State of Alaska
Alaska Energy Authority, Rural Energy Group

CONCEPTUAL DESIGN REPORT

AKIAK
RURAL POWER SYSTEM UPGRADES

March 5, 2008

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EXECUTIVE SUMMARY

This report has been prepared for the Alaska Energy Authority, Rural Energy Group. Its purpose is to provide the basis for a new power plant with an associated schedule and cost estimate for the community of Akiak, Alaska.

The report includes a review of the existing power plant and power distribution system, an analysis of future needs, a conceptual design to meet these needs, a proposed project schedule, and a budget level cost estimate for the project.

The City of Akiak will be the only participant in the proposed power plant.

The existing power plant has a potential power generation capacity of 450 kW from three generators with individual capacities of 200 kW, 150 kW and a 100 kW generator. At the time this report was prepared, only the 200 kW generator was operable**.** The power plant is in poor condition. It is a single unit module that houses switchgear, controls and three generators. The module is a wood frame structure with T1-11 exterior siding, supported by a post and pad foundation. A waste heat recovery system is incorporated into the power plant generators and currently provides supplemental heat for the water plant, washeteria and old city hall building. The community has had to ration power in recent years. Since the existing power plant is non-code compliant, it should be replaced.

The site selection process involved reviewing pertinent public documents and aerial photographs, consulting with community leaders, and conversations with government agencies. The result of these efforts was the selection of a site for the proposed power plant that is adjacent to the existing power plant. The proposed power plant will be located within sections 30 and 31, Township 10 North, Range 67 West, Seward Meridian, Alaska.

The proposed building is a pile supported, metal structure, measuring 36 feet by 48 feet. A new, 12,000 gallon, intermediate tank would be installed at the site to provide the proposed plant with fuel storage. The tank would be pile supported, and connected to a new fuel pipeline running from the existing tank farm.

A power generation capacity of 800 kW to 1,000 kW is recommended for the proposed power plant. The generators and their sizing will allow the plant to meet the power needs of the entire community for the next ten years. The plant will be designed to allow the plant's electrical generation capacity to be increased if the community's growth exceeds the estimated growth rate used to size the plant.

The total budget level cost estimate for the proposed power plant, fuel pipeline and recommended option of electrical distribution system is $ 3,386,477.00. This estimate includes the costs for: upgrades to the existing electrical distribution system, design, construction administration, permitting, legal and insurance costs, construction costs and a 15% construction contingency.

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I. INTRODUCTION

The Alaska Energy Authority (AEA), Rural Energy Group is pursuing grant funds to upgrade rural power systems. The following terms and conditions of the program will affect your village:

- Most of the funds are federal and provided through the Denali Commission. Other federal funding may be available from HUD (ICDBG) and the Environmental Protection Agency (EPA). Additional funds may be available from the State of Alaska, through the Department of Environmental Conservation and the Department of Education.

- In order to receive grant funds, each village must first produce an acceptable community plan for development. The Denali Commission defines a community's community plan as a road map for how the community wants to develop. A community plan should include current and historical information regarding the community as well as a plan for the future. A community plan is an umbrella document that is made complete by various infrastructure and program specific plans. Other plans that a community develops should fit into a larger comprehensive document – or – incorporate the items listed below into the current plan. For example, an Indian Housing Plan or CEDS Plan may be considered an acceptable plan if it speaks to the nine points listed below.

  1. Community vision (developed by community);
  2. Community goals and objectives (developed by community);
  3. Community involvement and process;
  4. Background for planning;
  5. Economy and Population summary;
  6. Land use summary;
  7. Community facilities and utilities summary;
  8. Transportation summary;
  9. and a plan for implementation.

  Agency Coordination: In an effort to coordinate and begin using the same information for community documents, the Denali Commission suggests that communities first check with state and federal agencies to review information that has been collected on their community, and to get the data from those agencies rather than pay someone else to gather it for them.

  Possible Resources: The Denali Commission does not want to create additional hardship on communities as they strive to meet this planning requirement. They encourage communities to use existing plans and simply add information that may be absent for that particular planning standard. Agencies can be a tremendous resource as can some regional organizations including housing authorities, health corporations, non-profits, boroughs, CDQs, ARDORs, and School Districts. Successful plans are locally developed and regionally supported.

- In order to receive grant funds, each village must demonstrate that the proposed facility will be sustainable with a Business Plan under Denali Commission policies. The business plan must describe who will own the facility, and how it will be operated and maintained. The plan will need to describe how the village will collect funds to pay for operations, maintenance, insurance, major repairs, and long term replacement. A business plan will be prepared as part of this project.

- New power plants are funded, designed, and constructed in three phases: Phase 1 – Conceptual Design; Phase 2 – Design Completion; and Phase 3 – Construction.

- During Phase 1 – Conceptual Design, staff from AEA will visit a village, discuss the program, and work with residents and the local government to select a site for the new power plant. The local government will be requested to decide if it wants this program, and to indicate that AEA should proceed with conceptual design by passing a formal resolution.

- At the completion of Phase 1 – Conceptual Design, the village will be requested to review and formally approve the location and capacity of the power plant, by resolution.

- During Phase 2 – Design Completion, the design for the new power plant will be completed.

- Each village will be requested to provide "in kind" contributions by providing land for the new power plant and free use of local heavy equipment. The grant funds pay for fuel, maintenance, and repairs during construction.

- Project may include local hire and construction trade training programs, subject to Denali Commission funding.

- **Exclusions:**
  - Project does not include purchase of lands.
  - Project does not include remediation of contaminated soils.
  - Project does not include decommissioning of existing fuel tanks or pipelines.

This report has been prepared for the Alaska Energy Authority, Rural Energy Group, to identify the design basis for the development of a new power plant in the community of Akiak, Alaska.

Included in the report is a review of the existing power generation facility and electrical distribution system, an analysis of future power needs, a conceptual design for a new power plant, a proposed project schedule, and a budget level cost estimate for the project.

An engineering investigation was made which included a review of overhead aerial photography and design documents, and a site visit. The investigation also included conversations with

community leaders, governmental agencies, and their representatives. Research was also provided by various consultants.

The only participant in the proposed power generation facility will be the City of Akiak.

On June 8, 2007, Paul Ahtin and Kurt Hanson with AEA and Egor Esipov with LCMF LLC, met in Akiak with local community leaders to discuss the project. The existing power system and the potential new power plant sites were inspected during the site visit. An electrical distribution system inspection was conducted from June 8 to June 10, 2007 by Greg Errico with Errico Electrical Engineering.

Subsequent data gathering was performed by Egor Esipov of LCMF LLC. Subconsultants used for this project were Rick Elliott for site control research, Duane Miller Associates for geotechnical consultation, and Greg Errico with Errico Electrical Engineering for the distribution system inspection and evaluation.

A. CONTACTS

1. Project Team

Alaska Energy Authority:	813 West Northern Lights Blvd, Anchorage, AK 99503	
Kris Noonan	Project Manager, Rural Power Systems	(907) 771-3061
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2. Participants

Akiak Native Community:		
Ivan Ivan	Chief	(907) 765-7112
Samuel Jasper	Power Plant Operator	(907) 765-7411
Fax		(907) 765-7512
City of Akiak:		
Andrew Jasper	Mayor	(907) 765-7411
Fax		(907) 765-7512
Kokarmuit Corporation:		
Ivan Ivan	President	(907) 765-7228

3. Subconsultants

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Rick Elliott		(907) 868-4043
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Duane Miller Associates:	5821 Arctic Blvd, Anchorage, AK 99518	
Duane Miller	Principal Engineer	(907) 644-0510
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Errico Electrical Engineering:	P.O. Box 220471, Anchorage, AK 99522	
Greg Errico	Principal Engineer	(907) 345-6168
Fax		(907) 345-6168

4. Additional Contacts

Additional information for this report was provided by the following people:

Abraham Palacios	AVCP, Native Housing Authority	(907) 543-3121
John Gwinn	Regional Native Health Corporation	(907) 543-6020
Pete Mitchell	Alaska Native Health Consortium	(907) 729-3600
Michael Stoianoff	ADOT, Airports	(907) 269-0653
Joe Slats	Yupiit School District	(907) 825-3601

B. APPLICABLE REGULATIONS, CODES AND POLICIES

1. State and Federal Regulations

The design and operation of a new power plant and the associated fuel systems are controlled by the following state and federal regulations:

- State of Alaska Fire and Life Safety Regulations (13 AAC 50).
- 2003 International Fire Code as adopted by 13 AAC 50.
- 2003 International Building Code as adopted by 13 AAC 50.
- EPA Oil Pollution Prevention Regulations (40 CFR Part 112).
- State of Alaska Oil and Hazardous Substances Pollution Control Regulations (18 AAC 75).
- ADEC Air Quality Regulations (18 AAC 52).
- Regulatory Commission of Alaska (RCA) Certification (3 AAC 42.05.221).
- 2005 National Electrical Code (NEC)
- 2005 National Electrical Safety Code (NESC)

The current State of Alaska Fire and Life Safety Regulations adopted the 2003 editions of the International Fire Code (IFC) and the International Building Code (IBC). The code

requirements of the IFC establish the primary design requirements for new facilities. The State of Alaska Air Quality Regulations applies to emission generating equipment. The facility will require certification from RCA prior to initial use.

The U.S. Environmental Protection Agency (EPA) Spill Prevention Control and Countermeasures Plan (SPCC) identifies minimum fuel facility requirements for aboveground tanks larger than 1,320 gallons.

2. Alaska Energy Authority Policies

a. Site control must be obtained before a grant agreement is finalized and prior to construction. The grantee is responsible for obtaining site control of the main facility site and associated pipelines. AEA's goal is to have site control complete for the power plant facility by mid-December, the year prior to the construction season in which construction of the facility will begin.

b. Land for constructing the power plant facility on should be provided as an in-kind contribution to signify community ownership and responsibility for the facility once completed. When local governments control the land it is anticipated that the land will be donated to the grantee in perpetuity for the benefit of the community. In case of pipeline easements, a land transfer may not be required. If the project will be located on land re-conveyed from the ANCSA Native Corporation to the community for community use or expansion purposes, it is anticipated that the re-conveyed land would be donated. Donated land should be recognized in the grant agreement as an in-kind contribution.

3. Denali Commission Policies

See Appendix H for the Denali Commission Policies.

II. EXISTING POWER GENERATION FACILITY

A. FACILITY DESCRIPTION

The City of Akiak operates the power plant that provides electricity to the entire community. The plant is located on the east side of the community, near to the community hall and water treatment plant. See Figure 1 for a Location Map. The plant is a single unit module that houses switchgear, controls and three generators. The module is a wood frame structure with T1-11 exterior siding. The plant is in poor condition with a post and pad foundation. The generation equipment is in need of routine maintenance. Some of the control gauges do not appear to be functioning and all of the equipment and interior surfaces of the modules are covered with a heavy oil film due to crankcase vents terminating inside the building. A waste heat recovery system is incorporated into the

power plant generators and currently provides supplemental heat for the water plant, washeteria and old city hall building.

The plant has three generators, 200 kW, 150 kW and 100 kW generators. At the time this report was prepared only the 200 kW generator was operable. As of June 2007, the 150 kW generator had 56,935 hours of service, and the 200 kW generator had 2,798 hours of service.

The plant's generators are supplied with fuel oil by a day tank located inside the plant. The day tank draws fuel oil from a 1,100 gallon diked intermediate tank located 15 feet north of the plant. There is no pipeline connection between the intermediate tank and the village collocated tank farm. The intermediate tank draws fuel from the adjacent 2,000 gallon single wall tank by the use of pump and soft hose connection, the City of Akiak transfers the 2,000 gallon tank for fuel fill at the tank farm as needed.

B. EXISTING ELECTRICAL DISTRIBUTION SYSTEM

Errico Electrical Engineering evaluated the existing electrical distribution system as a part of this report. The village of Akiak's distribution system contains three-phase medium voltage, overhead, 2,400 kV Delta system. The existing power plant feeds 3 three-phase step-up transformers mounted on a pole supported platform. The distribution system is in fair to poor condition. See Appendix A – Electrical Distribution System Report.

FIGURE 1 - LOCATION MAP

SCALE: *AS SHOWN*

ALASKA ENERGY AUTHORITY

RURAL POWER SYSTEM UPGRADES
AKIAK, ALASKA

LCMF LLC
615 E. 82nd Ave. Suite 200-Anchorage, Ak 99518 (907) 273-1830

CONCEPTUAL DESIGN REPORT

REVISIONS:

DRAWN BY: EE
CHECKED BY:
DATE: 09/18/07
JOB NUMBER: 06-765
SCALE: AS SHOWN

DRAWING TITLE:
PROJECT OVERVIEW

SHEET: OF
FIG-1

III. PROJECTED ELECTRICAL CONSUMPTION (DEMAND)

In order to project future electrical demand, several factors affecting demand were identified and analyzed. These factors are projected population growth, the historical relationship between demand and season, artificial restrictions to consumption (such as storage shortfall/rationing), projected new sources of demand (outside of historical norms), and access to and potential use of alternative energies.

A. POPULATION GROWTH

The Alaska Department of Labor has projected population growth in the Bethel Census Area in which Akiak is located. These projections predict the Bethel Census area will grow 22% between the years 2008 and 2018, or 2.0% per year.

The Alaska Department of Labor data taken from the Alaska Department of Community and Economic Development database shows a population growth from 2000 to 2006 of 15.8% for the 6-year period, or an annualized growth rate of 2.9% per year. Trend analysis of the Department of Labor data indicates a 25% growth rate over the next 10 years, or an annualized growth rate of 2.9% per year. See Appendix G for Department of Labor population estimates and trend line analysis.

Akiak Population Data			
Year	**Population**	**% Growth Yearly**	**% Growth (5-Year)**
2000	309		
2001	301	-2.7%	
2002	345	12.8%	
2003	346	0.3%	
2004	368	6.0%	
2005	378	2.6%	
2006	367	-3.0%	15.8%

Based on the above data a 2.9% annualized population growth rate for Akiak, or an equivalent 10 year growth rate of 33%, is recommended as a conservative projection of future electrical demand and fuel consumption based on population growth.

B. ENERGY DEMAND/HISTORICAL CONSUMPTION TRENDS

Data for monthly peak loads, electrical consumption, and fuel consumption for the existing power plant over the past 7 years was extracted from Power Cost Equalization (PCE) data supplied by the Alaska Energy Authority. A historical analysis was

performed on the data from fiscal year 2000 through fiscal year 2006. The analysis shows the community experienced a 24% increase in electrical consumption in the fiscal year 2004 through fiscal year 2006. However, more detailed analysis cannot be performed due to growth rates having been skewed by the existing power plant's limited power generation capacity, which has forced the community to ration electrical power in recent years. See Appendix F – Peak Load Trend Analysis and PCE Data.

C. PRODUCTION SHORTFALL / RATIONING

The power plant operator, Samuel Jasper, and Akiak Native Community president, Ivan Ivan, have noted that the community has been forced to ration electrical power. When the existing power plant nears its power generation capacity, the power plant operator transmits messages to the community via VHF radio requesting the public to shut off non-essential appliances. Rationing is a good indication that the community's electrical power generation facilities are not meeting the community's electrical power demand.

D. NEW SOURCES OF DEMAND

Sources of increased electrical demand such as construction activities, new homes, new infrastructure, and changes in or upgrades to existing infrastructure all have potential impacts on future energy demand and consumption. To find out which, if any, of these potential sources are anticipated, the following entities were contacted and asked to provide estimates of planned activities:

- **State of Alaska Department of Transportation (Airport)** – An airport runway lighting and beacon were constructed in 2002. There are no upcoming new projects. Michael Stoianoff, with the State Department of Transportation estimated the current peak loads for the airport facilities to be 12 kW.
- **Yupiit School District** – The community's existing power plant provide power to the school and school housing units. The school is constantly experiencing a shortage of power and uses its 310 kW standby generator. Yupiit School District is currently constructing a school housing duplex. The peak load for the duplex is estimated to be 3.0 kW.
- **Regional Native Health Corporation –** Four months ago, a new clinic was completed and handed over to the community of Akiak. For the purpose of this report it is assumed that the peak load to be estimated at 5 kW.
- **Alaska Native Tribal Health Consortium (ANTHC) –** The water treatment plant has been operating since 2000. Currently, ANTHC is conducting an upgrade on the plant, which will increase the peak load from the current 55 kW to 100 kW.
- **Native Housing Authority (AVCP)** – Akiak Native Community currently has 4 single-family residential dwellings under construction and plans to build

up to 20 houses in 10 years. The peak load per home is estimated to be 2.0 kW. New home construction could result in a peak load increase of up to 46 kW by the year 2017.

E. ALTERNATIVE SOURCES OF ENERGY/EFFICIENCIES

In order to accurately address future fuel consumption based on energy demand, viability of potential alternative energy sources must be considered. For this report the following potential energy sources were briefly analyzed:

- **Heat Recovery**

  A waste heat recovery system is incorporated into the existing diesel power plant generators, and heat recovery from the power plant is used for the water treatment plant, washeteria and old city hall building.

  Waste heat accounts for 100 % of the building heat. This report incorporates the continued use of waste heat for new Power Plant and water treatment plant, washeteria and old City Hall building.

- **Wind Energy**

  The Alaska Energy Authority Alternative Energies group reviewed the wind energy potential in Akiak and determined that the community of Akiak appears to be a fair candidate for wind power. According to the draft wind energy atlas for Alaska produced by the National Renewable Energy lab, Akiak lies in an area with wind power classes of 3 and 4. Wind power classes from 4 to 7 are believed to be viable for generation of electricity by wind turbines.

  The community had requested that the Alaska Energy Authority install a wind monitoring tower at a potential wind turbine site to determine the quality of their wind resource. Alaska Energy Authority assisted in the installation of a wind monitoring station in Bethel, 30 miles southwest of Akiak. Data collected from December 2004 to July 2005 indicated an average wind speed of 14.7 mph at a height of 100 feet above ground level. These wind speeds suggested that Bethel lies within a Class 5 or 6 wind regime. See Appendix E – Wind Power Density Maps.

- **Hydroelectric**

  Research for this report did not find any hydroelectric plants operating on the Kuskokwim River, or data relating to the feasibility of generating hydroelectric power on the river. A Bethel census area energy narrative

located on the State of Alaska Department of Commerce, Community and Economic Development website noted no hydroelectric projects are generating utility power in the Bethel census area.

- **Alternative Fuels**

  City of Akiak currently utilizes diesel #1 as its generator fuel source. Use of diesel #2 has proven to provide increases in BTU production per gallon of fuel used in power generation facilities by a factor of 1.05 and up.

  The heating value of diesel #2 is 140,000 BTUs/gallon and diesel #1 is 133,000 BTUs/gallon (approximations based upon common fuel mixtures used in western Alaska). Using the current consumption figures of 99,100 gallons of diesel #1 per year, a conversion to diesel #2 would reduce fuel consumption to approximately 94,400 gallons resulting in an annual reduction in fuel consumption of 4,700 gallons. Assuming fuel pricing of $5/gallon for either product, this conversion could result in savings of $23,500 or more in annual operating funds.

  No other alternative fuels exist locally in significantly enough quantities to be considered.

- **Geothermal Energy**

  Based on a review of the 1983 and 2003 U.S. Department of Energy map of Alaska Geothermal Resources, no geothermal energy sources are available to the community of Akiak.

- **Efficiency Improvements (Energy Audit Recommendations)**

  An End Use Recommendation Assessment has been provided to the community of Akiak showing cost effective upgrades to lighting and heating systems by AEA. However, conservation impacts of the recommendations are not substantial enough to include in the projected electrical consumption.

  Data supplied by the Alaska Energy Authority showed that the community's power plant is generating between 11 and 13 kWh of electrical power per gallon of diesel fuel. With higher efficiency engines, improved switchgear and more efficient generator sizing, it is assumed that an efficiency of 14 kWh per gallon can be achieved.

F. PROJECTED ELECTRICAL DEMAND

Historical data for Akiak indicated that from 2000 to 2006 the population increased 15.8%, electrical consumption increased from 2004 to 2006 by 24%. The population and

electrical consumption during these years grew at a relatively constant rate. The PCE data was not used to determine a growth rate for estimating future electrical demand due to consistent historical malfunctioning of generators. It shows a constant electrical demand of 171 kW from 2005 to 2007 and 122 kW in 2001, 2002 and a better part of 2003.

Demand sources such as new housing and commercial development are assumed to be reflected in the normal long term population growth rate, based on the State of Alaska Department of Labor projections of 2.0% annually.

Connecting the new facilities, previously discussed in this report, to the community's electrical distribution system will increase electrical consumption and loads significantly. Bringing these facilities online will result in immediate increase peak loads estimated to be as much as 100 kW.

Due to the fact that the City of Akiak has been forced to ration electrical power and the City's power plant generators constant malfunctioning, neither a trend line analysis of historical peak loads nor population growth rate can be used to project the community's electrical power demand over the next ten years. LCMF used PCE data from the communities of Koyuk, Nulato and Tuntutuliak, which have relatively similar population sizes and power driven facilities to derive Akiak's future electrical power demand in fiscal year 2017.

The following table summarizes village's trend peak loads for the fiscal year 2007:

Fiscal Year 2007	Koyuk	Nulato	Tuntutuliak
Trend Peak Load	277 kW	210 kW	179 kW

Using Koyuk's trend peak load of 277 kW in FY 2007 and projecting an annual growth rate of 2.9% gives a 340 kW peak load in FY 2017. Adding the step increases of new facilities increases the projected peak demand to 440 kW in FY 2017.

The existing power plant does not have the capacity to accommodate this projected growth in demand and should be replaced. See Appendix F – Peak Load Trend Analysis and PCE Data.

IV. PROPOSED NEW FACILITY

A. SITE SELECTION

The site selected for construction of a new power plant is located within U.S. Survey 2243 which is within sections 30 and 31, Township 10 North, Range 67 West, Seward Meridian, Alaska, and is adjacent to the existing power plant. The surface estate of U.S. Survey 2243 was conveyed to the Kokarmuit Corporation by Interim Conveyance No.

610 dated December 29, 1982. See Appendix B for Site Control Opinion and Figure 1 for a Location Map.

Locating the new power plant near the existing one will reduce the costs associated with connecting the plant to the existing power distribution. Connecting to the existing power distribution system will require less than 300 feet of overhead power line.

Also, by locating the new power plant near the existing one will incorporate the use of the existing heat recovery system that currently provides supplemental heat to the washeteria, old city hall building and recently constructed water treatment plant. By recovering heat generated during the power generation process, the village can significantly reduce the amount of fuel oil used at the water treatment plant; thereby reducing the water treatment plant's operating and maintenance costs.

B. SITE CONTROL

Site Control for this report was provided by Rick Elliott, Land Consultant. Mr. Elliot concluded that, based on available public records, the site selected for the proposed power plant is owned by Kokarmuit Corporation. See Appendix B – Site Control Opinion.

C. SOIL CONDITIONS

Duane Miller Associates (DMA) gathered and studied historical information of soil conditions in Akiak. As discussed in the study the community is predominantly underlain by sand and silty sand. Akiak lies within the zone of discontinuous permafrost and previous explorations have encountered frozen soils below the active layer. The proposed power plant site is expected to be underlain by unfrozen soils. A field investigation should be conducted at the selected site to determine the subsurface soil conditions. After determining the soil conditions a foundation can be designed. Most likely, due to economical reasons, the foundation will consist of steel piles driven 40 to 50 feet. See Appendix C – Geotechnical Consultation.

D. COMMUNITY FLOOD DATA

The U.S. Army Corps of Engineers, Flood Plain Management Services, Alaska Communities flood hazard data website notes that the community of Akiak is subject to flooding, that flooding occurs from both ice jams and high runoff, and that some flooding occurs annually. See Appendix D – Flood Hazard Data.

E. LOCAL FILL MATERIAL

Local fill materials are not available. Sands and gravels will probably have to be barged from Bethel or Kalstag.

F. POWER GENERATION BUILDING FOUNDATION

The site is expected to be underlain by unfrozen soils with sands and silty sand. According to the DMA report, there were two foundation systems considered to support the power plant: a post and pad (spread footing) foundation and a driven pile foundation. A pile driven foundation is recommended, since it is economically feasible, has less risk of settlement from the loose layers that might underlie the site and will address high probability of flooding in the area. The elevation of building should be at 37.2 feet as recommended in Appendix D – Flood Hazard Data.

For the purpose of this report it is assumed that the pilings will have to be driven to depths of 40 feet so they would resist frost heave loads. The building foundation will be constructed with steel structural members.

G. POWER GENERATOR BUILDING

The building will be a 36 foot by 48 foot metal structure. It will be insulated, and have interior partitions to close off work areas from the generator noise. The building's main structural members will be steel. The building will house the generators and all associated switchgear. The building will include a waste heat recovery system. See Appendix J – Conceptual Design Drawings.

H. FUEL SYSTEM

The Kokarmiut Corporation utilizes a consolidated Bulk Fuel Tank Farm that was constructed in 1999. The fuel is used for the local housing, the power plant and for local commercial sale. The School's Bulk Fuel Tank Farm was constructed in 2006. It provides heating oil storage for the school only, and is not available to provide additional fuel oil storage for the proposed power plant. The following table details the tank owner, user, product, and usable capacities.

Owner	User	Product	Usable Capacity
Kokarmiut Corporation	Power Generation	Diesel / Gas	215,000
Yupiit Schools	Heating Oil	Diesel	70,250
Army National Guard	Dispensing	Diesel	5,500

PCE records indicated that 99,127 gallons of fuel oil were consumed by the power plant in fiscal year 2006. The existing bulk fuel farm will provide adequate power plant capacity for 2017 projected electrical demand. The village receives two fuel deliveries a year.

As part of this project, a new 12,000 gallon double wall intermediate tank should be purchased and installed at the proposed power plant site. The new tank will supply fuel to the proposed plant's day tank, and be filled by a new pipeline running from the existing bulk fuel tank farm. The tank must meet the most current edition of Underwriters Laboratories Inc. (UL) Standard UL 142. It should be supported by a pile driven foundation at the same elevation as the power plant with the step transformer. See Appendix J – Conceptual Design Drawings. The tank should be equipped with the following overfill prevention measures:

- Float actuated fill limiting valve.
- High level pump shut-off switch.
- Critical high level alarm.
- Liquid level gauge, and
- Whistle vent.

I. GENERATORS AND SWITCHGEAR

A power generation capacity of 800 kW to 1,000 kW is recommended for the proposed power plant. The 1,030 kW capacity can be provided by installing four generators with individual capacities of 350, 350, 180, and 150 kW. The generators will feed new load sensing switchgear, and pad mounted, step up transformers. The generators are sized to handle the projected peak loading, after the loss of the single largest generator. Additional load monitoring is required to properly size the generators, and should be included in the final design of the power plant.

J. CONNECTION TO EXISTING ELECTRICAL DISTRIBUTION SYSTEM

At the new Power Plant, it is proposed to install one three phase pad-mounted step-up transformer step-up the voltage to a distribution level of 7,200/12,500 V. The transformer is to be installed on the same piling platform as the Power Plant (see Appendix J – Conceptual Design Drawings). Improvements to the existing electrical distribution system will include conversion of the distribution system to 7,200/12.47 kV. This voltage is more common than the existing overhead, 2,400 kV Delta system and allows AEA to standardize on it; and it will reduce system losses.

The village of Akiak's distribution system contains three-phase medium voltage, overhead, 2,400 kV Delta system. The existing power plant feeds 3 three-phase step-up transformers mounted on a pole supported platform.

K. UPGRADES TO ELECTRICAL DISTRIBUTION SYSTEM

The system as a whole is in fair to poor condition with many NESC code violations noted during the electrical field evaluation performed in conjunction with this report. The

recommendation is to replace/upgrade the entire power distribution system to a 7.2/12.47 kV system and reutilize some of the newer constructed facilities. This will reduce future maintenance costs and increase the reliability of the system. See Appendix A – Electrical Distribution System Report.

L. OWNERSHIP AND OPERATION

The proposed power generation facility and upgraded electrical distribution system will be owned and operated by the City of Akiak.

M. PERMITTING

The construction and operation of the new power plant requires the following permitting:

1. Coastal Project Questionnaire

Since Akiak is located in a coastal zone, the project requires submittal of a Coastal Project Questionnaire to the State of Alaska, Department of Natural Resources (DNR). The DNR coordinates review of the questionnaire by various state agencies and assists in identifying required permits pertinent to the project. The standard review spans a 30-day period.

2. Fire Marshal Review

The construction of the new power generation facility will require submittal of a complete set of construction documents to the State of Alaska, Department of Public Safety, Division of Fire Prevention (Fire Marshal) for plan review and approval. The State Fire Marshal then issues a Plan Review Certificate to verify compliance with adopted Building, Fire, and Life Safety codes. Final stamped drawings must be submitted along with the application fee for project review. Anticipate a minimum of one month before comments may be received from the Fire Marshal.

3. United States Army Wetlands Permit

Projects that place fill material in wetlands require an Application for Department of the Army Permit to be submitted to the U.S. Army Corps of Engineers, Alaska District, before construction begins. It will be necessary for the Corps of Engineers to review this project to determine if the selected building site is considered to be wetlands. The standard review period varies from 30 to 90 days.

4. Federal Aviation Administration Review

Power plants located less than 5 miles from a runway or airport, such as this project, should complete Form 7460-1, “Notice of Proposed Construction or Alteration”, and submit all necessary elevation and height of structure information to the Federal Aviation

Administration (FAA), Alaska Region, prior to construction. The FAA reviews the project and determines if the project will present a hazard to air traffic in the vicinity. The FAA has typically provided project determinations within one month of the completed form submittal.

5. State of Alaska, Department of Environmental Conservation Review

The Alaska Department of Environmental Conservation (ADEC) regulates the operation of diesel power generation facilities by a consistency review process. The Application for Pre-Approved Limit Diesel Generation Facility must be submitted prior to the facility startup, provided that the nitrogen oxide emissions do not exceed 100 tons/year. The review is set up to accommodate future growth of a power plant, provided that growth is requested during the initial application, and it does not exceed the 100 ton/year of nitrogen oxide emissions. Power plants which fall into the sizes necessary for Alaska villages will not exceed the 100 ton/year emission level.

6. Regulatory Commission of Alaska Certification

The Regulatory Commission of Alaska (RCA) regulates public utilities by certifying qualified providers of public utility and pipeline services, and ensuring that they provide safe and adequate services and facilities at just and reasonable rates, terms, and conditions. This keeps rates as low as possible while allowing the utility to earn a fair return. The commission also determines the eligibility and the per kilowatt-hour support for electric utilities under the Power Cost Equalization (PCE) program. Akiak Power Utility is certified by RCA and enrolled in PCE program. See Appendix K – Regulatory Commission of Alaska.

7. State of Alaska Historical Preservation Office

The State Historic Preservation Office is required, under Section 106 of the National Historic Preservation Act, to review any state or federally funded project to determine if the project will disturb historical or cultural resources.

8. United States Fish and Wildlife Service

The United States Fish and Wildlife Service will review the project to determine what effect the project will have on endangered species.

9. U. S. Environmental Protection Agency Alaska Operations Office

SPCC (spill prevention and countermeasure) plan, for the proposed intermediate and day tanks, will be required for the United States Environmental Protection Agency prior to commissioning the intended system.

N. CONSTRUCTION METHOD

Construction of the new Power Plant is to be conducted using Force Account methods. Under qualified management, this construction method has traditionally produced cost effective results, fast construction schedules and increased local hire.

When working on a Force Account basis, the project typically hires a qualified superintendent and local labor where available. Additional personnel may need to be brought in to supplement the local labor force for specialty trades, such as pipe welding and electrical installation.

Traditionally, Force Account projects have enlisted the use of local equipment where available. Where the local equipment use cannot be donated to the project, equipment rental rates are negotiated or traded off for equipment repair.

1. Local labor

There are skilled labors in the community, but detailed list is not available.

2. Local Equipment

The City of Akiak owns John Deere 310A backhoe. Alaska Native Tribal Health Consortium utilizes John Deere 160C excavator for upgrading the water treatment plant. The excavator will be turned over to the City on a transfer agreement at the completion of project, which would be around fall 2008. For information concerning equipment current condition and availability contact the City of Akiak.

O. SCHEDULE

A construction schedule is presented below and has been prepared based on historical force account construction methods and crew sizes. Construction of the modular power plant is anticipated to occur at the manufacturer's /contractor's yard, and shipped complete to the project site after installation of the piles.

Construction Schedule
Akiak Rural Power System Upgrade

Activity	Start Date
Design and Permitting	Winter 2008
Procurement	Summer 2009
Mobilization/Material Delivery	Fall 2009
Begin Site Construction	Winter 2009
End Construction/Commissioning	Winter 2009
Demobilization	Spring 2009

Note: The proposed schedule is very dependent upon many inter-related factors, such as project start time, material availability and weather. If any of these items creates a delay, the project may run into the following season, which will increase the construction costs. In order to address this potential delay and increased cost, a 15% construction contingency should be used in cost estimating for the project.

P. BUDGET LEVEL COST ESTIMATE

A budget level cost estimate has been prepared for constructing the power plant and upgrading the existing electrical distribution system as presented in this report. Equipment rental rates are based on historical rental rates for similar equipment.

The construction cost estimate is based on a historical force account construction costs. The total budget estimate also includes costs associated with design, legal, and project management, and a construction contingency of 15%. The total cost is estimated to be $3,386,477.00.

The cost of upgrading the existing electrical distribution system is based on a cost estimate provided by Errico Electrical Engineering. See Appendix I – Budget Level Cost Estimate.

The cost per kW for the proposed power plant portion of the project is $2,693 or 29.4% over the benchmark limit (see table below). The main reason for such cost containment variance is that the construction costs have significantly increased over the past 5 years, while the Denali Commission Cost Containment Policy for Energy Projects benchmarks were last revised in April 2002.

HMS Incorporated, an Anchorage based cost estimating firm, has tracked construction costs from around the state for more than 25 years. Their findings have been published in the State of Alaska's Department of Education and Early Development for use in the Department's "Program Demand Cost Model for Alaskan Schools". This data was summarized in "Alaskan Construction Escalation Index for Anchorage, Alaska" and geographic adjustment factors are given in "Geographic Area Cost Factor" indexes. The data indicates the following:

1. Over the past five years, construction costs in Alaska have risen on average more than 8% per year.
2. Construction costs rose 42.88% between 2001 and 2006.
3. Over the past three years, construction costs in Alaska have risen on average more than 10% per year.
4. Construction costs rose 31.07% between 2003 and 2006.

The Alaska Department of Labor and Workforce Development tracks construction costs in their annual construction cost surveys. These surveys simulate construction costs for single family housing in selected areas/communities throughout Alaska. These surveys indicate an increase in construction costs, for the Anchorage area from 2002 to 2007, of 28%.

The combined data sources above confirm that the benchmark range should be increased by 28% to 43% to reflect current construction costs. This would put the current budget estimate of $2,693 within the adjusted benchmark.

Cost Variance					
Power Plant Portion Cost (Total $)	Design Power Generation Capacity (kW)	Project Cost ($/kW)	Denali Commission Benchmark Range ($/kW)	Benchmark Variance ($/kW)	Variance (%)
$2,773,477	1,030	$2,693	$1,900 to $1,600	$793	29.4%

APPENDIX A

ELECTRICAL DISTRIBUTION SYSTEM REPORT

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July 18, 2007

Egor Esipov
LCMF, LLC
615 East 82nd Ave., Suite 200
Anchorage, Alaska 99518

Re: Akiak Electrical Distribution condition survey

Dear Mr. Esipov:

As requested, I reviewed the electrical distribution system in Akiak on June 8, 2007 with yourself and two representatives from AEA. I also met with power plant operators, Ivan and Sam. I also spoke with several villagers who asked to have poles moved out of the road.

General Notes:

The distribution system is a 2400V Delta system. It is mostly in fair to poor condition, with trees growing into the lines in several locations. Several of the poles are leaning, but only a few excessively. Clearances are inadequate for many of the services and some of the secondaries. Clearances between telecommunication facilities and secondaries and services are inadequate on many poles, in spans, and at many buildings.

Insufficient clearance exists between primary conductors and buildings at several locations.

Many of the poles are not numbered. To facilitate reference to the poles within this report, unnumbered poles are assigned numbers. When a pole did not have a number in the field, its pole number will be proceeded with, "tbrta" which is short for "to be referred to as".

Many of these anchor rod eyes do not have anchor-rod-to-guy-bonding-clamps (peanuts), and where a peanut is missing it needs to be installed.

Where the anchor rod eye is buried, it should be uncovered.

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Ground rods extending above ground need to be re-driven and the pole ground re-worked as required.

General Recommendations:

I recommend replacing/upgrading the entire system to a 7.2/12.47kV system, re-utilizing some of the newer constructed facilities. This will reduce future maintenance costs, and increase the reliability of the system.

Condition survey beginning at the power plant:

Poles (tbrta) C19 & C18: Provide pole numbers; add peanut to guy.

Pole C17: No comment

Pole (tbrta) C17A-1: Provide pole number; pole set shallow; ground guy; bond messenger; re-drive ground rod to below grade; add staples to pole ground; repair broken street light glass; raise service to provide 40" clearance to telecommunications; ground street light bracket to pole ground; trim bolts; provideguy marker; **retire energized #2 triplex wrapped around pole and on ground; uncover buried anchor eye.**

Pole (tbrta) C17A-2: Provide pole number; raise services and secondary in span to pole 4—insufficient clearance between secondary and tele in span; uncover buried anchor eye; ground guy to secondary neutral; bond tele messenger to guy.

Starting again at C17:

Pole (tbrta) C16: Provide pole number.

Pole C14: Add peanut at guy; repair broken street light glass; ground street light bracket to pole ground; trim guy bolt; re-work secondary/service drip loops where insufficient clearance between tele and secondary; lower tele drop.

Pole (tbrta) C13B-1: Provide pole number; add staples to ground; trim transformer and tele bolts; add guy—pole leaning; rework tele/secondary—clearance insufficient.

Pole (tbrta) C13B-2: Provide pole number; #2 service is too low over roof beyond 6' from its attachment.

Starting again at (tbrta) C13B-1:

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Pole C13: Ground guy or retire—guy is loose at 7-8° line angle; add peanut.

Pole (tbrta) C13A-1: Provide pole number; bond span guy to down guy; add span guy for small line angle

Starting again at C13:

Pole C12: Add staples to ground wire; insufficient clearance: tele/sec and tele/xfmr; ground tele messenger; Pole is leaning 2'.

Pole (tbrta) C12A-1: Replace pole—pole is not treated and is rotting; 1/0 is very low at service; add guy marker; add peanut.

Starting again at C12:

Pole C11: Pole is leaning 2'.

Pole C10: Pole is leaning 2'; there is insufficient clearance: tele/sec, tele/service, and mid-span at #2; clean up drip loop; lower tele.

Pole C9: Raise low service; add staples to pole ground; bond tele messenger to pole ground; replace guy marker; raise conductor with insufficient clearance: tele/service, tele/secondary, and tele/transformer.

Pole (tbrta) C9A-1: Provide pole number; raise 1/0 service where low over roof; insufficient midspan tele/secondary clearance to C9.

Starting again at C9:

Pole (tbrta) C9B-1: Provide pole number; raise #2 low service over connex (not energized)

Starting again at C9:

Pole C8: Source below load; ground guy; recommend dead end construction; C7 at an angle to line; add peanut.

Pole C8A-1: Ground street light bracket; ground guy and add peanut; fix insufficient clearance: tele/secondary and tele/service.

Pole (tbrta) C8A-1-1: Provide pole number; verify clearance of secondary over roof.

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Starting again at C8A-1:

Pole (tbrta) C8A-2: Provide treated pole to replace untreated pole (leaning 30°); ground guy; add peanut; provide guy to secondary; fix insufficient clearance at tele/secondary; retire 2x4 holding up secondary at structure.

Pole (tbrta) C8A-3: Provide pole number; clear R-O-W—secondary is in trees.

Starting again at C8:

Pole C8B-1: no comment

Pole C8B-2: Rework daisy chained service to structures; replace broken street light bulb; lower street light; raise low 1/0 secondary/service; bond messenger to secondary neutral.

Poles (tbrta) C8B-3 & C8B-4: Provide pole numbers; replace broken cut-out crossarm; retire and replace structure—platform failing; add pole ground.

Pole (tbrta) C8B-5: Provide pole number; raise low 1/0 conductor.

Pole (tbrta) C8B-6: Provide pole number; replace street light photocell—has failed in on position.

Starting again at (tbrta) C8B-3 & C8B-4:

Pole (tbrta) C8B-3-1: Provide pole number; raise low conductor over generator connex; add peanut; ground guy.

Starting again at C8:

Pole C7: Replace street light photocell—has failed in on position; replace broken street light glass; fix insufficient clearance: tele/secondary and tele/service.

Pole C6: Fix insufficient clearance: tele/secondary and tele/service.

Pole C6A-1: Fix insufficient clearance: **primary over roof** and tele/service; add guy marker; ground guy.

Starting again at C6:

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Pole C5: fix insufficient clearance: tele/secondary; redrive ground rod; add staples to pole ground.

Pole C5A-1: Pole leaning 3', service is inappropriately guyed—use extended weatherhead riser; fix insufficient clearance in tele/secondary span.

Starting again at C5:

Pole (tbrta) C5B-1: Provide pole number; retire dangling de-energized drop.

Starting again at C5:

Pole C4: Replace broken street light bulb and glass.

Pole C3: Add staples to pole ground, fix insufficient clearance: tele/secondary and tele/service.

Pole C3A-1: Remove birdhouse; remove basketball goal; trim bolt; trim bolt; straighten pole—leaning 5'; fix insufficient midspan clearance at tele/secondary

Starting again at C3:

Pole C2: Add guy marker; ground guy; fix insufficient clearance: tele/secondary and tele/service (tele drop is on service drop); add staples to ground; add peanut; replace anchor—anchor rod is 4' out of ground; retire perpendicular guy.

Pole C1U: Pole leaning; add peanut; ground guy; replace broken street light bulb and glass.

Pole (tbrta) C1A-1: Provide pole number; replace broken pole ground; redrive ground rod.

Starting again at C6:

Pole C6B-1: Fix insufficient clearance: tele/secondary and tele/service; replace broken street light glass.

Pole A7-2: Fix insufficient **primary clearance** over roof it crosses.

Pole A7-1: no comment.

Pole A7: Street light is above primary; replace broken street light bulb.

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Pole (tbrta) A7A-1: Provide pole number.

Poles (tbrta) A7A-2 and A7A-3: Provide pole number; ground guys; add guy markers and peanuts; make pole less climbable; retire old unused platform and unused pole; and lower crossarm; retire service (not in use); add guy and anchor.

Pole 82: Consumer-owned service is touching down guy; make riser not readily climbable—8'-2" between lowest and second lowest brackets.

Pole (tbrta) 82-1: Provide pole number (communication pole)

Starting again at A7:

Pole A6: Redrive ground rod; add staples to ground wire; pole leaning 3'; raise low service.

Pole (tbrta) A6A-1: Provide pole number; raise low service over roof with intermediate mast at 6' from weatherhead.

Starting again at A6:

Pole A5: Swerve guy tail; add guy marker; add peanut; ground guy.

Pole A4: Pole leaning 2.5'; redrive ground rod; add staples to ground wire; add tank ground; trim bolts; fix insufficient clearance: tele/service and tele/secondary.

Pole A4A-1: Ground guy; replace guy marker; add peanut; ground street light bracket; replace broken street light bulb.

Starting again at A4:

Pole A3: no comment.

Pole (tbrta) A2: Provide pole number; add staples to ground wire; ground guys; add peanuts.

Pole A2A-1U: Cross arm at angle to pole, but is okay.

Pole A2A-2U: no comment.

Pole A2A-3U: Provide guy attachment; replace anchor—3.5' out of ground; ground guys; add peanut; add staples to ground wire; replace photocell—broken

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in on position; ground transformer tank; replace untreated pole, used as lift pole to service, with treated pole.

Starting again at A7:

Pole A8: Add staples, fix insufficient clearance: tele/service, tele/secondary, and tele/transformer.

Pole A8A-1: Fix insufficient clearance at tele/secondary drip loop; add guy marker; add peanut; ground guy.

Starting again at A8:

Pole (tbrta) A8B-1: Provide pole number; raise low #4 service; swerve guy; ground guy; add guy marker; add peanut.

Starting again at A8:

Pole A9: Fix insufficient clearance: tele/service and tele/secondary; service low over roof at 6' from weatherhead; service is daisy chained to church; opposite service has tele touching service.

Pole A10: Add staples to ground wire; add transformer tank ground; fix insufficient clearance: tele/service and tele/secondary; raise low service at structure.

Pole A11: Fix insufficient clearance: tele/service and tele/secondary to structure and in span to A10.

Pole A12: Replace broken street light glass; replace broken street light photocell—failed in on position; add guy marker; swerve wire; add peanuts; fix insufficient clearance: tele/secondary; add staples to ground wire.

Pole A12A-1U: Ground guy; add guy marker; add peanut; raise low service at structure.

Starting again at A12:

Pole A13: Fix insufficient clearance in backspan for tele/secondary; fix insufficient clearance in front span for tele/secondary and tele/service; need service lift pole where service supported by tree.

Pole A14: no comment.

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Pole A15: Reset pole deeper—currently embedded 1.75'; ground guy; replace street light glass; ground street light bracket; add staples to ground wire; add peanuts; fix insufficient clearance: tele/service and tele/secondary; at closest structure: raise low service and fix insufficient span clearance between service and tele; fix service on adjacent structure supported by 2x4 on building; raise tele touching service at opposite service tap.

Pole A15A-1: clean up drip loops.

Starting again at A12:

Pole A12B-1U: no comment

Pole A12B-2U: Start of new UUI pole line in good condition; fix insufficient clearance: tele/primary jumper.

Pole (tbrta) A12B-2U-1 (duplicate number A12B-1U on pole): Renumber pole; add guy marker; ground guys; re-install pole ground and connect to ground rod; add staples to ground wire; street light installed above primary; fix insufficient clearance: tele/service, tele/secondary, and tele/transformer.

Pole (tbrta) A12B-2U-2: Provide pole number; pole leaning 2'; service low at structure and insufficient clearance in service span to tele; insufficient clearance in backspan at tele/secondary.

Starting again at A12B-2U:

Pole A12B-3: Street light installed above primary; ground guys; add peanuts fix insufficient clearance: tele/service, tele/secondary, and tele/transformer.

Pole A12B-4: no comment.

Starting again at A12B-3:

Pole A12A-3U: Tele touching secondary in frontspan; backspan is low over road.

Pole A12A-2U: Rework daisy chained #4 service between structures; add guy marker; ground guys; add peanuts.

Starting again at A12A-3U:

Pole (tbrta) A12A-4U: Replace untreated leaning pole with treated pole.

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Pole (tbrta) A12A-5U: Provide pole number; raise low service to structure.

Starting again at A12B-2U:

Pole (tbrta) B1: Provide pole number; tighten primary to help jumpering—clearance phase to phase at jumpers insufficient; replace guy marker; ground guys; ground tele messenger; add peanuts.

Pole (tbrta) B2: Provide pole number; attach electric not attached, **primary** on both sides of pole; tele touching secondary in frontspan.

Pole (tbrta) B3: Provide pole number;

Pole (tbrta) B3B-1: Provide pole number; add peanut.

Starting again at (tbrta) B3:

Pole (tbrta) B3A-1: Provide pole number; add peanut

Pole (tbrta) B3A-2: Provide pole number; use pole as source for new structure

Pole (tbrta) B3A-3: Provide pole number; add peanut; fix insufficient clearance: secondary riser to tele.

Starting again at (tbrta) B3:

Pole (tbrta) B4: Provide pole number; redrive ground rod; rework pole ground; add staples to ground wire; ground guys; add peanuts; fix insufficient clearance: tele/service and tele/secondary—raise secondary and service.

Pole (tbrta) B5: Provide pole number; fix insufficient midspan clearance tele/secondary; fix insufficient clearance at pole: tele/secondary and tele/service—raise secondary and services.

Pole (tbrta) B6: Provide pole number; add peanut; ground guy.

Pole (tbrta) B7: Provide pole number; source below load; fix insufficient clearance: tele/secondary; ground guy; add peanut; rework guy in middle of road.

Pole (tbrta) B7A-1: Provide pole number; fix insufficient clearance in frontspan and backspan: tele/secondary; raise low service at post office.

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Pole (tbrta) B7A-2: Provide pole number; fix insufficient clearance in backspan: tele/secondary.

Starting again at (tbrta) B7A-1:

Pole (tbrta) B7A-3: Provide pole number; fix insufficient clearance in backspan: tele/secondary.

Starting again at (tbrta) B7:

Pole (tbrta) B8: Provide pole number; fix insufficient clearance at pole: tele/electric;

Pole (tbrta) B8A-1: Provide pole number; extend service riser; raise secondary—it's below tele.

Starting again at (tbrta) B8:

Pole (tbrta) B8A-2: Provide pole number; add guy marker; extend pole ground; ground guy; fix insufficient span clearance: tele/electric; install peanut.

Starting again at (tbrta) B8:

Pole (tbrta) B9: Provide pole number.

Pole (tbrta) B10: Provide pole number.

Pole (tbrta) B10A-1: Provide pole number; replace guy and guy marker.

Pole (tbrta) B10A-2: Provide pole number; unbury anchor rod eye.

Starting again at (tbrta) B10:

Pole (tbrta) B11: Provide pole number.

Pole (tbrta) B12: Provide pole number.

Pole (tbrta) B13: Provide pole number.

Pole (tbrta) B14: Provide pole number.

Pole (tbrta) B15: Provide pole number; retire service on ground—de-energized.

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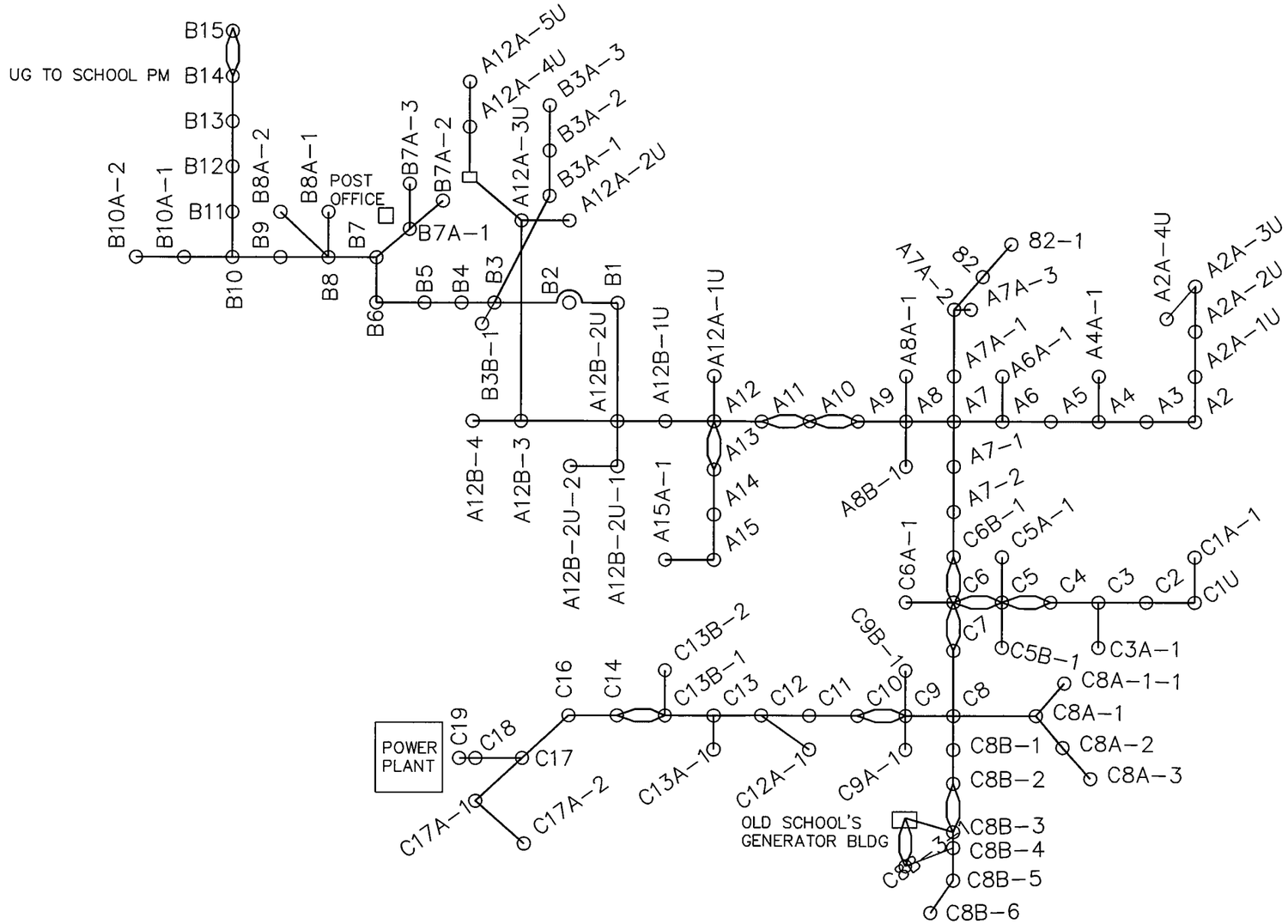
If you have any questions regarding this report, please do not hesitate to call me.

Regards,

Gregory M. Errico, PE

Attachments: Schematic pole layout



SCHEMATIC DIAGRAM OF EXISTING POLES AND CONNECTING ELECTRICAL CIRCUITS
NOT TO SCALE

PRIMARY AND SECONDARY CONDUCTORS ARE NOT DIFFERENTIATED.

PURPOSE OF DRAWING IS TO GIVE GENERAL LOCATION OF EXISTING POLES AND CIRCUITS. NUMBERS SHOWN FOR UN-NUMBERED POLES ARE FOR REFERENCE IN REPORT WHERE NUMBER IS PRECEDED BY (TBRTA)=TO BE REFERRED TO AS.

ELECTRICAL DISTRIBUTION SYSTEM
CONDITION SURVEY LAYOUT DIAGRAM

AKIAK, ALASKA

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ARRICO ELECTRICAL ENGINEERING, LLC

CONDITION SURVEY
REVISIONS:

DRAWN BY: ME
CHECKED BY: GE
DATE: 7-18-07
JOB NUMBER:
DWG FILE:

DRAWING TITLE:
SCEMATIC DIAGRAM OF EXISTING POLES AND ELECTRICAL CIRCUITS

SHEET: 1 OF 1
E1

PLOTTING DATE: 00/00/96
XREF:

APPENDIX B

SITE CONTROL OPINION

Land Status Report
Akiak Power Plant

As requested, I have reviewed the land status for the proposed power plant in Akiak. I reviewed the land status for two sites. Site A is located adjacent to the existing power plant and Site B is located near the existing tank farm and old high school site as shown in the drawing provided to me (attachment #1).

Land Status Research

Land records were researched at the Bureau of Land Management and the State Recording Office. All research was conducted on line. There was no community profile map available from the State Department of Commerce, Community and Economic Development.

Site A. The proposed site is located within U.S. Survey 2243 which is within sections 30 and 31, Township 10 North, Range 67 West, Seward Meridian, Alaska. The surface estate of U.S. Survey 2243 was conveyed to the Kokarmuit Corporation by Interim Conveyance No. 610 dated December 29, 1982. The document was recorded on October 16, 1995, in Book 69, Pages 652-663 in the Bethel Recording District. A copy of the pertinent portion of the recorded conveyance is attached (attachment #2). Although there have been some recorded conveyances within U.S. Survey 2243, the surface estate of the proposed site appears to be still under the ownership of Kokarmuit Corporation. The subsurface estate of this property was conveyed to the Calista Corporation by Interim Conveyance No. 611. This document was recorded on January 14, 1983, in Book 33, Page 72-81. This document was not available on line.

Site B. The proposed site is located within Block 13, U.S Survey No. 5068, Akiak Townsite. According to the drawing provided, the site appears to be within Lots 3, Block 13. Lots 3, 4 and 5, Block 13 were conveyed to Kokarmuit Corporation by Patent No. 50-85-0676 on September 30, 1985. This document was recorded on October 16, 1995, at Book 69, Pages 666-667 in the Bethel Recording District. A copy of the document is attached (attachment #3). Lots 7, Block 13 was conveyed to the City of Akiak by Federal Townsite Deed on September 5, 1989. It should also be noted that the Yupitt School District issued a quit claim deed for interest in Lot 3 and 4, Block 13 to Kokarmuit Corporation. The Yupitt School District also issued a quitclaim deed for interest in Lot 7, Block 13 to the City of Akiak. However, both specifically excluded the "tank farm and the vocational/educational shop building" for retention. From the limited research, Yupitt School District does not appear to be in the chain of title but apparently has some type of equitable interest in the old school facilities. Lots 1, 2, 6 and 8, Block 13 were conveyed to individuals as restricted townsite deeds by the Federal Townsite Trustee in 1985. If this site were to be selected, on the ground location of lot lines would be required and additional research should be performed to accurately ascertain land ownership.

Land Status Summary: The apparent owner of Site A is Kokarmuit Corporation. If site B is within Lots 3, Block 13, as it appears from limited information, the apparent owner is also Kokarmuit Corporation.

Disclaimer: This land status report does not purport to insure, warrant or certify title. The research of the BLM and Recorders Office records was limited to a review of the information on line. The opinion is the result of a limited research effort as described above.

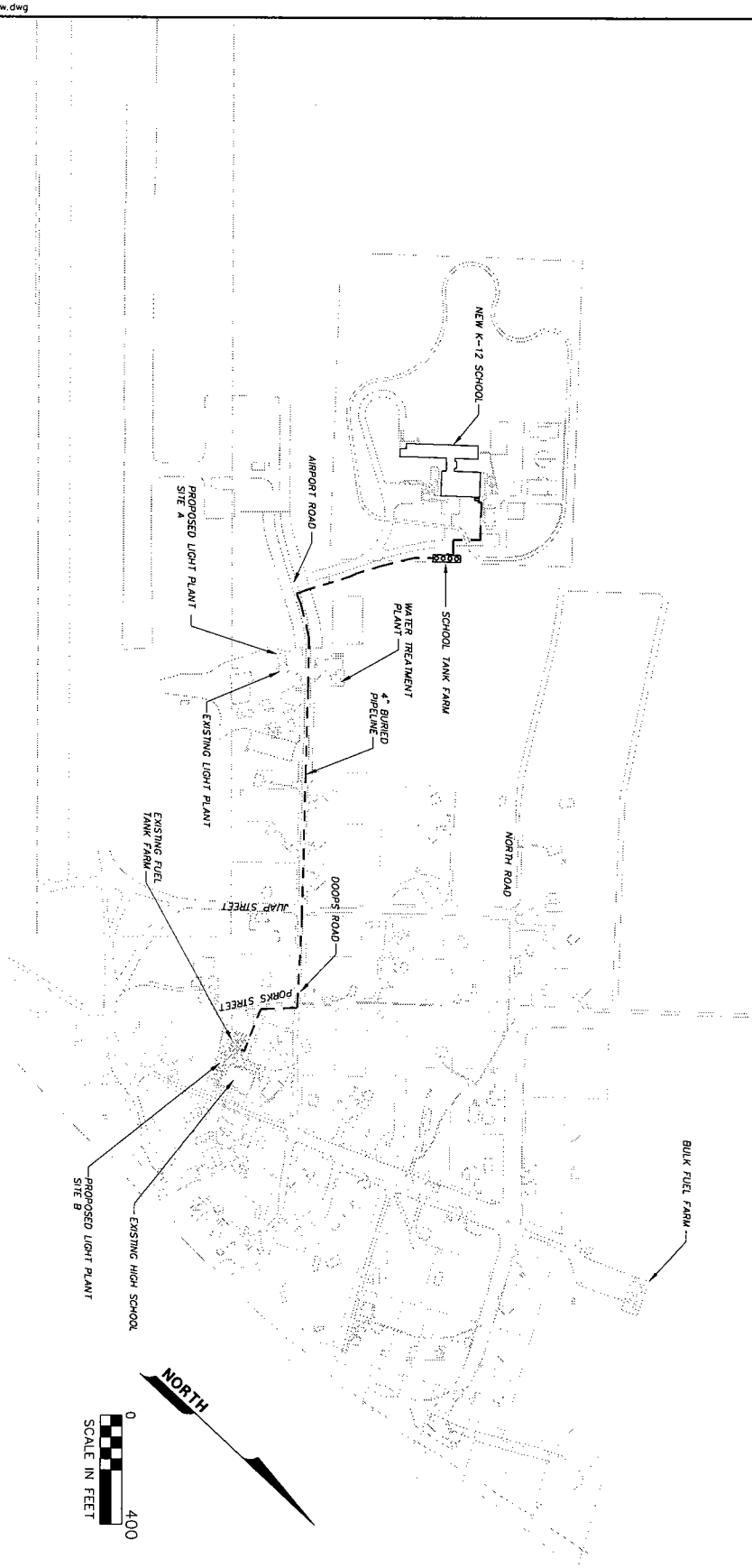
Prepared by

Rick Elliott

Rick Elliott
Land Consultant
for LCMF, Inc.
July 19, 2007

Attachments: a/s

PLOTTING DATE: 7/6/07 (11:13) BY: eesipov
AUTOCAD DRAWING NAME: Project Over view.dwg



Attachment #1

SHEET: OF	DRAWN BY:	65% DESIGN DRAWINGS	LCMF LLC 913 E. 62nd Ave. Suite 200 Anchorage, AK 99518 279-1688	CLIENT
	CHECKED BY:	REVISIONS:		PROJECT NAME
	DATE:			LOCATION
	JOB NUMBER:			
	SCALE: AS SHOWN			
	DRAWING TITLE:			

F-14824-A

BOOK 69 PAGE 652

INTERIM CONVEYANCE

BK 69, Pg 652
rec. Oct 16, 1995

WHEREAS

Kokarmuit Corporation

is entitled to a conveyance pursuant to Secs. 14(a) and 22(j) of the Alaska Native Claims Settlement Act of December 18, 1971 (43 U.S.C. 1601, 1613(a), 1621(j) (Supp. IV, 1980)) of the surface estate in the following described lands:

U.S. Survey No. 2243, Alaska, situated at the Native village of Akiak, on the right bank of the Kuskokwim River, excluding U.S. Survey No. 5068, Townsite of Akiak, Alaska.

Containing approximately 1,189 acres.

Seward Meridian, Alaska (Unsurveyed)

T. 9 N., R. 65 W.
Sec. 29;
Sec. 30, excluding Native allotment F-18140;
Secs. 31 and 32.

Containing approximately 2,516 acres.

T. 8 N., R. 66 W.
Secs. 1 to 6, inclusive;
Sec. 7, excluding Native allotments AA-8966 Parcel B and F-17063 Parcel A;
Secs. 8 to 17, inclusive;
Sec. 18, excluding Native allotment F-17209 Parcel A.

Containing approximately 11,320 acres.

T. 9 N., R. 66 W.
Sec. 4, excluding Native allotments F-15906 and F-17077;
Sec. 5, excluding Native allotment F-17077;
Sec. 6;
Sec. 7, excluding Native allotment F-17082;
Sec. 8, excluding Native allotment F-17077;
Sec. 9, excluding Native allotments F-033569, F-15906, and F-17077;
Secs. 10 and 15;
Sec. 16, excluding Native allotment F-033569;
Sec. 17, excluding Native allotment F-17081;
Sec. 18, excluding Native allotments F-17081 and F-17082;
Sec. 19, excluding Native allotments F-15904, F-17081, and those lands formerly within Native allotment F-025251;
Sec. 20, excluding Native allotment F-17081;
Secs. 21 and 22;
Sec. 25, excluding Native allotments F-17542 and F-18140;
Sec. 26, excluding Native allotment F-17542;
Sec. 27;
Sec. 28, excluding those lands formerly within Native allotment F-030770;
Sec. 29, excluding Native allotment F-15915 and those lands formerly within Native allotment F-030770;
Sec. 30, excluding those lands formerly within Native allotment F-025251;
Sec. 31;

Bethel Recording District
Return to:
Kokarmiut Corporation
P.O. Box 215
~~Akiak~~, Alaska 99552

Interim Conveyance No. 610

Date DEC 29 1982

Attachment #2

Form 1860-9
(November 1984)

The United States of America

To all to whom these presents shall come, Greeting:

F-14824-A

BOOK 69 PAGE 666

WHEREAS

Kokarmuit Corporation

is entitled to a patent pursuant to Sec. 14(a) of the Alaska Native Claims Settlement Act of December 18, 1971, 43 U.S.C. 1601, 1613(a), of the surface estate in the following-described lands:

U.S. Survey No. 5068, Alaska, the townsite of Akiak: Tract A, Block 13, lots 3, 4 and 5; Block 14, lot 3.

Containing 65,088 sq. ft., as shown on plat of survey accepted August 17, 1977.

NOW KNOW YE, that there is, therefore, granted by the UNITED STATES OF AMERICA, unto the above-named corporation the surface estate in the lands above described; TO HAVE AND TO HOLD the said estate with all the rights, privileges, immunities, and appurtenances, of whatsoever nature, thereunto belonging, unto the said corporation, its successors and assigns, forever.

EXCEPTING AND RESERVING TO THE UNITED STATES from the lands so granted:

The subsurface estate therein, and all rights, privileges, immunities, and appurtenances, of whatsoever nature, accruing unto said estate pursuant to the Alaska Native Claims Settlement Act of December 18, 1971, 43 U.S.C. 1601, 1613(f).

Bethel Recording District
Return to:
Kokarmiut Corporation
P. O. Box 215
Akiak, Alaska 99552

Patent Number 50-85-0676

Attachment #3

Form 1860-10
(March 1986)

BOOK 69 PAGE 667

THE GRANT OF THE ABOVE-DESCRIBED LANDS IS SUBJECT TO:

1. Valid existing rights therein, if any, including but not limited to those created by any lease (including a lease issued under Sec. 6(g) of the Alaska Statehood Act of July 7, 1958, 48 U.S.C. Ch. 2, Sec. 6(g)), contract, permit, right-of-way, or easement, and the right of the lessee, contractee, permittee, or grantee to the complete enjoyment of all rights, privileges, and benefits thereby granted to him. Further, pursuant to Sec. 17(b)(2) of the Alaska Native Claims Settlement Act of December 18, 1971 (ANCSA), 43 U.S.C. 1601, 1616(b)(2), any valid existing right recognized by ANCSA shall continue to have whatever right of access as is now provided for under existing law; and

2. Requirements of Sec. 14(c) of the Alaska Native Claims Settlement Act of December 18, 1971, 43 U.S.C. 1601, 1613(c), as amended, that the grantee hereunder convey those portions, if any, of the lands hereinabove granted, as are prescribed in said section.

95-2085

18

RE-RECORDED-~~FILED~~
BETHEL RECORDING
DISTRICT

OCT 16 10 06 AM '95

REQUESTED BY KOKARMUIT CORP

ADDRESS _____

IN TESTIMONY WHEREOF, the undersigned authorized officer of the Bureau of Land Management, in accordance with the provisions of the Act of June 17, 1948 (62 Stat. 476), has, in the name of the United States, caused these letters to be made Patent, and the Seal of the Bureau to be hereunto affixed.

GIVEN under my hand, in ANCHORAGE, ALASKA the THIRTIETH day of SEPT. in the year of our Lord one thousand nine hundred and EIGHTY-FIVE and of the Independence of the United States the two hundred and TENTH.

By Ann Johnson
Ann Johnson
Chief, Branch of ANCSA Adjudication

50-85-0676

Patent Number _____

APPENDIX C

GEOTECHNICAL CONSULTATION

Duane Miller Associates LLC
Arctic & Geotechnical Engineering
5821 Arctic Boulevard, Suite A
Anchorage, AK 99518-1654
(907) 644-3200 Fax 644-0507
www.alaskageo.com

August 20, 2007

LCMF LLC
615 E 82nd Avenue
Anchorage, Alaska 99518

Attention: Egor Esipov

Subject: Akiak Power (Light) Plant
Akiak, Alaska
DMA Job No. 4095.132

This letter presents Duane Miller Associates' (DMA) review of existing information and a general discussion of foundation options for the proposed power (light) plant in Akiak, Alaska. At this time, there are two proposed sites for the new power (light) plant. The first site has been proposed to be adjacent to the existing power (light) plant, while the second site is near the existing high school. Our review and recommendations are based on existing information only; no project-specific field reconnaissance or exploration has been conducted.

Site Conditions

The community of Akiak is approximately 20 air miles northeast of Bethel. Akiak is a village of about 367 people situated on the west bank of the Kuskokwim River. The village is in the southeast portion of the Yukon-Kuskokwim Lowland, a major physiographic province of Alaska. The lowland is a portion of the vast delta formed by the Yukon and Kuskokwim Rivers.

Akiak is relatively flat with a gentle slope toward the Kuskokwim River. The area is dominated by meander scars which cut paths across the town. The surface vegetation consists of willow, alder, birch and coniferous trees.

The surface soils in the area are a result of Pleistocene deltaic deposits and Holocene flood-plain alluvium deposited by the Kuskokwim River. Akiak is predominantly underlain by sand and silty sand. Akiak lies within the zone of discontinuous permafrost and previous explorations have encountered frozen soils below the active layer.

Flooding is a potential hazard in this area. The US Army Corps of Engineers (USACE) recommended in 1998 that buildings be constructed approximately 18 feet above the summer level of the Kuskokwim River or about 1 foot above the front doorsill of the existing clinic building. Several flooding events occurred during the 1980's.

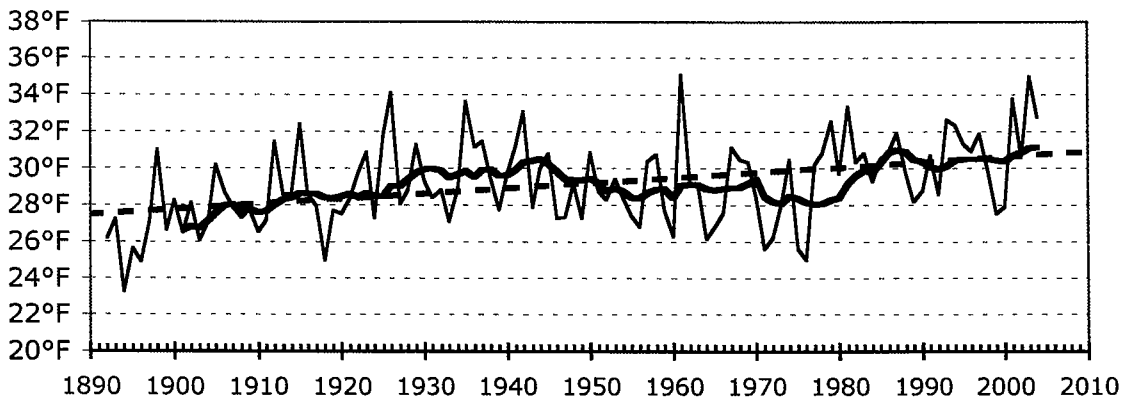
Climate

The climate in the region is characterized by long, cold winters and short, cool summers. The records for the Bethel airport (the nearest weather station) show that the winds predominantly come from the north or northeast. Since about 1977, the weather conditions in the area appear to have been getting warmer. In 2005, DMA reviewed the climate records for 6 different weather stations in Alaska, including Bethel. For Bethel the average annual temperature after 1977 was found to be 2 degrees Fahrenheit (°F) warmer than for the previous 30 years. The following table compares climatic data for Bethel interpreted from the *Environmental Atlas of Alaska* by Hartman and Johnson, 1978, with values from our 2005 analysis:

	H&J, 1978	DMA, 2005
Average Air Temperature	28.5° F	32.0° F
Average Freezing Index	3500° F-days	2860° F-days
Design Freezing Index	4500° F-days	3720° F-days
Average Thawing Index	2400° F-days	2710° F-days
Design Thawing Index	3100° F-days	3400° F-days

The following chart shows a summary of mean annual temperatures for Bethel from 1892 through 2004 along with a trailing 10-year average and a 113-year trend line. The long-term trend indicates about 3°F warming per century; but, the shorter record over the more recent years suggests that warming could be as fast as 6°F per century.

Bethel Mean Annual Air Temperature



Previous Investigations

A brief description of previous geotechnical explorations in Akiak are provided below. A map showing test hole locations is presented on Plate 2, and available exploration logs from select test holes are attached.

Akiak airport runway extension DOWL Engineers, July 1996

DOWL Engineers (DOWL) excavated and logged 21 test pits to depths of 4.6 feet to 8.5 feet near the existing Akiak airport runway in July 1996, to provide recommendations for runway improvements. The approximate locations are shown on Plate 2, Site Map. The airport is located approximately 1200 feet south west of proposed power (light) plant Site A. Test pit A was excavated in a materials borrow site 1100 feet southeast of the proposed light plant Site A. The material site appeared to have been previously mined. The natural soils generally consisted of a surface layer of organics and silt over poorly graded sands, with interbedded layers of silt. The silt layers contained small amounts of organic material. Roots were observed as deep as 2.5-feet below the ground surface. Permafrost was not observed in any of the pits. The water table was only observed in the test pits at the borrow sites at depths ranging from 4.5 to 7 feet. Gravel is not found in the area, and gravel was not observed in any of the test pits other than the imported material on the runway surface.

Akiak K-12 School, DOWL Engineers, March 2004

In December 2002, DOWL drilled 10 test borings for a subsurface investigation at the Akiak K-12 School. Five of the test borings were drilled to 40 foot depths in the vicinity of the building footprint and five borings were drilled to 15 feet deep. The approximate locations are shown on Plate 2, Site Map. The subsurface soils across the site were consistent with a surface organic layer about six inches thick overlying a layer of sandy silt (ML) to silty sand (SM) that extended to about four feet deep. The sandy silt and silty sand layer was observed in most of the test borings. Underlying the near surface silty soils, there was a layer of poorly graded sand with trace silt (SP-SM) extending to a maximum depth of 14 feet. Below a depth of fourteen feet, poorly graded sands (SP) were encountered.

Seasonal frost was present in all of the borings. Thermistor measurements in Test Boring 4 indicated a possible permafrost zone at a depth of 32 feet below ground surface. A two foot thick layer of of frozen ground was logged at about 10 feet in Test Boring 9. Moisture contents ranged from 6% to 33% in the active layer and 7% and 37% below the active layer. The ground water was measured at depths of between 11.5 to 14.5 feet.

Akiak Communication Tower, Bratslavsky Consulting Engineers with Duane Miller Associates, February 2005

In May 2004, Bratslavsky Consulting Engineers (BCE) drilled and logged subsurface conditions for the foundation design for the UUI communication tower southwest of the main village. DMA performed the laboratory tests and foundation analysis. Two test borings were drilled to depths of 16 feet and then penetrometer probes were made to 45 and 60 feet. The approximate locations are shown on Plate 2, Site Map. Prior to the investigation, the tower site was relatively undisturbed and vegetated with tundra, grass and low shrubs. The surface material at the two locations was organic-rich soil, and frozen to 2.5 feet deep. Beneath the surface soils was unfrozen sand to depths of 16.5 feet. Penetrometer probes were driven beyond 16 feet and suggested the soils below the last recovered sample were unfrozen, and most likely sand. The soil appeared to increase in density below 40 feet. Groundwater in both borings was observed at approximately 15 feet below grade.

Site and Subsurface Conditions

Based on the previous geotechnical investigations, we expect the soils at the proposed power plant sites to consist of interbedded deposits of silt and fine to medium-grained sand, with surface deposits of peat and organic silt. Small amounts of organic material are dispersed throughout the near surface soil column. The soils are generally unfrozen except for the surface seasonal frost. In undisturbed areas, seasonal frost penetrates to depths between 1 to 6 feet. Localized areas of discontinuous permafrost have been found but are uncommon. Where found, the permafrost typically contains either no visible ice or small individual ice crystals in the pore spaces. Groundwater is typically at depths of about 15 feet but is expected to vary with the level of the river and the recency of rainfall.

Foundation Options

The power plant sites are expected to be underlain by unfrozen soils, but that should be confirmed by a subsurface exploration before the foundation design is finalized. The surface soils (organics and silt) are highly frost susceptible and heave and settle each year as they seasonally freeze and thaw. The underlying unfrozen sand is generally medium dense but some loose layers are indicated by the low sampling blow counts.

Two alternative foundation systems are considered appropriate for support of the power plant. A post and pad (spread footing) foundation bearing on the sand or prop-

erly compacted fill would provide positive support. The post and pad would need to be placed below the compressible organic soils, or the organic soil needs to be removed and replaced with properly compacted fill. The local sand can be used for compacted fill, but the material is easily eroded by wind or water. The post and pad should be designed using a low bearing pressure because of the risk of loose pockets in the natural sand. Vibratory loadings from the power plant might induce additional settlements if loose pockets of sand are present. Provisions for releveling the foundation might be needed for satisfactory performance.

The post and pad also needs to be protected from seasonal frost action either by deep burial or by using an insulation layer to limit the depth of penetration of the seasonal frost. The attachment between the post and pad needs to resist frost heave forces on the post.

A driven pile foundation would also provide positive support for the power plant and probably have less risk of settlement from the loose layers that might underlie the site. Driven timber or closed-end pipe piles would be suitable for support. For initial estimates assume that the piles are driven to depths of 40 feet so they will resist frost heave loads.

Very truly yours,
Duane Miller Associates LLC

David Freese

Duane L. Miller

David A. Freese
Engineering Technician

Duane L. Miller P.E.
Civil Engineer 3696

Attachments:

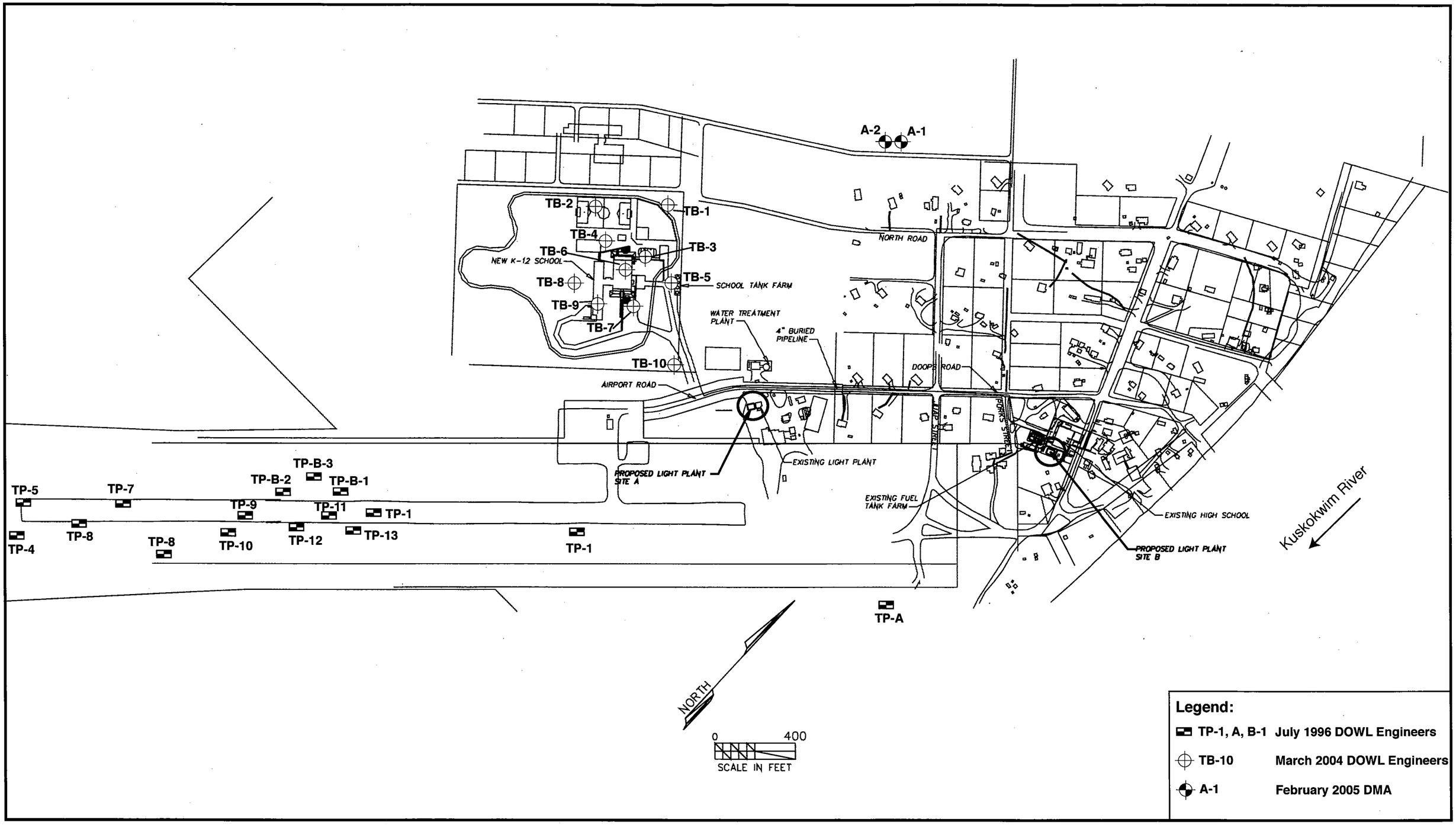
Plate 1	Vicinity Map
Plate 2	Boring Location Map
Appendix A	Logs of Test Pits Akiak Airport
Appendix B	Logs of Test Borings Akiak K-12 School
Appendix C	Logs of Test Borings Akiak Communication Tower

Note: Map provided by Aero Metric, INC., 10/3/2005

Duane Miller Associates LLC
Job No.: 4095.132
Date: July 2007

VICINITY MAP
Akiak Power Plant
Akiak, Alaska

Plate
1



Note: AUTOCAD Drawing provided by LCMF Date 6/25/07.

Duane Miller Associates LLC
Job No.: 4095.132
Date: July 2007

SITE MAP
Akiak Power Plant
Akiak, Alaska

Plate
2

Appendix A

Logs of Test Pits Akiak Airport

DOWL Engineers, July 1996

TEST PIT 1

LOCATION: SEE TEST PIT LOCATION MAP
ELEVATION:

Other Tests	Temp °C	Moisture Content (%)	Blows/300mm	Samples	Frost Depth	DEPTH	Description
				SP		0	13mm LAYER OF **GRAVEL** ON SURFACE, GRAVEL SUBROUNDED TO SUBANGULAR TO 19mm, GRAVEL TO 76mm IN AREA (~5-10%)
				ML			
				SP			NFS, BROWN, **POORLY GRADED SAND**, ABOUT 5% SILT, FINE TO MEDIUM SAND, DAMP, MEDIUM DENSE - ORGANICS (ROOTS) TO 0.3m (~25% BY VOLUME)
				ML			
				SP			ROOTS TO 0.76m (~5%)
				ML			
				SP		1	
				ML			
				SP			INTERBEDDED LAYERS TO 0.15m THICK OF F4, BROWN, **SILT**, ABOUT 10% SAND, LOW PLASTICITY, FINE SAND, DAMP, STIFF
				ML			
				SP			
				ML			
				SP		2	SMALL LAYERS OF ORGANICS IN SILT (~5%)
				ML			
				SP			
				ML			
				SP			
						2.44m	TEST PIT COMPLETED AT 2.44 METERS NO GROUND WATER OBSERVED WHILE DIGGING
						3	
						4	

DEPTH (METERS)

KEY
MA = Mechanical Analysis
LL = Liquid Limit
PI = Plastic Index
PP = Pocket Penetrometer (TSF)
TV = Torvane (TSF)
☐ = Grab Sample
◪ = SPT Sample
⊠ = Shelby Tube - pushed
⊞ = 65.5mm I.D. Spoon Sample
154.2kg weight, .76m fall
T = Sample Temperature (° C) probably affected by sampling procedure

CLIENT: ADOT & PF
PROJECT: AKIAK AIRPORT
LOGGED BY: MARIA E. KAMPSEN
PIT COMPLETED: 8/1/98
W.O. D55844A

DOWL ENGINEERS ALASKA TESTLAB	LOG OF PIT	FIGURE 17

TEST PIT 2

LOCATION: SEE TEST PIT LOCATION MAP
ELEVATION:

Other Tests	Temp °C	Moisture Content (%)	Blows/300mm	Samples	Frost Depth	DEPTH	
						0	13mm LAYER OF **GRAVEL** ON SURFACE, GRAVEL SUBROUNDED TO 19mm, GRAVEL TO 76mm IN AREA (~5-10%)
		6					NFS, BROWN, **POORLY GRADED SAND**, ABOUT 5% SILT, FINE TO MEDIUM SAND, DAMP, MEDIUM DENSE - ORGANICS (ROOTS) TO 0.76m (~10%)
					SP		
							SAMPLE CONTAINS APPROX. 5% SILT
		11				1	
					WOOD	1.22m	LARGE ROOTS AND WOOD — 1.28m
					ML		F4, GRAY, **SILT WITH SAND**, ABOUT 20% SAND, LOW PLASTICITY, FINE SAND, DAMP, STIFF
MA		35				1.52m	F4, BROWN **SILT**, ABOUT 10% SAND, LOW PLASTICITY, FINE SAND, DAMP, STIFF - SMALL ORGANIC LAYERS IN THE SILT (~5%)
					ML	2	
						2.59m	TEST PIT COMPLETED AT 2.59 METERS NO GROUND WATER OBSERVED WHILE DIGGING
						3	
						4	

DEPTH (METERS)

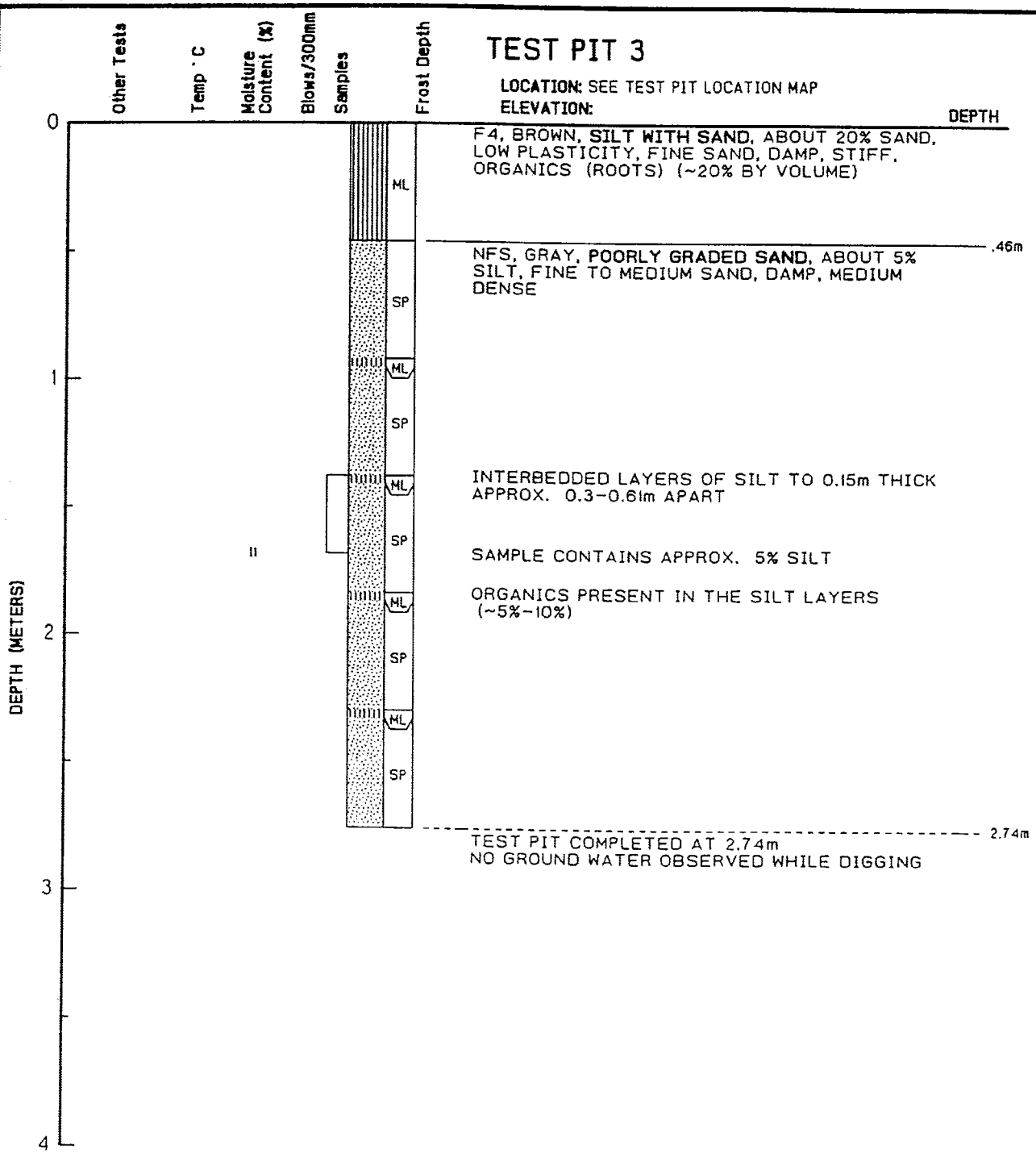
KEY
MA = Mechanical Analysis
LL = Liquid Limit
PI = Plastic Index
PP = Pocket Penetrometer (TSF)
TV = Torvane (TSF)
☐ = Grab Sample
◪ = SPT Sample
◱ = Shelby Tube - pushed
⊠ = 65.5mm I.D. Spoon Sample 154.2kg weight, .76m fall
T = Sample Temperature (°C) probably affected by sampling procedure

CLIENT: ADOT & PF
PROJECT: AKIAK AIRPORT
LOGGED BY: MARIA E. KAMPSEN
PIT COMPLETED: 7/31/96
W.O. 055844A

DOWL ENGINEERS ALASKA TESTLAB	LOG OF PIT	FIGURE 18

TEST PIT 3

LOCATION: SEE TEST PIT LOCATION MAP
ELEVATION:



KEY
MA = Mechanical Analysis
LL = Liquid Limit
PI = Plastic Index
PP = Pocket Penetrometer (TSF)
TV = Torvane (TSF)
□ = Grab Sample
◪ = SPT Sample
▧ = Shelby Tube - pushed
⊠ = 85.5mm I.D. Spoon Sample 154.2kg weight, .76m fall
T = Sample Temperature (° C) probably affected by sampling procedure

CLIENT: ADOT & PF
PROJECT: AKIAK AIRPORT
LOGGED BY: MARIA E. KAMPSEN
PIT COMPLETED: 7/31/98
W.O. D55844A

DOWL ENGINEERS ALASKA TESTLAB	LOG OF PIT	FIGURE 19

TEST PIT 4

LOCATION: SEE TEST PIT LOCATION MAP
ELEVATION:

Other Tests	Temp ° C	Moisture Content (%)	Blows/300mm	Samples	Frost Depth	DEPTH	Description
					ML	0	F4, BROWN, **SANDY SILT**, ABOUT 50% SAND, LOW PLASTICITY, FINE SAND, DAMP TO WET, STIFF TO VERY STIFF, ORGANICS (ROOTS) (~20% BY VOLUME)
		39			SP	.3m	NFS, GRAY, **POORLY GRADED SAND**, ABOUT 5% SILT, FINE TO MEDIUM SAND, DAMP, MEDIUM DENSE
					ML, SP		INTERBEDDED LAYERS OF SILT TO 0.2m THICK APPROX. 0.3m APART
					ML, SP		SMALL ORGANIC LAYERS WITHIN THE SILT (~5%)
					ML, SP	1	SAMPLE CONTAINS APPROX. 10% SILT
		9			ML, SP		
		29			ML, SP		SAMPLE CONTAINS APPROX. 30% SILT
					ML, SP		
					ML, SP	2	
					ML, SP		
					ML, SP		
					ML, SP	3	
					ML, SP	2.74m	
						4	TEST PIT COMPLETED AT 2.74 METERS NO GROUND WATER OBSERVED WHILE DIGGING

DEPTH (METERS)

KEY
MA = Mechanical Analysis
LL = Liquid Limit
PI = Plastic Index
PP = Pocket Penetrometer (TSF)
TV = Torvane (TSF)
☐ = Grab Sample
◪ = SPT Sample
⧅ = Shelby Tube - pushed
⧈ = 65.5mm I.D. Spoon Sample
154.2kg weight, .76m fall
T = Sample Temperature (° C) probably affected by sampling procedure

CLIENT: ADOT & PF
PROJECT: AKIAK AIRPORT
LOGGED BY: MARIA E. KAMPSEN
PIT COMPLETED: 7/31/98
W.O. 055644A

DOWL ENGINEERS ALASKA TESTLAB	LOG OF PIT	FIGURE 20

TEST PIT 5

LOCATION: SEE TEST PIT LOCATION MAP
ELEVATION:

Other Tests	Temp °C	Moisture Content (%)	Blows/300mm	Samples	Frost Depth	DEPTH	Description
					ML	0	51mm LAYER OF F4, BROWN, **SILT WITH SAND**, ABOUT 20% SAND, LOW PLASTICITY, FINE SAND, DAMP TO WET, STIFF TO VERY STIFF, ORGANICS (ROOTS) (~25% BY VOLUME)
					SP		NFS, BROWN, **POORLY GRADED SAND**, ABOUT 5% SILT, FINE TO MEDIUM SAND, DAMP, MEDIUM DENSE
							INTERBEDDED SILT LAYERS TO 25mm (<5%)
							TRACES OF ORGANICS WITHIN THE SILT (~5%)
					ML		ROOTS TO 0.76m (~25%)
					SP	1	
					ML		
					SP		ROOTS TO 1.21m (<5%)
					ML		
					SP		
					ML		
					SP	2	
					ML		
					SP		SAMPLE CONTAINS APPROX. 5% SILT
					ML		
			10		SP		
						2.44m	TEST PIT COMPLETED AT 2.44 METERS PIT WALLS SLOUGHED NO GROUND WATER OBSERVED WHILE DIGGING
						3	
						4	

DEPTH (METERS)

KEY
MA = Mechanical Analysis
LL = Liquid Limit
PI = Plastic Index
PP = Pocket Penetrometer (TSF)
TV = Torvane (TSF)
□ = Grab Sample
◪ = SPT Sample
⊡ = Shelby Tube - pushed
⊠ = 85.5mm I.D. Spoon Sample 154.2kg weight, .76m fall
T = Sample Temperature (°C) probably affected by sampling procedure

CLIENT: ADOT & PF
PROJECT: AKIAK AIRPORT
LOGGED BY: MARIA E. KAMPSEN
PIT COMPLETED: 7/31/98
W.O. D55644A

DOWL ENGINEERS
ALASKA TESTLAB

LOG OF PIT

FIGURE 21

TEST PIT 6

LOCATION: SEE TEST PIT LOCATION MAP
ELEVATION:

Other Tests	Temp °C	Moisture Content (%)	Blows/300mm	Samples	Frost Depth	DEPTH	Description
					ML	0 – .15m	F4, BROWN, **SILT**, ABOUT 10% SAND, LOW PLASTICITY, FINE SAND, DAMP, STIFF, ORGANICS (ROOTS) (~20% BY VOLUME)
					SP	.15m – 2.13m	NFS, GRAY, **POORLY GRADED SAND**, ABOUT 5% SILT, FINE TO MEDIUM SAND, DAMP, MEDIUM DENSE ROOTS TO 0.76m (~15%) 0.1m **SILT** LAYER AT 1.37m, F4, BROWN, ABOUT 10% SAND, LOW PLASTICITY, FINE SAND, DAMP, STIFF, SMALL ORGANIC LAYERS WITHIN THE SILT (~5%–10%)
					ML		
					SP		

DEPTH (METERS): 0, 1, 2, 3, 4

2.13m

TEST PIT COMPLETED AT 2.13m
PIT WALLS SLOUGHED
NO GROUND WATER OBSERVED WHILE DIGGING

KEY
MA = Mechanical Analysis
LL = Liquid Limit
PI = Plastic Index
PP = Pocket Penetrometer (TSF)
TV = Torvane (TSF)
☐ = Grab Sample
◪ = SPT Sample
⊡ = Shelby Tube – pushed
⊠ = 65.5mm I.D. Spoon Sample 154.2kg weight, .76m fall
T = Sample Temperature (° C) probably affected by sampling procedure

CLIENT: ADOT & PF
PROJECT: AKIAK AIRPORT
LOGGED BY: MARIA E. KAMPSEN
PIT COMPLETED: 7/31/96
W.O. D55644A

DOWL ENGINEERS ALASKA TESTLAB	LOG OF PIT	FIGURE 22

TEST PIT 7

LOCATION: SEE TEST PIT LOCATION MAP
ELEVATION:

Other Tests	Temp °C	Moisture Content (%)	Blows/300mm	Samples	Frost Depth	DEPTH	Description
					OL	0	51mm ORGANIC MAT OVER 76mm OF F4, BROWN, **ORGANIC SILT**, ABOUT 5% SAND, WET, FIRM, ORGANICS (ROOTS) (~40% BY VOLUME)
						.15m	F4, BROWN, **SANDY SILT**, ABOUT 30% SAND, NONPLASTIC, FINE SAND, DAMP, HARD, ORGANICS (ROOTS) ~10%
					ML		FROZEN TO 0.76m, WELL BONDED, SOME EXCESS ICE (~1%), ICE CRYSTALS (<2mm), Vi
						1.22m	
					SP		NFS, GRAY, **POORLY GRADED SAND**, ABOUT 5% SILT, FINE TO MEDIUM SAND, DAMP, MEDIUM DENSE
					ML, SP, ML, SP, ML, SP, ML, SP, ML, SP, ML, SP		INTERBEDDED LAYERS TO 25mm OF F4, BROWN, **SILT**, ABOUT 10% SAND, LOW PLASTICITY, FINE SAND, DAMP, STIFF
		10					SAMPLE CONTAINS APPROX. 10% SILT
							SMALL ORGANIC LAYERS WITHIN THE SILT (~5%)
						2.29m	TEST PIT COMPLETED AT 2.29 METERS NO GROUND WATER OBSERVED WHILE DIGGING

DEPTH (METERS): 0, 1, 2, 3, 4

KEY
MA = Mechanical Analysis
LL = Liquid Limit
PI = Plastic Index
PP = Pocket Penetrometer (TSF)
TV = Torvane (TSF)
☐ = Grab Sample
◪ = SPT Sample
▧ = Shelby Tube - pushed
▣ = 65.5mm I.D. Spoon Sample 154.2kg weight, .76m fall
T = Sample Temperature (°C) probably affected by sampling procedure

CLIENT: ADOT & PF
PROJECT: AKIAK AIRPORT
LOGGED BY: MARIA E. KAMPSEN
PIT COMPLETED: 7/31/98
W.O. D55644A

DOWL ENGINEERS
ALASKA TESTLAB

LOG OF PIT

FIGURE 23

TEST PIT 8

LOCATION: SEE TEST PIT LOCATION MAP
ELEVATION:

Other Tests	Temp °C	Moisture Content (%)	Blows/300mm	Samples	Frost Depth	DEPTH	Description
					OL	0	F4, BROWN, **ORGANIC SILT**, ABOUT 10% SAND, DAMP, STIFF, ORGANICS (ROOTS) ~50% BY VOLUME
					ML	.15m	F4, BROWN, **SILT WITH SAND**, ABOUT 20% SAND, LOW PLASTICITY, FINE SAND, DAMP, STIFF, ORGANICS (ROOTS) (~20% BY VOLUME)
					SP	.3m	NFS, GRAY, **POORLY GRADED SAND**, ABOUT 5% SILT, FINE TO MEDIUM SAND, DAMP, MEDIUM DENSE
					ML		INTERBEDDED LAYERS OF **SILT** TO 0.1m THICK APPROX. 0.3m APART
					SP		ORGANICS PRESENT IN THE SILT LAYERS (~5%)
					ML		ROOTS TO 0.91m (~5%)
					SP	1	
					ML		
					SP		
					ML		
					SP		
					ML		SILT LAYERS TO 0.02m EVERY 0.05m–0.08m
					SP	2	
					ML		
					SP		
					ML		SAMPLE CONTAINS APPROX. 45% SILT
MA		21			SP		
					ML		
					SP		
					ML		
					SP	2.59m	TEST PIT COMPLETED AT 2.59 METERS NO GROUND WATER OBSERVED WHILE DIGGING
						3	
						4	

DEPTH (METERS)

KEY
MA = Mechanical Analysis
LL = Liquid Limit
PI = Plastic Index
PP = Pocket Penetrometer (TSF)
TV = Torvane (TSF)
□ = Grab Sample
◪ = SPT Sample
⊡ = Shelby Tube – pushed
⊡ = 65.5mm I.D. Spoon Sample 154.2kg weight, .76m fall
T = Sample Temperature (° C) probably affected by sampling procedure

CLIENT: ADOT & PF
PROJECT: AKIAK AIRPORT
LOGGED BY: MARIA E. KAMPSEN
PIT COMPLETED: 7/31/98
W.O. 055644A

DOWL ENGINEERS
ALASKA TESTLAB

LOG OF PIT

FIGURE 24

TEST PIT 9

LOCATION: SEE TEST PIT LOCATION MAP
ELEVATION:

Other Tests	Temp °C	Moisture Content (%)	Blows/300mm	Samples	Frost Depth	DEPTH	Description
					MIX	0	F4, BROWN, **ORGANICS, PEAT, SILT, AND WOOD MIX**, ABOUT 25% ORGANICS, 20% PEAT, 25% SILT, AND 30% WOOD, DAMP, STIFF
					ML	1.22m	F4, BROWN, **SILT WITH SAND**, ABOUT 20% SAND, LOW PLASTICITY, FINE SAND, DAMP, STIFF
					SP	1.68m	NFS, GRAY, **POORLY GRADED SAND**, ABOUT 5% SILT, FINE TO MEDIUM SAND, DAMP, MEDIUM DENSE
					ML		INTERBEDDED LAYERS OF F4, BROWN, **SILT WITH SAND**, ABOUT 20% SAND, LOW PLASTICITY, FINE SAND, DAMP, STIFF
					SP		
		19			ML		SAMPLE CONTAINS APPROX. 15% SILT
					SP		SMALL ORGANIC LAYERS WITHIN THE SILT (~5%)
						2.44m	TEST PIT COMPLETED AT 2.44 METERS NO GROUND WATER OBSERVED WHILE DIGGING

DEPTH (METERS): 0, 1, 2, 3, 4

KEY
MA = Mechanical Analysis
LL = Liquid Limit
PI = Plastic Index
PP = Pocket Penetrometer (TSF)
TV = Torvane (TSF)
☐ = Grab Sample
◪ = SPT Sample
⊠ = Shelby Tube – pushed
⊠ = 65.5mm I.D. Spoon Sample
154.2kg weight, .76m fall
T = Sample Temperature (°C) probably affected by sampling procedure

CLIENT: ADOT & PF
PROJECT: AKIAK AIRPORT
LOGGED BY: MARIA E. KAMPSEN
PIT COMPLETED: 7/31/98
W.O. D55644A

DOWL ENGINEERS ALASKA TESTLAB	LOG OF PIT	FIGURE 25

TEST PIT 10

LOCATION: SEE TEST PIT LOCATION MAP
ELEVATION:

Other Tests	Temp °C	Moisture Content (%)	Blows/300mm	Samples	Frost Depth	DEPTH	Description
					PT	0	F4, DARK BROWN, **PEAT**, DAMP, FIRM
					OL	.15m	F4, BROWN, **ORGANIC SILT**, ABOUT 20% SAND, LOW PLASTICITY, FINE SAND, DAMP, STIFF, ORGANICS (ROOTS) ~40% BY VOLUME
		33			ML	.61m	F4, BROWN, **SANDY SILT**, ABOUT 50% SAND, LOW PLASTICITY, FINE SAND, DAMP, STIFF, ORGANICS (ROOTS) ~10% TO 0.9m
					SP	1.52m	NFS, GRAY, **POORLY GRADED SAND**, ABOUT 5% SILT, FINE TO MEDIUM SAND, DAMP, MEDIUM DENSE
					ML, SP, ML, SP, ML, SP, ML		INTERBEDDED LAYERS OF F4, BROWN, **SILT WITH SAND**, ABOUT 20% SAND, LOW PLASTICITY, FINE SAND, DAMP, STIFF - SMALL ORGANIC LAYERS WITHIN THE SILT (~5%)
						1.98m	
		6			SP		NFS, GRAY, **POORLY GRADED SAND**, ABOUT 5% SILT, NONPLASTIC, FINE SAND, DAMP, MEDIUM DENSE SAMPLE CONTAINS APPROX. 5% SILT
						2.59m	TEST PIT COMPLETED AT 2.59 METERS NO GROUND WATER OBSERVED WHILE DIGGING

DEPTH (METERS): 0, 1, 2, 3, 4

KEY
MA = Mechanical Analysis
LL = Liquid Limit
PI = Plastic Index
PP = Pocket Penetrometer (TSF)
TV = Torvane (TSF)
☐ = Grab Sample
◪ = SPT Sample
S = Shelby Tube - pushed
⊠ = 65.5mm I.D. Spoon Sample (54.2kg weight, .76m fall)
T = Sample Temperature (°C) probably affected by sampling procedure

CLIENT: ADOT & PF
PROJECT: AKIAK AIRPORT
LOGGED BY: MARIA E. KAMPSEN
PIT COMPLETED: 7/31/98
W.O. D55644A

DOWL ENGINEERS
ALASKA TESTLAB

LOG OF PIT

FIGURE 26

TEST PIT 11

LOCATION: SEE TEST PIT LOCATION MAP
ELEVATION:

Other Tests	Temp °C	Moisture Content (%)	Blows/300mm	Samples	Frost Depth	DEPTH	Description
					PT		F4, DARK BROWN, **PEAT**, DAMP, FIRM
						.09m	
					OL		F4, BROWN, **ORGANIC SILT**, ABOUT 20% SAND, LOW PLASTICITY, FINE SAND, DAMP, STIFF, ORGANICS (ROOTS) ~40% BY VOLUME
						.3m	
					ML		F4, BROWN, **SANDY SILT**, ABOUT 40% SAND, NO TO LOW PLASTICITY, FINE SAND, DAMP, STIFF, ORGANICS (ROOTS) ~10% TO 0.9m
						.76m	
					SP		NFS, GRAY, **POORLY GRADED SAND**, ABOUT 5% SILT, FINE TO MEDIUM SAND, DAMP, MEDIUM DENSE
					ML, SP		INTERBEDDED LAYERS TO 0.1m OF F4, BROWN, **SILT**, ABOUT 10% SAND, LOW PLASTICITY, FINE SAND, DAMP, STIFF - SMALL ORGANIC LAYERS WITHIN THE SILT (~5%)
					ML, SP		
		4			ML, SP		SAMPLE CONTAINS APPROX. 5% SILT
					ML, SP		
					ML, SP		
					ML, SP		
					ML, SP		
					ML, SP	2.74m	

TEST PIT COMPLETED AT 2.74 METERS
NO GROUND WATER OBSERVED WHILE DIGGING

DEPTH (METERS): 0, 1, 2, 3, 4

KEY
MA = Mechanical Analysis
LL = Liquid Limit
PI = Plastic Index
PP = Pocket Penetrometer (TSF)
TV = Torvane (TSF)
☐ = Grab Sample
◪ = SPT Sample
⧅ = Shelby Tube - pushed
⊠ = 65.5mm I.D. Spoon Sample 154.2kg weight, .76m fall
T = Sample Temperature (°C) probably affected by sampling procedure

CLIENT: ADOT & PF
PROJECT: AKIAK AIRPORT
LOGGED BY: MARIA E. KAMPSEN
PIT COMPLETED: 7/31/96
W.O. D55844A

DOWL ENGINEERS
ALASKA TESTLAB

LOG OF PIT

FIGURE 27

TEST PIT 12

LOCATION: SEE TEST PIT LOCATION MAP
ELEVATION:

Other Tests	Temp °C	Moisture Content (%)	Blows/300mm	Samples	Frost Depth	DEPTH	Description
				PT		0	F4, DARK BROWN, **PEAT**, DAMP, FIRM
				OL		.15m	F4, BROWN, **ORGANIC SILT**, ABOUT 20% SAND, LOW PLASTICITY, FINE SAND, DAMP, STIFF, ORGANICS (ROOTS, WOOD) ~45% BY VOLUME
				ML		.46m	F4, BROWN, **SANDY SILT**, ABOUT 30% SAND, LOW PLASTICITY, FINE SAND, DAMP, STIFF, ORGANICS (ROOTS) ~5% TO 0.91m
				SP		1.22m	NFS, GRAY, **POORLY GRADED SAND**, ABOUT 5% SILT, FINE TO MEDIUM SAND, DAMP, MEDIUM DENSE
				ML, SP, ML, SP, ML, SP, ML, SP, ML, SP, ML, SP			INTERBEDDED LAYERS TO 0.30m OF F4, BROWN, **SILT**, ABOUT 10% SAND, LOW PLASTICITY, FINE SAND, DAMP, STIFF – SMALL ORGANIC LAYERS WITHIN THE SILT (~5%)
		26					SAMPLE CONTAINS APPROX. 20% SILT
						2.44m	TEST PIT COMPLETED AT 2.44 METERS NO GROUND WATER OBSERVED WHILE DIGGING

DEPTH (METERS): 0, 1, 2, 3, 4

KEY
MA = Mechanical Analysis
LL = Liquid Limit
PI = Plastic Index
PP = Pocket Penetrometer (TSF)
TV = Torvane (TSF)
☐ = Grab Sample
◪ = SPT Sample
⊡ = Shelby Tube – pushed
⊠ = 65.5mm I.D. Spoon Sample 154.2kg weight, .76m fall
T = Sample Temperature (°C) probably affected by sampling procedure

CLIENT: ADOT & PF
PROJECT: AKIAK AIRPORT
LOGGED BY: MARIA E. KAMPSEN
PIT COMPLETED: 7/31/98
W.O. 055644A

DOWL ENGINEERS
ALASKA TESTLAB

LOG OF PIT

FIGURE 28

TEST PIT 13

LOCATION: SEE TEST PIT LOCATION MAP
ELEVATION:

Other Tests	Temp °C	Moisture Content (%)	Blows/300mm	Samples	Frost Depth	DEPTH	Description
					PT	0	F4, DARK BROWN, **PEAT**, DAMP, FIRM
					OL	.12m	F4, BROWN, **ORGANIC SILT**, ABOUT 20% SAND, LOW PLASTICITY, FINE SAND, DAMP, STIFF, ORGANICS (ROOTS) ~40% BY VOLUME
					ML	.3m	F4, BROWN, **SANDY SILT**, ABOUT 30% SAND, LOW PLASTICITY, FINE SAND, DAMP, STIFF, ORGANICS (ROOTS) ~5% TO 0.91m
					SP, ML, SP, ML, SP, ML, SP, ML, SP, ML, SP, ML, SP, ML, SP, ML, SP, ML, SP	1.07m	INTERBEDDED LAYERS (~50/50) OF NFS, GRAY, **POORLY GRADED SAND**, ABOUT 5% SILT, FINE TO MEDIUM SAND, DAMP, MEDIUM DENSE AND F4, BROWN, **SILT**, ABOUT 10% SAND, LOW PLASTICITY, FINE SAND, DAMP, STIFF – SMALL ORGANIC LAYERS WITHIN THE SILT (~5%) DECREASING SILT LAYERS (~75/25) SAMPLE CONTAINS APPROX. 5% SILT DECREASING SILT (~90/10)
			15			2.59m	TEST PIT COMPLETED AT 2.59 METERS NO GROUND WATER OBSERVED WHILE DIGGING

DEPTH (METERS): 0, 1, 2, 3, 4

KEY
MA = Mechanical Analysis
LL = Liquid Limit
PI = Plastic Index
PP = Pocket Penetrometer (TSF)
TV = Torvane (TSF)
☐ = Grab Sample
◪ = SPT Sample
☒ = Shelby Tube – pushed
⊠ = 65.5mm I.D. Spoon Sample 154.2kg weight, .76m fall
T = Sample Temperature (° C) probably affected by sampling procedure

CLIENT: ADOT & PF
PROJECT: AKIAK AIRPORT
LOGGED BY: MARIA E. KAMPSEN
PIT COMPLETED: 7/31/98
W.O. D55844A

DOWL ENGINEERS
ALASKA TESTLAB

LOG OF PIT

FIGURE 29

TEST PIT 14

LOCATION: SEE TEST PIT LOCATION MAP
ELEVATION:

Other Tests	Temp °C	Moisture Content (%)	Blows/300mm	Samples	Frost Depth	DEPTH	Description
					PT	0	F4, BROWN, **PEAT**, DAMP, FIRM
					OL	.11m	F4, BROWN, **ORGANIC SILT**, ABOUT 10% SAND, NONPLASTIC, FINE SAND, DAMP, STIFF, ORGANICS (ROOTS) ~45% BY VOLUME
					ML	.21m	F4, BROWN, **SILT WITH SAND**, ABOUT 15% SAND, LOW PLASTICITY, FINE SAND, DAMP, STIFF, SMALL ORGANIC LAYERS (~5%-10%)
						1	ROOTS TO 1.07m (~5%)
					SP	1.07m	NFS, GRAY, **POORLY GRADED SAND**, ABOUT 5% SILT, FINE TO MEDIUM SAND, DAMP, MEDIUM DENSE
					ML, SP		
					ML, SP		INTERBEDDED BROWN SILT LAYERS TO 25mm THICK (~10%-15%)
					ML, SP	2	SMALL ORGANIC LAYERS IN THE SILT (~5%)
			18		ML, SP		SAMPLE CONTAINS ~20% SILT
					ML, SP	2.59m	TEST PIT COMPLETED AT 2.59 METERS NO GROUND WATER OBSERVED WHILE DIGGING
						3	
						4	

DEPTH (METERS)

KEY
MA = Mechanical Analysis
LL = Liquid Limit
PI = Plastic Index
PP = Pocket Penetrometer (TSF)
TV = Torvane (TSF)
□ = Grab Sample
◪ = SPT Sample
⊡ = Shelby Tube - pushed
⊠ = 65.5mm I.D. Spoon Sample
154.2kg weight, .76m fall
T = Sample Temperature (°C) probably affected by sampling procedure

CLIENT: ADOT & PF
PROJECT: AKIAK AIRPORT
LOGGED BY: MARIA E. KAMPSEN
PIT COMPLETED: 8/1/96
W.O. D55844A

DOWL ENGINEERS ALASKA TESTLAB	LOG OF PIT	FIGURE 30

TEST PIT 15

LOCATION: SEE TEST PIT LOCATION MAP
ELEVATION:

Other Tests	Temp °C	Moisture Content (%)	Blows/300mm	Samples	Frost Depth	DEPTH	Description
					PT	0	F4, BROWN, **PEAT**, DAMP, FIRM
					OL	.11m	F4, BROWN, **ORGANIC SOIL**, ABOUT 10% SAND, NONPLASTIC, FINE SAND, DAMP, STIFF, ORGANICS (ROOTS) ~45% BY VOLUME
					ML	.21m	F4, BROWN, **SILT WITH SAND**, ABOUT 20% SAND, LOW PLASTICITY, FINE SAND, DAMP, STIFF, SMALL ORGANIC LAYERS (~5%-10%)
					SP	.76m	NFS, GRAY, **POORLY GRADED SAND**, ABOUT 5% SILT, FINE TO MEDIUM SAND, DAMP, MEDIUM DENSE
					ML, SP, ML, SP, ML, SP, ML, SP, ML, SP		INTERBEDDED SILT LAYERS TO 76mm THICK (~10%)
						2.44m	TEST PIT COMPLETED AT 2.44 METERS NO GROUND WATER OBSERVED WHILE DIGGING

DEPTH (METERS): 0, 1, 2, 3, 4

KEY
MA = Mechanical Analysis
LL = Liquid Limit
PI = Plastic Index
PP = Pocket Penetrometer (TSF)
TV = Torvane (TSF)
□ = Grab Sample
◪ = SPT Sample
⊡ = Shelby Tube - pushed
⊠ = 65.5mm I.D. Spoon Sample
154.2kg weight, .76m fall
T = Sample Temperature (°C) probably affected by sampling procedure

CLIENT: ADOT & PF
PROJECT: AKIAK AIRPORT
LOGGED BY: MARIA E. KAMPSEN
PIT COMPLETED: 8/1/96
W.O. 055644A

DOWL ENGINEERS
ALASKA TESTLAB

LOG OF PIT

FIGURE 31

TEST PIT 16

LOCATION: SEE TEST PIT LOCATION MAP
ELEVATION:

Other Tests	Temp °C	Moisture Content (%)	Blows/300mm	Samples	Frost Depth	DEPTH	Description
					PT		F4, BROWN, **PEAT**, DAMP, FIRM
					OL	.11m	F4, BROWN, **ORGANIC SOIL**, ABOUT 10% SAND, NONPLASTIC, FINE SAND, DAMP, STIFF, ORGANICS (ROOTS) ~35% BY VOLUME
MA		35			ML	.21m	F4, BROWN, **SANDY SILT**, ABOUT 40% SAND, LOW PLASTICITY, FINE SAND, DAMP, STIFF, ROOTS TO 0.61m (~25% BY VOLUME)
					SP	.81m	NFS, GRAY, **POORLY GRADED SAND**, ABOUT 5% SILT, FINE TO MEDIUM SAND, DAMP, MEDIUM DENSE
					ML, SP, ML, SP, ML, SP, ML, SP, ML, SP		INTERBEDDED **SILT** LAYERS TO 51mm THICK (~5%-10%)
		10					SAMPLE CONTAINS APPROX. 5% SILT
						2.44m	TEST PIT COMPLETED AT 2.44 METERS NO GROUND WATER OBSERVED WHILE DIGGING

DEPTH (METERS): 0, 1, 2, 3, 4

KEY
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LL = Liquid Limit
PI = Plastic Index
PP = Pocket Penetrometer (TSF)
TV = Torvane (TSF)
☐ = Grab Sample
◪ = SPT Sample
S = Shelby Tube - pushed
⊠ = 65.5mm I.D. Spoon Sample (54.2kg weight, .76m fall
T = Sample Temperature (°C) probably affected by sampling procedure

CLIENT: ADOT & PF
PROJECT: AKIAK AIRPORT
LOGGED BY: MARIA E. KAMPSEN
PIT COMPLETED: 8/1/96
W.O. 055644A

DOWL ENGINEERS
ALASKA TESTLAB

LOG OF PIT

FIGURE 32

TEST PIT 17

LOCATION: SEE TEST PIT LOCATION MAP
ELEVATION:

Other Tests	Temp °C	Moisture Content (%)	Blows/300mm	Samples	Frost Depth	DEPTH	Description
					PT		F4, BROWN, **PEAT**, DAMP, FIRM
					OL	.11m	F4, BROWN, **ORGANIC SOIL**, ABOUT 10% SAND, NONPLASTIC, FINE SAND, DAMP, STIFF, ORGANICS (ROOTS) ~35% BY VOLUME
					ML	.21m	F4, BROWN, **SILT**, ABOUT 10% SAND, LOW TO MEDIUM PLASTICITY, FINE SAND, DAMP, STIFF, ROOTS TO 0.91m (~5%–10%)
					SP	.61m	NFS, BROWN, **POORLY GRADED SAND**, ABOUT 5% SILT, FINE TO MEDIUM SAND, DAMP, MEDIUM DENSE
					ML, SP, ML, SP, ML, SP, ML, SP, ML, SP		INTERBEDDED SILT LAYERS TO 51mm THICK (~5%)
						2.44m	TEST PIT COMPLETED AT 2.44 METERS NO GROUND WATER OBSERVED WHILE DIGGING

DEPTH (METERS): 0, 1, 2, 3, 4

KEY
MA = Mechanical Analysis
LL = Liquid Limit
PI = Plastic Index
PP = Pocket Penetrometer (TSF)
TV = Torvane (TSF)
□ = Grab Sample
◪ = SPT Sample
◫ = Shelby Tube – pushed
⊠ = 65.5mm I.D. Spoon Sample 154.2kg weight, .76m fall
T = Sample Temperature (° C) probably affected by sampling procedure

CLIENT: ADOT & PF
PROJECT: AKIAK AIRPORT
LOGGED BY: MARIA E. KAMPSEN
PIT COMPLETED: 8/1/96
W.O. 055644A

DOWL ENGINEERS ALASKA TESTLAB	LOG OF PIT	FIGURE 33

TEST PIT A

LOCATION: SEE TEST PIT LOCATION MAP
ELEVATION:

Other Tests	Temp °C	Moisture Content (%)	Blows/300mm	Samples	Frost Depth	DEPTH (METERS)	Description
					OL	0	51mm LAYER OF F4, BROWN, **ORGANIC SILT WITH SAND**, ABOUT 25% SAND, NONPLASTIC, FINE SAND, WET, STIFF, ORGANICS (ROOTS) ~20% BY VOLUME
					SP		NFS, GRAY, **POORLY GRADED SAND WITH GRAVEL**, ABOUT 20% GRAVEL AND 5% SILT, GRAVEL SUBROUNDED TO 6mm, FINE SAND, DAMP, MEDIUM DENSE - ORGANICS (ROOTS) TO 0.46m (~10%-15%)
							ROOTS TO 0.76m (~10%)
					ML		0.1m LAYER OF F4, BROWN, **SILT**, ABOUT 10% SAND, LOW PLASTICITY, FINE SAND, DAMP, STIFF, ORGANICS (ROOTS) PRESENT (~5-10%)
						1	
							WET
					SP		WATER SEEPING IN AT 1.52m
MA		20					
						2	SATURATED
							2.13m TEST PIT COMPLETED AT 2.13 METERS PIT WALLS SLOUGHED
						3	
						4	

KEY
MA = Mechanical Analysis
LL = Liquid Limit
PI = Plastic Index
PP = Pocket Penetrometer (TSF)
TV = Torvane (TSF)
☐ = Grab Sample
◪ = SPT Sample
⊠ = Shelby Tube - pushed
⊠ = 65.5mm I.D. Spoon Sample 154.2kg weight, .76m fall
T = Sample Temperature (° C) probably affected by sampling procedure

CLIENT: ADOT & PF
PROJECT: AKIAK AIRPORT
LOGGED BY: MARIA E. KAMPSEN
PIT COMPLETED: 7/31/96
W.O. 055644A

DOWL ENGINEERS
ALASKA TESTLAB

LOG OF PIT

FIGURE 34

TEST PIT B-1

LOCATION: SEE TEST PIT LOCATION MAP
ELEVATION:

Other Tests	Temp °C	Moisture Content (%)	Blows/300mm	Samples	Frost Depth	DEPTH	Description
				ML		0	F4, BROWN, **SILT WITH SAND**, ABOUT 20% SAND, LOW PLASTICITY, FINE SAND, DAMP, STIFF, ORGANICS (ROOTS) ~35% BY VOLUME
						.15m	NFS, GRAY, **POORLY GRADED SAND**, ABOUT 5% SILT, FINE TO MEDIUM SAND, DAMP, MEDIUM DENSE
				SP			
						1	INTERBEDDED LAYERS OF **SAND** AND F4, BROWN, **SILT** UP TO 25mm THICK, ABOUT 10% SAND, LOW PLASTICITY, FINE SAND, WET, STIFF
				ML SP			SAMPLE CONTAINS APPROX. 20% SILT
		29					
				ML SP			SMALL LAYERS OF ORGANICS IN THE SILT (~5%)
				ML SP			WATER SEEPING IN AT 1.37m
							SATURATED
				ML SP			
						1.68m	TEST PIT COMPLETED AT 1.68 METERS PIT WALLS SLOUGHED

DEPTH (METERS): 0, 1, 2, 3, 4

KEY
MA = Mechanical Analysis
LL = Liquid Limit
PI = Plastic Index
PP = Pocket Penetrometer (TSF)
TV = Torvane (TSF)
☐ = Grab Sample
◪ = SPT Sample
⧅ = Shelby Tube - pushed
⧅ = 85.5mm I.D. Spoon Sample 154.2kg weight, .76m fall
T = Sample Temperature (°C) probably affected by sampling procedure

CLIENT: ADOT & PF
PROJECT: AKIAK AIRPORT
LOGGED BY: MARIA E. KAMPSEN
PIT COMPLETED: 7/31/96
W.O. 055644A

DOWL ENGINEERS ALASKA TESTLAB	LOG OF PIT	FIGURE 35

TEST PIT B-2

LOCATION: SEE TEST PIT LOCATION MAP
ELEVATION:

Other Tests	Temp °C	Moisture Content (%)	Blows/300mm	Samples	Frost Depth	DEPTH	Description
					OL	0 – .15m	F4, BROWN, **ORGANIC SILT WITH SAND**, ABOUT 25% SAND, NONPLASTIC, FINE SAND, WET, STIFF, ORGANICS (ROOTS) ~30% BY VOLUME
					SP	.15m – 1	NFS, GRAY, **POORLY GRADED SAND**, ABOUT 5% SILT, FINE TO MEDIUM SAND, DAMP, MEDIUM DENSE – ORGANICS (ROOTS) TO 0.46m (~10%–15%)
					ML		25mm LAYER OF F4, BROWN, **SILT**, ABOUT 10% SAND, LOW PLASTICITY, FINE SAND, WET, STIFF
					SP	1 – 2	SMALL LAYERS OF ORGANICS IN THE SILT (~5%)
					ML	2 – 2.13m	INTERBEDDED LAYERS OF SILT AND SAND (~50/50)
					SP		
					ML		WATER SEEPING IN AT 2.13m
					SP	2.13m – 2.29m	

DEPTH (METERS): 0, 1, 2, 3, 4

2.29m — TEST PIT COMPLETED AT 2.29 METERS
PIT WALLS SLOUGHED

KEY
MA = Mechanical Analysis
LL = Liquid Limit
PI = Plastic Index
PP = Pocket Penetrometer (TSF)
TV = Torvane (TSF)
☐ = Grab Sample
◪ = SPT Sample
◧ = Shelby Tube - pushed
◨ = 65.5mm I.D. Spoon Sample 154.2kg weight, .76m fall
T = Sample Temperature (°C) probably affected by sampling procedure

CLIENT: ADOT & PF
PROJECT: AKIAK AIRPORT
LOGGED BY: MARIA E. KAMPSEN
PIT COMPLETED: 7/31/96
W.O. D55644A

DOWL ENGINEERS ALASKA TESTLAB	LOG OF PIT	FIGURE 36

TEST PIT B-3

LOCATION: SEE TEST PIT LOCATION MAP
ELEVATION:

Other Tests	Temp °C	Moisture Content (%)	Blows/300mm	Samples	Frost Depth	DEPTH	Description
					OL	0	F4, BROWN, **ORGANIC SOIL**, ABOUT 10% SAND, DAMP, FIRM, ORGANICS (ROOTS) ~40% BY VOLUME
						.11m	NFS, BROWN, **POORLY GRADED SAND**, ABOUT 5% SILT, FINE TO MEDIUM SAND, DAMP, MEDIUM DENSE - ORGANICS (ROOTS) TO 1.37m (~5%)
					SP		
					ML	1	25mm LAYER OF F4, BROWN, **SILT**, ABOUT 10% SAND, LOW PLASTICITY, SAND, DAMP, STIFF
							SAMPLE CONTAINS APPROX. 5% SILT
		7			SP		
					ML		0.1m LAYER OF **SILT**, SMALL ORGANIC LAYERS WITHIN THE SILT (~5%)
					SP	2	
						1.98m	TEST PIT COMPLETED AT 1.98 METERS PIT WALLS SLOUGHED NO GROUND WATER OBSERVED WHILE DIGGING
						3	
						4	

DEPTH (METERS)

KEY
MA = Mechanical Analysis
LL = Liquid Limit
PI = Plastic Index
PP = Pocket Penetrometer (TSF)
TV = Torvane (TSF)
☐ = Grab Sample
◪ = SPT Sample
S = Shelby Tube - pushed
⊠ = 65.5mm I.D. Spoon Sample
154.2kg weight, .76m fall
T = Sample Temperature (° C) probably affected by sampling procedure

CLIENT: ADOT & PF
PROJECT: AKIAK AIRPORT
LOGGED BY: MARIA E. KAMPSEN
PIT COMPLETED: 7/31/98
W.O. 055844A

DOWL ENGINEERS ALASKA TESTLAB	LOG OF PIT	FIGURE 37

Appendix B

Logs of Test Borings Akiak K-12 School

DOWL Engineers, December 2002

TEST BORING 1

LOCATION: SEE TEST BORING LOCATION MAP
ELEVATION:

Other Tests	Temp °F	Moisture Content (%)	Blows / Foot	Samples	Frost Depth	DEPTH (FEET)	Description	Depth
						0	**FOREST SURFACE**	
		33			ML		F4, BROWN, **SILT WITH SAND**, ABOUT 15% SAND, LOW PLASTICITY, FINE SAND, **FROZEN**	
						5		4.5
	31.8	31	7				F3, BROWN, **SILTY SAND**, ABOUT 25% SILT, NONPLASTIC, MEDIUM SAND, **FROZEN**	
					SM	10	BECOMING SANDIER, ABOUT 15% SILT	
	34.1	19	10					
							DAMP, LOOSE, GROUNDWATER ENCOUNTERED AT 14.5' WHILE DRILLING	13.5
					SP	15	NFS, GRAY, **POORLY GRADED SAND**, ABOUT 5% SILT, MEDIUM SAND, SATURATED, LOOSE	
	35.5	25	6					16.5
						20	TEST BORING COMPLETED AT 16.5 FT ON 12-15-02	
							PVC STANDPIPE INSTALLED THERMISTOR STANDPIPE INSTALLED	
							GROUNDWATER MEASURED AT 14' ON 12-17-02	
						25		
						30		

KEY
- ☐ = Grab Sample
- ◪ = SPT Sample
- ⊡ = Shelby Tube - pushed
- ⊠ = 2.5" I.D. Spoon Sample 340# weight, 30" fall
- T = Sample Temperature (°F) probably affected by sampling procedure

CONTRACTOR: DENALI DRILLING, INC.
EQUIPMENT: CME-45, SKID MOUNTED
OPERATOR: JASON LOVE
METHOD: HOLLOW-STEM AUGER

CLIENT: KOONCE PFEFFER BETTIS
PROJECT: AKIAK K-12 SCHOOL
LOGGED BY: ERICA M. SNARE
BORING COMPLETED: 12-15-02
W.O. D57412A

DOWL ENGINEERS

LOG OF BORING

FIGURE 3

TEST BORING 2

LOCATION: SEE TEST BORING LOCATION MAP
ELEVATION:

Other Tests	Temp °F	Moisture Content (%)	Blows / Foot	Samples	Frost Depth	Description	DEPTH
						FOREST SURFACE	
		6				S2, BROWN, **POORLY GRADED SAND WITH SILT**, ABOUT 10% SILT, FINE SAND, **FROZEN**	
							4.0
MA	31.7	13	10			F2, BROWN, **SILTY SAND**, ABOUT 21% SILT, NONPLASTIC, MEDIUM SAND, **FROZEN**	
					SM		
	33.7	23	14			SAME, ABOUT 25% SILT, DAMP, MEDIUM DENSE	
							13.0
					SP/SM	GROUNDWATER ENCOUNTERED AT 14.5' WHILE DRILLING	
	35.4	24	16			S2, BROWN, **POORLY GRADED SAND WITH SILT**, ABOUT 10% SILT, MEDIUM SAND, SATURATED, MEDIUM DENSE	
							16.5

DEPTH (FEET): 0, 5, 10, 15, 20, 25, 30

TEST BORING COMPLETED AT 16.5 FT ON 12-15-02

PVC STANDPIPE INSTALLED
THERMISTOR STANDPIPE INSTALLED

GROUNDWATER MEASURED AT 13' ON 12-17-02

KEY
MA = Mechanical Analysis
☐ = Grab Sample
◪ = SPT Sample
T = Shelby Tube - pushed
☒ = 2.5" I.D. Spoon Sample 340# weight, 30" fall
T = Sample Temperature (°F) probably affected by sampling procedure

CONTRACTOR: DENALI DRILLING, INC.
EQUIPMENT: CME-45, SKID MOUNTED
OPERATOR: JASON LOVE
METHOD: HOLLOW-STEM AUGER

CLIENT: KOONCE PFEFFER BETTIS
PROJECT: AKIAK K-12 SCHOOL
LOGGED BY: ERICA M. SNARE
BORING COMPLETED: 12-15-02
W.O. D57412A

DOWL ENGINEERS

LOG OF BORING

FIGURE 4

TEST BORING 3

LOCATION: SEE TEST BORING LOCATION MAP
ELEVATION:

DEPTH (FEET)	Other Tests	Temp °F	Moisture Content (%)	Blows / Foot	Samples	Frost Depth	DEPTH	
0							**FOREST SURFACE**	
	MA		17			SM	F3, BROWN, **SILTY SAND**, ABOUT 38% SILT, NONPLASTIC, MEDIUM SAND, **FROZEN**	
								4.0
5		31.7	13	12		SP/SM	S2, BROWN, **POORLY GRADED SAND WITH SILT**, ABOUT 10% SILT, MEDIUM SAND, **FROZEN**	
								8.5
10		34.6	7	13			NFS, BROWN, **POORLY GRADED SAND**, ABOUT 5% SILT, MEDIUM SAND, DAMP, MEDIUM DENSE	
							GROUNDWATER ENCOUNTERED AT 14.5' WHILE DRILLING	
15		34.5	27	9			SAME, SATURATED, LOOSE	
						SP		
20		34.6	26	21			SAME, MEDIUM DENSE	
25				12			NO SAMPLE RECOVERED, HEAVING SANDS ENCOUNTERED	
30								

(continued on next page)

KEY
MA = Mechanical Analysis
☐ = Grab Sample
◪ = SPT Sample
◫ = Shelby Tube - pushed
⊠ = 2.5" I.D. Spoon Sample 340# weight, 30" fall
T = Sample Temperature (°F) probably affected by sampling procedure

CONTRACTOR: DENALI DRILLING, INC.
EQUIPMENT: CME-45, SKID MOUNTED
OPERATOR: JASON LOVE
METHOD: HOLLOW-STEM AUGER

CLIENT: KOONCE PFEFFER BETTIS
PROJECT: AKIAK K-12 SCHOOL
LOGGED BY: ERICA M. SNARE
BORING COMPLETED: 12-16-02
W.O. D57412A

DOWL ENGINEERS

LOG OF BORING

FIGURE 5

TEST BORING 3 (Continued)

LOCATION: SEE TEST BORING LOCATION MAP
ELEVATION:

Other Tests	Temp °F	Moisture Content (%)	Blows / Foot	Samples	Frost Depth	DEPTH	
							SAME, LOOSE
	36.9	25	10				
					SP		SAME, MEDIUM DENSE
	35.5	25	13				
							SAMPLER FILLED WITH HEAVING SANDS, BLOW COUNT IS NOT ACCURATE, BLOW COUNTS DO NOT REFLECT DENSITY
	36.6	23	30/6"				
						41.5	

TEST BORING COMPLETED AT 41.5 FT ON 12-16-02

PVC STANDPIPE INSTALLED
THERMISTOR STANDPIPE INSTALLED

GROUNDWATER MEASURED AT 13.5' ON 12-17-02

DEPTH (FEET): 30, 35, 40, 45, 50, 55, 60

KEY
MA = Mechanical Analysis
☐ = Grab Sample
◪ = SPT Sample
T = Shelby Tube - pushed
☒ = 2.5" I.D. Spoon Sample 340# weight, 30" fall
T = Sample Temperature (°F) probably affected by sampling procedure

CONTRACTOR: DENALI DRILLING, INC.
EQUIPMENT: CME-45, SKID MOUNTED
OPERATOR: JASON LOVE
METHOD: HOLLOW-STEM AUGER

CLIENT: KOONCE PFEFFER BETTIS
PROJECT: AKIAK K-12 SCHOOL
LOGGED BY: ERICA M. SNARE
BORING COMPLETED: 12-16-02
W.O. D57412A

DOWL ENGINEERS

LOG OF BORING

FIGURE 5

TEST BORING 4

LOCATION: SEE TEST BORING LOCATION MAP
ELEVATION:

Other Tests	Temp °F	Moisture Content (%)	Blows / Foot	Samples	Frost Depth	DEPTH	Description
						0	**FOREST SURFACE**
		27			ML		F4, BROWN, **SILT WITH SAND**, ABOUT 15% SAND, LOW PLASTICITY, FINE SAND, **FROZEN**
						4.0	
	32.2	12	10		SP SM		S2, BROWN, **POORLY GRADED SAND WITH SILT**, ABOUT 10% SILT, MEDIUM SAND, DAMP, MEDIUM DENSE, SILT IS FOUND IN 1/4" THICK LAYERS EVERY 3" IN SAMPLE
						8.5	
	37.3	19	15				NFS, BROWN, **POORLY GRADED SAND**, ABOUT 5% SILT, MEDIUM SAND, DAMP, MEDIUM DENSE
					∇		GROUNDWATER ENCOUNTERED AT 14.5' WHILE DRILLING
	35.8	28	4				SAME, SATURATED, VERY LOOSE
							HEAVING SANDS
					SP		
	35.3	36	4				SAME, SATURATED, VERY LOOSE
	33.2	29	8				SAME, LOOSE

DEPTH (FEET): 0, 5, 10, 15, 20, 25, 30

(continued on next page)

KEY
- ☐ = Grab Sample
- ◪ = SPT Sample
- ⊡ = Shelby Tube - pushed
- ⊠ = 2.5" I.D. Spoon Sample 340# weight, 30" fall
- T = Sample Temperature (°F) probably affected by sampling procedure

CONTRACTOR: DENALI DRILLING, INC.
EQUIPMENT: CME-45, SKID MOUNTED
OPERATOR: JASON LOVE
METHOD: HOLLOW-STEM AUGER

CLIENT: KOONCE PFEFFER BETTIS
PROJECT: AKIAK K-12 SCHOOL
LOGGED BY: ERICA M. SNARE
BORING COMPLETED: 12-15-02
W.O. D57412A

DOWL ENGINEERS

LOG OF BORING

FIGURE 6

TEST BORING 4 (Continued)

LOCATION: SEE TEST BORING LOCATION MAP
ELEVATION:

DEPTH (FEET)	Other Tests	Temp °F	Moisture Content (%)	Blows / Foot	Samples	Frost Depth	DEPTH	
30							NO SAMPLE RECOVERED	
				9			THERMISTOR READING INDICATES FROZEN MATERIAL	
35							SAME, LOOSE	
		35.5	28	7	SP			
40							NO SAMPLE RECOVERED	
				12				41.5
							TEST BORING COMPLETED AT 41.5 FT ON 12-15-02	
45							PVC STANDPIPE INSTALLED THERMISTOR STANDPIPE INSTALLED	
							GROUNDWATER MEASURED AT 12' ON 12-17-02	
50								
55								
60								

KEY
- ☐ = Grab Sample
- ◪ = SPT Sample
- ⊡ = Shelby Tube - pushed
- ⊠ = 2.5" I.D. Spoon Sample 340# weight, 30" fall
- T = Sample Temperature (°F) probably affected by sampling procedure

CONTRACTOR: DENALI DRILLING, INC.
EQUIPMENT: CME-45, SKID MOUNTED
OPERATOR: JASON LOVE
METHOD: HOLLOW-STEM AUGER

CLIENT: KOONCE PFEFFER BETTIS
PROJECT: AKIAK K-12 SCHOOL
LOGGED BY: ERICA M. SNARE
BORING COMPLETED: 12-15-02
W.O. D57412A

DOWL ENGINEERS

LOG OF BORING

FIGURE 6

TEST BORING 5

LOCATION: SEE TEST BORING LOCATION MAP
ELEVATION:

Other Tests	Temp °F	Moisture Content (%)	Blows / Foot	Samples	Frost Depth	Description	DEPTH
						FOREST SURFACE	
		27			ML	F4, BROWN, **SANDY SILT**, ABOUT 45% SAND, NONPLASTIC, FINE TO MEDIUM SAND, **FROZEN**	4.0
	32.1	19	11		SP/SM	S2, GRAY, **POORLY GRADED SAND WITH SILT**, ABOUT 10% SILT, MEDIUM SAND, DAMP, MEDIUM DENSE	
	32	18	10			SAME	
						GROUNDWATER ENCOUNTERED AT 12.5' WHILE DRILLING	14.0
	37.8	27	9		SP	NFS, GRAY, **POORLY GRADED SAND**, ABOUT 5% SILT, MEDIUM SAND, SATURATED, LOOSE	16.5

DEPTH (FEET): 0, 5, 10, 15, 20, 25, 30

TEST BORING COMPLETED AT 16.5 FT ON 12-15-02

PVC STANDPIPE INSTALLED
THERMISTOR STANDPIPE INSTALLED

GROUNDWATER MEASURED AT 11.5' ON 12-18-02

KEY
- ☐ = Grab Sample
- ◪ = SPT Sample
- T = Shelby Tube - pushed
- ☒ = 2.5" I.D. Spoon Sample 340# weight, 30" fall
- T = Sample Temperature (°F) probably affected by sampling procedure

CONTRACTOR: DENALI DRILLING, INC.
EQUIPMENT: CME-45, SKID MOUNTED
OPERATOR: JASON LOVE
METHOD: HOLLOW-STEM AUGER

CLIENT: KOONCE PFEFFER BETTIS
PROJECT: AKIAK K-12 SCHOOL
LOGGED BY: ERICA M. SNARE
BORING COMPLETED: 12-15-02
W.O. D57412A

DOWL ENGINEERS

LOG OF BORING

FIGURE 7

TEST BORING 6

LOCATION: SEE TEST BORING LOCATION MAP
ELEVATION:

Other Tests	Temp °F	Moisture Content (%)	Blows / Foot	Samples	Frost Depth	Description	DEPTH
						FOREST SURFACE	
		20			SM	F3, BROWN, **SILTY SAND**, ABOUT 35% SILT, NO TO LOW PLASTICITY, MEDIUM SAND, **FROZEN**	
							4.0
	35.1	16	9		SP/SM	S2, BROWN, **POORLY GRADED SAND WITH SILT**, ABOUT 10% SILT, MEDIUM SAND, DAMP, LOOSE	
							8.5
	37.4	10	12			NFS, MOTTLED BROWN/GRAY, **POORLY GRADED SAND**, ABOUT 5% SILT, MEDIUM SAND, DAMP, MEDIUM DENSE	
						∇ GROUNDWATER ENCOUNTERED AT 13.5' WHILE DRILLING	
MA	36.2	25	9			GRAY, ABOUT 3% SILT, SATURATED, LOOSE	
					SP		
	36.6	26	12			SAME, MEDIUM DENSE	
	36.6	24	13			SAME	

DEPTH (FEET): 0, 5, 10, 15, 20, 25, 30

(continued on next page)

KEY
MA = Mechanical Analysis
☐ = Grab Sample
◪ = SPT Sample
[T] = Shelby Tube - pushed
☒ = 2.5" I.D. Spoon Sample 340# weight, 30" fall
T = Sample Temperature (°F) probably affected by sampling procedure

CONTRACTOR: DENALI DRILLING, INC.
EQUIPMENT: CME-45, SKID MOUNTED
OPERATOR: JASON LOVE
METHOD: HOLLOW-STEM AUGER

CLIENT: KOONCE PFEFFER BETTIS
PROJECT: AKIAK K-12 SCHOOL
LOGGED BY: ERICA M. SNARE
BORING COMPLETED: 12-16-02
W.O. D57412A

DOWL ENGINEERS

LOG OF BORING

FIGURE 8

TEST BORING 6 (Continued)

LOCATION: SEE TEST BORING LOCATION MAP
ELEVATION:

Depth (Feet)	Other Tests	Temp °F	Moisture Content (%)	Blows / Foot	Samples	Frost Depth	Description
30							SAME, 1/4" SILT LAYERS
		37.5	22	15			
35						SP	SAME
		33.1	26	12			
40							SAME
		36.1	23	22			
41.0							TEST BORING COMPLETED AT 41.0 FT ON 12-16-02
45							PVC STANDPIPE INSTALLED THERMISTOR STANDPIPE INSTALLED
							GROUNDWATER MEASURED AT 13.5' ON 12-17-02
50							
55							
60							

DEPTH (FEET)

KEY
MA = Mechanical Analysis
☐ = Grab Sample
◪ = SPT Sample
◫ = Shelby Tube - pushed
⊠ = 2.5" I.D. Spoon Sample 340# weight, 30" fall
T = Sample Temperature (°F) probably affected by sampling procedure

CONTRACTOR: DENALI DRILLING, INC.
EQUIPMENT: CME-45, SKID MOUNTED
OPERATOR: JASON LOVE
METHOD: HOLLOW-STEM AUGER

CLIENT: KOONCE PFEFFER BETTIS
PROJECT: AKIAK K-12 SCHOOL
LOGGED BY: ERICA M. SNARE
BORING COMPLETED: 12-16-02
W.O. D57412A

DOWL ENGINEERS

LOG OF BORING

FIGURE 8

TEST BORING 7

LOCATION: SEE TEST BORING LOCATION MAP
ELEVATION:

Other Tests	Temp °F	Moisture Content (%)	Blows / Foot	Samples	Frost Depth	DEPTH	Description
						0	**FOREST SURFACE**
		11		SM			F2, BROWN, **SILTY SAND**, ABOUT 20% SILT, NONPLASTIC, MEDIUM SAND, **FROZEN**
						4.0	
	33.3	8	11			5	NFS, BROWN, **POORLY GRADED SAND**, ABOUT 5% SILT, MEDIUM SAND, DAMP, MEDIUM DENSE
	32.1	17	9			10	SAME, LOOSE
					∇	13.5	GROUNDWATER ENCOUNTERED AT 13.5' WHILE DRILLING
	32.9	26	11	SP		15	SAME, SATURATED, MEDIUM DENSE
	34.6	20	10			20	SAME, LOOSE
MA	35.1	25	13			25	SAME, HEAVING SANDS, ABOUT 5% SILT
						30	

DEPTH (FEET)

(continued on next page)

KEY
MA = Mechanical Analysis
☐ = Grab Sample
◪ = SPT Sample
◫ = Shelby Tube - pushed
☒ = 2.5" I.D. Spoon Sample 340# weight, 30" fall
T = Sample Temperature (°F) probably affected by sampling procedure

CONTRACTOR: DENALI DRILLING, INC.
EQUIPMENT: CME-45, SKID MOUNTED
OPERATOR: JASON LOVE
METHOD: HOLLOW-STEM AUGER

CLIENT: KOONCE PFEFFER BETTIS
PROJECT: AKIAK K-12 SCHOOL
LOGGED BY: ERICA M. SNARE
BORING COMPLETED: 12-18-03
W.O. D57412A

DOWL ENGINEERS

LOG OF BORING

FIGURE 9

TEST BORING 7 (Continued)

LOCATION: SEE TEST BORING LOCATION MAP
ELEVATION:

Other Tests	Temp °F	Moisture Content (%)	Blows / Foot	Samples	Frost Depth	DEPTH	
							NO SAMPLE PERFORMED, TOO MUCH HEAVE TO SAMPLE PROPERLY
					SP		NO SAMPLE PERFORMED, HEAVING SANDS
							SAME, MEDIUM DENSE
	36.8	21	12			41.5	
							TEST BORING COMPLETED AT 41.5 FT ON 12-18-03
							PVC STANDPIPE INSTALLED THERMISTOR STANDPIPE INSTALLED
							GROUNDWATER MEASURED AT 12.5' ON 12-19-02

DEPTH (FEET): 30, 35, 40, 45, 50, 55, 60

KEY
MA = Mechanical Analysis
☐ = Grab Sample
◪ = SPT Sample
◫ = Shelby Tube - pushed
☒ = 2.5" I.D. Spoon Sample 340# weight, 30" fall
T = Sample Temperature (°F) probably affected by sampling procedure

CONTRACTOR: DENALI DRILLING, INC.
EQUIPMENT: CME-45, SKID MOUNTED
OPERATOR: JASON LOVE
METHOD: HOLLOW-STEM AUGER

CLIENT: KOONCE PFEFFER BETTIS
PROJECT: AKIAK K-12 SCHOOL
LOGGED BY: ERICA M. SNARE
BORING COMPLETED: 12-18-03
W.O. D57412A

DOWL ENGINEERS

LOG OF BORING

FIGURE 9

TEST BORING 8

LOCATION: SEE TEST BORING LOCATION MAP
ELEVATION:

Other Tests	Temp °F	Moisture Content (%)	Blows / Foot	Samples	Frost Depth	Description	DEPTH
						FOREST SURFACE	
MA		23			SM	F3, BROWN, **SILTY SAND**, ABOUT 49% SILT, NONPLASTIC, MEDIUM SAND, **FROZEN**	
							4.5
	33	13	9			NFS, BROWN, **POORLY GRADED SAND**, ABOUT 5% SILT, MEDIUM SAND, DAMP, LOOSE	
	38.2	9	8		SP	SAME	
						GROUNDWATER ENCOUNTERED AT 14.5' WHILE DRILLING	
	38.4	26	6			SAME, SATURATED, LOOSE	
							16.5

DEPTH (FEET): 0, 5, 10, 15, 20, 25, 30

TEST BORING COMPLETED AT 16.5 FT ON 12-15-02

PVC STANDPIPE INSTALLED
THERMISTOR STANDPIPE INSTALLED

GROUNDWATER MEASURED AT 12' ON 12-17-02

KEY
MA = Mechanical Analysis
□ = Grab Sample
◪ = SPT Sample
▥ = Shelby Tube - pushed
⊠ = 2.5" I.D. Spoon Sample 340# weight, 30" fall
T = Sample Temperature (°F) probably affected by sampling procedure

CONTRACTOR: DENALI DRILLING, INC.
EQUIPMENT: CME-45, SKID MOUNTED
OPERATOR: JASON LOVE
METHOD: HOLLOW-STEM AUGER

CLIENT: KOONCE PFEFFER BETTIS
PROJECT: AKIAK K-12 SCHOOL
LOGGED BY: ERICA M. SNARE
BORING COMPLETED: 12-15-02
W.O. D57412A

DOWL ENGINEERS

LOG OF BORING

FIGURE 10

LOG OF EXPLORATION 57412A.GPJ DOWL.GDT 01/31/03

TEST BORING 9

LOCATION: SEE TEST BORING LOCATION MAP
ELEVATION:

Other Tests	Temp °F	Moisture Content (%)	Blows / Foot	Samples	Frost Depth	DEPTH	Description
						0	**FOREST SURFACE**
		23			ML		F4, BROWN, **SANDY SILT**, ABOUT 50% SAND, NO TO LOW PLASTICITY, FINE TO MEDIUM SAND, **FROZEN**
						4.0	
	32.2	8	13			5	NFS, BROWN, **POORLY GRADED SAND**, ABOUT 5% SILT, MEDIUM SAND, DAMP, MEDIUM DENSE
	30.8	8	15			10	SAME, **FROZEN**
						13.5	GROUNDWATER ENCOUNTERED AT 13.5' WHILE DRILLING
	34.5	27	7		SP	15	SAME, SATURATED, LOOSE
	33.3	22	9			20	SAME
	36.3	24	4			25	SAME, VERY LOOSE
						30	

DEPTH (FEET)

(continued on next page)

KEY
- ☐ = Grab Sample
- ◪ = SPT Sample
- ⊡ = Shelby Tube - pushed
- ⊠ = 2.5" I.D. Spoon Sample 340# weight, 30" fall
- T = Sample Temperature (°F) probably affected by sampling procedure

CONTRACTOR: DENALI DRILLING, INC.
EQUIPMENT: CME-45, SKID MOUNTED
OPERATOR: JASON LOVE
METHOD: HOLLOW-STEM AUGER

CLIENT: KOONCE PFEFFER BETTIS
PROJECT: AKIAK K-12 SCHOOL
LOGGED BY: ERICA M. SNARE
BORING COMPLETED: 12-17-02
W.O. D57412A

DOWL ENGINEERS

LOG OF BORING

FIGURE 11

TEST BORING 9 (Continued)

LOCATION: SEE TEST BORING LOCATION MAP
ELEVATION:

Depth (Feet)	Other Tests	Temp °F	Moisture Content (%)	Blows / Foot	Samples	Frost Depth	Description	Depth
30							SAME, MEDIUM DENSE	
		35.2	25	14	SP		HEAVING SANDS IMPACTED DRILLING, UNABLE TO CONTINUE	31.5
							TEST BORING COMPLETED AT 31.5 FT ON 12-17-02	
35							PVC STANDPIPE INSTALLED	
							NO MEASURABLE GROUNDWATER TO 16' ON 12-18-02	
40								
45								
50								
55								
60								

DEPTH (FEET)

KEY
- ☐ = Grab Sample
- ◪ = SPT Sample
- ⊡ = Shelby Tube - pushed
- ⊠ = 2.5" I.D. Spoon Sample 340# weight, 30" fall
- T = Sample Temperature (°F) probably affected by sampling procedure

CONTRACTOR: DENALI DRILLING, INC.
EQUIPMENT: CME-45, SKID MOUNTED
OPERATOR: JASON LOVE
METHOD: HOLLOW-STEM AUGER

CLIENT: KOONCE PFEFFER BETTIS
PROJECT: AKIAK K-12 SCHOOL
LOGGED BY: ERICA M. SNARE
BORING COMPLETED: 12-17-02
W.O. D57412A

DOWL ENGINEERS

LOG OF BORING

FIGURE 11

TEST BORING 10

LOCATION: SEE TEST BORING LOCATION MAP
ELEVATION:

Other Tests	Temp °F	Moisture Content (%)	Blows / Foot	Samples	Frost Depth	Description	DEPTH
						FOREST SURFACE	
		21			SM	F2, BROWN, **SILTY SAND**, ABOUT 25% SILT, NO TO LOW PLASTICITY, MEDIUM SAND, **FROZEN**	
							4.5
	32.5	10	9			S2, BROWN, **POORLY GRADED SAND**, ABOUT 5% SILT, MEDIUM SAND, DAMP, LOOSE	
	32.7	7	8		SP	SAME	
						GROUNDWATER ENCOUNTERED AT 13.5' WHILE DRILLING	
	35.8	28	6			SAME, SATURATED, LOOSE	
							16.5

DEPTH (FEET): 0, 5, 10, 15, 20, 25, 30

TEST BORING COMPLETED AT 16.5 FT ON 12-18-02

PVC STANDPIPE INSTALLED
THERMISTOR STANDPIPE INSTALLED

GROUNDWATER MEASURED AT 13' ON 12-19-02

KEY
- ☐ = Grab Sample
- ◪ = SPT Sample
- ◫ = Shelby Tube - pushed
- ☒ = 2.5" I.D. Spoon Sample 340# weight, 30" fall
- T = Sample Temperature (°F) probably affected by sampling procedure

CONTRACTOR: DENALI DRILLING, INC.
EQUIPMENT: CME-45, SKID MOUNTED
OPERATOR: JASON LOVE
METHOD: HOLLOW-STEM AUGER

CLIENT: KOONCE PFEFFER BETTIS
PROJECT: AKIAK K-12 SCHOOL
LOGGED BY: ERICA M. SNARE
BORING COMPLETED: 12-18-02
W.O. D57412A

DOWL ENGINEERS

LOG OF BORING

FIGURE 12

LOG OF EXPLORATION 57412A.GPJ DOWL.GDT 01/31/03

Appendix C

Logs of Test Borings Akiak Communication Tower

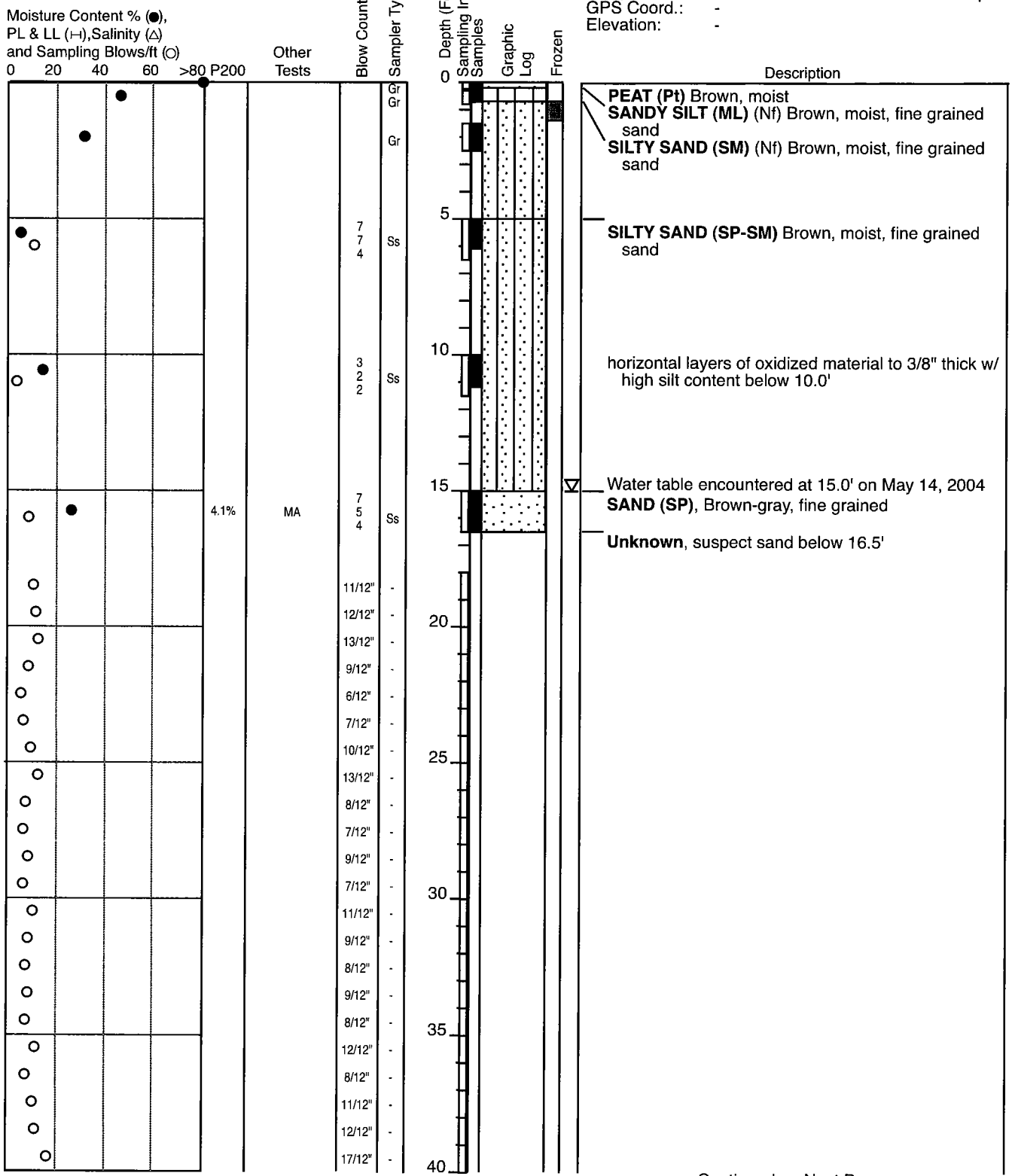
Duane Miller Associates, February 2005

DUANE MILLER & ASSOCIATES

Project: LYC Towers
DM&A Job No.: 4209.002
Logged By: Simon Evans

Log of HOLE: A1

Date Drilled: May 14, 2004
Contractor.: Salzbrun Service, Inc.
Equipment: SSD2 w/ 140 lbs Hammer & 1.5" Split Spoon
GPS Coord.: -
Elevation: -



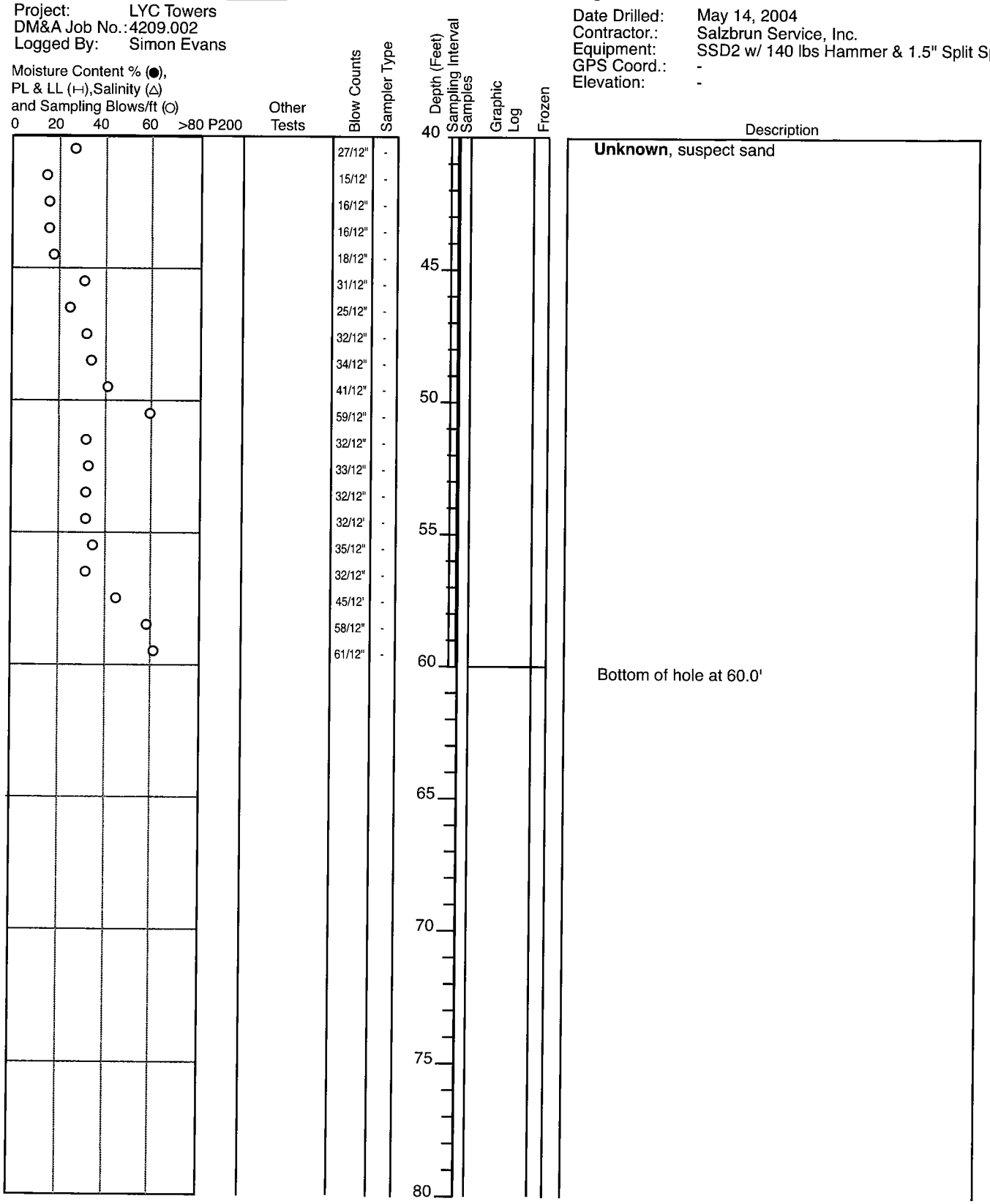
Continued on Next Page

DUANE MILLER & ASSOCIATES

Project: LYC Towers
DM&A Job No.: 4209.002
Logged By: Simon Evans

Log of HOLE: A1

Date Drilled: May 14, 2004
Contractor.: Salzbrun Service, Inc.
Equipment: SSD2 w/ 140 lbs Hammer & 1.5" Split Spoon
GPS Coord.: -
Elevation: -



Duane Miller & Associates
Job No.: 4209.002
Date: November 2004

LOG of TEST HOLE A1
United Utilities Tower
Akiak, Alaska

DRAFT

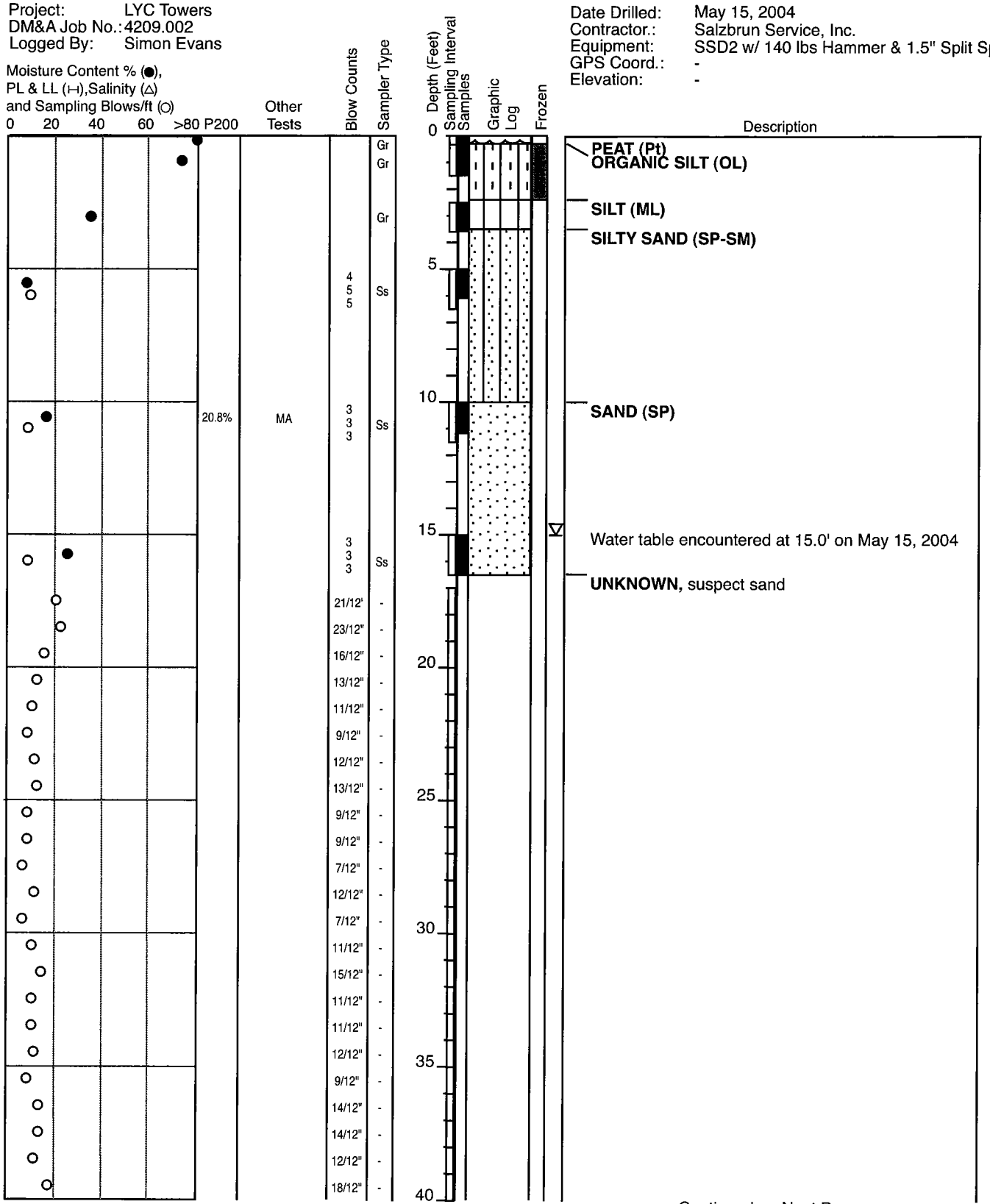
Plate
2

DUANE MILLER & ASSOCIATES

Project: LYC Towers
DM&A Job No.: 4209.002
Logged By: Simon Evans

Log of HOLE: A2

Date Drilled: May 15, 2004
Contractor.: Salzbrun Service, Inc.
Equipment: SSD2 w/ 140 lbs Hammer & 1.5" Split Spoon
GPS Coord.: -
Elevation: -



Continued on Next Page

DUANE MILLER & ASSOCIATES

Project: LYC Towers
DM&A Job No.: 4209.002
Logged By: Simon Evans

Log of HOLE: A2

Date Drilled: May 15, 2004
Contractor.: Salzbrun Service, Inc.
Equipment: SSD2 w/ 140 lbs Hammer and 1.5" Split Spoon S
GPS Coord.: -
Elevation: -

Depth (Feet)	Moisture Content % (●), PL & LL (⊢), Salinity (△) and Sampling Blows/ft (○) 0 20 40 60 >80	P200	Other Tests	Blow Counts	Sampler Type	Sampling Interval Samples	Graphic Log	Frozen	Description
40	○			25/12"	-				**UNKNOWN,** suspect sand
	○			28/12"	-				
	○			25/12"	-				
	○			20/12"	-				
	○			23/12"	-				
45									
50									
55									
60									
65									
70									
75									
80									

APPENDIX D

U.S. ARMY CORPS OF ENGINEERS
FLOOD HAZARD DATA

Akiak | City Office: (907) 765-7411 | Revised:

STATUS	2nd class city	LAST FLOOD EVENT	1988
POPULATION	338	FLOOD CAUSE	
BUILDINGS		ELEVATION	
RIVER SYSTEM	Kuskokwim River	FLOOD OF RECORD	1964
COASTAL AREA	none	FLOOD CAUSE	ice jam
		ELEVATION	35.2
NFIP STATUS	not participating	WORST FLOOD EVENT	1964
FLOODPLAIN REPORT	yes	FLOOD CAUSE	ice jam
FLOOD INSURANCE STUDY	no	FLOOD GAUGE	yes

Comments: The following references are based on the National Weather Service's slope gauge, which has an arbitrary base. The "A" marker on the slope gauge is a brass cap on a steel rod at the streamward, upstream corner of Mary Jackson's home. A NWS staff gauge is on the same corner. The elevation of the "A" marker is 30.81 ft. (Add 19.05 ft to the staff readings to correlate to the slope gauge data.)

SURVEY INFORMATION AS OF JUNE 1998

Recommended building elevation	37.2
Front doorsill of the clinic	36.4
Front doorsill of Arlicaq School	35.0
First floor of the city office building	34.2
Centerline of the runway at the tarmac	33.7
0.0 ft elevation on the flood gauge	31.8
Typical bottom of the school fuel tank farm	30.2
Water level of the Kuskokwim River on 6/18/98	19.5

The flood gauge was installed on the Akiak library. High Water Elevation (HWE) signs were also placed on utility poles adjacent to the road between the high school and the library about 300 and 500 yards upstream of the high school. HWE signs were placed on the shoreward, downstream corner of the library and on the shoreward, downstream corner of the old BIA school. Flooding occurred in 1920, 1964, 1971, 1982, 1984, 1987 and 1988.

HWE sign #1 is on a power pole about 500 yards upstream of the high school and adjacent to the road that goes between the high school and the library.

HWE sign #2 is on a power pole about 300 yards upstream of the high school and adjacent to the road which goes between the high school and the library.

HWE sign #3 is on the shoreward, downstream, corner of the Akiak library.

HWE sign #4 is on the shoreward, downstream, corner of the old BIA school.

HWE sign #5 is on the upstream, streamward corner of Mary Jackson's house adjacent to the NWS staff gauge.

Floodplain Manager (907) 753-2610

APPENDIX E

WIND POWER DENSITY MAPS

Wind Powering America: Alaska Wind Resource MapU.S. Department of Energy -
Energy Efficiency and Renewable Energy
Wind and Hydropower Technologies Program - Wind Powering America
Alaska Wind Resource Map

This map of Alaska shows the wind resource at 50 meters.

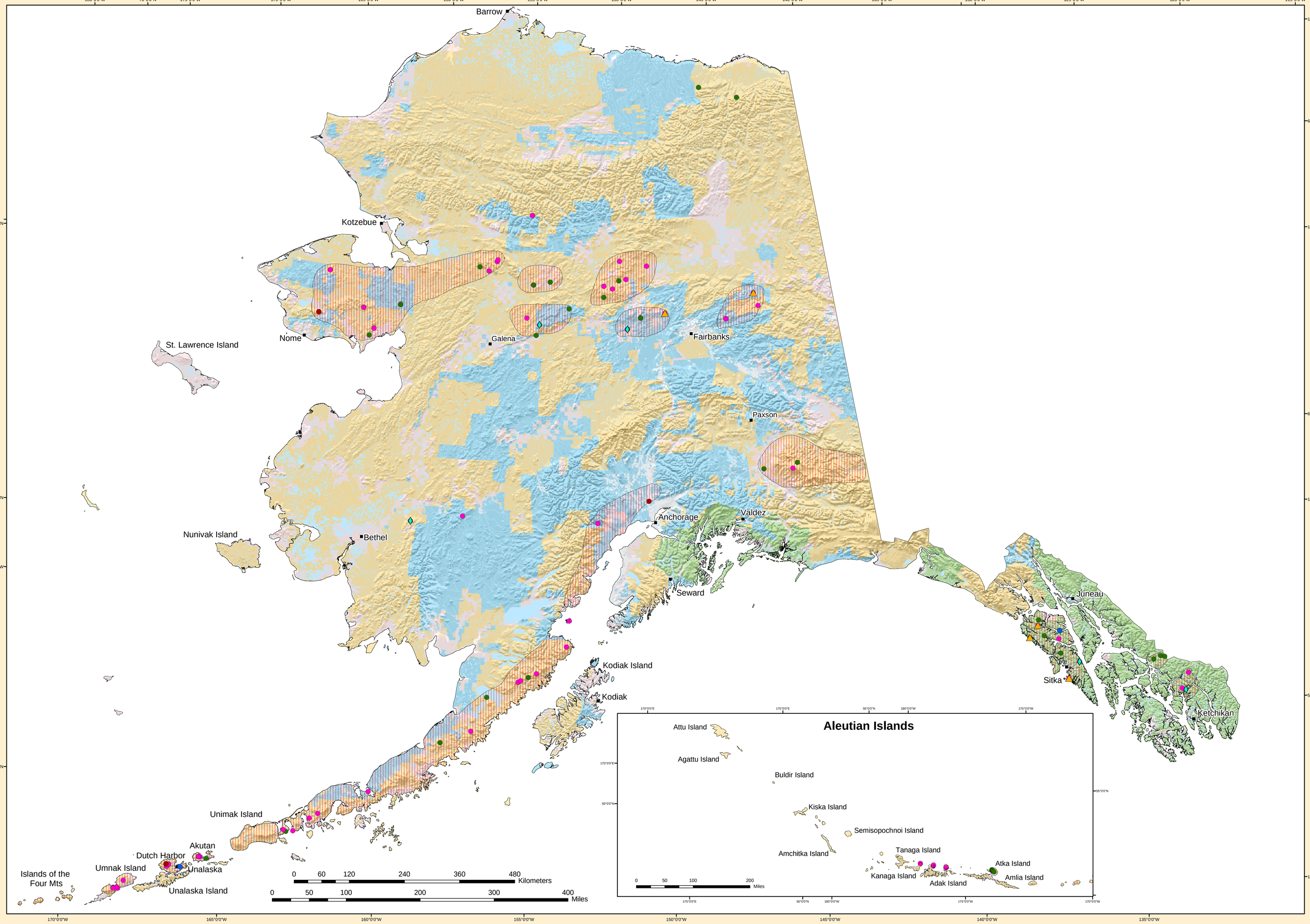
Viewing Options
Larger Jpeg: Click Map
Printable:(PDF 6.1 MB)
Download Adobe Reader

The Department of Energy's Wind Program and the National Renewable Energy Laboratory (NREL) published a new wind resource map for the state of Alaska. This resource map shows wind speed estimates at 50 meters above the ground and depicts the resource that could be used for utility-scale wind development. Future plans are to provide wind speed estimates at 30 meters, which are useful for identifying small wind turbine opportunities. As a renewable resource, wind is classified according to wind power classes, which are based on typical wind speeds. These classes range from Class 1 (the lowest) to Class 7 (the highest). In general, at 50 meters, wind power Class 4 or higher can be useful for generating wind power with large turbines. Class 4 and above are considered good resources. Particular locations in the Class 3 areas could have higher wind power class values at 80 meters than shown on the 50 meter map because of possible high wind shear. Given the advances in technology, a number of locations in the Class 3 areas may suitable for utility-scale wind development.
This map indicates that mainland Alaska has wind resources consistent with utility-scale production. The largest contiguous low elevation area of good-to-excellent resource is located in the western part of the state between Bethel and the Yukon River Delta. Coastal locations along the Bering Sea and the Arctic Ocean are likely to have good-to-excellent resource. Excellent wind resources are located on higher ridge crests crest locations throughout mainland Alaska including the Brooks and Alaska Ranges and the Chugach Mountains.

Note: Wind resource at a micro level can vary significantly; therefore, you should get a professional evaluation of your specific area of interest.

Webmaster | Security & Privacy | Wind and Hydropower Technologies Program
Home | EERE Home
U.S. Department of Energy
Last Updated: 10/30/2006

Alaska Geothermal Resources



Legend

- Cities/Towns
- Rivers/Streams
- Lakes/Reservoirs

Geothermal Categories

- Space Heating
- Spas/Resorts/Recreation Sites
- Regions of Known or Potential Geothermal Resources
- Wells > 50 Degrees C
- Springs > 50 Degrees C
- Wells ≥ 20 and ≤ 50 Degrees C
- Springs ≥ 20 and ≤ 50 Degrees C

Ownership

- Private Lands
- Bureau of Land Management and Other Federal Lands
- State Lands
- Native American Lands
- U.S. Forest Service Lands

Map prepared by Patrick Laney and Julie Brizzee at the Idaho National Engineering and Environmental Laboratory
for
The U.S. Department of Energy Office of Energy Efficiency and Renewable Energy Geothermal Technologies Program

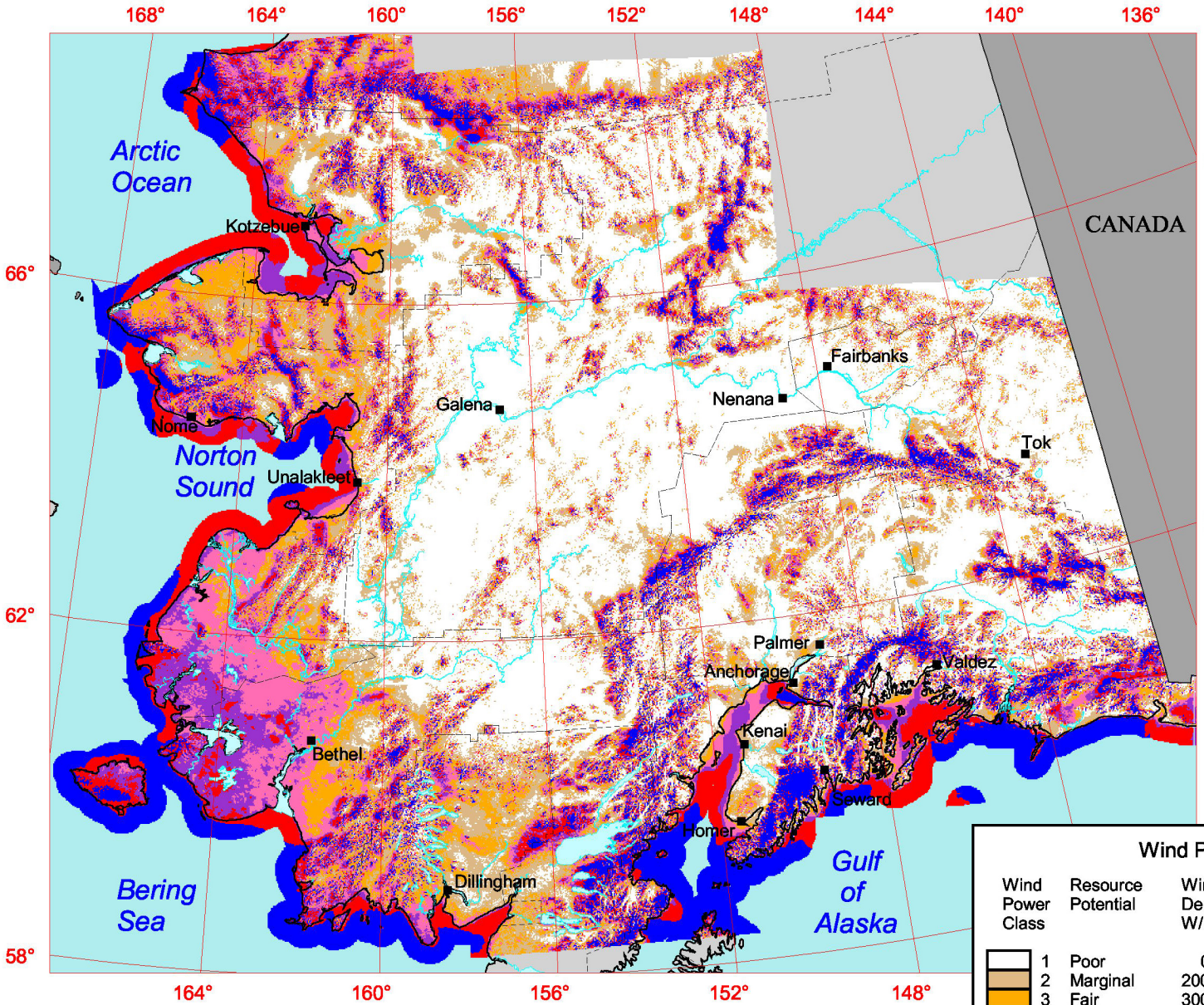
Geothermal Data Provided by:

1. Geo-Heat Center State Geothermal Database, [Compact Disk], February 2002
2. National Geophysical Data Center, National Oceanic and Atmospheric Administration, 1983, Geothermal Resources of Alaska: Prepared for the Geothermal and Hydropower Technologies Division United States Department of Energy, Map 1:2,500,000

Alaska Geothermal Resources
Publication No. - INEEL/MIS-2002-1623 Rev. 1
November 2003

Map Projection Information:
Projection: Albers
Central Meridian: -154.00
Standard Parallel 1: 55.00
Standard Parallel 2: 65.00
Latitude Of Origin: 50.00

Alaska Mainland Regions 50 m Wind Power



The annual wind power estimates for this map were produced by AWS Truewind using their Mesomap system and historical weather data. It has been validated with available surface data by NREL and wind energy meteorological consultants.

Wind Power Classification

Wind Power Class	Resource Potential	Wind Power Density at 50 m W/m 2	Wind Speed[a] at 50 m m/s	Wind Speed[a] at 50 m mph
1	Poor	0 - 200	0.0 - 5.3	0.0 - 11.9
2	Marginal	200 - 300	5.3 - 6.1	11.9 - 13.7
3	Fair	300 - 400	6.1 - 6.7	13.7 - 15.0
4	Good	400 - 500	6.7 - 7.3	15.0 - 16.4
5	Excellent	500 - 600	7.3 - 7.7	16.4 - 17.2
6	Outstanding	600 - 800	7.7 - 8.5	17.2 - 19.0
7	Superb	> 800	> 8.5	> 19.0

[a] Wind speeds are based on a Weibull k of 1.8. Weibull k values in Alaska vary from 1.4 to 2.0.

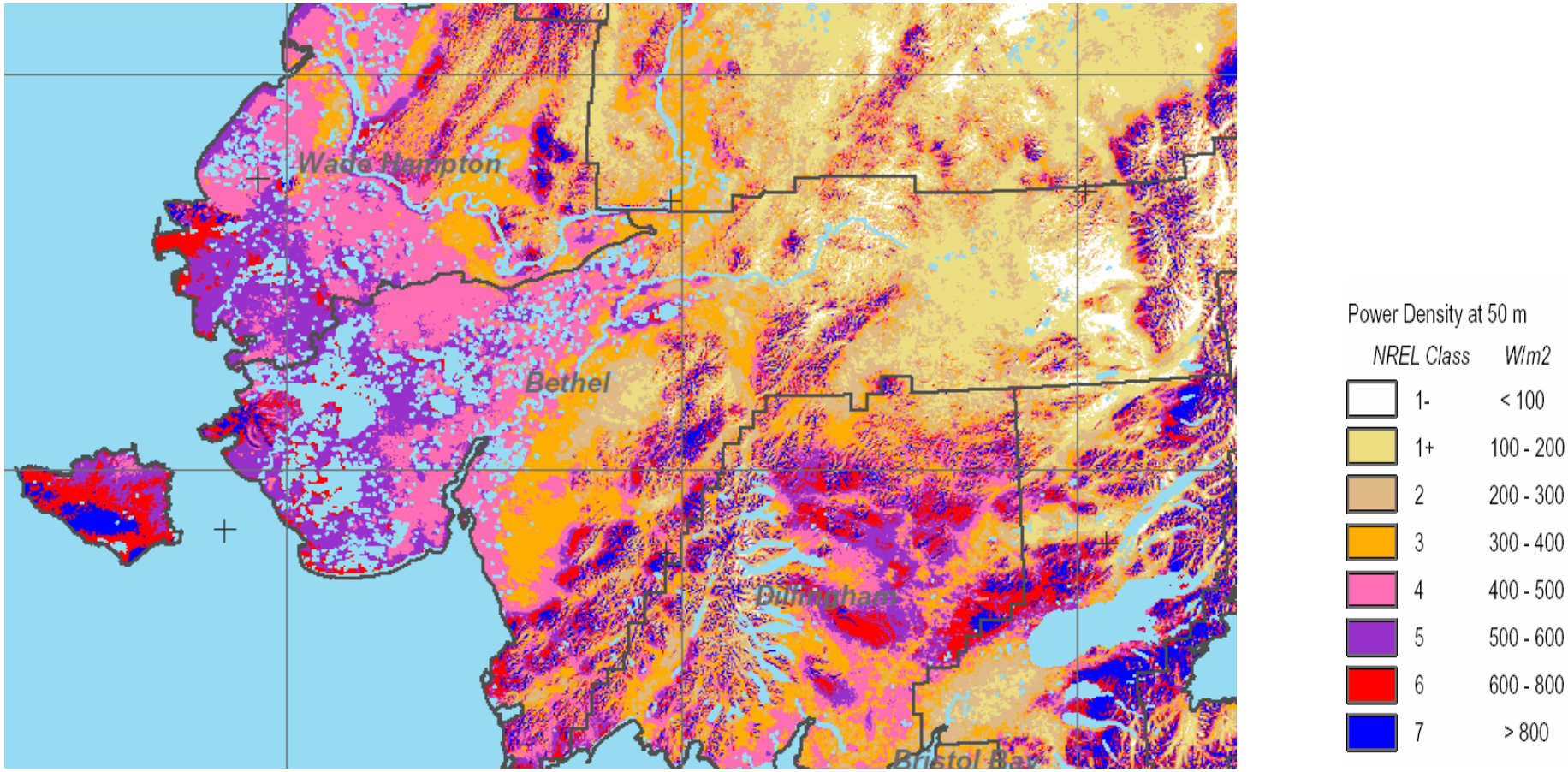
100 0 100 200 300 400 Kilometers

50 0 50 100 150 200 250 Miles

U.S. Department of Energy
National Renewable Energy Laboratory

18-JAN-2006 4.1.1

Wind Power Density Map



This map is an exert from the Wind Power Density Map of Alaska created by TrueWind Solutions.

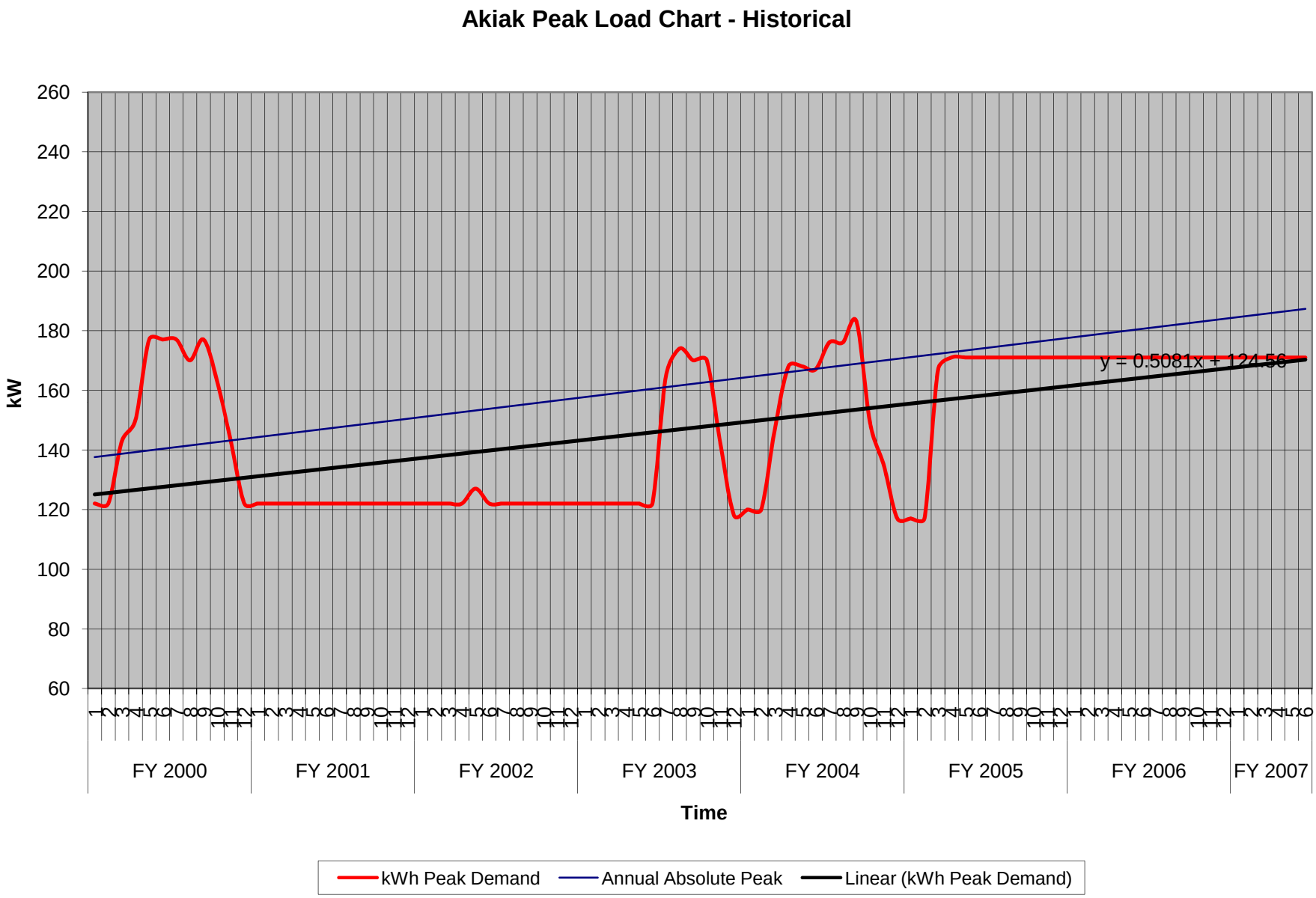
APPENDIX F

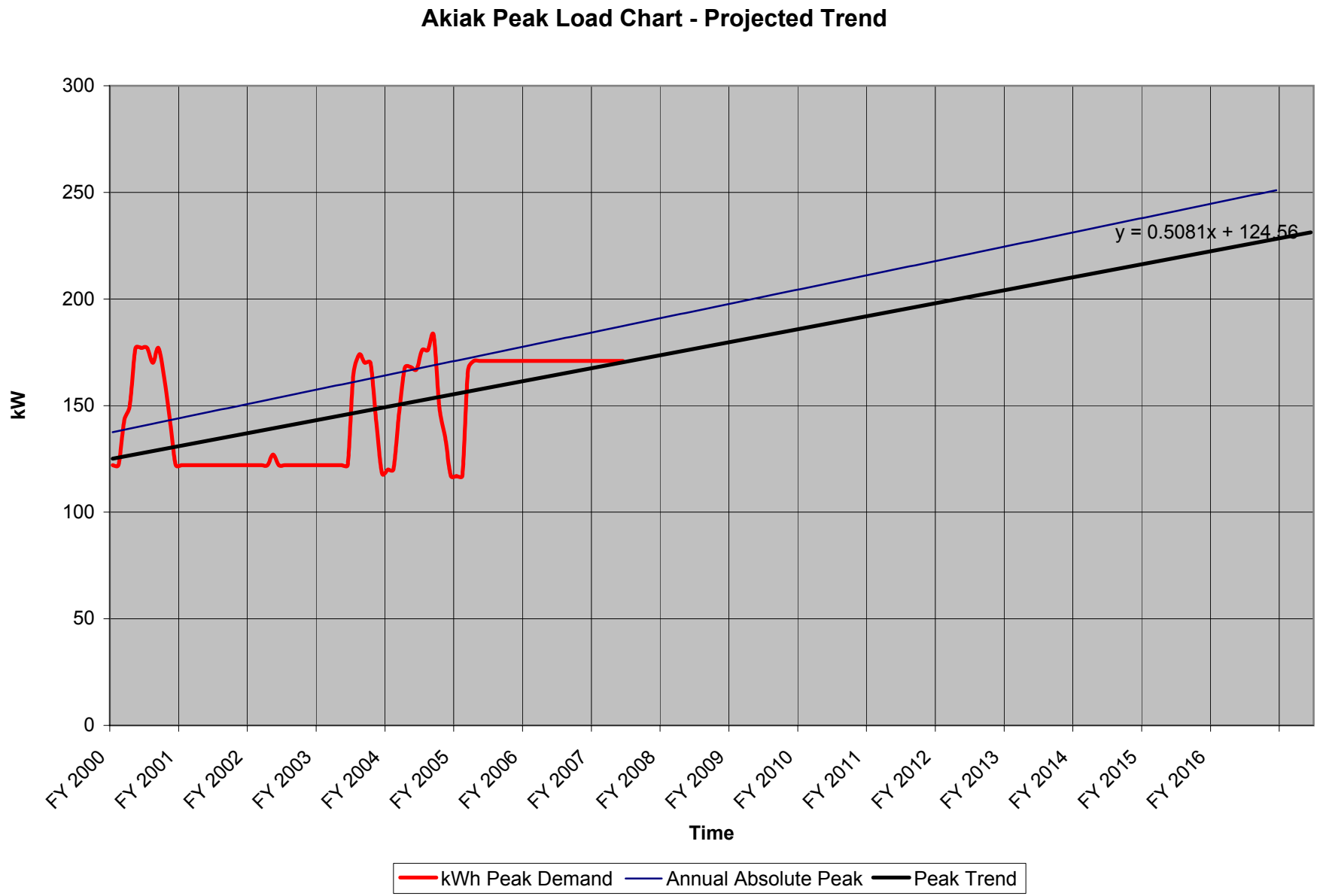
PEAK LOAD TREND ANALYSIS AND PCE DATA

Fiscal Year	Fiscal Month	KWH Gen Diesel	Diesel Used (gallons)	Diesel Fuel Cost	kWh Powerhouse	kWh Peak Demand	Absolute Annual High Trend Load	Absolute Annual High Peak/Trend %		Trend Line	Trend Line @ 110%
FY 2000	1	51,480	5,348	$5,936.28	2,514	122			1	125	138
	2	55,966	5,348	$5,936.28	2,566	122			2	126	138
	3	60,697	5,564	$6,176.04	1,874	143			3	126	139
	4	68,818	5,473	$7,169.63	1,967	150			4	127	139
	5	68,813	5,643	$7,392.33	3,189	177			5	127	140
	6	86,191	6,845	$8,966.95	3,696	177			6	128	140
	7	85,908	6,842	$8,963.02	3,789	177			7	128	141
	8	77,674	6,371	$8,346.01	4,079	170			8	129	141
	9	78,685	6,392	$8,373.52	4,139	177	129	137%	9	129	142
	10	72,668	5,819	$7,622.89	3,617	163			10	130	143
	11	64,154	5,205	$6,818.55	3,015	143			11	130	143
	12	56,560	4,603	$6,029.93	3,640	122			12	131	144
FY 2001	1		4,740	$6,209.40	2,209	122			13	131	144
	2		5,449	$7,138.19	2,344	122			14	132	145
	3		5,920	$7,755.20	2,431	122			15	132	145
	4		6,609	$10,970.94	2,013	122			16	133	146
	5		7,583	$12,587.78	2,147	122			17	133	147
	6		6,723	$11,160.18	2,028	122			18	134	147
	7		7,022	$11,656.52	2,007	122			19	134	148
	8		5,798	$9,624.68	2,183	122			20	135	148
	9		6,637	$11,017.42	1,755	122			21	135	149
	10		5,174	$8,588.84	1,653	122			22	136	149
	11		3,558	$5,906.28	1,881	122			23	136	150
	12		5,123	$8,504.18	2,134	122	137	89%	24	137	150
FY 2002	1		4,789	$7,949.74	1,965	122			25	137	151
	2		5,119	$8,497.54	2,221	122			26	138	152
	3		5,725	$9,503.50	2,181	122			27	138	152
	4		6,084	$9,478.87	1,824	122			28	139	153
	5	83,152	6,443	$10,038.19	1,925	127			29	139	153
	6	96,758	7,584	$11,815.80	2,084	122			30	140	154
	7		6,669	$10,390.30	2,043	122			31	140	154
	8		6,564	$14,900.28	1,827	122			32	141	155
	9		6,880	$15,617.60	2,006	122			33	141	155
	10		5,799	$13,163.73	1,820	122			34	142	156
	11		5,222	$11,853.94	2,034	122			35	142	157
	12		4,224	$9,588.48	211	122	143	85%	36	143	157
FY 2003	1		5,114	$11,608.78	311	122			37	143	158
	2		5,460	$12,394.20	2,439	122			38	144	158
	3		9,090	$12,253.32	2,247	122			39	144	159
	4		6,004	$8,093.39	2,442	122			40	145	159
	5		6,542	$8,818.62	1,522	122			41	145	160
	6		6,898	$9,298.50	2,147	122			42	146	160
	7	27,123	7,425	$10,008.90	2,683	165			43	146	161
	8	81,308	7,041	$9,491.27	2,523	174	147	118%	44	147	162
	9	91,693	7,518	$10,134.26	2,697	170			45	147	162
	10	73,633	5,981	$8,062.39	2,221	170			46	148	163
	11	67,056	5,442	$7,335.82	2,064	142			47	148	163
	12	54,865	9,839	$13,905.46	2,094	118			48	149	164
FY 2004	1	59,551	4,716	$6,665.12	2,248	120			49	149	164
	2	68,146	5,458	$7,713.79	2,396	120			50	150	165
	3	69,325	5,479	$7,743.47	2,128	147			51	150	166
	4	77,685	6,577	$9,295.27	2,185	168			52	151	166
	5	79,131	6,531	$9,230.26	2,753	168			53	151	167
	6	98,062	7,167	$10,192.12	2,220	167			54	152	167
	7	97,913	7,907	$11,174.96	1,688	176			55	153	168
	8	71,085	5,741	$8,113.76	1,217	176			56	153	168
	9	77,735	6,314	$8,923.58	1,518	183	154	119%	57	154	169
	10	72,995	5,893	$8,328.58	1,594	149			58	154	169
	11	65,166	5,256	$7,428.30	1,617	135			59	155	170
	12	54,876	4,533	$9,201.99	1,551	117			60	155	171
FY 2005	1	64,098	5,275	$10,708.25	2,207	117			61	156	171
	2	62,368	5,477	$11,118.31	1,925	117			62	156	172
	3	86,629	6,626	$13,450.78	2,352	167			63	157	172
	4	69,500	6,414	$13,020.42	2,596	171			64	157	173
	5	93,666	6,414	$13,020.42	2,635	171			65	158	173
	6	90,508	6,414	$13,020.42	2,086	171			66	158	174
	7	93,858	6,414	$13,020.42	1,912	171			67	159	174
	8	79,446	5,715	$11,601.45	1,729	171			68	159	175
	9	91,661	4,258	$8,643.74		171			69	160	176
	10	86,260	6,589	$13,375.67		171			70	160	176
	11	79,191	6,276	$12,740.28		171			71	161	177
	12	67,818	5,220	$12,250.30	2,144	171	161	106%	72	161	177

Fiscal Year	Fiscal Month	KWH Gen Diesel	Diesel Used (gallons)	Diesel Fuel Cost	kWh Powerhouse	kWh Peak Demand	Absolute Annual High Trend Load	Absolute Annual High Peak/Trend %		Trend Line	Trend Line @ 110%
FY 2006	1	68,370	5,353	$12,526.02	2,363	171			73	162	178
	2	86,676	6,645	$15,549.30	2,872	171			74	162	178
	3	93,275	7,073	$16,550.82	2,804	171			75	163	179
	4	122,647	9,575	$22,405.50	3,314	171			76	163	179
	5	128,460	10,234	$23,845.22	3,207	171			77	164	180
	6	119,572	8,890	$21,713.70	3,169	171			78	164	181
	7	126,468	9,939	$23,157.87	3,058	171			79	165	181
	8	84,259	6,818	$15,885.94	3,130	171			80	165	182
	9	108,169	8,285	$15,885.94	2,976	171			81	166	182
	10	88,962	6,768	$15,769.44	2,622	171			82	166	183
	11	95,211	14,111	$32,878.63	2,622	171			83	167	183
	12	48,768	5,436	$12,665.88	1,204	171	167	102%	84	167	184
FY 2007	1	75,361	6,137	$14,299.21	926	171			85	168	185
	2	57,135	6,189	$19,928.58	926	171			86	168	185
	3		6,540	$15,238.20	1,185	171			87	169	186
	4	54,357	7,123	$16,596.59	1,324	171			88	169	186
	5	61,424	8,066	$25,923.32	2,250	171			89	170	187
	6	72,367	8,433	$27,102.81	1,449	171	170	101%	90	170	187
	7								91	171	188
	8								92	171	188
	9				**% Ave absolute peak trend**			110%	93	172	189
	10								94	172	190
	11								95	173	190
	12								96	173	191
FY 2008	1								97	174	191
	2								98	174	192
	3								99	175	192
	4								100	175	193
	5								101	176	193
	6								102	176	194
	7								103	177	195
	8								104	177	195
	9								105	178	196
	10								106	178	196
	11								107	179	197
	12								108	179	197
FY 2009	1								109	180	198
	2								110	180	198
	3								111	181	199
	4								112	181	200
	5								113	182	200
	6								114	182	201
	7								115	183	201
	8								116	183	202
	9								117	184	202
	10								118	185	203
	11								119	185	204
	12								120	186	204
FY 2010	1								121	186	205
	2								122	187	205
	3								123	187	206
	4								124	188	206
	5								125	188	207
	6								126	189	207
	7								127	189	208
	8								128	190	209
	9								129	190	209
	10								130	191	210
	11								131	191	210
	12								132	192	211
FY 2011	1								133	192	211
	2								134	193	212
	3								135	193	212
	4								136	194	213
	5								137	194	214
	6								138	195	214
	7								139	195	215
	8								140	196	215
	9								141	196	216
	10								142	197	216
	11								143	197	217
	12								144	198	217

Fiscal Year	Fiscal Month	KWH Gen Diesel	Diesel Used (gallons)	Diesel Fuel Cost	kWh Powerhouse	kWh Peak Demand	Absolute Annual High Trend Load	Absolute Annual High Peak/Trend %		Trend Line	Trend Line @ 110%
FY 2012	1								145	198	218
	2								146	199	219
	3								147	199	219
	4								148	200	220
	5								149	200	220
	6								150	201	221
	7								151	201	221
	8								152	202	222
	9								153	202	223
	10								154	203	223
	11								155	203	224
	12								156	204	224
FY 2013	1								157	204	225
	2								158	205	225
	3								159	205	226
	4								160	206	226
	5								161	206	227
	6								162	207	228
	7								163	207	228
	8								164	208	229
	9								165	208	229
	10								166	209	230
	11								167	209	230
	12								168	210	231
FY 2014	1								169	210	231
	2								170	211	232
	3								171	211	233
	4								172	212	233
	5								173	212	234
	6								174	213	234
	7								175	213	235
	8								176	214	235
	9								177	214	236
	10								178	215	237
	11								179	216	237
	12								180	216	238
FY 2015	1								181	217	238
	2								182	217	239
	3								183	218	239
	4								184	218	240
	5								185	219	240
	6								186	219	241
	7								187	220	242
	8								188	220	242
	9								189	221	243
	10								190	221	243
	11								191	222	244
	12								192	222	244
FY 2016	1								193	223	245
	2								194	223	245
	3								195	224	246
	4								196	224	247
	5								197	225	247
	6								198	225	248
	7								199	226	248
	8								200	226	249
	9								201	227	249
	10								202	227	250
	11								203	228	250
	12								204	228	251


Akiak Peak Load Chart - Historical
260
240
220
200
180
160
140
120
100
80
60
kW
y = 0.5081x + 124.56
FY 2000
FY 2001
FY 2002
FY 2003
FY 2004
FY 2005
FY 2006
FY 2007
Time
kWh Peak Demand
Annual Absolute Peak
Linear (kWh Peak Demand)


Akiak Peak Load Chart - Projected Trend
300
250
200
150
100
50
0
kW
y = 0.5081x + 124.56
FY 2000
FY 2001
FY 2002
FY 2003
FY 2004
FY 2005
FY 2006
FY 2007
FY 2008
FY 2009
FY 2010
FY 2011
FY 2012
FY 2013
FY 2014
FY 2015
FY 2016
Time
kWh Peak Demand
Annual Absolute Peak
Peak Trend

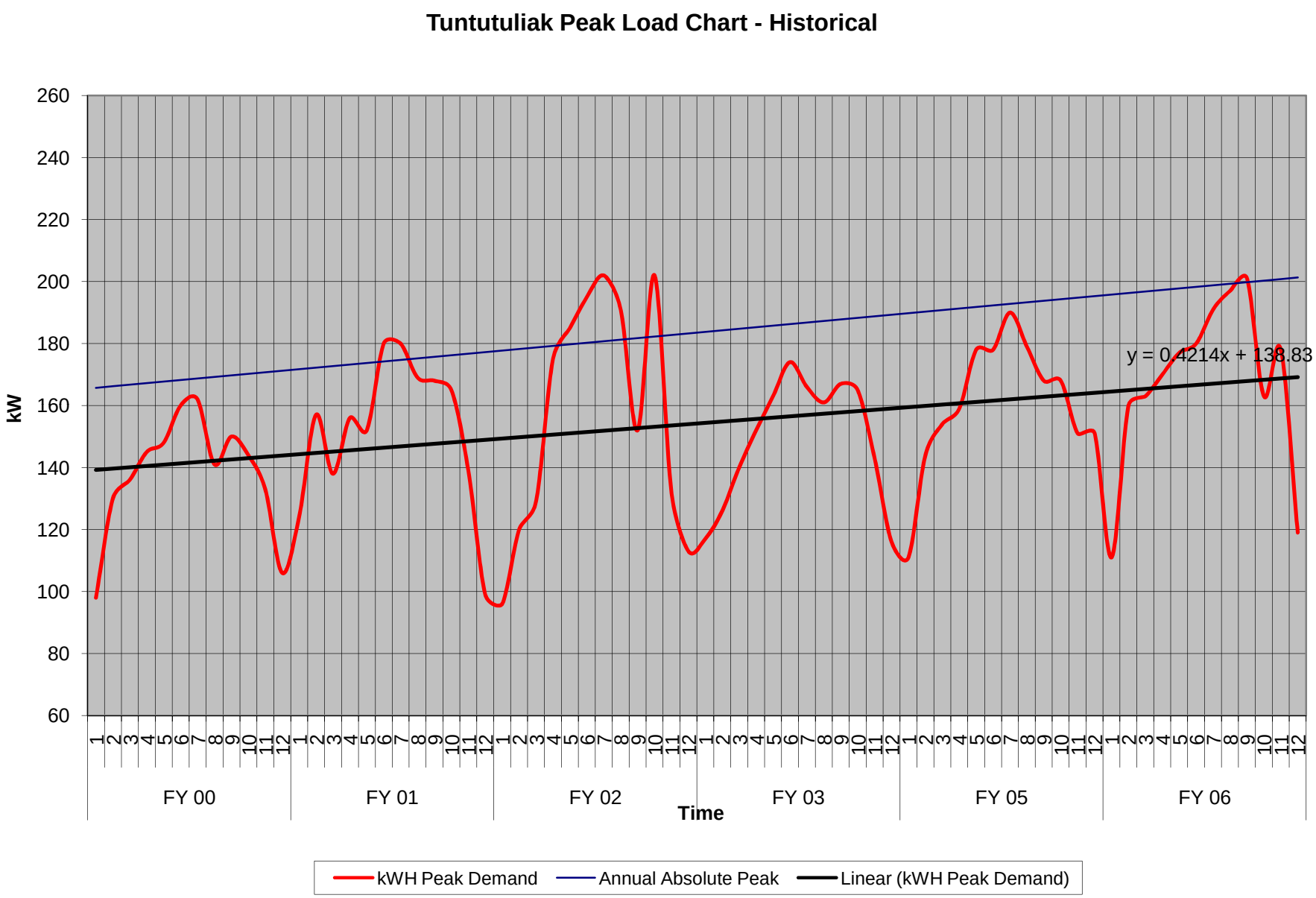
TUNTUTULIAK PCE DATA

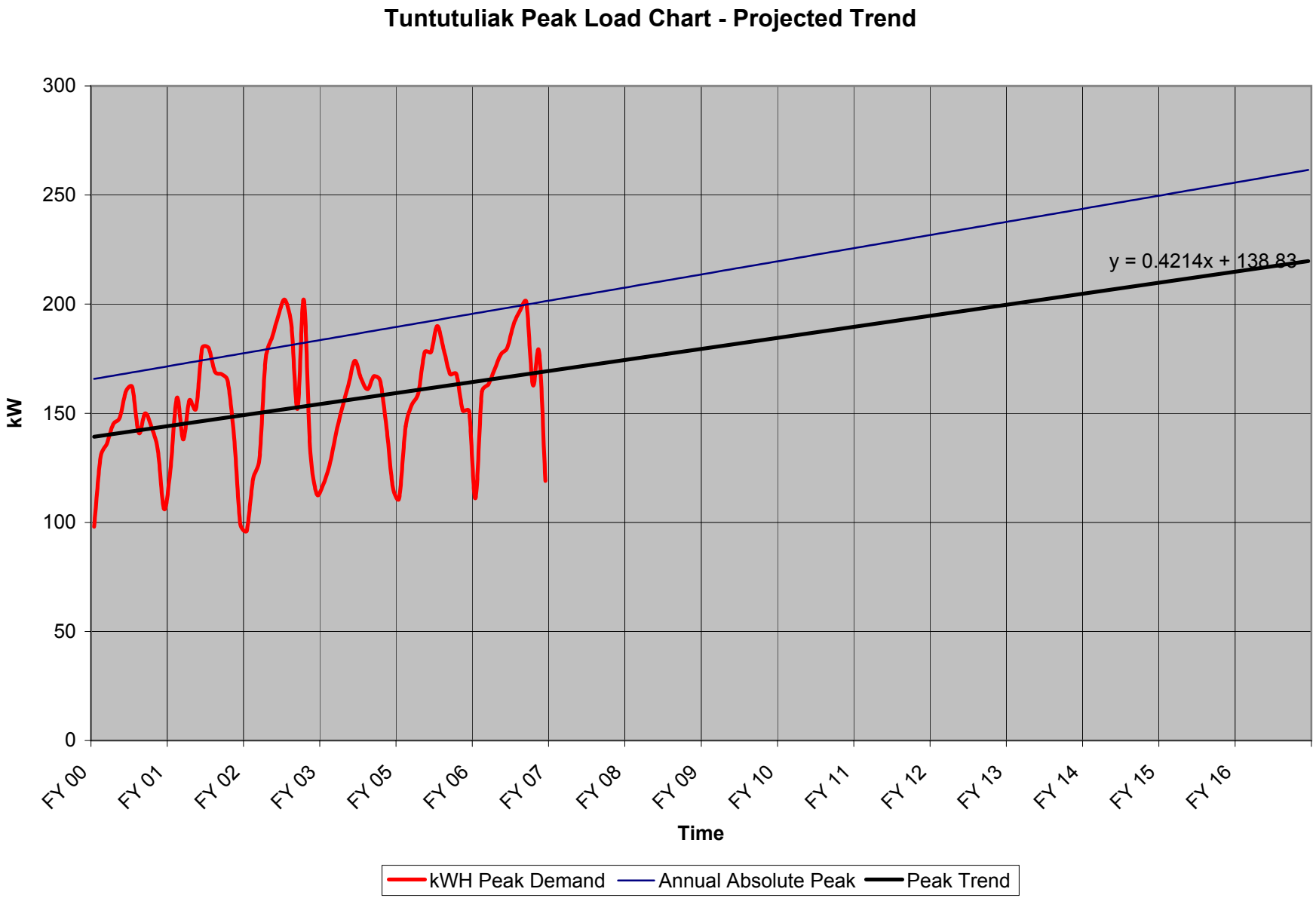
Fiscal Year	Fiscal Month	kWH Gen Diesel	Fuel Used Diesel	Diesel Fuel Cost	kWH Powerhouse	kWH Peak Demand	Absolute Annual High Trend Load	Absolute Annual High		Trend Line	Trend Line @ 119%
FY 00	1	44120	3117	$3,272.33	594	98			1	139	166
	2	59240	3590	$3,769.82	538	130			2	140	166
	3	56080	3701	$4,404.43	798	136			3	140	167
	4	66120	3701	$4,404.43	798	145			4	141	167
	5	74680	4372	$5,202.56	2089	148			5	141	168
	6	75320	6354	$7,563.64	1871	160			6	141	168
	7	78600	4710	$5,604.31	2076	162	142	114%	7	142	169
	8	74200	4160	$4,951.00	1848	141			8	142	169
	9	69600	4335	$5,158.53	2127	150			9	143	170
	10	72840	3831	$4,558.53	2383	144			10	143	170
	11	61800	3802	$4,524.38	3383	133			11	143	171
	12	48200	5358	$5,011.04	267	106			12	144	171
FY 01	1	45280	4204	$5,358.20	150	124			13	144	172
	2	57120	4204	$5,358.20	187	157			14	145	172
	3	66480	5767	$8,022.45	1168	138			15	145	173
	4	80160	5230	$8,671.34	628	156			16	146	173
	5	75440	4065	$12,003.92	315	152			17	146	174
	6	83600	6710	$11,125.18	313	180			18	146	174
	7	81160	6455	$10,702.39	398	180	147	122%	19	147	175
	8	71797	6786	$11,251.85	1826	169			20	147	175
	9	69575	8535	$14,151.03	1276	168			21	148	176
	10	88957	8535	$14,151.03	1072	165			22	148	176
	11	46520	7010	$11,622.58	1995	139			23	149	177
	12	46920	4870	$7,494.93	2134	99			24	149	177
FY 02	1	46320	4106	$6,319.13	2295	96			25	149	178
	2	54800	5355	$8,241.35	2561	120			26	150	178
	3	62080	4675	$7,194.83	2676	129			27	150	179
	4	77139	5273	$8,808.00		175			28	151	179
	5	61740	7901	$12,159.79		185			29	151	180
	6	68201	6992	$10,761.15		195			30	151	180
	7	94660	8667	$13,338.36		202			31	152	181
	8	88292	6650	$10,234.65	834	191			32	152	181
	9	75138	6339	$9,755.26	1713	152			33	153	182
	10	70784	5961	$9,174.59	1599	202	153	132%	34	153	182
	11	66105	7196	$11,074.95	1921	132			35	154	183
	12	51927	5132	$6,327.14	2002	113			36	154	183
FY 03	1	50620	5136	$6,332.44	1987	117			37	154	184
	2	57209	4889	$6,027.77	2110	126			38	155	184
	3	68440	5437	$6,703.82	2104	140			39	155	185
	4	73834	7438	$9,170.93	2010	152			40	156	185
	5	69785	6406	$7,898.84	1744	163			41	156	186
	6	90135	6353	$8,893.92	1955	174	157	111%	42	157	186
	7	72488	6069	$8,496.04	1575	166			43	157	187
	8	85027	6175	$8,645.00	1882	161			44	157	187
	9	74172	6156	$8,618.12	1580	167			45	158	188
	10	75282	7147	$10,005.52	1948	165			46	158	188
	11	65656	5274	$7,072.57	2031	143			47	159	189
	12	58016	6288	$8,432.21	2474	116			48	159	189
FY 05	1	52020	6112	$12,102.55		111			49	159	190
	2	74166	3280	$6,493.80	2891	144			50	160	190
	3	63347	7257	$14,368.86	2087	154			51	160	191
	4	77111	5945	$11,771.10	1983	159			52	161	191
	5	87097				178			53	161	192
	6	82984				178			54	162	192
	7	90147	6694	$19,412.60	2391	190	162	117%	55	162	193
	8	93075	6350	$18,415.29	2200	179			56	162	193
	9	76918	6142	$17,811.51	2280	168			57	163	194
	10	84068	7708	$22,354.36	2197	168			58	163	194
	11	70760	5679	$16,467.65	2252	151			59	164	195
	12	55041	6190	$17,950.42		151			60	164	195
FY 06	1	53558	4735	$13,732.08	2723	111			61	165	196
	2	69002	5360	$15,543.13	2857	160			62	165	196

Fiscal Year	Fiscal Month	kWH Gen Diesel	Fuel Used Diesel	Diesel Fuel Cost	kWH Powerhouse	kWH Peak Demand	Absolute Annual High Trend Load	Absolute Annual High		Trend Line	Trend Line @ 119%
	3	76452	7520	$17,263.96		163			63	165	197
	4	78407	4546	$10,437.63		170			64	166	197
	5	89583	6306	$14,477.78		177			65	166	198
	6	85698	7948	$18,246.56		180			66	167	198
	7	94352	6666	$15,304.27	1995	191			67	167	199
	8	92246	6979	$16,022.85	1976	197			68	167	199
	9	82021	7906	$18,151.52	1544	201	168	120%	69	168	200
	10	84583	5968	$13,700.19	1731	163			70	168	200
	11	79474	7084	$16,263.72	2155	178			71	169	201
	12	55576	4562	$10,473.67	2029	119			72	169	201
FY 07	1								73	170	202
	2								74	170	202
	3								75	170	203
	4							119%	76	171	203
	5								77	171	204
	6								78	172	204
	7								79	172	205
	8								80	173	205
	9								81	173	206
	10								82	173	206
	11								83	174	207
	12								84	174	207
FY 08	1								85	175	208
	2								86	175	208
	3								87	175	209
	4								88	176	209
	5								89	176	210
	6								90	177	210
	7								91	177	211
	8								92	178	211
	9								93	178	212
	10								94	178	212
	11								95	179	213
	12								96	179	213
FY 09	1								97	180	214
	2								98	180	214
	3								99	181	215
	4								100	181	215
	5								101	181	216
	6								102	182	216
	7								103	182	217
	8								104	183	217
	9								105	183	218
	10								106	183	218
	11								107	184	219
	12								108	184	219
FY 10	1								109	185	220
	2								110	185	220
	3								111	186	221
	4								112	186	221
	5								113	186	222
	6								114	187	222
	7								115	187	223
	8								116	188	223
	9								117	188	224
	10								118	189	224
	11								119	189	225
	12								120	189	225
FY 11	1								121	190	226
	2								122	190	226
	3								123	191	227
	4								124	191	227

Fiscal Year	Fiscal Month	kWH Gen Diesel	Fuel Used Diesel	Diesel Fuel Cost	kWH Powerhouse	kWH Peak Demand	Absolute Annual High Trend Load	Absolute Annual High		Trend Line	Trend Line @ 119%
	5								125	192	228
	6								126	192	228
	7								127	192	229
	8								128	193	229
	9								129	193	230
	10								130	194	230
	11								131	194	231
	12								132	194	231
FY 12	1								133	195	232
	2								134	195	232
	3								135	196	233
	4								136	196	233
	5								137	197	234
	6								138	197	234
	7								139	197	235
	8								140	198	235
	9								141	198	236
	10								142	199	236
	11								143	199	237
	12								144	200	237
FY 13	1								145	200	238
	2								146	200	238
	3								147	201	239
	4								148	201	239
	5								149	202	240
	6								150	202	240
	7								151	202	241
	8								152	203	241
	9								153	203	242
	10								154	204	242
	11								155	204	243
	12								156	205	243
FY 14	1								157	205	244
	2								158	205	244
	3								159	206	245
	4								160	206	245
	5								161	207	246
	6								162	207	246
	7								163	208	247
	8								164	208	247
	9								165	208	248
	10								166	209	248
	11								167	209	249
	12								168	210	249
FY 15	1								169	210	250
	2								170	210	250
	3								171	211	251
	4								172	211	251
	5								173	212	252
	6								174	212	252
	7								175	213	253
	8								176	213	253
	9								177	213	254
	10								178	214	254
	11								179	214	255
	12								180	215	255
FY 16	1								181	215	256
	2								182	216	256
	3								183	216	257
	4								184	216	257
	5								185	217	258
	6								186	217	258

Fiscal Year	Fiscal Month	kWH Gen Diesel	Fuel Used Diesel	Diesel Fuel Cost	kWH Powerhouse	kWH Peak Demand	Absolute Annual High Trend Load	Absolute Annual High		Trend Line	Trend Line @ 119%
	7								187	218	259
	8								188	218	259
	9								189	218	260
	10								190	219	260
	11								191	219	261
	12								192	220	261


Tuntutuliak Peak Load Chart - Historical
kW
260
240
220
200
180
160
140
120
100
80
60
y = 0.4214x + 138.83
FY 00
FY 01
FY 02
FY 03
FY 05
FY 06
Time
kWH Peak Demand
Annual Absolute Peak
Linear (kWH Peak Demand)


Tuntutuliak Peak Load Chart - Projected Trend
300
250
200
150
100
50
0
kW
y = 0.4214x + 138.83
FY 00
FY 01
FY 02
FY 03
FY 05
FY 06
FY 07
FY 08
FY 09
FY 10
FY 11
FY 12
FY 13
FY 14
FY 15
FY 16
Time
kWH Peak Demand
Annual Absolute Peak
Peak Trend

NULATO PCE DATA

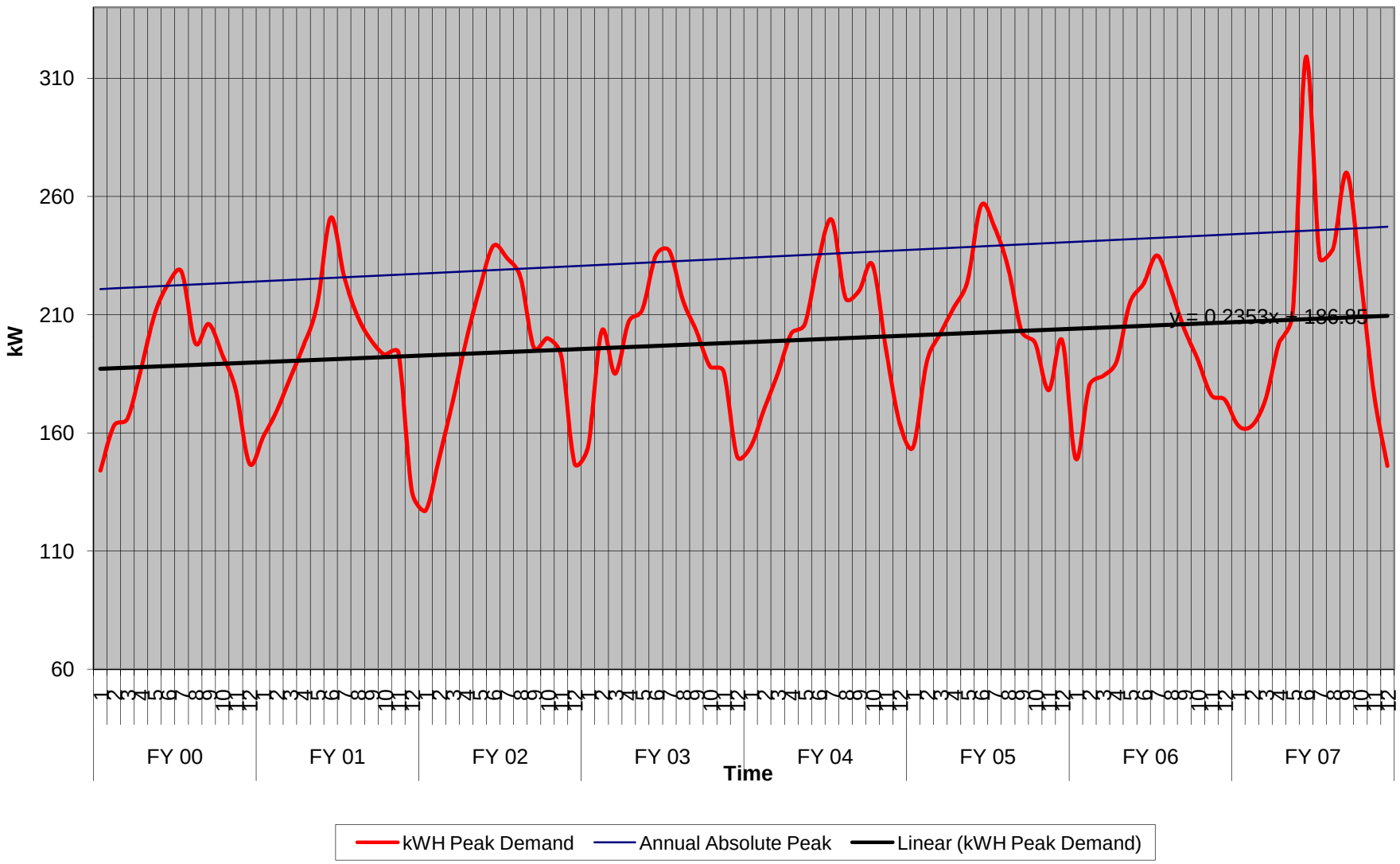
Fiscal Year	Fiscal Month	kWH Gen Diesel	Fuel Used Diesel	Diesel Fuel Cost	kWH Powerhouse	kWH Peak Demand	Absolute Annual High Trend Load	Absolute Annual High Peak/Trend %		Trend Line	Trend Line @ 118%
FY 00	1	62976	4933	$5,235.98	1858	144			1	187	221
	2	70659	5306	$5,754.57	1871	163			2	187	221
	3	84663	6642	$7,203.51	1593	166			3	188	221
	4	92745	7119	$7,720.84	1967	187			4	188	222
	5	106830	9340	$10,129.60	2929	210			5	188	222
	6	120037	10520	$11,409.36	2739	223			6	188	222
	7	121394	9451	$10,249.99	3002	228	203	112%	7	188	222
	8	102512	8224	$8,919.26	2436	198			8	189	223
	9	109078	8137	$8,824.90	2592	206			9	189	223
	10	98445	7232	$7,843.39	2228	193			10	189	223
	11	89077	6938	$7,524.54	1823	178			11	189	224
	12	68172	5540	$6,833.26	1812	147			12	190	224
FY 01	1	71169	6198	$8,338.42	1687	158			13	190	224
	2	79282	5988	$8,172.18	1874	169			14	190	224
	3	85953	6424	$8,767.22	2217	183			15	190	225
	4	101378	7697	$10,504.56	2304	197			16	191	225
	5	107134	8681	$11,847.48	2424	214			17	191	225
	6	124325	9198	$12,553.06	2801	251	205	122%	18	191	225
	7	119966	8957	$12,224.16	2894	226			19	191	226
	8	102315	8039	$10,971.31	2475	209			20	192	226
	9	107642	9386	$12,809.64	2895	199			21	192	226
	10	99358	7590	$10,358.53	2598	193			22	192	227
	11	87499	6628	$9,045.63	2429	194			23	192	227
	12	58718	4656	$6,354.32	2043	135			24	192	227
FY 02	1	60377	4781	$7,050.49	1967	127			25	193	227
	2	69838	5417	$7,988.40	1990	149			26	193	228
	3	81965	6161	$9,085.57	2340	173			27	193	228
	4	103470	7964	$12,554.53	2933	199			28	193	228
	5	111843	8708	$13,727.38	3401	221			29	194	229
	6	121868	9088	$14,326.41	3420	239	208	115%	30	194	229
	7	122278	9149	$14,422.58	3540	234			31	194	229
	8	104636	7862	$12,393.74	2405	226			32	194	229
	9	103252	7832	$12,346.44	2920	196			33	195	230
	10	96635	7394	$11,655.98	2663	200			34	195	230
	11	84673	6169	$9,724.87	2338	193			35	195	230
	12	65990	4963	$7,823.72	1938	147			36	195	230
FY 03	1	73250	5492	$7,806.66	2177	154			37	196	231
	2	75927	5871	$8,217.99	2194	203			38	196	231
	3	85630	6346	$8,882.69	2322	185			39	196	231
	4	102197	8162	$11,424.60	2843	207			40	196	232
	5	106381	9149	$12,806.13	2876	212			41	196	232
	6	119036	9473	$13,259.64	2976	235			42	197	232
	7	121791	9172	$12,838.32	3314	237	211	112%	43	197	232
	8	98142	7448	$10,425.19	2745	216			44	197	233
	9	104514	8523	$11,929.90	3027	203			45	197	233
	10	95623	6858	$9,599.35	2496	188			46	198	233
	11	86492	7914	$11,077.46	2372	186			47	198	234
	12	66970	5040	$7,447.61	2108	150			48	198	234
FY 04	1	70507	5288	$8,255.63	2186	154			49	198	234
	2	77298	5753	$8,981.58	2403	170			50	199	234
	3	87667	6443	$10,151.40	2282	185			51	199	235
	4	98555	7653	$12,057.84	2522	202			52	199	235
	5	101672	8016	$12,629.77	2781	206			53	199	235
	6	120180	9049	$14,257.33	3096	233			54	200	235
	7	122963	9255	$14,581.90	3149	250	214	117%	55	200	236
	8	104937	8017	$12,631.34	2501	217			56	200	236
	9	105899	8108	$12,774.72	2781	220			57	200	236
	10	98022	7005	$11,036.87	2565	231			58	200	237
	11	89226	6334	$9,979.66	2324	195			59	201	237
	12	71905	5061	$9,652.19	1921	164			60	201	237
FY 05	1	70303	5014	$9,562.55	1997	154			61	201	237
	2	73112	5203	$9,923.01	2100	190			62	201	238
	3	91131	6520	$12,434.75	2284	202			63	202	238
	4	109473	7867	$15,003.71	2719	213			64	202	238

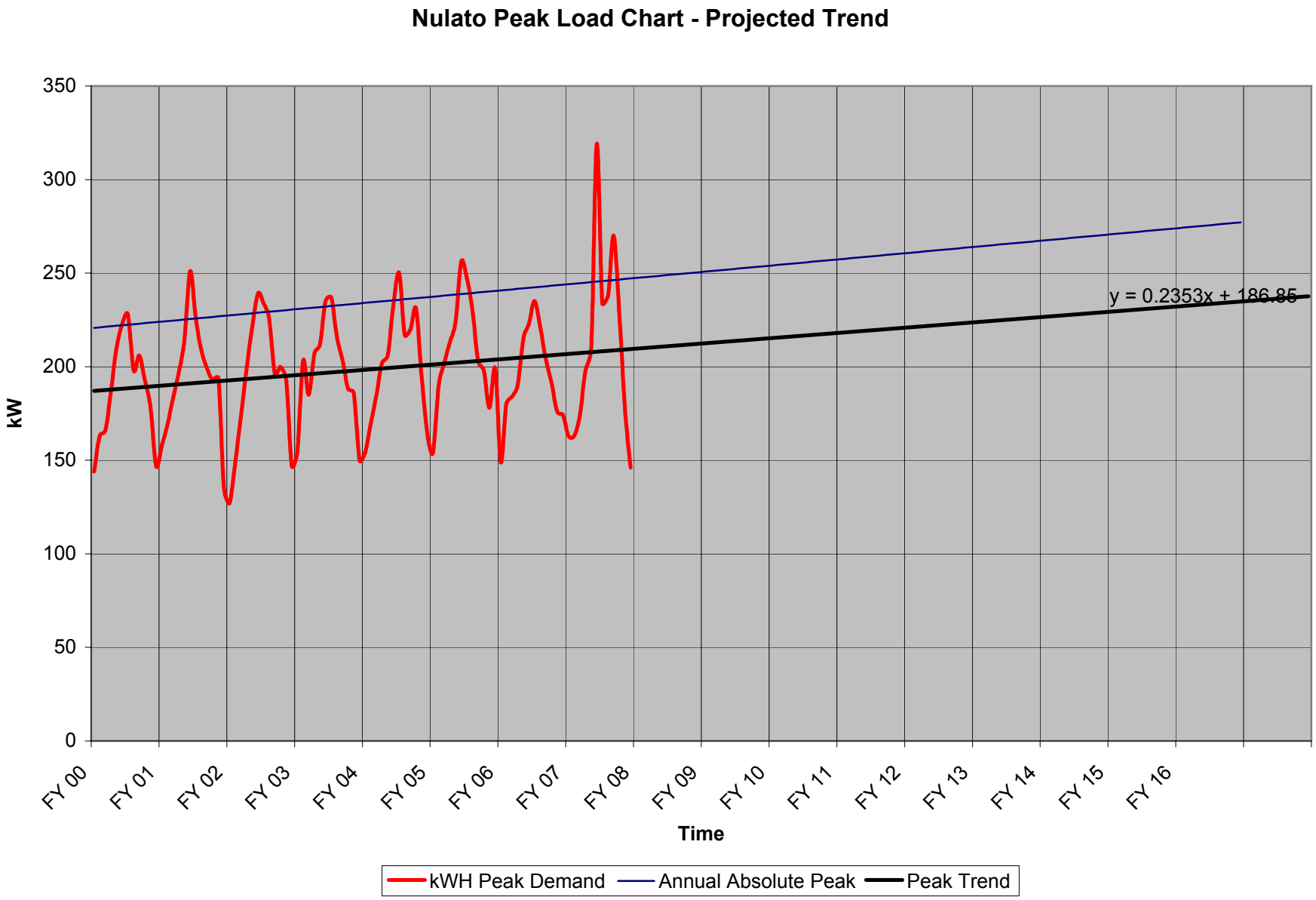
Fiscal Year	Fiscal Month	kWH Gen Diesel	Fuel Used Diesel	Diesel Fuel Cost	kWH Powerhouse	kWH Peak Demand	Absolute Annual High Trend Load	Absolute Annual High Peak/Trend %		Trend Line	Trend Line @ 118%
	5	110962	7926	$15,116.23	3389	224			65	202	239
	6	123948	8801	$16,785.00	2165	256	216	119%	66	202	239
	7	123530	8793	$16,769.74	3141	247			67	203	239
	8	104465	7491	$14,286.61	2634	230			68	203	239
	9	104766	7635	$14,561.24	2811	203			69	203	240
	10	93583	6873	$13,107.98	2543	198			70	203	240
	11	85159	6169	$11,765.33	2392	178			71	204	240
	12	66199	4935	$11,564.68	2354	199			72	204	240
FY 06	1	66877	5569	$13,050.39	2839	149			73	204	241
	2	80752	6176	$14,685.97	3164	180			74	204	241
	3	81218	6307	$14,997.48	2359	184			75	204	241
	4	93218	6585	$15,658.54	2288	190			76	205	242
	5	106427	7891	$18,764.09	3013	215			77	205	242
	6	115247	8429	$20,043.40	3032	223			78	205	242
	7	120474	9024	$21,458.35	2714	235	220	107%	79	205	242
	8	96799	7379	$17,546.67	2147	221			80	206	243
	9	106681	8088	$19,232.62	2865	204			81	206	243
	10	92973	7057	$16,780.98	2264	191			82	206	243
	11	81761	6395	$15,206.80	2256	176			83	206	244
	12	70126	5694	$15,968.14	2251	174			84	207	244
FY 07	1	73690	5793	$16,826.87	2288	163			85	207	244
	2	73100	5201	$15,107.29	2345	163			86	207	244
	3	77458	5816	$16,893.68	2426	174			87	207	245
	4	92663	7345	$21,334.95	2480	198			88	208	245
	5	101413	7420	$21,552.80	2473	210			89	208	245
	6	114011	8291	$24,082.78	3167	319	222	144%	90	208	245
	7	116325	8649	$25,122.66	3410	234			91	208	246
	8	100900	7480	$21,727.08	3010	238			92	208	246
	9	115241	9205	$26,737.67	3480	270			93	209	246
	10	95684	8069	$23,437.94	3031	227			94	209	247
	11	80346	6129	$17,802.85	2333	177			95	209	247
	12	62787	5285	$15,351.29	2174	146			96	209	247
FY 08	1								97	210	247
	2							118%	98	210	248
	3								99	210	248
	4								100	210	248
	5								101	211	249
	6								102	211	249
	7								103	211	249
	8								104	211	249
	9								105	212	250
	10								106	212	250
	11								107	212	250
	12								108	212	250
FY 09	1								109	212	251
	2								110	213	251
	3								111	213	251
	4								112	213	252
	5								113	213	252
	6								114	214	252
	7								115	214	252
	8								116	214	253
	9								117	214	253
	10								118	215	253
	11								119	215	254
	12								120	215	254
FY 10	1								121	215	254
	2								122	216	254
	3								123	216	255
	4								124	216	255
	5								125	216	255
	6								126	216	255
	7								127	217	256
	8								128	217	256

Fiscal Year	Fiscal Month	kWH Gen Diesel	Fuel Used Diesel	Diesel Fuel Cost	kWH Powerhouse	kWH Peak Demand	Absolute Annual High Trend Load	Absolute Annual High Peak/Trend %		Trend Line	Trend Line @ 118%
	9								129	217	256
	10								130	217	257
	11								131	218	257
	12								132	218	257
FY 11	1								133	218	257
	2								134	218	258
	3								135	219	258
	4								136	219	258
	5								137	219	259
	6								138	219	259
	7								139	220	259
	8								140	220	259
	9								141	220	260
	10								142	220	260
	11								143	220	260
	12								144	221	260
FY 12	1								145	221	261
	2								146	221	261
	3								147	221	261
	4								148	222	262
	5								149	222	262
	6								150	222	262
	7								151	222	262
	8								152	223	263
	9								153	223	263
	10								154	223	263
	11								155	223	264
	12								156	224	264
FY 13	1								157	224	264
	2								158	224	264
	3								159	224	265
	4								160	224	265
	5								161	225	265
	6								162	225	265
	7								163	225	266
	8								164	225	266
	9								165	226	266
	10								166	226	267
	11								167	226	267
	12								168	226	267
FY 14	1								169	227	267
	2								170	227	268
	3								171	227	268
	4								172	227	268
	5								173	228	269
	6								174	228	269
	7								175	228	269
	8								176	228	269
	9								177	228	270
	10								178	229	270
	11								179	229	270
	12								180	229	270
FY 15	1								181	229	271
	2								182	230	271
	3								183	230	271
	4								184	230	272
	5								185	230	272
	6								186	231	272
	7								187	231	272
	8								188	231	273
	9								189	231	273
	10								190	232	273
	11								191	232	274
	12								192	232	274

Fiscal Year	Fiscal Month	kWH Gen Diesel	Fuel Used Diesel	Diesel Fuel Cost	kWH Powerhouse	kWH Peak Demand	Absolute Annual High Trend Load	Absolute Annual High Peak/Trend %		Trend Line	Trend Line @ 118%
FY 16	1								193	232	274
	2								194	232	274
	3								195	233	275
	4								196	233	275
	5								197	233	275
	6								198	233	275
	7								199	234	276
	8								200	234	276
	9								201	234	276
	10								202	234	277
	11								203	235	277
	12								204	235	277

Nulato Peak Load Chart - Historical




Nulato Peak Load Chart - Projected Trend
350
300
250
200
150
100
50
0
kW
y = 0.2353x + 186.85
FY 00
FY 01
FY 02
FY 03
FY 04
FY 05
FY 06
FY 07
FY 08
FY 09
FY 10
FY 11
FY 12
FY 13
FY 14
FY 15
FY 16
Time
kWH Peak Demand
Annual Absolute Peak
Peak Trend

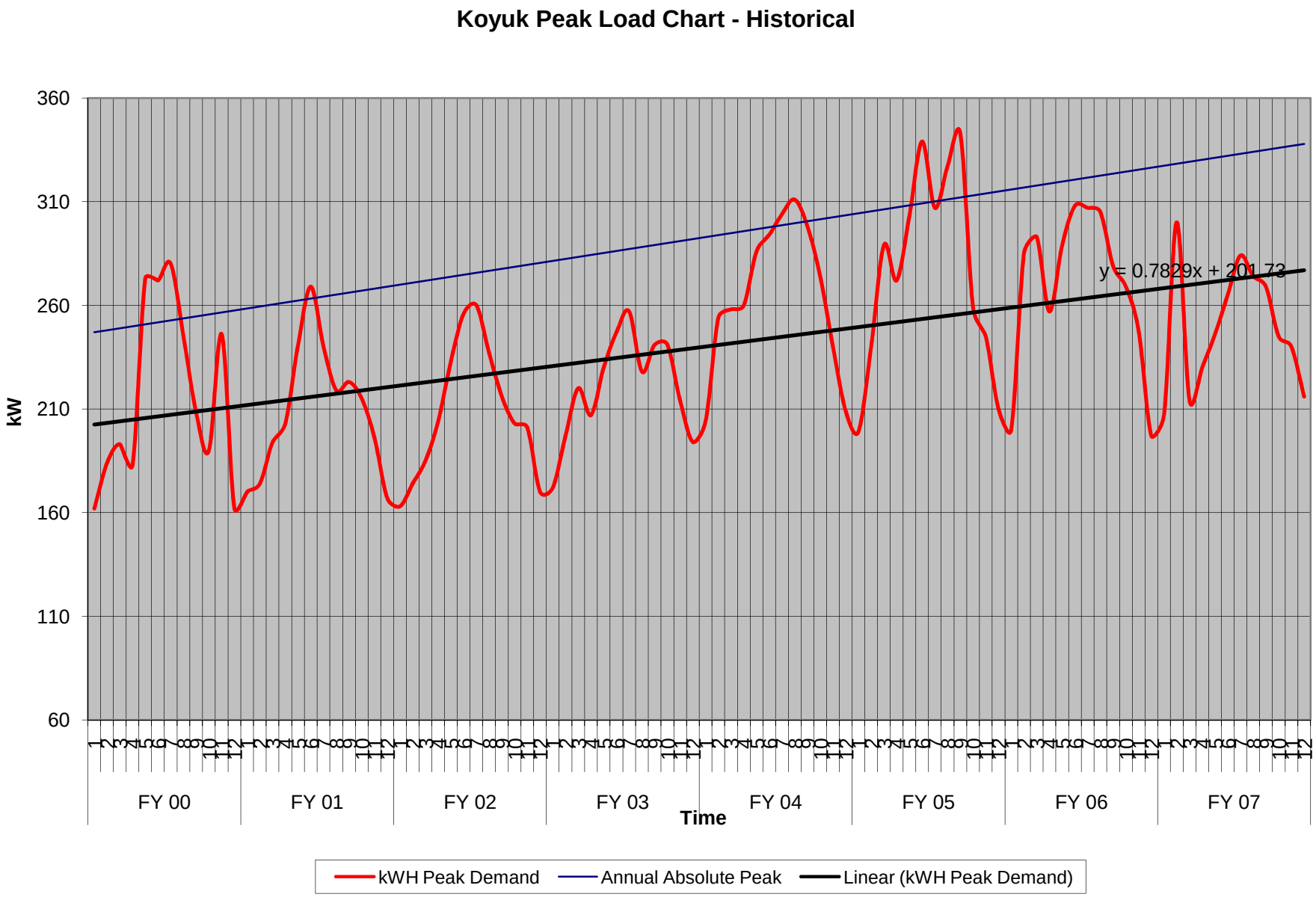
KOYUK PCE DATA

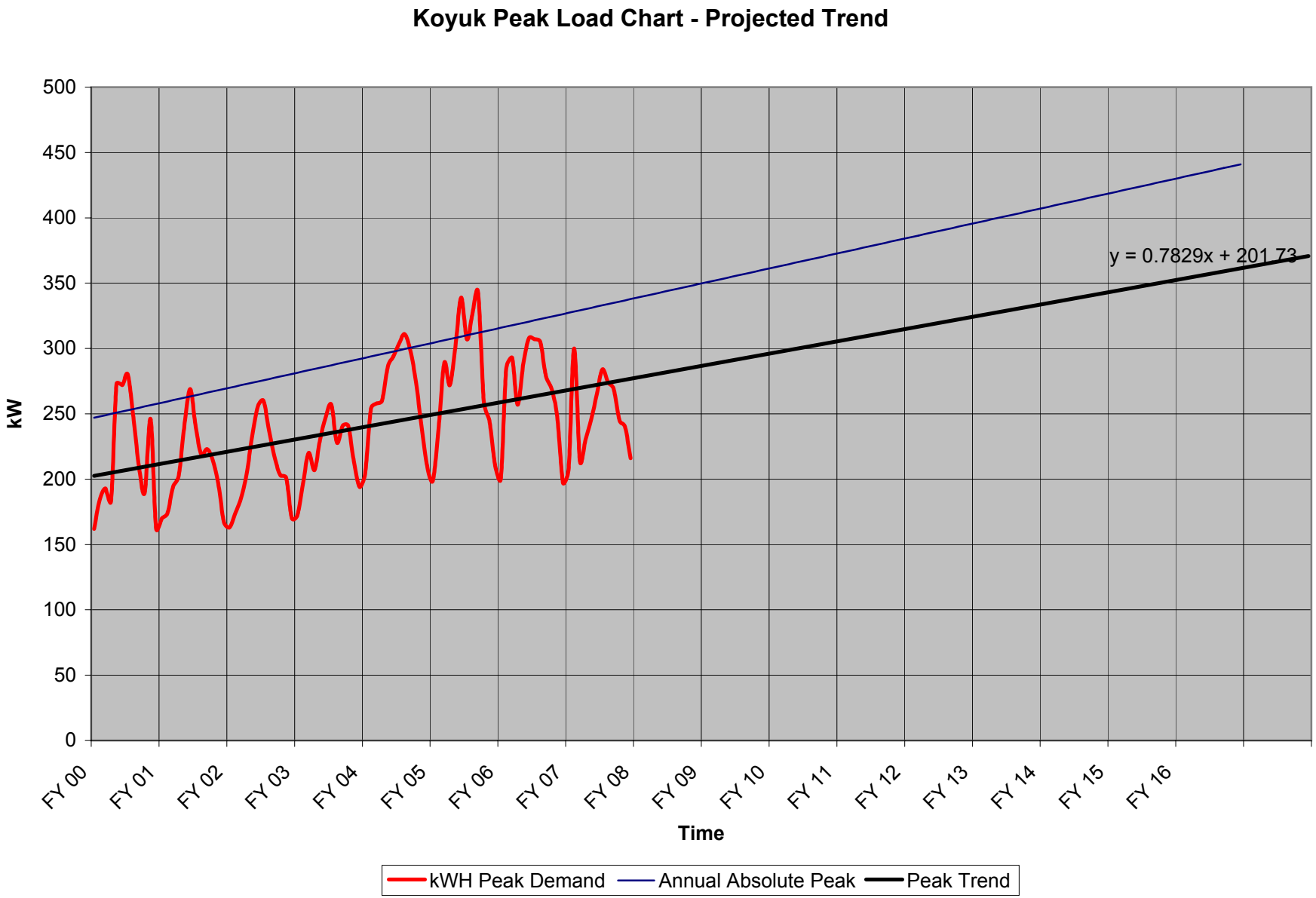
Fiscal Year	Fiscal Month	kWH Gen Diesel	Fuel Used Diesel	Diesel Fuel Cost	kWH Powerhouse	kWH Peak Demand	Absolute Annual High Trend Load	Absolute Annual High Peak/Trend %		Trend Line	Trend Line @ 122%
FY 00	1	69484	5184	$5,381.46	2137	162			1	203	247
	2	79411	5837	$6,059.33	2201	184			2	203	248
	3	83166	6136	$6,371.87	1720	193			3	204	249
	4	96635	7089	$7,361.50	1859	183			4	205	250
	5	119365	8464	$8,789.36	2272	273			5	206	251
	6	136799	9896	$10,276.40	2367	272			6	206	252
	7	188648	13195	$13,702.22	3131	280	207	135%	7	207	253
	8	53443	3513	$3,648.04	902	245			8	208	254
	9	105005	7403	$7,687.57	1746	208			9	209	255
	10	91805	6574	$6,826.70	1794	190			10	210	256
	11	86098	6393	$6,638.75	2206	246			11	210	257
	12	72168	5579	$5,793.46	2557	162			12	211	258
FY 01	1	74926	5764	$7,162.00	2227	170			13	212	259
	2	76551	5854	$7,314.46	2070	174			14	213	259
	3	81802	6141	$7,673.06	2072	194			15	213	260
	4	96532	6998	$8,743.86	2810	203			16	214	261
	5	102054	7270	$9,083.72	2188	241			17	215	262
	6	113626	7948	$9,930.87	2872	269	216	125%	18	216	263
	7	116690	8002	$9,998.34	2501	240			19	217	264
	8	99983	6934	$8,663.89	1696	219			20	217	265
	9	108976	7498	$9,368.60	1870	223			21	218	266
	10	99417	7055	$8,815.08	1801	215			22	219	267
	11	93671	6770	$8,458.98	1899	196			23	220	268
	12	73510	5349	$6,683.47	1731	167			24	221	269
FY 02	1	72436	5442	$6,799.67	2172	163			25	221	270
	2	81219	6191	$7,642.73	2816	174			26	222	271
	3	81315	5989	$7,368.93	2210	185			27	223	272
	4	100089	7063	$8,690.39	2024	204			28	224	273
	5	92683	6335	$7,794.65	1609	233			29	224	274
	6	145185	9868	$12,141.69	2299	256			30	225	275
	7	122843	8326	$10,244.39	1950	260	226	115%	31	226	276
	8	103274	7073	$8,702.69	1799	237			32	227	277
	9	104507	7286	$8,964.77	2150	216			33	228	278
	10	94864	6669	$8,205.60	1854	203			34	228	279
	11	89454	6422	$7,901.69	2168	201			35	229	280
	12	71173	5195	$6,391.98	2160	170			36	230	280
FY 03	1	73522	5304	$5,782.85	2226	172			37	231	281
	2	83489	6039	$6,631.97	2353	197			38	231	282
	3	89164	6479	$7,115.17	2079	220			39	232	283
	4	103185	7230	$7,939.91	1967	207			40	233	284
	5	107783	7453	$8,184.81	1789	230			41	234	285
	6	120268	8153	$8,953.54	1879	247			42	235	286
	7	121541	8234	$9,042.50	2144	257	235	109%	43	235	287
	8	105585	7351	$8,072.79	1711	228			44	236	288
	9	119877	8061	$8,852.51	2324	241			45	237	289
	10	105749	7237	$7,947.60	1897	241			46	238	290
	11	97818	6900	$7,577.51	2088	214			47	239	291
	12	81994	5728	$7,486.56	2042	194			48	239	292
FY 04	1	83498	5836	$7,627.71	2218	204			49	240	293
	2	106409	7526	$9,969.47	3293	254			50	241	294
	3	111701	7665	$10,153.60	3052	258			51	242	295
	4	98483	6775	$8,974.64	2054	260			52	242	296
	5	124814	8408	$11,137.83	2619	286			53	243	297
	6	141400	9412	$12,467.79	2087	294			54	244	298
	7	149608	9943	$13,171.19	2421	304			55	245	299
	8	138468	9595	$12,710.21	2011	311	246	126%	56	246	300
	9	133064	8945	$11,849.17	2129	298			57	246	301
	10	112886	7820	$10,358.92	1776	274			58	247	302
	11	105611	7428	$19,322.68	3013	240			59	248	302
	12	91336	6657	$17,317.05	2617	209			60	249	303
FY 05	1	94164	6888	$12,966.38	2608	199			61	249	304
	2	103240	7429	$13,984.80	3043	240			62	250	305
	3	108791	7624	$14,306.21	3212	289			63	251	306
	4	125547	8573	$16,086.98	3188	272			64	252	307
	5	136197	9110	$17,094.64	2660	303			65	253	308

Fiscal Year	Fiscal Month	kWH Gen Diesel	Fuel Used Diesel	Diesel Fuel Cost	kWH Powerhouse	kWH Peak Demand	Absolute Annual High Trend Load	Absolute Annual High Peak/Trend %		Trend Line	Trend Line @ 122%
	6	146323	9722	$18,243.04	2358	339			66	253	309
	7	150726	10137	$19,021.78	2021	307			67	254	310
	8	124965	8406	$15,773.61	2226	327			68	255	311
	9	129235	9334	$17,514.97	3645	343	256	134%	69	256	312
	10	118485	8535	$16,015.67	2765	259			70	257	313
	11	104219	7465	$13,919.99	2841	245			71	257	314
	12	90276	6540	$12,272.11	2588	210			72	258	315
FY 06	1	89735	6578	$12,228.50	2591	200			73	259	316
	2	100588	7304	$13,625.98	2484	285			74	260	317
	3	107074	7796	$14,543.83	2688	293			75	260	318
	4	118745	8509	$15,873.96	2484	257			76	261	319
	5	134709	9626	$17,957.78	2831	289			77	262	320
	6	138698	9970	$18,599.53	2920	308	263	117%	78	263	321
	7	147469	10649	$19,866.24	3163	307			79	264	322
	8	123141	9113	$17,000.76	2526	305			80	264	323
	9	131834	9837	$18,351.42	3111	279			81	265	323
	10	117949	8920	$16,640.71	2917	269			82	266	324
	11	107311	8086	$15,084.84	2529	248			83	267	325
	12	84300	6319	$11,788.41	2342	197			84	267	326
FY 07	1	90435	6808	$12,700.66	2362	207			85	268	327
	2	97743	7487	$14,092.85	2652	300	269	112%	86	269	328
	3	95028	7204	$13,650.28	2383	214			87	270	329
	4	102160	7852	$14,878.13	2652	230			88	271	330
	5	113156	8440	$15,992.28	2515	246			89	271	331
	6	124691	9275	$17,574.46	2890	265			90	272	332
	7	132916	9751	$18,476.39	2884	284			91	273	333
	8	112472	8327	$15,778.17	2589	274			92	274	334
	9	128021	9483	$17,968.58	3164	269			93	275	335
	10	109219	8216	$15,567.84	2300	245			94	275	336
	11	102893	7838	$14,851.60	2371	240			95	276	337
	12	83386	6580	$12,467.92	2471	216			96	277	338
FY 08	1							122%	97	278	339
	2								98	278	340
	3								99	279	341
	4								100	280	342
	5								101	281	343
	6								102	282	344
	7								103	282	344
	8								104	283	345
	9								105	284	346
	10								106	285	347
	11								107	286	348
	12								108	286	349
FY 09	1								109	287	350
	2								110	288	351
	3								111	289	352
	4								112	289	353
	5								113	290	354
	6								114	291	355
	7								115	292	356
	8								116	293	357
	9								117	293	358
	10								118	294	359
	11								119	295	360
	12								120	296	361
FY 10	1								121	296	362
	2								122	297	363
	3								123	298	364
	4								124	299	365
	5								125	300	366
	6								126	300	366
	7								127	301	367
	8								128	302	368
	9								129	303	369
	10								130	304	370

Fiscal Year	Fiscal Month	kWH Gen Diesel	Fuel Used Diesel	Diesel Fuel Cost	kWH Powerhouse	kWH Peak Demand	Absolute Annual High Trend Load	Absolute Annual High Peak/Trend %		Trend Line	Trend Line @ 122%
	11								131	304	371
	12								132	305	372
FY 11	1								133	306	373
	2								134	307	374
	3								135	307	375
	4								136	308	376
	5								137	309	377
	6								138	310	378
	7								139	311	379
	8								140	311	380
	9								141	312	381
	10								142	313	382
	11								143	314	383
	12								144	314	384
FY 12	1								145	315	385
	2								146	316	386
	3								147	317	387
	4								148	318	387
	5								149	318	388
	6								150	319	389
	7								151	320	390
	8								152	321	391
	9								153	322	392
	10								154	322	393
	11								155	323	394
	12								156	324	395
FY 13	1								157	325	396
	2								158	325	397
	3								159	326	398
	4								160	327	399
	5								161	328	400
	6								162	329	401
	7								163	329	402
	8								164	330	403
	9								165	331	404
	10								166	332	405
	11								167	332	406
	12								168	333	407
FY 14	1								169	334	408
	2								170	335	408
	3								171	336	409
	4								172	336	410
	5								173	337	411
	6								174	338	412
	7								175	339	413
	8								176	340	414
	9								177	340	415
	10								178	341	416
	11								179	342	417
	12								180	343	418
FY 15	1								181	343	419
	2								182	344	420
	3								183	345	421
	4								184	346	422
	5								185	347	423
	6								186	347	424
	7								187	348	425
	8								188	349	426
	9								189	350	427
	10								190	350	428
	11								191	351	429
	12								192	352	429
FY 16	1								193	353	430
	2								194	354	431
	3								195	354	432

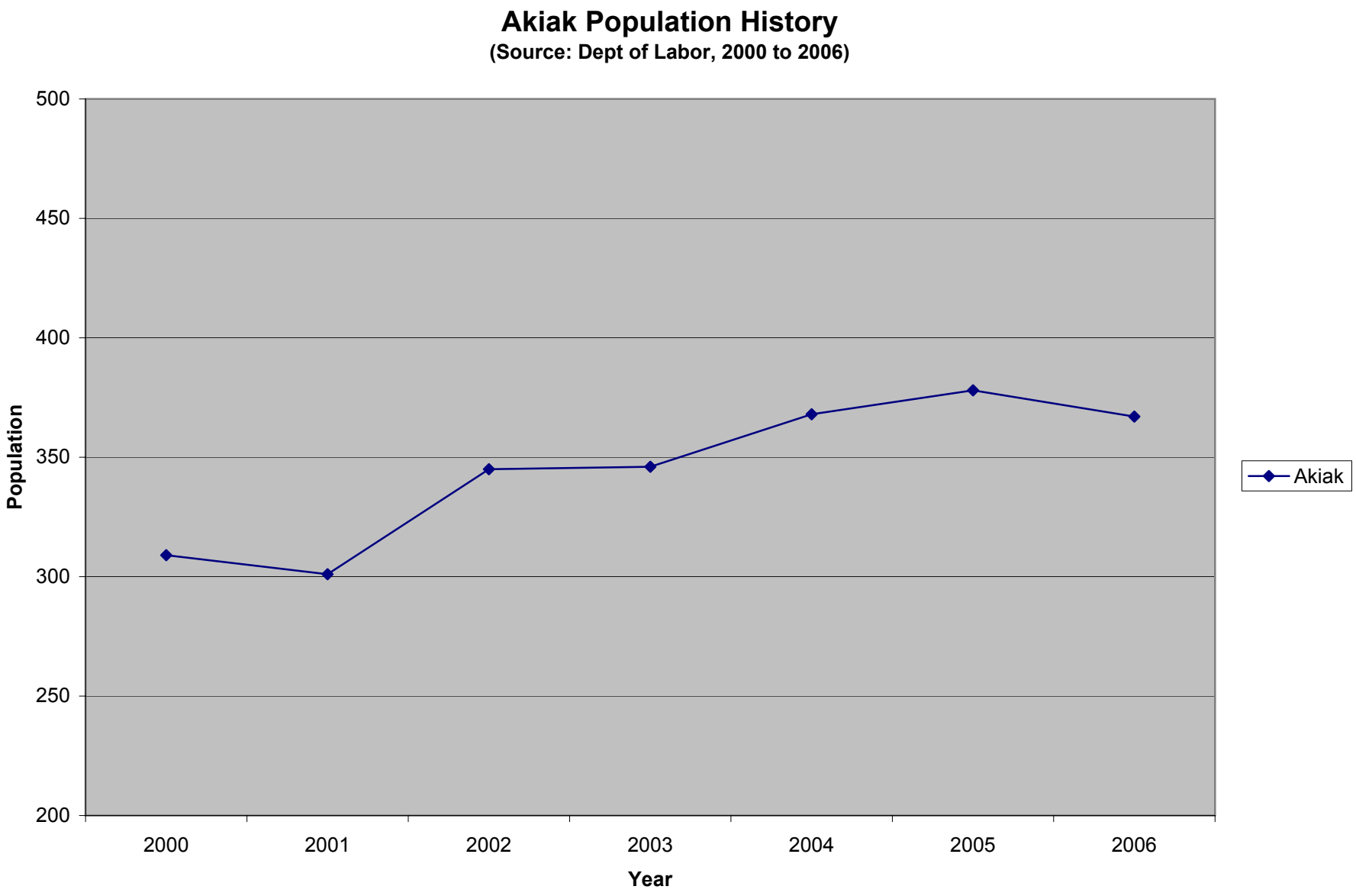
Fiscal Year	Fiscal Month	kWH Gen Diesel	Fuel Used Diesel	Diesel Fuel Cost	kWH Powerhouse	kWH Peak Demand	Absolute Annual High Trend Load	Absolute Annual High Peak/Trend %		Trend Line	Trend Line @ 122%
	4								196	355	433
	5								197	356	434
	6								198	357	435
	7								199	358	436
	8								200	358	437
	9								201	359	438
	10								202	360	439
	11								203	361	440
	12								204	361	441

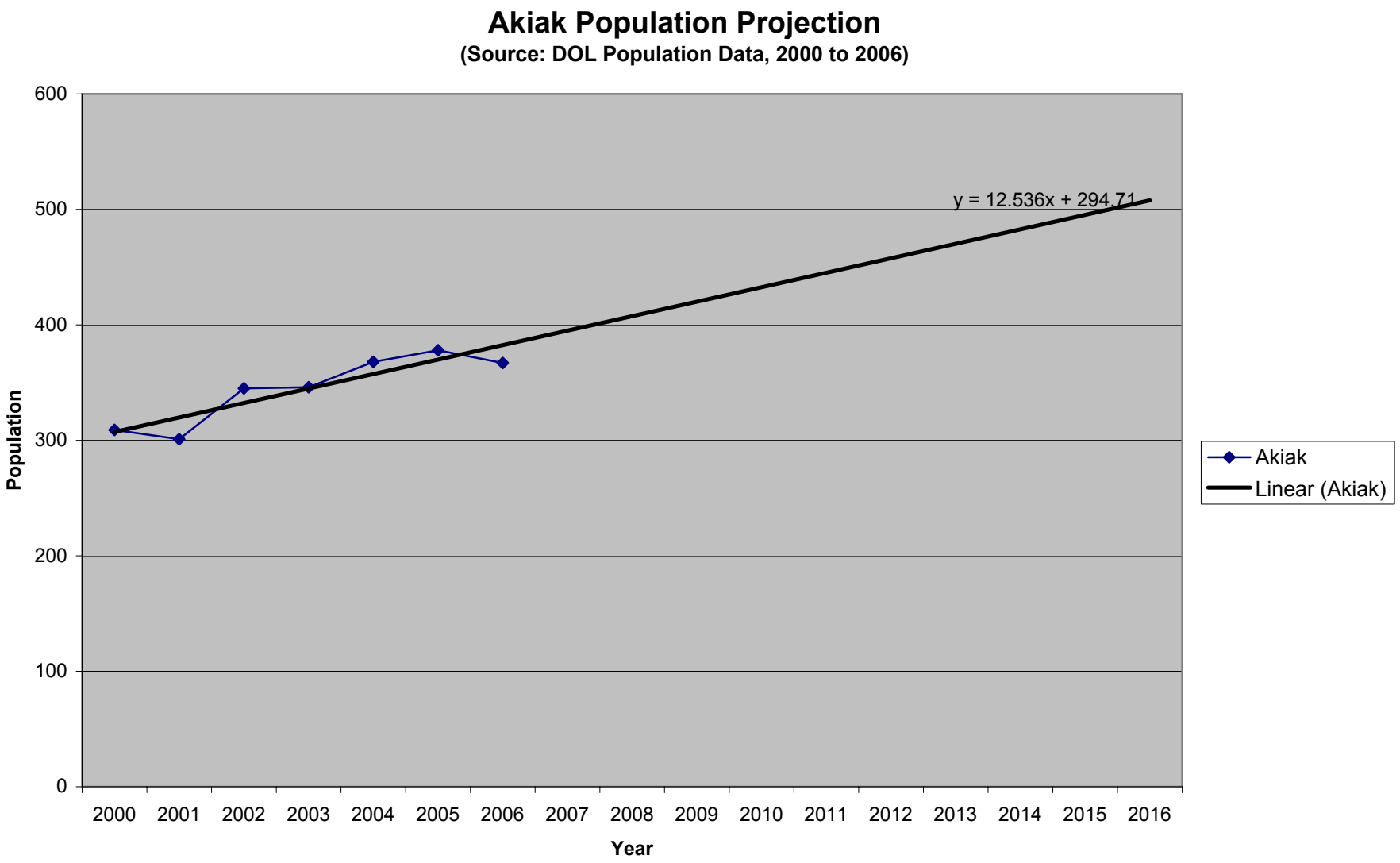

Koyuk Peak Load Chart - Historical
360
310
260
210
160
110
60
kW
y = 0.7829x + 201.73
FY 00
FY 01
FY 02
FY 03
FY 04
FY 05
FY 06
FY 07
Time
kWH Peak Demand
Annual Absolute Peak
Linear (kWH Peak Demand)


Koyuk Peak Load Chart - Projected Trend
500
450
400
350
300
250
200
150
100
50
0
kW
y = 0.7829x + 201.73
FY 00
FY 01
FY 02
FY 03
FY 04
FY 05
FY 06
FY 07
FY 08
FY 09
FY 10
FY 11
FY 12
FY 13
FY 14
FY 15
FY 16
Time
kWH Peak Demand
Annual Absolute Peak
Peak Trend

APPENDIX G

POPULATION TREND ANALYSIS


Akiak Population History
(Source: Dept of Labor, 2000 to 2006)
500
450
400
350
300
250
200
Population
2000
2001
2002
2003
2004
2005
2006
Year
Akiak


Akiak Population Projection
(Source: DOL Population Data, 2000 to 2006)
y = 12.536x + 294.71
Population
Year
0
100
200
300
400
500
600
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
Akiak
Linear (Akiak)

APPENDIX H

DENALI COMMISSION POLICIES

ENERGY PROJECT DESIGN CAPACITY POLICY (April 2002)

a. The design capacity for power system projects shall be based on the projected village power requirements for not less than five nor more than ten years. The design capacity for power plant projects must provide sufficient firm capacity to ensure reliable power with acceptable fuel efficiency. The minimum firm generation capacity is that required to carry the system's peak loads after the loss of the single largest generating unit in the power plant.

b. Where feasible, the design layout should allow space for future expansion of capacity to meet the anticipated requirements for at least twenty years.

c. The rate of change of population increase or decrease over the past ten years and population projections by village leaders, state agencies and others shall be taken into consideration.

d. Historical power production and consumption data shall be taken into consideration, including the most recent data of the Power Cost Equalization Program and the rate of change over time.

e. Where fuel delivery is by barge, thirteen months of storage capacity is recommended, depending on local conditions and freight logistics. Where fuel delivery is by air, two to three months of storage capacity is recommended, depending on local conditions and freight logistics. If the design includes both barge and airport headers, village input and anticipated fuel costs shall be included in the determination of tank farm capacity.

f. Designers shall take into account seasonal variations in fuel consumption.

g. Infrastructure development projects may impact storage capacity requirements by increasing fuel and electric energy consumption. Designers shall investigate current and anticipated projects by interviewing village leaders, reviewing the Department of Community and Economic Development Grants Database, and contacting other agencies such as Village Safe Water, Alaska Energy Authority, Alaska Native Tribal Health Consortium, Department of Transportation and Public Facilities, the local school district, etc. Where an adopted comprehensive community development plan exists, that plan shall be taken into account in forecasting the design capacity of facilities.

h. Project managers and/or designers are to explain the disadvantages of excess power plant generating capacity to participants, such as decreased fuel efficiency with oversized generators, and increased costs for capital renewal and replacement, insurance, operations and maintenance. These additional costs must be factored into the business plan cost tables and will result in a per kilowatt-hour cost increase for project participants.

COST CONTAINMENT FOR ENERGY PROJECTS POLICY (Revised April 2002)

a. ***Cost Effective Designs.*** Cost containment requires that designs provide cost-effective solutions for the needs of Alaskan communities. Capacity and other design and site decisions should be based on a comprehensive community plan. Designs should be selected that address the identified needs in the most cost-effective manner feasible, considering operational and maintenance costs as well as construction costs to yield the lowest life cycle costs. This may mean implementing innovative technologies that provide real life cycle cost savings; or it may mean using very simple technologies that are sufficiently effective instead of more expensive approaches that increase costs without substantial benefit.

b. ***Need Specific Designs.*** Project cost containment dictates that designs directly provide real, substantial and quantifiable benefits addressing specific Alaskan community needs. Designs should not be expanded to address other needs or desires within the community, unless those increased costs are funded from another source or explicitly approved by the Commission. Similarly, designs should not be based on unrealistic or unsubstantiated estimates for increased demand (see Commission Policy for Energy Design Capacity). Projects should not result in expenditures for items providing little or no real benefit, or that are outside the program goals. Design components need to be limited to items that address real, identified needs in a beneficial manner, and are not merely "convenience" items. Required components should not be "over-designed" for the sake of community convenience, nor based on unreasonable projections.

c. ***Competitive Procurement***. Cost containment requires that products, labor, materials, transportation, services, and other items must be provided at fair and cost-competitive prices for best value considering all the Denali Commission goals.

d. ***Effective Project Management***. Cost containment requires that actual construction activities be competently managed to minimize or eliminate costs associated with scheduling, vendor coordination, material delivery, efficient utilization of labor and similar items. This will result in minimizing or eliminating unexpected costs from delays or other issues.

e. ***Maximization of Cost Benefit via Project Selection***. Part of cost containment is ensuring the greatest benefit for the cost. If a project exhibits abnormally high unit costs, even for valid reasons, the overall greatest benefit may be to fund projects with equally valid needs that can be completed for lower unit costs.

f. ***Cost Containment Parameters***. The following unit costs are to be calculated as the total project budget divided by the total design power generation capacity. A larger capacity project should relate to the lower end of the cost range for each capacity level.

Capacity Benchmark Unit Costs:

0 – 200 kilowatts	$5,500 to $3,500 per kilowatt
201 – 400 kilowatts	$3,500 to $2,900 per kilowatt
400 – 600 kilowatts	$2,900 to $2,400 per kilowatt
601 – 800 kilowatts	$2,400 to $1,900 per kilowatt
801 – 1,000 kilowatts	$1,900 to $1,600 per kilowatt
1,001 – 1,200 kilowatts	$1,600 to $1,250 per kilowatt
Greater than 1,200 kilowatts	$1,250 to $500 per kilowatt

INVESTMENT POLICY (April 2004)

General Policy

Commission investments are directed by federal law, by the Commission's Guiding Principles, and by specific allocation decisions made by the Commission. Infrastructure needs of rural Alaska are enormous compared to available funding; thus, it is imperative that each dollar be invested in a way that will maximize the sustainable long term benefits to Alaskans. The Commission will promote investment in infrastructure where the promise of sustainability (facility and services) can reasonably be demonstrated both now and in the future. Infrastructure sustainability can be enhanced by adapting available technology and appropriately sizing facilities to meet the particular needs and circumstances of communities.

Factors which will influence investment decisions:

a. ***Imminent environmental threats.*** Facilities will be placed so as to be protected from imminent environmental threats such as flooding and erosion. Long term investments generally will not be made in areas that are subject to imminent environmental threats.

b. ***Priority to be placed on needs of existing communities.*** The Commission will give priority to the critical infrastructure needs of existing communities before considering proposals to create new communities, unless there is a congressionally directed relocation of an existing community.

c. ***Regional support.*** The Commission recognizes that borough and local governments promote equity among Alaskans, and that the existence of a state-chartered government increases the probability that basic infrastructure and services provided with Denali Commission funds will be sustained over the long term. The Commission also recognizes that other regional organizations share both responsibility and capacity to contribute to sustainability. Consistency with a regionally approved plan is a factor lending strength to investing in a particular project.

d. ***Proximity/access to existing services and/or facilities.*** In determining the need for a new facility, a careful evaluation of existing access to services or facilities will be performed. Where the needs of two or more communities in close proximity to one another can be adequately and more cost effectively served by a single facility, that option will be selected over separate facilities for each community. Investments will be made where critical unmet needs are demonstrated.

e. ***Renovation versus new construction.*** Where existing facilities can be renovated or expanded to adequately meet community needs at significantly lower life-cycle costs than new construction, that option will be favored.

f. ***Population trends.*** Infrastructure will be sized to meet needs that can reasonably be projected over the design life of the project. If population is increasing, appropriate excess capacity will be provided to accommodate growth. Decreasing population may result in a smaller facility than the current population would dictate. For communities with populations declining 20% or greater over a 10-year census period, and where there is indication such trends will continue, special attention will be given to appropriate design and sizing of facilities.

g. ***Affordability.*** The Commission will evaluate proponents' capacities to afford the life-cycle costs associated with sustaining proposed services and/or facilities, either through user fees, industry support, government transfer payments or grants from private entities.

h. ***Per capita investment.*** While there are many factors which may explain extreme variations in per capita investment in communities, the Commission will compile and review this data to ensure that there is reasonable equity in the distribution of funds across all rural Alaska communities.

SUSTAINABILITY POLICY OF ELECTRIC UTILITY SYSTEMS (April 2002):

a. The utility is operating in substantial conformance with a business and work plan under a margin that is consistent with its long-range financial needs. A renewal and replacement fund will be established and sufficient funds will be accrued to cover the projected costs of major repairs, renovations, renewals, and replacement of major plant components.

b. The utility system is in compliance with the laws and regulations that govern its operation.

c. The utility provides for adequate preventive and scheduled maintenance of its facilities, and keeps its facilities in good condition and repair.

d. The utility arranges for annual financial audits that are conducted by qualified, independent auditors, and which consistently find no significant financial irregularities.

e. The utility is not in default with respect to any of its financial obligations, including debts, taxes, or other established liabilities.

f. Rates are based on cost of service such that no customer class subsidizes another to a significant extent, and the risks of possible loss of large consumers are minimized by power sales agreements that protect the economics of a utility's operations.

g. The utility maintains adequate business insurance covering all significant risks. Self-insurance will be allowed for specific risks, provided the utility can clearly demonstrate how adequate funds would be made available in a timely fashion to satisfy possible claims.

h. The utility has a credible business and work plan that is updated no less frequently than once every five years, and that includes provision for adequate preventive and scheduled maintenance, a ten-year capital replacement and expansion plan, a ten-year financial forecast, and a rate structure analysis.

i. In the case of joint ventures, the utility has sufficient management control or other contractual safeguards with respect to the construction and operation of jointly owned facilities to ensure that the utility's interests are protected and the utility lender's credit risk is minimized.

j. Where rates or investment decisions are subject to approval by regulatory authorities, there is reasonable expectation that such approvals regarding development of the project will be forthcoming.

APPENDIX I

BUDGET LEVEL COST ESTIMATE

BUDGET COST ESTIMATE
Akiak Power Plant

PROJECT:	Akiak Power Plant
PROJECT No.:	06-765
LEVEL:	Budget
DATE:	2/27/2008
REFERENCE DRAWING(S):	Conceptual Design
BASIS:	Force Account
FREIGHT RATE:	$0.55/lb

COST SUMMARY

Power Plant Cost……...……	**2,517,260**
Miscellaneous Project Costs ……	**256,217**
Power Plant Total:	**$2,773,477**
$/kW (1,030 kW):	**$2,693**

Upgrades to Distribution System[3]

Option #1 (Recommended): Upgrade to 7.2/12.47kV…….	**$613,000**
Option #2: Code Compliance Upgrade……..	**$431,000**
Total Budget Level Cost w/ Option #1:	**$3,386,477**

BUDGET COST ESTIMATE
Akiak Power Plant

No.	ITEM	QTY	UNITS	MATERIAL UNIT COST	MATERIAL MATL TOTAL	LABOR MAN DAYS	LABOR UNIT COST	LABOR LABOR TOTAL	OTHER OR EQUIP RENT	FREIGHT	TOTAL
	Estimated Project Duration	90	DAYS								
	Foreman/Operator	1	EA								
	Truck Driver	1	EA								
	Carpenters/Welders	2	EA								
	Local Labor	4	EA								
	Labor - not included in building construction (based on 60 hours per week)										**56,000**
1	Project Manager		MD's			7	800	5,600			5,600
2	Foreman/Operator		MD's			14	700	9,800			9,800
3	Carpenters/Welders		MD's			14	700	9,800			9,800
4	Local Labor		MD's			56	550	30,800			30,800
	Miscellaneous										**282,990**
5	Mob/DeMob	1	SUM	20,000	20,000						20,000
6	Crew Per Diem	270	MD's	50	13,500						13,500
7	Crew Housing	270	MD's	50	13,500						13,500
8	Crane Rental [4]	2	MO	20,000					40,000		40,000
9	Skid Steer Rental	4	MO	3,925					15,700	4,710	20,410
10	Welder Rental	4	MO	4,000					16,000	4,800	20,800
11	Dump Truck Rental	2	MO	5,000					10,000	3,000	13,000
12	Pick-up Truck Rental	4	MO	1,500					6,000	1,800	7,800
13	Excavator Rental	2	MO	3,875					7,750	2,325	10,075
14	Loader Rental	4	MO	12,000					48,000	14,400	62,400
15	Compactor Rental	2	MO	3,675					7,350	2,205	9,555
16	Fuel	1	LS	8,000	8,000				8,000	2,400	18,400
17	Tool Rental	4	MO	4,000					16,000	4,800	20,800
18	Consumables	1	LS	5,000	5,000				5,000	2,750	12,750
	Foundation Construction										**316,732**
19	Piles [1]	27	EA	5,000	135,000						135,000
20	W12x35x12' [1]	3,780	LBS	1.30	4,914		1.20	4,536			9,450
21	W12x35x18' [1]	6,300	LBS	1.30	8,190		1.20	7,560			15,750
22	W12x35x4' [1]	280	LBS	1.30	364		1.20	336			700
23	W8x35x4' [1]	420	LBS	1.30	546		1.20	504			1,050
24	W10x12x12' [1]	6,336	LBS	1.30	8,237		1.20	7,603			15,840
25	W8x35x20' [1]	2,100	LBS	1.30	2,730		1.20	2,520			5,250
26	W8x35x2.67' [1]	280	LBS	1.30	364		1.20	336			700
27	C12x10.6x20' [1]	424	LBS	1.30	551		1.20	509			1,060
28	3/8" Metal Plate [1]	26,438	LBS	1.30	34,369		1.20	31,726			66,095
29	Metal Bar Grate [1]	208	SF	28.00	5,824		16.00	3,328			9,152
30	Galvanized Pipe Handrails [1]	200	LF	49.00	9,800		15.20	3,040			12,840
31	Galvanized Metal Treads [1]	10	EA	106.00	1,060		32.00	320			1,380
32	Spray-on Insulation	1	LS	25,000.00	25,000						25,000
33	Fencing & Gates	350	FT	20	7,000		20.00	7,000		3,465	17,465

BUDGET COST ESTIMATE
Akiak Power Plant

No.	ITEM	QTY	UNITS	MATERIAL UNIT COST	MATERIAL MATL TOTAL	LABOR MAN DAYS	LABOR UNIT COST	LABOR LABOR TOTAL	OTHER OR EQUIP RENT	FREIGHT	TOTAL
Building/Generation Equipment/Mechanical & Electrical/Etc[2]											**1,125,000**
34	Building	1	LS	100,000	100,000			100,000		55,000	255,000
35	Generators and Switchgear	1	LS	450,000	450,000			30,000		14,000	494,000
36	Mech. & Elec. Systems	1	LS	200,000	200,000			100,000		16,000	316,000
37	Lodging/Fuel/Training-Etc.	1	LS	30,000	30,000			30,000			60,000
Waste Heat Recovery											**50,000**
38	Power Plant Connection	1	LS	50,000	50,000						50,000
Fuel System											**358,200**
39	12,000 Gallon Intermediate Tank	1	EA	16,200	16,200					12,000	28,200
40	Piping	3,200	LF	50	160,000		50	160,000		10,000	330,000
											2,188,922
									Contingency @	15%	328,338
									Power Plant Total:		**2,517,260**
Upgrades to Distribution System[3]											
41	**Option #1**: Upgrade to 7.2/12.47kV	1	LS	613,000	613,000						**613,000**
42	**Option #2**: Code Compliance Upgrade	1	LS	431,000	431,000						**431,000**

[1] Material cost includes freight.
[2] Per estimate provided by AE&E
[3] Per estimate provided by Errico Electrical Engineering. Includes materials, freight, and labor.
[4] Crane freight cost included in pile unit cost

MISCELLANEOUS COSTS

41	Project Insurance	20,000
42	Site Control Legal Work	15,000
43	Engineering Allowance	110,000
44	Construction Management Allowance	100,000
45	Grant Audit	4,000
46	Fire Marshall Review Fee	7,217
	Misc. Cost Total =	**256,217**

ERRICO
ELECTRICAL
ENGINEERING, LLC

PO Box 220471
Anchorage, Alaska 99522
Ph/Fx: (907) 345-6168
Cell: (907) 242-7669
Email: errico@gci.net

August 7, 2007

Egor Esipov
LCMF, LLC
615 East 82nd Ave., Suite 200
Anchorage, Alaska 99518

Re: Akiak Electrical Distribution cost estimate

Dear Mr. Esipov:

As requested, I have looked into a few different scenarios for the cost estimate based on my system evaluation letter dated 7-18-07.

The existing distribution system is a 2400V Delta system. As noted, my general recommendation was replacing/upgrading the entire system to a 7.2/12.47kV grounded wye system, re-utilizing some of the newer constructed facilities.

Option 1: upgrade existing system for code compliance:

This is not my recommended solution for the distribution system; however, existing distribution could be brought into code compliance with the replacement in situ (more or less) of approximately 45 new poles. The anticipated conceptual cost for the entire refurbishment would be approximately $431,000.

Option 2: upgrade existing system to 7.2/12.47kV:

It is anticipated that a complete reconstruction of the village's electrical distribution system would require approximately 75 new poles. The anticipated conceptual cost for the voltage conversion upgrade would be approximately $613,000.

The actual costs could vary widely based on actual location of existing facilities to proposed rights-of-way for new facilities; method of contract prosecution and village cooperation.

Regards,

Gregory M. Errico, PE

	UNIT or TASK	QUANTITY	LABOR HOURS	LABOR RATE	LABOR COST	MATERIAL COST/UNIT	MATERIAL COST	MATERIAL WEIGHT	FREIGHT	EXTENDED COST
CONSTRUCTION	NUMBER POLE	35	0.75	$175	$4,594	$7.0	$245	1.0	$32	$4,871
	PROVIDE POLE GROUND	43	2.5	$175	$18,813	$45.0	$1,935	35.0	$1,370	$22,117
	GROUND APPURTENANCE ON POLE	89	0.75	$175	$11,681	$13.0	$1,157	5.0	$405	$13,243
	TRIM BOLT	27	0.25	$175	$1,181	$0.0	$0	0.0	$0	$1,181
	RETIRE NON-PRIMARY ITEM	15	0.25	$175	$656	$0.0	$0	0.0	$0	$656
	PROVIDE JUMPERING PIN	2	1.25	$175	$438	$27.0	$54	15.0	$27	$519
	ADD PEANUT	30	0.25	$175	$1,313	$7.0	$210	5.0	$137	$1,659
	PROVIDE GUY	20	1	$175	$3,500	$167.0	$3,340	55.0	$1,001	$7,841
	PROVIDE GUY MARKER	30	0.25	$175	$1,313	$17.0	$510	10.0	$273	$2,096
	PROVIDE GUY STRAIN INSULATOR	6	0.75	$175	$788	$57.0	$342	20.0	$109	$1,239
	PROVIDE ANCHOR	10	7	$175	$12,250	$79.0	$790	40.0	$364	$13,404
	TIGHTEN PRIMARIES (LOT)	1	40	$175	$7,000	$0.0	$0	0.0	$0	$7,000
	RE-WORK SECONDARY	10	1.5	$175	$2,625	$17.0	$170	10.0	$91	$2,886
	RE-DRIVE GROUND ROD AND ADD STAPLES	25	1.5	$175	$6,563	$19.0	$475	20.0	$455	$7,493
	RAISE SECONDARY OR SERVICE	25	0.75	$175	$3,281	$17.0	$425	10.0	$228	$3,934
	RE-WORK PRIMARY FRAMING	10	4	$175	$7,000	$375.0	$3,750	300.0	$2,730	$13,480
	TIGHTEN GUY	15	0.5	$175	$1,313	$0.0	$0	0.0	$0	$1,313
	PROVIDE NEW SERVICE	10	2.5	$175	$4,375	$135.0	$1,350	35.0	$319	$6,044
	PROVIDE AN INTERMEDIATE MAST	10	3.25	$175	$5,688	$63.0	$630	30.0	$273	$6,591
	RETIRE POLE	10	3	$175	$5,250	$0.0	$0		$0	$5,250
	PROVIDE NEW 40/4 OR 45/4 POLE	45	10	$175	$78,750	$765.0	$34,425	650.0	$61,220	$174,395
	PROVIDE C1X FRAMING	10	4	$175	$7,000	$234.0	$2,340	150.0	$1,365	$10,705
	REPLACE STREET LIGHT GLASS	10	1.25	$175	$2,188	$21.0	$210	10.0	$91	$2,489
	PROVIDE NEW STREET LIGHT BULB	10	0.5	$175	$875	$3.0	$30	5.0	$46	$951
	PROVIDE NEW STREET LIGHT PHOTOCELL	7	0.5	$175	$613	$13.0	$91	10.0	$64	$767
	RETIRE SERVICE OR SECONDARY	5	0.5	$175	$438	$0.0	$0	0.0	$0	$438
	STRAIGHTEN POLE	20		$175	$0	$0.0	$0		$0	$0
REFURBISHMENT DESIGN	New Layout drawing staking sheets, and bid unit tab.	1	90	$120	$10,800					$10,800
	Site visit to complete/finalize construction documents (including transportation)	1	40	$120	$5,400					$5,400
CONSTRUCTION ENGINEERING	Quality Assurance during construction (including transportation) - if desired	1	50	$120	$7,200					$7,200
	Facility Asbuilt Documentation (including transportation - not incuding survey) - if desired	1	70	$120	$8,400					$8,400

Subtotal	$344,358
Contingency	1.25
Estimated cost of Electrical Distribution Upgrade	$430,447.56

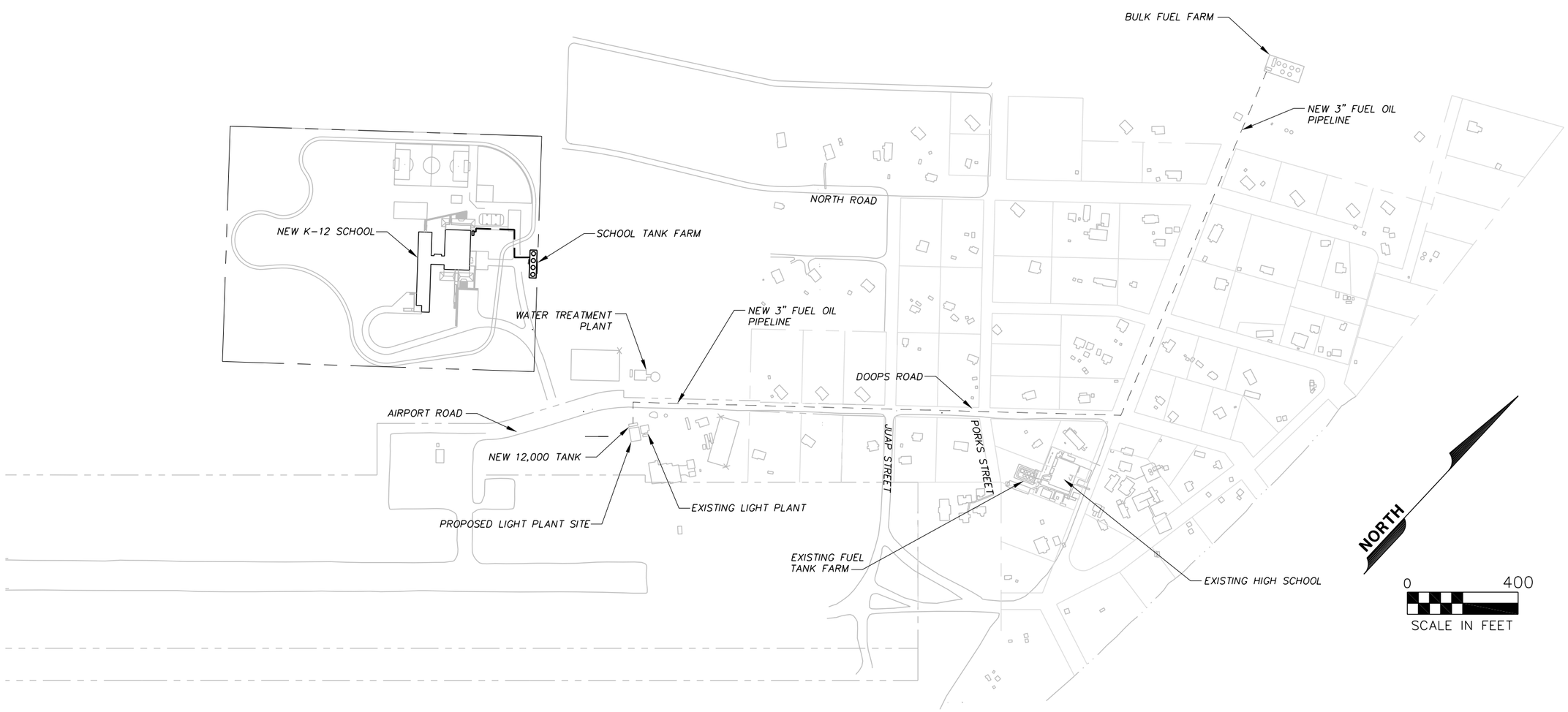
	UNIT or TASK	QUANTITY	LABOR HOURS	LABOR RATE	LABOR COST	MATERIAL COST/UNIT	MATERIAL COST	MATERIAL WEIGHT	FREIGHT	EXTENDED COST
CONSTRUCTION	NUMBER POLE	75	0.5	$175	$6,563	$5.0	$375	0.1	$7	$6,944
	PROVIDE NEW 40/4 OR 45/4 POLE	75	8	$175	$105,000	$550.0	$41,250	350.0	$23,888	$170,138
	PROVIDE POLE GROUND	25	1.75	$175	$7,656	$35.0	$875	20.0	$455	$8,986
	C1	25	2.5	$175	$10,938	$110.0	$2,750	25.0	$569	$14,256
	C7-1	15	4	$175	$10,500	$185.0	$2,775	75.0	$1,024	$14,299
	A1	30	1.5	$175	$7,875	$45.0	$1,350	35.0	$956	$10,181
	A5, A5-1, A5-2	20	2.5	$175	$8,750	$55.0	$1,100	25.0	$455	$10,305
	PROVIDE GUY	45	1	$175	$7,875	$125.0	$5,625	25.0	$1,024	$14,524
	PROVIDE GUY STRAIN INSULATOR	10	1	$175	$1,750	$55.0	$550	15.0	$137	$2,437
	PROVIDE ANCHOR	25	7	$175	$30,625	$35.0	$875	30.0	$683	$32,183
	PROVIDE PRIMARY (#2 ACSR)	25000	0.005	$175	$21,875	$0.3	$6,250	0.1	$2,503	$30,628
	PROVIDE SECONDARY (1/0 TRI) per FT	2500	0.007	$175	$3,063	$1.4	$3,575	1.2	$2,730	$9,368
	PROVIDE SERVICE (#4 TRI) per FT	7500	0.006	$175	$7,875	$0.8	$5,850	0.7	$4,436	$18,161
	PROVIDE#2 URD primary per FT	600	0.1	$175	$10,500	$2.5	$1,500	0.7	$0	$12,000
	PROVIDE INTERMEDIATE MAST	10	3.25	$175	$5,688	$40.0	$400	25.0	$228	$6,315
	PROVIDE single phase TRANSFORMER OH	22	3	$175	$11,550	$725.0	$15,950	300.0	$6,006	$33,506
	PROVIDE 3-phase TRANSFORMER UG	2	16	$175	$5,600	$6,500.0	$13,000	2100.0	$3,822	$22,422
	RETIRE EXISTING DISTRIBUTION (lot)	1	160	$175	$28,000	$0.0	$0		$0	$28,000
LINE EXTENSION DESIGN	Survvey of existing facilites and homes (including transportation)	1	110	$110	$12,100					$12,100
	New Layout drawing staking sheets, and bid unit tab (including site visit to finalize)	1	115	$120	$13,800					$13,800
CONSTRUCTION ENGINEERING	Quality Assurance during construction (including transportation) - if desired	1	100	$120	$13,200					$13,200
	Facility Asbuilt Documentation (including transportation - not incuding survey) - if desired	1	50	$120	$6,000					$6,000

Subtotal	$489,751
Contingency	1.25
Estimated cost of Electrical Distribution Upgrade	$612,188.22

Labor rate chosen includes contractors labor overhead including transportation and lodging.

APPENDIX J

CONCEPTUAL DESIGN DRAWINGS



SITE PLAN

SCALE: AS SHOWN

ALASKA ENERGY AUTHORITY

RURAL POWER SYSTEM UPGRADE
AKIAK, ALASKA

LCMF LLC
615 E. 82nd Ave. Suite 200-Anchorage, AK 99518 (907) 273-1830

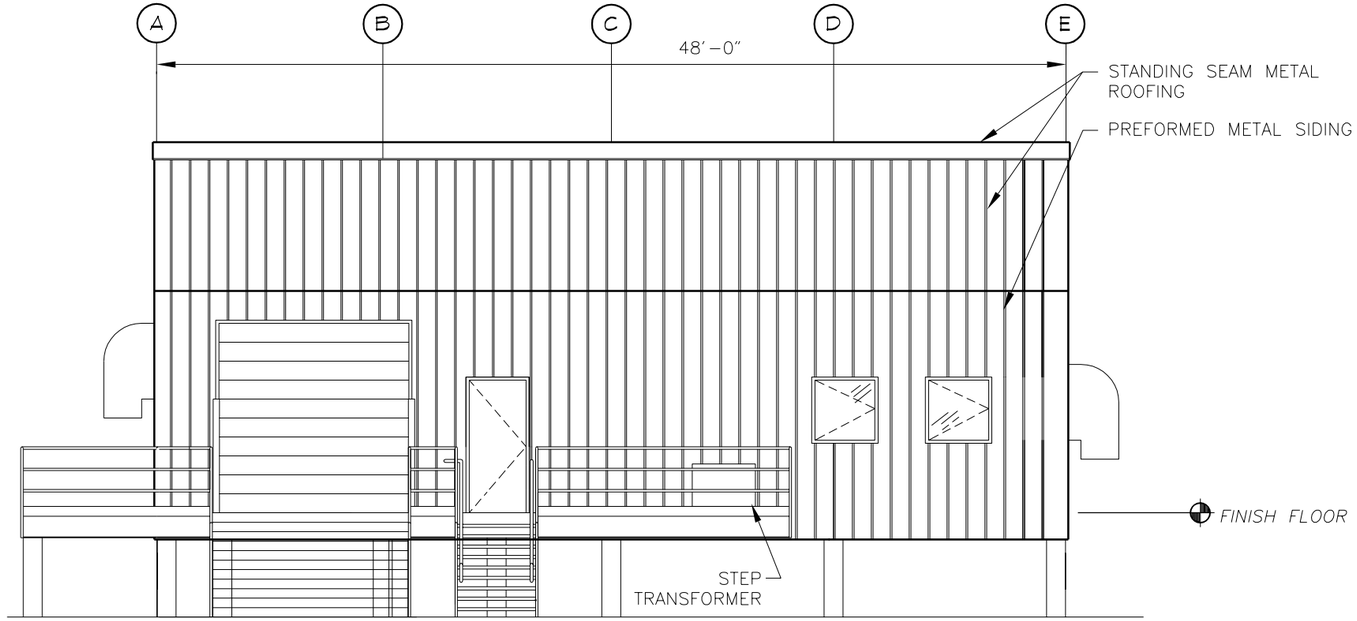
CONCEPTUAL DESIGN

REVISIONS:

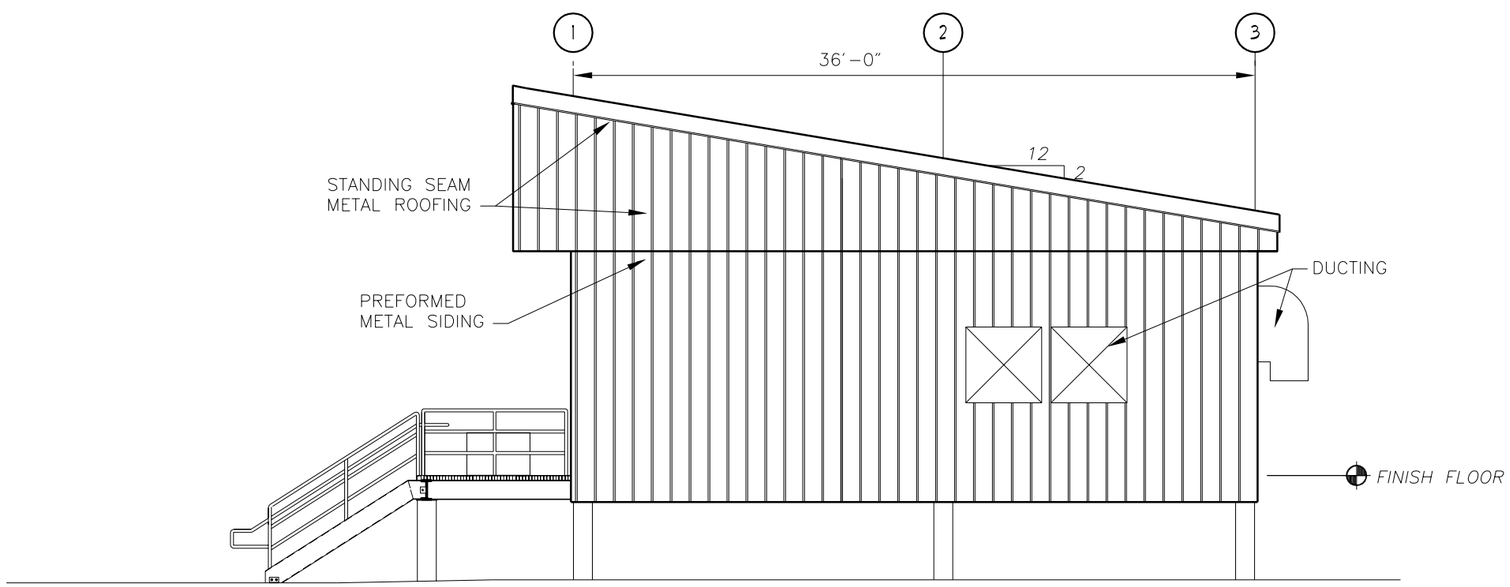
DRAWN BY: EE
CHECKED BY:
DATE: 09/11/07
JOB NUMBER: 06-765
SCALE: AS SHOWN

DRAWING TITLE:
SITE PLAN

SHEET: OF
C-1



1 / A-1 **FRONT ELEVATION**
SCALE: 1/8" = 1'-0"



2 / A-1 **SIDE ELEVATION**
SCALE: 1/8" = 1'-0"

FIELD BOOKS:
PLOTTING DATE: 12/14/04 (11:48)
AUTOCAD DRAWING NAME: 718-A2.DWG

ALASKA ENERGY AUTHORITY

RURAL POWER PLANT SYSTEM UPGRADE
AKIAK, ALASKA

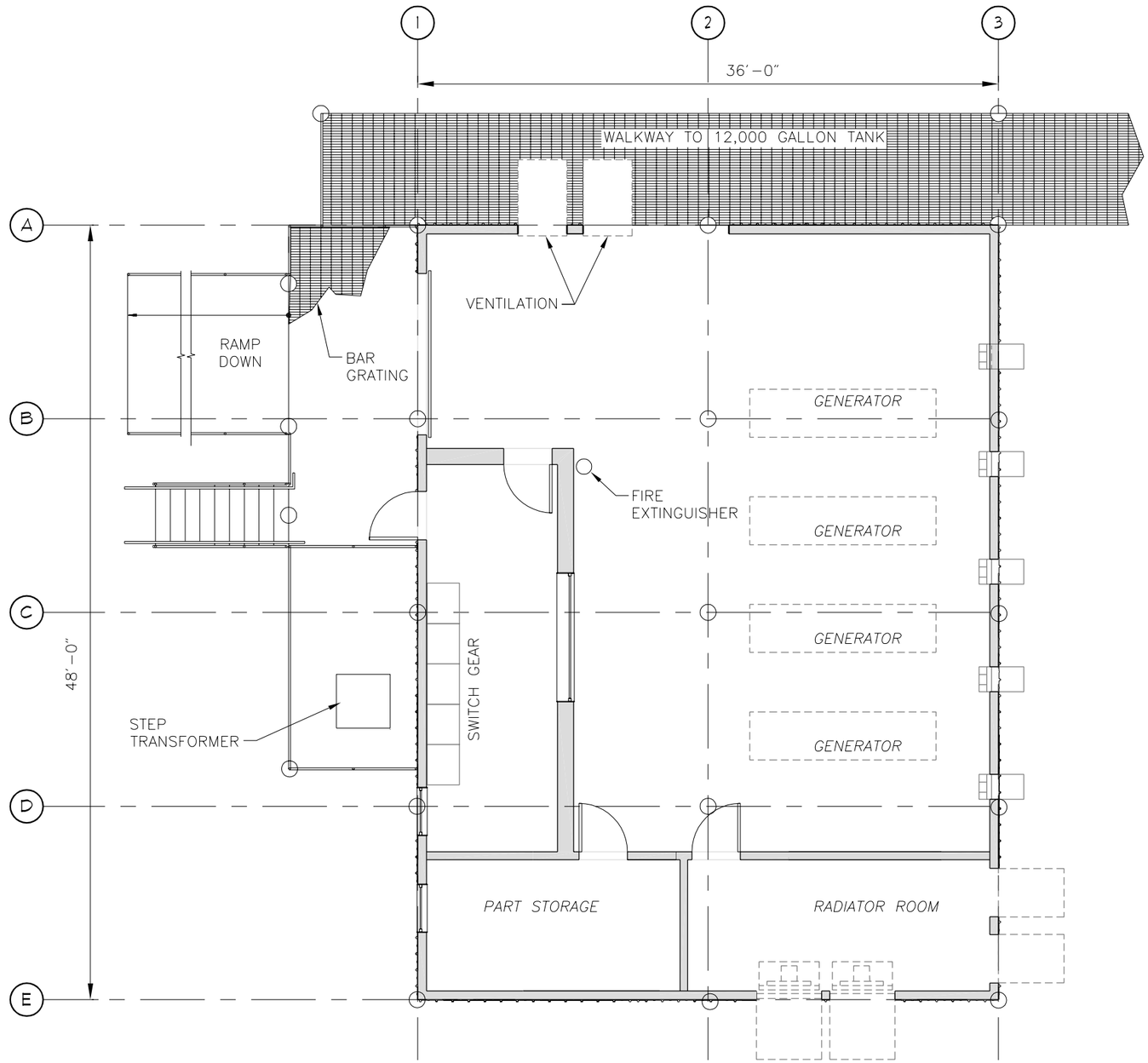
LCMF LLC
139 E. 51st Ave. / Anchorage, Alaska 99503 (907)273-1830

CONCEPTUAL DESIGN
REVISIONS:

DRAWN BY: EE
CHECKED BY:
DATE: 02/13/08
JOB NUMBER: 06-765
SCALE: AS SHOWN

DRAWING TITLE:
EXTERIOR ELEVATIONS

SHEET: OF
A-1



1 / A-2 **FLOOR PLAN**

SCALE: 1/8" = 1'-0"

FIELD BOOKS:
PLOTTING DATE: 12/14/04 (11:48)
AUTOCAD DRAWING NAME: 718-A1.DWG

ALASKA ENERGY AUTHORITY

RURAL POWER PLANT SYSTEM UPGRADE
AKIAK, ALASKA

LCMF LLC
139 E. 51st Ave. / Anchorage, Alaska 99503 (907)273-1530

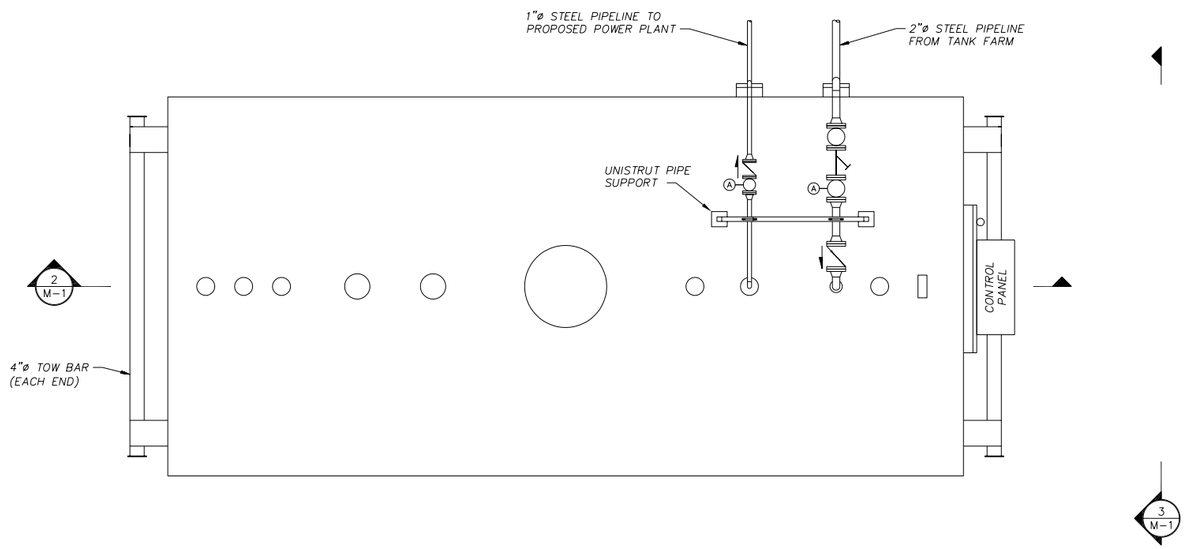
CONCEPTUAL DESIGN

REVISIONS:

DRAWN BY: EE
CHECKED BY:
DATE: 02/13/08
JOB NUMBER: 06-765
SCALE: AS SHOWN

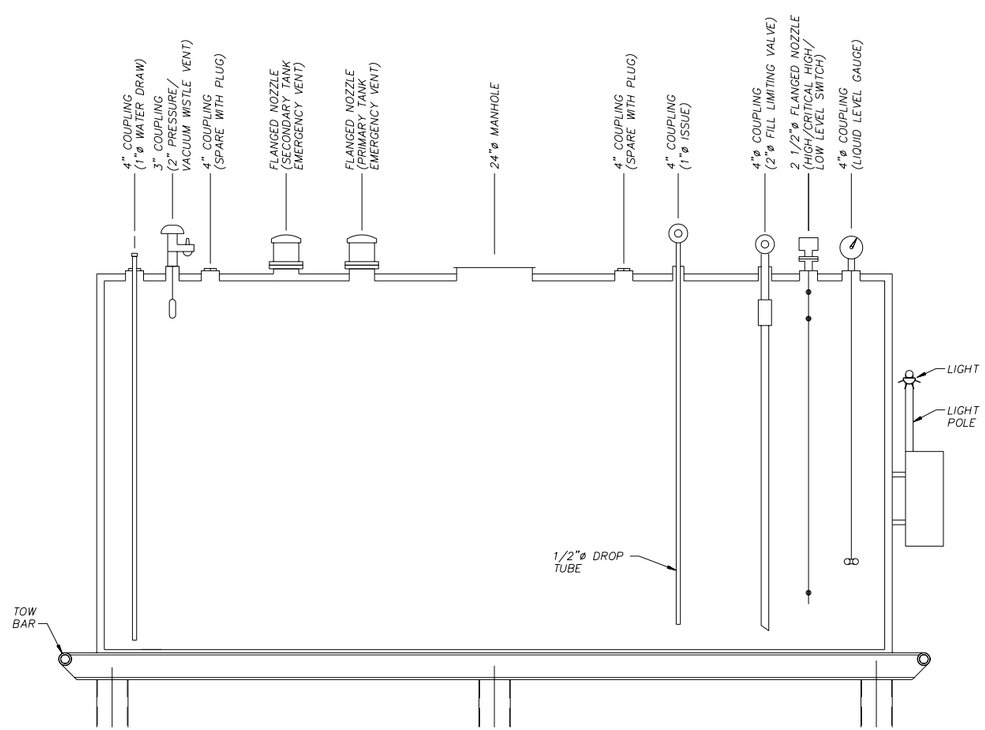
DRAWING TITLE:
FLOOR PLAN

SHEET: OF
A-2



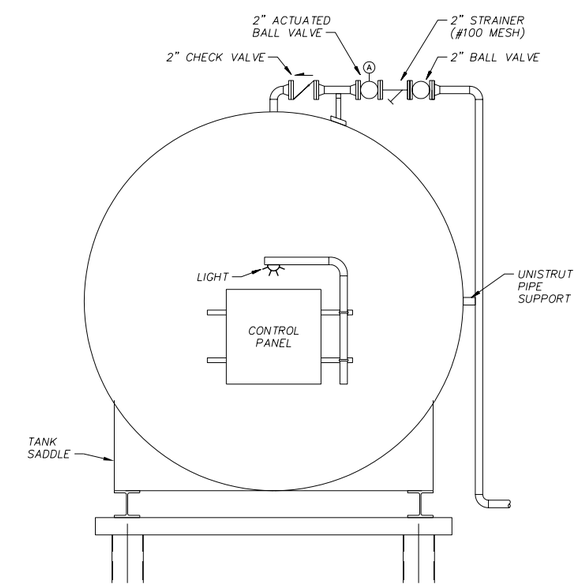
1 M-1 TANK PLAN VIEW

SCALE: NOT TO SCALE



2 M-1 TANK SECTION VIEW

SCALE: NOT TO SCALE



3 M-1 TANK END VIEW

SCALE: NOT TO SCALE

PLOTTING DATE: 9/11/07 (11:14) BY: eesipov
AUTOCAD DRAWING NAME: 12,000 Gallon Tank.dwg

ALASKA ENERGY AUTHORITY

RURAL POWER SYSTEM UPGRADE
AKIAK, ALASKA

LCMF LLC
615 E. 82nd Ave. Suite 200 Anchorage, AK 99518 (907) 273-1830

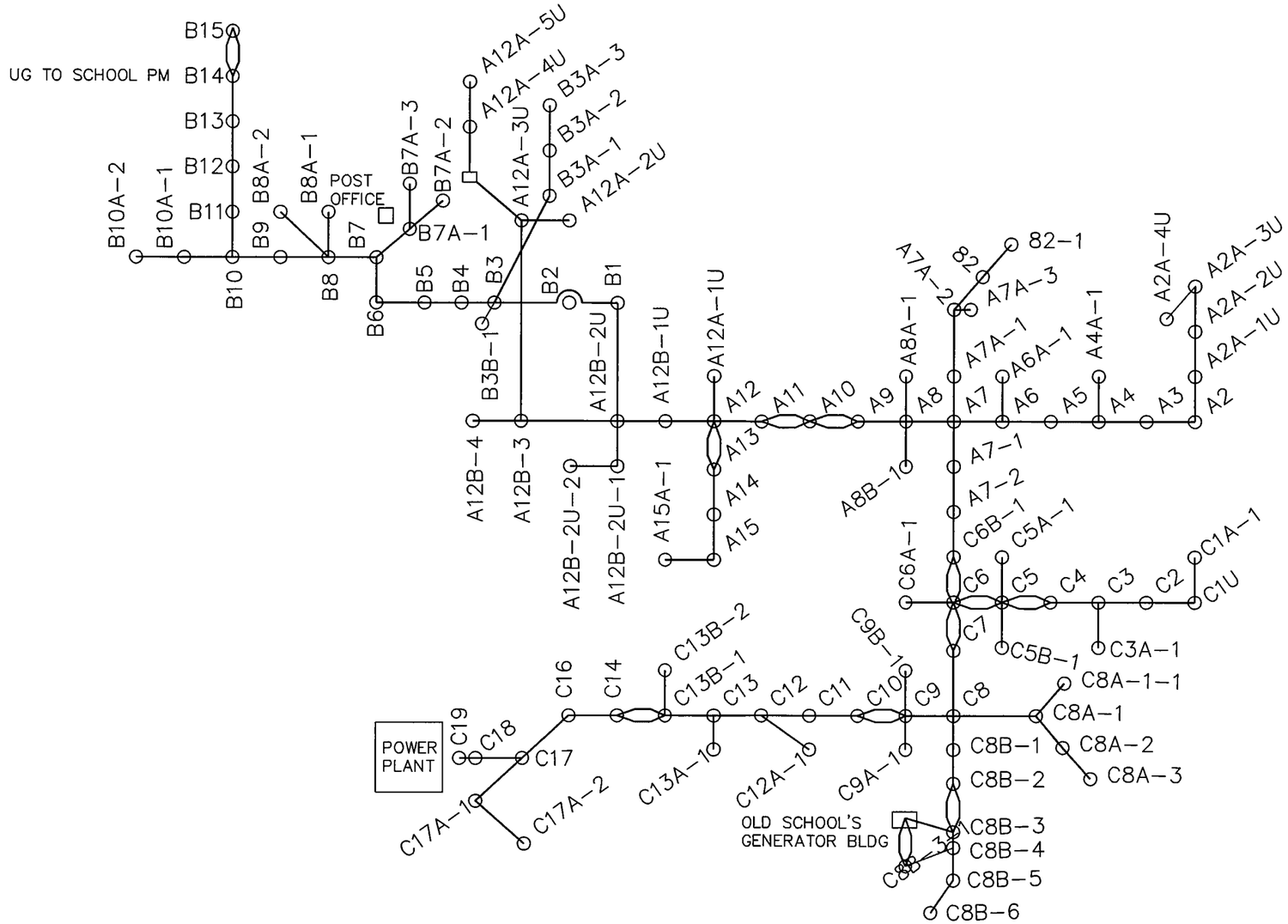
CONCEPTUAL DESIGN

REVISIONS:

DRAWN BY: EE
CHECKED BY:
DATE: 09/11/07
JOB NUMBER: 06-765
SCALE: AS SHOWN

DRAWING TITLE:
12,000 GALLON TANK

SHEET: OF
M-1



SCHEMATIC DIAGRAM OF EXISTING POLES AND CONNECTING ELECTRICAL CIRCUITS
NOT TO SCALE

PRIMARY AND SECONDARY CONDUCTORS ARE NOT DIFFERENTIATED.

PURPOSE OF DRAWING IS TO GIVE GENERAL LOCATION OF EXISTING POLES AND CIRCUITS. NUMBERS SHOWN FOR UN-NUMBERED POLES ARE FOR REFERENCE IN REPORT WHERE NUMBER IS PRECEDED BY (TBRTA)=TO BE REFERRED TO AS.

ELECTRICAL DISTRIBUTION SYSTEM
CONDITION SURVEY LAYOUT DIAGRAM

AKIAK, ALASKA

LCMF LLC
1516 E 6TH Ave. • Anchorage, Alaska 99501 • (907)279-1580
PO Box 220471
Anchorage, AK 99522
(907) 345-5188
Cell: (907) 242-7669
Email: arrico@gci.net
ARRICO ELECTRICAL ENGINEERING, LLC

CONDITION SURVEY
REVISIONS:

DRAWN BY: ME
CHECKED BY: GE
DATE: 7-18-07
JOB NUMBER:
DWG FILE:

DRAWING TITLE:
SCEMATIC DIAGRAM OF EXISTING POLES AND ELECTRICAL CIRCUITS

SHEET: 1 OF 1
E1

PLOTTING DATE: 00/00/96
XREF:

APPENDIX K

REGULATORY COMMISSION OF ALASKA

CPCN 635: Akiak Power Utilities

Status: Active

SUMMARY

View Additional Information about AKIAK POWER UTILITIES; CITY OF AKIAK

Certificate Type	CPCN
Utility Type	Electric
Regulatory Code	Political Subdivision of the State (42.05.711(b))
Statutory Provision	42.05.990(4)(A)
Certificate Document	
Current Tariff	

POWER COST EQUALIZATION PROGRAM

Enrolled in PCE Program?	Yes
Status in PCE Program	Active
Date of Last Surcharge Filing	
Date Next Surcharge Filing Due	

AKIAK POWER UTILITIES; CITY OF AKIAK

SUMMARY

Short Name AKIAK

Address P. O. BOX 52028
AKIAK, AK 99552

Website

Phone 907-765-7512

Email

CERTIFICATES

Certificate Number	Utility Type	Certificate Name	Certificate Status	
635	Electric	Akiak Power Utilities	Active	-