated a 10 meter elevation wind power density of 195 W/m^2, which correlates to a high Class 3 (fair) wind resource. This classification difference is less than it appears however as the variance between the two wind power density calculations is only about seven percent.

As one can see in the Wind Resource Map of Deering (courtesy of AEA), the airport itself in Deering is predicted to be a Class 2 wind resource, but the area just north of the airport, between the airport and the village, is predicted to be a Class 3 wind resource. Presumably the ASOS station is located within the boundaries of the predicted Class 3 wind resource and hence, the data analysis indicating a low Class 4 or high Class 3 wind resource correlates with the modeled wind resource prediction. With this correlation of ASOS data to the wind resource map, we are confident that the predicted superior wind resources at the project site near Cape Deceit are accurate. If so, the Cape Deceit site can be expected to be a Class 4 wind resource.

An analysis of interest to indicate the viability of a potential wind turbine project in Deering is to consider the predicted turbine performance of a Distributed Energy NW100/21 (the new "B" model turbine with a 21 meter rotor diameter). As indicated in below, one NW100/21 located at the airport (the location of the ASOS station) could be expected to generate approximately 205,000 kWh per year of energy (30 meter hub height and 96% turbine availability). If a Cape Deceit site were to prove to be 15% superior to the ASOS site in terms of energy production, one could expect to generate 236,000 kWh per year; if 25% superior, one could expect to generate 257,000 kWh per year (per turbine).

NW100/21 Predicted Annual Energy Generation

Distributed Energy NW100/21, 21 meter rotor diam., 30 m hub height, 96% availability

	Airport ASOS Site					Site 1 estimate, +15%			Site 2 estimate, +25%		
Month	Hub Height Wind Speed (m/s)	Average Net Power Output (kW)	Average Net Energy Output (kWh)	Average Net Capacity Factor (%)	Diesel Fuel Displaced (Gal)	Average Net Energy Output (kWh)	Average Net Capacity Factor (%)	Diesel Fuel Displaced (Gal)	Average Net Energy Output (kWh)	Average Net Capacity Factor (%)	Diesel Fuel Displaced (Gal)
Jan	7.01	33.2	24,681	33.2	1,974	28,383	39.4	2,271	30,851	42.8	2,468
Feb	7.50	35.7	24,005	35.7	1,920	27,606	38.3	2,208	30,006	41.7	2,401
Mar	5.57	21.3	15,856	21.3	1,268	18,234	25.3	1,459	19,820	27.5	1,586
Apr	5.62	22.6	16,246	22.6	1,300	18,683	25.9	1,495	20,308	28.2	1,625
May	5.27	19.3	14,333	19.3	1,147	16,483	22.9	1,319	17,916	24.9	1,433
Jun	5.06	17.6	12,693	17.6	1,015	14,597	20.3	1,168	15,866	22.0	1,269
Jul	5.30	19.8	14,755	19.8	1,180	16,968	23.6	1,357	18,444	25.6	1,476
Aug	5.99	25.0	18,591	25.0	1,487	21,380	29.7	1,710	23,239	32.3	1,859
Sep	5.56	21.6	15,519	21.6	1,242	17,847	24.8	1,428	19,399	26.9	1,552
Oct	5.34	20.1	14,932	20.1	1,195	17,172	23.8	1,374	18,665	25.9	1,493
Nov	5.13	18.4	13,246	18.4	1,060	15,233	21.2	1,219	16,558	23.0	1,325
Dec	6.31	27.4	20,419	27.4	1,634	23,482	32.6	1,879	25,524	35.4	2,042
Overall	5.80	23.4	205,275	23.4	16,422	236,067	26.9	18,885	256,595	29.3	20,528
				Displaced diesel fuel annual value:	$ 69,794			$ 80,263			$ 87,242

Notes:

1) Diesel generator efficiency assumed to equal 12.5 kWh/gal
2) Assume one-to-one tradeoff of wind turbine kW for diesel generator kW
3) Assume diesel fuel cost of $4.25/gallon
4) Turbine availability assumed to be 96%

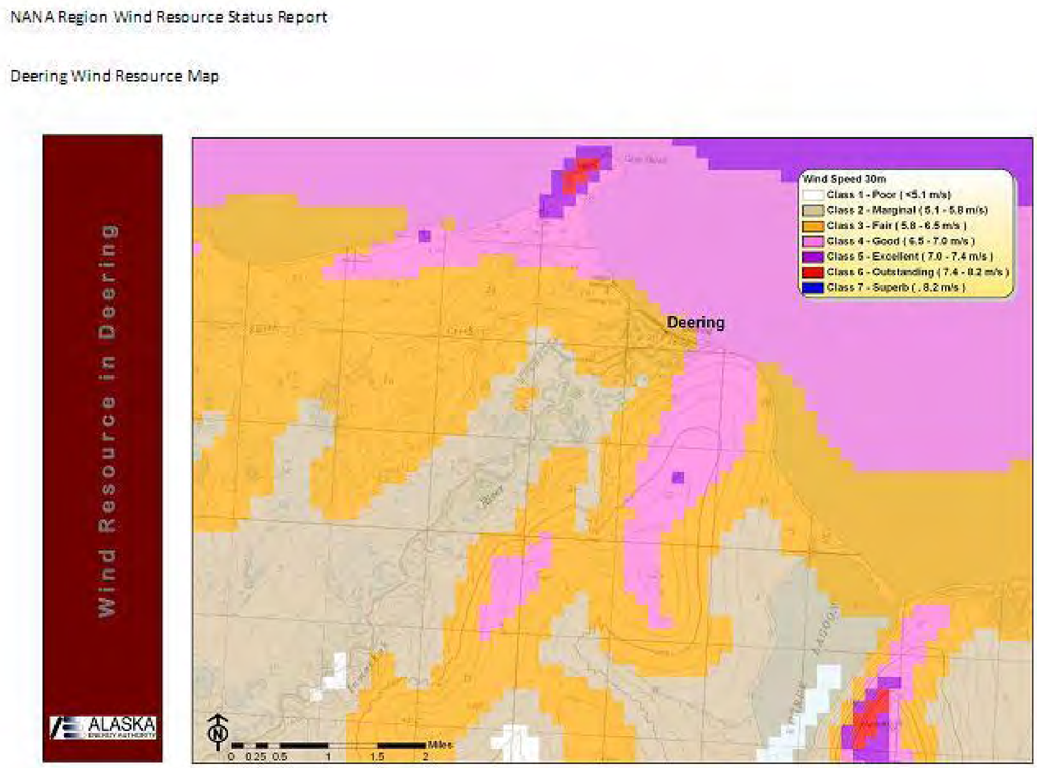


Figure 9: Wind Resource in Deering

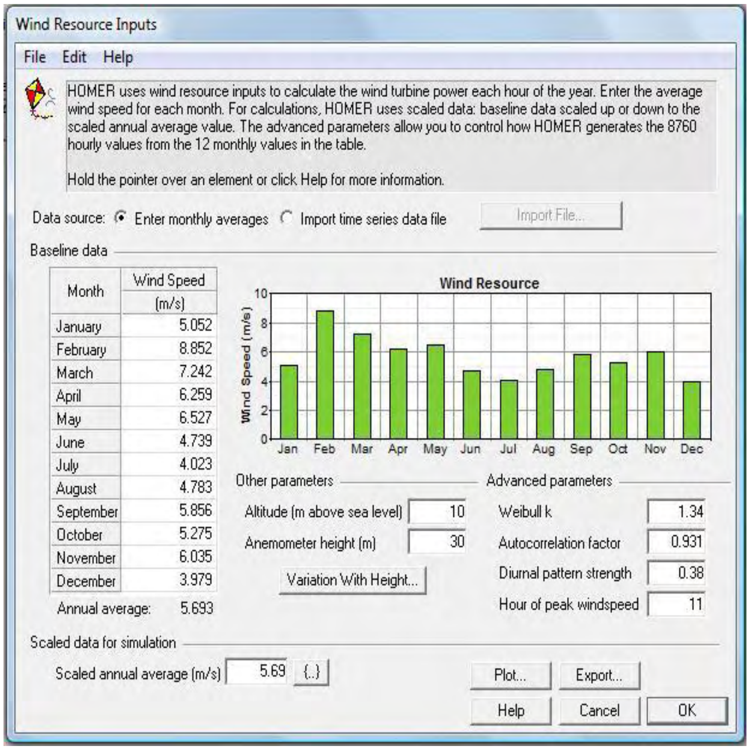
4.1.3. Noorvik

Noorvik exhibits a fair wind resource for wind power development, with an annual average wind speed at 30 meters elevation of 5.7 m/s and wind power Class 2 to 4 (likely Class 3), depending on the method of calculation. Although not outstanding, this wind resource is acceptable for wind power development, especially considering the very high cost of diesel fuel in Noorvik.

A wind resource assessment was conducted in Noorvik from September 2001 to September 2002 with grant funding from the Administration for American Natives (ANA) grant no. 90NK0108/01. A 30 meter NRG met tower was erected, according to the project final report, about four miles east of Noorvik along the road to the gravel pit. The final report, published by Maniilaq Association, describes the measured wind resource as “good” with an average annual wind speed at 30 meters elevation of 12.7 mph (5.7 m/s). An attempt was made to recover the original data files and reanalyze the data. This was partially successful in that data from September 25 to March 19 (with three weeks in December missing) were obtained from Maniilaq Corp., but the remaining original files appear to be lost. However, using the recovered data plus data presented in the Maniilaq report, it was possible to construct a full year data set using features of Windographer software and Homer software (both written by Tom Lambert of Mistaya Engineering in Calgary, Alberta, Canada).

The Maniilaq report states that the met tower was sited approximately four miles away from Noorvik along the road that leads to what appears to be a rock quarry located at the foot of Hotham Peak. This road is approximately six miles long so the test site therefore was about two thirds distance from Noorvik to the quarry. Note that the Noorvik utility company, Alaska Village Electric Cooperative, Inc., has stated that they would be most interested in locating wind turbines, should a project proceed, on the old runway near the village. This site is advantageous as it is near the existing power plant, easy to access in poor weather, and is situated perpendicular to the midpoint of the new airport, which presumably will alleviate concerns FAA might have regarding erecting wind turbines under the runway landing and departure routes.

The annual average wind speed at the 30 meter level is 5.7 m/s, by itself representative of a high Class 2 to low Class 3 wind resource. Because the recovered data files were incomplete, the monthly and annual wind data was taken from summary data presented in the Maniilaq report. This included monthly average winds measured by the two installed anemometers – one at 100 ft (30 meters) elevation and the other at 75 ft (23 meters). Then, by extracting certain statistical information from the five months of recovered data – Weibull K value, auto correction factor, diurnal pattern strength, and hour of peak wind – a virtual annual wind data set was created using statistical estimates of hourly wind speed averages. This annual data set is limiting in many respects compared to the five months of recovered data – there is no wind direction information for instance and one must rely on the Homer software to create a virtual annual wind profile – but it allows one to estimate turbine performance for an entire year without biasing the estimate with a short data set.



Month	Hub Height Wind Speed (m/s)	Time At Zero Output (%)	Time At Rated Output (%)	Average Net Power Output (kW)	Average Net Energy Output (kWh)	Average Net Capacity Factor (%)
Jan	4.98	20.8	1.2	18.6	13,875	18.6
Feb	8.27	10.9	10.0	40.4	27,153	40.4
Mar	7.24	13.4	6.2	33.7	25,036	33.7
Apr	6.15	15.9	3.5	27.0	19,445	27.0
May	6.41	14.7	4.5	28.8	21,415	28.8
Jun	4.48	23.0	0.1	15.1	10,837	15.1
Jul	3.94	27.6	0.0	11.2	8,338	11.2
Aug	4.66	22.7	0.7	16.4	12,172	16.4
Sep	5.71	17.5	2.5	24.0	17,276	24.0
Oct	5.18	19.7	1.2	20.1	14,983	20.1
Nov	5.87	16.8	2.4	24.9	17,941	24.9
Dec	3.98	27.6	0.1	11.3	8,377	11.3
Annual	5.55	19.3	2.6	22.5	196,808	22.5

As one can see, an average annual net energy output of 197,000 kWh per year at a net capacity factor of 22.5% is predicted for the NW100/21. Using a diesel generator fuel efficiency of 12.5 kWh/gal equates to an avoided fuel usage of 15,750 gallons/year.

With a fuel cost of $4.25 per gallon, the savings would be $67,000 per year for each turbine installed in Noorvik. A Noorvik installation of three NW100/21 turbines would save the community $201,000 of fuel cost per year. The average wind penetration would be: 0.22*100 kW*3 turbines*8760 hr/2,008,285 kWh (2007 data) = 0.29.

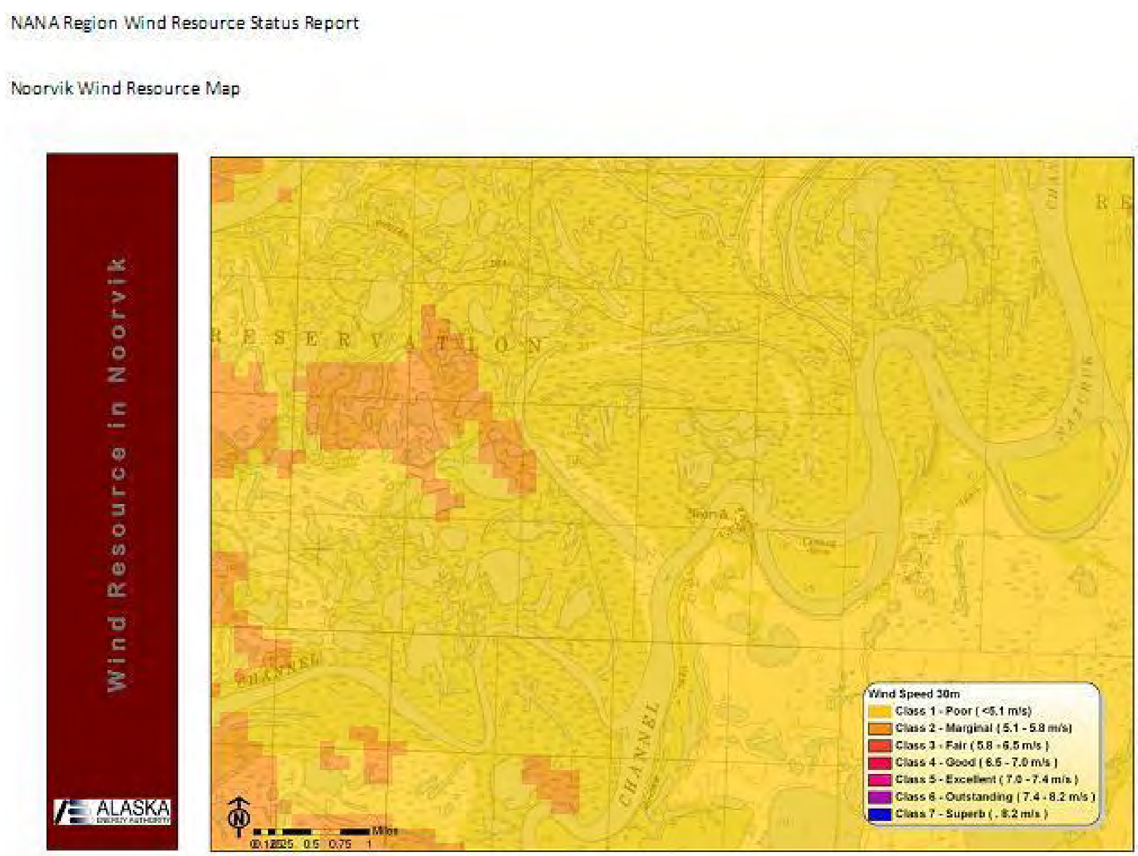


Figure 10: Wind Resource in Noorvik

4.2. Existing Energy System

4.2.1. Basic Configuration of Existing Energy System

4.2.1.1. Buckland

Buckland, a community of 457 people, is about 75 miles southeast of Kotzebue. The City of Buckland currently provides power to the community with a 650 kW diesel power plant. This consists of :

- o Caterpillar 3456 (455 kW)
- o Caterpillar 3456 (455 kW)
- o Caterpillar 3456 (175 kW)

The facility, operated by the city under contract to the Kotzebue Electric Association, generated 1,423,267 kWh total in Buckland during fiscal year 2007. During the same period of time, the community imported 118,708 gallons of fuel. The overall plant efficiency is 13.8 kWh / gallon. The peak load is 396 kW and the average load is 251 kW. In September 2008, the cost per gallon of diesel was $4.79.

The Alaska Energy Authority (AEA) upgraded the bulk fuel storage, power house, and associated equipment in Buckland in 2007. The power houses have new switch gear and are fully automated with paralleling capabilities.

4.2.1.2. Deering

Deering, a community of 131 people, is 57 miles south west of Kotzebue. The Ipnatchiaq Electric Company currently provides power to the community of Deering, with a 453 kW diesel power plant. This consists of:

- o Cummins (170 kW)
- o Cummins (170 kW)
- o John Deere (100 kW)
- o John Deere (125 kW)

The facility generated 709,559 kWh in Buckland during fiscal year 2007 and consumed 62,878 gallons of fuel for power generation.

The diesel fuel used for power generation is shipped to Deering and Buckland from Kotzebue on the spring and fall barges owned by Crowely Maritime. As in Buckland, the Alaska Energy Authority (AEA) upgraded the bulk fuel storage, power house, and associated equipment in Deering in 2000. The powerhouses have new switch gear and are fully automated with paralleling capabilities.

4.2.1.3. Noorvik

Noorvik, a community of 636 people, is 45 miles east of Kotzebue. The Alaska Village Electric Cooperative currently provides power to the community of Noorvik with an 1163 kW diesel power plant. This consists of:

- Detroit Diesel 60 (314 kW)
- Cummins kTA 1964 (499kW)
- MTU 12V2000 (756kW)

The utility generated 1,991,566 kWh during fiscal year 2006 which consumed 149,669 gallons of fuel for power generation. The overall plant efficiency is 13.8 kWh / gallon. The peak load is 474kW and the average load 226 kW. The cost per gallon of diesel in September 2008 was $5.10.

The community of Noorvik will need assessment and review of its control system in order to integrate wind into the system.

4.3. Proposed System

4.3.1. System Design

4.3.1.1. Rationale for a Wind Diesel System

The Northwest Arctic Borough, including Kotzebue Electric Association (KEA) and Alaska Village Electric Cooperative (AVEC), has been a long-time leader in developing, designing, building, and operating wind-diesel hybrid systems in remote locations in rural Alaska and the NWAB will build upon the area's collective competencies and experience. Based on assessments of energy resources in these communities the NWAB believes that a medium to high penetration wind-diesel hybrid system is a desirable option and is technically feasible for the targeted communities.

4.3.1.2. Description of Technology

The Northwind100 combines best-in-class technologies to deliver high performance and long term reliability in a 100 kW turbine that is at once leading edge and proven. The turbine's performance and reliability can be attributed to three main technology advances:

- Gearless design that dramatically reduces part counts and offers a package that is simple and rugged.

- Permanent magnet power generator which is highly efficient, dependable, and eliminates the need for messy power hydraulics. It provides high energy capture to maximize benefits of available wind.

- Advanced power electronics system which was designed by the Northern team and optimized specifically for wind turbine operation. The system is inverter coupled and can perform AC-DC-AC conversion with a perfect sine wave output

4.3.1.3. Rationale for Selecting Northwind100:

Together, these advances equate to excellent power production and low lifetime O&M costs, and thus lower life cycle costs. A critical mass of installed NW 100 turbines in Alaska and the Yukon is occurring which will enable improved O&M over its lifecycle. The Northwind100 wind turbine was designed in partnership with NASA, NREL and NSF to provide reliable, cost-effective and efficient power in remote and extreme weather environments. Northern Power Systems, a subsidiary of DES, makes the Northwind100 technology commercially available in Alaska. Over time, Northern's focus on continuous improvement has resulted in efficiency gains and a reduction in the effort required for turbine installation and service. Every turbine comes standard with one concurrent user license (CUL) of Northern's proprietary and web-based SmartView software. Smartview gives turbine owners a view of their turbine's real-time and historical performance – as well as supervisory controls - from a desktop anywhere in the world. Also standard is a 2-year parts only warranty (extended warranties available).

4.3.2. Land Ownership

The land proposed for use in this project consists of sites in Buckland, Deering, and Noorvik in the NANA region of NW Alaska. All sites are owned by NANA Regional Corporation, NRC, and NRC has provided these sites as an in-kind resource. The letter of commitment is contained previously in the proposal.

4.3.3. Permits

After reviewing the land and project with technical advisors and representatives of government agencies responsible for permitting, NANA Pacific and the NWAB have concluded that NEPA, IMDA, and other permits are not necessary. In addition, while no navigable air issues were identified, FAA non-objection is required. FAA Form 7460-1 will be filed for all three communities. Communication will continue with relevant agencies to address and mitigate their concerns as additional project information becomes available or if operating assumptions change.

As needed, the project team will prepare a permit schedule denoting critical permitting milestones and the estimated time to complete the permitting process.

Potential regulatory agencies could include the NWAB, US Fish and Wildlife Service, and the Coastal Zone Management Program.

4.3.4. Environmental

Environmental benefits and impacts of the project, based on reduction of hydrocarbon use, include reduced potential for fuel spills/contamination episodes in transport, storage, or use (thus protecting vital water and subsistence food sources), improved air quality, decreased contribution to global climate change from fossil fuel use, decreased coastal erosion due to climate change.

NANA Pacific has undertaken a preliminary environmental survey and review of the proposed sites with interested parties[2] and found no complaints/issues. A review of endangered species through the U.S. Fish and Wildlife Service (USFWS) identified some avian species concerns; however mitigation measures, including 'bird-diverters' and 'guy-guards' installed on the turbines will minimize the risk of avian collisions and thus reduce likelihood of harm to threatened, endangered, or migratory species.

4.3.4.1. Environmental Checklist-Completed by NANA Pacific

Pre-Existing Contamination
Buckland, Deering, and Noorvik: Based on consultation with landowner NANA Regional Corporation, there is no pre-existing contamination at the project site.

Asbestos
Buckland, Deering, and Noorvik: No existing piping or facility will be disturbed; therefore no asbestos will be disturbed or removed as part of this project.

Navigable Air Space
Buckland: The project site is more than 4 miles from the Buckland airport, and should not impact navigable air space, and a FAA Form 7460-1 will be submitted.

Deering: The project site is more than 1 mile from the Deering airport, and should not impact navigable air space, and a FAA Form 7460-1 will been submitted.

Noorvik: The project site is more than 1 mile from the Noorvik airport at a direction that is perpendicular to the runway, and should not impact navigable air space in any way. However a FAA Form 7460-1 will been submitted.

[2] It is assumed that the anemometer site will serve as a proxy site for wind turbine installation and that environmental, historical, and archaeological issues are the same.

Archeological/Cultural Resources
Buckland, Deering, and Noorvik: Based on consultation with NANA Regional Corp., there are no known archeological or cultural sites within or in the vicinity of the project site.

Threatened/Endangered
Buckland, Deering, and Noorvik: Based on consultation with the U.S. Fish and Wildlife Service, two iter bird species in the region are listed as threatened. However, mitigations measures, including 'bird-diverters' and 'guy-guards', installed on the towers should minimize the risk of avian collisions.

Other Protected Species
Buckland, Deering, and Noorvik: Based on consultation with the U.S. Fish and Wildlife Service, migratory birds in the region are protected by treaty. However, mitigations measures, including 'bird-diverters' and 'guy-guards', installed on the turbine should minimize the risk of avian collisions.

Coastal Zones
Buckland: The project site is in the watershed of the Buckland River, which drains into Kotzebue Sound (20 miles to the north). However, the tower installations should have no impact on the watershed.

Deering: The project site is near shores of Kotzebue Sound, which drains into Kotzebue Sound (20 miles to the north). However, the met tower installation should have no impact on the watershed.

4.4. Proposed System

4.4.1. Project Development Cost

4.4.1.1. Total anticipated project cost: $10,921,928

4.4.1.1.1. Buckland: $5,279,369

4.4.1.1.2. Deering:$2,690,191

4.4.1.1.3. Noorvik: $2,951,869

4.4.1.2. Requested grant funding: $10,758,928

4.4.1.3. Applicant matching funds: $162,500

4.4.1.4. Identification of other funding sources:

The NWAB will also pursue funding through USDA's Rural Energy Grants.

4.4.2. Wind energy financial analysis: Buckland, Deering, and Buckland

Based the assumptions listed below, a pre-feasibility financial analysis of a small wind farm installation for the communities of Deering, Buckland and Noorvik was conducted using the software program RETScreen.

Wind turbine installation characteristics:

- Wind turbines used are 100-kW Northwind100 machines with a 30 m hub-height
- Two and turbines installed in Deering (200-kW total wind capacity)
- Three turbines installed in Buckland and Noorvik(300-kW total wind capacity)

Installation cost assumptions (for all three communities):

• Feasibility, development and engineering costs-	$100,000
• Wind turbines-	$250,000/turbine
• Substation-	$150,000
• Installation labor costs-	$150,000
• Foundation-	$200,000
• Misc./contingencies-	$301,100 to 497,275
• Transmission line cost-	$350,000/mile
• Annual operations and maintenance (O&M) costs-	$22,000
• Drive train replacement-	$30,000 every 10 years

- Blade replacement $80,000 every 15 yrs

Financial assumptions-

- Electricity avoided cost (compared to diesel)- $0.20/kWh
- Annual electricity cost escalation rate- 10%
- Inflation rate- 2.5%
- Discount rate- 7%
- Project life- 25 years

	Deering	Buckland	Noorvik
Average annual wind speed	7.2 m/s	6.8 m/s	5.8 m/s
Wind plant capacity factor	29.1%	25.9%	18.0 %
Total installed wind capacity	200-kW	300-kW	300-kW
Annual wind energy generated	510 MWh	682 MWh	473 MWh
Total generated in FY2007[3]	710 MWh	1423 MWh	1992 MWh
Transmission line length	1.5 miles	5 miles	0.5 mile
Transmission line cost	$525,000	$1,750,000	$175,000
Total installation cost	$1,926,100	$3,597,275	$1,812,800
Equity payback	11.6 years	13.6 years	11.8 years
Benefit-cost (B-C) ratio	**1.72**	**1.27**	**1.68**

Figure 11: Proposed Project Economics

	No. of Tur-bines	kWh/Yr	Equiv. Diesel Gallons	FY2007 Diesel Gallons Used for Power Generation	Reduction in Diesel Fuel/Yr.	Cost of fuel	Avoided Cost/Yr.
Buckland	3	682,000	54,560	118,708	45%	$4.25/Gal	$231,880
Deering	2	510,000	40,800	62,878	65%	$4.25/Gal	$173,400
Noorvik	3	473,000	37,840	149,669	25%	$4.25/Gal	$160,820

Figure 12: Reduction in diesel fuel and annual avoided costs

[3] *Statistical Report of the Power Cost Equalization (PCE) Program*, Fiscal Year 2007, Alaska Energy Authority

Application Cost Worksheet-BUCKLAND

1. Renewable Energy Source- BUCKLAND

The Applicant should demonstrate that the renewable energy resource is available on a sustainable basis.

Annual average resource availability.	Wind Speed: 6.8 m/s documented (class 5 predicted)

Unit depends on project type (e.g. windspeed, hydropower output, biomasss fuel)

2. Existing Energy Generation- BUCKLAND

a) Basic configuration (if system is part of the railbelt grid, leave this section blank)

i. Number of generators/boilers/other	3
ii. Rated capacity of generators/boilers/other	455 kW, 455 kW, 175 kW
iii. Generator/boilers/other type	Caterpillar Gen-Sets
iv. Age of generators/boilers/other	2007
v. Efficiency of generators/boilers/other	13.8 kWh/gallon

b) Annual O&M cost

i. Annual O&M cost for labor	
ii. Annual O&M cost for non-labor	

c) Annual electricity production and fuel usage (fill in as applicable)

i. Electricity [kWh]	1,423,267 kWh per year
ii. Fuel usage (if system is part of the Railbelt grid, leave this section blank	
Diesel [gal]	118,708 gallons per year
Other	
iii. Peak Load	396 kW
iv. Average Load	251 kW
v. Minimum Load	106 kW
vi. Efficiency	13.8 kWh/gallon
vii. Future trends	

d) Annual heating fuel usage (fill in as applicable)

i. Diesel [gal or MMBtu]	n/a
ii. Electricity [kWh]	n/a
iii. Propane [gal or MMBtu]	n/a
iv. Coal [tons or MMBtu]	n/a
v. Wood [cords, green tons, dry tons]	n/a

3. Proposed System Design-BUCKLAND

a) Installed capacity	300 kW

b) Annual renewable electricity generation

i. Diesel [gal or MMBtu]	
ii. Electricity [kWh]	682,000 kWh/yr
iii. Propane [gal or MMBtu]	

4. Project Cost- BUCKLAND

a) Total capital cost of new system	$5,279,369
b) Development cost	$0
c) Annual O&M cost of new system	$22,000
d) Annual fuel cost	n/a

5. Project Benefits- BUCKLAND

a) Amount of fuel displaced for

i. Electricity	54,560 gallons
ii. Heat	
iii. Transportation	
b) Price of displaced fuel	At $4.79 this is $261,342/year.
c) Other economic benefits	

6. Power Purchase/Sales Price- BUCKLAND

a) Price for power purchase/sale	n/a

7. Project Analysis- BUCKLAND

a) Basic Economic Analysis

Project benefit/cost ratio	**1.27**
Payback	13.6 years

Application Cost Worksheet-DEERING

1. Renewable Energy Source- DEERING

The Applicant should demonstrate that the renewable energy resource is available on a sustainable basis.

Annual average resource availability.	Wind Resource-7.2 m/s

Unit depends on project type (e.g. windspeed, hydropower output, biomasss fuel)

2. Existing Energy Generation- DEERING

a) Basic configuration (if system is part of the railbelt grid, leave this section blank)

i. Number of generators/boilers/other	4
ii. Rated capacity of generators/boilers/other	170 kW, 170 kW, 125 kW, 100 kW
iii. Generator/boilers/other type	2 Cummins and 2 John Deere
iv. Age of generators/boilers/other	2002-2003
v. Efficiency of generators/boilers/other	Approx 13.5 kWh/gallon

b) Annual O&M cost

i. Annual O&M cost for labor	
ii. Annual O&M cost for non-labor	

c) Annual electricity production and fuel usage (fill in as applicable)

i. Electricity [kWh]	709,559 kWh per year
ii. Fuel usage (if system is part of the Railbelt grid, leave this section blank	
Diesel [gal]	62,878 gallons per year
Other	
iii. Peak Load	
iv. Average Load	
v. Minimum Load	
vi. Efficiency	13.5 kW/gallon
vii. Future trends	

d) Annual heating fuel usage (fill in as applicable)

i. Diesel [gal or MMBtu]	n/a
ii. Electricity [kWh]	n/a
iii. Propane [gal or MMBtu]	n/a
iv. Coal [tons or MMBtu]	n/a
v. Wood [cords, green tons, dry tons]	n/a

3. Proposed System Design- DEERING

a) Installed capacity	200 kW

b) Annual renewable electricity generation

i. Diesel [gal or MMBtu]	
ii. Electricity [kWh]	510,000 kWh/year
iii. Propane [gal or MMBtu]	

4. Project Cost- DEERING

a) Total capital cost of new system	$2,690,191
b) Development cost	$0
c) Annual O&M cost of new system	$22,000
d) Annual fuel cost	n/a

5. Project Benefits- DEERING

a) Amount of fuel displaced for

i. Electricity	40,800
ii. Heat	
iii. Transportation	
b) Price of displaced fuel	At $4.80 this is $195,840 /year.
c) Other economic benefits	

6. Power Purchase/Sales Price- DEERING

a) Price for power purchase/sale	n/a

7. Project Analysis- DEERING

a) Basic Economic Analysis

Project benefit/cost ratio	1.72
Payback	11.6 years

Application Cost Worksheet-NOORVIK

1. Renewable Energy Source- NOORVIK

The Applicant should demonstrate that the renewable energy resource is available on a sustainable basis.

Annual average resource availability.	Wind Resource 5.8 m/s

Unit depends on project type (e.g. windspeed, hydropower output, biomasss fuel)

2. Existing Energy Generation- NOORVIK

a) Basic configuration (if system is part of the railbelt grid, leave this section blank)

i. Number of generators/boilers/other	3
ii. Rated capacity of generators/boilers/other	314 kW, 499 kW, 756 kW
iii. Generator/boilers/other type	Detroit Diesel, Cummins, MTU
iv. Age of generators/boilers/other	
v. Efficiency of generators/boilers/other	13.02kWh/gallon

b) Annual O&M cost

i. Annual O&M cost for labor	
ii. Annual O&M cost for non-labor	

c) Annual electricity production and fuel usage (fill in as applicable)

i. Electricity [kWh]	1,991,566 kWh per year
ii. Fuel usage (if system is part of the Railbelt grid, leave this section blank	
Diesel [gal]	149,669 gallons per year
Other	
iii. Peak Load	454 kW
iv. Average Load	229 kW
v. Minimum Load	110 kW
vi. Efficiency	13.02 kW/gallon
vii. Future trends	

d) Annual heating fuel usage (fill in as applicable)

i. Diesel [gal or MMBtu]	n/a
ii. Electricity [kWh]	n/a
iii. Propane [gal or MMBtu]	n/a
iv. Coal [tons or MMBtu]	n/a
v. Wood [cords, green tons, dry tons]	n/a

3. Proposed System Design- NOORVIK

a) Installed capacity	300 kW
b) Annual renewable electricity generation	
i. Diesel [gal or MMBtu]	473,000
ii. Electricity [kWh]	
iii. Propane [gal or MMBtu]	

4. Project Cost- NOORVIK

a) Total capital cost of new system	$1,991,941
b) Development cost	$0
c) Annual O&M cost of new system	$22,000
d) Annual fuel cost	n/a

5. Project Benefits- NOORVIK

a) Amount of fuel displaced for	
i. Electricity	37,840 gallons
ii. Heat	
iii. Transportation	
b) Price of displaced fuel	At $5.10 / gallon this is $192,984 /year.
c) Other economic benefits	

6. Power Purchase/Sales Price- NOORVIK

a) Price for power purchase/sale	n/a

7. Project Analysis- NOORVIK

a) Basic Economic Analysis	
Project benefit/cost ratio	1.68
Payback	11.8 years

4.4.3. Business Plan

The NWAB will take advantage of the existing hub and spoke concept for its wind-diesel operations and maintenance plan. The NWAB is home to Alaska's wind-diesel industry leaders Kotzebue Electric Association and Alaska Village Electric Cooperative. The selected technology is already in use by these utility providers and their knowledge will be relied upon for operations and maintenance on either an ownership basis or contractual arrangement. Using templates created by the Alaska Department of Commerce and Economic Development, a business and operations plan will be developed that delineates operations and maintenance services to Deering and Buckland; AVEC is the utility provider for Noorvik. The operations and maintenance plan will utilize the standard protocols of AVEC and KEA as adapted for the business process in the targeted communities. Northern Power has developed operations and maintenance manuals for the Northwind100 which will serve as a baseline document.

The NWAB will also send local operators to Northern Power's in-depth training program, as has been done in other Alaskan communities. This training enables the local operator to have detailed discussions with many of the lead engineers, programmers, and operations personnel. This will be done before final installation. During final commissioning of the wind turbines, a manufacturer's representative will be on-site to review and refine operating procedures.

4.4.4. Analysis and Recommendations

According to the Alaska Rural Energy Plan, key parameters that drive the economic assessment and viability of wind-diesel hybrid systems in Alaska include the abundance of usable wind, price of displaced diesel fuel, installed capital cost of the wind-diesel system components, and the economic value of potentially delayed/avoided costs.

The economic analysis used the above parameters and evaluated them using the Benefit-Cost ratio methodology as outlined in the Alaska Rural Energy Plan. These results were stated in the above cost worksheets.

While this is not a heating application there are heat-related benefits that are likely to result from the proposed wind-diesel hybrid system. While the primary purpose of the wind-diesel hybrid system will be to generate electric power for existing electric loads, as a side benefit electrical resistance heaters will be powered by excess wind-generated electricity. These "dump loads," can be located in the powerhouse or other community buildings (such as the school), for either space or water heating. Such systems can augment other forms of waste-heat recovery or co-generation involving each community's diesel-powered generators. In addition, dump loads offer a convenient way for the power system to absorb sudden increases in wind generation output without passing power surges onto the community power grid, shunting electricity that would otherwise go unused while improving overall system reliability.

5. Project Benefit

5.1.1. Environmental Benefits

Environmental benefits and impacts of the project, based on reduction of hydrocarbon use, include reduced potential for fuel spills/contamination episodes in transport, storage, or use (thus protecting vital water and subsistence food sources), improved air quality, decreased contribution to global climate change from fossil fuel use, decreased coastal erosion due to climate change.

5.1.2. Financial Benefits

The avoided costs in each community for 2008 would be:

Buckland: $261,342

Deering: $195,840

Noorvik: $192,984

However, the cost of diesel has been increasing exponentially and the future avoided costs will be much greater.

5.1.3. Non-Income Benefits

Faced with the challenges of high costs, limited local employment options and the need to support their families, rural Alaskans are being faced with the choice of leaving village life behind in order to relocate to larger cities in search of employment and affordable living. In such small communities, each household is important to the well-being of the entire community. With more affordable energy available in the villages, more of our region's households will be able to afford to stay in their communities, promoting community stability and wellness and helping to stem the tide of rural migration. The proposed wind generation infrastructure will help stabilize energy costs, providing long-term socio-economic benefits to villages.

6. Grant Budget

The total project cost for the Wind Diesel Project in Buckland, Deering, and Noorvik is $9,961,501, of which $9,799,001 is requested in grant funds. The remaining $162,500 will be matched in-kind by NANA Regional Corporation. The total cost for preliminary design and initial construction is $216,258. This sum includes the review of existing data and the final design, construction plan, O& M plan, and the business plan submittal. The total cost for the $9,745,243. Broken down for each village the total project costs are:

- Buckland: $5,279,369
- Deering: $2,690,191
- Noorvik: $2,951,869

This can be broken down further. The capital cost and shipping of the 7 Northwind 100s is $3,254,400. The cost of the foundations for materials and shipping is $2,488,000. The next significant cost is the transmission lines for Buckland and Deering.

BUDGET INFORMATION-Noorvik

BUDGET SUMMARY:

Milestone or Task	Federal Funds	State Funds	Local Match Funds (Cash)	Local Match Funds (In-Kind)	Other Funds	TOTALS
1 Northwind 100 Nacelle Turbine & Tower		$1,236,900				$1,236,900
2 Foundation Costs		$1,240,890				$1,240,890
3 Shipping		$386,232				$386,232
4 Functional Check Out & Commissioning		$10,973				$10,973
5 Spare Parts Set		$4,788				$4,788
6 Transmission		$0				$0
7 Preliminary Construction		$17,886	$50,000	$4,200		$72,086
	$0	$2,897,669	$50,000	$4,200	$0	**$2,951,869**

Milestone # or Task #

BUDGET CATAGORIES:	1	2	3	4	5	6	7	TOTALS
Direct Labor and Benefits				$8,250			$54,200	$62,450
Travel, Meals, or Per Diem								$0
Equipment	$930,000	$933,000	$290,400		$3,600			$2,157,000
Supplies								$0
Contractual Services	$139,500	$139,950	$43,560	$1,238	$540		$8,130	$332,918
Construction Services	$167,400	$167,940	$52,272	$1,485	$648		$9,756	$399,501
Other Direct Costs								$0
TOTAL DIRECT CHARGES	$1,236,900	$1,240,890	$386,232	$10,973	$4,788	$0	$72,086	**$2,951,869**

Figure 13: Budget Breakdown-Noorvik

BUDGET INFORMATION-Deering

BUDGET SUMMARY:

Milestone or Task	Federal Funds	State Funds	Local Match Funds (Cash)	Local Match Funds (In-Kind)	Other Funds	TOTALS
1 Northwind 100 Nacelle Turbine & Tower		$824,600				$824,600
2 Foundation Costs		$827,260				$827,260
3 Shipping		$257,480				$257,480
4 Functional Check Out & Commissioning		$7,040				$7,040
5 Spare Parts Set		$3,072				$3,072
6 Transmission Lines		$672,000				$672,000
7 Preliminary Construction		$17,886	$50,000	$4,200		$72,086
	$0	$2,609,338	$50,000	$4,200	$0	**$2,663,538**

Milestone # or Task #

BUDGET CATAGORIES:	1	2	3	4	5	6	7	TOTALS
Direct Labor and Benefits				$5,500			$54,200	$59,700
Travel, Meals, or Per Diem								$0
Equipment	$620,000	$622,000	$193,600		$2,400	$525,000		$1,963,000
Supplies								$0
Contractual Services	$93,000	$93,300	$29,040	$825	$360	$78,750	$8,130	$303,405
Construction Services	$111,600	$111,960	$34,848	$990	$432	$94,500	$9,756	$364,086
Other Direct Costs								$0
TOTAL DIRECT CHARGES	$824,600	$827,260	$257,488	$7,315	$3,192	$698,250	$72,086	**$2,690,191**

Figure 14: Budget Breakdown-Deering

BUDGET INFORMATION-Buckland

BUDGET SUMMARY:

Milestone or Task	Federal Funds	State Funds	Local Match Funds (Cash)	Local Match Funds (In-Kind)	Other Funds	TOTALS
1 Northwind 100 Nacelle Turbine & Tower		$1,236,900				$1,236,900
2 Foundation Costs		$1,240,890				$1,240,890
3 Shipping		$386,232				$386,232
4 Functional Check Out & Commissioning		$10,560				$10,560
5 Spare Parts Set		$4,608				$4,608
6 Transmission Lines		$1,750,000				$1,750,000
7 Preliminary Construction		$17,886	$50,000	$4,200		$72,086
	$0	$4,647,076	$50,000	$4,200	$0	**$4,701,276**

Milestone # or Task #

BUDGET CATAGORIES:	1	2	3	4	5	6	7	TOTALS
Direct Labor and Benefits				$8,250			$54,200	$62,450
Travel, Meals, or Per Diem								$0
Equipment	$930,000	$933,000	$290,400		$3,600	$1,750,000		$3,907,000
Supplies								$0
Contractual Services	$139,500	$139,950	$43,560	$1,238	$540	$262,500	$8,130	$595,418
Construction Services	$167,400	$167,940	$52,272	$1,485	$648	$315,000	$9,756	$714,501
Other Direct Costs								$0
TOTAL DIRECT CHARGES	$1,236,900	$1,240,890	$386,232	$10,973	$4,788	$2,327,500	$72,086	**$5,279,369**

Figure 15: Budget Breakdown - Buckland

BUDGET INFORMATION-Overall

BUDGET SUMMARY:

Milestone or Task	Federal Funds	State Funds	Local Match Funds (Cash)	Local Match Funds (In-Kind)	Other Funds	TOTALS
1 Northwind 100 Nacelle Turbine & Tower	$0	$3,298,400	$0	$0	$0	$3,298,400
2 Foundation Costs	$0	$3,309,040	$0	$0	$0	$3,309,040
3 Shippping	$0	$1,029,944	$0	$0	$0	$1,029,944
4 Functional Check Out & Commissioning	$0	$28,573	$0	$0	$0	$28,573
5 Spare Parts Set	$0	$12,468	$0	$0	$0	$12,468
6 Transmission Lines	$0	$2,422,000	$0	$0	$0	$2,422,000
7 Preliminary Construction	$0	$53,658	$150,000	$12,600	$0	$216,258
	$0	$10,154,083	$150,000	$12,600	$0	**$10,316,683**

	Milestone # or Task #							
BUDGET CATAGORIES:	1	2	3	4	5	6	7	TOTALS
Direct Labor and Benefits	$0	$0	$0	$22,000	$0	$0	$162,600	$184,600
Travel, Meals, or Per Diem	$0	$0	$0	$0	$0	$0	$0	$0
Equipment	$2,480,000	$2,488,000	$774,400	$0	$9,600	$2,275,000	$0	$8,027,000
Supplies	$0	$0	$0	$0	$0	$0	$0	$0
Contractual Services	$372,000	$373,200	$116,160	$3,300	$1,440	$341,250	$24,390	$1,231,740
Construction Services	$446,400	$447,840	$139,392	$3,960	$1,728	$409,500	$29,268	$1,478,088
Other Direct Costs	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL DIRECT CHARGES	$3,298,400	$3,309,040	$1,029,952	$29,260	$12,768	$3,025,750	$216,258	**$10,921,428**

7. Additional Documentation and Certification

The undersigned certifies that this application for a renewable energy grant is truthful and correct, and that the applicant is in compliance with, and will continue to comply with, all federal and state laws including existing credit and federal tax obligations.

Print Name	Jade Hill
Signature	
Title	Economic Development Director
Date	7 OCT 08

NORTHWEST ARCTIC BOROUGH ASSEMBLY
RESOLUTION 08-45

A RESOLUTION OF THE NORTHWEST ARCTIC BOROUGH (BOROUGH) ASSEMBLY TO FORMALLY APPROVE APPLICATION FOR A RENEWABLE ENERGY FUND GRANT THROUGH THE ALASKA ENERGY AUTHORITY (AEA) FOR WIND DIESEL PROJECTS IN THE COMMUNITIES OF BUCKLAND, DEERING, AND NOORVIK, AND FOR RELATED PURPOSES.

WHEREAS, the Northwest Arctic Borough Assembly is the governing body of the Northwest Arctic Borough and is eligible to apply for this grant; and

WHEREAS, Buckland, Deering and Noorvik are communities within the Northwest Arctic Borough interested in pursuing renewable wind energy generation to help offset the extremely high cost of (petroleum based) fuel in their villages; and

WHEREAS, these communities have collected sufficient data to determine that installation of wind turbines is both technically and economically viable; and

WHEREAS, NANA Pacific has agreed to act as the prime consultant/contractor for the Buckland/Deering/Noorvik Wind-Diesel Project being responsible for coordination of all activities, developing and managing sub-contracts with appropriate sub-contractors and consultants, providing technical assistance, and completing the final report; and

WHEREAS, Kotzebue Electric Authority (KEA) and Alaska Village Electric Cooperative (AVEC) have agreed to assist the NWAB in whatever capacity is needed, including technical assistance and advice, consulting, project management, operations and maintenance, or any other tasks that would help the NWAB to ensure a successful project; and

WHEREAS, the Borough authorizes this application for project funding indicated in the application; and

WHEREAS, the Borough authorizes the individual named as point of contact to represent the Borough for purposes of this application; and

WHEREAS, the Borough is in compliance with all federal, state, and local laws including existing credit and federal tax obligations.

NOW THEREFORE BE IT RESOLVED THAT THE NORTHWEST ARCTIC BOROUGH ASSEMBLY FORMALLY APPROVES APPLICATION FOR A RENEWABLE ENERGY FUND GRANT THROUGH THE ALASKA ENERGY AUTHORITY (AEA) FOR WIND DIESEL PROJECTS IN THE COMMUNITIES OF BUCKLAND, DEERING, AND NOORVIK, AND FOR RELATED PURPOSES.

PASSED AND ADOPTED THIS ____th day of October, 2008.

____
Clement Richards, Assembly President

PASSED AND APPROVED THIS ____th day of October, 2008.

____
Siikauraq Martha Whiting, Mayor

SIGNED AND ATTESTED THIS ____th day of October, 2008.

____
Helena Hildreth, Borough Clerk

Figure 16: Northwest Arctic Borough Resolution

Ipnatchiaq Electric Company

RESOLUTION FY08-01

A RESOLUTION SUPPORTING AN RENEWABLE ENERGY GRANT PROPOSAL FOR THE INSTALLATION OF WIND-DIESEL HYBRID POWER SYSTEM FOR DEERING

WHEREAS; adequate, reliable, reasonably priced and safe supply of electrical energy is necessary for prosperity and positive development of any community, and

WHEREAS; nearly every community in the NANA region relies exclusively on diesel fuel to generate electricity, and,

WHEREAS; the price of diesel fuel has risen dramatically in the last several years and is likely to continue to rise because of growing world demand for oil, and,

WHEREAS; the rising cost of electricity in the NANA region is causing significant economic hardship to the citizens of the region, and,

WHEREAS; according to data compiled by the Alaska Energy Authority and other Government agencies many communities in the NANA region possess excellent, developable wind and other renewable energy resources, and,

WHEREAS; several rural Alaskan communities have installed wind energy projects that work together with existing diesel systems, including communities in the NANA region, and

WHEREAS; increased renewable energy development and energy efficiency measures in the NANA region will create jobs that local citizens can be trained to do, and,

WHEREAS; increased renewable energy development and energy efficiency measures in the NANA region will significantly displace the amount of diesel fuel the region must purchase and import each year, and,

WHEREAS; Deering has been the object of multiple and intensive wind diesel studies by Alaska Energy Authority, National Renewable Energy Laboratories, and other entities, and,

WHEREAS; technical assistance exists at the state and federal level for communities in the NANA region to develop renewable energy and implement energy efficiency measures appropriately using the latest state-of-the art technology, and, WHEREAS; increased development of renewable energy is consistent with the recommendations of the Alaska Energy Policy Task Force established by the Legislature in 2003 as well as other subsequent reports on the state of rural energy in Alaska, and,

WHEREAS; the citizens of Deering believe that renewable energy and energy efficiency measures will help the people of this community through reduced costs for electricity, and,

WHEREAS; the selected site for wind turbine installation is located 1.5 miles northwest of Deering, near the end of an existing road, on land owned by NANA Regional Corporation, and,

WHEREAS; the generating system is fully automated with paralleling capabilities, and

WHEREAS; Ipnatchiaq Electric Company, a subsidiary of the City of Deering will supply $10,000 with in-kind time and other sources, and,

NOW THEREFORE BE IT RESOLVED that the Ipnatchiaq Electric Utility Board support the development of a renewable energy grant for the installation of wind-diesel hybrid power generation in Deering, Alaska.

Approved by Ipnatchiaq Electric Utility Board on this 6th day of May, 2008.

Signed: ______________
Chairman

Attest: ______________
Board Secretary

Figure 17: Ipnatchiaq Electric Company Resolution

City of Buckland
P.O. Box 49
Buckland, Alaska 99727
Ph: (907) 494-2121
Fax: (907) 4940-2138

Resolution 2008-10

A RESOLUTION OF THE CITY OF BUCKLAND SUPPORTING A RENEWABLE ENERGY GRANT PROPOSAL FOR THE INSTALLATION OF A WIND-DIESEL HYBRID POWER SYSTEM FOR BUCKLAND

WHEREAS, the Buckland City Council is the governing body of the City of Buckland, and

WHEREAS, an adequate, reliable, and reasonably priced and safe supply of electrical energy is necessary for the prosperity and positive development on any community; and

WHEREAS, nearly every community in the NANA region relies exclusively on diesel fuel to generate electricity; and

WHEREAS, the price of diesel fuel has risen dramatically in the last several years and is likely to continue to rise because of growing world demands for oil; and

WHEREAS, the rising cost of electricity in the NANA region is causing significant economic hardship to the citizens of the region; and

WHEREAS, according to data compiled by the Alaska Energy Authority and other government agencies many communities in the NANA region possess excellent, developable wind and other renewable energy resources; and

WHEREAS, several Alaska communities have installed wind energy projects that work together with existing diesel systems, including communities in the NANA region; and

WHEREAS, wind-diesel systems in Kotzebue and Selawik are already saving significant amounts of diesel fuel; and

WHEREAS, increased renewable energy development and increased energy efficiency measures in the NANA region will create jobs that local citizens can be trained to do; and

WHEREAS, increased renewable energy development and increased energy efficiency measures in thee NANA region will significantly displace the amount of diesel fuel the region must purchase and import each year; and

WHEREAS, technical assistance exists at the state and federal level for communities in the NANA region to develop renewable energy and implement energy efficiency measures appropriately using the latest state of the art technology; and

WHEREAS, the Denali Commission and Alaska Energy Authority have grant funds to support renewable energy development in Alaska; and

WHEREAS, increased development of renewable energy is consistent with the recommendations of the Alaska Energy Policy Task Force established by the Legislature in 2003 as well as other subsequent reports on the state of rural energy infrastructure in Alaska; and

WHEREAS, the citizens of Buckland believe that renewable energy and energy efficiency measures will help the people of this community through reduced costs for heating and electricity; and

WHEREAS, the City of Buckland will supply $8,000 dollars via staff time and other in-kind sources for continuation of the wind-diesel power project; and

NOW THEREFORE BE IT RESOLVED that the undersigned citizens of Buckland support the development of a renewable energy grant that support the installation of a wind-diesel hybrid power generation system in Buckland, Alaska.

PASSED AND ADOPTED BY THE BUCKLAND CITY COUNCIL ON THIS 7TH DAY OF May, 2008.

Floyd H. Ticket, Mayor

Mona Washington, City Clerk

Figure 18: City of Buckland Resolution

ALASKA VILLAGE ELECTRIC COOPERATIVE, INC.

May 8, 2008

Marie Greene, President
NANA Regional Corporation
P.O. Box 49
Kotzebue, AK 99752

RE: Wind-Diesel Project Development - Deering, Buckland, and Noorvik

Dear Ms. Greene:

AVEC supports the NANA Regional Corporation (NRC) proposal for *Deering, Buckland, and Noorvik Wind-Diesel Systems* to the Department of Energy. As the member-owned nonprofit electric cooperative serving Noorvik, AVEC is very concerned about the high cost of power and energy and is committed to minimizing the impact of fossil fuel cost escalation for its members in Noorvik. A wind-diesel project for Noorvik is an important supplemental step in containing the cost of energy.

AVEC understands that NRC will provide the necessary leadership capital in the coordination of this program and that funding will be sought to provide support for AVEC staff resources, permitting and installation. Furthermore, it is important to consider wind-diesel hybrid systems from a regional and multi-community perspective in order to benefit from economies of scale, co-mobilization, bulk purchasing, and other cost savings measures.

The scope of AVEC commitment includes support from our professional staff, provided that funds and availability permit, to include:

- Coordination of site planning activities, assistance with site control, coordination with the community of Noorvik, and serving as the representative for power needs for Noorvik;
- Participation in design development and scoping meetings, review of designs, QA/QC on design review, and other coordination activities associated with design and connection of the wind-turbine(s) to the local grid;
- Coordination on turbine installation, planning, and construction activities;
- Participation with commissioning activities of the proposed turbine(s).

With an excellent understanding of Noorvik's electrical energy needs, combined with technical competencies in wind-diesel systems in rural Alaska, we are ideally positioned to support wind-diesel development for Noorvik.

Please let us know if you have any questions.

Sincerely,

Meera Kohler,
President and CEO

4831 Eagle Street • Anchorage, Alaska 99503-7497 • Phone (907) 561-1818 • In State (800) 478-1818 • Fax (907) 562-4086

Figure 19: AVEC Letter of Commitment

Appendix II-E:

July 2009 Red Dog Port Preliminary Wind Energy Assessment, WHPacific

Red Dog Port:
Preliminary Wind Energy Assessment

HOMER is a computer model that simplifies the task of evaluating design options for both off-grid and grid-connected power systems for remote, stand-alone, and distributed generation (DG) applications. The HOMER software was used to model possible configurations of a wind-diesel hybrid generation system at the Red Dog Port. The existing Red Dog Port power system is comprised of four diesel generators: a 1285 kW Caterpillar unit and three 650 kW Caterpillar/Newage units. Power generation data from the Red Dog Port's power plant, for the first five months of 2009 and the final seven months of 2008, was used for the HOMER model.

For the purposes of this HOMER analysis, the wind turbine under consideration for this site is a Vestas V82, 1.65 MW turbine. The wind resource data is based on the data collected between October 2008 and March 2009, from the communications tower along the road, about 2 miles (3.5 km) from the Red Dog Port. Based on this data, the wind resource report by V3 Energy (Appendix C) predicts a Class 7, or superb, wind resource with an average wind speed to date of 7.76 m/s (to date, at 33 m height).

Assumptions:

- Turbine installation cost (per 1.65 MW turbine, see Appendix D): $5,000,000
- Installation cost of 1 km power line, and all other associated systems/infrastructure: $1,000,000
- Investment tax credit subsidy: 30% of total installation capital cost
- Operating and maintenance costs (per 1.65 MW turbine): $50,000/year
- Real annual interest rate: 6%
- Project lifetime: 25 years
- Diesel price will remain constant over the 25-year period (for each fuel cost modeled)

It is assumed that no new roads would need to be built, as the presumed wind turbine site would be 1 km from the existing port power plant. Also, it is assumed that there would be no capital costs for diesel generators, only replacement costs, as the existing diesel generators will be used.

Section 1102 of the American Recovery and Reinvestment Act of 2009 allows "businesses who place in service facilities that produce electricity from wind and some other renewable resources after Dec 31, 2008 can choose either the energy investment tax credit, which generally provides a 30 percent tax credit for investments in energy projects or the production tax credit, which can provide a credit of up to 2.1 cents per kilowatt-hour for electricity produced from renewable sources. A business may not claim both credits for the same facility". The 30% investment tax credit appears to be the most appropriate federal incentive for a wind installation at the Red Dog Port.

Results:

A system configuration modeled consists of one or more 1.65 MW wind turbines connecting to the Red Dog Port via a 1 km power line. The HOMER calculations for the three scenarios below (based on the cost of diesel fuel) are based on an assumed average wind speed of 7 m/s.

Low diesel fuel cost scenario ($3.42/gallon):

At a diesel fuel cost of $3.42/gallon ($0.90/liter), the HOMER model recommends a two-turbine wind-diesel system, with a total wind generation capacity of 3.3 MW. HOMER estimates a NPC of $33,544,214 for this wind-diesel configuration, resulting in a COE of **$0.233/kWh**. The base-case scenario, of diesel-only generation at a fuel cost of $3.42/gallon, would result in an NPC of $42,375,592 and a COE of **$0.295/kWh**. This cost savings of $0.062/kWh would translate to an annual cost savings of $748,206 (assuming 12,067,840 kWh of annual production). With an initial capital cost of $7,700,000, these annual cost savings would result in a simple payback of **10.3 years**.

Medium diesel fuel cost scenario ($4.18/gallon):

At a diesel fuel cost of $4.18/gallon ($1.10/liter), the HOMER model recommends a two-turbine wind-diesel system, with a total wind generation capacity of 3.3 MW. HOMER estimates a NPC of $38,725,936 for this wind-diesel configuration, resulting in a COE of **$0.269/kWh**. The base-case scenario, of diesel-only generation at a fuel cost of $4.18/gallon, would result in an NPC of $51,225,664 and a COE of **$0.356/kWh**. This cost savings of $0.087/kWh would translate to an annual cost savings of $1,049,902 (assuming 12,067,840 kWh of annual production). With an initial capital cost of $7,700,000, these annual cost savings would result in a simple payback of **7.3 years**.

High diesel fuel cost scenario ($5.70/gallon):

At a diesel fuel cost of $5.70/gallon ($1.50/liter), the HOMER model recommends a two-turbine wind-diesel system, with a total wind generation capacity of 3.3 MW. HOMER estimates a NPC of $49,089,372 for this wind-diesel configuration, resulting in a COE of **$0.341/kWh**. The base-case scenario, of diesel-only generation at a fuel cost of $5.70/gallon, would result in an NPC of $68,925,808 and a COE of **$0.479/kWh**. This cost savings of $0.138/kWh would translate to an annual cost savings of $1,665,362 (assuming 12,067,840 kWh of annual production). With an initial capital cost of $7,700,000, these annual cost savings would result in a simple payback of **4.6 years**.

Kivalina Intertie:

The HOMER analysis was redone for the two-turbine wind-diesel system, with the addition of the electric load of the nearby village of Kivalina (1,247,209 kWh annual load, 260 kW peak). Power generation statistics of Kivalina used for the HOMER model were estimated from the 2006 end-of-year report by the Alaska Village Electric Cooperative (AVEC). The addition of the Kivalina load resulted in no significant difference in the cost of electricity produced by the wind-diesel system, for each of the three fuel-cost scenarios modeled above ($0.232/kWh, $0.269/kWh, and $0.343/kWh respectively). This is chiefly due to the fact that Kivalina's electricity demand in peaks in the winter, while the port's demand peaks in summer. Therefore, the addition of the village load will have no negative impact on the economics of a wind-diesel installation of the Red Dog Port, and simply provides a slightly higher overall capacity factor (and slightly more diesel fuel consumption) for the wind-diesel system, and slightly balances year-round demand trends. Overall, the annual electric energy consumption of Kivalina is about 11% that of the port's annual consumption.

While generation costs at the Red Dog Port would not change significantly with the additional village load, the cost of a power line between the port and Kivalina (a distance of about 20 miles) is not included in the HOMER model. According the Fiscal Year 2007 report of the Alaska Energy Authority's Power Cost Equalization Program, the pre-subsidy residential electric rate charged in Kivalina by AVEC was $0.5116/kWh. For a power line from the port to be economic, the cost of power generated at the Red Dog Port delivered to Kivalina must be lower than the generation-only cost of power from AVEC's existing diesel power plant in the village. If the wind-diesel installation at the port were to sell, via an intertie, 1,200,000 kWh of annually electricity to Kivalina at cost based on the rates predicted by the HOMER models, the revenues/simple payback are shown in the table below:

Diesel cost ($/gallon)	**Cost of electricity generated ($/kWh)**	**Annual revenues of power sales to Kivalina (at cost, 1,200,000 kWh)**	**Annual benefit (savings+revenue)**	**Simple payback (of $7,700,000 installation cost)**
3.42	0.232	$278,400	$1,026,606	7.5 years
4.18	0.269	$322,800	$1,372,702	5.6 years
5.70	0.343	$411,600	$2,076,962	3.7 years

As the table shows above, the sales of electricity (generated by both wind and diesel) to Kivalina would improve the economics of a wind-diesel installation at the port.

Emissions Reduction:

A two-turbine (3.3 MW) wind-diesel installation, compared to the base case of diesel-only generation, would annually reduce emissions overall by 41%:

- carbon dioxide emissions by 3,778,342 kg
- carbon monoxide emissions by 9,326 kg
- unburned hydrocarbons by 1,033 kg
- particulate matter by 703 kg
- sulfur dioxide emissions by 7,587 kg
- nitrogen oxides by 83,219 kg

Appendices:

Appendix A: HOMER model System Report for V82 wind-diesel system: 7 m/s, $1.10/liter fuel price

Appendix B: HOMER model System Report for diesel-only generation: $1.10/liter fuel price

Appendix C: Red Dog Port MS5 site wind resource analysis (V3 Energy)

Appendix D: Cost estimate spreadsheet for turbine installation cost

System Report - RedDogPort-WindDieselSystem VestasV82.hmr

Sensitivity case

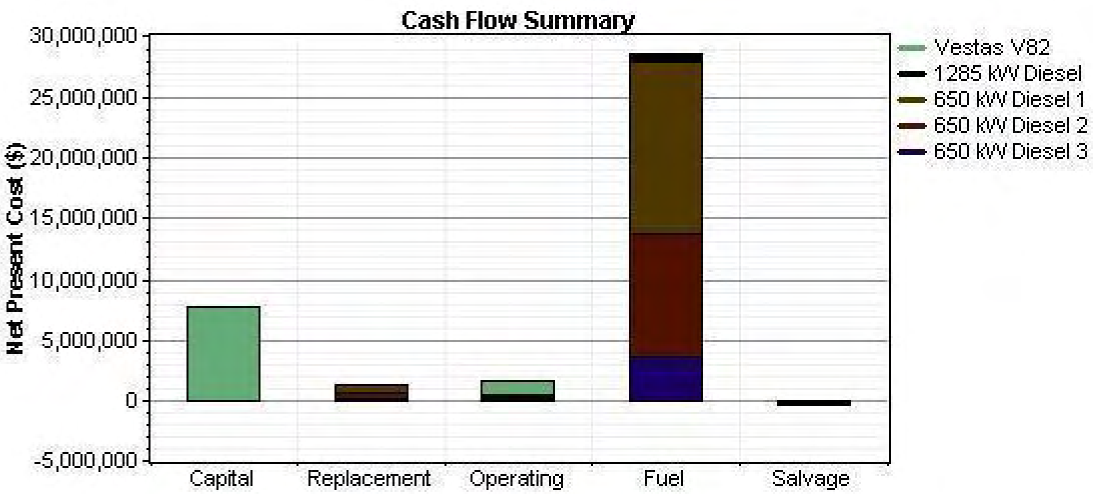
Wind Data Scaled Average: 7 m/s
Diesel Price: 1.1 $/L

System architecture

Wind turbine	2 Vestas V82
1285 kW Diesel	1,285 kW
650 kW Diesel 1	650 kW
650 kW Diesel 2	650 kW
650 kW Diesel 3	650 kW

Cost summary

Total net present cost	$ 38,725,936
Levelized cost of energy	$ 0.269/kWh
Operating cost	$ 2,427,057/yr

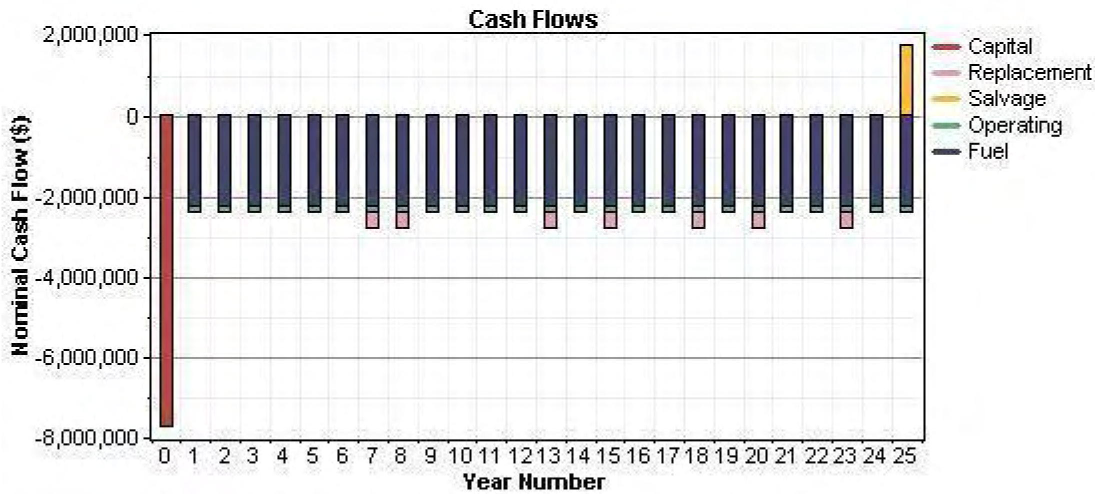


Net Present Costs

Component	Capital	Replacement	O&M	Fuel	Salvage	Total
	($)	($)	($)	($)	($)	($)
Vestas V82	7,700,000	0	1,278,336	0	0	8,978,338
1285 kW Diesel	0	0	13,870	615,640	-295,326	334,184
650 kW Diesel 1	0	598,942	161,045	14,243,167	-5,883	14,997,268
650 kW Diesel 2	0	540,140	138,776	10,062,218	-56,619	10,684,516
650 kW Diesel 3	0	145,899	59,085	3,578,443	-51,784	3,731,643
System	7,700,000	1,284,981	1,651,112	28,499,470	-409,612	38,725,952

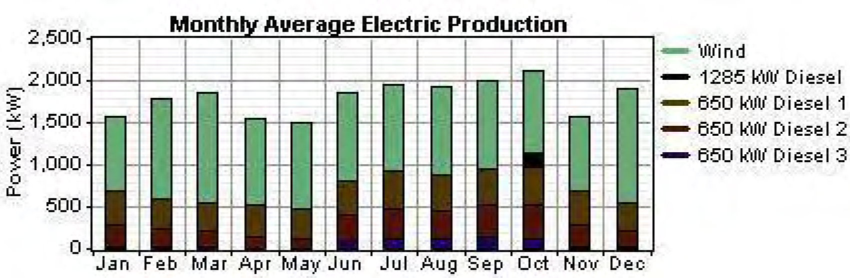
Annualized Costs

Component	Capital	Replacement	O&M	Fuel	Salvage	Total
	($/yr)	($/yr)	($/yr)	($/yr)	($/yr)	($/yr)
Vestas V82	602,346	0	100,000	0	0	702,346
1285 kW Diesel	0	0	1,085	48,160	-23,102	26,142
650 kW Diesel 1	0	46,853	12,598	1,114,196	-460	1,173,187
650 kW Diesel 2	0	42,253	10,856	787,134	-4,429	835,815
650 kW Diesel 3	0	11,413	4,622	279,930	-4,051	291,914
System	602,346	100,520	129,161	2,229,420	-32,043	3,029,404



Electrical

Component	Production	Fraction
	(kWh/yr)	
Wind turbines	9,348,529	59%
1285 kW Diesel	112,711	1%
650 kW Diesel 1	3,487,508	22%
650 kW Diesel 2	2,290,398	15%
650 kW Diesel 3	537,239	3%
Total	15,776,384	100%



Load	Consumption	Fraction
	(kWh/yr)	
AC primary load	11,249,297	100%
Total	11,249,297	100%

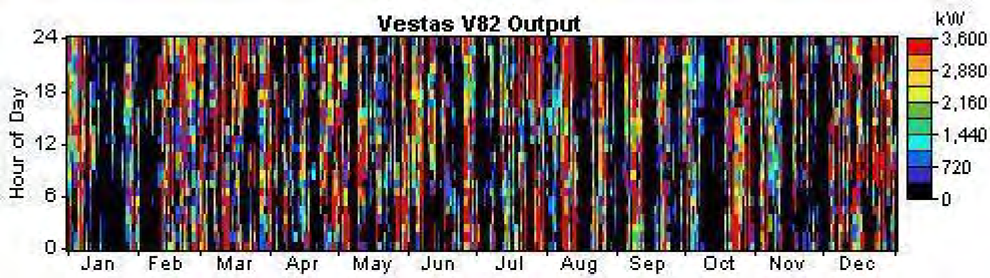
Quantity	Value	Units
Excess electricity	4,527,118	kWh/yr
Unmet load	0.0979	kWh/yr
Capacity shortage	0.00	kWh/yr
Renewable fraction	0.593	

AC Wind Turbine: Vestas V82

Variable	Value	Units
Total rated capacity	3,300	kW
Mean output	1,067	kW
Capacity factor	32.3	%
Total production	9,348,529	kWh/yr

Variable	Value	Units
Minimum output	0.00	kW

Maximum output	3,284	kW
Wind penetration	83.1	%
Hours of operation	5,942	hr/yr
Levelized cost	0.0751	$/kWh

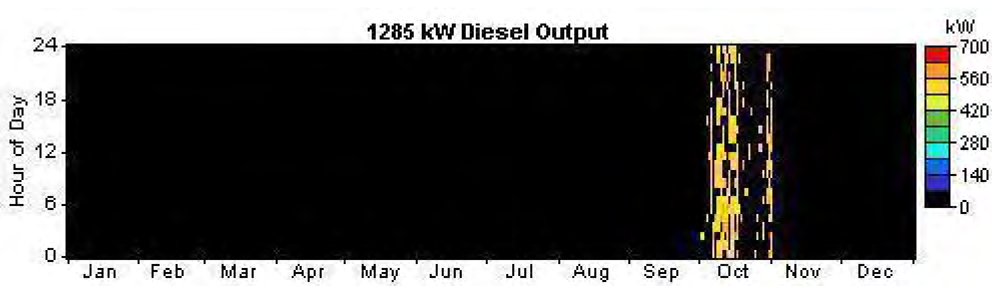


1285 kW Diesel

Quantity	Value	Units
Hours of operation	217	hr/yr
Number of starts	84	starts/yr
Operational life	161	yr
Capacity factor	1.00	%
Fixed generation cost	133	$/hr
Marginal generation cost	0.264	$/kWhyr

Quantity	Value	Units
Electrical production	112,711	kWh/yr
Mean electrical output	519	kW
Min. electrical output	469	kW
Max. electrical output	631	kW

Quantity	Value	Units
Fuel consumption	43,781	L/yr
Specific fuel consumption	0.388	L/kWh
Fuel energy input	430,809	kWh/yr
Mean electrical efficiency	26.2	%



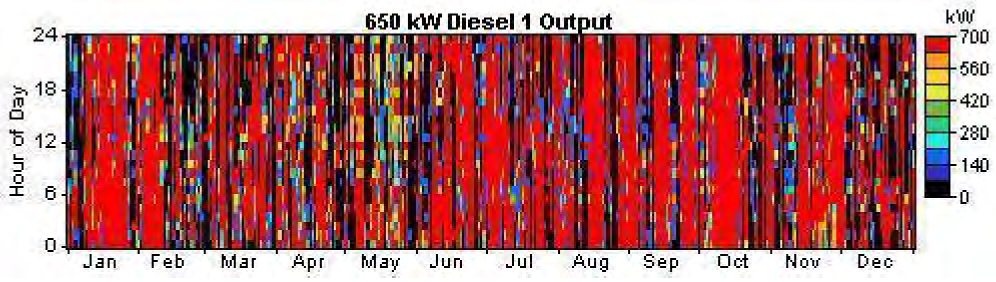
650 kW Diesel 1

Quantity	Value	Units
Hours of operation	6,299	hr/yr
Number of starts	451	starts/yr
Operational life	6.35	yr
Capacity factor	61.2	%
Fixed generation cost	54.9	$/hr
Marginal generation cost	0.242	$/kWhyr

Quantity	Value	Units

Electrical production	3,487,508	kWh/yr
Mean electrical output	554	kW
Min. electrical output	195	kW
Max. electrical output	650	kW

Quantity	Value	Units
Fuel consumption	1,012,905	L/yr
Specific fuel consumption	0.290	L/kWh
Fuel energy input	9,966,987	kWh/yr
Mean electrical efficiency	35.0	%

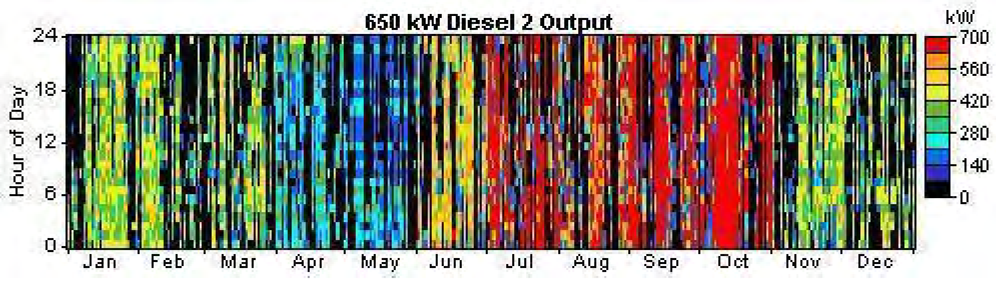


650 kW Diesel 2

Quantity	Value	Units
Hours of operation	5,428	hr/yr
Number of starts	486	starts/yr
Operational life	7.37	yr
Capacity factor	40.2	%
Fixed generation cost	54.9	$/hr
Marginal generation cost	0.242	$/kWhyr

Quantity	Value	Units
Electrical production	2,290,398	kWh/yr
Mean electrical output	422	kW
Min. electrical output	195	kW
Max. electrical output	650	kW

Quantity	Value	Units
Fuel consumption	715,576	L/yr
Specific fuel consumption	0.312	L/kWh
Fuel energy input	7,041,273	kWh/yr
Mean electrical efficiency	32.5	%



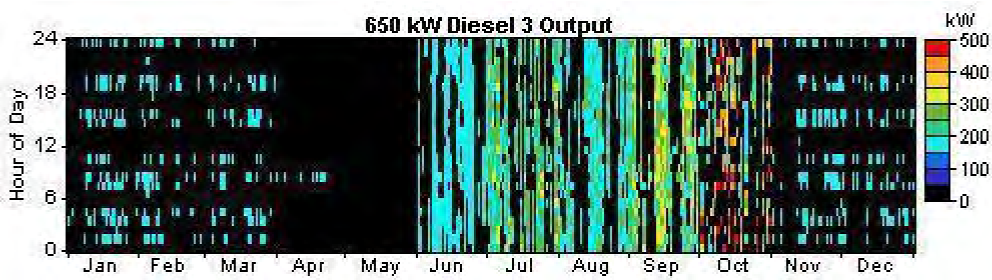
650 kW Diesel 3

Quantity	Value	Units
Hours of operation	2,311	hr/yr
Number of starts	640	starts/yr

Operational life	17.3	yr
Capacity factor	9.44	%
Fixed generation cost	69.2	$/hr
Marginal generation cost	0.275	$/kWhyr

Quantity	Value	Units
Electrical production	537,239	kWh/yr
Mean electrical output	232	kW
Min. electrical output	195	kW
Max. electrical output	471	kW

Quantity	Value	Units
Fuel consumption	254,482	L/yr
Specific fuel consumption	0.474	L/kWh
Fuel energy input	2,504,099	kWh/yr
Mean electrical efficiency	21.5	%



Emissions

Pollutant	Emissions (kg/yr)
Carbon dioxide	5,337,085
Carbon monoxide	13,174
Unburned hydocarbons	1,459
Particulate matter	993
Sulfur dioxide	10,718
Nitrogen oxides	117,551

System Report - RedDogPort-WindDieselSystem VestasV82.hmr

Sensitivity case

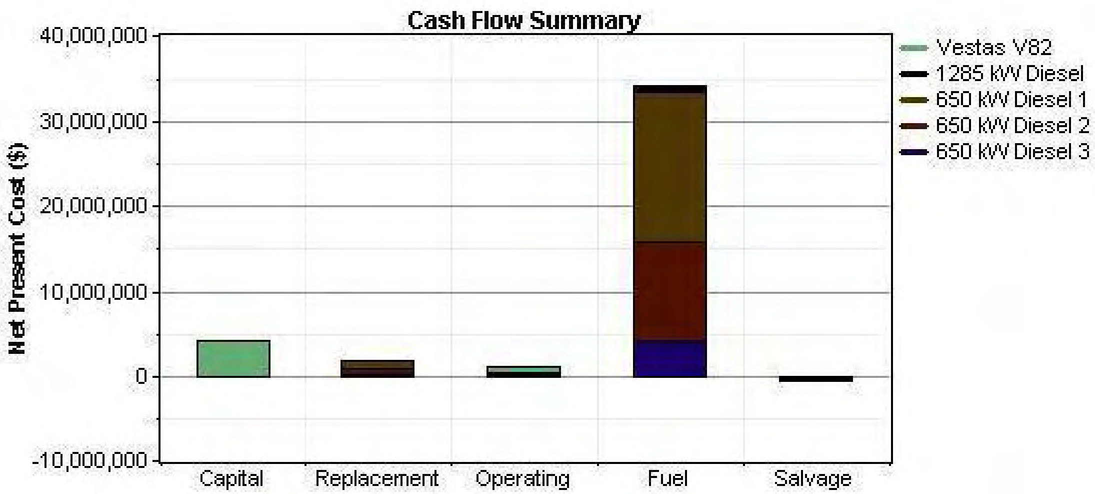
Wind Data Scaled Average: 7 m/s
Diesel Price: 1.1 $/L

System architecture

Wind turbine	1 Vestas V82
1285 kW Diesel	1,285 kW
650 kW Diesel 1	650 kW
650 kW Diesel 2	650 kW
650 kW Diesel 3	650 kW

Cost summary

Total net present cost	$ 40,593,236
Levelized cost of energy	$ 0.282/kWh
Operating cost	$ 2,846,923/yr

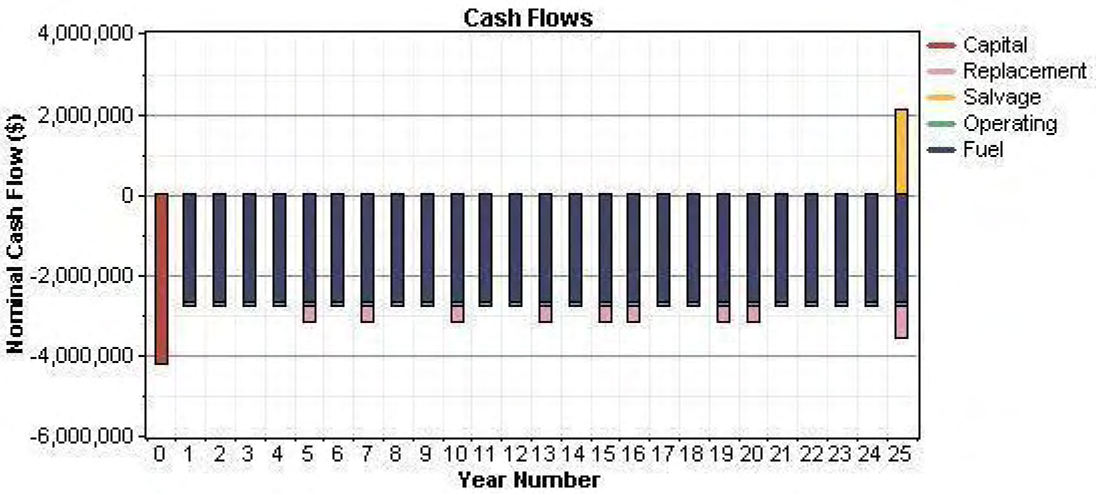


Net Present Costs

Component	Capital ($)	Replacement ($)	O&M ($)	Fuel ($)	Salvage ($)	Total ($)
Vestas V82	4,200,000	0	639,168	0	0	4,839,170
1285 kW Diesel	0	0	14,765	654,684	-291,831	377,618
650 kW Diesel 1	0	922,903	209,622	17,550,570	-81,608	18,601,486
650 kW Diesel 2	0	701,840	164,726	11,708,792	-90,695	12,484,663
650 kW Diesel 3	0	165,826	67,675	4,089,023	-32,212	4,290,312
System	4,200,000	1,790,569	1,095,956	34,003,076	-496,346	40,593,248

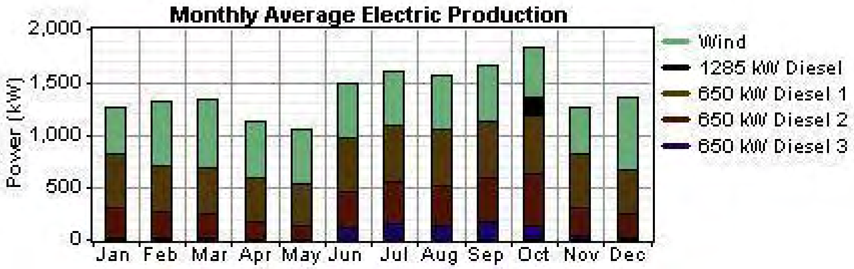
Annualized Costs

Component	Capital ($/yr)	Replacement ($/yr)	O&M ($/yr)	Fuel ($/yr)	Salvage ($/yr)	Total ($/yr)
Vestas V82	328,552	0	50,000	0	0	378,552
1285 kW Diesel	0	0	1,155	51,214	-22,829	29,540
650 kW Diesel 1	0	72,196	16,398	1,372,924	-6,384	1,455,133
650 kW Diesel 2	0	54,903	12,886	915,940	-7,095	976,634
650 kW Diesel 3	0	12,972	5,294	319,871	-2,520	335,617
System	328,552	140,070	85,733	2,659,949	-38,828	3,175,477



Electrical

Component	Production	Fraction
	(kWh/yr)	
Wind turbine	4,674,265	38%
1285 kW Diesel	119,783	1%
650 kW Diesel 1	4,219,880	34%
650 kW Diesel 2	2,642,748	22%
650 kW Diesel 3	612,591	5%
Total	12,269,267	100%



Load	Consumption	Fraction
	(kWh/yr)	
AC primary load	11,249,297	100%
Total	11,249,297	100%

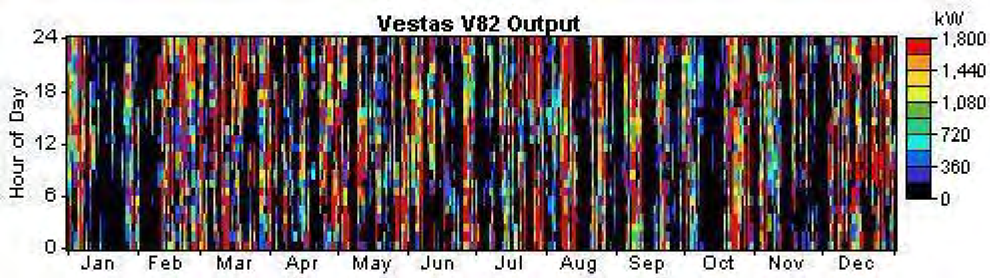
Quantity	Value	Units
Excess electricity	1,019,972	kWh/yr
Unmet load	0.129	kWh/yr
Capacity shortage	0.00	kWh/yr
Renewable fraction	0.381	

AC Wind Turbine: Vestas V82

Variable	Value	Units
Total rated capacity	1,650	kW
Mean output	534	kW
Capacity factor	32.3	%
Total production	4,674,265	kWh/yr

Variable	Value	Units
Minimum output	0.00	kW

Maximum output	1,642	kW
Wind penetration	41.6	%
Hours of operation	5,942	hr/yr
Levelized cost	0.0810	$/kWh

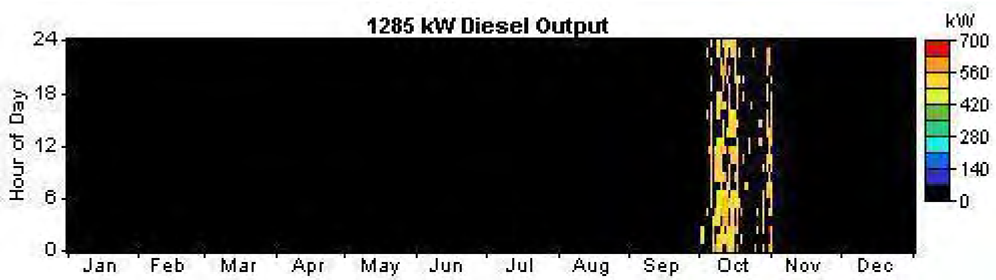


1285 kW Diesel

Quantity	Value	Units
Hours of operation	231	hr/yr
Number of starts	89	starts/yr
Operational life	152	yr
Capacity factor	1.06	%
Fixed generation cost	133	$/hr
Marginal generation cost	0.264	$/kWhyr

Quantity	Value	Units
Electrical production	119,783	kWh/yr
Mean electrical output	519	kW
Min. electrical output	405	kW
Max. electrical output	631	kW

Quantity	Value	Units
Fuel consumption	46,558	L/yr
Specific fuel consumption	0.389	L/kWh
Fuel energy input	458,130	kWh/yr
Mean electrical efficiency	26.1	%



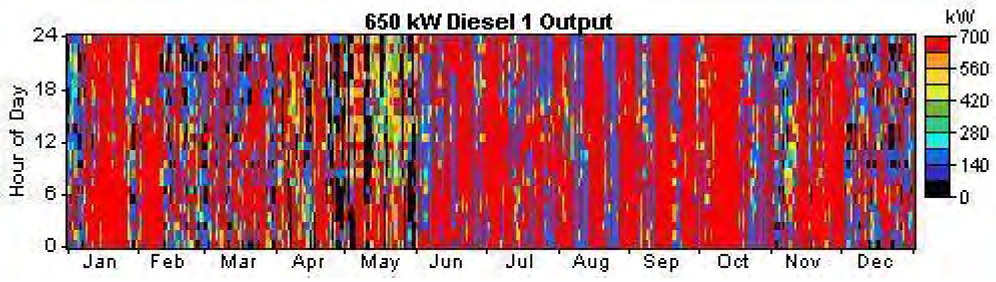
650 kW Diesel 1

Quantity	Value	Units
Hours of operation	8,199	hr/yr
Number of starts	277	starts/yr
Operational life	4.88	yr
Capacity factor	74.1	%
Fixed generation cost	54.9	$/hr
Marginal generation cost	0.242	$/kWhyr

Quantity	Value	Units

Electrical production	4,219,880	kWh/yr
Mean electrical output	515	kW
Min. electrical output	195	kW
Max. electrical output	650	kW

Quantity	Value	Units
Fuel consumption	1,248,112	L/yr
Specific fuel consumption	0.296	L/kWh
Fuel energy input	12,281,421	kWh/yr
Mean electrical efficiency	34.4	%

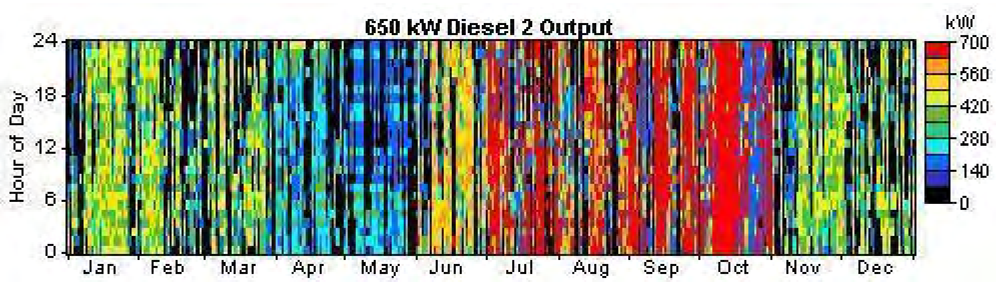


650 kW Diesel 2

Quantity	Value	Units
Hours of operation	6,443	hr/yr
Number of starts	438	starts/yr
Operational life	6.21	yr
Capacity factor	46.4	%
Fixed generation cost	54.9	$/hr
Marginal generation cost	0.242	$/kWhyr

Quantity	Value	Units
Electrical production	2,642,748	kWh/yr
Mean electrical output	410	kW
Min. electrical output	195	kW
Max. electrical output	650	kW

Quantity	Value	Units
Fuel consumption	832,673	L/yr
Specific fuel consumption	0.315	L/kWh
Fuel energy input	8,193,500	kWh/yr
Mean electrical efficiency	32.3	%



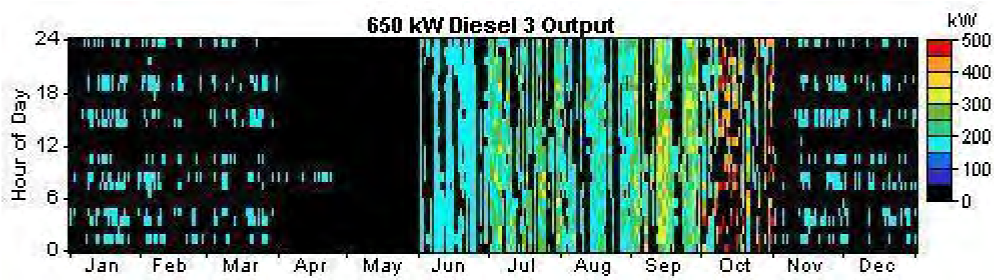
650 kW Diesel 3

Quantity	Value	Units
Hours of operation	2,647	hr/yr
Number of starts	639	starts/yr

Operational life	15.1	yr
Capacity factor	10.8	%
Fixed generation cost	69.2	$/hr
Marginal generation cost	0.275	$/kWhyr

Quantity	Value	Units
Electrical production	612,591	kWh/yr
Mean electrical output	231	kW
Min. electrical output	195	kW
Max. electrical output	471	kW

Quantity	Value	Units
Fuel consumption	290,792	L/yr
Specific fuel consumption	0.475	L/kWh
Fuel energy input	2,861,389	kWh/yr
Mean electrical efficiency	21.4	%



Emissions

Pollutant	Emissions (kg/yr)
Carbon dioxide	6,367,743
Carbon monoxide	15,718
Unburned hydocarbons	1,741
Particulate matter	1,185
Sulfur dioxide	12,788
Nitrogen oxides	140,252

System Report - RedDogPort-WindDieselSystem VestasV82.hmr

Sensitivity case

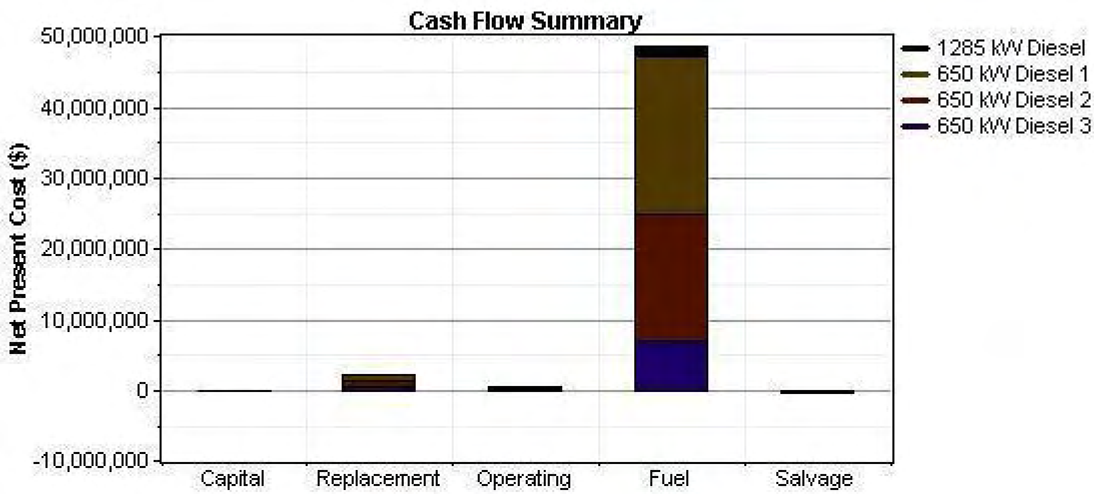
Wind Data Scaled Average: 7 m/s
Diesel Price: 1.1 $/L

System architecture

1285 kW Diesel	1,285 kW
650 kW Diesel 1	650 kW
650 kW Diesel 2	650 kW
650 kW Diesel 3	650 kW

Cost summary

Total net present cost	$ 51,225,664
Levelized cost of energy	$ 0.356/kWh
Operating cost	$ 4,007,216/yr

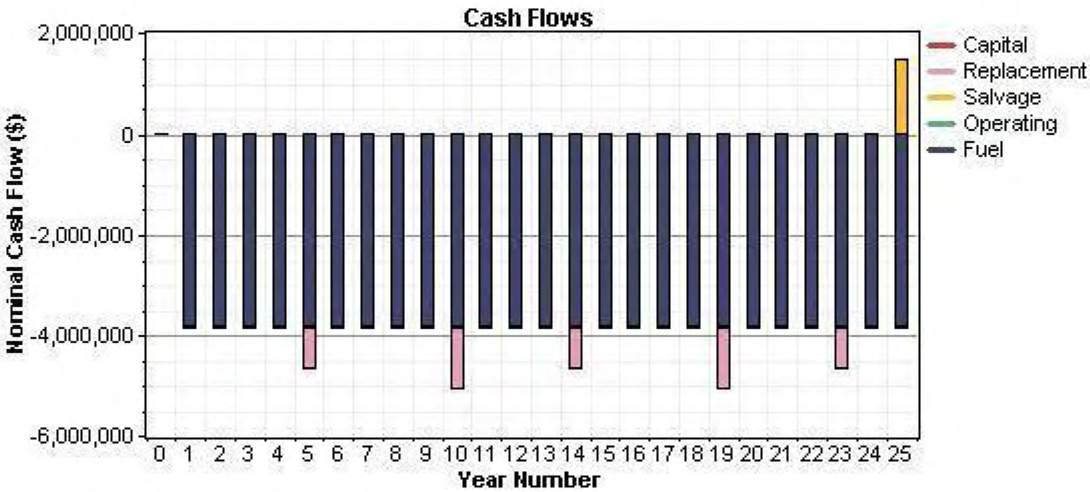


Net Present Costs

Component	Capital ($)	Replacement ($)	O&M ($)	Fuel ($)	Salvage ($)	Total ($)
1285 kW Diesel	0	0	32,342	1,442,106	-223,180	1,251,268
650 kW Diesel 1	0	965,296	223,965	22,375,212	-48,930	23,515,548
650 kW Diesel 2	0	965,296	223,965	17,980,664	-48,930	19,120,996
650 kW Diesel 3	0	372,931	111,982	6,877,433	-24,465	7,337,881
System	0	2,303,523	592,253	48,675,412	-345,504	51,225,692

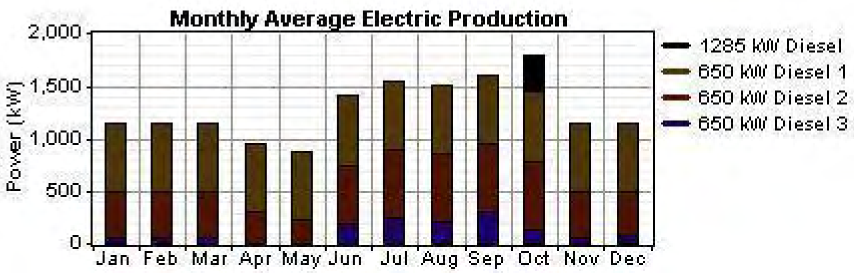
Annualized Costs

Component	Capital ($/yr)	Replacement ($/yr)	O&M ($/yr)	Fuel ($/yr)	Salvage ($/yr)	Total ($/yr)
1285 kW Diesel	0	0	2,530	112,811	-17,459	97,883
650 kW Diesel 1	0	75,512	17,520	1,750,339	-3,828	1,839,544
650 kW Diesel 2	0	75,512	17,520	1,406,568	-3,828	1,495,773
650 kW Diesel 3	0	29,173	8,760	537,999	-1,914	574,018
System	0	180,197	46,330	3,807,718	-27,028	4,007,218



Electrical

Component	Production	Fraction
	(kWh/yr)	
1285 kW Diesel	264,763	2%
650 kW Diesel 1	5,679,894	50%
650 kW Diesel 2	4,259,351	38%
650 kW Diesel 3	1,045,318	9%
Total	11,249,326	100%



Load	Consumption	Fraction
	(kWh/yr)	
AC primary load	11,249,297	100%
Total	11,249,297	100%

Quantity	Value	Units
Excess electricity	0.00	kWh/yr
Unmet load	0.00	kWh/yr
Capacity shortage	0.00	kWh/yr
Renewable fraction	0.000	

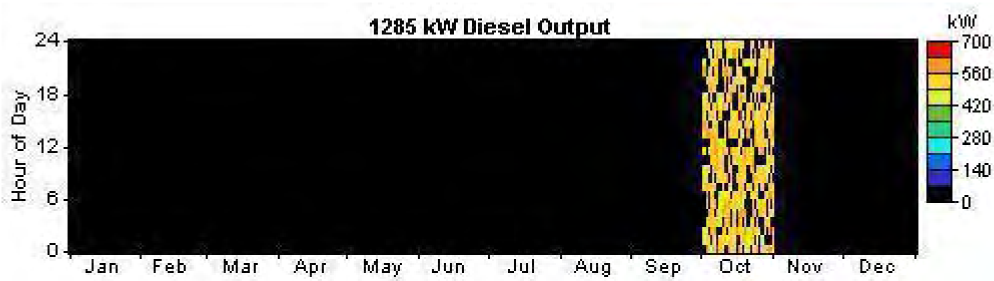
1285 kW Diesel

Quantity	Value	Units
Hours of operation	506	hr/yr
Number of starts	160	starts/yr
Operational life	69.2	yr
Capacity factor	2.35	%
Fixed generation cost	133	$/hr
Marginal generation cost	0.264	$/kWhyr

Quantity	Value	Units

Electrical production	264,763	kWh/yr
Mean electrical output	523	kW
Min. electrical output	473	kW
Max. electrical output	655	kW

Quantity	Value	Units
Fuel consumption	102,556	L/yr
Specific fuel consumption	0.387	L/kWh
Fuel energy input	1,009,147	kWh/yr
Mean electrical efficiency	26.2	%

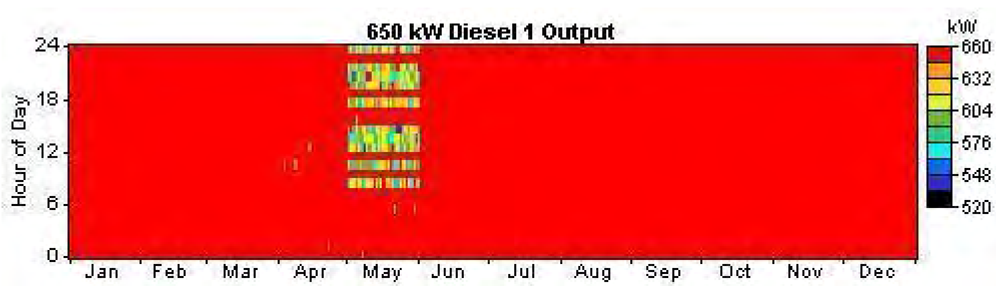


650 kW Diesel 1

Quantity	Value	Units
Hours of operation	8,760	hr/yr
Number of starts	1	starts/yr
Operational life	4.57	yr
Capacity factor	99.8	%
Fixed generation cost	54.9	$/hr
Marginal generation cost	0.242	$/kWhyr

Quantity	Value	Units
Electrical production	5,679,894	kWh/yr
Mean electrical output	648	kW
Min. electrical output	536	kW
Max. electrical output	650	kW

Quantity	Value	Units
Fuel consumption	1,591,217	L/yr
Specific fuel consumption	0.280	L/kWh
Fuel energy input	15,657,577	kWh/yr
Mean electrical efficiency	36.3	%



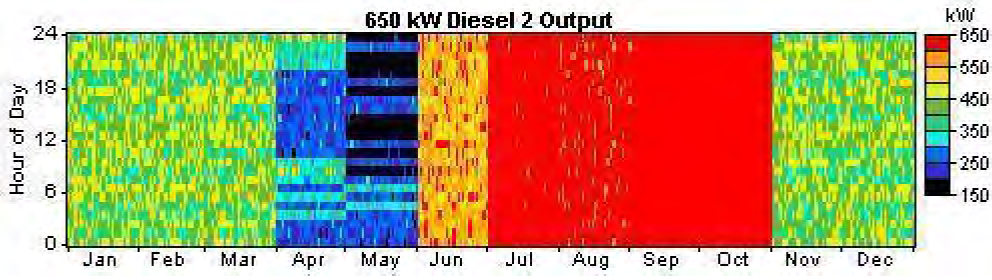
650 kW Diesel 2

Quantity	Value	Units
Hours of operation	8,760	hr/yr
Number of starts	1	starts/yr

Operational life	4.57	yr
Capacity factor	74.8	%
Fixed generation cost	54.9	$/hr
Marginal generation cost	0.242	$/kWhyr

Quantity	Value	Units
Electrical production	4,259,351	kWh/yr
Mean electrical output	486	kW
Min. electrical output	195	kW
Max. electrical output	650	kW

Quantity	Value	Units
Fuel consumption	1,278,698	L/yr
Specific fuel consumption	0.300	L/kWh
Fuel energy input	12,582,387	kWh/yr
Mean electrical efficiency	33.9	%

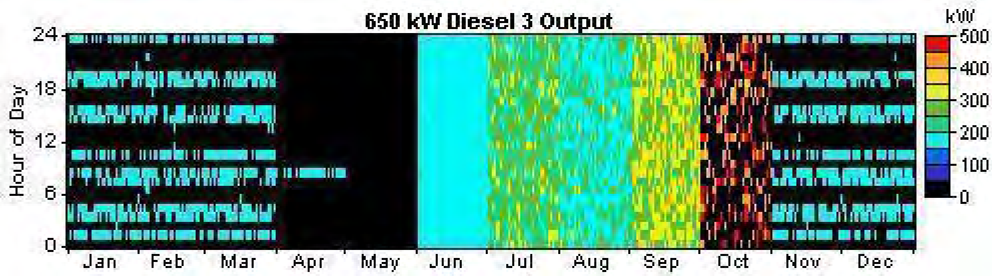


650 kW Diesel 3

Quantity	Value	Units
Hours of operation	4,380	hr/yr
Number of starts	1,072	starts/yr
Operational life	9.13	yr
Capacity factor	18.4	%
Fixed generation cost	69.2	$/hr
Marginal generation cost	0.275	$/kWhyr

Quantity	Value	Units
Electrical production	1,045,318	kWh/yr
Mean electrical output	239	kW
Min. electrical output	195	kW
Max. electrical output	472	kW

Quantity	Value	Units
Fuel consumption	489,090	L/yr
Specific fuel consumption	0.468	L/kWh
Fuel energy input	4,812,643	kWh/yr
Mean electrical efficiency	21.7	%



Emissions

Pollutant	Emissions (kg/yr)
Carbon dioxide	9,115,427
Carbon monoxide	22,500
Unburned hydocarbons	2,492
Particulate matter	1,696
Sulfur dioxide	18,305
Nitrogen oxides	200,770

Red Dog Port Site 5 Wind Resource Update Report, 3/09

Report written by: Douglas Vaught, P.E., V3 Energy, LLC, Eagle River, Alaska
Date of Report: March 25, 2009

Photo: Randy Grogan

Summary Information

Site 5 is an existing approximately 35 meter communication tower located approximately 3.5 kilometers from the Chukchi Sea at the Port of Red Dog. The general area of the tower was selected during a re-connaissance visit in August 2008 as a potential wind power site for the port facility and potentially for Red Dog Mine itself someday. Data collected to date (5.4 months of data) indicates superb potential for wind power development at this site.

Test Site Location

Google Earth Map

Meteorological Tower Data Synopsis

Data start date	October 10, 2008
Data end date	March 22, 2009 (5.4 months of data)
Wind power class	Class 7 (predicted, to date)
Wind speed average (33 meters)	7.76 m/s (to date)
Maximum two second wind gust	23.1 m/s (October 2008)
Wind power density (33 meters)	1,247 W/m^2
Weibull distribution parameters	k = 1.13, c = 8.10 m/s
Roughness Class	1.18 (description: fallow field)
Power law exponent	0.152 (moderate wind shear)
Frequency of calms (4 m/s threshold)	39%
Representative Turbulence Intensity	0.090 (IEC 3rd ed. turbulence category C-)

Tower Sensor Information

Channel	Sensor type	Height	Multiplier	Offset	Orientation
1	NRG #40C anemometer	33 m (A)	.757	.38	000
2	NRG #40C anemometer	33 m (B)	.760	.34	115
3	NRG #40C anemometer	21 m (A)	.757	.38	000
4	NRG #40C anemometer	21 m (B)	.757	.40	115
7	NRG #200P wind vane	29 m	0.351	180	000
9	NRG #110S Temp C	2 m	0.136	-86.383	000
10	Voltmeter		0.021	0	
12	RH-5 humidity sensor	2 m	20	0	

General Site Information

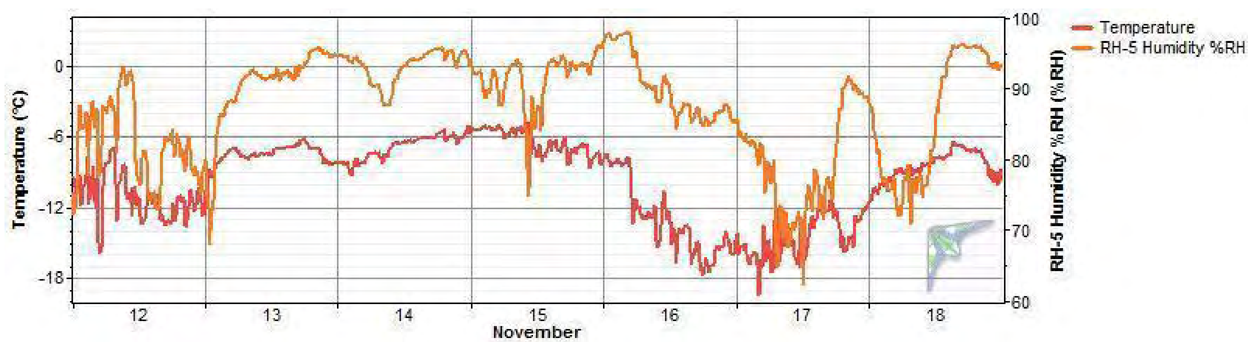
Site number	Red Dog Port Site 5 (datalogger site 9476)
Site Description	Port of Red Dog, communications tower 3.5 km from coastline
Latitude/longitude	N 67° 35’ 48.9”, W 164° 59’ 42.1”
Site elevation	49 meters
Datalogger/modem type	NRG Symphonie/NRG Iridium satellite iPack
Tower type	Existing approx. 35 meter lattice communications tower

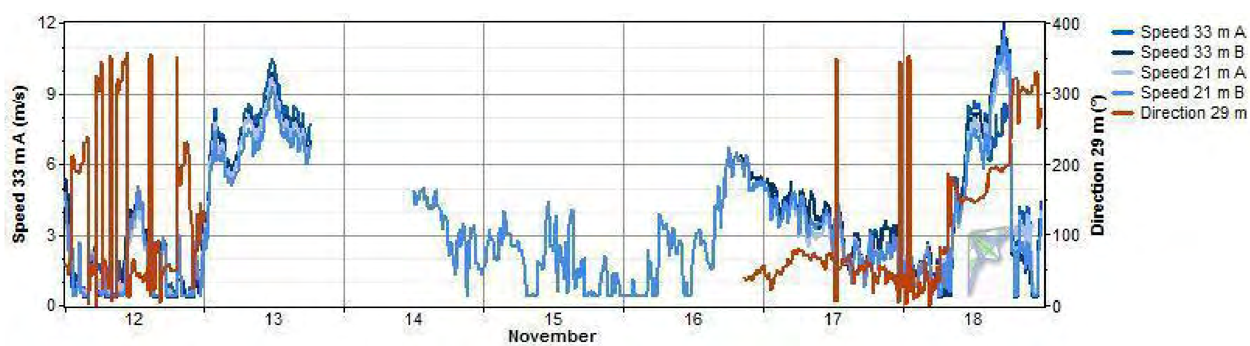
Data Quality Control

Data was filtered manually to remove obvious icing data. Typically, anemometer icing is identified by non-variant data readings at the sensor offset values, a standard deviation of zero, temperature near or below freezing, and very high relative humidity percentage values. This is evident below in the icing event of mid-November, 2008 which resulted in data loss from the wind vane and from the anemometers: the temperature was -6 to -12° C at greater than 90% relative humidity (see below). Also note that wind vane (direction) data recovery is low compared to other sensors due to sensor inoperability after initial installation, corrected several days later. In general though, other than the November icing event, data loss due to icing events has been very low, especially for a coastal Alaska location. This likely is due to the very cold, dry climate of the region. This bodes well for wind power development as turbine icing problems will be minimal

Despite the 100 percent data recovery, note that from December 15 to February 13 the relative humidity (RH) sensor functioned abnormally with high normal readings alternating with zero readings. This is because the RH sensor is powered by the solar panels and iPack battery. During this period of seasonal darkness, the iPack battery discharged and partially recharged daily with the very small amount of light gathered by the solar panels. This discharged state affected the RH sensor function. With the recent return of normal levels of sunlight, the iPack battery voltage and hence RH sensor have returned to normal working status.

Sensor	Ch	Units	Height	Possible Records	Valid Records	Recovery Rate (%)
Speed 33 m A	1	m/s	33 m	23,556	23,031	97.8
Speed 33 m B	2	m/s	33 m	23,556	23,069	97.9
Speed 21 m A	3	m/s	21 m	23,556	22,997	97.6
Speed 21 m B	4	m/s	21 m	23,556	23,403	99.4
Direction 29 m	7	°	29 m	23,556	22,247	94.4
Temperature	9	°C		23,556	23,556	100.0
Voltmeter	10	volts		23,556	23,556	100.0
RH-5 Humidity %RH	12	%RH		23,556	23,556	100.0



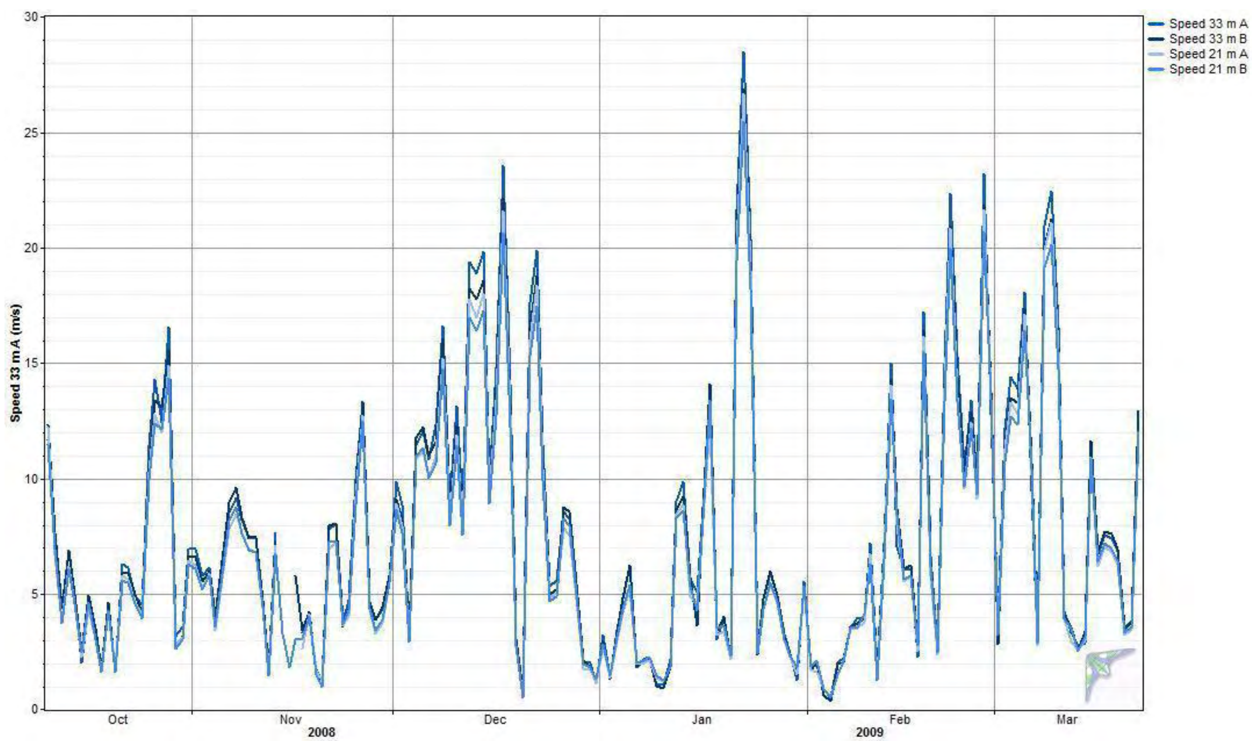


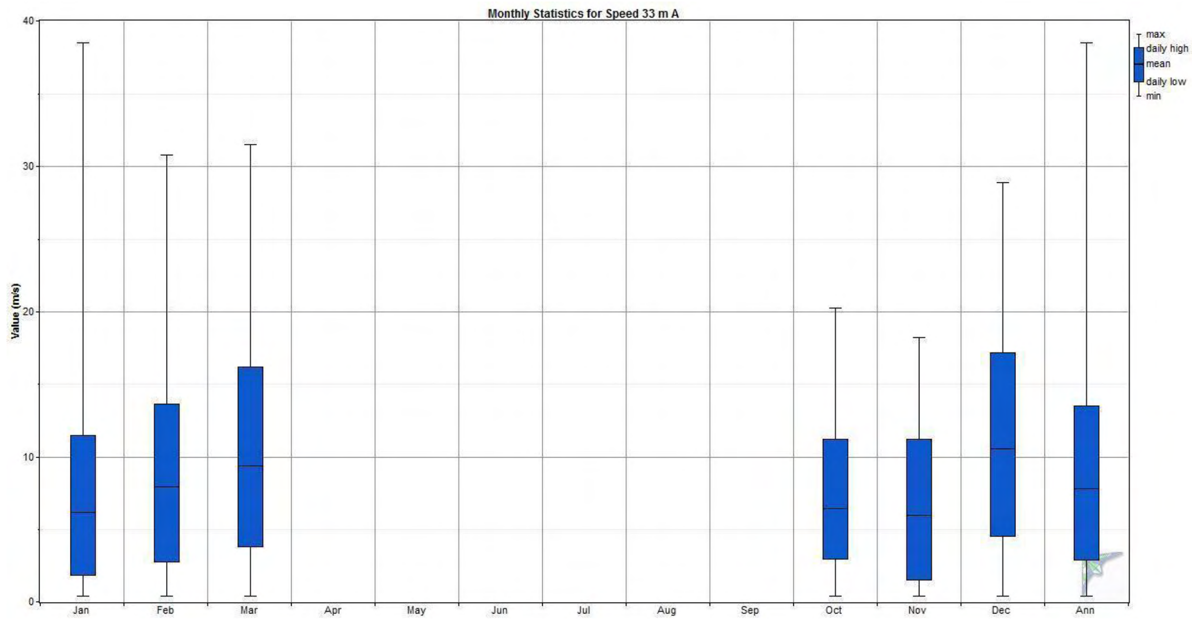
Measured Wind Speeds

The 33 meter anemometer wind speed averages (anemometer A and B) for the measurement period are a very promising 7.76 and 7.55 m/s. The maximum recorded wind gust was 43.5 m/s recorded in January 2009.

Variable	Speed 33 m A	Speed 33 m B	Speed 21 m B	Speed 21 m A
Height above ground (m)	33.0	33.0	21.0	21.0
Mean wind speed (m/s)	**7.76**	7.55	7.03	7.19
MMM wind speed (m/s)	7.74	7.54	7.05	7.18

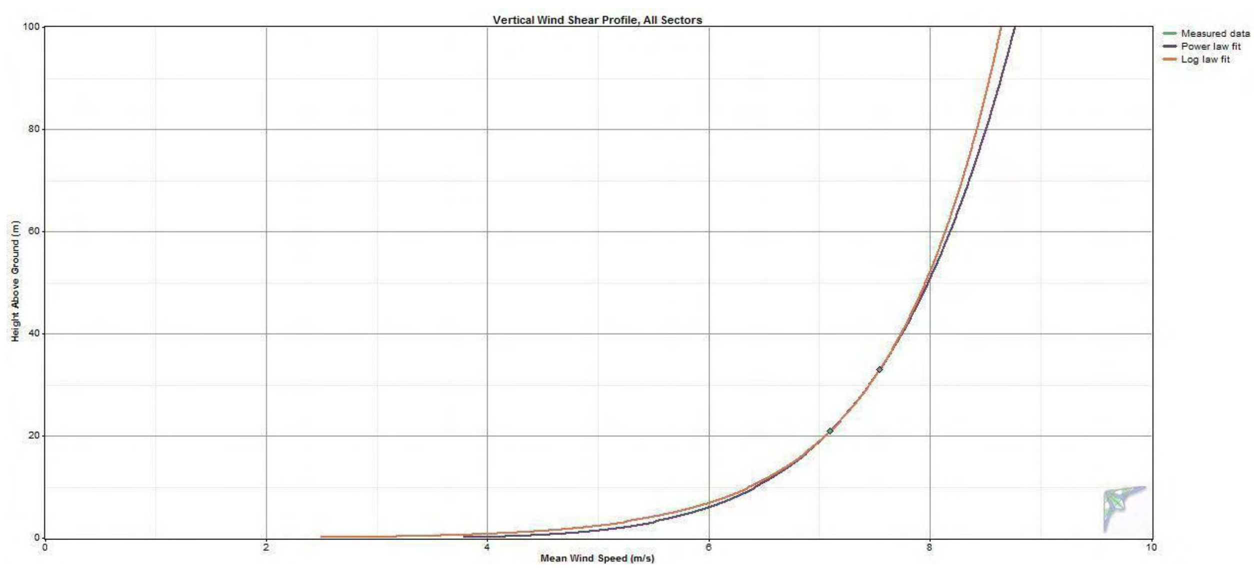
Median wind speed (m/s)	5.90	5.80	5.40	5.40
Min wind speed (m/s)	0.4	0.3	0.4	0.4
Max wind speed (m/s)	38.5	36.7	34.4	36.1
Weibull k	1.13	1.11	1.14	1.13
Weibull c (m/s)	8.10	7.83	7.37	7.52
Mean power density (W/m²)	1,247	1,095	892	1,002
MMM power density (W/m²)	1,218	1,073	883	979
Mean energy content (kWh/m²/yr)	10,920	9,588	7,814	8,776
MMM energy content (kWh/m²/yr)	10,672	9,396	7,738	8,579
Energy pattern factor	4.01	3.83	3.85	4.05
Frequency of calms (%)	38.1	38.0	40.7	41.6
1-hr autocorrelation coefficient	0.954	0.952	0.95	0.952
Diurnal pattern strength	0.046	0.044	0.042	0.044
Hour of peak wind speed	19	18	18	18





Wind Shear

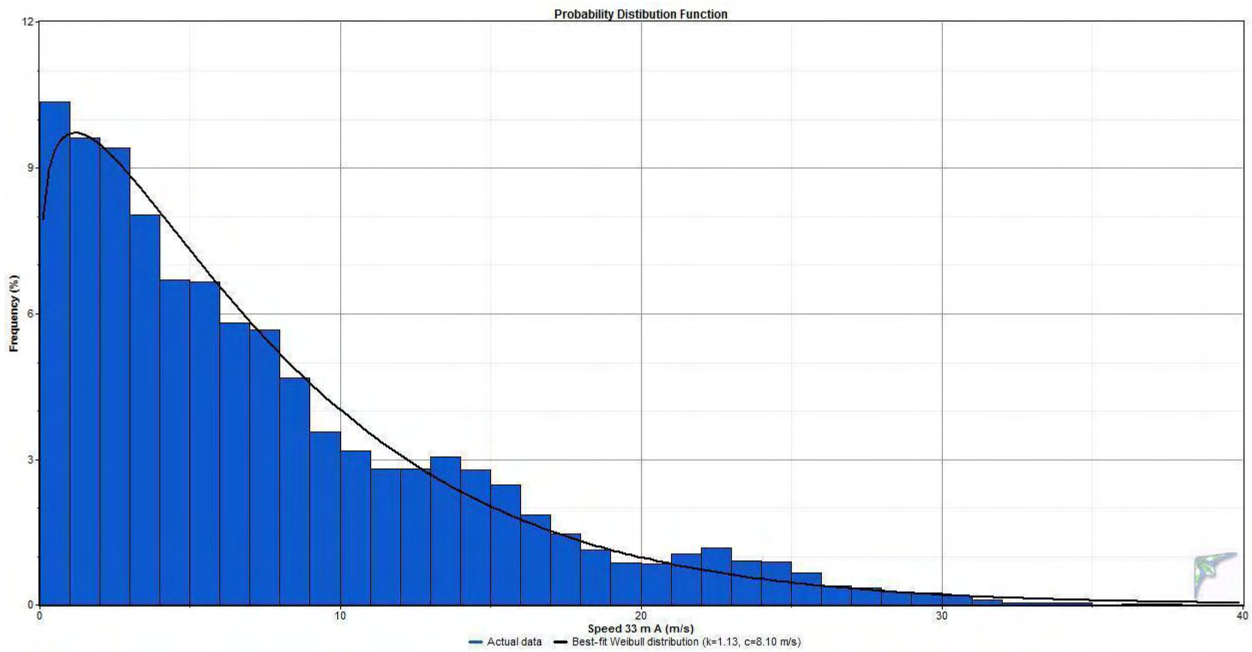
The power law exponent was calculated at 0.152, or 0.135 if one considers only the "B" sensors oriented to the southeast, indicating moderate wind shear at Site 5. The practical application of this data is that a higher turbine tower height might be desirable as there could be a worthwhile marginal gain in wind speed and hence power recovery with additional height.



Probability Distribution Function

The probability distribution function provides a visual indication of measured wind speeds in one meter per second "bins". Note that most wind turbines do not begin to generate power until the wind speed at hub height reaches 4 m/s, known as the "cut-in" wind speed. The black line in the graph is a best fit Weibull distribution.

Based on data to date, Site 5 data exhibits an unusual wind distribution profile: one dominated by a rather large percentage of calm winds yet also characterized by a significant percentage of very high winds (greater than 20 m/s). In fact, 3.4 percent of the 10-minute average wind speeds measured to date exceeds 20 m/s. By itself, this doesn't seem particularly high, but these high wind speeds contain significant power density and help explain the Class 7 wind class prediction even though 39 percent of the winds are less than 4 m/s (typical turbine cut-in).

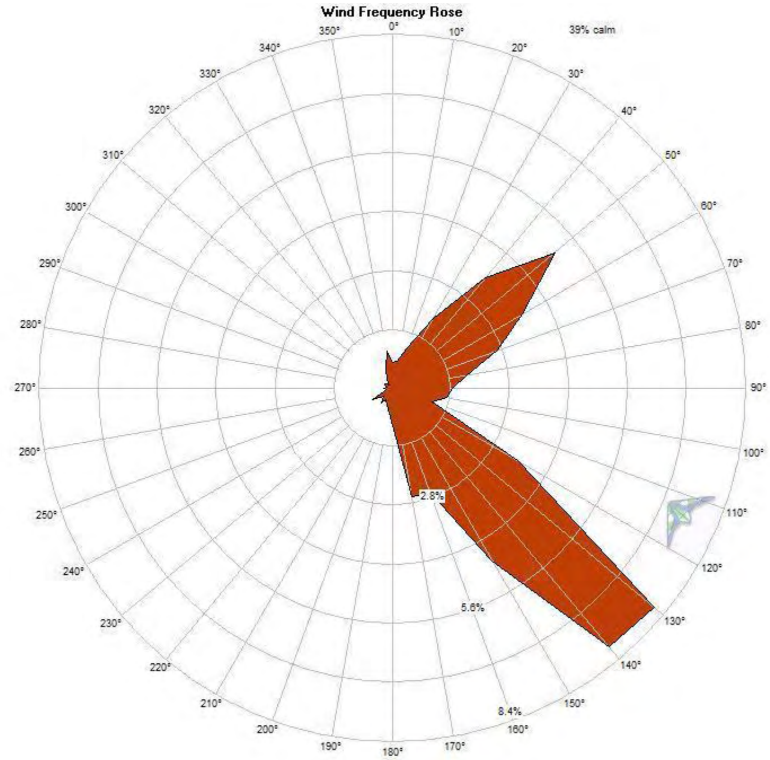


Wind Roses

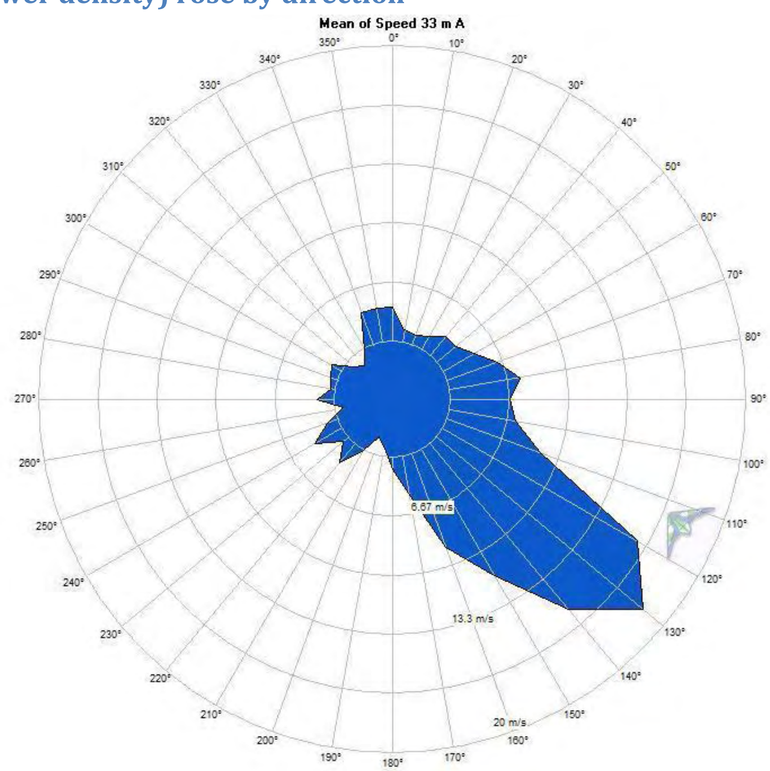
Port of Red Dog Site 5 winds during the measurement periods were highly directional northeast and southeast (refer to the frequency rose). Interestingly though, the southeast winds are much stronger than the northeast winds (refer to the mean value rose), resulting in a power density wind rose that is dominated by southeast winds.

Note that a wind threshold of 4 m/s was selected for the definition of calm winds. As mentioned above, this wind speed represents the cut-in wind speed of most wind turbines. By this definition, Site 5 experienced 39 percent calm conditions during the measurement period (see wind frequency rose below).

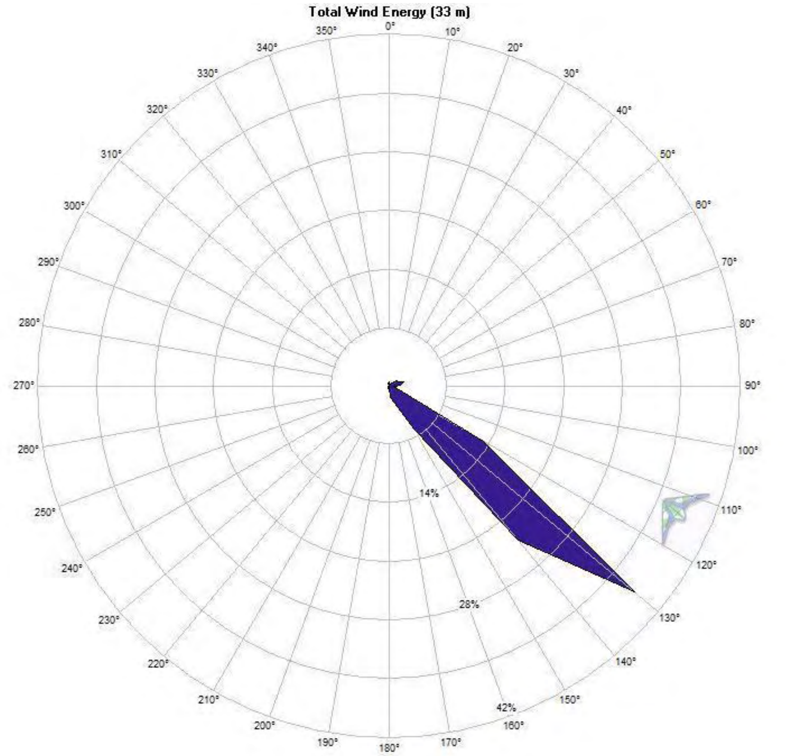
Wind Frequency Rose



Mean Value (power density) rose by direction

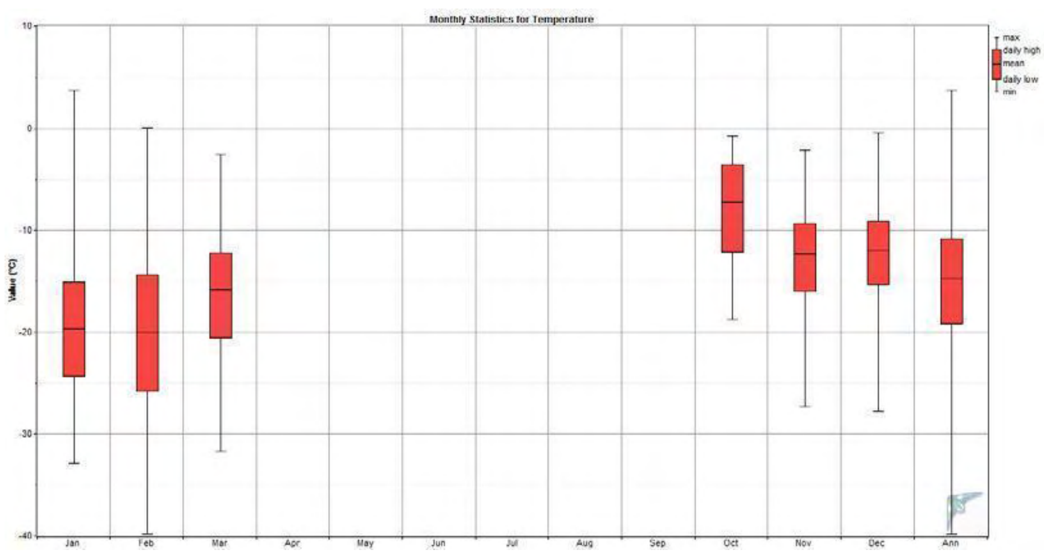


Total value (power density) rose



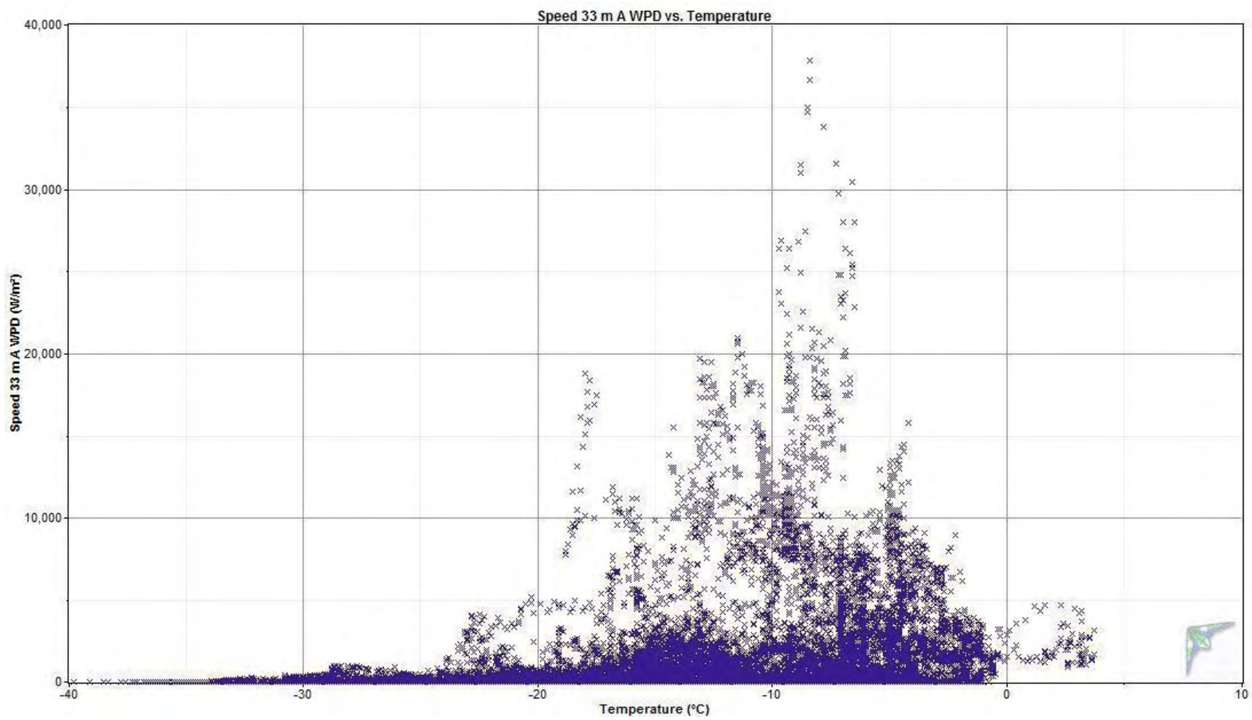
Air Temperature and Density

During the measurement period, Red Dog Port Site 5 had a mean temperature of -14.8° C. The minimum recorded temperature during the measurement period was -40.7° C and the maximum temperature was 4.2° C. Of course, the measured mean temperature will increase as spring and summer data are added to the data set.



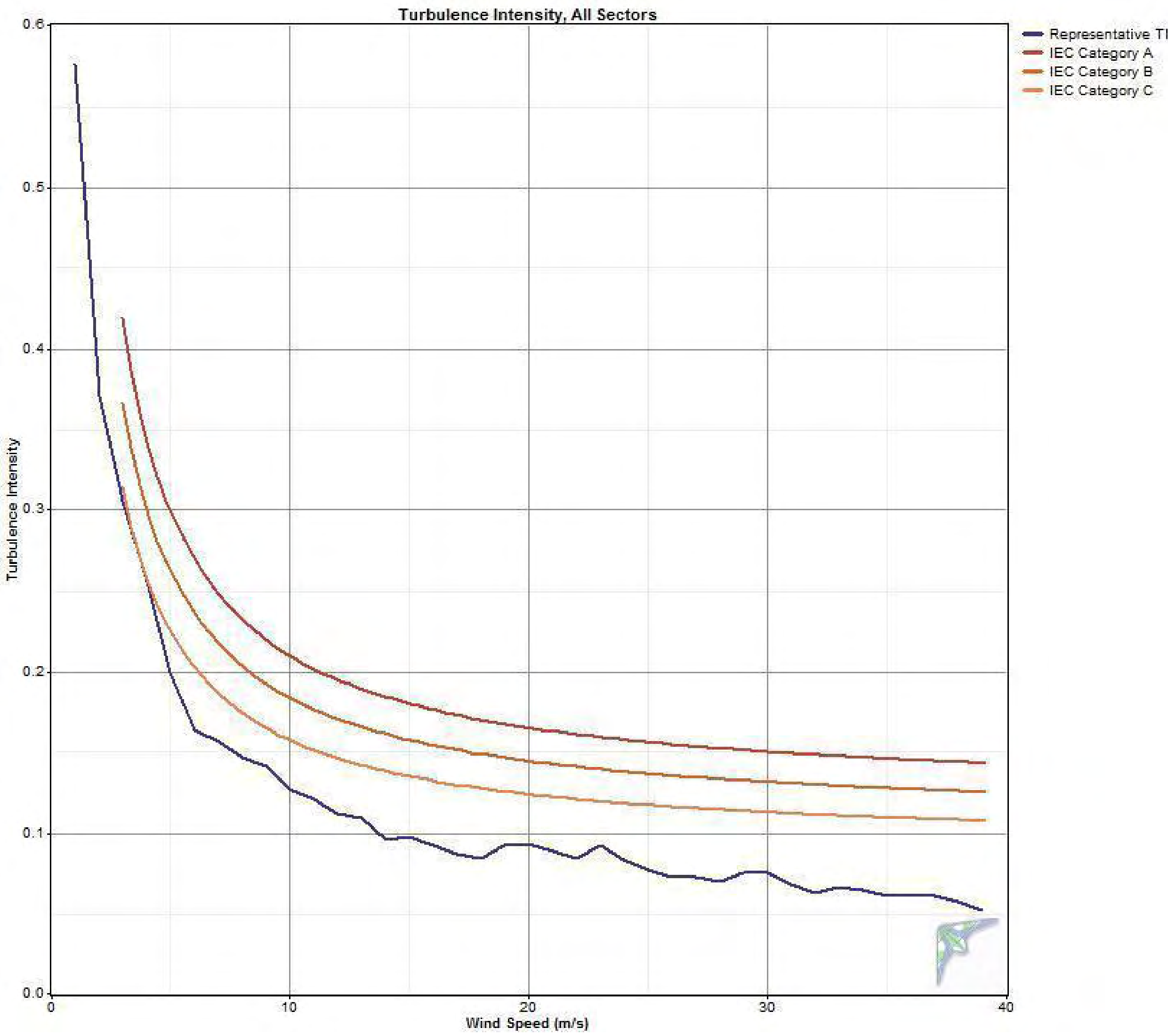
Consequent to the Port's cool temperatures, the mean air density for the measurement period of 1.358 kg/m^3 is eleven percent higher than the standard air density of 1.219 kg/m^3 (14.7° C and 100.7 kPa standard temperature and pressure) at 49 m elevation, indicating that the Port has denser air than the standard air density used to calculate turbine power curves (power curves are calculated at a sea level standard of 15.0° C and 101.3 kPa pressure).

Given the extremely cold winter temperatures at Red Dog, selection of wind turbines should be conducted with due consideration to extreme cold weather capability. Note in the scatterplot graph below that although relatively wind power density is very minimal at temperatures colder than -25° C, but at temperatures higher than -25° C, significant wind power density, in other words, power winds, are relatively frequent. Hence, turbines should be capable of operation at -25° C and preferably colder.



Turbulence

Air turbulence at Site 5 during the measurement period was desirably low, meeting International Electrotechnical Commission (IEC) 61400-1 3rd Edition (2005) Category C criteria (note that Category C is the lowest classification of turbulence for wind power development). Representative turbulence intensity (defined at 15 m/s) is 0.097. In all respects, this is a low turbulence wind site.


Turbulence Intensity, All Sectors
Representative TI
IEC Category A
IEC Category B
IEC Category C
Turbulence Intensity
Wind Speed (m/s)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0
10
20
30
40

Installation Cost for Utility Scale Turbines at Red Dog Mine

	$/MW	Notes
Industry Benchmark	$2,000,000	Installed lower 48 cost per MW of capacity. Per conversation with Clipper Wind.
Adjusted for Anchorage Installation	$2,080,000	5% cost differential for Anchorage installed costs vs lower 48 cost
Ship to Anchorage	$300,000	Per conversation with Clipper Wind
Total	$2,380,000	
Denali Commission Regional Multiplier for Maniilaq/NANA	1.39	Multiplier would include all price differentials for construction at the Red Dog Mine Port. Reference: Denali Commission Cost Containment Report
Total installed cost (per MW capacity)	**$3,308,200**	
Cost for 1.5 MW turbine installed at Red Dog Port	**$4,962,300.0**	

2009

Renewable Energy Fund Round 3
Kivalina Wind Grant Application

Alaska Village
Electric Cooperative
11/03/2009

Tab 1

Grant Application

Renewable Energy Fund Round 3
Grant Application

SECTION 1 – APPLICANT INFORMATION		
Name (*Name of utility, IPP, or government entity submitting proposal)*		
Alaska Village Electric Cooperative		
Type of Entity: Electric Utility		
Mailing Address 4831 Eagle Street Anchorage, AK 99503		**Physical Address**
Telephone (907) 565-5531	**Fax** (907) 562-4086	**Email**

1.1 APPLICANT POINT OF CONTACT

Name Brent Petrie		**Title** Manager, Community Development Key Accounts
Mailing Address 4831 Eagle Street Anchorage, AK 99503		
Telephone (907)565-5531	**Fax** (907)562-4086	**Email** BPetrie@avec.org

1.2 APPLICANT MINIMUM REQUIREMENTS

Please check as appropriate. If you do not to meet the minimum applicant requirements, your application will be rejected.

1.2.1 As an Applicant, we are: *(put an **X** in the appropriate box)*

X	An electric utility holding a certificate of public convenience and necessity under AS 42.05, or
	An independent power producer in accordance with 3 AAC 107.695 (a) (1), or
	A local government, or
	A governmental entity (which includes tribal councils and housing authorities);
Yes	1.2.2. Attached to this application is formal approval and endorsement for its project by its board of directors, executive management, or other governing authority. If the applicant is a collaborative grouping, a formal approval from each participant's governing authority is necessary. (Indicate Yes or No in the box)
Yes	1.2.3. As an applicant, we have administrative and financial management systems and follow procurement standards that comply with the standards set forth in the grant agreement.
Yes	1.2.4. If awarded the grant, we can comply with all terms and conditions of the attached grant form. (Any exceptions should be clearly noted and submitted with the application.)
Yes	1.2.5 We intend to own and operate any project that may be constructed with grant funds for the benefit of the general public.

SECTION 2 – PROJECT SUMMARY

This is intended to be no more than a 1-2 page overview of your project.

2.1 Project Title – (Provide a 4 to 5 word title for your project)

Kivalina Wind-Intertie Feasibility Analysis and Conceptual Design

2.2 Project Location

Include the physical location of your project and name(s) of the community or communities that will benefit from your project.

Kivalina (with a population of 406) is at the tip of an 8-mile barrier reef located between the Chukchi Sea and Kivalina River. Kivalina is 17 miles northwest of the Delong Mountain Transportation System (DMTS) port facility serving the Red Dog Mine.

2.3 PROJECT TYPE

*Put **X** in boxes as appropriate*

2.3.1 Renewable Resource Type

X	Wind		Biomass or Biofuels
	Hydro, including run of river	X	Transmission of Renewable Energy
	Geothermal, including Heat Pumps		Small Natural Gas
	Heat Recovery from existing sources		Hydrokinetic
	Solar		Storage of Renewable
	Other (Describe)		

2.3.2 Proposed Grant Funded Phase(s) for this Request *(Check all that apply)*

	Reconnaissance		Design and Permitting
X	Feasibility		Construction and Commissioning
X	Conceptual Design		

2.4 PROJECT DESCRIPTION

Provide a brief one paragraph description of your proposed project.

To determine the feasibility of installing wind towers in the vicinity of Kivalina, AVEC proposes to complete a **wind power** study and conceptual design. To this end, AVEC will install a wind meteorological (met) tower and complete geotechnical work. AVEC also proposes to conduct a feasibility study and conceptual design to examine the extension of a **power intertie** from Kivalina to the power system at the AIDEA-owned DMTS Port, 17 miles to the southwest, with the addition of wind power generation along the intertie. AVEC will analyze and report findings about both areas to partners and community members. AVEC This total project concept, with wind generation and an intertie, could be segmented into the following phases:

- Phase 1. Feasibility study & conceptual design.
- Phase 2. Financing and negotiation of power purchase agreement.
- Phase 3. Design and engineering.
- Phase 4. Installation of transmission and wind energy.
- Phase 5. Operations and maintenance.

2.5 PROJECT BENEFIT

Briefly discuss the financial and public benefits that will result from this project, (such as reduced fuel costs, lower energy costs, etc.)

The **financial benefits** of the project include the following:

- **Reduced Cost of Electricity.** AVEC customers in Kivalina will see reduced electricity costs through lower bulk fuel costs at the Red Dog Port. Operations and maintenance (O&M) costs will be reduced in Kivalina with no prime power generators to service, repair, and replace. Through the diesel fuel purchasing power of Teck and a transmission line to Kivalina, the possibility of lowering the cost of energy and power in Kivalina is significant.
- **Avoided Cost of Rural Power System (RPS) Upgrade and Bulk Fuel Upgrade**. The need to replace the RPS/Bulk Fuel facility is imminent, but has been delayed due to uncertainty about relocation and land availability.
- **Wind Energy Development to Displace Diesel Fuel**. An intertie linking the DMTS Port and Kivalina provides access to prime wind power locations along the route. Geographic and FAA airspace constraints preclude wind generation in the immediate vicinity of Kivalina. In order to deliver wind power to Kivalina a power line would need to extend to the east 3-8 miles to satisfy FAA requirements and be on suitable ground. Larger scale wind power generation could be located along the intertie in the DMTS Port vicinity as well. A preliminary HOMER analysis has been done; the analysis indicated that significant fuel savings can be achieved.
- **Reduced Construction Costs**. Reduced project construction costs can be achieved with the use of the DMTS Port housing facilities, Teck construction equipment, and bulk shipment facilities in place.

The **public benefits** of the project include the following:

- **Increased Power Reliability**. The prospect of tapping into an industrial power supply has the potential to increase both quality and reliability of power in Kivalina. Moreover, if Kivalina does relocate to a site further inland, which will have no barge access, the intertie could be branched to the new location to supply electric power. A tank farm, prime power plant and a lengthy, bulk fuel line may not be needed for the new site.
- **Reduced Pollution and Greenhouse Gas Emissions**. Reduced air, noise and ground pollution from the diesel exhaust, power plant and tank farm fuel system, respectively. Due to the sizing of the power plant, there are increased regulatory requirements. The potential of reducing pollution through wind energy is an appealing option.

Other Benefits to the Alaskan public will also exist. An important benefit of installing the proposed wind turbines would be to reduce the direct and indirect costs of using fossil fuels in the region. This project could help stabilize energy costs and provide long-term socio-economic benefits to village households. Locally produced, affordable energy will empower community residents and may help avert rural to urban migration. This project would have many environmental benefits resulting from a reduction of hydrocarbon use. These benefits include:

- Reduced potential for fuel spills or contamination during transport, storage, or use (thus protecting vital water and subsistence food sources);
- Improved air quality;
- Decreased contribution to global climate change from fossil fuel use; and
- Decreased coastal erosion due to climate change.

2.6 PROJECT BUDGET OVERVIEW

Briefly discuss the amount of funds needed, the anticipated sources of funds, and the nature and source of other contributions to the project.

This feasibility analysis, wind resource assessment, and conceptual design phase is estimated at $193,000, of which $183,350 is requested in grant funds. The remaining $9,650 will be matched in cash by AVEC. The entire project, through the construction phase, is estimated to cost approximately $22,193,000, in the following 4 phases with potential sources of funding or financing:

1) Feasibility analysis, resource assessment, and conceptual design $193,000 (AEA-R3)
2) Planning, permitting, and design $2M (Denali Commission)
3) Intertie and substations construction $14M (AIDEA)
4) Wind power construction $6M (AIDEA)

The project has two areas of concentration: power intertie and wind generation.

Intertie

The intertie between Kivalina and DMTS Port will be evaluated by looking at land use, permitting, and cost. A business model will look at the ownership and operational aspects of an intertie. AC and DC power transmission systems will be considered for cost estimating and O&M purposes. A business model will explore the relationship between Teck (current DMTS operator) and AVEC.

Wind Generation

The work will involve obtaining a letter of non-objection for placement of the wind tower and geotechnical fieldwork, permitting, purchasing, transporting, and installing a met tower, studying the wind resource for one year, and conducting a geotechnical investigation to determine the soil conditions and needed engineering at the site. A conceptual design will be created based on the outcome of the met tower recordings and geotechnical investigation.

The entire area from Kivalina to the DMTS Port is considered to be an excellent wind resource. The wind resource at the DMTS Port has been evaluated and is a Class 6/7. An intertie between Kivalina and the DMTS Port would provide access to prime wind generation locations with regard to low turbulence near the DMTS Port and away from geographic and FAA airspace restrictions near Kivalina. A business model will look at wind generation on both ends of the intertie and the financial considerations for both.

2.7 COST AND BENEFIT SUMARY

Include a summary of grant request and your project's total costs and benefits below.

Grant Costs *(Summary of funds requested)*	
2.7.1 Grant Funds Requested in this application.	**$** 183,350
2.7.2 Other Funds to be provided (Project match)	**$** 9,650
2.7.3 Total Grant Costs (sum of 2.7.1 and 2.7.2)	**$ 193,000**

Project Costs & Benefits (*Summary of total project costs including work to date and future cost estimates to get to a fully operational project)*	
2.7.4 Total Project Cost (Summary from Cost Worksheet	**$** 22,193,000

including estimates through construction)	
2.7.5 Estimated Direct Financial Benefit (Savings)	To be determined
2.7.6 Other Public Benefit (If you can calculate the benefit in terms of dollars please provide that number here and explain how you calculated that number in your application (Section 5.)	To be determined, based on avoided fuel costs.

SECTION 3 – PROJECT MANAGEMENT PLAN

Describe who will be responsible for managing the project and provide a plan for successfully completing the project within the scope, schedule and budget proposed in the application.

3.1 Project Manager

Tell us who will be managing the project for the Grantee and include a resume and references for the manager(s). If the applicant does not have a project manager indicate how you intend to solicit project management support. If the applicant expects project management assistance from AEA or another government entity, state that in this section.

Alaska Village Electric Cooperative (AVEC), the electric utility serving Kivalina, will provide overall project management and oversight.

Brent Petrie, Manager, Community Development and Key Accounts, will take the lead role as project manager. He has worked for Alaska Village Electric Cooperative since 1998, where he manages the development of alternatives to diesel generation for AVEC such as using hydro, wind, or heat recovery. He also manages relationships with AVEC's largest customers and is the project manager for AVEC's many construction projects as an energy partner of the federally funded Denali Commission.

Mr. Petrie has been employed in the energy and resource field for more than thirty years, having worked for federal and state governments as consultant, planner, and project manager. He has been a utility manager or management consultant since 1993. As General Manager of Iliamna-Newhalen-Nondalton Electric Cooperative from 1994 to 1998, he reported to a seven-member, elected board of directors, and served as project manager on its hydroelectric project development. He is an elected member of the Board of Directors of the Utility Wind Interest Group representing rural electric cooperatives and serves on the Power Supply Task force of the National Rural Electric Cooperative Association. Mr. Petrie has a Master's Degree in Water Resource Management and a Bachelor's degree in Geography. His resume is attached.

3.2 Project Schedule

Include a schedule for the proposed work that will be funded by this grant. (You may include a chart or table attachment with a summary of dates below.)

The project's ten key milestones or tasks, and their subtasks, are listed below with estimated completion dates (by task or subtask if subtasks are spread over more than one month):

1. Project scoping and contractor solicitation: September 15, 2010

Authorization to proceed
Engineering contractor selection

2. Detailed energy resource analysis: September 2010-September 2011

Obtain site control/right of entry/permits: September 2010
Ship and erect met tower: September 2010

Complete monitor met tower data: September 2011

3. Identification of land and regulatory issues: January 31, 2011
Land and Regulatory Issues Memorandum

4. Permitting and environmental analysis: January 31, 2011
Environmental and Permitting Memorandum

5. Detailed analysis of existing/ future energy costs and markets: March 30, 2011

6. Conceptual business and operations plans: June 30, 2011
Conceptual Business Plan
Conceptual Operating Plan

7. Assessment of alternatives: August 30, 2011
Geotech Field Work: June 2011
Draft Wind Resource Report: July 2011
Geotech Report: August 2011
Alternatives Assessment: August 2011

8. Detailed economic and financial analysis: October 31, 2011
Dismantle met tower: September 2011
Analyze data: October 2011

9. Conceptual design analysis and cost estimate: November 30, 2011
Wind Resource Report
Conceptual Design and Cost Estimate

10. Final project report and recommendations: December 31, 2011
Final Combined Report

3.3 Project Milestones

Define key tasks and decision points in your project and a schedule for achieving them. The Milestones must also be included on your budget worksheet to demonstrate how you propose to manage the project cash flow. (See Section 2 of the RFA or the Budget Form.)

Coastal erosion has limited the development and improvement of infrastructure in Kivalina, Alaska for the past 20-30 years. Erosion has recently caused AVEC to relocate their fuel tank farm in Kivalina as a temporary solution. The AVEC power plant in Kivalina has also reached its service life and needs to be replaced. Due to the natural setting of Kivalina and limited land availability options, there are few options available to AVEC for improved reliability and efficiency. The DMTS Port, AVEC, Teck Alaska and NANA Regional Corporation represent a unique opportunity for a public private partnership (PPP) for providing lower-cost energy and power to the community of Kivalina. This could be done through a 17 mile transmission line between the port site and Kivalina; development of a power purchase agreement between Teck and AVEC; and development of wind energy along the transmission/intertie line. To determine the viability of the wind-intertie concepts, the project will implement the following milestones:

1. Project scoping and contractor solicitation (September 1-September 15, 2010)
AVEC will select a contractor for the wind feasibility, geotechnical analysis, and conceptual

design immediately following AEA's authorization to proceed.

2. Detailed energy resource analysis (September 1-September 30, 2010)
To initiate the wind resource analysis before winter, AVEC will ship and erect the met tower in September 2010. AVEC will immediately seek approvals from permitting agencies, starting the process before the grant is awarded to ensure that the met tower can be installed in the late fall. The earlier the met tower is collecting data, the earlier AVEC will have the wind resource data to ascertain the suitability of use of this renewable resource.

3. Identification of land and regulatory issues (November 1, 2010-January 31, 2011)
AVEC will conduct site control discussions with the land owner and detail site control needs in a memorandum.

4. Permitting and environmental analysis (November 1, 2010-January 31, 2011)
AVEC will discuss the project with regulatory agencies to determine permitting requirements. Needed permits and any studies (i.e., bird studies) will be documented in a memorandum.

5. Detailed analysis of existing/future energy costs and markets (February 1-March 30, 2011)
AVEC will draft a memorandum documenting the existing and future energy costs and markets in Kivalina. The information will be based on AVEC records and community plans. A community meeting will be held to determine future energy markets.

6. Conceptual business and operations plans (April 1-June 30, 2011)
Draft business and operational plans will be developed working with Teck, NANA Regional Corporation, and AIDEA.

7. Assessment of alternatives (June 1, 2011-August 30, 2011)
A draft wind resource report will be written using the first three quarters of collected met tower data. Geotechnical field work will be completed and a report would be written during this time. A draft Alternatives Assessment Memorandum will be written detailing the reasonable alternatives and the preferred alternative using the wind and geotechnical data. It is expected that alternatives will vary in number and size of wind turbines and their configuration. A final Alternatives Assessment will incorporate the last three months of the wind monitoring findings and specify the alternative to bring forward to conceptual design. This assessment will be included in the final report described in Milestones 9 and 10 below.

8. Detailed economic and financial analysis (September 1-October 31, 2011)
An economic and financial analysis which examines potential final design and construction costs, operating and maintenance costs, user rates, and other funding mechanisms will be developed.

9. Conceptual design analysis and cost estimate (October 1-December 31, 2011)
The met tower will be dismantled and the Final Wind Resource Report will be finalized by incorporating the last three months of data. A conceptual design and cost estimate will be prepared for the preferred alternative.

10. Final report and recommendations (December 31, 2011)
All of the memoranda and reports written for the project will be combined in a final report and submitted to AEA. The Final Report will include final drafts of the following:

- Land and Regulatory Issues Memorandum
- Environmental and Permitting Memorandum
- Existing and Future Energy Costs and Markets Memorandum
- Transmission/Intertie Feasibility and Conceptual Design
- Conceptual Business Plan
- Conceptual Operating Plan
- Wind Resource Report
- Geotechnical Report
- Alternatives Assessment
- Economic and Financial Analysis
- Conceptual Design Analysis and Cost Estimate

3.4 Project Resources

Describe the personnel, contractors, equipment, and services you will use to accomplish the project. Include any partnerships or commitments with other entities you have or anticipate will be needed to complete your project. Describe any existing contracts and the selection process you may use for major equipment purchases or contracts. Include brief resumes and references for known, key personnel, contractors, and suppliers as an attachment to your application.

AVEC will use a team of AVEC staff and external consultants--a project management approach that has been used to successfully design and construct wind turbines throughout rural Alaska.

AVEC staff and their role on this project includes the following:

- Meera Kohler, President and Chief Executive Officer, will act as Project Executive and will maintain ultimate authority programmatically and financially.
- Brent Petrie, Manager of the Community Development Group, will be the project manager. Together with his group, Brent will provide coordination of the installation of the met tower, geotechnical work, and conceptual design. The group's resources include a project coordinator, contracts clerk, accountant, engineer, and a community liaison. Specific duties of the project manager will include the following:
    - Obtaining site control/access and permits for the installation of the met tower and geotechnical work.
    - Selecting, coordinating, and managing the engineering consultant.
    - Communicating with Kivalina residents to ensure that the community is informed.
- Debbie Bullock, Manager of Administrative Services, will provide support in accounting, payables, financial reporting, and capitalization of assets in accordance with AEA guidelines.

Contractors for this project will include the following:

- <u>Engineering consultant.</u> AVEC will employ an engineering consultant who will:
    - o Provide wind resource assessment services including installation of the met tower, operation and maintenance of the met tower, and a draft wind resource report.
    - o Provide Feasibility Analysis, Wind Resource Assessment, and Conceptual Design of a Kivalina-DMTS Port intertie and wind generation facilities in the vicinity of Kivalina.
    - o Provide business and operational models for Public/Private Partnership (PPP) relationship.
    - o Supervise geotechnical investigation and draft the geotechnical report.

- Provide final feasibility and conceptual design report.

Selection Process for Contractors: The engineering consultant selection will be based upon technical competencies, past performance, written proposal quality, cost, and general consensus from the technical steering committee. The selection of the consultant will occur in strict conformity with corporate procurement policies, conformance with OMB circulars, and DCAA principles.

There is interest by all parties to develop wind energy in the general area of the port site for the benefit of Kivalina. The proposed roles and responsibilities include the following:

- **AVEC Role.** Alaska Village Electric Cooperative (AVEC) is the Regulatory Commission of Alaska recognized power provider in Kivalina. The concept includes AVEC buying power from Red Dog Mine (DMTS) Port (operator) and then retailing power to the community of Kivalina through a transmission line from the port to Kivalina. AVEC would own and operate the transmission line and maintain back-up/emergency power in Kivalina in the event of power disruption. AVEC would also own and operate any wind generation in the vicinity of Kivalina.

- **TECK Role.** Teck Alaska would maintain the existing operating arrangement at the port. Through a power purchase agreement, Teck would provide power to AVEC.

- **NANA Regional Corporation (NRC) Role.** NRC will help facilitate the concept, negotiate the arrangement, and provide technical services as needed. NRC can also provide land for installation of wind turbines.

3.5 Project Communications

Discuss how you plan to monitor the project and keep the Authority informed of the status.

AVEC will assign a project manager to the project who will compile periodic progress reports for use by the Alaska Energy Authority. Weekly and monthly project coordination meetings will be held with the project team to track progress and address issues as they arise.

3.6 Project Risk

Discuss potential problems and how you would address them.

Site Control/Access and Permitting. In the NANA Region Strategic Energy Plan, community members expressed support for investigating the potential for wind power. It is expected that the community would support erection of the met tower. Consultation with the U.S. Fish and Wildlife Service would be conducted to comply with the Endangered Species Act. AVEC would work openly with the agency and conduct studies as appropriate.

Weather. Weather could delay geotechnical field work; however, an experienced consultant, familiar with Alaskan weather conditions, will be selected. It is unlikely that a delay in the total project schedule would occur if the field work is delayed. The met tower will be installed to withstand Kivalina’s winter weather conditions. The met tower will be monitored to ensure the met tower is up and functioning.

Logistics. Transport of the met tower to Kivalina will not be difficult, as there is good barge and air access to the community.

SECTION 4 – PROJECT DESCRIPTION AND TASKS

- *Tell us what the project is and how you will meet the requirements outlined in Section 2 of the RFA.*
- ***The level of information will vary according to phase(s) of the project you propose to undertake with grant funds.***
- ***If you are applying for grant funding for more than one phase of a project provide a plan and grant budget form for completion of each phase.***
- *If some work has already been completed on your project and you are requesting funding for an advanced phase, submit information sufficient to demonstrate that the preceding phases are satisfied and funding for an advanced phase is warranted.*

4.1 Proposed Energy Resource

Describe the potential extent/amount of the energy resource that is available.

Discuss the pros and cons of your proposed energy resource vs. other alternatives that may be available for the market to be served by your project.

According to the AEA Alaska high resolution wind resource map, Kivalina is rated as a class 6 wind regime. Correlating NANA's anemometer data from the DMTS Port site, which is in a class 6/7 wind regime, we expect the annual wind resource to be 35% of installed wind turbine capacity. A 200-300 kW wind turbine project can be expected to produce up to an average of 900,000 kWh per year.

Solar power from photovoltaic solar arrays is a potential alternative, but has higher capital cost and lower resource availability than wind in Kivalina.

Woody biomass is not readily available in the area.

Hydroelectric potential is low in the area due to geographic and arctic conditions of the area. Hydrokinetic power generation is possible in the Wulik River, but has not been explored.

Anemometer equipment for measuring the wind resource was installed at the Red Dog Mine Port ("Site 5") in September of 2008. In March of 2009, a preliminary analysis of the wind data was undertaken.

Site 5 is an existing 35 meter communication tower located approximately 3.5 kilometers from the Chukchi Sea at the DMTS Port of the Red Dog Mine. The general area of the tower was selected during a reconnaissance visit in August 2008 as a potential wind power site for the port facility and potentially for Red Dog Mine itself someday. Data collected to date (5.4 months of data) indicates superb potential for wind power development at this site. The following data points were taken:

- Wind power class: Class 7 (predicted, to date)
- Wind speed average: (33 meters) 7.76 m/s (to date)
- Maximum two second wind gust: 23.1 m/s (October 2008)
- Wind power density: (33 meters) 1,247 W/m2
- Weibull distribution parameters: (k = 1.13, c = 8.10 m/s)
- Roughness Class: 1.18 (description: fallow field)
- Power law exponent: 0.152 (moderate wind shear)
- Frequency of calms: (4 m/s threshold) 39%
- Representative Turbulence Intensity: 0.090 (IEC 3rd ed. turbulence category C-)

Port of Red Dog (DMTS Port) Site 5 winds during the measurement periods were highly directional northeast and southeast (refer to the frequency rose). Interestingly though, the southeast winds are much stronger than the northeast winds (refer to the mean value rose), resulting in a power density wind rose that is dominated by southeast winds.

4.2 Existing Energy System

4.2.1 Basic configuration of Existing Energy System

Briefly discuss the basic configuration of the existing energy system. Include information about the number, size, age, efficiency, and type of generation.

AVEC currently provides power to the community of Kivalina with a diesel generator. The power plant includes three generator sets with a combined capacity of 950 kW. Detail of each generator follows:

Type	kW	Age
DD	363	1 year
Cat	337	32 years
CMS	250	2 years

AVEC data indicates that the peak demand in Kivalina in 2007 was 283 kW. Average demand over the same period was approximately 145 kW. The power plant generated 13.04 kWh for each gallon of fuel consumed in 2007. Note that the DD 363kW unit was installed in 2009 which replaced an older unit operating in FY2007.

Both the DMTS Port and the community of Kivalina use diesel fuel for power generation. Both Kivalina and the DMTS generating systems are due for major upgrades. The DMTS power plant could be upgraded; however, the Kivalina powerplant cannot be upgraded for additional power output due to the age and space available in the facility.

4.2.2 Existing Energy Resources Used

Briefly discuss your understanding of the existing energy resources. Include a brief discussion of any impact the project may have on existing energy infrastructure and resources.

Kivalina and the DMTS Port use diesel and heating oil as the primary energy resources. If this study finds the construction of an intertie and wind generation suitable, installation of wind turbines in the vicinity of Kivalina and at the DMTS Port would decrease the amount of diesel fuel used for power generation and lower costs of electricity for both locations.

The existing power plants in both Kivalina and Red Dog Mine port produce electrical energy by burning diesel fuel in engine-driven generators. By adding wind turbines to the existing system, we expect the project to provide the same amount of electrical energy using substantially less diesel fuel than is true today. In addition to offsetting much of the diesel-generated electricity, we also expect to use whatever wind-generated energy that exceeds electrical demand to heat water, further displacing diesel fuel that is presently burned in boilers.

4.2.3 Existing Energy Market

Discuss existing energy use and its market. Discuss impacts your project may have on energy customers.

Kivalina Energy Market

Kivalina is located in Northwest Alaska on the Chukchi Sea. Average temperatures range from 15 to 57°F. 26.4 percent of the population is below the poverty line; the median household income is $30,833 which is half of the State's average of $59,036. The community has been designated a "distressed community" by the Denali Commission.

The electricity consumption in Kivalina in 2008 was 1,158,987 kWh. The load is highest during the winter months, with the bulk of electricity consumed by residences and the school. If this study finds that winds are suitable, the addition of wind turbines to the electric generation system could reduce the amount of diesel fuel used for power generation and for heating. The study will also determine if an intertie to the DMTS Port with wind generation could substantially reduce the cost of electricity in Kivalina.

Kivalina is an isolated village, relying on air transportation for delivery of medical goods and transport of sick or injured individuals. Reliable electric service is essential to maintaining vital navigation aids and runway lights for the safe operation of aircraft. Emergency medical service is provided in a health clinic by a health aide. Medical problems and emergencies must be relayed by telephone or by some other communication means for outside assistance. Operation of the telephone system requires electricity. Reliable telephone service requires reliable electric service.

In Kivalina, water is obtained from the Wulik River, then treated and stored in a large insulated tank. Only the school is connected to a piped water and sewer system, and reliable electric service is required to ensure that pipes do not freeze in the winter. A washeteria and water dispenser are available to Kivalina residents.

Like all of Alaska, Kivalina is subject to long periods of darkness. Reliable electric service is essential for the operation of home lighting, streetlights, and security lighting. Outside lighting ensures the safety of children.

Public-Private Partnership (PPP) Opportunity

Kivalina is located 17 miles northwest of the DMTS Port which is operated by Teck Alaska and services the Red Dog Mine. The DMTS Port power system has a diesel power plant which burns fuel purchased at a large bulk discount due to the high annual fuel consumption of the Red Dog Mine. The excellent wind resource in the area can decrease the cost of energy for both entities.

The creation of a PPP between AVEC and Teck Alaska can be beneficial to both parties with regard to reducing electricity costs and creating possible tax credits, "green tags," and "CREB"s (Clean Renewable Energy Bonds). This study will further explore the PPP opportunity.

4.3 Proposed System

Include information necessary to describe the system you are intending to develop and address potential system design, land ownership, permits, and environmental issues.

4.3.1 System Design

Provide the following information for the proposed renewable energy system:

- A description of renewable energy technology specific to project location
- Optimum installed capacity
- Anticipated capacity factor
- Anticipated annual generation
- Anticipated barriers
- Basic integration concept
- Delivery methods

Alternative Energy Technology and Renewable Energy Transmission. AVEC plans to conduct a

Feasibility Analysis, Wind Resource Assessment, and Conceptual Design to assess the possibility of an intertie with the DMTS Port and wind generation along the intertie.

Optimum installed capacity/Anticipated capacity factor/Anticipated annual generation. The purpose of this work is to gather background information to plan a future alternative energy facility. The capacity is unknown at this time.

Anticipated barriers. The potential barriers to success of this project include site access, permitting, and weather. The barriers are minor and do not pose a threat to the completion of this project or tasks which must be accomplished.

Basic integration concept/Delivery methods. Conceptual design, to be completed as a part of this project, will detail how power from a wind turbine would be integrated and delivered into the existing system. If the wind is suitable for development, the turbines will interconnect with the power plant. It is expected that wind-generated electrical energy will be delivered via a transmission line of intertie with the DMTS Port.

4.3.2 Land Ownership

Identify potential land ownership issues, including whether site owners have agreed to the project or how you intend to approach land ownership and access issues.

The proposed location of the met tower and geotechnical work and routing of the intertie will be determined during this study.

To obtain permission to place met towers and complete geotech work, AVEC will travel to the community immediately following the Authorization to Proceed from AEA. AVEC will discuss the project with community members and representatives from the City of Kivalina and the Native Village of Kivalina.

4.3.3 Permits

Provide the following information as it may relate to permitting and how you intend to address outstanding permit issues.

- List of applicable permits
- Anticipated permitting timeline
- Identify and discussion of potential barriers

Consultation with the U.S. Fish and Wildlife Service in compliance with the Endangered Species Act will be required to install the met tower. AVEC will work with the agency to ensure that the requirements of the Act are met, while allowing for the success of the project.

An U.S. Army Corps of Engineers Wetlands Permit may be needed for the geotechnical work. The Corps has a “Nationwide Permit” for survey work, including geotechnical field work. This permit usually takes no more than three weeks to obtain.

(Because a Corps’ Nationwide Permit exists, a State of Alaska Department of Natural Resources, Division of Coastal and Ocean Management Coastal Project Questionnaire and Enforceable Policies Consistency Determination is not needed.)

The DMTS intertie component of the project will need to comply with any National Park Service National Monument permits which are unknown at this time. The DMTS Port lies within the Cape Krusenstern National Monument. This project will identify what the procedures would be to construct an intertie on Cape Krusenstern National Monument lands to connect to the Port.

4.3.4 Environmental

Address whether the following environmental and land use issues apply, and if so how they will be addressed:

- Threatened or Endangered species
- Habitat issues
- Wetlands and other protected areas
- Archaeological and historical resources
- Land development constraints
- Telecommunications interference
- Aviation considerations
- Visual, aesthetics impacts
- Identify and discuss other potential barriers

The purpose of this work is to gather background information to plan for future wind turbines and a renewable energy transmission line/intertie. A met tower will be installed, and geotechnical field work will be completed. As stated above, compliance with the Endangered Species Act will be needed. Also a U.S. Army Corps of Engineers Wetlands Nationwide Permit may be needed to conduct geotechnical work, depending on if the work is located within wetlands. Further work to comply with other environmental laws, including the National Environmental Policy Act (if federal funding is sought for construction), the Clean Water Act (for work in wetlands), and the National Historic Preservation Act, would be conducted during the next stage of development, if the economics and wind resource are suitable for moving forward with the installation of an intertie and turbines.

AVEC will obtain permission to place the met tower and conduct geotechnical fieldwork from the land owner as a part of this project. The community has supported this project in the past, and it is not expected that a right of entry will problematic. Further work to obtain a long term lease will be needed if the study finds that the wind turbines are feasible.

Environmental Review and Due Diligence Approach. AVEC's consultant will organize a pre-application meeting to be coordinated with the ADNR, OC&OM office for the project. All agencies, including federal agencies, will be asked to participate. The meeting will identify and discuss appropriate permit issues and provide agency perspective on the proposed development. Discussions will include actions to avoid, minimize, and mitigate wetlands impacts. Possible compensation for wetlands loss will also be discussed. Preliminary concerns for impacts to the National Preserve and possible cultural sites will be identified. Results of this agency pre-application meeting will be a 3-5 page meeting report summarizing agency concerns, issues, and possible mitigation or compensation proposals. This will be as comprehensive as possible but may not identify all permits required for project development given the preliminary nature of the development proposal.

The following permits and/or authorizations will be necessary for installation of a wind farm, at a minimum, and will be reviewed and discussed in the report:

- USACE Section 404/401 Wetlands Permit and Water Quality Assurance
- ADNR, OC&OM Coastal Zone Consistency Determination
- Title 16 Fish Habitat Permit
- SHPO "No Historic Properties Affected"
- Storm Water Pollution Prevention Plan
- Alaska Pollutant Discharge Elimination System
- Vegetation Clearing Not Permitted between May 20 and July 20, except for black scoter

habitat where the end of the avoidance period is August 10

4.4 Proposed New System Costs and Projected Revenues
(Total Estimated Costs and Projected Revenues)

The level of cost information provided will vary according to the phase of funding requested and any previous work the applicant may have done on the project. Applicants must reference the source of their cost data. For example: Applicants Records or Analysis, Industry Standards, Consultant or Manufacturer's estimates.

4.4.1 Project Development Cost

Provide detailed project cost information based on your current knowledge and understanding of the project. Cost information should include the following:

- Total anticipated project cost, and cost for this phase
- Requested grant funding
- Applicant matching funds – loans, capital contributions, in-kind
- Identification of other funding sources
- Projected capital cost of proposed renewable energy system
- Projected development cost of proposed renewable energy system

AVEC plans to conduct a Feasibility Analysis, Wind Resource Assessment, and Conceptual Design to assess the possibility of using wind power via transmission/intertie line in Kivalina. This work will cost $193,000. AVEC requests $183,350 from AEA. AVEC will provide $9,650 as cash contribution.

If the wind resource and intertie prove suitable, the next phase of this project would be Final Design and Permitting. Although it is difficult to determine without an assessment of the resource and what type, size, and number of turbines would be needed, AVEC expects that Final Design and Permitting would cost $2,000,000. It is possible that the funding for this work could come from the AEA Renewable Energy Program, the Denali Commission, a USDA Rural Utility Service program, or another grant program.

The final phase of this project would be Construction and Commissioning. AVEC estimates that this phase could cost $20,000,000. It is possible that the funding for this work could come from the AEA Renewable Energy Program, the Denali Commission, AIDEA, a USDA Rural Utility Service program, or another grant program.

4.4.2 Project Operating and Maintenance Costs

Include anticipated O&M costs for new facilities constructed and how these would be funded by the applicant.
(Note: Operational costs are not eligible for grant funds however grantees are required to meet ongoing reporting requirements for the purpose of reporting impacts of projects on the communities they serve.)

The met tower will require monthly monitoring and data management. It is expected that this will cost $700. The cost will be funded by this grant award.

4.4.3 Power Purchase/Sale

The power purchase/sale information should include the following:

- Identification of potential power buyer(s)/customer(s)
- Potential power purchase/sales price - at a minimum indicate a price range
- Proposed rate of return from grant-funded project

AVEC, the existing electric utility serving Kivalina, is a member owned cooperative electric utility and typically owns and maintains the generation, fuel storage, and distribution facilities in the villages it serves.

Kivalina includes 93 households and 7 community facilities, including a health clinic, city office, tribal council office, and water treatment plant, which purchase power from AVEC (source: FY2008 PCE data).

At this point in project development, the potential power price and rate of return on the project is unknown.

This project concept is predicated upon a power purchase agreement between Teck Alaska (current DMTS operator) and AVEC. Teck will be the producer and AVEC will retail the power and energy to Kivalina and maintain the transmission line.

The power purchase agreement will be based upon the cost to produce energy plus an AVEC surcharge for retailing power and maintaining the power purchase agreement. The following scenarios are plausible ranges for the terms of a power purchase agreement.

- *Base-case diesel fuel cost scenario ($4.18/gallon):* A one-turbine wind-diesel system, with a total wind generation capacity of 1.65 MW, was modeled for a diesel fuel cost of $4.18/gallon ($1.10/liter). HOMER estimates a net present cost (NPC) of $40,593,236 for this wind-diesel configuration, resulting in a cost of energy (COE) of **$0.282/kWh**. The diesel-only generation scenario at a fuel cost of $4.18/gallon would result in an NPC of $51,225,664 and a COE of **$0.356/kWh**. This cost savings of $0.074/kWh would translate to an annual cost savings of $832,448 (assuming 11,249,297 kWh of annual consumption). With an initial capital cost of $4,200,000, these annual cost savings would result in a simple payback of **5.0 years**.

- *High diesel fuel cost scenario ($5.70/gallon):* At a diesel fuel cost of $5.70/gallon ($1.50/liter), HOMER estimates a NPC of $52,957,984 for a 1.65 MW wind-diesel configuration, resulting in a COE of **$0.368/kWh**. The diesel-only generation scenario at a fuel cost of $5.70/gallon would result in an NPC of $68,925,808 and a COE of **$0.479/kWh**. This cost savings of $0.111/kWh would translate to an annual cost savings of $1,248,672 (assuming 11,249,297 kWh of annual consumption). With an initial capital cost of $4,200,000, these annual cost savings would result in a simple payback of **3.4 years**.

4.4.4 Project Cost Worksheet

Complete the cost worksheet form which provides summary information that will be considered in evaluating the project.

See attached.

SECTION 5– PROJECT BENEFIT

Explain the economic and public benefits of your project. Include direct cost savings, and how the people of Alaska will benefit from the project.

The benefits information should include the following:

- Potential annual fuel displacement (gal and $) over the lifetime of the evaluated renewable energy project
- Anticipated annual revenue (based on i.e. a Proposed Power Purchase Agreement price, RCA tariff, or cost based rate)
- Potential additional annual incentives (i.e. tax credits)
- Potential additional annual revenue streams (i.e. green tag sales or other renewable energy subsidies or programs that might be available)
- Discuss the non-economic public benefits to Alaskans over the lifetime of the project

Potential Fuel Displacement: The possible displacement of diesel fuel used for village power generation in Kivalina will be determined. More displacement of fuel is possible if electric heating is used instead of heating fuel. The exact amount of fuel displacement at this point in the project is not known.

Potential annual fuel displacement: In 2008, AVEC spent an average of $4.43 per gallon for the fuel for power generation. If the wind resource proves suitable and turbines are installed, the residents of Kivalina would benefit from decreased fuel use; however, at this point in the project the amount of fuel displacement is unknown. If an intertie proves suitable between Kivalina and the DMTS Port fuel would only be needed for back up purposes.

Anticipated annual revenue/Potential additional annual incentives/Potential additional annual revenue streams. Because this project is in the feasibility and concept design stage, revenue and incentives are unknown.

Non-economic public benefits. If wind energy and an intertie are feasible in Kivalina and wind turbines are installed in the vicinity of the community, energy costs could stabilize and long-term socio-economic benefits could result. Wind power would have many environmental benefits resulting from a reduction of hydrocarbon use, including reduced potential for fuel spills or contamination, improved air quality, and decreased contribution to global climate change from fossil fuel use.

The HOMER analysis was redone for DMTS Port the two-turbine wind-diesel system, with the addition of the electric load of the nearby village of Kivalina (1,247,209 kWh annual load, 260 kW peak). Power generation statistics of Kivalina used for the HOMER model were estimated from the 2006 end-of-year report by the Alaska Village Electric Cooperative (AVEC). The addition of the Kivalina load resulted in no significant difference in the cost of electricity produced by the wind-diesel system, for each of the three fuel-cost scenarios modeled above ($0.232/kWh, $0.269/kWh, and $0.343/kWh respectively). This is chiefly due to the fact that Kivalina’s electricity demand peaks in the winter, while the port’s demand peaks in summer. Therefore, the addition of the village load will have no negative impact on the economics of a wind-diesel installation of the Red Dog Port, and simply provides a slightly higher overall capacity factor (and slightly more diesel fuel consumption) for the wind-diesel system, and slightly balances year-round demand trends. Overall, the annual electric energy consumption of Kivalina is about 11% that of the port’s annual consumption.

While generation costs at the Red Dog Port will not change significantly with the additional village load, the cost of a power line between the port and Kivalina (a distance of about 20 miles) is not included in the HOMER model. According AVEC's 2007-2008 rate schedules, the pre-subsidy residential electric rate charged in Kivalina by AVEC was $0.5814/kWh, of which $0.32/kWh was the "base rate" and $0.2614/kWh was the "cost of fuel." For a power line from the port to be economic, the cost of power generated at the Red Dog Port delivered to Kivalina must be lower than the generation-only cost of power from AVEC's existing diesel power plant in the village. If the wind-diesel installation at the port were to sell, via an intertie, 1,200,000 kWh of electricity per year to Kivalina at cost based on the rates predicted by the HOMER models, the revenues/simple payback are shown in the table below:

Diesel cost ($/gallon)	Cost of electricity generated ($/kWh)	Annual revenues of power sales to Kivalina (at cost, 1,200,000 kWh)	Annual benefit (savings+revenue)	Simple payback (of $7,700,000 installation cost)
4.18	0.269	$322,800	$1,372,702	5.6 years
5.70	0.343	$411,600	$2,076,962	3.7 years

As the table above shows, the sales of electricity (generated by both wind and diesel) to Kivalina would improve the economics of a wind-diesel installation at the port.

SECTION 6– SUSTAINABILITY

Discuss your plan for operating the completed project so that it will be sustainable.

Include at a minimum:

- Proposed business structure(s) and concepts that may be considered.
- How you propose to finance the maintenance and operations for the life of the project
- Identification of operational issues that could arise.
- A description of operational costs including on-going support for any back-up or existing systems that may be require to continue operation
- Commitment to reporting the savings and benefits

Business plan structures and concepts which may be considered: The wind turbines and intertie, if feasible, would be incorporated into AVEC's power plant operation. Local plant operators provide daily servicing. AVEC technicians provide periodic preventative or corrective maintenance and are supported by AVEC headquarters staff, purchasing, and warehousing.

How O&M will be financed for the life of the project: The costs of operations and maintenance will be funded through ongoing energy sales to the villages.

Operational issues which could arise: There are no known operational issues. TBD.

Operating costs: AVEC's existing NW100 wind turbines at other sites require two maintenance visits a year. Those visits currently cost AVEC $3,500 per turbine per year. The new Northwind 100 model requires only one maintenance visit each year. Therefore, two turbines at Kivalina will require a combined annual maintenance cost of $3,500.

Commitment to reporting the savings and benefits: AVEC is fully committed to sharing the savings and benefits information accrued from this project with their shareholders and AEA. In addition, AVEC acknowledges and agrees that if/when the wind-intertie is constructed, it shall be constructed, owned, and operated for the benefit of the general public and will not deny any person use and/or benefit of project facilities due to race, religion, color, national origin, age, physical handicap, sex, marital status, changes in marital status, pregnancy or parenthood.

SECTION 7 – READINESS & COMPLIANCE WITH OTHER GRANTS

Discuss what you have done to prepare for this award and how quickly you intend to proceed with work once your grant is approved.

Tell us what you may have already accomplished on the project to date and identify other grants that may have been previously awarded for this project and the degree you have been able to meet the requirements of previous grants.

In recent years, AVEC's investment in Kivalina's utility infrastructure has been minimal due to the ongoing coastal erosion and community relocation unknowns. To meet energy needs while keeping these barriers in mind, AVEC has begun researching alternative energy sources for the area. Looking at the existing wind maps, we see that both Kivalina and DMTS Port are excellent wind resources. The wind resources and the large industrial complex nearby (DMTS Port) present two opportunities for AVEC to reduce the cost of energy in Kivalina. An intertie between Kivalina and the DMTS Port would provide a means of accessing wind power for Kivalina and a possibly more economic power supply from the DMTS Port. Recognizing this as a good option for the area, AVEC has initiated discussions with key organizations that would need to be on board for this project to be successful: Teck Alaska, AIDEA, NANA Regional Corporation, and representatives from Kivalina. Because this foundation has been laid, work on this grant can proceed immediately on this feasibility and conceptual design project.

No other grants have been awarded on this project. AVEC has been awarded several Denali Commission grants for the feasibility, design and construction of interties and wind generation. A successful, grant-funded intertie/wind project linking the communities of Toksook Bay, Nightmute and Tunuunak has afforded AVEC significant project experience that will be beneficial to Kivalina. This feasibility study and conceptual design will combine the knowledge gained in AVEC's other wind/intertie projects to determine the best means of developing the Kivalina wind resource and an intertie to the DMTS Port.

SECTION 8– LOCAL SUPORT

Discuss what local support or possible opposition there may be regarding your project. Include letters of support from the community that would benefit from this project.

AVEC has developed a foundation of support for the project. Key supporters are described below:

- AVEC – AVEC seeks to reduce energy costs for its members through the most economical means. Interties and wind power in other AVEC communities have been proven to help reduce energy costs. It is the goal of AVEC to explore the feasibility and the conceptual design of an intertie with the DMTS Port with wind power generation.
- NANA Regional Corporation – NANA supports projects that will help reduce the cost of energy for their shareholders. NANA is committed to assisting with this project to determine if the wind –intertie project will provide a viable energy source for Kivalina.
- Teck Alaska- As the operator of the DMTS Port and the Red Dog Mine, Teck Alaska seeks means of reducing operating costs. The Port has an excellent wind resource (assessed to be a Class 7) and seeks to utilize it with the right economic conditions. Generating and retailing power to Kivalina through an intertie could help improve the economics of a project and benefit both Kivalina and Teck with lower energy costs.

AVEC has not faced any opposition to the project at this stage of resource identification. This feasibility study and conceptual design project will examine what opposition and support there is for a constructed project. In addition to working with the partners described above to identify and address concerns that could lead to opposition, AVEC will also conduct community meetings to gauge village-level opposition and support of the proposed concept. AVEC is committed to ensuring a positive process as well as an effective outcome.

SECTION 9 – GRANT BUDGET

Tell us how much you want in grant funds Include any investments to date and funding sources, how much is being requested in grant funds, and additional investments you will make as an applicant.

Include an estimate of budget costs by milestones using the form – GrantBudget3.doc

AVEC plans to conduct a Feasibility Analysis, Wind Resource Assessment, and Conceptual Design to assess the possibility of using wind power and a renewable energy transmission line/intertie. This work will cost $193,000. AVEC requests $183,350 from AEA. AVEC will provide $9,650 as cash contribution.

A detail of the grant budget follows. Also, please see Tab 4.

Milestone	Grant Request	AVEC Cash Match	Total Cost
1. Project scoping and contractor solicitation	$1,900	$100	$2,000
2. Detailed energy resource analysis	$9,500	$500	$10,000
3. Identification of land and regulatory issues	$6,650	$350	$7,000
4. Permitting and environmental analysis	$9,500	$500	$10,000
5. Detailed analysis of existing/future energy costs and markets	$9,500	$500	$10,000
6. Conceptual business and operations plans	$14,250	$750	$15,000
7. Assessment of alternatives	$80,750	$4,250	$85,000
8. Detailed economic and financial analysis	$14,250	$750	$15,000
9. Conceptual design analysis and cost estimate	$34,200	$1,800	$36,000
10. Final report and recommendations	$2,850	$150	$3,000
TOTALS	**$183,350**	**9,650**	**$193,000**

SECTION 9 – ADDITIONAL DOCUMENTATION AND CERTIFICATION
SUBMIT THE FOLLOWING DOCUMENTS WITH YOUR APPLICATION:

A. **Resumes of Applicant's Project Manager, key staff, partners, consultants, and suppliers per application form Section 3.1 and 3.4.**

B. **Cost Worksheet per application form Section 4.4.4.**

C. **Grant Budget Form per application form Section 9.**

D. **Letters demonstrating local support per application form Section 8.**

E. **An electronic version of the entire application on CD per RFA Section 1.6.**

F. **Governing Body Resolution or other formal action taken by the applicant's governing body or management per RFA Section 1.4 that:**

- **Commits the organization to provide the matching resources for project at the match amounts indicated in the application.**
- **Authorizes the individual who signs the application has the authority to commit the organization to the obligations under the grant.**
- **Provides as point of contact to represent the applicant for purposes of this application.**
- **Certifies the applicant is in compliance with applicable federal, state, and local, laws including existing credit and federal tax obligations.**

F. **CERTIFICATION**

The undersigned certifies that this application for a renewable energy grant is truthful and correct, and that the applicant is in compliance with, and will continue to comply with, all federal and state laws including existing credit and federal tax obligations.	
Print Name	Meera Kohler
Signature	
Title	President and CEO
Date	November 10, 2009

Tab 2

Resumes

ALASKA VILLAGE ELECTRIC COOPERATIVE, INC.
KEY MANAGEMENT BIOGRAPHIES

Meera Kohler
President and CEO

Meera Kohler has more than 25 years of experience in the Alaska electric utility industry. She was appointed Manager of Administration and Finance at Cordova Electric Cooperative in 1983, General Manager of Naknek Electric Association in 1990, and General Manager of Municipal Light & Power in Anchorage, in late 1997.

Since May 2000, Ms. Kohler has been the President and CEO of Alaska Village Electric Cooperative, headquartered in Anchorage, Alaska. AVEC employs approximately 77 employees and serves more than 7,200 consumers located in 52 communities throughout Alaska, encompassing one third of Alaska's rural population.

Meera Kohler's credentials consist of a Bachelor's degree in Economics and a Master's degree in Business Administration from the University of Delhi, India.

Mark Teitzel
Vice President / Manager, Engineering

Mark Teitzel's' employment with Alaska Village Electric Cooperative began in 1980 as the Manager of Engineering. In 1985 he was promoted to Vice President of Engineering. Mr. Teitzel has experience with planning short and long range electrical distribution systems serving approximately 7500 meters, and has also performed power requirement studies, and designed system extensions and improvements.

Mark Teitzel coordinates the development of departmental operating policies and procedures, and is also responsible in developing future AVEC projects. He acts as liaison with the Alaska Division of Energy, USDA Rural Utilities Service and other governmental authorities.

Mr. Teitzel holds a Master's in Business Administration, a Bachelor of Science degree, and also graduated with an Arctic Engineering and Arctic Utility Distribution Systems. He is also a Licensed Professional Engineer in the states of Alaska and Idaho.

Mark Bryan
Manager of Operations

Mark Bryan supervises the cooperative's line operations, generation operations and all field construction programs. He has worked at Alaska Village Electric Cooperative since 1980, was appointed Manager of Construction in May 1998 and was promoted to Manager of Operations in June 2003.

Mr. Bryan previously held a position as a field plant instructor where he supervised the installation of diesel generators and hydronic systems. He has also assisted in the calibration of new generator installations, and designed and installed special research and development projects for the construction department.

Mr. Bryan is a Certified Journeyman Electrician. He attended American Diesel College, and is educated in many different areas including fire safety, electrical distribution systems, and hazardous waste operations and emergency responses.

Debbie Bullock
Manager of Administrative Services

Debbie Bullock is the Manager of Administrative Services at Alaska Village Electric Cooperative. Ms. Bullock has been employed with AVEC since 1993 and is responsible for all administrative and financial records of the cooperative. She is responsible for preparing USDA-RUS reports, Regulatory Commission of Alaska rate filings, financial forecasts, budgets and Power Cost Equalization reports as well as overseeing the day-to-day office operations.

Ms. Bullock has worked for previous employers as office manager, bookkeeper, and has held a tax internship where she prepared individual, partnership and corporate tax returns.

Ms. Bullock has a BBA in Accounting and has attended various specialized training programs in her area of expertise including National Rural Electric Cooperative Association's management internship program.

Brent Petrie
Manager, Community Development and Key Accounts

Brent Petrie has worked for Alaska Village Electric Cooperative since 1998, where he manages the development of alternatives to diesel generation for AVEC such as using hydro, wind or heat recovery. He also manages relationships with AVEC's largest customers and is the project manager for AVEC's many construction projects as an energy partner of the federally funded Denali Commission.

Mr. Petrie has been employed in the energy and resource field for more than thirty years, having worked for the federal and state governments as consultant, planner and project manager. He has been a utility manager or management consultant since 1993. As General Manager of Iliamna-Newhalen-Nondalton Electric Cooperative from 1994 to 1998, he reported to a seven-member, elected board of directors, and served as project manager on its hydroelectric project development. He is an elected member of the Board of Directors of the Utility Wind Interest Group representing rural electric cooperatives and serves on the Power Supply Task force of the National Rural Electric Cooperative Association.

Mr. Petrie has a Master's Degree in Water Resource Management, and a Bachelor's degree in Geography.

Georgia Shaw
Manager of Member Services

Georgia Shaw has been employed with Alaska Village Electric Cooperative since April 1979 and is currently the Manager of Member Services. She is responsible for consumer relations, education, and monthly electric billings. She also handles the collection and disconnection proceedings and maintains the utility's electric tariff.

Ms. Shaw began her career with AVEC as an Accounts Payable Bookkeeper, and also has worked as a General Ledger Bookkeeper. Ms. Shaw has been responsible for entering monthly and fixed journal entries, assisted in the annual audit and also receiving and recording all vendor invoices.

She attended Schiller College in Heidelberg, Germany and also attended Anchorage Community College and University of Alaska Anchorage where she studied Accounting, Business Management and Business Law.

BRIAN B. YANITY, EIT
Electrical Designer

PROFESSIONAL EDUCATION
2007 M.S. in Arctic Engineering, University of Alaska Anchorage, Anchorage, AK
2006 B.S. in Electrical Engineering, Columbia University New York, NY
2004 B.A. in Physics, Bard College, Annandale-on-Hudson, NY
Additional education: Project Management, Engineering Management, Engineering Economy

Professional Affiliations
IEEE Power and Energy Society
International Network on Small Hydropower (IN-SHP)
European Small Hydropower Association
American Association for the Advancement of Science

Professional Conference Presentations
- ✓ "A review of regional small hydropower development strategies involving proposed international transmission lines connecting Alaska to Canada", Small Hydro 2009 conference, Vancouver, Canada, April 2009.
- ✓ "In-Stream River Energy Panel", 2008 Alaska Federation of Natives Convention, Anchorage, Alaska, October 2008.
- ✓ "Small Scale-Hydro in Girdwood", 2008 Alaska Rural Energy Conference, Girdwood, Alaska, September 2008.
- ✓ "Cold Climate Problems of a Micro-Hydroelectric Development on Crow Creek, Alaska", Arctic Energy Summit, Anchorage, Alaska, October 2007.
- ✓ "EPRI's Tidal Energy Feasibility Project in Cook Inlet", 2005 Alaska Rural Energy Conference, Valdez, Alaska, September 2005.

PROFESSIONAL SUMMARY
Brian Yanity is an electrical designer in renewable energy development projects, focusing on village-scale projects for rural Alaska. In particular, for the past several years Brian has worked on a variety of projects in the small-scale hydropower, wind, tidal, wood biomass and geothermal energy. He has also been involved in evaluation for multi-use facility program for the Denali Commission, as well as electric transmission line studies and policy review.

PROFESSIONAL EXPERIENCE

- ***Geothermal Energy Resource Assessment Project – Northwest Arctic Borough, Alaska.*** This project consisted of research and evaluation of geothermal energy resources.
- ***Wind Energy Resource Assessment Project – Northwest Borough, Alaska.*** This project consisted of installation of wind-measurement towers in the Northwest Arctic Borough, Alaska communities, and collection of wind data.
- ***Denali Commission Alaska Electric Transmission Study Line – Various Locations, Alaska.*** Brian was the project engineer for technical, economic, and policy evaluation of proposed electric transmission lines across the state of Alaska.

- ***NANA Region Strategic Energy Plan – Northwest Arctic Borough, Alaska.*** This project consisted of research, feasibility assessment/analysis of energy sources and energy efficiency/conservation strategies for the NANA region/Northwest Arctic Borough, Alaska.
- ***Feasibility and Planning Studies – Various Locations, Alaska.*** This project consisted of feasibility and planning studies for energy projects in the Northwest Arctic Borough, Alaska. It also included renewable energy (wind, geothermal) feasibility studies, evaluation of multi-use facility program for the Denali Commission.
- ***Denali Commission Multi-Use Facility Evaluation.*** This project consisted of review of community multi-use facilities in rural Alaskan communities, including an inspection visit to a Denali Commission-funded youth center in Tuluksak.
- ***ANTHC Electrical Short Circuit and Protective Coordination – Anchorage, Alaska.*** As-built the entire Alaska native Tribal Health Consortium distribution system from the utility services down to the 200+ distribution panels. Using the as-built information, preformed a coordination study to establish the adjustable circuit breaker and ground fault settings. From the short circuit calculations and the coordination study, established the required PPE for each piece of distribution equipment and provide the required specific PPE warning labels for each piece of distribution equipment.
- ***MOA Public Transit Department – Anchorage, Alaska.*** This job consisted of GIS-based studies of transportation corridors and transit service.
- ***Four Dam Pool Power Agency – Anchorage, Alaska.*** Brian assisted with the operation and maintenance of four hydroelectric plants in Alaska.
- ***University of Alaska Anchorage – Anchorage, Alaska.*** Brian was a teaching assistant for the School of Engineering's fluid mechanics laboratory, including operation of hydraulic research flume.
- ***E3, Inc.(energy/environmental consulting) – New York, NY.*** Brian assisted with tidal, micro-hydro, and in-stream hydroelectric energy surveys with related renewable economic analysis.
- ***Columbia Plasma Physics Laboratory – New York, NY.*** Brian was the mechanical and electrical technician for plasma experimental equipment.
- ***UNLV Physics Department – Las Vegas, Nevada.*** Brian assisted in x-ray and neutron diffraction studies of materials under very high pressures.
- ***Sondrestrom Research Facility – Kangerlussuaq, Greenland.*** Brian operated the laser-radar (LIDAR) system for upper-atmosphere studies.

WHPacific

DIANA RIGG, AICP
Senior Environmental Scientist/Planner/Permitting

PROFESSIONAL EDUCATION
M.A./Anthropology/The Ohio State University
B.A./Anthropology/The Ohio State University

PROFESSIONAL REGISTRATIONS
1997/American Institute of Certified Planners

PROFESSIONAL AFFILIATIONS
American Planning Association

PROFESSIONAL SUMMARY
As a Senior Planner and Environmental Scientist, Diana has a detailed and profound knowledge of both environmental and planning processes. She has over twenty years of professional experience with the Alaska Department of Natural Resources and the Alaska Department of Transportation and Public Facilities in applying multiple federal guidelines and regulations in support of projects with local, regional and statewide significance. This experience has led to substantial expertise in dealing with both elected officials and the public.

Diana Rigg also assists with Public Involvement and is responsible for the environmental documentation. Diana will acquire all environmental permits necessary to implement the project and is capable of supplying construction monitoring to insure compliance with permit conditions. Diana spent six years as an Environmental Analyst for ADOT&PF as the responsible party for numerous Environmental Assessments and CE Checklists.

Project Experience

Kaktovik Shareholders Homesite Subdivision. WHPacific designed roads for a new village subdivision. The project included developing environmental documentation and determining which permits are required. Diana acquired the FONSI and all necessary permits.

Chuathbaluk Loop Road. Diana wrote the Environmental Assessment, acquired the FONSI and permits and the project is now in construction.

Wishbone Road - Chickaloon Village. Diana provided environmental documentation and permits for this project which provides improved access to Chickaloon Traditional Village's tribal housing areas. The first portion of the road design project was to resurface .6 miles of an existing gravel road.

Atka Road Upgrades: Diana completed an EA and FONSI for these roads and acquired all permits necessary for construction. The upgrades are currently underway (summer 2009).

Nulato First Addition Subdivision: This new subdivision in Nulato will allow for community expansion away from the floodplain of the Yukon River. It required an EA with a FONSI and permits for gravel extraction from the Yukon River, including a Material Sale Agreement with the Alaska Department of Natural Resources and a USACE Section 404/10 permit. All environmental work was completed in time to obtain sufficient funding to begin construction in 2009.

Stevens Village Local Roads: The EA and FONSI were acquired by WHPacific staff and Diana acquired the necessary permits for implementation. This included preparing an Essential

Fish Habitat determination and a Title 16 permit for material extraction in the Yukon River as well as the USACE Section 404/10 permit. The project will bid in the summer 2009 and construction will begin in 2010.

Noorvik Cemetery Road: This project will provide a dedicated public access to an existing community cemetery. Diana completed public involvement, agency scoping and prepared a draft EA/FONSI for BIA review. Permits required include the USACE Section 404 and a Coastal Zone Consistency Determination as well as a Title 16 Fish Habitat permit. Applications for all permits have been submitted to resource agencies for review.

Ekwok Landfill: Diana prepared a draft Environmental Review pursuant to USDA Rural Utility Service guidelines for an access road and new landfill for Ekwok. The environmental challenge on this project is crossing Klutuk Creek, and staying out of the creek wetlands. Additionally, Diana used a Resource Conservation Service Soils Survey Report to analyze the potential for wetlands both on the access road alignment and at the selected landfill site.

2009 Homer Airport EA – the project involves developing an EA for near term projects that came from a Master Planning effort. Project include a new General Aviation parking apron, a full length parallel taxiway, obstruction removal, and a new, combined, Aircraft Rescue and Fire Fighting (ARFF) Building and Snow Removal Equipment building (SREB).

2009 Dillingham Airport EA – the project will involve developing an EA for near term projects that came from a Master Planning effort when DOT re-activates the project. Projects include new apron space and possibly re-aligning the runway as well as clearing the safety area.

WHPacific

JAY HERMANSON
Project Manager

PROFESSIONAL EDUCATION

2001/M.A./Business Administration, University of Alaska Anchorage
1991/B.S./Arts Management, Washington State University

PROFESSIONAL REGISTRATIONS

Registered Electrical Engineer, Alaska #EE9354
Registered Electrical Engineer, Washington #EE44091

PROFESSIONAL SUMMARY

Jay is the Director of Alternative Energy Solutions for WHPacific's Alaska Operations. He has over 17 years of project management experience in Alaska, international, and rural sectors in the areas of management, infrastructure operation and business planning, economic development, financial analysis and estimating, infrastructure development, and program management, and business (accounting, finance, human resources, strategy, and business planning) competencies. Jay has excellent client support and service skills, able to effectively communicate objectives, maintain positive client rapport, identify client problems, and collaboratively develop appropriate solutions. He was the lead consultant/PI project manager on USAID, Denali Commmission/Department of Energy, EPA, AVEC, and VSW sponsored studies and projects. As a focused communicator, he able to assure client satisfaction, scope congruence, and project stakeholder involvement.

Jay was the Lead Consultant/PI/Project Manager on the USAID, Denali Commission/ Department of Energy, EPA, AVEC and VSW sponsored studies and projects. He is currently managing a regional energy plan, regional wind energy project in NW Alaska, with active involvement from the private sector mining interests and governmental stakeholders. He was also a project manager on a utility scale wind project in Western Montana for feasibility and pre-construction activities. In addition, Mr. Hermanson is managing an alternative energy planning process and geothermal and biomass feasibility study for NW Alaska.

PROFESSIONAL EXPERIENCE

- ***Alternative and Renewable Energy Systems – Anchorage, Alaska.*** Project & Program Development, project management, consulting and technical assistance services for government, non-profit, and private sector clients serving. Projects include renewable energy, rural power generation conceptual studies, needs assessments, permitting, technology management, cost containment studies, accounting audit and compliance, public involvement campaigns, evaluations, program planning, and other management consulting projects. Primary markets include rural power and energy, homeland security, emergency preparedness and response, rural markets, and oil and gas. Coordination with specialty consultants for alternative energy.
- ***Bulk Fuel and Power System Upgrades, Various Locations, Alaska.*** Jay worked under contract with AVEC to assist in the planning and development of rural power systems and bulk fuel upgrades for the above communities. The approach involved working closely with village stakeholders in the sizing of bulk fuel tanks and the diesel power system, planning of design and construction. The approach entailed intricate understanding of the Denali Commission's amalgamated program and careful coordination with stakeholders.

- ***NRC Geothermal Assessment, Northwest Region, Alaska.*** Jay assisted with the geothermal feasibility assessment study for Kotzebue, Granite Mountain and Division Hot Springs. Services included identifying developable geothermal sites, sub-contracting with qualified entities for geophysical and other appropriate areas as the available budget allows, analyzing wind data, writing reports, participating in Regional Stakeholder meetings as requested by NANA Regional Corporation, Traveling to appropriate stakeholder events to represent NRC on Geothermal related issues and coordinating information and opportunities with regional stakeholders.

- ***NRC Wind Assessment, Northwest Region, Alaska.*** Jay is currently providing assistance with the technical support as it relates to wind energy development for the NANA region. The assessments are taking place in Noatak, Ambler, Kivilina and Kiana areas. The types of service are identifying developable wind sites in the above referenced areas, siting available met towers, analyzing wind data, writing reports, participating in Regional Stakeholder meetings as requested by NANA Regional Corporation and coordinating information and opportunities with regional stakeholders.

- ***NRC Energy and Sustain, Northwest Region, Alaska.*** Jay is currently assisting NANA Regional Corporation and other regional stakeholders with technical support as it relates to energy (alternative, natural gas, energy efficiency, sustainable development, etc.) The responsibilities under this contract include representing NANA Regional Corporation at external meetings and events related to energy development, participating in Regional Stakeholder meetings, providing technical support to NRC Sr. Management and Staff as it relates to energy, provide briefing/opinion memos and papers on certain topics as it relates to energy and sustainable development, update the NANA Regional Energy Plan as needed and coordinate information and opportunities with regional stakeholders.

- ***NANA Wind Resource Assessment, Northwest Arctic Borough, Alaska.*** During the summer of 2008 when met towers were installed near three communities: Buckland, Deering and Noorvik, Jay collected wind data for analysis in periodic reports. Plans for collecting wind data in the NANA region communities of Noatak and Ambler are being developed. Jay helped with coordination of weekly planning meetings, development of bi-monthly written reports, development of wind resource assessment monitoring plan in conjunction with client and sub-contractors.

- ***Snowbreeze Development, LLC.*** Wind Farm Development Pre-engineering phase project development, including wind resource assessment.

- ***Red Dog Mine.*** Wind Resource Assessment project manager.

- ***Mining/Industrial (Confidential).*** Wind Resource Assessment project manager.

- ***NW Alaska Biomass Assessment Program.*** Project Manager on integrated biomass assessment project concept.

- ***NANA Regional Corporation.*** Project Manager & Consultant: Development of the NANA Geothermal Power Generation Assessment Program; NANA Wind Power Assessment Program; and the NANA Region Strategic Energy Planning and Energy Options Analysis proposal concepts.

WHPacific

MATTHEW BERGAN, P.E.
Mechanical Engineer

PROFESSIONAL EDUCATION

1997/B.S./Mechanical Engineering/Norwich University, VT

Norwich University Corps of Cadets

PROFESSIONAL REGISTRATIONS

Professional Mechanical Engineer, State of Alaska, License No. ME10572

PROFESSIONAL SUMMARY

Matt Bergan, PE, is a Mechanical Engineer with over 12 years experience. He specializes in renewable energy development projects, focusing on village-scale projects for rural Alaska. In particular, for the past several years Mr. Bergan has worked on a variety of projects in wind power, ad heat systems, monitor and record wind turbine sites, and solar energy systems. His experience includes installation, maintenance and operation of wind power projects. His accomplishments include the development and implementation of health facilities infrastructure replacement and build-out, development and design of $2,100,000 of successfully awarded ARRA Stimulus funded projects.

Mr. Bergan has more than 11 years experience as a mechanical engineer with the Kotzebue Electric Association and most recently with Maniilaq Association. His broad experience includes installation, maintenance and operation of wind power projects, diesel power plant operations and maintenance, and rural health facilities infrastructure replacement and build-out.

PROFESSIONAL EXPERIENCE

- ***Maniilaq Association health facilities – Kotzebue, Alaska.*** Develop and implementation of Maniilaq Association health facilities infrastructure replacement and build-out.
- ***ARRA Stimulus Projects – Kotzebue, Alaska.*** Development and design of $2,100,000 of successfully awarded ARRA Stimulus funded projects for the Maniilaq Health Center.
- ***Wind Power Projects – Kotzebue, Wales and Selawik, Alaska.*** Installed, operated and maintained wind power projects. These were first utility-grade turbines installed in Alaska.
- ***City of Kotzebue - Kotzebue, Alaska.*** Worked in conjunction with the City of Kotzebue to design, engineer, and procure the recently commissioned City-KEA ad-heat system. Revenues from the project are kept in the community this reducing the cost of energy and utilities.
- ***Installation and Maintenance – Kotzebue, Alaska.*** Installed and maintained a supervisory control and data acquisition system (SCADA) to remotely monitor and record the Kotzebue wind turbine site.

- ***Install Solar Energy System – Kotzebue, Alaska.*** Collaborated with the NWABSD to install a 2.8 kW solar energy system at the Alaska Technical Center.

Maniilaq Association, Kotzebue, AK

Capital Projects Director

- Development and implementation of Maniilaq Association health facilities infrastructure replacement and build-out.
- Development and design of $2,100,00 of successfully awarded ARRA Stimulus funded projects for the Maniilaq Health Center in Kotzebue, Alaska.

Kotzebue Electric Assoc., Inc. (KEA), Kotzebue, AK

Project /Mechanical Engineer

- Installed, operated and maintained wind power projects in Kotzebue, Wales and Selawik, Alaska. These are the first utility-grade turbines installed in Alaska.
- Worked in conjunction with the City of Kotzebue to design, engineer, and procure the recently commissioned City-KEA ad-heat system. Revenues from the project are kept in the community this reducing the cost of energy and utilities.
- Installed and maintained a supervisory control and data acquisition system (SCADA) to remotely monitor and record the Kotzebue wind turbine site.
- Collaborated with the NWABSD to install a 2.8 kW solar energy system at the Alaska Technical Center in Kotzebue, Alaska.

1997–1998 Atlantic Orient Corporation, Inc.(AOC) Norwich, VT

Field Service Engineer

- Updated and revised an outmoded product bill of materials and vendor sources for AOC 15/50 wind turbine, achieving more efficient manufacturing.
- Project engineer for turbine installations in Morocco, Canada and United States.

Professional Affiliations

- American Society of Mechanical Engineers.
- National Society of Professional Engineers.

Tab 3
Cost Worksheet

Renewable Energy Fund Round 3
Project Cost/Benefit Worksheet

Please note that some fields might not be applicable for all technologies or all project phases. The level of information detail varies according to phase requirements.

1. Renewable Energy Source

The Applicant should demonstrate that the renewable energy resource is available on a sustainable basis.

Annual average resource availability.	Wind (Class 6/7)
Unit depends on project type (e.g. windspeed, hydropower output, biomasss fuel)	

2. Existing Energy Generation and Usage

a) Basic configuration (if system is part of the Railbelt[1] grid, leave this section blank)

i. Number of generators/boilers/other	3 diesel generators
ii. Rated capacity of generators/boilers/other	950 kW
iii. Generator/boilers/other type	Cat 337kW; CMS 250kW; DD 363kW
iv. Age of generators/boilers/other	32 years; 2 years; 1 year
v. Efficiency of generators/boilers/other	Total efficiency: 13.04 kWh/gal

b) Annual O&M cost (if system is part of the Railbelt grid, leave this section blank)

i. Annual O&M cost for labor	See next response
ii. Annual O&M cost for non-labor	$170,000 Total labor and non-labor

c) Annual electricity production and fuel usage (fill in as applicable) (if system is part of the Railbelt grid, leave this section blank)

i. Electricity [kWh]	1,158,987 kWh (fy08 PCE data)
ii. Fuel usage	
Diesel [gal]	99,221 gal (fy08 PCE data)
Other	N/A
iii. Peak Load	282.7 kW
iv. Average Load	145 kW
v. Minimum Load	N/A
vi. Efficiency	13.04 kWh/gal
vii. Future trends	N/A

d) Annual heating fuel usage (fill in as applicable)

i. Diesel [gal or MMBtu]	N/A
ii. Electricity [kWh]	N/A
iii. Propane [gal or MMBtu]	N/A
iv. Coal [tons or MMBtu]	N/A
v. Wood [cords, green tons, dry tons]	N/A
vi. Other	N/A

3. Proposed System Design Capacity and Fuel Usage

[1] The Railbelt grid connects all customers of Chugach Electric Association, Homer Electric Association, Golden Valley Electric Association, the City of Seward Electric Department, Matanuska Electric Association and Anchorage Municipal Light and Power.

(Include any projections for continued use of non-renewable fuels)

a) Proposed renewable capacity (Wind, Hydro, Biomass, other) [kWh or MMBtu/hr]	Wind - up to 3.3MW at DMTS Port Wind - up to 300kW near Kivalina
b) Proposed Annual electricity or heat production (fill in as applicable)	
i. Electricity [kWh]	TBD by this project
ii. Heat [MMBtu]	TBD by this project
c) Proposed Annual fuel Usage (fill in as applicable)	
i. Propane [gal or MMBtu]	N/A
ii. Coal [tons or MMBtu]	N/A
iii. Wood [cords, green tons, dry tons]	N/A
iv. Other	N/A

4. Project Cost

a) Total capital cost of new system	Estimated (wind and intertie): $20,000,000
b) Development cost	Estimated (including this phase): $2,193,000
c) Annual O&M cost of new system	Estimated $100,000
d) Annual fuel cost	N/A

5. Project Benefits

a) Amount of fuel displaced for	
i. Electricity	TBD by this project
ii. Heat	TBD by this project (heat produced w/ med-high penetration system)
iii. Transportation	N/A
b) Price of displaced fuel	Variable
c) Other economic benefits	Production tax credits, "CREB"s, "green tags"
d) Amount of Alaska public benefits	Reducing pollution and others benefits TBD by this project

6. Power Purchase/Sales Price

a) Price for power purchase/sale	TBD by this project

7. Project Analysis

a) Basic Economic Analysis	
Project benefit/cost ratio	TBD by this project
Payback	TBD by this project

Tab 4

Grant Budget Form

Kivalina DMTS Port Intertie/Wind Feasibility Milestone or Task	Anticipated Completion Date	RE- Fund Grant Funds	Grantee Matching Funds	Funds: Cash/In-kind/Federal Grants/Other State	TOTALS
1. Project scoping and contractor solicitation	September 15, 2010	$1,900	$100	Cash	**$2,000**
2. Detailed energy resource analysis	September 30, 2011	$9,500	$500	Cash	**$10,000**
3. Identification of land and regulatory issues	January 31, 2011	$6,650	$350	Cash	**$7,000**
4. Permitting and environmental analysis	January 31, 2011	$9,500	$500	Cash	**$10,000**
5. Detailed analysis of existing/ future energy costs and markets	March 30, 2011	$9,500	$500	Cash	**$10,000**
6. Conceptual business and operations plans (details below)	June 30, 2011	$14,250	$750	Cash	**$15,000**
7. Assessment of alternatives (details below)	August 30, 2011	$80,750	$4,250	Cash	**$85,000**
8. Detailed economic and financial analysis	October 31, 2011	$14,250	$750	Cash	**$15,000**
9. Conceptual design analysis and cost estimate (details below)	November 30, 2011	$34,200	$1,800	Cash	**$36,000**
10. Final project report and recommendations	December 31, 2011	$2,850	$150	Cash	**$3,000**
TOTALS		**$183,350**	**$9,650**		**$193,000**
Budget Categories:					
Direct Labor & Benefits			$6,650	Cash	**$6,650**
Travel & Per Diem			$2,000	Cash	**$2,000**
Equipment					
Materials & Supplies			$1,000	Cash	**$1,000**
Contractual Services		$183,350			**$183,350**
Construction Services					
Other					
TOTALS		**$183,350**	**$9,650**		**$193,000**

Milestone Details

Milestone 6 includes a conceptual business plan ($10,000) and a conceptual operations plan ($5,000)
Milestone 7 includes a Draft Wind Resource Report ($7,000), geotechnical work ($76,000), and Alternatives Assessment Memo ($2,000)
Milestone 9 includes met tower monitoring and dismantling ($20,000), final wind resource report ($1,000), and conceptual design and cost estimate ($15,000)

Milestone		Cost
1. Project scoping and contractor solicitation		$2,000
2. Detailed energy resource analysis		$10,000
3. Identification of land and regulatory issues		$7,000
4. Permitting and environmental analysis		$10,000
5. Detailed analysis of existing and future energy costs and markets		$10,000
6. Conceptual business and operations plans		$15,000
7. Assessment of alternatives		$85,000
8. Detailed economic and financial analysis		$15,000
9. Conceptual design analysis and cost estimate		$36,000
10. Final report and recommendations		$3,000
	TOTALS	$193,000

Tab 5
Delegation of Authority

ALASKA VILLAGE ELECTRIC COOPERATIVE, INC.

Delegations of Authority from the Board of Directors to the President & CEO

I. OBJECTIVE

To define the delegations of authority and responsibilities from the Board of Directors to the President and Chief Executive Officer to enable him/her to adequately direct the operations of Alaska Village Electric Cooperative, Inc. and to report to the Board on the results achieved.

II. POLICY

A. Planning

1. Policies

   To formulate, with the staff as appropriate, the policies of Alaska Village Electric Cooperative to be recommended by the President and Chief Executive Officer to the Board of Directors for their consideration. Such policies shall be reviewed by the President and Chief Executive Officer at least once a year and a recommendation made to the Board on any revisions required.

2. To develop, with the staff, the viewpoints, objectives and goals of Alaska Village Electric Cooperative and to review periodically these objectives and goals, as well as the results achieved, with the Board.

3. Long and Short-Range Plans

   To conduct studies with the staff and outside consultants, if necessary, and recommend to the Board short and long-range plans, including plans in such areas as system studies, engineering work plans, power requirements and load forecasts, financial forecasts, energy management, member and public relations, construction, facilities, etc., and to report to the Board on results compared to such plans.

4. Membership Meetings

   To develop, with the staff, plans for annual and other meetings of Alaska Village Electric Cooperative, and to make appropriate recommendations to the Board.

5. Work Plans and Budgets

   To formulate, with the staff, annual work plans and budgets for Alaska Village Electric Cooperative and recommend them to the Board for their consideration,and to provide detailed quarterly reports on revenue, expenses and other results compared to such plans.

6. Legislation

To analyze and determine, with the Board and with the staff and in coordination with organizations such as Alaska Rural Electric Cooperative Association (ARECA) and the National Rural Electric Cooperative Association (NRECA), state and federal legislative and regulatory matters to be proposed, supported or opposed consistent with Cooperative goals and philosophy.

B. <u>Organization</u>

1. Organization Structure

a. To periodically review activities of Alaska Village Electric Cooperative and to determine with the staff as appropriate, the organization structure best suited to carry out the overall objectives of Alaska Village Electric Cooperative within the limitations of the budget.

b. To determine, with the appropriate staff members, the need for additional positions, the transfer, reassignment, or elimination of present positions, and to effect such changes, provided they are within the limitations of the personnel costs of the approved budget.

2. Selection of Personnel

a. To develop or approve standards and qualifications for use in recruitment, transfer, and promotion of personnel. Such standards and qualifications should meet all federal and state legal requirements.

b. To select, appoint, transfer, promote, demote, discipline and terminate personnel.

3. Training

a. To ensure that the staff members are trained in accordance with the qualifications and requirements of their positions.

b. To initiate and promote, through appropriate staff, training programs for all personnel within the limitations of the approved budget, including sending personnel to training programs outside the organization.

4. Performance Appraisals

a. To appraise, at least annually, the performance of immediate staff members and to counsel with them and assist them to develop and improve.

b. To ensure that a performance appraisal program is established and carried out for all personnel and that adjustments for those outside the bargaining unit are based on merit.

5. Position Descriptions

To ensure that written position descriptions and job specifications are prepared and reviewed as necessary for all personnel.

6. Fringe Benefits

To administer or approve activities and actions with respect to annual leave, holidays, and other fringe benefit programs for the personnel within established policies and within the limitations of the budget. A report shall be presented annually to the Board or committee of the Board describing the various benefits and employee and employer contribution, if any, and what percent fringes are of payroll.

7. Consultants

a. To recommend to the Board the employment of general counsel and independent auditors, and contracts and agreements for their services with the committee making an appropriate recommendation to the Board.

b. To select and appoint other outside specialized consultants, and to negotiate contracts or agreements for services of such specialized consultants, within the limitations of the work plan and budget, and to advise the Board of actions taken.

c. To report to the Board periodically on services provided and the fees received by principal consultants.

8. Wage and Salary Administration

a. To develop wage and salary policy and present it to the Board for approval.

b. To determine all salaries, except the President and Chief Executive Officer's, within the Board approved wage and salary policy and within the limitations of the budget. A report is to be provided to the Board annually on the administration of the wage and salary policy.

9. Labor Relations

a. To negotiate, with or without consulting assistance, labor contracts and make appropriate recommendations to the Board.

b. To administer the approved labor contract and see that the appropriate supervisors understand the provisions of the contract and its administration.

C. <u>Operations</u>

1. Overall Administration

a. To direct the day-to-day operations and activities of Alaska Village Electric Cooperative except as specified otherwise by the By-Laws or the Board; to delegate authority to immediate staff; to authorize further delegation of authority to any level of management with full recognition that the President and Chief Executive Officer cannot be relieved of overall responsibility or accountability.

b. To manage operations of Alaska Village Electric Cooperative in accordance with the policies of the Board and in accordance with policies and procedures of RUS and other lending institutions; as well as applicable federal, state, and local laws.

c. To designate an appropriate person to serve as Acting President and Chief Executive Officer in an extended absence of the President and Chief Executive Officer. In case the President and Chief Executive Officer becomes incapacitated, the Assistant President and Chief Executive Officer shall serve temporarily as Acting President and Chief Executive Officer until the Board of Directors takes appropriate action, at a meeting to be convened as soon as possible.

d. To ensure that staff advice and assistance is provided to the Board and its committees, and to participate in the deliberation of these committees as requested or required.

e. To accept invitations to participate in or designate other staff members to participate in national, regional, state, and local meetings which further the best interests of Alaska Village Electric Cooperative, within the limitations of Board policy and the approved budget. Participation by the President and Chief Executive Officer in such activities which require considerable time over a sustained period requires the approval of the Board. The President and Chief Executive Officer's serving on the board of other organizations shall be reported to the Board.

f. To serve as the authorized spokesperson for Alaska Village Electric Cooperative on matters and to keep the Board up-to-date and well informed on such matters.

g. The President and Chief Executive Officer shall take all necessary steps in the event that the Cooperative is served with legal process to protect all interests of the Cooperative with respect to such litigation and such matters shall be brought to the attention of the Board at the next scheduled meeting.

2. Membership Services

To direct membership services in such areas as, but not necessarily confined to, public and member relations, load management, energy conservation, communications, and research as authorized by the Board.

3. Legislation

a. To develop and carry out, in coordination with organizations such as ARECA and NRECA, and within expressed Board philosophy, a legislative program furthering Alaska Village Electric Cooperative's objectives and policies. Such a program will include, but not be limited to, research, preparation, and presentation of testimony before appropriate committees, consultation with members of Congress, the State Legislature, and state and federal administrative and regulatory agencies.

b. To participate with allied groups to obtain their increased understanding and support of Alaska Village Electric Cooperative's legislative and regulator objectives and programs.

4. Financial

a. To make expenditures in accordance with the approved budget, including approval of non-budget items up to $100,000 or all non-budgeted items which, in his judgement are vital to effect unanticipated emergency maintenance or repairs. Non-budgeted items exceeding $100,000 which are not items vital to effect unanticipated emergency maintenance or repairs, must be presented to the Board for approval.

b. To invest or reinvest funds, cash investments when due, and cash government bonds, when and if necessary to protect Alaska Village Electric Cooperative's cash position and to carry out an effective cash management program. Investments will generally be made in CFC securities, in federal government insured or guaranteed securities or in other securities approved by the lending agencies.

c. To authorize and approve the travel expenses of personnel except the President and Chief Executive Officer's on company business within the limitations of the budget and within established policy. Such expenses shall be supported by itemized expense accounts with receipts attached, as appropriate. Expenses of the President and Chief Executive Officer will be reviewed by the Secretary/Treasurer.

d. To approve account systems, procedures, statistics, and types of reports necessary for sound financial management and to meet the requirements of lending and regulatory agencies and for necessary control information required by the Board.

e. To purchase or lease all equipment, vehicles, hardware, furniture, materials, and supplies within the guidelines of the budget. All purchases shall comply with RUS policies or procedures.

f. To negotiate contracts for construction in accordance with RUS procedures. The contracts will be awarded in accordance with RUS procedures so construction completed can be reimbursed from loan funds without delay.

g. To execute and deliver purchase orders or contracts for projects previously approved by the Board.

h. To approve and sign changes under contracts previously approved by the Board and RUS if under $50,000. Those changes in excess of $50,000 are to be reported to the Board at the next Board meeting and all changes are to be approved by RUS if appropriate.

i. To authorize individual memberships in civic clubs and organizations in which he/she thinks of him/herself or staff members would be beneficial and to authorize payment of dues by Alaska Village Electric Cooperative within the limitations of the budget. Professional registration fees will only be paid for registration in the State of Alaska, if such registration is desirable or required.

j. To execute and delivery on behalf of Alaska Village Electric Cooperative agreements essential to the management of the Cooperative, such as affidavits, agreements, and leases to implement Board actions.

k. To negotiate franchises and execute all petitions and documents in relation thereto; to acquire by purchase or lease all easements and power plant sites and execute, deliver and accept all documents relating thereto; to execute and deliver all environmental studies and reports; to make application for all permits relating to the operations of Alaska Village Electric Cooperative's design, route, and determine the site for all facilities.

1. To perform all acts necessary or incidental to the management of the operations of Alaska Village Electric Cooperative, unless such acts are specifically reserved to the Board pursuant to law, and Articles of Incorporation, the By-Laws, or policies.

5. Controls

a. Operations

To submit periodic and special reports to the Board on conformity of operations with approved policies and programs; to recommend any revisions requiring Board approval and to direct any remedial action required.

b. Finances

To submit periodic and special financial reports to the Board to keep them informed of Alaska Village Electric Cooperative's financial position and conformance to financial plans and forecasts, and to see that all persons having access to cash or responsible for purchasing of materials are properly bonded in accordance with all requirements of the lending agencies.

c. Budgets

To report quarterly to the Board on revenues and expenditures compared to budget. To recommend any revisions required, and to direct any necessary remedial action.

d. Annual Financial Audit

To participate with the Board in the review, with the auditor present, of the annual financial audit and management letter and to direct any remedial action required and to ensure that the management letter, along with the Audit Report, is sent to each Board member prior to the meeting at which they are to be discussed.

e. Materials Management

1. To determine the amount of and establish proper control of all physical inventories to minimize investment in inventories needed to meet operating and construction needs.

2. To ensure that a system is established to accurately account for all materials used.

f. Member Complaints

To submit periodically to the Board an analysis of member complaints and to take any corrective action required or to recommend appropriate revisions in Board policy.

g. Reliability of Service

To submit annually to the Board a report on service reliability and any remedial action taken.

h. By-Laws

To report to the Board on annual review with the General Counsel of the By-Laws and to recommend any revisions required.

i. Availability of Power Supply

To report periodically to the Board on load growth compared to the power requirements studies and to recommend plans to meet anticipated growth to ensure an adequate and reliable supply for the members at the lowest possible cost consistent with sound business and management practices.

j. Rates

To continually study power and other costs compared to projections and to recommend to the Board, as far in advance as possible, any changes in retail electric rates necessary to maintain financial strength and stability and to meet all requirements of lending and regulatory agencies.

k. Construction

To review construction practices with appropriate staff to make sure projects are being constructed in accordance with RUS policies and procedures so that reimbursement for completed construction can be obtained promptly.

l. Internal Auditing

To independently assess the adequacy, effectiveness and efficiency of the system of control within the organization and the quality of ongoing operations against policies and procedures established by management and/or the Board, and rules of RUS and other lending institutions; as well as applicable federal, state and local laws.

IV. RESPONSIBILITY

A. The President and Chief Executive Officer shall report to the Board periodically on how these delegations are being carried out. Chairman of the Board shall be kept appraised of all major issues on a regular basis between all Board Meetings. The President and Chief Executive Officer may make further delegations to his staff as required.

B. The Board is responsible for approving any changes in the delegations to the President and Chief Executive Officer.

C. The Chairman shall be responsible for seeing that the performance of the President and Chief Executive Officer is appraised prior to his/her anniversary date each year by the Executive Committee of the Board and that a report is made at a subsequent meeting to the full Board, on the results of such appraisal, and that the results of such appraisal are discussed with the President and Chief Executive Officer.

Date Adopted: 3-23-92 Resolution # 92-18

Date Revised: 5-05-00 Resolution # 00-37

ATTEST: Julia A. Walker

Julia Walker, Secretary

RESOLUTION 00-37

Delegations of Authority from the Board of Directors To the President & CEO

WHEREAS, the policy for delegation of authority from the Board of Directors to the General Manager has been reviewed; and

WHEREAS, the title of General Manager has been changed to President & CEO and this change has been made in the policy noted above.

NOW, THEREFORE, BE IT RESOLVED that the attached updated policy for delegation of authority from the Board of Directors to the President & CEO is approved.

Certification

I, Julia A. Walker, Secretary, do hereby certify that the above is a true and correct excerpt from the minutes of the meeting of the Board of Directors of the Alaska Village Electric Cooperative, Inc., 4831 Eagle Street, Anchorage, Alaska 99503, on the 5th day of May 2000, at which meeting a quorum was present.

(seal) ALASKA VILLAGE ELECTRIC COOP., INC. CORPORATE SEAL ★ ALASKA ★

Julia A. Walker

Julia A. Walker, Secretary
Alaska Village Electric Cooperative, Inc.

Tab 6

Supplemental Materials

Letter of Support NANA Regional Corporation

Friday, November 06, 2009

To Whom It May Concern:

NANA Regional Corporation (NANA) is taking a proactive role in pursuing renewable energy sources by participating in the "Renewable Energy Project" proposal for the Alaska Energy Authority (AEA).

Recent surveys have shown that NANA region residents are supportive of renewable energy development and are willing to participate in pursuing renewable energy projects. A McDowell Group study released in April of 2009 found that the Arctic region was 48 percent more expensive to live in than Anchorage. Kotzebue was 61 percent more expensive. This disparity is largely caused by the escalating cost of energy. It is these costs that are motivating NANA region residents to look for new energy sources and identifying ways to harness these sources for their communities.

Out-migration of NANA shareholders due to astronomical energy prices, and the burden placed on shareholder families due to energy costs threatens the regions Iñupiat cultural heritage and NANA shareholders subsistence lifestyle. It is for these reasons that NANA is committed to helping Alaska Village Electric Cooperative (AVEC) and Teck Resources, Ltd. (Teck) perform a feasibility study to determine if wind energy and transmission could be developed for the benefit of Kivalina and other communities in order to alleviate energy costs in these villages.

Wind Energy has the potential to displace costs associated with currently utilized heating and electrical sources. NANA will support development of these projects by providing the services of Sonny Adams, NANA projects manager, and Jay Hermanson, alternative energy manager with WHPacific, Inc., a NANA subsidiary company.

WHPacific, Inc. and other consultants will provide expertise in the research, development and creation of the feasibility study. WHPacific, Inc. will also provide support services to Teck and AVEC, such as technical and planning services. NANA will provide members from the NANA Strategic Energy Plan group to provide guidance throughout the project.

If you have any questions, please contact me.

Sincerely,

Lance Miller,
Vice President - Resources
NANA Regional Corporation

Project Execution Plan Northwest Arctic Borough Wind-Diesel Project

6/30/2009

Signature Page

Project Manager Approval

Project Manager: Date

Business Line Approval

Director: Date

Operations Approval

Operations Manager: Date

Section 1 INTRODUCTION

1.1 Project Background

In October 2007, the NW Arctic Borough (NWAB) initiated a wind study of regional communities, including the installation of Alaska Energy Authority Met towers in Deering, Buckland, and Noorvik. The very high costs of diesel fuel in the region results in some of the highest electricity costs in the nation, as the communities of Deering, Buckland, and Noorvik presently rely on diesel for all of their power generation needs. In the NWAB communities of Kotzebue and Selawik, wind turbines have been successfully used to displace diesel fuel consumption. In October 2008, the NWAB submitted a proposal to the Alaska Energy Authority (AEA) for funding for wind-diesel development for these three communities. In February, 2009, the Alaska Energy Authority provided preliminary approval of the proposal. In order to secure the grant agreement, the NWAB needs to develop and present a project execution plan (PEP) and schedule that provides a summary overview of project execution.

The purpose of this PEP is provide a conceptual level framework for project execution, including the pre-construction and construction activities. This document is the initial overview PEP for the NWAB project and will evolve to include a deeper level of detail as additional information becomes available.

1.2 Project Objectives

The project objectives include:

- Assessment Phase: Finalize the wind resource report for Deering, Buckland, and Noorvik;
- Pre-design Phase: Update PEP, including siting, environmental, permitting, and business and operations planning;
- Design (separate) Phase: Design individual wind-diesel systems for Deering, Buckland, and Noorvik;
- Bid Phase: Prepare bid documents, distribute to selected contractors, and select contractor;
- Procurement Phase: Procure the best available equipment at the best price, within the available budget;
- Implementation Phase: Construct, install, and commission equipment in a cost effective manner.
- Commission Phase: Assure proper functioning of installed system through manufacturing systems testing:
- Operation Phase: Turn-over the system to the communities utilities.

1.3 Project Cost Objectives.

- ***Earned Value Approach***. The project will utilize the concept of earned value for cost monitoring and control throughout the project lifecycle.
- ***Continual Budget, Engineer's, and Construction Estimating***. In order to assure sufficient budget resources for project scope, estimates will be performed at incremental periods of the project. This will include preliminary (in-house) engineer (third party), and construction (contractor bid) cost estimate at appropriate intervals in the project lifecycle;
- ***Communication of Cost Progress Using the Earned Value Approach.*** Utilizing earned value, the project costs will be communicated monthly to project stakeholders.
- ***Exercise cost containment and value engineering practices.*** Implement appropriate cost containment practices to assure best value for the client and the state.

1.4 Project Schedule Objectives.

- Complete project within a 24 month time-frame with commissioning completed and operations commencing in summer of 2011 (see attached schedule);
- Identify opportunities to accelerate the schedule as appropriate and allowable.

1.5 Project Priorities (Critical Success Factors)

- Stakeholder alignment on project objectives;
- Effective and efficient review of design documents;
- Aligning design lead times and technical milestones with seasonal construction and logistics constraints;
- Coordinating technical and design milestones between the operating constraints of three different utilities and communities;
- Coordinating long lead times for procurement;
- Communicating effectively between the stakeholders;
- Working effectively within the constraints of the NWAB and AEA procurement policies;
- Assuring that the three separate designs and planning efforts are well coordinated;
- Identifying long lead items and working with them to prevent delays;

Section 2 TECHNICAL PLAN

2.1 Project Description/Scope of Work

- The project description includes the planning, design, construction, commissioning and startup of wind-diesel systems in the communities of Deering, Buckland, and Noorvik.

- The technical scope of work includes management and execution of all pre-construction activities, including environmental, right of way, permitting, HOMER Modeling, design, equipment specification, development of construction and procurement documents, and selection of contractor.

- The Business and Operations plan will develop a financial and business model for operations of a combined wind diesel system. ***Critical to the business and operations plan is to identify and confirm responsibility of ownership and operations of the integrated system.***

- The construction and procurement scope of work will be detailed in the construction and bid documents.

- The commissioning, startup and monitoring of system performance to include operator training.

2.2 NWAB Contract Plan

NWAB will manage two separate contracts- one for pre-construction and one for construction and procurement. Both lump-sum and time & materials contract options will be considered for the various task orders of the project depending on scope. Operations and maintenance activities subsequent to commissioning are beyond the scope of this contract and plan.

2.2.1 Pre-Construction. NWAB will sub-contract with NANA Pacific for Planning, Design, and Construction Administration. NANA Pacific will work with those entities identified in section 5.1.3 NANA Pacific and its subs will develop RFP documents that will allow a construction contractor to submit a proposal on the construction of the proposed wind-diesel system. Commissioning support will be included in the Construction administration budget.

2.2.2 Procurement and Construction. NANA Pacific will administer a competitive bid process to pre-selected contractors on behalf of NWAB. During construction, NANA Pacific will serve as owner's representative for NWAB on this project. Commissioning support will be included in the construction contract.

2.3 Work Breakdown Structure (WBS)

The section below highlights a general WBS for project implementation. Each separate WBS element will be developed in detail as the project evolves.

0100	**1. Project Initiation**
0100.1	identify project partners
0100.2	develop project plan
0100.3	preliminary budget estimate
0101	**2. Data Collection**
0101.1	compile historical wind and energy data
0101.2	collect initial wind data
0101.3	wind data analysis
0101.4	wind data resource report/HOMER Analysis & Write-up
0101.5	redeployment (if needed) of met towers
0102	**3. Environmental Impacts and Permit Review**
0102.1	finalize sites for wind turbines and power lines

0102.2	avian habitat and endangered species review
0102.3	flood plain/wetlands/hydrology and fisheries review
0102.4	historical and archeological review
0102.5	permit review
0103	**4. Design and Planning**
0103.1	assess existing energy demand and wind resource
0103.2	preliminary project budget estimate
0103.3	geotechnical study
0103.4	wind-diesel integration study
0103.5	develop preliminary system design (65%)
0103.6	conduct preliminary system design review
0103.7	specify major system components including turbines and control systems
0103.8	site control for wind turbines secured
0103.9	develop final system design (95%)
0103.10	conduct final system design review
0103.11	final engineers estimated budget
0103.12	issue construction documents
0103.13	develop business plan, O&M plan for wind-diesel installations
0200	**5. Procurement of Equipment and Contractors**
	Initiate all permitting
0200.1	procure construction contractors
0200.2	procure power system control and energy utilization equipment
0200.3	procure diesel automation and modification equipment
0200.4	procure wind towers and foundation equipment
0200.5	procure wind turbines
0200.6	procure communications and other ancillary equipment
0201	**6. Deering-Buckland-Noorvik Installation**
	Finalize all permitting before mobilization
0201.1	mobilization
0201.2	install tower foundations and towers
0201.3	upgrade diesel gen-set controls
0201.4	install system controller
0201.5	install resistance heaters in power plant and school
0201.6	install wind turbines
0201.7	install power converter and battery storage
0201.8	install power line from wind turbines to power plant
0201.9	install communications system
0202	**7. Commissioning**
0202.1	write O&M manuals
0202.2	local operator training, maintenance and technical support services
0202.3	make system modifications
0202.4	monitor and report on system performance

2.4 Project Deliverables

The following are identified as key deliverables in the overall scope of work for each village:

- Wind Resource Assessment Final Reports
- Business and O&M Plan, that includes site control and all relevant permits;
- Final Construction Documents;
- Contractor selection
- Construction/Installation Plan;
- Functional/Fully Commissioned Wind-diesel System.

Section 3 PROJECT BUDGET

3.1 Total Project Cost

The estimated total project cost is $10,900,000. This figure includes project management, technical planning, engineering, and construction activities, and does not include NWAB costs such as salaries of borough personnel administering the project, meetings, and travel expenses.

- Planning, Design, and Construction Administration will constitute approximately 12-15% of the total budget;
- Equipment approximately will constitute approximately 25-35% of the total budget;
- Construction & Installation will constitute approximately 55-65% of the total;

3.2 Project Funding Profile

- The project funding derives from the Alaska Energy Authority round 1 funding through HB152. The initial preliminary budget estimate was done in May 2008 by an estimator at NANA Colt Engineering (now NANA Worley Parsons) and later refined in October 2008 as part of the final proposal.

  The assumptions used in the proposal included the specification of NW100 wind turbines and known construction costs associated with procurement installation of these NW100 systems in May of 2008, including 2008 logistics and construction costs. In October of 2008, the budget estimates for the grant proposal were subsequently updated. We will update the costs once the project is better defined. Funding over the course of the project will depend upon milestones reached.

3.3 Contingency

The plan will need to include cost contingencies for several reasons:

- The proposal, planning, and implementation phases span several years, during and following a time a when rural construction in Alaska and equipment in the wind power generation have experienced significant volatility and escalation.
- While some contingency was integrated into the initial budget estimate, it is possible that the originally anticipated contingencies will prove insufficient.
- Cost escalation may continue during the next 24 months.

Therefore, budgeting process will include contingencies and ongoing review of costs will be part of the plan.

Section 4 PROJECT SCHEDULE

4.1 Schedule.

Refer to schedule found in the appendix.

4.2 Major Milestones

Milestone Date	Deliverable
August 2009	Pre-design scope of work delivered
January 2010	Specification of equipment, procurement in time for spring/fall barges
April 2010	Complete geotechnical study
May 2010	Final design documents
July 2010	All needed permits, site control, and right-of-ways secured
October 2010	Selection of construction contractor
April 2011	Foundation and Tower Installation
June 2011	Construction complete
September 2011	Wind-diesel systems functional and operating

Section 5 MANAGEMENT PLAN

5.1 Organization and Team Responsibilities

5.1.1 Client Organization and responsibilities. The NWAB is working on behalf of the electric utilities serving the communities of Deering, Buckland, and Noorvik. NWAB will not own nor operate the proposed system. The NWAB responsibilities include:

- Administering the Alaska Energy Authority resources.
- Manage the engineering/construction administration contract;
- Contract directly for equipment procurement and with the construction contractor with technical assistance.
- Assure that the community's utilities maintain ownership and assure that the system is properly commissioned.
- Develop appropriate memorandums of understanding and agreements between the various communities and utilities;
- Involvement of NWAB in utility meetings;

- Final approval of designs;
- Facilitate effective communication between the utilities.

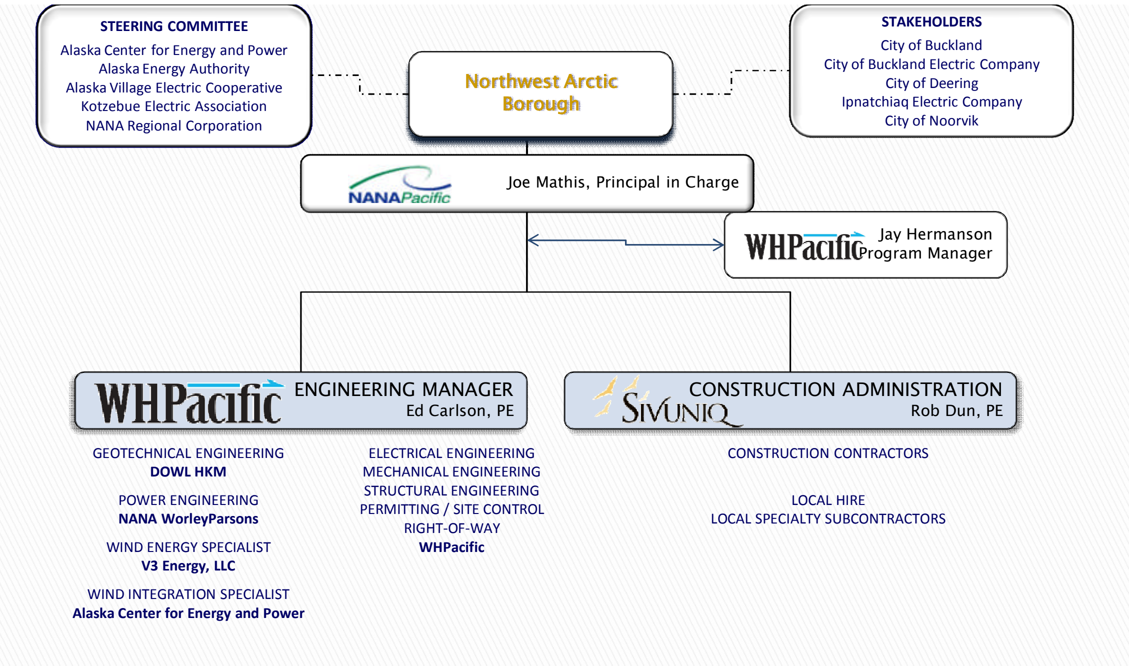
5.1.2 Owner Organization and Responsibilities.

Owner Organization and Responsibilities. The owners are referred to the three Regulatory Commission of Alaska (RCA) utilities for Deering (IEC), Buckland (City of Buckland), and Noorvik (Alaska Village Electric Cooperative). Their respective roles and responsibilities include:

- Operate the integrated wind-diesel systems;
- Work with the NWAB to identify ownership of the wind component of the integrated wind diesel system;
- Enter into agreement with the NWAB concerning project implementation;
- Enter into land-use agreement with land owner;
- Participate in the effective development of a business and operations plan;
- Participate in operator training as needed;
- Provide design review/approval as appropriate;
- Participate in business, operations, and commissioning planning;
- Participate in meetings as needed;

5.1.3 Project Team Organization

The proposed project team organization chart is found below.



Northwest Arctic Borough
Wind-Diesel Project for Buckland, Deering and Noorvik
Organizational Chart

5.2 Prime Contractor Responsibilities

NANA Pacific is the prime contractor and has as responsibilities:

- All responsibilities associated with being the prime contractor
- Negotiate task order and scope of works with NAB
- QA/QC
- Document control
- Project Communications
- Monthly teleconferences with client to monitor project progress;
- Manage the individual pre-construction contract scope of work with Deering
- Provide contract administration;
- Provide project controls support and earned value reports;
- Provide legal review of contracts;
- Provide risk management support;
- Approve relevant documents and drawings for diffusion;
- Develop, negotiate and coordinate task order proposals to the NAB
- Earned Value Management of the program

WHPacific, under Subcontractor to Nana Pacific, will provide a Program Manager. Jay Hermanson has been named to serve in this role. WH Pacific's subcontract will include:

- Coordination with NWAB and project stakeholders;
- Development & confirmation of technical scope of works with the NWAB and NANA Pacific contracting;
- Coordination with donors;
- Additional support to technical project managers.

WHPacific's subcontract will also include managing scope, schedule and budget for each technical work-order in this phase. WHPacific has named Ed Carlson, PE the Pre-Construction Project Manager for these activities, which will include:

- Environmental;
- Right of way;
- Permitting;
- Wind Integration/HOMER Modeling;
- Design;
- Equipment specification;
- Business and Operations plan;
- Development of construction and procurement documents, and
- Assist with the selection of the contractor.

WHPacific will issue subcontracts to NANA Worley Parsons, V3 Energy, and Dowl HKM to obtain access to their special capabilities in Power Engineering, Wind Resource Assessment and Geotechnical engineering respectively.

NANA Pacific will issue a subcontract to Sivuniq, LLC for construction administration services for the construction phase. The Construction Phase Project Manager will be Rob Dunn, PE, who will oversee:

- Management of the procurement process for the construction contractor;
- QA/QC, and management of submittals;
- Documentation
- Periodic reporting of project status
- Safety
- Earned value management of procurement and construction.

5.3 Project Team Responsibilities.

The technical team and their respective role and responsibility is highlighted in the table below.

Item/Responsibility	Company	Individual
Grant Management/Project Coordination	NWAB	Jade Hill, Ingemar Mathiasson
Prime Contract Management	NANA Pacific	Joe Mathis
Project Controls	NANA Pacific	Debbie Bettinger
QA/QC & Contract Management	NANA Pacific	Dale Nelson, PE
Document Control/Project Communication	NANA Pacific	Anna Weiss
Wind Resource Assessment Reports	WHPacific/V3 Energy	Brian Yanity/Doug Vaught
Environmental	WHPacific	Dianna Riggs
ROW/Site Control/Permitting	WHPacific	Dianna Riggs
Electrical Engineering	WHPacific	Ed Carlson, PE
Civil Engineering	WHPacific	Jeff Potts, PE or other
Structural Engineering	WHPacific	Cindy Ferari, PE
Geotechical Engineering	DOWL HKM	Maria Kampsen, PE
Power Engineering	NANA Worley Parsons	Dave Biegel, PE
Mechanical Engineering	WHPacific	Chris Linford, PE
Wind Integration Technical Support	WHPacific/ACEP	Ed Carlson, PE/Kat Keith
Construction Administration	Sivuniq/NANA Pacific	Rob Dunn, PE/Joe Mathis
Construction Contractor	TBD	TBD

5.4 Contact Information List

The project contact list is found in appendix 1.

5.5 Quality Program

- The QA/QC for planning design and construction administration will follow WHPacific standards for each milestone. The WHPacific QA/QC checklist is found in the appendices.

5.6 Reporting

There will be three written reports involved in the pre-construction program- weekly, monthly, and quarterly. During field visits and when personnel are on site, there will be daily reports done.

- **Weekly Reporting.** Includes a project summary progress narrative and identification of obstacles.
- **Monthly Reporting.** Includes summary of weekly reports and an earned value report.
- **Quarterly Reporting.** Includes progress summary, schedule update, earned value reports, and any proposed changes to the project baseline.

Section 6 PROJECT COMMUNICATION

6.1 General

Effective communication remains one of the critical success factors of the project. NWAB will designate one individual as the point of contact for project execution. This POC will communicate with the project stakeholders and with the contractor. There will be at least quarterly meetings with Alaska Energy Authority to communicate progress. There will be at least one monthly project meeting. There will be weekly e-mail that communicates progress as well.

- ***Project Web-Site***. The technical contractor will develop a project web-site for the NWAB web page that communicates the project objectives to interested external parties; this webpage will have regular updates on project activities and status
- ***Project Document FTP Site.*** A secure FTP site will be available for designated project stakeholders that will have project documents available for review.
- ***Community Meetings and Public Outreach.*** To insure that members of the public in Deering, Buckland, and Noorvik are informed about the project goals and status, community meetings will be conducted by the NWAB project team in each community.

Section 7 RISK MANAGEMENT

7.1 Risk Management Approach.

The risk management approach will include active involvement of stakeholders, designers, engineers, and other project players to proactively discuss project risk in the context of the project. Each specific deliverable will have a risk management matrix that identifies potential risks and risk mitigation measures.

7.2 Environment, Safety, and Health Risk

- Remote site logistics and management;
- Access to health facilities during construction;

7.3 Technical Risk

- Coordination between the various technical leads and disciplines;

- Limited vendors- 2-3 equipment vendors only for the desired technical application;
- Utility availability to review technical drawings and specifications;
- Scope creep.

7.4 Project Risk

- Coordination between the various entities involved in the overall project;
- Remote site logistics and availability of seasonal barge travel;
- Escalating construction costs could cause problems with the preliminary budget;
- Health and safety;

Section 8 ACQUISITION STRATEGY

8.1 Strategy

- **Planning, Design, and Construction Administration**. The procurement strategy will include planning, design, and construction administration to be done by NANA Pacific and its sister engineering companies. NANA Pacific will sub-contract with the appropriate entities, including WHPacific, V3 Energy, DOWL HKM, NANA Worley Parsons, and the Alaska Center for Energy and Power for additional technical assistance.
- **Procurement & Construction- Competitively Bid**. The procurement and construction process will be competitively bid and the bid process managed by NANA Pacific serving as NWAB's owner's representative.

8.2 Contracts

NWAB will issue two contracts to two separate entitities:

- NWAB ⇒ NANA Pacific for Planning, Design, and Construction Administration.
- NWAB ⇒ General Contractor for equipment procurement and construction/installation.

Section 9 REFERENCES

The following two documents are reference documents to this project execution plan.

Alaska Energy Authority Grant Agreement

Alaska Energy Authority Grant Application, October 2008

Appendix I- Project Contact List

Name	Organization	Phone #	E-mail Address	Role
Jade Hill	NWAB	907-442-2500, ext. 115	JHill@nwabor.org	Project Coordinator
Ingemar Mathiasson	NWAB	907-445-2031	IMathiasson@nwabor..org	Project Coordinator
Joe Mathis	NANA Pacific	907-257-1750	jmathis@nanapacific.com	Project Manager
Jay Hermanson	WHPacific	907-339-6514	jhermanson@whpacific.com	Program Manager
Ed Carlson, PE	WHPacifc	907-339-5325	ecarlson@whpacific.com	Project Manager
Brent Petrie	AVEC	907-565-5258	bpetrie@avec.org	Utility for Noorvik
Ruth Moto Hinsbergen	IEC	907-339-2157	ipnatchiaqec@msn.com	GM for Deering Utility
Mona Washington	City of Buckland	907-494-2121	city_of_buckland@yahoo.com	Utility for Buckland
Kat Keith	ACEP	651-332-0584	kkeith@mtaonline.net	Technical Assistance
James Jensen	AEA	907-771-3043	jjensen@aidea.org	Funder
Rob Dunn, PE	Sivuniq			Construction Manager

Appendix II- QA/QC Checklist

QUALITY REVIEW ITEMS CHECKLIST

Project Name: Level: (i.e., 50%, 80%, 100%) _____

Deliverables:

Project No.:

Project Manager:

Reviewer: Date:

Preliminary Review Items (Is package ready for review?):

1. Is there a project notebook with a QA/QC section?
2. Is there an established quality control program in the workplan?
3. Is there sufficient checking documentation to continue review? (Peer Review forms)
4. Has adequate basis of design been established?
5. Does the product comply with client, agency and/or WHPacific standards?

If yes to these questions, proceed with review

Critically review the materials provided including:

1 Quickly make an overview of complete project, spending no more than one minute per plan sheet and scanning through project execution plans, reports, design basis documents, cost estimates, etc. to become familiar with the project. Identify any items that present liability issues to the client or WHPacific

2 Report/Design Documents Check
(a) Read document for overview.
(b) Is it clear and concise?
(c) Are there contradictions?
(d) Is it complete?

(e) Are conclusions and recommendations well supported by text/data?
(f) Are graphics clear, legible and pertinent to the text?
(g) Could you, if you were the client, determine a clear course of action from the report?
(h) Is grammar and spelling satisfactory?

3 Specifications Check
(a) Check Submittal List against submittal requirements in technical sections.
(b) Check specs for bid items. Are they coordinated with the bid proposal? Are the bid items correctly identified in the measurement and payment paragraphs in the technical specs? Are measurement and payment paragraphs coordinated with lump sum items as well as unit cost items?
(c) Check specs for phasing of construction. Are the phases clear and agree with drawings?
(d) Check specs for additive alternate bid items. Are they clear and agree with drawings?
(e) Compare architectural finish schedule to specification index. Ensure all finish materials are specified.
(f) Check major items of equipment and verify that they are coordinated with contract drawings. Pay particular attention to horsepower and voltage requirements.
(g) Verify that items specified "as indicated" or "where indicated" are in fact indicated on contract drawings.

4 Cost Estimate
(a) Check bid items in specs against items in cost estimate, and make sure names match exactly, and are consistent with the plans.
(b) Check items in cost estimate against specifications index. Are all items in specs included in cost estimate, and vice versa?
(c) Compare architectural finish schedules and electrical/mechanical equipment schedules with cost estimate. Are costs included for all items?
(d) Review costs as percentage of total construction. Compare to previous similar projects.
(e) Check cost estimate for alternate bids - compare to plans and specs.
(f) Scan through plans and verify that all the various items and sizes of items in plans are included in cost estimate. Do not verify specific quantities, this should already have been done during peer review.
(g) Look over subtotals by discipline as an overall comparison with the project scope - does the construction cost appear reasonable. Compare to "ball park" averages from Means or other sources.

5 Plan Check
(a) Check that bid item names are consistent with the bidding documents and cost estimate. Check the plans for constructability, conciseness, consistency and completeness. Is it constructible? If constructed, will it function as intended/required?

(b) Perform Coordination Review. Use "Redicheck List" template if appropriate. Note: The "Redicheck" review will not determine if the design will in fact meet project requirements or perform as required. This is intended to be accomplished by proper planning, execution of the design and evaluation of the output. The Redicheck review helps identify inconsistencies, uncoordinated data, etc. Use overlays wherever possible to ensure coordination. Use "at variance with" (AVW) to identify problems. Do not try to solve the inconsistency; this is the project team's responsibility.

The Redicheck Check Lists for various disciplines are presented in the attached forms, and are titled "Interdisciplinary Check List." The title also indicated which discipline is covered by the specific check list.

Appendix III. Project Schedule.

ID	WBS	Physical % Complete	Task Name	Duration	Start	Finish
0		0%	**Deering-Buckland-Noorvik Wind Diesel**	**702 days**	**Thu 6/18/09**	**Thu 3/8/12**
1	**0100**	**0%**	**1. Project Initiation**	**31 days**	**Thu 6/18/09**	**Fri 7/31/09**
2	0100.1	0%	identify project partners	31 days	Thu 6/18/09	Fri 7/31/09
3	0100.2	0%	develop project plan	31 days	Thu 6/18/09	Fri 7/31/09
4	**0101**	**0%**	**2. Data Collection**	**384 days**	**Wed 7/1/09**	**Fri 12/31/10**
5	0101.1	0%	compile historical wind and energy data	384 days	Wed 7/1/09	Fri 12/31/10
6	0101.2	0%	collect initial wind data	384 days	Wed 7/1/09	Fri 12/31/10
7	0101.3	0%	wind data analysis	384 days	Wed 7/1/09	Fri 12/31/10
8	0101.4	0%	wind data resource report	30 days	Wed 7/1/09	Wed 8/12/09
9	0101.5	0%	redeployment (if needed) of met towers	100 days	Thu 4/1/10	Wed 8/18/10
10	**0102**	**0%**	**3. Environmental Impacts and Permit Review**	**253 days**	**Wed 7/1/09**	**Thu 7/1/10**
11	0102.1	0%	finalize sites for wind turbines and power lines	60 days	Wed 7/1/09	Thu 9/24/09
12	0102.2	0%	avian habitat and endangered species review	253 days	Wed 7/1/09	Thu 7/1/10
13	0102.3	0%	flood plain/wetlands/hydrology and fisheries review	253 days	Wed 7/1/09	Thu 7/1/10
14	0102.4	0%	historical and archeological review	253 days	Wed 7/1/09	Thu 7/1/10
15	0102.5	0%	permit review	253 days	Wed 7/1/09	Thu 7/1/10
16	**0103**	**0%**	**4. Design and Planning**	**217 days**	**Wed 7/1/09**	**Wed 5/12/10**
17	0103.1	0%	assess existing energy demand and wind resource	130 days	Wed 7/1/09	Mon 1/11/10
18	0103.2	0%	preliminary project budget estimate	10 days	Mon 11/16/09	Tue 12/1/09
19	0103.3	0%	geotechnical study	90 days	Wed 7/1/09	Thu 11/5/09
20	0103.4	0%	wind-diesel integration study	90 days	Wed 7/1/09	Thu 11/5/09
21	0103.5	0%	develop preliminary system design (65%)	90 days	Wed 7/1/09	Thu 11/5/09
22	0103.6	0%	conduct preliminary system design review	30 days	Thu 11/5/09	Fri 12/18/09
23	0103.7	0%	specify major system components including turbines and control systems	20 days	Fri 12/18/09	Thu 1/21/10
24	0103.8	0%	site control for wind turbines secured	30 days	Thu 11/5/09	Fri 12/18/09
25	0103.9	0%	develop final system design (95%)	60 days	Fri 12/18/09	Thu 3/18/10
26	0103.10	0%	conduct final system design review	10 days	Thu 3/18/10	Wed 3/31/10
27	0103.11	0%	final engineers estimated budget	10 days	Thu 3/18/10	Wed 3/31/10
28	0103.12	0%	issue construction documents	30 days	Thu 4/1/10	Wed 5/12/10
29	0103.13	0%	develop business plan, O&M plan for wind-diesel installations	200 days	Wed 7/1/09	Mon 4/19/10
30	**0200**	**0%**	**5. Procurement of Equipment and Contractors**	**271 days**	**Mon 1/25/10**	**Mon 2/7/11**
31	0200.1	0%	procure construction contractors	180 days	Mon 1/25/10	Fri 10/1/10
32	0200.2	0%	procure power system control and energy utilization equipment	180 days	Mon 1/25/10	Fri 10/1/10
33	0200.3	0%	procure diesel automation and modification equipment	180 days	Mon 1/25/10	Fri 10/1/10
34	0200.4	0%	procure wind towers and foundation equipment	180 days	Mon 1/25/10	Fri 10/1/10
35	0200.5	0%	procure wind turbines	180 days	Mon 1/25/10	Fri 10/1/10
36	0200.6	0%	procure communications and other ancillary equipment	180 days	Tue 6/1/10	Mon 2/7/11
37	**0201**	**0%**	**6. Deering-Buckland-Noorvik Installation**	**137 days**	**Mon 1/3/11**	**Tue 7/12/11**
38	0201.1	0%	mobilization	45 days	Mon 1/3/11	Fri 3/4/11
39	0201.2	0%	install tower foundations and towers	30 days	Tue 3/1/11	Mon 4/11/11
40	0201.3	0%	upgrade diesel gen-set controls	60 days	Fri 4/1/11	Thu 6/23/11
41	0201.4	0%	install system controller	20 days	Thu 5/19/11	Wed 6/15/11
42	0201.5	0%	install resistance heaters in power plant and school	20 days	Wed 6/1/11	Tue 6/28/11
43	0201.6	0%	install wind turbines	20 days	Wed 6/1/11	Tue 6/28/11
44	0201.7	0%	install power converter and battery storage	30 days	Wed 6/1/11	Tue 7/12/11
45	0201.8	0%	install power line from wind turbines to power plant	60 days	Tue 3/1/11	Mon 5/23/11
46	0201.9	0%	install communications system	20 days	Wed 6/1/11	Tue 6/28/11
47	**0202**	**0%**	**7. Commissioning**	**180 days**	**Fri 7/1/11**	**Thu 3/8/12**
48	0202.1	0%	write O&M manuals	20 days	Fri 7/1/11	Thu 7/28/11
49	0202.2	0%	local operator training, maintenance and technical support services	60 days	Fri 7/1/11	Thu 9/22/11
50	0202.3	0%	make system modifications	30 days	Mon 8/1/11	Fri 9/9/11
51	0202.4	0%	monitor and report on system performance	180 days	Fri 7/1/11	Thu 3/8/12