CONCEPT DESIGN REPORT AND
CONSTRUCTION COST ESTIMATE
FOR CONSOLIDATION AND RENOVATION OF
FUEL STORAGE FACILITIES AND AVEC POWER PLANT
IN THE COMMUNITY OF:

SHAGELUK

PREPARED FOR:

ALASKA VILLAGE ELECTRIC COOPERATIVE

PREPARED BY:

Alaska Energy and Engineering, Inc.
Mailing Address - P.O. Box 111405
Anchorage, AK 99511-1405
(907) 349-0100
349-8001 FAX

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EXECUTIVE SUMMARY

Alaska Energy and Engineering, Inc. (AE&E) has prepared this report for the Alaska Village Electric Cooperative (AVEC). The purpose of this study is to provide a concept design and construction cost estimate for consolidation and upgrade of all public diesel fuel and gasoline storage in the community of Shageluk. This report also provides a concept design and construction cost estimate for construction of a new AVEC power plant. For the purpose of this study, the term "diesel fuel" refers to all fuel oil products used for space heating, electrical generation, and heavy equipment operation. The participants in the project include AVEC, the City of Shageluk (City), Zho-Tse, Inc. (Corp.), and Iditarod Area School District (IASD).

Steve Stassel and Trevor Krupa of Alaska Energy and Engineering (AE&E) were in Shageluk August 28 through 30, 2003, to perform a site investigation for the proposed bulk fuel and power plant upgrade project. Molly Sheldon of AVEC arrived on August 29 and a community meeting was held to discuss the project. Local citizens along with City council and Zho-Tse board members attended the meeting. On October 9, 2003, Allan Murfitt of A.W. Murfitt Company traveled to Shageluk with Trevor Krupa to perform a geotechnical evaluation of the proposed project sites and to identify potential borrow sources.

The new collocated tank farm will provide virtually all bulk storage of diesel fuel and gasoline for the community. The collocated tank farm will also included all retail dispensing of gasoline and diesel fuel for residential use. A double wall tank will provide all bulk storage of diesel fuel at the school. Diesel fuel is used to heat city buildings, the school, residential homes, generate electricity and to fuel heavy equipment. All gasoline is for retail sales for use in vehicles, four wheelers, and private boats.

AVEC will be the primary owner and operator of its tank farm and power plant facility. The City/Corp. tank farm will be located on City land and will be the primary owner of the facility. The Corp. will operate all retail sales and will have the majority of storage capacity. The Corp. is the prime candidate to serve as the primary operator with overall management responsibility for the facility. The IASD will be the primary owner and operator of its tank and piping systems.

A total of eight new tanks will be required to meet the projected fuel storage and dispensing requirements for the community. The project provides bulk gross storage (tank shell) capacities of 155,000 gallons of diesel fuel, and 27,000 gallons of gasoline. A dispensing tank will provide an additional 4,000 gallons of diesel fuel and 4,000 gallons of gasoline. The total gross tank capacity of the project is 190,000 gallons. The existing tank farm gross storage capacity is 130,617 gallons. The proposed capacity exceeds the Denali Commission guideline of 120% of existing capacity.

AVEC has standardized and fabricated two sizes of bulk tanks, a 22,300 gallon and a 27,000 gallon gross capacity. To minimize the dike footprint and corresponding site development work, and to meet the Denali Commissions 13 month capacity requirement, only the 27,000 gallon gross capacity tanks will be considered for use on this project. With the exception of the IASD, each participant's proposed annual fuel consumption has been rounded up to the next whole 27,000-gallon tank.

The bulk storage and dispensing tanks will be installed within two individually lined earthen dike cells that share a full height dike wall. Separate security fencing will enclose each dike cell. The IASD tank and marine header will also be installed within chain link security fences. A service station style dispenser will provide for retail sales of gasoline and diesel fuel. A hose and nozzle will serve as a drum/heavy equipment fill stand for the City.

All fuel will be delivered via barge. The collocated facility will include three marine fill pipelines: one for AVEC, one for the City/Corp. diesel fuel, and one for the Corp. gasoline. The AVEC marine header will be located outside the northwest corner of the City/Corp. dike cell. The City/Corp. diesel and the Corp. gasoline marine headers will be located within the City/Corp. dike cell. Fuel will be transferred to the dispensing tank and AVEC day tank via new 2-inch above grade transfer pipelines. The IASD tank will be filled at a marine header through a new 3-inch below grade diesel fuel fill pipeline. Fuel will be transferred from the tank to a new day tank in the school via new 2-inch below grade transfer pipeline. The IASD tank will also be equipped with a hose and nozzle to allow for the current practice of transferring fuel to the voc-ed, shop, garage, and duplex by a mobile tank.

The proposed project schedule calls for design and permitting to be completed to allow for pad development in the summer of 2004, and tank farm construction and AVEC modules placement May through July 2005. The tank farm facility should be ready to receive fuel and fully functional in August 2005.

The total project cost including all design, supervision, inspection, permitting, and a 20% contingency is estimated to be $4,085,327. The estimated cost of the bulk fuel upgrade portion is $2,068,397 that equates to a unit cost of $10.89 per gallon based on a gross storage capacity of 190,000 gallons. This is within the Denali Commission benchmark cost range of $12.00 to $9.50 per gallon for 100,001 gallons to 200,000 gallons capacity tank farms. The estimated cost of the power plant upgrade portion is $2,016,930 that equates to a unit cost of $3,361 per kW based on a total installed capacity of 600kW. This is above the Denali Commission benchmark cost range of $2,900 to $2,400 per installed kW for 401kW to 600kW capacity power plants. The higher cost is primarily due to the need to elevate the power plant pad approximately 6 feet higher than the surrounding grade to mitigate flood damage.

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ACRONYMS AND ABBREVIATIONS

ADCED	Alaska Department of Community and Economic Development
ADEC	Alaska Department of Environmental Conservation
AEA/REG	Alaska Energy Authority/Rural Energy Group
AIDEA	Alaska Industrial Development and Export Authority
API	American Petroleum Institute
ANTHC	Alaska Native Tribal Health Consortium
AVEC	Alaska Village Electric Cooperative
CDR	Conceptual Design Report
CITY	City of Shageluk
COE	U. S. Army Corps of Engineers
CORP.	Zho-Tse, Inc.
DEC	Alaska Department of Environmental Conservation
DOE	State of Alaska, Division of Energy
DOT	Alaska Department of Transportation and Public Facilities
F	degrees Fahrenheit
FRP	Facility Response Plan
EPA	U.S. Environmental Protection Agency
HUD	Housing and Urban Development
IASD	Iditarod Area School District
IFC	International Fire Code
NEC	National Electric Code
NFPA	National Fire Prevention Association
NFS	non-frost susceptible
SHPO	State Historic Preservation Officer
SPCC	Spill Prevention Control and Countermeasures
USCG	United States Coast Guard
USS	United States Survey
VSW	Village Safe Water
WTP	Water Treatment Plant

1.0 INTRODUCTION

Alaska Energy and Engineering, Inc. (AE&E) has prepared this report for the Alaska Village Electric Cooperative (AVEC). The purpose of this study is to provide a concept design and construction cost estimate for consolidation and upgrade of all public diesel fuel and gasoline storage in the community of Shageluk. This report also provides a concept design and construction cost estimate for construction of a new AVEC power plant facility. For the purpose of this study, the term "diesel fuel" refers to all fuel oil products used for space heating, electrical generation, and heavy equipment operation. The participants in the project include:

- Alaska Village Electric Cooperative (AVEC)
- City of Shageluk (City)
- Zho-Tse, Inc. (Corp.)
- Iditarod Area School District (IASD)

1.1 Program Overview

The Alaska Village Electric Cooperative (AVEC) is pursuing grant funds to upgrade rural bulk fuel tank farms. Following is a brief outline of the program:

- 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 community must demonstrate that the proposed facility will be sustainable by preparing a business plan. The business plan shall describe who will own the facility, and how it will be operated, maintained and replaced.
- New tank farms 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 AVEC will visit a community, discuss the program, and work with residents and the local government to select a site for the new tank farm.
- At the completion of Phase 1 Conceptual Design, the community will be requested to review and approve the location of the collocated tank farm and power plant, the number and volume of fuel tanks, and a draft business plan.
- During Phase 2, Design Completion, the design for the new tank farm will be completed. An environmental assessment will be prepared and site control documented. A business plan will be prepared for signing.
- Each community will be requested to provide "in kind" contributions by providing the land for the new tank farm and power plant and free use of local heavy equipment. The grant funds pay for equipment fuel, maintenance, and repairs of equipment during construction.
- Project may include local hire and construction trade training programs, subject to Denali Commission funding.

- If construction funding is awarded then the business plan will be sent for signature and construction procurement will start.
- Ineligible Projects: Funding is not available through AVEC for fuel tank trucks or trailers, fuel to fill the tank farm, operation & maintenance costs, or residential tank upgrades. Loans for fuel tank trucks and trailers may be available through USDA.
- Training Available: AVEC has several training programs available for communities.

1.2 Community Description

Shageluk is located on the east bank of the Innoko River, approximately 20 miles east of Anvik and 34 miles northeast of Holy Cross. The Innoko is a tributary of the Yukon River. It lies at approximately 62.68222° North Latitude and -159.56194° West Longitude. (Sec. 22, T030N, R055W, Seward Meridian.) The area encompasses 10.6 sq. miles of land and 1.4 sq. miles of water. Shageluk has a cold, continental climate. Summer temperatures average from 42 to 80, winters can range from -62 to 0. Annual precipitation is 67 inches, with average snowfall of 110 inches. The Innoko River is generally ice-free from June through October. The population was estimated at 129 residents in 2000. Local governments include a second class city, an IRA council, and a village corporation. Shageluk is located in the Mt. McKinley Recording District, the Iditarod Area School District, and Doyon, Limited, Regional Native Corporation, but is not within an organized borough.

1.3 Site Investigation

Steve Stassel and Trevor Krupa of Alaska Energy and Engineering (AE&E) were in Shageluk August 28 through 30, 2003, to perform a site investigation for the proposed bulk fuel and power plant upgrade project. Molly Sheldon of the Alaska Village Cooperative (AVEC) arrived on August 29, and a community meeting was held to discuss the project. Local citizens along with the following City council and Corp. board members attended the meeting:

- Betty Howard, Shageluk City Council
- Brenda Goldie, Shageluk City Council
- Harvey Benjamin, Shageluk City Council
- Myrtle Benjamin, Shageluk City Council
- Kathy Workman, Shageluk City Council
- Alden Walker, Sr., Corp. President
- David Walker, Corp. Board
- Frank Benjamin, Corp. Board

On October 9th, Allan Murfitt of A.W. Murfitt Company traveled to Shageluk with Trevor Krupa to perform a geotechnical evaluation of the proposed project site and to identify potential borrow sources.

Prior to the field investigation, available information was obtained and analyzed, including a prior Bulk Fuel Assessment prepared for the AEA/REG, aerial photographs, community profile, survey plats, PCE fuel use data, Corps of

Engineers wetlands and flood information, and other relevant data. Additional information and input was obtained from the following individuals:

- Mark Teitzel, AVEC, 561-1818, 561-5683 fax
- Betty Howard, City, 473-8221, 473-8220 fax
- David Shelborne, IASD, 524-3033, 524-3933 fax
- Lisa Benjamin, Corp., 473-8262, 473-8217 fax
- Liz Shelvers, Yukon Fuels, 777-5505, 777-5550 fax
- Shaen Tarter, Yukon Fuels, 777-5505, 777-5550 fax
- Carey Carpenter, ANTHC, 729-3709, 729-4089 fax

1.4 Code Analysis

Prior work performed by the State of Alaska Division of Energy (DOE) included a code evaluation of existing facilities and preparation of a database summarizing results. The existing facilities were reviewed and information in the database verified. Since the time the DOE code evaluation was performed, significant changes have occurred to tank farm facility 4. The following is a summary of existing facility deficiencies observed:

- Improper Secondary Containment (Diking) – All tanks are within lined dikes that appear to be of adequate capacity as required by the Fire Code and EPA. All dikes have weeds or willows growing in the containment areas, and liners may not be liquid tight.
- No Security Fence – All tanks are currently accessible to the public with no security fencing. This presents a hazard to the community as well as increasing the chance of a spill or fire due to vandalism and theft.
- Improper Piping and Valves - Existing piping systems consist of steel piping with a combination of welded and threaded joints. Threaded joints are particularly prone to leaking. Some valves are made of bronze, in violation of the Fire Code.
- Improper Tank Foundations - Several tanks are installed on improper timber cribbing foundations in violation of the Fire Code.
- No Emergency Vents – Some tanks do not have emergency vents, in violation of the Fire Code.
- Improper Tank Setback - Several tanks do not meet setback requirements of the Fire Code.
- Dispensing From Aboveground Tanks Without Protective Systems - State Fire Marshall requirements stipulate protective devices and piping systems to limit the quantity of fuel directly connected to the dispensers and to prevent a gravity discharge of fuel in the event of a failure of the dispenser or piping. No protective devices are installed.

The combination of deficiencies poses a significant threat to public safety and the environment. A major project is required to construct a new code and regulation compliant tank farm to meet the long-term needs of Shageluk.

The concept design for the new facility has been prepared to meet current code and regulatory requirements, which include:

- The 2000 Edition of the International Fire Code, including State of Alaska Amendments
- The 2002 Edition of the National Electrical Code
- 40 CFR, Part 112.1-12, U.S. Environmental Protection Agency Spill Prevention Requirements
- 33 CFR, Part 154.30 & 154.1030, U.S. Coast Guard Spill Prevention Requirements

The design also incorporates appropriate industry standards such as National Fire Protection Association (NFPA) and American Petroleum Institute (API) as well as proven methods and materials that have been used successfully on other rural bulk fuel facilities in similar locations and climates.

2.0 EXISTING FUEL STORAGE FACILITIES - FUNCTION AND CAPACITY

The existing fuel storage facilities are located at four separate sites – one approximately 1,050' north of the city building, one approximately 875' northwest of the city building, one approximately 700' west of the city building, and one approximately 650' southwest of the city building. Locations of existing facilities are shown on attached drawing M1. Refer to Appendix F for existing tankage data and Appendix G for representative photos. Tank farm numbers below correspond to the numbers assigned in the DOE database. Each individual facility was evaluated to determine specific needs and deficiencies, and tanks were visually examined to determine suitability for re-use. The following paragraphs summarize findings for each tank farm:

- ***AVEC – Community Power Plant (#1).*** The AVEC tank farm is located on the platted AVEC Generator and Tank Farm site at the north end of the community adjacent to Hamilton Slough. The AVEC tank farm consists of six vertical BIA style single wall tanks in a lined earthen dike. Tank foundations consist of multiple courses of timbers. Tanks are barge filled at a marine header located at the south bank of the slough and through a combination threaded and grooved end fill pipeline to a threaded tank manifold. Fuel is fed from the manifold through a threaded pipeline to the power plant. This facility has no security fencing and no warning or identification signs.

- ***IASD – Innoko River School (#2).*** The IASD tank farm is located on Lot 4, Block 9 of U.S. Survey 4493. The IASD tank farm consists of eight vertical BIA style single wall tanks in a lined earthen dike. Two tanks are disconnected from the piping manifold and are used for contingency storage. Tank foundations consist of multiple courses of timbers. Tanks are barge filled by dragging a hose to a fill connection located in the dike and through welded steel piping manifold to threaded valve and tank connection. Fuel is fed from the piping manifold to a transfer pump through below grade welded steel distribution piping to a partially buried intermediate tank at the school. From the intermediate tank, fuel is fed to a day tank in the school. This facility has no security fencing.

- ***CORP. - Retail Sales (#3)***. The Corp. facility is located on the same lot with the IASD facility. The Corp. operates a retail sales facility consisting of three horizontal single wall gasoline tanks and one horizontal single wall diesel fuel tank. Tank foundations consist of timbers/mudsills. The tanks are barge filled directly by dragging a hose from the barge landing. Gasoline is dispensed through a meter, pump, hose and nozzle within a locked wooden shed. Diesel fuel is dispensed through a meter, pump, hose and nozzle. There are inadequate offsets from tanks to the dispenser. This facility has no security fencing and no warning or identification signs.

- ***CITY – Heavy Equipment/Drum Fill (#4)***. The City facility is located on Lot 2, Block 7 of U.S. Survey 4493. The City tank farm consists of two vertical BIA style single wall tanks in a lined earthen dike. Tank foundations consist of multiple courses of timbers. The tanks are barge filled directly by dragging a hose from the barge landing. The City operates this facility for the fueling of heavy equipment and for heating City buildings. Diesel fuel is dispensed through a meter, pump, hose and nozzle. There are inadequate offsets from tanks to the dispenser. This facility has no security fencing and no warning or identification signs.

2.1 Existing Equipment Suitable for Reuse

All of the existing tanks and piping systems are old and in very poor condition. There is nothing suitable for reuse.

2.2 Existing Tanks

Tank cleaning, demolition, and/or disposal is not included in the scope of this project. The scope of this project does include removal from service and abandoning in place existing tanks identified on sheet M1. All abandoned tanks will be drained of product, piping removed, and tank connections plugged or blind flanged. The existing AVEC tanks will be removed from the AVEC dike and stored along the northern edge of the new AVEC dike. AVEC will work with the community to seek grant funding to clean, remove and dispose of existing tankage not used in this project.

For purposes of seeking separate funding for tank cleaning and disposal, a budgetary cost estimate is provided in this section. For prior similar projects in rural Alaska, the average cost to clean, cut-up and dispose in a local landfill a diesel tank is $10,000. The average cost to clean, cut-up and dispose in a local landfill a gasoline tank is $11,000, including off-site disposal of 12 drums of contaminated product. The total estimated cost to properly clean and dispose of 21 fuel tanks in Shageluk is $266,400 (refer to Appendix F for existing tank data).

3.0 CURRENT FUEL CONSUMPTION

Diesel fuel is used to heat various city buildings (post office, preschool, teen center, washeteria, city office, clinic), the school, and residential homes. Diesel fuel is also used to generate electricity and to fuel the City's heavy equipment. All gasoline is for retail sales for use in vehicles, four wheelers, and private boats. Current consumption quantities are based on fuel delivered to the community by Yukon Fuels for the years of 2001 and 2002.

The following table summarizes average and peak consumption and existing storage capacity. All capacities are in gallons. Net capacity is calculated as 90% of the tank gross (shell) capacity.

CURRENT CONSUMPTION VERSUS EXISTING CAPACITY

Project Participant (Product)	Average Annual Use	Peak Annual Use	Existing Net Capacity (90% Gross)	Existing Gross Capacity
AVEC (Diesel)	29,500	35,394	51,360	57,066
IASD (Diesel)	12,500	15,006	28,975	32,196
Corp. (Diesel)	10,025	11,889	7,219	8,021
Corp. (Gasoline)	16,000	17,500	18,746	20,829
City (Diesel)	10,007	11,010	11,254	12,505
		Existing Total	**117,554**	**130,617**

Appendix F of this report identifies existing and proposed tanks by owners, and provides dimensions, gross and net capacities, and contents by products. Appendix F also shows the percent increase in proposed gross capacity over existing capacity.

3.1 Planned Infrastructure Improvements

It is important to evaluate the impact of recent installations and planned near-term infrastructure improvement projects on existing utility systems and fuel consumption. School additions, water and sewer expansions, new homes, as well as other community improvements all can adversely impact the adequacy of existing utilities. Planned infrastructure improvements within 5 to 10 years that are anticipated to increase local fuel consumption include the possible addition of one new house, a new duplex at the school (under construction), and a future water and sewer project. A new clinic was completed in 2002. Fuel use data for the new clinic is not included in the historical use data received. Additional capacity will be included in the new tank farm to meet the anticipated increase in the local fuel consumption caused by these projects. Following is the estimated impact of these projects:

- Heating for one New Home – 1,000 Gallon Increase in Corp. Diesel Sales.
- Population Growth – 2,000 Gallon Increase in Corp. Gasoline Sales.
- Heating for New Duplex at School – 3,000 Gallon Increase in IASD Diesel Use.
- Water and Sewer Project – 6,000 Gallon Increase in City Diesel Use.

- Heating for New Clinic - 2,000 Gallon Increase in City Diesel Use.

In 2002, the Shageluk power plant consumed a total of 32,398 gallons of diesel fuel. According to AVEC's current model for load growth, the 10 year projected annual fuel consumption for Shageluk is 64,825 gallons. (200% of the current consumption).

3.2 Alternative Energy / Efficiency Improvements

The AVEC diesel electric generators provide all electric power for the community of Shageluk. The existing power plant does not have heat recovery capability, in part due to its remote location from potential enduser buildings and the relatively small amount of heat available from the power plant.

The potential to provide recovered heat from the new power plant was investigated as part of this study. The two closest community facilities are the school and water plant. The school is located a straight line distance of about 1,200 feet and the washeteria 1,000 from the power plant. The new power plant will utilize electronically injected diesel engines with air-cooled aftercoolers. Diesel engines that have air-cooled aftercoolers reject about 2/3rds of the heat to the jacket water as compared to diesel engines that have water-cooled aftercoolers.

It is estimated that the new power plant will reject approximately 7,215 equivalent gallons of heating fuel annually to the engine cooling system. Of this amount, about 5,623 equivalent gallons will be available during the heating season (between September and May). The new power plant is estimated to use the equivalent of about 3,692 gallons of heating fuel annually for plant heat, parasitic piping and radiator losses, which leaves 1,931 gallons available for end-user buildings. The nearest community building (water plant) is about 1,450 lineal feet from the power plant, which would require 2,900-feet of arctic pipe round trip. The heat loss over this length of arctic piping equates to about 509 gallons of fuel per month. The net result is that there is insufficient recovered heat available from the power plant to provide useable heat to a building located more than about 100-feet from the power plant.

The Alaska Energy Authority/Alaska Industrial Development and Export Authority published a draft Rural Alaska Energy Plan dated December 31, 2002 as a follow-up report to the previously released Screening Report of Alaska Rural Energy Plan dated April 2001. The Screening Report evaluated a dozen alternative energy technologies, other than diesel engine heat recovery. Only wind energy was identified as an alternative energy technology warranting further evaluation in the draft Rural Alaska Energy Plan. Currently available wind data does not support Shageluk as a viable candidate for a wind energy program using currently available technologies.

There are no other known practical energy sources, such as solid fuel or natural gas, available at Shageluk. Additionally, there is no watershed capable of producing commercial quantities of power using currently available hydroelectric technologies. At this time, it appears that diesel generation and possibly end-use conservation are the only viable energy technologies available for Shageluk.

3.3 Tank Capacity Requirements

The tank farm must be designed to meet the combined needs of all users with sufficient capacity to accommodate future growth. The combined gross storage capacity of existing community tank farms is 130,617 gallons. The proposed new facility gross capacity of 190,000, which is 145% of the existing capacity. This exceeds the Denali Commission guideline of 120% of existing capacity. AVEC has standardized and fabricated two sizes of bulk storage tanks - 22,300-gallon gross capacity (10' diameter by 38' long) and 27,000-gallon gross capacity (11' diameter by 38' long). It would require nine of the smaller tanks to meet the Denali Commission's 13-month capacity requirement, compared to only six of the larger tanks. To minimize the dike footprint and the corresponding site development work, the larger 27,000-gallon gross capacity tanks will be used. With the exception of the IASD, each participant's proposed annual fuel consumption has been rounded up to the next whole 27,000-gallon tank. The tank farm will utilize six of the 27,000-gallon tanks at the tank farm, and one 8,000-gallon dual product fire-rated dispensing tank. Due to the distance from the tank farm, a 20,000-gallon double wall tank will be located at the school. In total, this will provide a gross storage (shell) capacity of 190,000 gallons and a net storage (90% of gross) capacity of 171,000 gallons. With this capacity, there should be no need to provide space in the dikes for installation of future additional tanks.

The following table compares the annual use of each product to the proposed net useable tank capacity for the new facility:

SHAGELUK ESTIMATED CONSUMPTION VERSUS PROPOSED CAPACITY

Project Participant (Product)	Current Peak Annual Use in Gallons	Estimated Future Peak Annual Use in Gallons (1)	Proposed Net Capacity in Gallons (2)	Proposed Gross Capacity in Gallons
AVEC (Diesel)	35,394	64,825	72,900	81,000
IASD (Diesel)	15,006	18,006	18,000	20,000
Corp. (Diesel)	11,889	12,889	27,900	31,000 **(3)**
Corp. (Gasoline)	17,500	19,552	27,900	31,000 **(3)**
City (Diesel)	11,010	19,010	24,300	27,000
		Proposed Total	**171,000**	**190,000**

(1) Estimated future use based on planned development.

(2) Net capacity (90% of gross shell capacity).

(3) Includes the bulk storage tank and fire rated dispensing tank.

4.0 SITE SELECTION

Available land within the community suitable for a new power plant and tank farm is limited. The community is surrounded by hills to the south and east, by Hamilton Slough to the north, and the Innoko River to the west. The best option for the new tank farm and power plant appears to be the existing AVEC plant site and adjoining undeveloped City property to east. This proposed site was presented at the community meeting held on August 29 with no objections received from community members in attendance (Refer to Appendix G for site photos).

A sanitation facilities master plan has been prepared for Shageluk by URS. Carey Carpenter with ANTHC was contacted regarding the proposed water and sewer project. A copy of the final master plan was obtained and reviewed for potential impacts to the power plant and tank farm project. The sanitation master plan includes the development of a new sewage lagoon on the City property just east of the existing lagoon. The proposed tank farm and power plant site does not appear to conflict with the future construction of the new sewage lagoon. The proposed project location (and approximate location of the future sewage lagoon) is shown on the attached site plan sheet M1.

4.1 Tank Farm Site

The new collocated tank farm facility will be built on the existing AVEC plant site and adjacent City property. The existing AVEC parcel is a 0.862-acre lot within Block 10 of the Shageluk Townsite Survey, U.S. Survey 4493, as shown on plat 85-4 and recorded in the Mt. McKinley recording district. The adjacent City property is a portion of block 10 of the Shageluk Townsite Survey, U.S. Survey 4493 located immediately west of the AVEC parcel.

The existing AVEC plant site will be leveled, the surface vegetation and organic materials removed, and any excess material reused for the new power plant pad. Earthen berm containment dikes for the new tank farm will be constructed of locally available silty sands and silts, and will be capped with imported gravel. The existing AVEC pad is elevated about 6' above the surrounding terrain, which is above all reported flood events. The proposed project location is shown on the attached site plan sheet M1.

4.2 Power Plant Site

The new power plant will be constructed on an earthen pad adjacent to the existing AVEC site. The new pad will be elevated to match the existing AVEC pad and extend about 200-feet to the east. The power plant site will be partially located on the existing AVEC parcel, as well as on Block 10 of the Shageluk Townsite Survey, U.S. Survey 4493.

Two test holes were dug at the new pad site and soil samples collected for analysis. The top six-inches of test hole #2 contained discarded trash and tin cans. At the community meeting, residents indicated that the existing AVEC pad is built atop an abandoned landfill, but were unable to confirm how far east of the AVEC plant site the landfill extended. A geotechnical investigation confirmed the proposed site soils are suitable for pad construction. All surface vegetation, organic materials, and trash will be removed, and a geotextile fabric placed prior to placing fill on the site. The new pad will be constructed of locally available silty sands and silts, and will be capped with locally available material. The proposed project location is shown on the attached site plan sheet M1.

4.3 School Site

The IASD double wall tank will be placed on an earthen pad constructed south of the school voc-ed building. The new pad will be located within the school site, Lot 5, Block 4 of the Shageluk Townsite Survey, U.S. Survey 4493, as recorded in the Mt. McKinley recording district.

A geotechnical investigation confirmed the proposed site is suitable for pad development. All surface vegetation and organic materials will be removed and a geotextile fabric placed prior to placing fill on the site. The new pad will be constructed of locally available silty sands and silts, and will be capped with imported gravel. The new pad will be elevated approximately 2' above the surrounding terrain and the site graded to provide positive drainage along the east side of the school property. The proposed project location is shown on the attached site plan sheet M1.

4.4 Site Control

A Certificate to Plat was prepared by Fairbanks Title Agency on August 25, 2003, and is included in Appendix C. The Certificate to Plat indicates the AVEC plant site was deeded from the City to AVEC on May 2, 1985. The remainder of Block 10 is owned by the City of Shageluk.

The project site will be surveyed and a plat prepared as shown on sheet M1. The plat will provide separate lots for the AVEC power plant/tank farm and new community tank farm, as well as a dedicated road right-of-way to provide access to both lots. Appropriate site control documents and deeds will be prepared for review, approval and execution by the City and AVEC to carry out the objective of the replat.

The Shageluk School is located within Lot 5, Block 4, and the IASD and Corp. tank farms are located on Lot 4, Block 9, of U.S. Survey 4493. A small rectangular parcel within Lot 5 has been deeded from the Bureau of Indian Affairs (BIA) to the State of Alaska, Division of Design and Construction, and was recorded in the Mt. McKinley recording district. The remainder of Lot 5 and all of Lot 4 (Shageluk School Site) was deeded in October 1984 from the BIA to the State of Alaska, Department of Education. However, the Shageluk School Site Deed was incorrectly recorded in the Kuskokwim Recording District.

The Department of Education and Early Development has been notified of the error and has been requested to record the Deed in the Mt. McKinley Recording District.

5.0 PROPOSED FACILITY DESCRIPTION

The proposed tank farm and power plant project is contingent upon relocating and upgrading the new AVEC power plant facility just east of the existing AVEC site. Unless the AVEC plant facility is relocated, the new collocated tank farm site will need to be moved to a less accessible and convenient location. The cost estimate included in Section 8.0 assumes both the tank farm and power plant project will go forward as a combined project.

5.1 Bulk Fuel Storage Consolidation and Upgrade

The tank farm project will collocate the AVEC, City, and Corp. tanks. The proposed design includes a two-cell dike to contain the tanks in accordance with Fire Code and EPA requirements. Though joined by a common full height dike wall, two separate lined and fenced earthen containment cells will be constructed.

The City/Corp. cell will contain three 27,000-gallon single wall bulk storage tanks, and one 8,000-gallon dual compartment fire rated dispensing tank. The City will have one diesel bulk tank. The Corporation will have one diesel bulk tank, one gasoline bulk tank, and the dual product dispensing tank. The AVEC cell will contain three 27,000-gallon single wall bulk storage tanks. The AVEC bulk tanks will be piped to a day tank at the power plant. The dike cells will be enclosed within a chain link fence topped with barbed wire.

A service station style dual product dispenser with a gravel turnaround area will be located west of the new tank farm. The dispenser will be operated by the Corp. for the retail sales of diesel fuel and gasoline, and will be installed in a lighted and fenced security enclosure. The Corp. requested the dispenser be equipped with an inventory control system. The City drum/heavy equipment fueling station will be located adjacent to the dispensing facility.

The power plant facility will consist of eight modular buildings, including three generator modules, one control module, three storage modules, and one housing module. The power plant facility will be enclosed within a chain link fence topped with barbed wire.

Due to the distance from the school to the tank farm location, a 20,000-gallon double wall tank will be located at the school site adjacent to the voc-ed building. The IASD tank will be filled by a pipeline from a marine header located on school property near the barge landing. The IASD tank will be piped to the exterior wall of the school boiler room. The project will provide grant funds to IASD, but IASD will be responsible to perform all work interior to the school. This includes routing the pipe through the school wall, replacing the existing 25-gallon day tank with a new 100-gallon day tank, and making all fuel piping and electrical connections to the new day tank. The new day tank will be equipped with redundant overfill protective devices. The new IASD double wall tank will be provided with a submersible pump, arctic grade hose, and a nozzle for filling existing day tanks at the voc-ed building, shop, garage, and future teacher duplex by mobile tank. The relatively small fuel consumption of these out buildings does not justify the cost and complexity required to retrofit the existing day tanks with the necessary overfill protective devices and controls to pipe them to the new IASD tank. The IASD tank will be fenced with a chain link fence and topped with barbed wire.

The proposed tank farm, power plant, and school facilities are shown on the attached site plan sheet M1.

5.1.1 Secondary Containment

The International Fire Code and E.P.A. regulations require fuel tanks to be installed within a secondary containment structure that is capable of holding the contents of the largest tank plus sufficient freeboard to hold accumulated precipitation. The regulations include provisions for alternative secondary containment utilizing double wall tanks with redundant overfill protection

equipment. Based upon local soils conditions and availability of silts, an earthen berm with a membrane liner was determined to be the most practical means of providing secondary containment for the collocated tank farm facility.

The City/Corp. earthen berm dike cell will be sized to provide a net capacity of 43,434 gallons, which is the volume of the largest tank plus 8" of freeboard for precipitation. The AVEC earthen berm dike cell will be sized to provide a net capacity of 38,669 gallons, which is the volume of the largest tank plus 7" of freeboard for precipitation. A full height dike wall will separate the dike cells, and both cells will be lined with separate membrane liners compatible with both #1 diesel fuel and gasoline. A non-woven geotextile fabric will be installed above and below the liner to minimize the risk of puncture and damage and a 4" deep layer of gravel cover will be placed over the liner. A 4" deep cellular confinement grid will be installed over the liner on the interior dike walls to hold the gravel cover in place on the side slopes. A drainage sump will be provided for storm water removal via a siphon hose or portable pump with suction hose.

The IASD tank will be a double wall tank, equipped with redundant overfill protection devices as required to comply with E.P.A. provisions for alternative secondary containment.

5.1.2 Tanks

The new 27,000-gallon tanks are shop built single wall horizontal welded steel tanks built and labeled in accordance with UL 142 and equipped with steel saddle and skid foundations.

The new dispensing tank will be a shop built double wall, dual product, partitioned horizontal welded steel tank built and labeled in accordance with UL 2085 and equipped with a steel saddle and skid foundation. The tank is required to be a two-hour fire rated tank due to its proximity to property lines and road right-of-ways.

The new IASD tank will be a shop built double wall horizontal welded steel tank built and labeled in accordance with UL 142 and equipped with a steel saddle and skid foundation.

All new tanks will be equipped with level gauges, pressure/vacuum whistle vents, emergency vents, manholes, water draws, and flanged fill/withdrawal connections.

The tank farm tank skids will be placed on concrete footings sized to limit soil bearing pressure to 2,000 pounds per square foot. The new IASD tank will be placed on timber mudsills sized to limit soil bearing pressure to 1,500 pounds per square foot.

5.1.3 Piping/Valves/Pumps/Accessories

All piping will be schedule 80 steel except for 1" piping located in exposed areas, which will be schedule 160. All above grade piping within dikes, fenced areas, and buildings will be pre-primed and painted schedule 80 black steel. All buried piping will be schedule 80 steel with a high density polyethylene coating, and provided with cathodic protection. All above grade piping will be installed on

concrete pads, supported from tanks or buildings, and secured with steel pipe straps or hangers. All piping joints will be welded or flanged except for connections to pumps and specialty valves, which may be threaded. Sufficient flanged joints will be provided to allow service of pumps and other devices. All connections to pumps and tanks will be made with stainless steel flexible connectors. Each isolated section of piping will be provided with pressure relieving devices to account for thermal expansion of product caused by temperature fluctuations. Provisions for movement of the piping caused by thermal expansion and contraction will be included. All valves will be steel body industrial grade valves intended for use with fuels.

The collocated facility will include new 3-inch diameter fill pipelines routed on top of the dike walls from the bulk tanks to marine headers. There will be separate marine headers for AVEC, the City/Corp. diesel fuel, and for the Corp. gasoline. The AVEC marine header will be located outside the northwest corner of the City/Corp. dike cell within an enclosed 84-gallon metal drip pan. The City/Corp. diesel and the Corp. gasoline marine headers will be located within the City/Corp. dike cell. For AVEC, a 2" diameter transfer pipeline will be routed from the bulk tanks to the day tank pump in the power plant control module. A normally closed actuated ball valve electrically interlocked to the day tank pump will be installed in the AVEC transfer pipeline to prevent gravity flow of product when the day tank pump is not running. For the Corp., separate 2" diameter transfer pipelines will be routed along the dike wall from submersible pumps in the bulk tanks to the dual product dispensing tank. Separate 2" diameter transfer pipelines will be routed from submersible pumps in the dispensing tank to a service station dual product dispenser. The dual product dispenser will be installed in a security enclosure west of the tank farm. A key-access type inventory control system will be installed to allow local residents access to fuel without requiring a Corp. employee to oversee sales. This system has separate keys for each party (family or business). A key is required to activate the dispensing system. Adjacent to each key switch is a mechanical totalizing meter that maintains a permanent total of fuel dispensed by each party. For the City, a 2" diameter transfer pipeline will be routed along the dike wall from a submersible pump in the bulk tank to the drum/heavy equipment fueling station equipped with a filter, meter, hose and nozzle. Drawing M4 shows the proposed AVEC tanks and piping, and drawing M5 shows the proposed Corp. and City tanks and piping.

At the school facility, a new 3" diameter fill pipeline will be routed below grade from the IASD tank to the marine fill point located near the barge landing as shown on M1. A 2" diameter transfer pipeline will be routed below grade from the IASD tank to a new 100-gallon packaged day tank in the school mechanical room. The packaged day tank will be equipped with a suction pump, automatic controls, level gauges, and redundant overfill protection devices and alarms. A normally closed actuated ball valve electrically interlocked to the day tank pump will be installed at the IASD tank outlet to prevent gravity flow of product when the day tank pump is not running. The IASD tank will also be equipped with a hose and nozzle for transferring diesel fuel by portable tank to the voc-ed, shop and garage day tanks. Drawings M6 and M7 show the proposed IASD tank and piping.

5.1.4 Security

The AVEC tank farm and power plant facility will be fenced separately from the community tank farm facility by an 8' tall chain link fence with a 1' high barbed wire top. Three feet and 16' wide access gates will be provided into the AVEC fenced enclosure.

The community tank farm facility and the IASD tank will each be enclosed by 8' tall chain link fences with a 1' high barbed wire tops. Three feet wide access gates will be provided in the fenced enclosures for ingress and egress.

The dual product dispenser will be installed within a post structure with concrete floor slab, metal roof, and full-height chain link fence walls. All valves will be provided with lockable handles to prevent theft and vandalism. Pump controls will be installed within fenced security areas or buildings. Area lighting controlled by photocell will be provided at the dispensers, pump controls, and dike for security and spill detection and to enhance winter operation.

5.2 Existing AVEC Power Plant

The existing AVEC power plant is housed in a 15'x36' insulated metal building on a wood post and pad foundation and two storage containers. The power plant building was constructed in the mid-1970's and was located in the center of the community. The plant site was relocated at the request of the community to the present site in the mid-1980's. The power plant is equipped with three diesel gen-sets: one Cummins LTA-10 rated at 142 kW, and two Allis Chalmers 3500's each rated at 70 kW. The generating voltage is 208/120 volt grounded-Y. Power is provided to the community via a 7.2/12.47 kVA three phase overhead distribution system. There are two banks of three phase step-up transformers adjacent to the plant, which feed power to distribution system. The distribution system is sectionalized into two separate feeds. The existing power plant structure is nearing the end of its useful life and the generation equipment is in need of replacement (see Appendix G for photos).

Historical peak loads exceed the generating capability of the two 70 kW gen-sets, which requires the single LTA-10 gen-set be operational and on-line during the winter months. There is currently no piped central water and sewer system in Shageluk. Projected electric loads based on meeting the electric demand of the future piped water and sewer project are between 35% and 45% greater than the present load.

5.2.1 New AVEC Power Plant

The new AVEC power plant will be constructed using prefabricated modules. The facility will include three generator modules, one control module, one office module, and three storage modules (refer to Appendix A). The skid-mounted modules will be installed at grade on the new power plant pad and accessed by the new platted road along side the new tank farm. The new power plant will be tied into the distribution system at the existing terminal poles located adjacent to the bridge.

The resulting power generation capacity for the power plant is as follows:

Proposed Total Diesel Power Generation Capacity

Generator	Description	Capacity (Kilowatts)
No. 1	Detroit Series 60	200 kW
No. 2	Detroit Series 60	200 kW
No. 3	Detroit Series 60	200 kW
		Total = 600 kW

The Detroit Diesel Series 60 gen-sets are highly efficient at low loads, with efficiencies of better than 14.3 kW generated per gallon at 50% load and 12.5 kWh per gallon at 25% load. This exceptional efficiency at low loads allows sizing the gen-sets to carry the future increased loads associated with the future piped water & sewer project without sacrificing fuel efficiency or incurring increased maintenance costs in the interim.

5.3 Proposed Operating Scenario

The AVEC power plant and tank farm facility will be located on AVEC property. AVEC will be the primary owner and operator of the AVEC facility. As primary operator, AVEC will be responsible for the overall management of its facility.

The City/Corp. tank farm will be located on City land and will be the primary owner of the facility. The Corp. will continue to operate all retail sales and will have the majority of storage capacity. The Corp. is the prime candidate to serve as the primary operator with overall management responsibility for the facility. Management responsibilities include: daily operations; maintenance of all tanks, pumps, and piping systems; removal of storm water from the dike; annual pressure testing of pipelines; maintenance and replacement of spill response equipment and supplies; and snow removal. These operating costs will need to be determined on a per gallon of throughput basis (as part of the required Denali Commission required Facility Business Plan) and the price of fuel adjusted to cover the facility operating costs.

The IASD will be the owner and operator of the school tank and associated piping and will be responsible for the day-to-day operation of its fuel facility.

6.0 PERMITTING AND SPILL RESPONSE

The new facility will be subject to regulatory requirements of both State and Federal agencies including the Division of Governmental Coordination, Division of Fire Prevention, U.S. Environmental Protection Agency, and the U.S. Coast Guard. Depending upon specific local conditions, additional permitting agencies such as the U.S. Fish and Wildlife Service, the U.S. Army Corps of Engineers, the State Historic Preservation Office, and the Alaska Department of Natural Resources may be involved in the permitting process.

6.1 Environmental Assessment

An Environmental Assessment (EA) will be completed prior to construction of the project. An EA is required for all federally funded projects, or projects requiring a federal permit (such as a Corps of Engineers Wetlands Permit). The EA

confirms there is no significant impact to the environment caused by the project. Although Shageluk is not located in a Coastal Management area, as part of the EA, a Coastal Zone Management Project Questionnaire will be completed and submitted to the Division of Governmental Coordination. The Coastal Zone Management Project Questionnaire will help identify state or federal permits that may be required. A Corps of Engineers Wetlands is not anticipated to be required, as the project does not involve placing of fill in wetlands or below ordinary high water. However, a Request for Jurisdictional Determination will be submitted to the Corps of Engineers as part of the EA permitting process. If required, this project should qualify for review under the Department of the Army General Permit 96-07 for village bulk fuel facilities, which streamlines the permitting process.

6.2 Fire Code

A Plan Review permit from the State Fire Marshal is required. Final stamped design drawings will be submitted for review and approval prior to construction. Plans will be reviewed for conformance with the International Fire Code and portions of related codes including the International Building Code and the National Electrical Code. In prior years, the review process has only taken 3 to 4 weeks; however, some projects have taken over 6 months. Generally, site work and mobilization is allowed to proceed prior to approval but the permit must be in place prior to placement of tanks or similar installation. Plans should be submitted by December 2004 to ensure approval in time for spring construction.

6.3 Spill Response

Because the new facilities will have oil storage tanks in excess of 1,320 gallons and will receive delivery by marine vessel, it will be subject to U.S. Environmental Protection Agency and U.S. Coast Guard regulations. Separate Operations Manuals and Letters of Intent will be prepared for each facility, and will be submitted to the Coast Guard. Separate Oil Spill Response Plans will be prepared and submitted to both the Coast Guard and the EPA. The facilities will also require preparation of a Spill Prevention Control and Countermeasures (SPCC) plans. The plans will address all tanks of 55 gallon or greater capacity at each location. The required Coast Guard and EPA plans will be prepared upon completion of facility construction as a coordinated package.

Spill response gear including sorbent material and protective safety gear will be purchased for each facility and left on-site upon project completion along with 5,000 gallon foldable portable tanks to serve as oil-spill contingency storage.

7.0 CONSTRUCTION PLAN

AVEC has a history of administering similar projects on a "modified" force-account basis. Force-account construction involves the owner or grantee acting as the employer and utilizing primarily local labor. This method tends to achieve a higher percentage of local hire and is strongly supported by many communities and funding agencies. The highly technical nature of tank farm projects requires a limited number of workers with specific experience and expertise to be brought in for the project when not available locally. All work must be supervised and managed by a superintendent with extensive experience in the construction of rural fuel facilities. Skilled craftsmen with appropriate certifications must perform

all specialty work, such as pipe welding and electrical installation. An experienced construction manager will be required to recruit the necessary skilled labor, coordinate the construction team, and oversee procurement and project logistics. The design engineer will provide quality control through communication with the construction manager and periodic on-site inspections.

7.1 Local Job Skills

An inquiry was made for information regarding the availability of specialty skilled labor in Shageluk. The following table summarizes the results:

Skilled Trades	Number Available
Certified Welder (1)	1
Welders Helper	3
Journeyman Electrician (2)	1
Apprentice Electrician	1
Heavy Equipment Operator	8
Heavy Equipment Mechanic	1
Truck Driver	8
Laborer	6

(1) With current API Welding Certificate
(2) With current Certificate of Fitness

In addition to the specialty trades listed, there are a number of local residents with general labor experience in various types of construction. It appears that at a minimum a project superintendent, a pipe welder/mechanical foreman, and a journeyman electrician will need to be brought into Shageluk for this project.

7.2 Local Equipment

A preliminary inventory was performed on local heavy equipment in Shageluk as listed in the following table:

Unit	**Make/Model #**	**Owner**	**Reported Condition**
6 yd. Dump Truck	Ford F Series 1994	City of Shageluk	Good
6 yd. Dump Truck	International 1982	City of Shageluk	Poor
Dozer	John Deere 750D	City of Shageluk	Poor
Dozer	John Deere 350CE with backhoe attach.	City of Shageluk	Fair
Loader	Caterpillar IT18B	City of Shageluk	Good
Loader	Ford A-62	City of Shageluk	Poor

The equipment was reported to be in poor to good condition. Prior to the start of construction, an experienced fleet service mechanic will need to be sent to Shageluk to go through the equipment with the local mechanic to ensure the equipment is in proper operating condition. An additional dump truck may be

required to be brought into the community for moving fill from the borrow source to the project site.

7.3 Material Sources

Silty sand and silts for constructing the power plant pad, bringing the existing AVEC pad to grade, and forming the dike walls are available from a local pit near the school approximately 1,400' from the project site. The City owns the land and the rights to the material in the pit. When removing material from this pit, attention needs to be given to avoid extending the pit further to the southwest towards the cemetery and to minimize runoff from the pit.

Select gravel for use in lining inside dike walls, making concrete, and topping selected driving and walking surfaces will be imported by barge into the community.

8.0 SCHEDULE

The construction schedule must take into account freight options and fuel delivery schedules. Line-haul barge deliveries originating in Seattle or Anchorage typically arrive in Shageluk twice a year once in June and then again in August. Though the community typically receives two barge deliveries per year, Yutana Barge Lines indicated the select gravel must be hauled on the first (spring) barge only. Barge fuel deliveries also typically occur in June and August.

Tools, miscellaneous supplies, and smaller materials can be brought directly to Shageluk by small freight aircraft (Casa or DC-3). The Shageluk airport is located over four miles outside the community.

The schedule shown below has been prepared based on a two-year construction schedule, with power plant pad development summer of 2004, and construction of the tank farm and power plant summer of 2005. If funding availability does not allow power plant pad development in 2004, it is feasible to condense the entire project into one year with construction beginning spring of 2005.

All construction materials and equipment required for power plant pad construction will arrive on the first barge in June 2004. The new power plant pad will be completed in July. Upon completion of the power plant pad, equipment and materials not needed for construction in 2005 will be backhauled out of the community on the last barge of the year.

All construction materials and equipment required for tank farm and power plant construction, including select gravel, AVEC modules, and tanks will arrive on the first barge in June 2005. The new AVEC modules will be set on the new pad, plumbed into temporary fuel storage, and brought online. Should alternative temporary power be required, one of the existing gen-sets in the AVEC Butler Building will be installed in a storage container and wired into the distribution system. The existing AVEC plant and tank farm will then be demolished, the new tank farm dike will be constructed, the tanks set and piping installed. The new tank farm and IASD tank will be complete enough to receive fuel on the last fuel barge in August. All punch list items should be completed by September 2005.

The schedule on the following page has been developed based on this proposed work plan:

PROPOSED PROJECT SCHEDULE

	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN
PH. II TASKS (2004)												
PERMITTING		x----------x										
65% DESIGN	x----x											
REVIEW & FUNDING		x----x										
FINAL DESIGN			x----x									
MOB DUMP TRUCK					x							
POWER PAD CONSTRUCTION					x---x							
DEMOB DUMP TRUCK							x					
PH. III TASKS (2005)												
ORDER TANKS	X—x											
ORDER MATERIALS		x------x										
FREIGHT & MOBILIZATION				x---------x								
PLACE MODULES					x							
INSTALL GROUNDING GRID					x							
TEMPORARY POWER					X							
DEMO EXIST. AVEC PLANT					X							
TANK FARM SITE/DIKE					x---x							
PLACE NEW TANKS						x--x						
RECEIVE FUEL						x-x						
PIPING, DISPENSER, ETC.							x----x					
FENCE, ELECTRICAL, ETC.							x----x					
PUNCH LIST COMPLETION							x-x					
SPILL PLANS & CLOSE OUT								x----x				

9.0 COST ESTIMATE

The construction cost estimates have been developed based on a "modified" force-account approach utilizing a combination of local labor, certified craftsmen, and specialty sub-contractors under the direction of an experienced construction manager. Labor rates are based on Title 36 equivalent wages for certified specialty labor and prevailing local force-account wage rates for general labor and equipment operation. Separate construction cost estimates were developed for the bulk fuel and the power plant portions of this project. The Denali Commission has separate cost containment guidelines for bulk fuel and power plant projects. Detailed cost estimates are included in Appendix B. The total

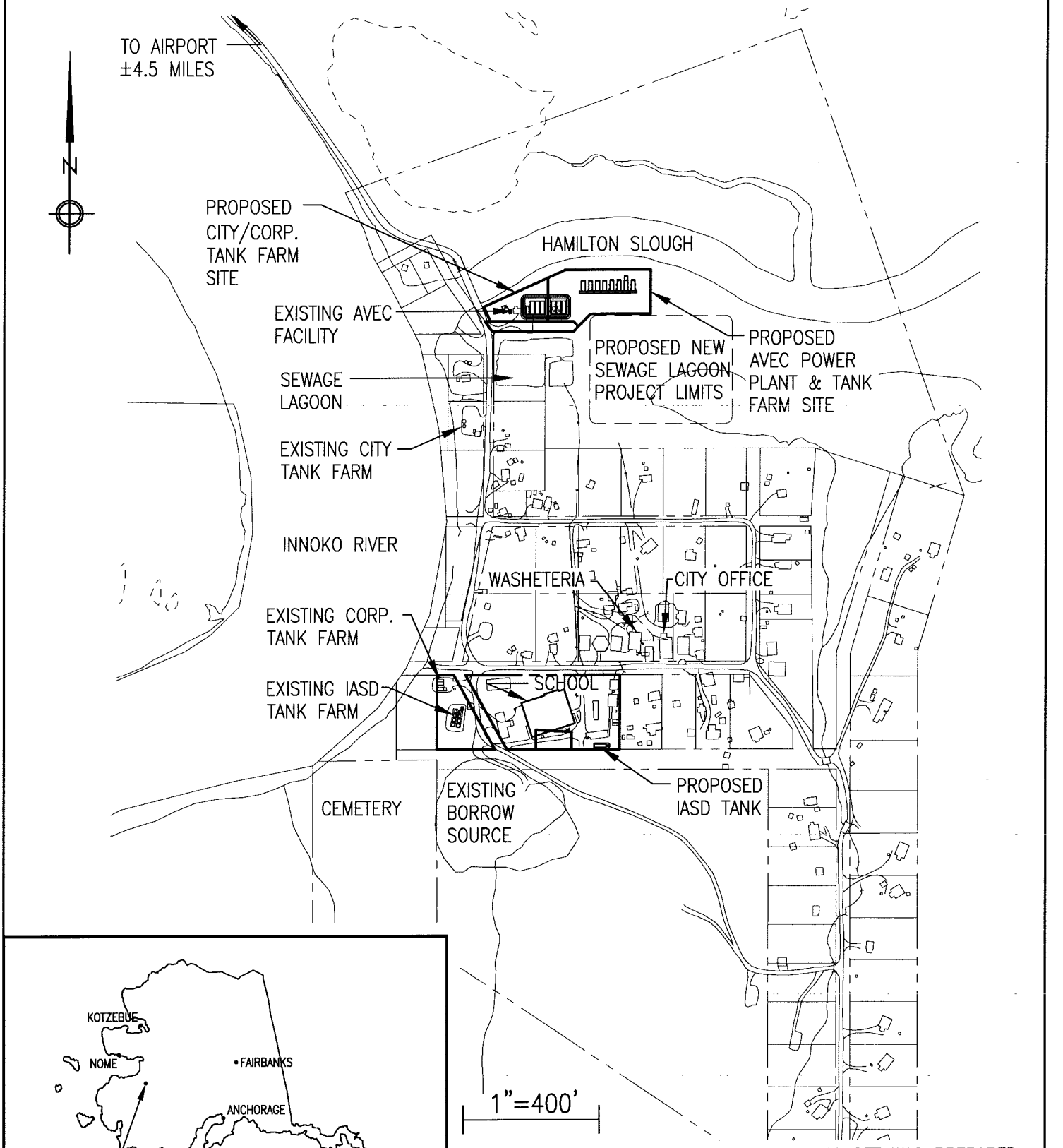
project cost including all design, supervision, inspection, permitting, and a 20% contingency is estimated to be:

- $2,068,397 Bulk Fuel Upgrade (190,000 gallons at $10.89/gallon)
- $2,016,930 Power Plant Project (600kW at $3,361/kW)
- **$4,085,327 Project Total**

The total project cost including all design, supervision, inspection, permitting, and a 20% contingency is estimated to be $4,085,327. The estimated cost of the bulk fuel upgrade portion is $2,068,397 that equates to a unit cost of $10.89 per gallon based on a gross storage capacity of 190,000 gallons. This is within the Denali Commission benchmark cost range of $12.00 to $9.50 per gallon for 100,001 gallons to 200,000 gallons capacity tank farms. The estimated cost of the power plant upgrade portion is $2,016,930 that equates to a unit cost of $3,361 per kW based on a total installed capacity of 600kW. This is above the Denali Commission benchmark cost range of $2,900 to $2,400 per installed kW for 401kW to 600kW capacity power plants. The higher cost is primarily due to the need to elevate the power plant pad approximately 6 feet higher than the surrounding grade to mitigate flood damage.

APPENDIX A

CONCEPT DESIGN DRAWINGS

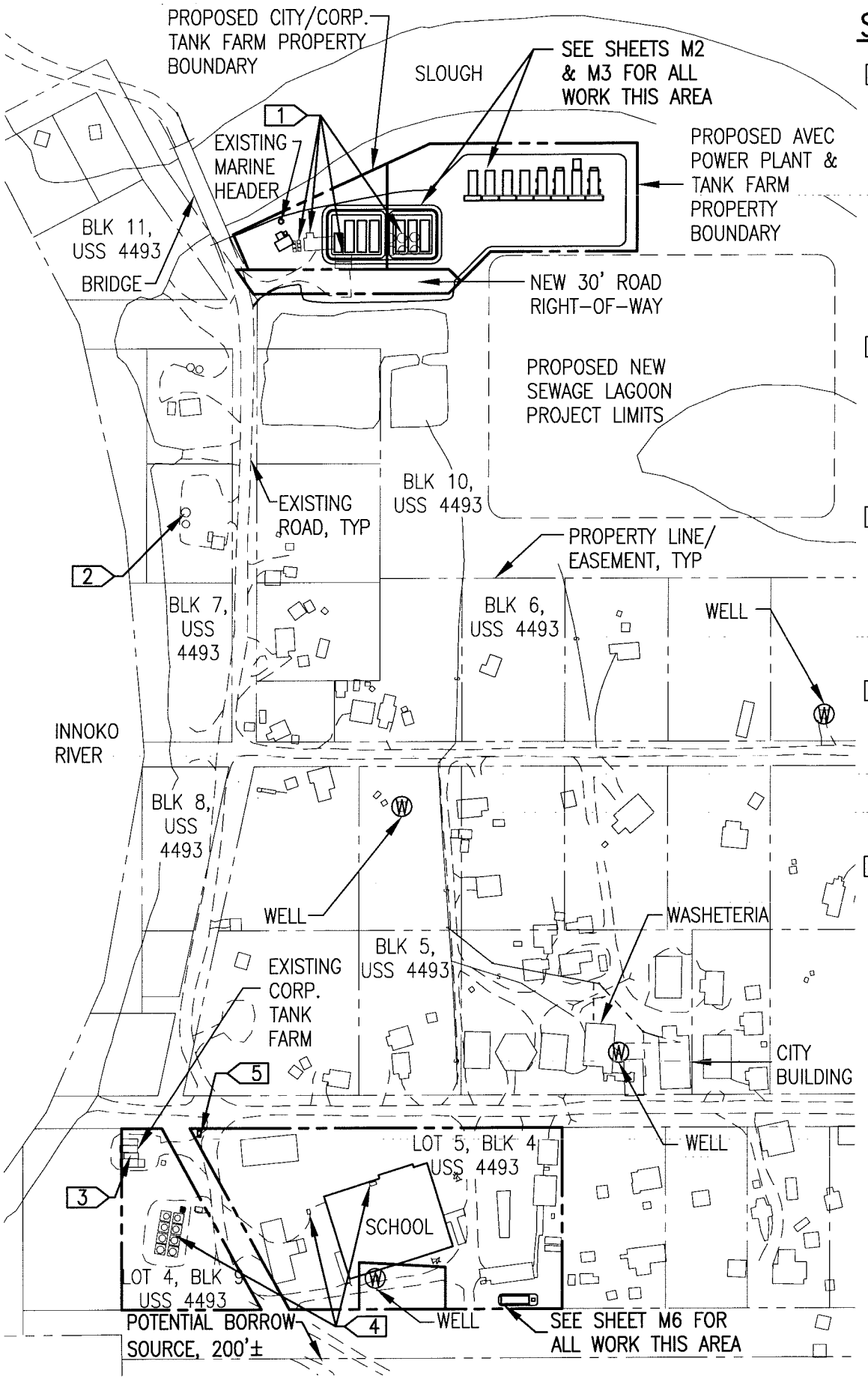


LOCATION MAP

SECTION 22, T30N, R55W LAT: 62° 41' NORTH
SEWARD MERIDIAN LONG: 159° 33' WEST

THE BACKGROUND MAPPING IN THIS DRAWING SET WAS PREPARED BY THE INTERIOR RIVERS RESOURCE DEVELOPMENT (RC&D) COUNCIL IN COOPERATION WITH THE ALASKA DEPARTMENT OF COMMUNITY AND ECONOMIC DEVELOPMENT (DCED) USING FUNDS PROVIDED BY THE U.S. BUREAU OF INDIAN AFFAIRS. THE ORIGINAL AUTOCAD DRAWING HAS BEEN REVISED TO INCLUDE TANK FARM AND POWER PLANT SPECIFIC DRAWINGS AND TEXT.

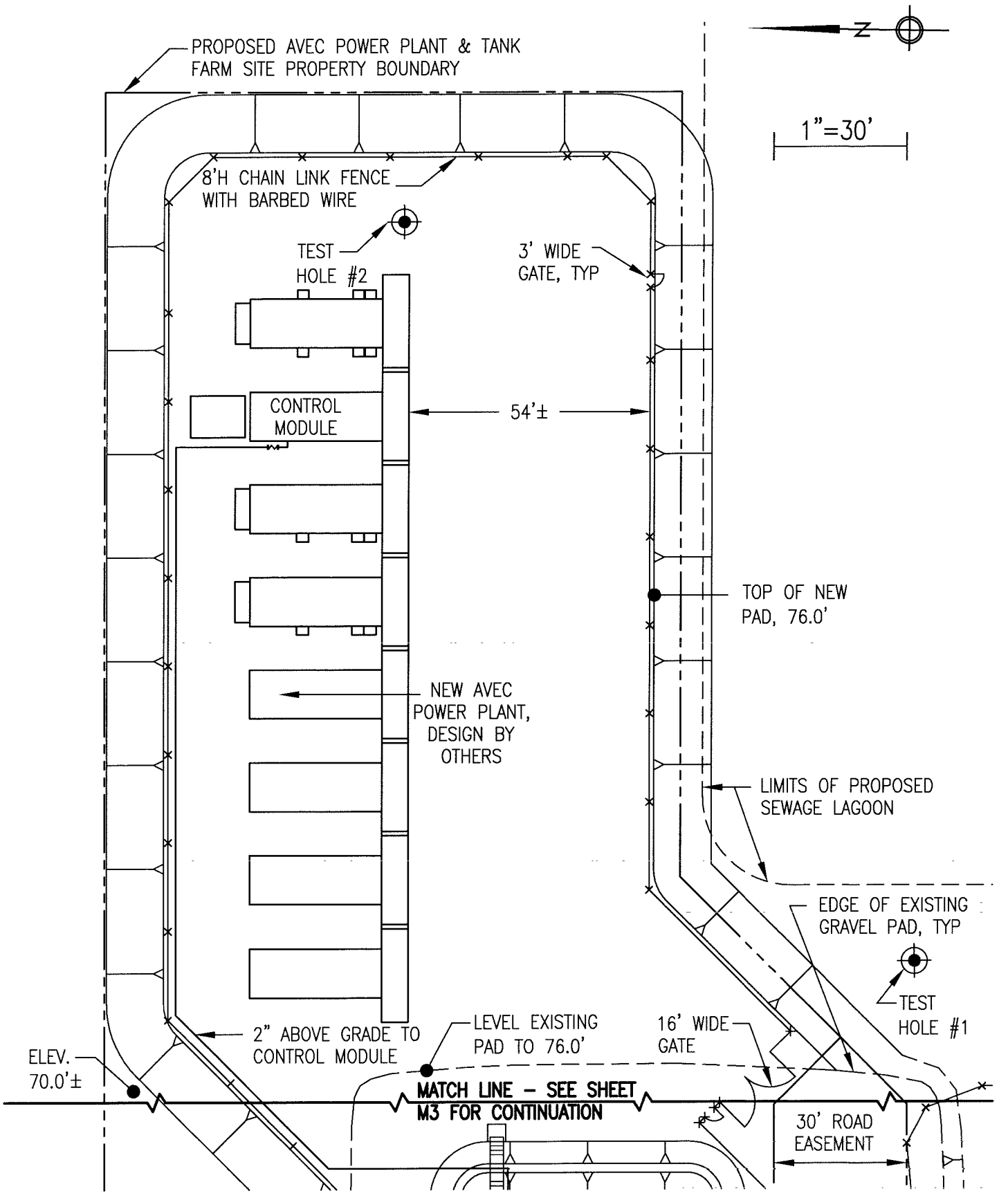
PROJECT: SHAGELUK BULK FUEL STORAGE & POWER PLANT UPGRADE	DRAWN BY: TDK	SCALE: 1"=400'	ALASKA ENERGY & ENGINEERING, INC.
	DESIGNED BY: TDK	DATE: 12/03/03	P.O. BOX 111405 ANCHORAGE, ALASKA 99511-1405
TITLE: LOCATION MAP & COMMUNITY MAP	FILE NAME SHAG-CDR-T1	SHEET T1 OF 1	PHONE (907) 349-0100



SPECIFIC NOTES:

1. 6 EA. EXISTING AVEC TANKS (57,066 GALLONS TOTAL CAPACITY), POWER PLANT, TRANSFORMERS, AND STORAGE CONTAINERS TO BE TAKEN OUT OF SERVICE.
2. 2 EA. EXISTING CITY TANKS (12,507 GALLONS TOTAL CAPACITY) TO BE TAKEN OUT OF SERVICE.
3. 4 EA. EXISTING CORP. TANKS (28,851 GALLONS TOTAL CAPACITY) TO BE TAKEN OUT OF SERVICE.
4. 10 EA. EXISTING SCHOOL TANKS (31,695 GALLONS TOTAL CAPACITY) TO BE TAKEN OUT OF SERVICE.
5. MARINE HEADER FOR SCHOOL TANK

PROJECT: SHAGELUK BULK FUEL STORAGE & POWER PLANT UPGRADE	DRAWN BY: TDK	SCALE: 1"=175'	ALASKA ENERGY & ENGINEERING, INC.
	DESIGNED BY: TDK	DATE: 12/03/03	P.O. BOX 111405 ANCHORAGE, ALASKA 99511-1405
TITLE: OVERALL SITE PLAN	FILE NAME SHAG-CDR-M1	SHEET M1 OF 8	PHONE (907) 349-0100



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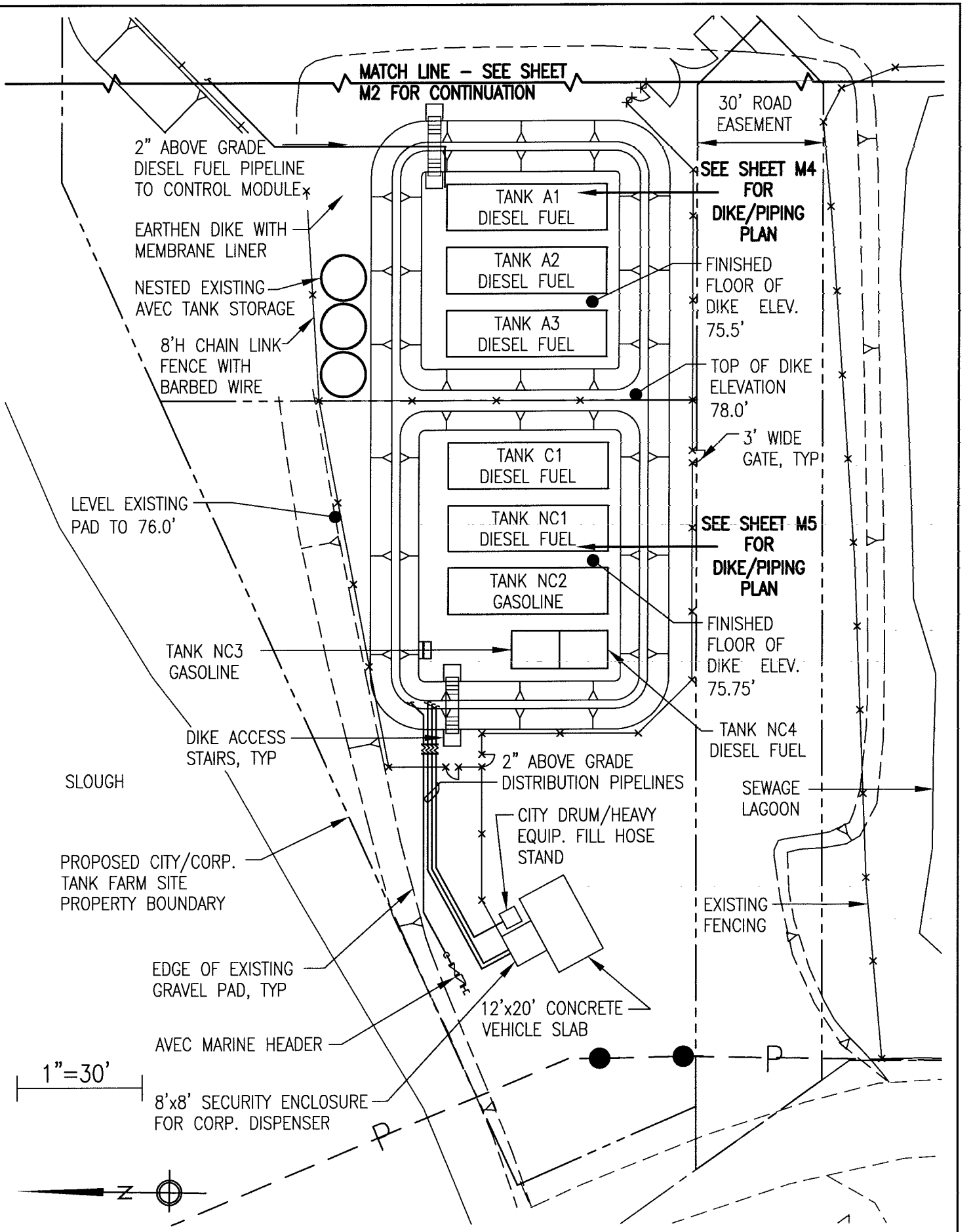
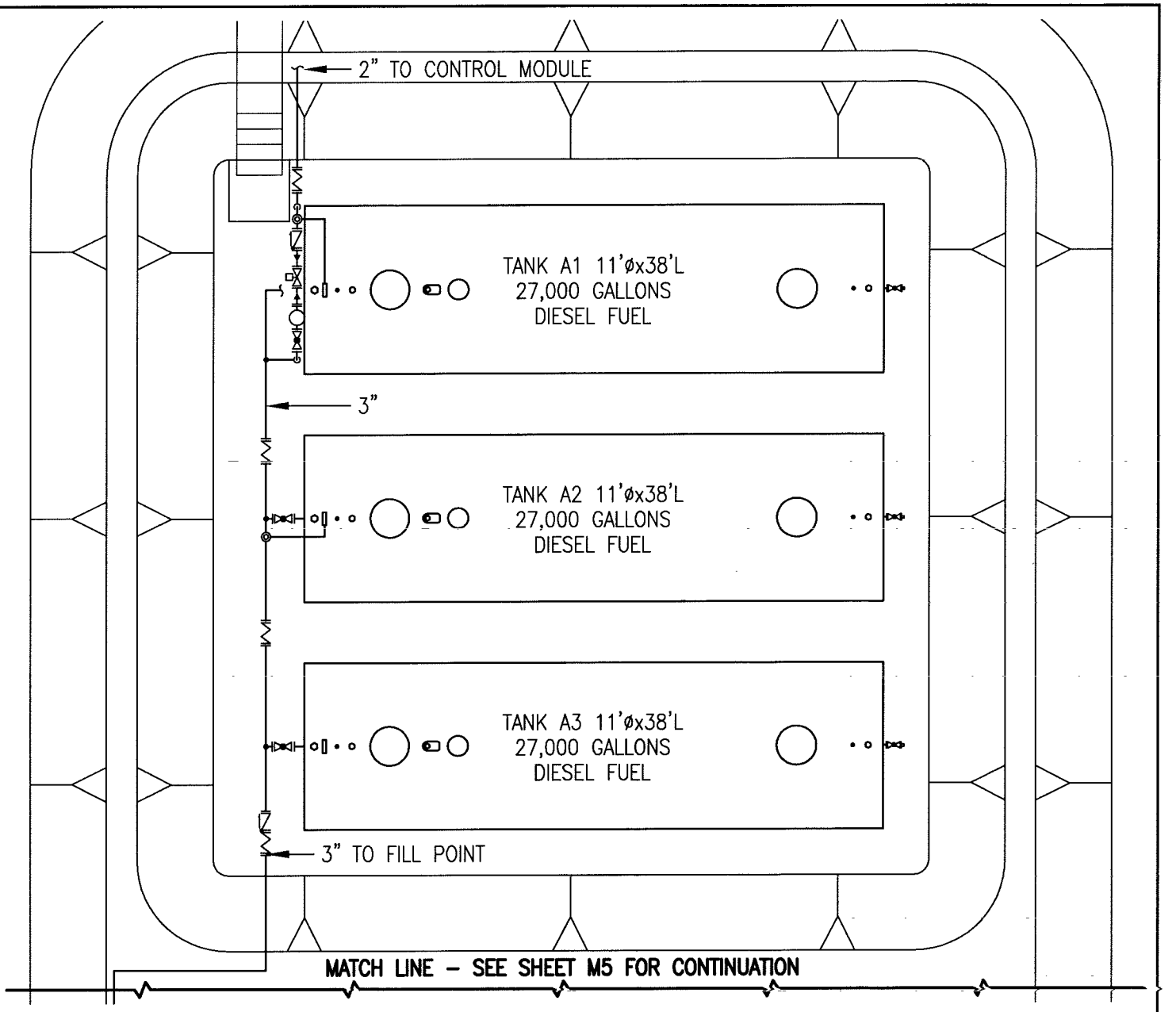
TITLE: AVEC POWER PLANT & TANKS FARM AREA SITE PLAN	FILE NAME SHAG-CDR-M2	SHEET M2 OF 8	PHONE (907) 349-0100



PROJECT: SHAGELUK BULK FUEL STORAGE & POWER PLANT UPGRADE	DRAWN BY: TDK	SCALE: 1"=30'	ALASKA ENERGY & ENGINEERING, INC.
	DESIGNED BY: TDK	DATE: 12/03/03	P.O. BOX 111405 ANCHORAGE, ALASKA 99511-1405
TITLE: AVEC & CITY/CORP. TANK FARM AREA SITE PLAN	FILE NAME SHAG-CDR-M3	SHEET M3 OF 8	PHONE (907) 349-0100



N

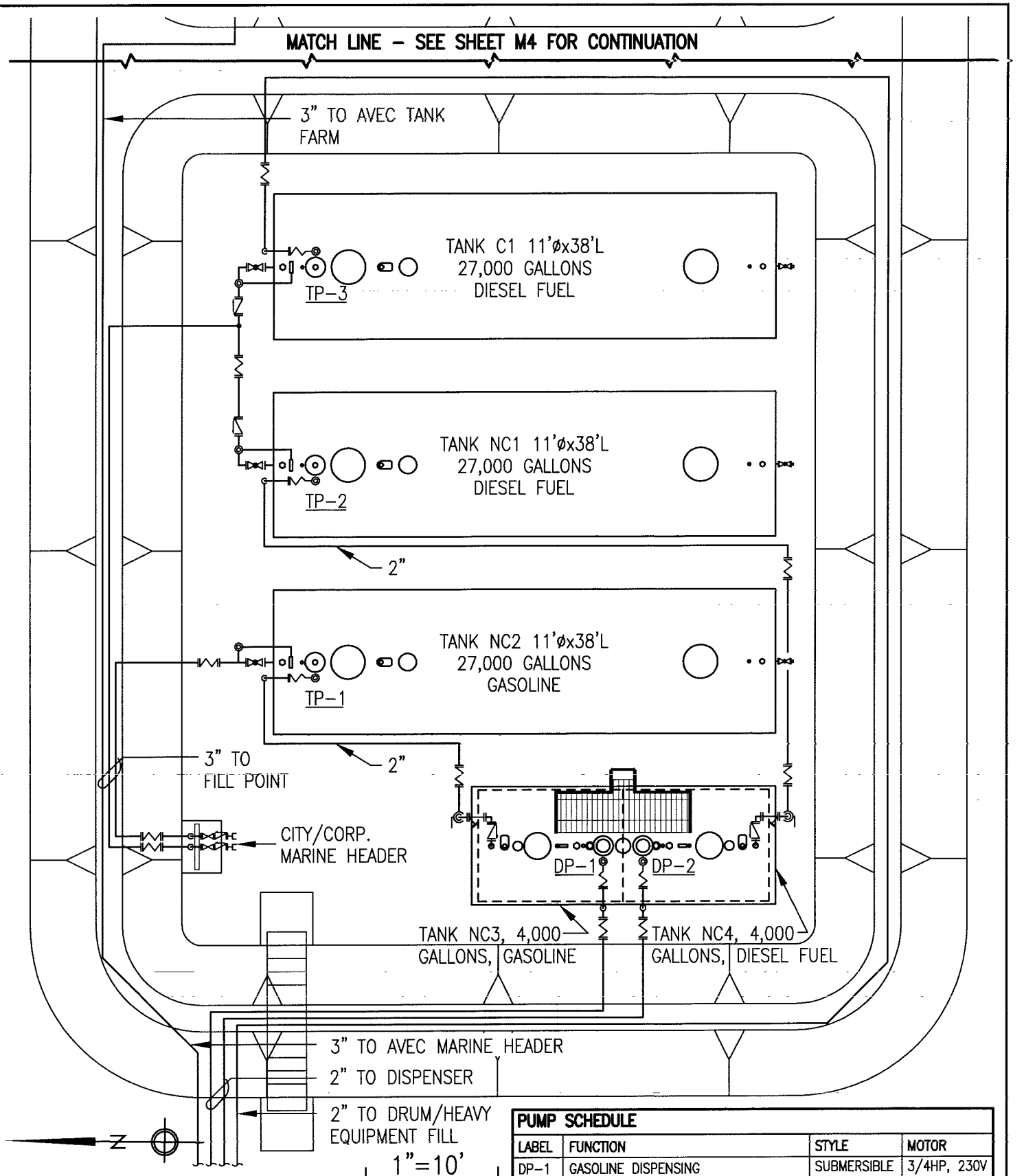
1"=10'

TANK SCHEDULE						
TANK #	NEW OWNER	NEW/ EXISTING	TYPE (2)	FUNCTION	DIESEL CAPACITY(1)	GASOLINE CAPACITY(1)
A1	AVEC	NEW	SW	BULK	27,000	
A2	AVEC	NEW	SW	BULK	27,000	
A3	AVEC	NEW	SW	BULK	27,000	
AVEC – NEW STORAGE TOTAL					**81,000**	
C1	CITY	NEW	SW	BULK	27,000	
CITY – NEW STORAGE TOTAL					**27,000**	
NC1	CORP.	NEW	SW	BULK	27,000	
NC2	CORP.	NEW	SW	BULK		27,000
NC3	CORP.	NEW	FR	DISPENSING		4,000
NC4	CORP.	NEW	FR	DISPENSING	4,000	
CORP. – NEW STORAGE TOTAL					**31,000**	**31,000**
S1	SCHOOL	NEW	DW	BULK	20,000	
SCHOOL – NEW STORAGE TOTAL					**20,000**	
PROJECT STORAGE CAPACITY BY PRODUCT					**159,000**	**31,000**
PROJECT TOTAL GROSS STORAGE CAPACITY						**190,000**
NOTES: 1) ALL CAPACITIES ARE GROSS SHELL CAPACITY IN GALLONS 2) SW=SINGLE WALL, DW=DOUBLE WALL, FR=TWO-HOUR FIRE RATED						

GENERAL NOTES:

1. THE AVEC NET TANK FARM DIKE CAPACITY IS 38,669 GALLONS, THE VOLUME OF THE LARGEST TANK PLUS 7" FREEBOARD FOR PRECIPITATION.

PROJECT: SHAGELUK BULK FUEL STORAGE & POWER PLANT UPGRADE	DRAWN BY: TDK	SCALE: 1"=10'	ALASKA ENERGY & ENGINEERING, INC.
	DESIGNED BY: TDK	DATE: 12/03/03	P.O. BOX 111405 ANCHORAGE, ALASKA 99511-1405
TITLE: AVEC TANK FARM PIPING PLAN & SCHEDULES	FILE NAME SHAG-CDR-M4	SHEET M4 OF 8	PHONE (907) 349-0100



GENERAL NOTES:

1. THE CITY/CORP. NET TANK FARM DIKE CAPACITY IS 43,434 GALLONS, THE VOLUME OF THE LARGEST TANK PLUS 8" FREEBOARD FOR PRECIPITATION.

PUMP SCHEDULE

LABEL	FUNCTION	STYLE	MOTOR
DP–1	GASOLINE DISPENSING	SUBMERSIBLE	3/4HP, 230V
DP–2	DIESEL DISPENSING	SUBMERSIBLE	3/4HP, 230V
TP–1	GASOLINE BULK TRANSFER	SUBMERSIBLE	3/4HP, 230V
TP–2	DIESEL BULK TRANSFER	SUBMERSIBLE	3/4HP, 230V
TP–3	DIESEL DRUM/HEAVY EQUIP. FILL	SUBMERSIBLE	3/4HP, 230V
TP–4	DIESEL BULK TRANSFER	SUBMERSIBLE	3/4HP, 230V

PROJECT: SHAGELUK BULK FUEL STORAGE & POWER PLANT UPGRADE

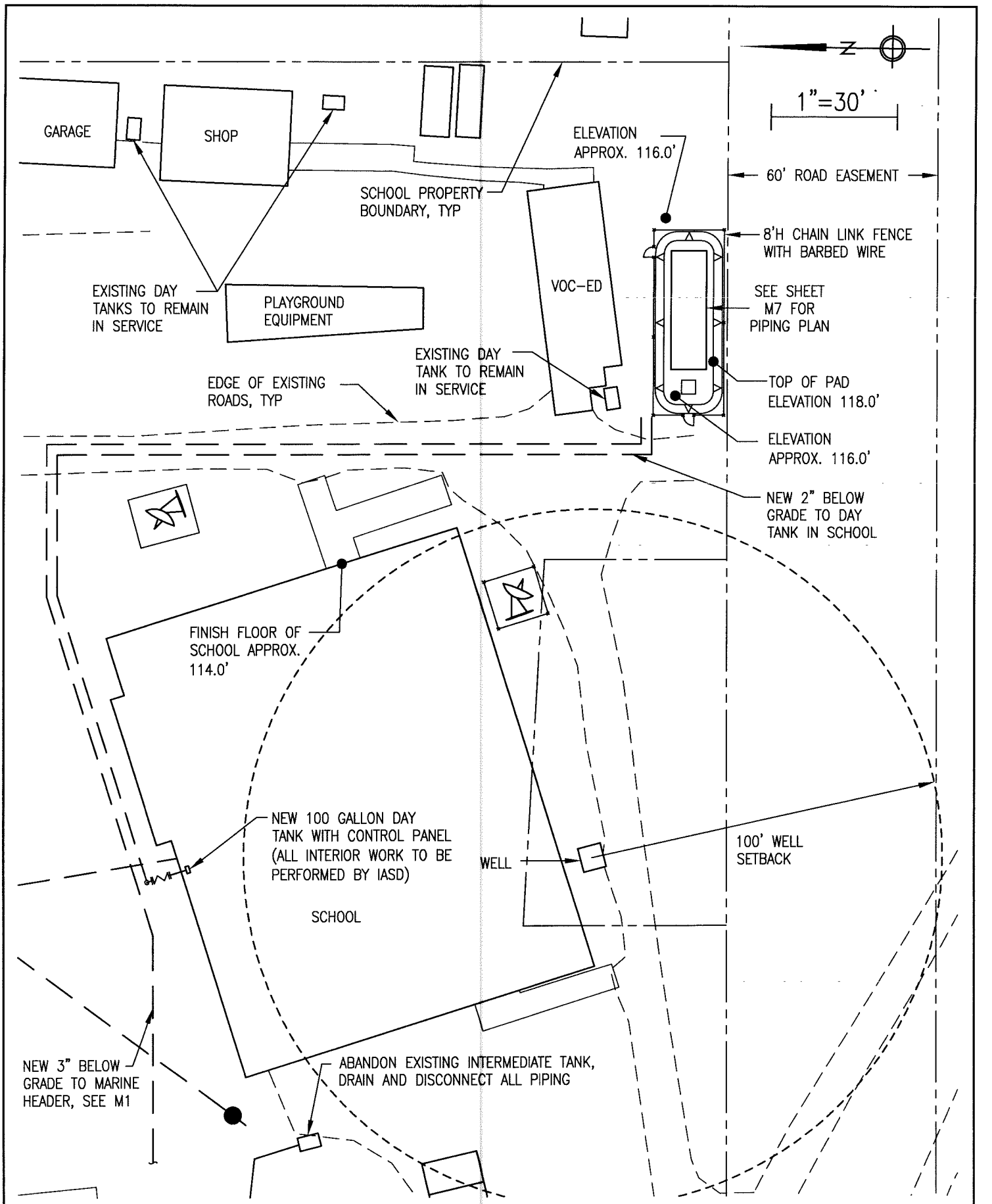
TITLE: CITY/CORP. TANK FARM PIPING PLAN & SCHEDULES

DRAWN BY: TDK | SCALE: 1"=10'

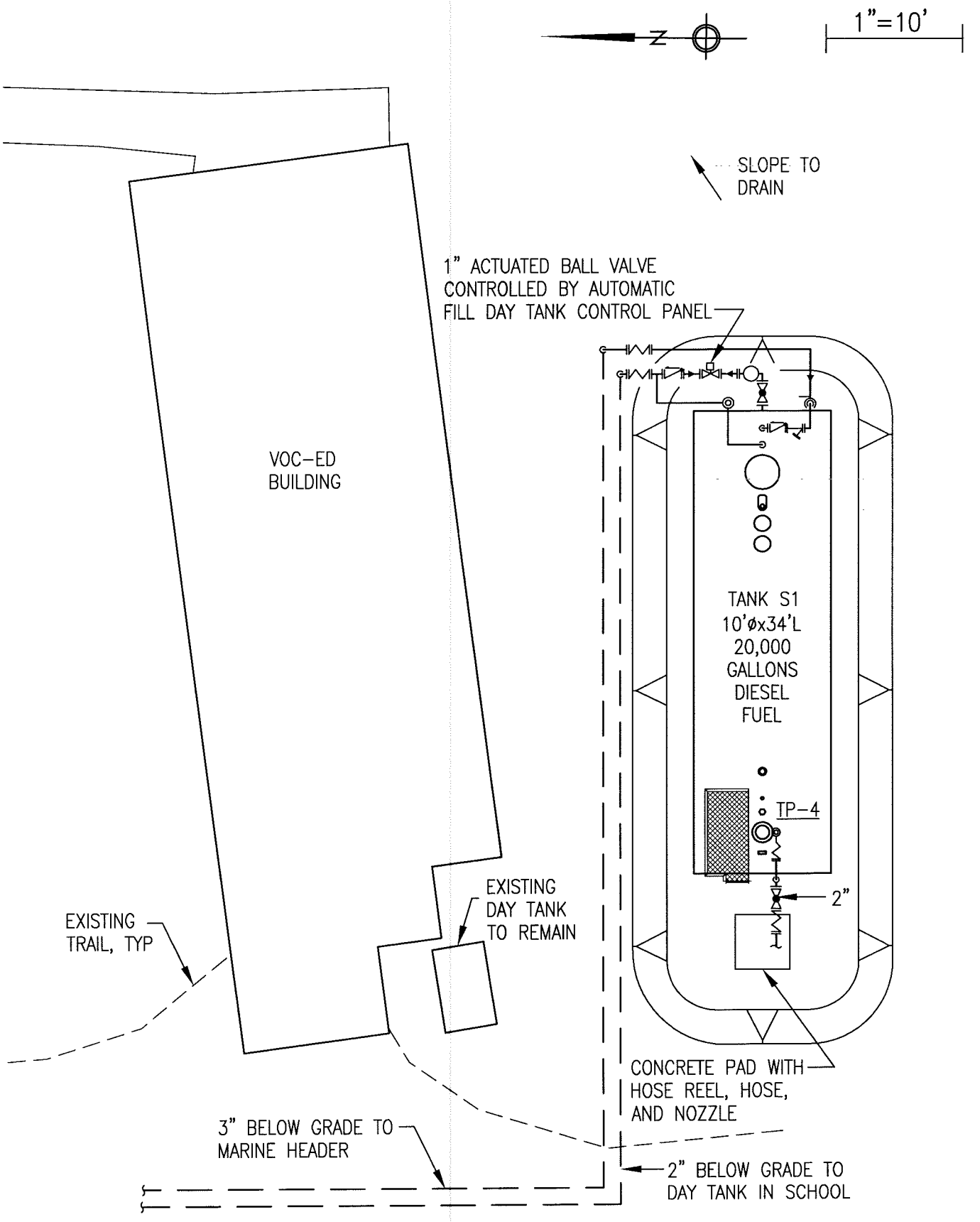
DESIGNED BY: TDK | DATE: 12/03/03

FILE NAME: SHAG–CDR–M5 | SHEET M5 OF 8

ALASKA ENERGY & ENGINEERING, INC.
P.O. BOX 111405 ANCHORAGE, ALASKA 99511–1405
PHONE (907) 349–0100



PROJECT: SHAGELUK BULK FUEL STORAGE & POWER PLANT UPGRADE	DRAWN BY: TDK	SCALE: 1"=30'	ALASKA ENERGY & ENGINEERING, INC.
	DESIGNED BY: TDK	DATE: 12/03/03	P.O. BOX 111405 ANCHORAGE, ALASKA 99511-1405
TITLE: SCHOOL TANK FARM AREA SITE PLAN	FILE NAME SHAG-CDR-M6	SHEET M6 OF 8	PHONE (907) 349-0100



PROJECT: SHAGELUK BULK FUEL STORAGE & POWER PLANT UPGRADE	DRAWN BY: TDK	SCALE: 1"=10'	ALASKA ENERGY & ENGINEERING, INC.
	DESIGNED BY: TDK	DATE: 12/03/03	P.O. BOX 111405 ANCHORAGE, ALASKA 99511-1405
TITLE: SCHOOL TANK FARM PIPING PLAN	FILE NAME SHAG-CDR-M7	SHEET M7 OF 8	PHONE (907) 349-0100

SETBACK/SEPARATION REQUIREMENTS

THE CONSOLIDATED TANK FARM WILL PERFORM THREE FUNCTIONS – BULK STORAGE, DRUM/HEAVY EQUIPMENT FILL, AND DISPENSING. ALL TANKS ARE INSTALLED ABOVE GROUND. TO COMPLY WITH THE REQUIREMENTS OF THE 2000 INTERNATIONAL FIRE CODE, THE 2002 ALASKA ENERGY AUTHORITY/DIVISION OF FIRE PREVENTION MEMORANDUM OF AGREEMENT, AND STATE OF ALASKA REGULATIONS THE FOLLOWING MINIMUM CLEARANCES ARE REQUIRED:

10' FROM THE DISPENSER TO ALL BUILDINGS AND PROPERTY LINES.

20' FROM THE DISPENSER TO FIXED SOURCES OF IGNITION.

50' FROM THE DISPENSER TO ALL UNPROTECTED TANKS.

5' FROM PROTECTED DISPENSING TANKS (6,000 GAL MAX) TO THE NEAREST IMPORTANT BUILDING OR NEAREST SIDE OF A PUBLIC WAY.

30' FROM 751–12,000 GAL BULK STORAGE TANKS TO THE NEAREST PROPERTY LINE WHICH IS OR CAN BE BUILT UPON.

40' FROM 12,001–30,000 GAL BULK STORAGE TANKS TO THE NEAREST PROPERTY LINE WHICH IS OR CAN BE BUILT UPON.

15' FROM THE DRUM/HEAVY EQUIPMENT FILL STAND TO THE NEAREST TANK, THE NEAREST IMPORTANT BUILDING, THE NEAREST PROPERTY LINE WHICH IS OR CAN BE BUILT UPON, COMBUSTIBLE MATERIALS, AND FIXED SOURCES OF IGNITION.

25' FROM FUEL TANKS AND PIPELINES TO RESIDENTIAL WATER WELLS

100' FROM FUEL TANKS AND PIPELINES TO PUBLIC WATER WELLS

PROJECT: SHAGELUK BULK FUEL STORAGE & POWER PLANT UPGRADE	DRAWN BY: TDK	SCALE: NO SCALE	ALASKA ENERGY & ENGINEERING, INC.
	DESIGNED BY: TDK	DATE: 12/03/03	P.O. BOX 111405 ANCHORAGE, ALASKA 99511–1405
TITLE: SETBACK/SEPERATION REQUIREMENTS	FILE NAME SHAG–CDR–M8	SHEET M8 OF 8	PHONE (907) 349–0100

APPENDIX B

CONSTRUCTION COST ESTIMATE

		Village Labor	Materials	Freight	Eq. Rental	Other Field	TOTAL
1. FOUNDATION, DIKE, & SITE	$155,702	$98,433	$57,269				$155,702
2. TANKS	$288,745	$52,831	$235,914				$288,745
3. PIPING SYSTEM	$118,934	$68,484	$50,450				$118,934
4. PUMPS, DISPENSER, POWER, CONTROLS, ETC.	$91,468	$48,120	$43,348				$91,468
5. MISCELLANEOUS	$77,070	$20,220	$56,850				$77,070
6. OVERHEAD	$196,185	$40,960	$5,000	$0	$96,000	$54,225	$196,185
7. FREIGHT	$345,664	$0	$0	$345,664	$0	$0	$345,664
8. CONSTRUCTION SUB-TOTAL	**$1,273,768**	**$329,048**	**$448,831**	**$345,664**	**$96,000**	**$54,225**	**$1,273,768**
9. CONSTRUCTION INSURANCE	$8,662					$8,662	$8,662
10. FIRST YEAR OPERATIONS INSURANCE	$18,470					$18,470	$18,470
DIRECT CONSTRUCTION - TOTAL (excl. Contin.):	**$1,300,899**	**$329,048**	**$448,831**	**$345,664**	**$96,000**	**$81,357**	**$1,300,899**
CONTINGENCY @ 20%:	$260,180	$65,810	$89,766	$69,133	$19,200	$16,271	$260,180
DIRECT CONSTRUCTION - TOTAL:	**$1,561,079**	**$394,858**	**$538,597**	**$414,797**	**$115,200**	**$97,628**	**$1,561,079**
11. DESIGN AND CONSTR ADMIN. (excl Contin.):	$170,000						$170,000
CONTINGENCY @ 20%:	$34,000						$34,000
DESIGN & CONSTR ADMIN TOTAL:	**$204,000**						**$204,000**
12. CONSTRUCTION MANAGEMENT	$170,000						$170,000
CONTINGENCY @ 20%:	$34,000						$34,000
CONSTR MANAGEMENT TOTAL:	**$204,000**						**$204,000**
13. TOTAL PROJECT COST (A.E.&E. ESTIMATE)	**$1,969,079**						**$1,969,079**
OTHER PROJECT COSTS							
Other Costs & Subs (Mikunda, etc.)	**$10,000**						**$10,000**
AVEC Engineering	**$1,500**						**$1,500**
AVEC Anc Whse, Field Staff & Other Direct Support	**$6,000**						**$6,000**
AVEC Travel & Misc.	**$4,000**						**$4,000**
TOTAL PROJECT COSTS - Subtotal:	**$1,990,579**						**$1,990,579**
AVEC Mgmt @ 3.9093421 %:							**$77,819**
GRAND TOTAL:							**$2,068,397**
14. TOTAL STORAGE CAPACITY		190,000 GAL. GROSS CAPACITY					
15. COST PER GALLON OF GROSS CAPACITY	**$10.89**						
AVEC	$848,615	42.6%	81,000 GAL. GROSS CAPACITY				
CITY	$282,872	14.2%	27,000 GAL. GROSS CAPACITY				
CORPORATION	$649,557	32.6%	62,000 GAL. GROSS CAPACITY				
SCHOOL	$209,535	10.5%	20,000 GAL. GROSS CAPACITY				

ITEM	QUAN	UNIT	UNIT COST	MATL COST	UNIT HRS	LAB HRS	LAB RATE	LABOR COST	OTHER FIELD	EQUIP RENTAL	FREIGHT COST	TOTAL COST	UNIT WT	TOTAL WT(#)
FOUNDATION, DIKE, & SITE														
Clear & Prep Site	1	lump	$0	$0	150	150	$60	$9,000				$9,000		0
Exist Connex&Power Plant Relo	1	lump	$0	$0	167	167	$60	$10,000				$10,000		0
Establish Temporary Power	1	lump	$10,000	$10,000	200	200	$60	$12,000				$22,000		0
Silty Sands/Silts/Silts & Rock	2,050	cu. yd.	$3.00	$6,150	0.180	369	$60	$22,140				$28,290		0
Select Gravel (Top Cover Only)	500	cu. yd.	$20.00	$10,000	0.320	160	$60	$9,600				$19,600		0
Dike Membrane Liner	10,350	sq. ft.	$1.30	$13,455	0.005	52	$60	$3,105				$16,560	0.17	1760
Non-Woven Geotextile (Dike)	43,200	sq. ft.	$0.09	$3,888	0.002	86	$60	$5,184				$9,072	0.08	3456
Woven Geotextile (Dike)	25,200	sq. ft.	$0.05	$1,260	0.001	25	$60	$1,512				$2,772	0.04	1008
4" Cellular Confinement	4,160	sq. ft.	$1.05	$4,368	0.01	42	$60	$2,496				$6,864	0.35	1456
8' Chain-Link Fence	582	lin.ft.	$14.00	$8,148	0.67	390	$60	$23,396				$31,544	20.00	11640
SUBTOTAL - FDN/DIKE/SITE:				**$57,269**				**$98,433**			**$0**	**$155,702**		
TANKS														
Drain & Disconnect Exist Tanks	22	ea.	$100	$2,200	11	247	$80	$19,730				$21,930		0
Set Up Temporary Storage	1	lump	$0	$0	40	40	$80	$3,200				$3,200		0
New 27k Bulk Tank	6	ea	$25,000	$150,000	0	0	$60	$0				$150,000		0
New 8,000 FR Disp Tank	1	ea	$28,000	$28,000	0	0	$60	$0				$28,000		0
New 20,000 Double Wall Tank	1	ea	$40,000	$40,000	0	0	$60	$0				$40,000		0
New Day Tanks	1	ea	$5,000	$5,000	30	30	$60	$1,800				$6,800	250	250
Emergency Vents	11	ea	$300	$3,300	2	22	$60	$1,320				$4,620	75	825
Pressure/Vacuum/Whistle Vents	9	ea	$250	$2,250	2	18	$60	$1,080				$3,330	20	180
~~Clock Type Gauges~~	~~9~~	~~ea~~	~~$280~~	~~$2,520~~	~~2~~	~~18~~	~~$60~~	~~$1,080~~				~~$3,600~~	~~20~~	~~180~~
Concrete Footings	25	cu.yd.	$100	$2,500	8	209	$60	$12,525				$15,025	600	15000
4x12 Treated Timber Mudsills	36	lin.ft.	$4.00	$144	0.10	4	$60	$216				$360	13	468
Place Tanks in Dike	7	ea	$0	$0	24	168	$60	$10,080				$10,080		0
Place Intermediate Tanks	1	ea	$0	$0	30	30	$60	$1,800				$1,800		0
SUBTOTAL - TANKS:				**$235,914**				**$52,831**				**$288,745**		
PIPING SYSTEM														
Demolish Old Piping	1	lump	$0	$0	60	60	$60	$3,600				$3,600		0
3" Sch 80 Welded Buried	680	lin. ft.	$7.00	$4,760	0.30	204	$60	$12,240				$17,000	10	6800
3" Sch 40 Welded Above Grade	460	lin. ft.	$5.00	$2,300	0.12	55	$60	$3,312				$5,612	8	3680
2" Sch 80 Welded Buried	400	lin. ft.	$4.50	$1,800	0.20	80	$60	$4,800				$6,600	5	2000
2" Sch 80 Welded Above Grade	1,140	lin. ft.	$5.00	$5,700	0.13	148	$60	$8,892				$14,592	5	5700
1" Sch 160 Welded Above Grade	100	lin. ft.	$5.00	$500	0.10	10	$60	$600				$1,100	3	300
Paint Piping	1,000	sq.ft.	$0.60	$600	0.10	100	$60	$6,000				$6,600	0.20	200
Concrete Support Blocks	50	ea.	$10.00	$500	1.00	50	$60	$3,000				$3,500	13	650
Misc Strut & Pipe Clamps	1	lump	$5,000	$5,000	100	100	$60	$6,000				$11,000	400	400
Flexible Connectors	35	ea	$125	$4,375	1	35	$60	$2,100				$6,475	10	350
Manifold & Dispensing Fittings	1	lump	$5,000	$5,000	180	180	$60	$10,800				$15,800	3000	3000
3" Flanged Gate Valves	4	ea	$250	$1,000	2	8	$60	$480				$1,480	50	200
3" Flanged Check Valves	8	ea	$200	$1,600	2	16	$60	$960				$2,560	50	400
2" Flanged Check Valves	5	ea	$175	$875	1	5	$60	$300				$1,175	30	150
3" Flanged Ball Valves	6	ea	$275	$1,650	2	12	$60	$720				$2,370	50	300

ITEM	QUAN	UNIT	UNIT COST	MATL COST	UNIT HRS	LAB HRS	LAB RATE	LABOR COST	OTHER FIELD	EQUIP RENTAL	FREIGHT COST	TOTAL COST	UNIT WT	TOTAL WT(#)
2" Flanged Ball Valves	7	ea	$175	$1,225	1	7	$60	$420				$1,645	30	210
1-1/2" Flanged Ball Valves	2	ea	$150	$300	1	2	$60	$120				$420	20	40
1" Flanged Ball Valves	3	ea	$100	$300	1	3	$60	$180				$480	15	45
Misc Threaded Ball Valves	1	lump	$300	$300	10	10	$60	$600				$900	50	50
1" Actuator Valves	2	ea	$1,400	$2,800	2	4	$60	$240				$3,040	35	70
2" Strainers	3	ea	$300	$900	1	3	$60	$180				$1,080	50	150
1" Flanged PRV	7	ea	$475	$3,325	1	7	$60	$420				$3,745	10	70
2" Anti-Syphon Valves	6	ea	$150	$900	2	12	$60	$720				$1,620	10	60
1-1/2" Shear/Fusible Valves	3	ea	$80	$240	2	6	$60	$360				$600	10	30
2" Fill Limiters	3	ea	$700	$2,100	4	12	$60	$720				$2,820	20	60
2" Pipeline Filter	2	ea	$1,200	$2,400	4	12	$60	$720				$3,120	100	200
SUBTOTAL - PIPING:				**$50,450**				**$68,484**				**$118,934**		
PUMPS, DISPENSER, POWER, CONTROLS, ETC.														
3/4 HP Submersible Pumps	6	ea	$1,000	$6,000	6	36	$60	$2,160				$8,160	100	600
Hose Reel, Power Rewind, Roller	1	ea	$1,500	$1,500	50	50	$60	$3,000				$4,500	150	150
3/4" Bulk Transfer Hose	200	lin. ft.	$10	$2,000	0.12	24	$60	$1,440				$3,440	1.0	200
Bulk Transfer Nozzle & Acces.	1	ea	$300	$300	1	1	$60	$60				$360	10	10
Dual Prod Mechanical Dispnsr	1	ea	$3,000	$3,000	20	20	$80	$1,600				$4,600	400	400
Key Control System	1	ea	$1,000	$1,000	10	10	$80	$800				$1,800	100	100
Daytank Control Panel	1	ea	$2,200	$2,200	20	20	$80	$1,600				$3,800	100	100
Pump Control Panel	1	ea	$10,000	$10,000	100	100	$80	$8,000				$18,000	200	200
3-Point High/Low Level Switches	2	ea	$1,400	$2,800	5	10	$80	$800				$3,600	50	100
2-Point High/Low Level Switches	1	ea	$1,000	$1,000	5	5	$80	$400				$1,400	50	50
Remote Signal Cable in Conduit	365	lin. ft.	$1.50	$548	0.05	18	$80	$1,460				$2,008	0.2	73
Meter Base & Panel Board	1	lump	$1,000	$1,000	60	60	$80	$4,800				$5,800	200	200
Area Lighting	1	lump	$2,000	$2,000	80	80	$80	$6,400				$8,400	300	300
Conduit, Conductors, & Devices	1	lump	$10,000	$10,000	195	195	$80	$15,600				$25,600	2000	2000
SUBTOTAL - PUMPS/DISPNS/ETC:				**$43,348**				**$48,120**				**$91,468**		
MISCELLANEOUS														
Concrete Slabs & Steps	11	cu.yd.	$100	$1,100	7	77	$60	$4,620				$5,720	600	6600
Misc. Steel (Shelters, Stairs..)	1	lump	$8,000	$8,000	190	190	$60	$11,400				$19,400	5000	5000
Form Lumber, Lags, Nails, Etc	1	lump	$3,000	$3,000	40	40	$60	$2,400				$5,400	4500	4500
Portable Fuel Transfer Pump	1	ea	$750	$750	0	0	$0	$0				$750	100	100
Portable Dike Drainage Pump	2	ea	$500	$1,000	0	0	$60	$0				$1,000	100	200
Signs & Valve Tags	1	lump	$2,000	$2,000	30	30	$60	$1,800				$3,800	150	150
Spill Response Supplies	1	lump	$5,000	$5,000	0	0	$60	$0				$5,000	600	600
5,000 Gallon Fol-Da-Tank	1	lump	$18,000	$18,000	0	0	$60	$0				$18,000	1200	1200
SmartAsh with spare parts	1	lump	$6,000	$6,000	0	0	$60	$0				$6,000	400	400
Misc Hardware	1	lump	$2,000	$2,000	0	0	$60	$0				$2,000	500	500
Misc Tools & Safety Gear	1	lump	$5,000	$5,000	0	0	$60	$0				$5,000	500	500
Welding Rod, Gases, Etc.	1	lump	$5,000	$5,000	0	0	$60	$0				$5,000	2000	2000
SUBTOTAL - MISCELLANEOUS:				**$56,850**				**$20,220**				**$77,070**		
OVERHEAD														

ITEM	QUAN	UNIT	UNIT COST	MATL COST	UNIT HRS	LAB HRS	LAB RATE	LABOR COST	OTHER FIELD	EQUIP RENTAL	FREIGHT COST	TOTAL COST	UNIT WT	TOTAL WT(#)
Audit Grants	1	lump							$6,000			$6,000		0
Replat, ROW, Legal Work	1	lump							$15,000			$15,000		0
Service Local Heavy Equip	1	lump	$5,000	$5,000	100	100	$60	$6,000		$20,000		$31,000		0
Rent/Mobilize Heavy Equip	1	lump								$50,000		$50,000		0
Skid Steer (Bobcat) Rent	2	mo.								$6,000		$6,000		0
Pickup & 4 Wheeler Rent	2	mo.							$3,000			$3,000		0
Welder/Compr/Misc Tool Rent	1	lump								$20,000		$20,000		0
Project Diesel Fuel/Gasoline	1	lump							$7,678			$7,678		0
Disp Startup/Training	1	lump							$2,500			$2,500		0
Commission System & Training	45	hr			1	45	$80	$3,600				$3,600		0
Superintendent Overhd Off-Site	100	hr			1	100	$80	$8,000				$8,000		0
Superintendent Overhd On-Site	100	hr			1	100	$80	$8,000				$8,000		0
Crew Travel Time	192	hr			1	192	$80	$15,360				$15,360		0
Crew Airfares	8	trips							$6,400			$6,400		0
Crew Per Diem	254	mn.dy							$10,647			$10,647		0
Housing Rent	2	mo.							$3,000			$3,000		0
SUBTOTAL - OVERHEAD:				**$5,000**				**$40,960**	**$54,225**	**$96,000**		**$196,185**		
FREIGHT														87,571
Barge Freight Select Gravel {1}	500	cu.yd.	$105.00								$52,500	$52,500		
Barge Freight Seattle-Shageluk	87571	lb.	$0.55								$48,164	$48,164		
Barge 6ea 27k Tanks Sea-Shag	1	lump	145,000								$145,000	$145,000		
Barge 20k DW Tank Sea-Shag	1	lump	$40,000								$40,000	$40,000		
Barge 8k FR Tank Sea-Shag	1	lump	$30,000								$30,000	$30,000		
Airplane Tool Mob/De-Mob	2	ea.	$10,000								$20,000	$20,000		
Misc Small Freight & Gold Streaks	1	lump	$10,000								$10,000	$10,000		
SUBTOTAL - FREIGHT:				**$0**				**$0**	**$0**	**$0**	**$345,664**	**$345,664**		
CONSTRUCTION SUB-TOTAL				**$448,831**		5,070		**$329,048**	**$54,225**	**$96,000**	**$345,664**	**$1,273,768**		
Construction Insurance	0.680%	Construction Cost							$8,662			$8,662		
First Yr. Ops. Insurance	1.450%	Construction Cost							$18,470			$18,470		
DIRECT CONSTR. TOTAL:				**$448,831**				**$329,048**	**$81,357**	**$96,000**	**$345,664**	**$1,300,899**		
Engineering (Design & CCA)	1	lump										$170,000		
Construction Management	1	lump										$170,000		
PROJECT SUB-TOTAL												$1,640,899		
Contingency	20	%										$328,180		
								TOTAL PROJECT COST				**$1,969,079**		

{1} Select gravel haul St. Mary's to Shageluk with Yutana Barge Lines on the first barge (Spring) into Shageluk only per Endil Moore.

CM COSTS		Village Labor	Mat'ls & Equip	Freight	Eq Rental	Other Field
1. PAD DEVELOPMENT	$183,244	$74,708	$35,903	$40,000	$23,750	$8,882
2. NEW POWER PLANT & STORE. MODS. PLACE.	$39,782	$3,900	$1,250	$0	$750	$33,882
3. FENCING	$71,194	$36,012	$13,738	$9,812	$2,750	$8,882
4. GROUNDING GRID INSTALLATION	$39,532	$21,100	$5,250	$550	$3,750	$8,882
5. WATER & SEWER SERVICE EXTENSION {1}	$0	$0	$0	$0	$0	$0
6. CONSTRUCTION SUB-TOTAL	**$333,753**	**$135,720**	**$56,141**	**$50,362**	**$31,000**	**$60,529**
Contingency @ 20%:	$66,751	$27,144	$11,228	$10,072	$6,200	$12,106
TOTAL CM - SUPPLIED DIRECT CONSTR COST:	**$400,503**	**$162,864**	**$67,369**	**$60,434**	**$37,200**	**$72,635**
TOTAL AVEC - SUPPLIED DIRECT CONSTR COST:	**$1,250,545**	**$95,700**	**$882,189**	**$272,656**	**$0**	**$0**
TOTAL DIRECT CONSTR COSTS:	**$1,651,048**	**$258,564**	**$949,558**	**$333,090**	**$37,200**	**$72,635**
7. DESIGN AND C.A. (incl 20% Contingency) {2}	**$12,000**					
8. CONSTRUCTION MGMT (incl Contingency) {3}	**$18,000**					
AVEC Field Constr Labor	**$180,000**					
AVEC Engineering	**$30,000**					
AVEC Travel & Misc.	**$50,000**					
SUBTOTAL:	**$1,941,048**					
Mgmt (@ 3.9%):	**$75,882**					
GRAND TOTAL:	**$2,016,930**					

{1} No piped water & sewer service in Shageluk.
{2} Engineering includes design of Pad Development, Fencing, and Grounding Grid only.
{3} Construction Management includes work on Pad Development, New Power Plant & Storage Modulues Placement, Fencing, Grounding Grid, and Existing Storage Vans & Power Plant Relocation only and assumes work done in conjunction with tank farm project.

Cost Estimate for Shageluk Power Plant			Village Labor	Mat'l & Equip	Freight	Equip Rental	Other Field	TOTAL
(Non-snow drift configuration)								
(200kW, 200kW, 200 kW - Total 600 kW)								
(AVEC SUPPLIED ESTIMATE)								
$1.74 Million Budget at $2,900 per kW								
Equipment Description								
200 kW generator set		$55,700		$55,700				$55,700
200 kW generator set		$55,700		$55,700				$55,700
200 kW generator set		$55,700		$55,700				$55,700
Engine Accessories		$3,300		$3,300				$3,300
Delivery adder FOB Anchorage		$5,800			$5,800			$5,800
Three Generator Module Enclosures FOB Anchorage		$122,475		$122,475				$122,475
One Control Module Enclosure FOB Anchorage		$37,088		$37,088				$37,088
Control Panels and Switchgear		$215,168		$215,168				$215,168
Three Control Panel								
One Master Section								
One Distribution Section								
Living Quarters FOB Calgary		$32,225		$32,225				$32,225
~~add 3 hour wall~~		$758		$758				$758
Freight Seattle		$3,500			$3,500			$3,500
Warm Storage Enclosure FOB Calgary		$27,920		$27,920				$27,920
Freight Seattle		$3,500			$3,500			$3,500
Cold Storage Enclosure FOB Calgary		$27,920		$27,920				$27,920
Freight Seattle		$3,500			$3,500			$3,500
Oil Storage Enclosure FOB Calgary		$27,985		$27,985				$27,985
Freight Seattle		$3,500			$3,500			$3,500
Canopy with Posts FOB Calgary		$25,950		$25,950				$25,950
Freight Seattle		$2,856			$2,856			$2,856
Systems (Material and Installation in Enclosures)			@33%	@67%				
Cooling	(3@$15,000)	$45,000	$14,850	$30,150				$45,000
Ventilation	(3@$10,000)	$30,000	$9,900	$20,100				$30,000
Fuel System	(3@$5,000)	$15,000	$4,950	$10,050				$15,000
Battery/Starting	(3@$5,000)	$15,000	$4,950	$10,050				$15,000
Oil Blending	(1@$15,000)	$15,000	$4,950	$10,050				$15,000
Hydronic Heating	(6@$4,000)	$24,000	$7,920	$16,080				$24,000
Exhaust	(3@$2,000)	$6,000	$1,980	$4,020				$6,000
Fire Suppression	(4@ $10,000)	$40,000	$13,200	$26,800				$40,000
Other Equipment (Material and Installation in Enclosure)								
Station Service	(8@$2,000)	$16,000	$5,280	$10,720				$16,000
Lighting	(8@$1,000)	$8,000	$2,640	$5,360				$8,000

Cost Estimate for Shageluk Power Plant				Village Labor	Mat'l & Equip	Freight	Equip Rental	Other Field	TOTAL
(Non-snow drift configuration)									
(200kW, 200kW, 200 kW - Total 600 kW)									
	Power Cables	(3@$5,000)	$15,000	$4,950	$10,050				$15,000
	Feeder Cables	(1@$15,000)	$15,000	$4,950	$10,050				$15,000
Other Equipment (Material and Installation in Enclosure)									
	Station Batteries/Charger	(1@$7,000)	$7,000	$2,310	$4,690				$7,000
	Daytank/Pump/Controls	(1@$5,000)	$5,000	$1,650	$3,350				$5,000
	Heat Exchangers	(3@$5,000)	$15,000	$4,950	$10,050				$15,000
	Cable Trays	(3@$1,000)	$3,000	$990	$2,010				$3,000
	Incinolet Toilet	(1@$2,500)	$2,500	$825	$1,675				$2,500
	Used Oil Piping	(3@$1,000)	$3,000	$990	$2,010				$3,000
	New Oil Piping	(3@$1,000)	$3,000	$990	$2,010				$3,000
	Aftercoolers	(3@$2,500)	$7,500	$2,475	$5,025				$7,500
Testing			$25,000	$25,000					$25,000
Main Components (Installation in Enclosures)									
	200 kW generator set		$5,000	$5,000					$5,000
	200 kW generator set		$5,000	$5,000					$5,000
	200 kW generator set		$5,000	$5,000					$5,000
	Control panels and switchgear		$30,000	$30,000					$30,000
Field Installation									
	Generator Modules	(3@$10,000)	$30,000	$30,000					$30,000
	Control Modules	(1@$25,000)	$25,000	$25,000					$25,000
	Storage Modules	(3@$5,000)	$15,000	$15,000					$15,000
	Living Quarters	(1@$5,000)	$5,000	$5,000					$5,000
	Canopy	(1@$5,000)	$5,000	$5,000					$5,000
	Plant Transformers		$30,000	$30,000					$30,000
Shipping to Village Barge Landing									
	Modules	(8@$30,000)	$240,000			$240,000			$240,000
	Canopy	(1@$10,000)	$10,000			$10,000			$10,000
Subtotal AVEC Direct Constr Costs (excl AVEC Field Labor):			**$1,430,545**	**$95,700**	**$882,189**	**$272,656**	**$0**	**$0**	**$1,250,545**
		AVEC Field Labor:		**$180,000**					**$180,000**
				$275,700					**$1,430,545**
		Pad Development		$74,708	$35,903	$40,000	$23,750	$8,882	$183,244
		New Power Plant & Storage Modules Placement		$3,900	$1,250	$0	$750	$33,882	$39,782
		Fencing		$36,012	$13,738	$9,812	$2,750	$8,882	$71,194
		Grounding Grid Installation		$21,100	$5,250	$550	$3,750	$8,882	$39,532
		Water & Sewer Service Extension {1}		$0	$0	$0	$0	$0	$0
		Construction Subtotal - CM Construction Direct		$135,720	$56,141	$50,362	$31,000	$60,529	$333,753
		Contingency @ 20%:		$27,144	$11,228	$10,072	$6,200	$12,106	$66,751
		TOTAL (CM SUPPLIED DIRECT FIELD COSTS):		**$162,864**	**$67,369**	**$60,434**	**$37,200**	**$72,635**	**$400,503**
		TOTAL DIRECT CONSTRUCTION COSTS:		**$258,564**	**$949,558**	**$333,090**	**$37,200**	**$72,635**	**$1,651,048**
{1} No piped water or sewer service in Shageluk.									

APPENDIX C

SITE CONTROL DOCUMENTS

Alaska Energy and Engineering, Inc.
Mailing Address - P.O. Box 111405
Anchorage, AK 99511-1405
(907) 349-0100
349-8001 fax

September 12, 2003

Sent Via Fax to: 452-5406
(3 Pages Total)

Ms. Rita Bowden
Fairbanks Title Agency
714 Third Avenue
Fairbanks, AK 99701

Re: Shageluk Bulk Fuel and Power Plant Upgrade
Request for Certificate to Plat

Dear Ms. Bowden:

Please find enclosed portions of the Shageluk Community Map that identify parcels 1 through 5. Please prepare a Certificate to Plat for the following parcels:

1. The entire Block 10 of U.S. Survey 4493.
2. The Alaska Village Electric Co-Operative Generator & Tank Farm Site, Plat 85-4, Mt. McKinley Recording District.
3. Lot 5, Block 4, U.S. Survey 4493. The book, page, and recording date shown on the Community Map for this parcel may be incorrect. A Shageluk School Site Deed was found at Book 17, Page 996-997, Kuskokwim Recording District.
4. That portion of Lot 5, Block 4, U.S. Survey 4493, identified as "Deed to SOA, Div. of Design & Construction 08/08/77".
5. Lot 4, Block 9, U.S. Survey 4493. The book, page, and recording date shown on the Community Map for this parcel may be incorrect. A Shageluk School Site Deed was found at Book 17, Page 996-997, Kuskokwim Recording District.

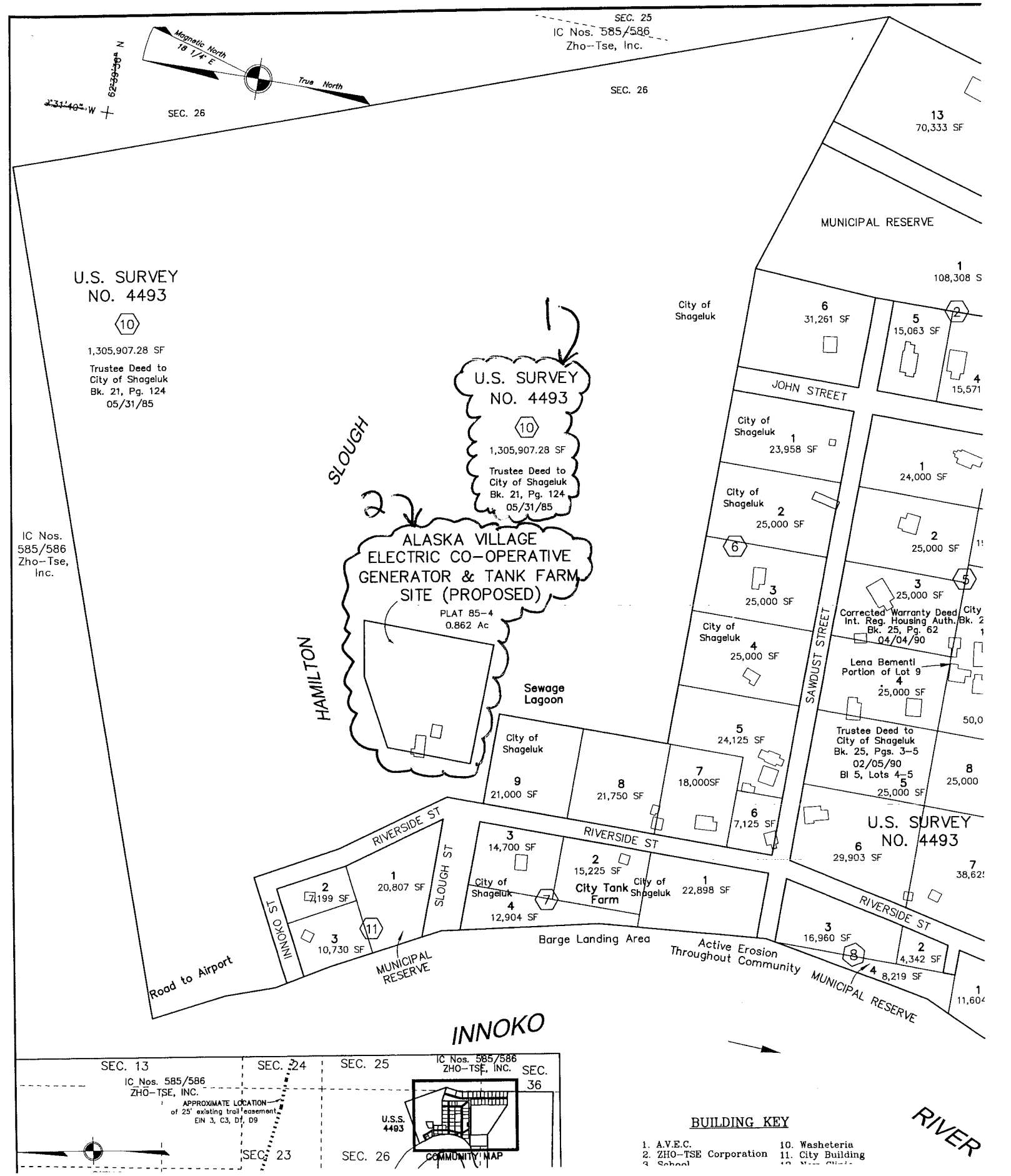
We request the Certificate to Plat prior to September 24, 2003. **You are authorized to bill up to $1,000.00 for this effort. If you are unable to meet the desired due date and anticipate exceeding this amount, please call prior to proceeding.**

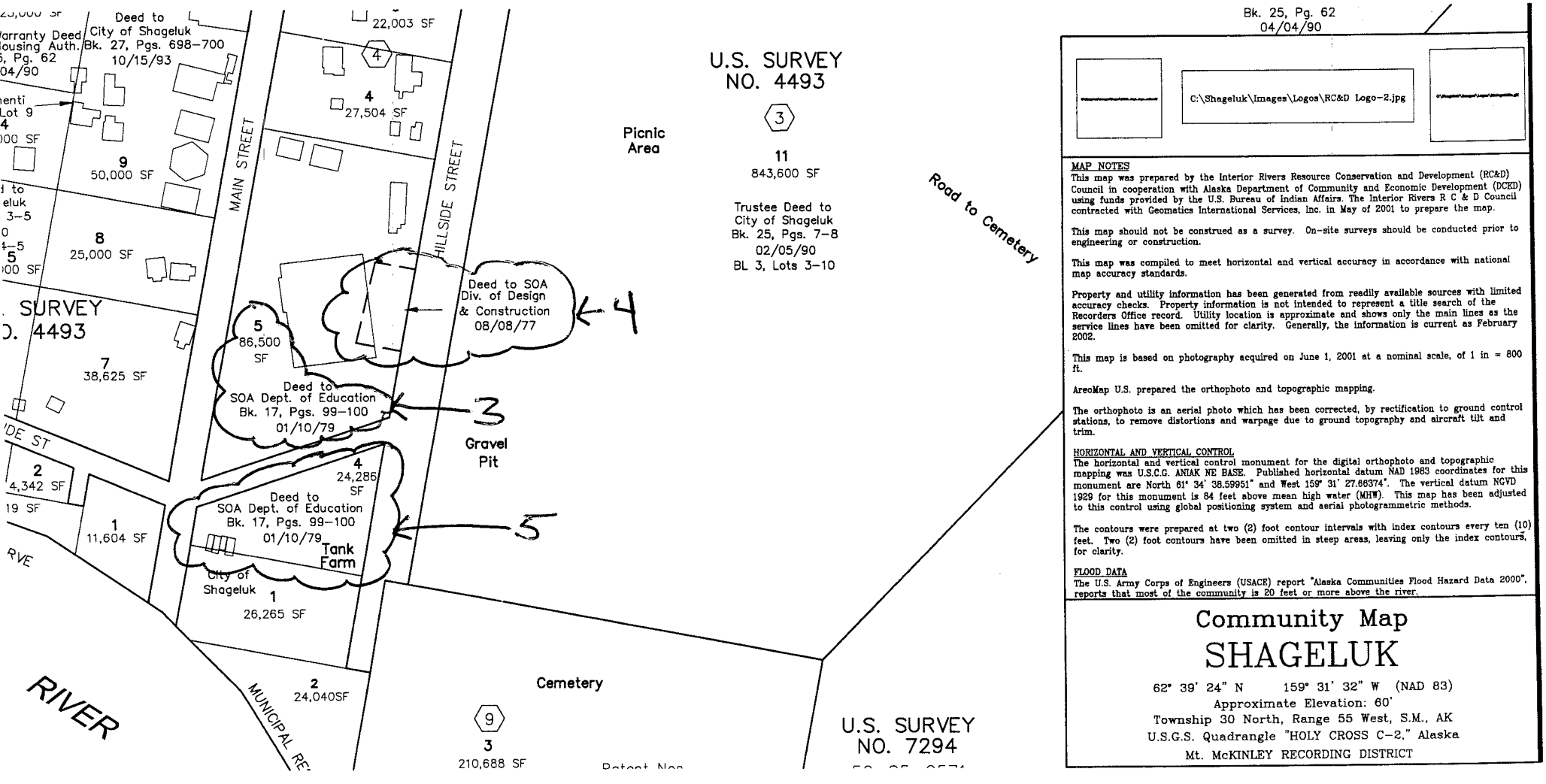
If you have any questions, please call (907) 349-0100, or fax comments to (907) 349-8001.

Sincerely,
Alaska Energy and Engineering, Inc.

Trevor D. Krupa, P.E.
Mechanical Engineer

attachments: as noted


SEC. 25
IC Nos. 585/586
Zho-Tse, Inc.
Magnetic North
18 1/4° E
True North
62°39'36" N
2°31'40" W
SEC. 26
SEC. 26
13
70,333 SF
MUNICIPAL RESERVE
1
108,308 S
U.S. SURVEY
NO. 4493
10
1,305,907.28 SF
Trustee Deed to
City of Shageluk
Bk. 21, Pg. 124
05/31/85
City of
Shageluk
6
31,261 SF
5
15,063 SF
2
4
15,571
JOHN STREET
City of
Shageluk
1
23,958 SF
1
24,000 SF
City of
Shageluk
2
25,000 SF
2
25,000 SF
6
3
25,000 SF
3
25,000 SF
5
City of
Shageluk
4
25,000 SF
SAWDUST STREET
Corrected Warranty Deed
Int. Reg. Housing Auth. Bk. 2
Bk. 25, Pg. 62
04/04/90
Lena Bementi
Portion of Lot 9
4
25,000 SF
50,0
Trustee Deed to
City of Shageluk
Bk. 25, Pgs. 3-5
02/05/90
Bl 5, Lots 4-5
5
25,000 SF
8
25,000
U.S. SURVEY
NO. 4493
6
29,903 SF
7
38,62
U.S. SURVEY
NO. 4493
10
1,305,907.28 SF
Trustee Deed to
City of Shageluk
Bk. 21, Pg. 124
05/31/85
SLOUGH
ALASKA VILLAGE
ELECTRIC CO-OPERATIVE
GENERATOR & TANK FARM
SITE (PROPOSED)
PLAT 85-4
0.862 Ac
HAMILTON
Sewage
Lagoon
IC Nos.
585/586
Zho-Tse,
Inc.
City of
Shageluk
9
21,000 SF
8
21,750 SF
7
18,000SF
5
24,125 SF
6
7,125 SF
RIVERSIDE ST
RIVERSIDE ST
RIVERSIDE ST
3
14,700 SF
2
15,225 SF
City of
Shageluk
4
12,904 SF
City Tank
Farm
City of
Shageluk
1
22,898 SF
2
7,199 SF
1
20,807 SF
SLOUGH ST
INNOKO ST
3
10,730 SF
11
MUNICIPAL
RESERVE
Road to Airport
Barge Landing Area
Active Erosion
Throughout Community
MUNICIPAL RESERVE
3
16,960 SF
8
2
4,342 SF
4
8,219 SF
1
11,604
INNOKO
SEC. 13
SEC. 24
SEC. 25
IC Nos. 585/586
ZHO-TSE, INC.
SEC.
36
IC Nos. 585/586
ZHO-TSE, INC.
APPROXIMATE LOCATION
of 25' existing trail easement
EIN 3, C3, D1, D9
U.S.S.
4493
SEC. 23
SEC. 26
COMMUNITY MAP
BUILDING KEY
1. A.V.E.C.
2. ZHO-TSE Corporation
10. Washeteria
11. City Building
RIVER



Bk. 25, Pg. 62
04/90

C:\Shageluk\Images\Logos\RC&D Logo-2.jpg

MAP NOTES

This map was prepared by the Interior Rivers Resource Conservation and Development (RC&D) Council in cooperation with Alaska Department of Community and Economic Development (DCED) using funds provided by the U.S. Bureau of Indian Affairs. The Interior Rivers R C & D Council contracted with Geomatics International Services, Inc. in May of 2001 to prepare the map.

This map should not be construed as a survey. On-site surveys should be conducted prior to engineering or construction.

This map was compiled to meet horizontal and vertical accuracy in accordance with national map accuracy standards.

Property and utility information has been generated from readily available sources with limited accuracy checks. Property information is not intended to represent a title search of the Recorders Office record. Utility location is approximate and shows only the main lines as the service lines have been omitted for clarity. Generally, the information is current as February 2002.

This map is based on photography acquired on June 1, 2001 at a nominal scale, of 1 in = 800 ft.

AreoMap U.S. prepared the orthophoto and topographic mapping.

The orthophoto is an aerial photo which has been corrected, by rectification to ground control stations, to remove distortions and warpage due to ground topography and aircraft tilt and trim.

HORIZONTAL AND VERTICAL CONTROL

The horizontal and vertical control monument for the digital orthophoto and topographic mapping was U.S.C.G. ANIAK NE BASE. Published horizontal datum NAD 1983 coordinates for this monument are North 61° 34' 38.59951" and West 159° 31' 27.66374". The vertical datum NGVD 1929 for this monument is 84 feet above mean high water (MHW). This map has been adjusted to this control using global positioning system and aerial photogrammetric methods.

The contours were prepared at two (2) foot contour intervals with index contours every ten (10) feet. Two (2) foot contours have been omitted in steep areas, leaving only the index contours, for clarity.

FLOOD DATA

The U.S. Army Corps of Engineers (USACE) report "Alaska Communities Flood Hazard Data 2000", reports that most of the community is 20 feet or more above the river.

Community Map

SHAGELUK

62° 39' 24" N 159° 31' 32" W (NAD 83)

Approximate Elevation: 60'

Township 30 North, Range 55 West, S.M., AK

U.S.G.S. Quadrangle "HOLY CROSS C-2," Alaska

Mt. McKINLEY RECORDING DISTRICT

Complete

Title & Escrow

Services

FAIRBANKS TITLE AGENCY

TEAM APPROACH

714 Third Avenue, Fairbanks, AK 99701 email – team@fairbankstitle.com
907-456-6626♦TITLE FAX 907-452-5406♦ESCROW FAX 907-457-7676

Trevor Krupa
ALASKA ENERGY AND ENGINEERING, INC.
P.O. Box 111405
Anchorage, AK 99511-1405

PLATTING CERTIFICATE

FILE NUMBER: **58646**

EFFECTIVE DATE: **August 25, 2003** at 8:00 a.m.

FEE: **$650.00**

VESTING: **PARCEL I: CITY OF SHAGELUK**
PARCEL II: ALASKA VILLAGE ELECTRIC COOPERATIVE, INC.
PARCEL III AND V: UNITED STATES OF AMERICA, BUREAU OF INDIAN AFFAIRS
PARCEL IV: STATE OF ALASKA, DIVISION OF DESIGN AND CONSTRUCTION

LEGAL DESCRIPTION:

PARCEL I:

Block Ten (10), SHAGELUK ADDITION TOWNSITE, U.S. SURVEY NUMBER 4493, Alaska, as shown on the plat of survey dated August 6, 1975 located in the Mt. McKinley Recording District, Fourth Judicial District, State of Alaska.

EXCEPTING THEREFROM any portion lying within ALASKA VILLAGE ELECTRIC CO-OP PROPOSED GENERATOR AND TANK SITE, according to the plat filed September 30, 1985 as Plat Number 85-4; Records of the Mt. McKinley Recording District, Fourth Judicial District, State of Alaska.

PARCEL II:

ALASKA VILLAGE ELECTRIC CO-OP PROPOSED GENERATOR AND TANK SITE, according to the plat filed September 30, 1985 as Plat Number 85-4; Records of the Mt. McKinley Recording District, Fourth Judicial District, State of Alaska.

PARCEL III:

That portion of Lot Five (5), Block Four (4), SHAGELUK ADDITION TOWNSITE, U.S. SURVEY NUMBER 4493, Alaska, as shown on the plat of survey dated August 6, 1975 located in the Mt. McKinley Recording District, Fourth Judicial District, State of Alaska, more particularly described as follows:

BEGINNING at the Northwest corner of Lot Five (5), Block Four (4); THENCE South 29°48' East a distance of 251.61 feet; THENCE North 89°13' East a distance of 85.00 feet; THENCE North 00°47' West a distance of 58.00 feet; THENCE South 87°30'46" East a distance of 105.17 feet; THENCE South 00°47' East a distance of 52.00 feet; THENCE North 89°13' East a distance of 142.11 feet; THENCE North 00°47' West a distance of 220.03 feet; THENCE South 89°13' West a distance of 454.15 feet to the POINT OF BEGINNING.

PARCEL IV:

That portion of Lot Five (5), Block Four (4), SHAGELUK ADDITION TOWNSITE, U.S. SURVEY NUMBER 4493, Alaska, as shown on the plat of survey dated August 6, 1975 located in the Mt. McKinley Recording District, Fourth Judicial District, State of Alaska, more particularly described as follows:

BEGINNING at the Southwest corner of Lot Five (5), Block Four (4); THENCE North 89°13' East a distance of 85.00 feet to the True Point of Beginning; THENCE continuing North 89°13' East a distance of 105.00 feet; THENCE North 00°47' West a distance of 52.00 feet; THENCE North 87°30'46" West a distance of 105.17 feet; THENCE South 00°47' East a distance of 58.00 feet to the TRUE POINT OF BEGINNING.

PARCEL V:

Lot Four (4), Block Nine (9), SHAGELUK ADDITION TOWNSITE, U.S. SURVEY NUMBER 4493, Alaska, as shown on the plat of survey dated August 6, 1975 located in the Mt. McKinley Recording District, Fourth Judicial District, State of Alaska.

SUBJECT TO:

1. **Reservations** as contained in U.S. Patent recorded July 23, 1976 in Book 10, Page 588.

2. **RIGHT-OF-WAY EASEMENT**, and the terms and conditions thereof;

DISCLOSED BY:	Instrument recorded November 10, 1977 in Book 11, Page 44
GRANTEE:	State of Alaska
PURPOSE:	Right of way
AREA AFFECTED:	Parcel I: See instrument

Decision, and the terms and conditions thereof, recorded February 15, 1978 in Book 11, Page 187.

3. **Rights of the public and governmental bodies** in and to any portion of said land lying below the mean high water line of sloughs, pond and Innoko River, as to Parcel I.

4. **Rights of the public and governmental bodies** in and to any portion of said land lying below the mean high water line of slough, as to Parcel II.

5. **Rights of the public and governmental bodies** in and to any portion of said land lying within a public highway or right of way.

6. **RESTATED MORTGAGE AND SECURITY AGREEMENT**, and the terms and conditions thereof;

DISCLOSED BY:	Instrument recorded April 26, 2000 in Book 35, Page 1
MORTGAGOR:	Alaska Village Electric Cooperative, Inc.
MORTGAGEE:	United State of America, Rural Utilities Service
AMOUNT:	Stated of be $100,000,000.00
AFFECTS:	Includes Other Property

NOTE: The holders of this note/indebtedness should be contacted for all pertinent information including the present amount due.

7. **No search of the public records for UCC filings,** including but not limited to any purchase money security interest in fixtures on the real estate herein described pursuant to Alaska Statute AS 45.09.2313 and any amendments thereto, has been made.

8. **Rights of parties in possession**.

NOTE: This report is restricted to the use of the addressee and is not to be used for closing any transaction affecting title to said property. Liability of the company is limited to the amount paid herein.

NOTE: Subject property lies outside an organized taxing district, therefore no taxes are payable.

Fairbanks Title Agency

September 22, 2003

APPENDIX D

GEOTECHNICAL REPORT

A.W. Murfitt Company

CONSULTING ENGINEERS & TESTING
13810 Venus Way ■ Anchorage, Alaska 99515 ■ (907) 345-2737

November 13, 2003

Alaska Energy and Engineering, Inc.
P.O. Box 111405
Anchorage, AK 99511-1405

ATTENTION: Mr. Steve Stassel, P.E.

RE: Subsurface Soil and Foundation Conditions
Shageluk Bulk Fuel Storage & Power Plant Upgrade, School Tank Farm
Block 10, USS 4493 and Lot 5, Block 4 USS 4493
Shageluk, Alaska
Our Job 03-313.12

Dear Mr. Stassel:

Pursuant to your request, we have completed an evaluation of the subsurface soils and foundation conditions for new bulk fuel tanks and power plant at Block 10 and a fuel tank for the school at Lot 5 of the referenced sites. Work was done in general accordance with the scope of work outlined in your email of October 2, 2003. This letter is intended to summarize our findings and provide recommendations for the design and construction of the foundations for the projects listed as well as transmit the test pit logs along with associated laboratory test data. Attached are site plans (as prepared by your office) for the structures Plates M1 through M7, the two test pit logs, four soil particle size distribution reports, keys to the symbols and terminology used to describe the soils, and select photographs of the sites.

FIELD WORK and BACKGROUND REVIEW

Mr. Trevor Krupa, P.E. of your firm on August 29, 2003, did initial subsurface exploration site work. A total of two test pits were dug using a John Deere 350 CE backhoe. The pits were dug near the boundaries of the proposed power plant "foot print" (location). Test pits were located so as not to conflict with the actual power plant foundations as disturbed soils would have to be carefully recompacted to correct the damage caused by test pit excavations. The walls of the pits were logged and samples obtained from the excavations by Mr. Krupa. The test pit locations are shown on Plate M2. The soil samples were then returned to our Anchorage laboratory for visual examination and testing by Mr. Krupa. Testing included moisture content and soil particle size/frost classification.

A subsequent trip was made by Mr. Allan Murfitt, P.E. of this firm, accompanied by Mr. Trevor Krupa, P.E. on October 9, 2003 to view the power plant, tank, and material sites. We traveled by riverboat to the material site approximately 9.4 miles up the Innoko River from the new bulk fuel storage site to view the weathered bedrock source. We also viewed the in town borrow site which is located south of the school. We walked to the school tank site and the new bulk fuel upgrade site, viewing surrounding building foundations and the actual sites. Digital photographs were taken of the material sites and tank sites of which selected prints have been attached to this report.

In conducting our evaluation of the sites we reviewed the following geotechnical reports: Engineering Geology Reconnaissance Report, Shageluk Airport – Material Sources, 8/98, Northern Region Technical Services Geology; Geotechnical Services, Inoko River School, 7/87, Harding Lawson Associates Job 9653,003.08; Geotechnical Investigation Water and Sewer Improvements, 8/03, Duane Miller and Associates, Inc. Job 4137.03.

The community of Shageluk is located approximately 190 miles northeast of Bethel on the Innoko River. The power plant site is located on the south bank of a slough that empties into the Innoko River, 160' to the west. Vegetation in the immediate area consists primarily of small and thin alder stands. The site is essentially flat. Currently, a fill pad supporting the existing tank farm and AVEC power plant occupies the eastern portion of the site. This tank farm will be abandoned and the fill pad used as part of this project. Prior to the tank farm construction in the mid-1980's, this site was used for the village landfill. The rest of the site is undeveloped. This site is reportedly permafrost free. The school tank site, next to the vocational education building, appears to have been partially filled with local material from the material site south of the school (Plate M6). The vocational education building, with a pad and post foundation, appears to have had substantial differential movement, with the footings shimmed (leveled) by as much as one foot. This site slopes to the east 3 to 5 percent and the proposed embankment appears to intercept a small drainage on the east end. This appears to be drainage from the material site to the southwest and could have a substantial periodic flow. No surface flow was visible during our visit and it had been raining for several days. The surface organic mat has been left in place and vegetation consists of sparse black spruce. Assorted debris and fill piles occupy the site. We would expect permafrost at this site (Boring 6 from the HLA report).

The US Army Corps of Engineers lists no threat of flood in Shageluk ("Alaskan Communities Flood Hazard Data 2000", US ACE). The Environmental Atlas of Alaska, 1979 edition, reports design snow loadings of 30 pounds per square foot. The area is reported to be generally underlain by continuous permafrost. The mean annual air temperature is 25 °F with a mean annual precipitation of 17.1 inches. Mean annual snowfall is estimated at 80 inches (ground snow load 60 pounds per square foot). IBC 2000 seismic coefficients are S_S of 52.3% gravity S_1

of 24.4% gravity with a site classification of D and an importance of III. This is a relatively low seismic risk area. The design wind speed is 120 miles per hour; Exposure C. Snow drifting may be significant.

SUBSURFACE SOIL CONDITIONS

The soil profile in Test Pit 1 consists of organics and organic silt to a depth of 1 foot, which is underlain by Silt (ML) with Sand to the limited 6.5-foot depth of exploration (limit of equipment). Test Pit 2 also has a one-foot layer of organics and organic silt, which is underlain by Sandy Silt (ML) to the bottom of excavation at 6.5 feet. Trash was evident in the first one foot of each test pit, but no water was present in either test pit. No frozen ground was observed in the test pits. Due to the near proximity of the Innoko River slough we would not expect permafrost/perennially frozen ground at the site. From data reviewed, we would expect seasonal frost to 6 feet in undisturbed areas and as much as 10 feet in disturbed areas. The test pit logs are shown on Plates 8 and 9. The existing tank farm embankment appears to have been constructed of the locally available fill. It appears to be stable (erosion and settlement).

Harding and Lawson Associates' Boring 6 appears to have been located near the vocational education building and adjacent to the proposed school tank site (original school destroyed by fire). The soil profile appears to be 18 to 19 feet of Silt (ML) with underlying weathered bedrock as is visible at the material site. We would estimate approximately 2 to 3 feet of organics at the site with Silt (ML) and underlying weathered bedrock. This boring shows relatively low ice content permafrost to the completion of boring at 25 feet. Foundation settlement at the vocational education building may have primarily occurred in the compression of the surface organics as an overlay fill was used.

Associated laboratory testing results are shown on the test pit logs opposite the corresponding depths of excavation and on the soil particle size distribution reports on Plates 10, 11, 12 and 13. Symbols and Terminology used to describe the soils are shown on Plates 14, 15 and 16. Selected project photographs have been attached.

FOUNDATION RECOMMENDATIONS

Based on our work, the existing tank farm site should provide a satisfactory location for the proposed bulk fuel storage and power generation facility. Subsurface soils will provide an adequate bearing media when prepared to the following recommendations.

The fill soils from the material site up river from Shageluk and in town were reviewed for use as structural fill on this project. We do not see the need to construct the above ground embankments entirely of clean, non-frost susceptible, processed gravel soils. In this regard, we would recommend that the core of the fill be constructed of finer grained soil, Sandy Silt with Gravel (ML, SM) soils and capped with gravel. Embankment soil shear strengths maybe enhanced by the use of geotextile fabrics. This would greatly reduce the quantity of processed gravel along with associated costs and allow the use of the in town materials. There appears to be adequate quantities of the finer grained fill in town and sufficient quantities of weathered gravel bedrock to cap embankments. Haul distances would be greatly reduced and the use of the in town site would allow all season access to the material (ice road required to access upriver site).

We understand that the new tanks will be horizontal cylinders, placed on concrete and/or treated wood sleepers (long, rectangular strip footings). These types of foundations have been used in the past at the tank farm site. The new power plant is comprised of modular units on skids that will be placed directly on the fill pad. Embankment back slopes, estimated to be on the order of 1.5 to 1, appear to be stable and adequate. These were capped with fine gravel (less than 3-inch particle size).

All organic soils (Peat, organic silt, etc.), refuse, and buried debris should be removed from all fill pad-bearing areas. It is recommended that all new installations be supported on structural fill soils (Sandy Silt with Gravel; relatively soft, weathered, greywacke bedrock) mined from the local borrow pit south of the school. The allowable soil bearing capacity of the compacted structural embankments may be proportioned at two thousand (2,000) pounds per square foot for combined dead and live loadings. This value may be increased by one-third for transient loads such as those associated with wind and seismic action. Slope stability and land spreading and/or lurching are not expected to be an issue.

From the review data, low ice content permafrost in the subsurface soils at the proposed school tank site should allow the use of an overlay fill after organics/debris are removed. An armored (erosion stable) drainage structure should be constructed at the east end of the embankment site to keep runoff water away from the structure. With accurate mapping to estimate the drainage basin, the size of structure could be more readily designed, but, lacking that, we would suggest that the structure be a minimum of 8 feet wide and 1 foot deep. A filter fabric should be placed over the mineral soil with a 1-foot cap of coarse gravel (2 to 8 inch).

At both locations, exposed subgrades supporting the new installations should be compacted (to correct for excavation disturbance) to 95 percent of the maximum density for that material as determined by the ASTM D-1557 or the equivalent AASHTO T-180 specification. Additional structural fill as described above should be placed in maximum one-foot lifts and compacted to a minimum density of 95 percent of the maximum density for that material. A geotextile fabric,

such as Typar 3400, Mirafi 500X, or an equivalent product, should be placed in accordance with the manufacturer's recommendations on top of the existing subgrades prior to fill placement in order to prevent the coarser fill from mixing with the existing silt materials. It also may be necessary to place an additional layer of fabric at an intermediate level in the embankment to stabilize soils if placement and/or workability become difficult due to moisture. The cap material can consist of 4-inch minus Gravel with a Silt content not to exceed 12 percent, nominally compacted (90 % of maximum density). Back slopes, as stated, should be at least 1.5 to 1.

The native materials and available structural fills are expected to undergo seasonal frost volume changes when freezing in the presence of available water, i.e. frost heave. However, embankment floors will be lined with an impermeable liner and available water should be minimal. We would expect frost heaving to be a relatively minor issue in this regard and embankments will be several feet above natural grades. Regardless, you will still need to consider flexible piping connections capable of tolerating at least 6 inches of differential movement.

We appreciate this opportunity to be of continued service. Please do not hesitate to call if you have any questions or we can be of further assistance.

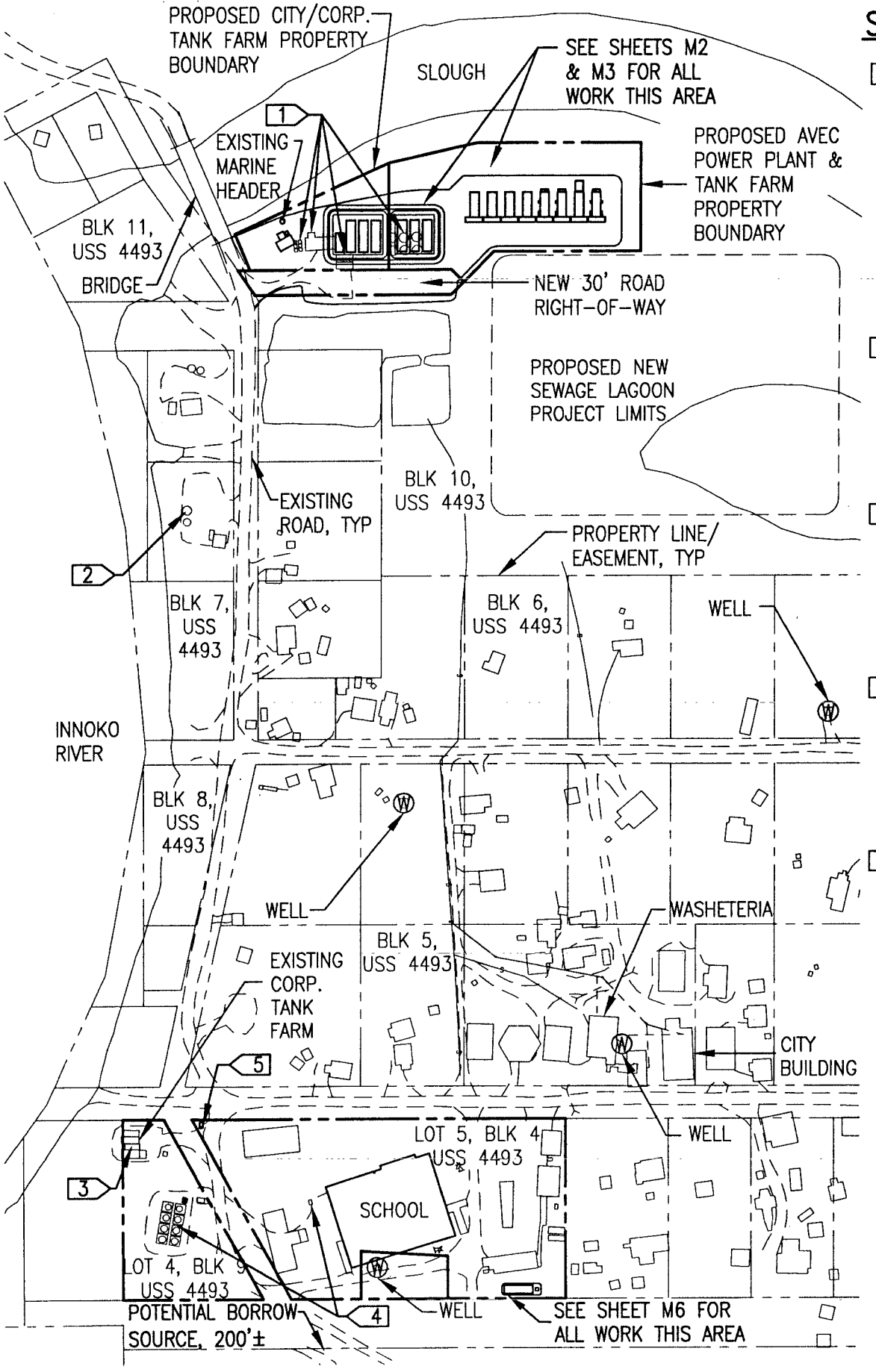
Sincerely,

A.W. Murfitt Company

12/02/03

Allan W. Murfitt, P.E.
Registered Civil Engineer 4977-E

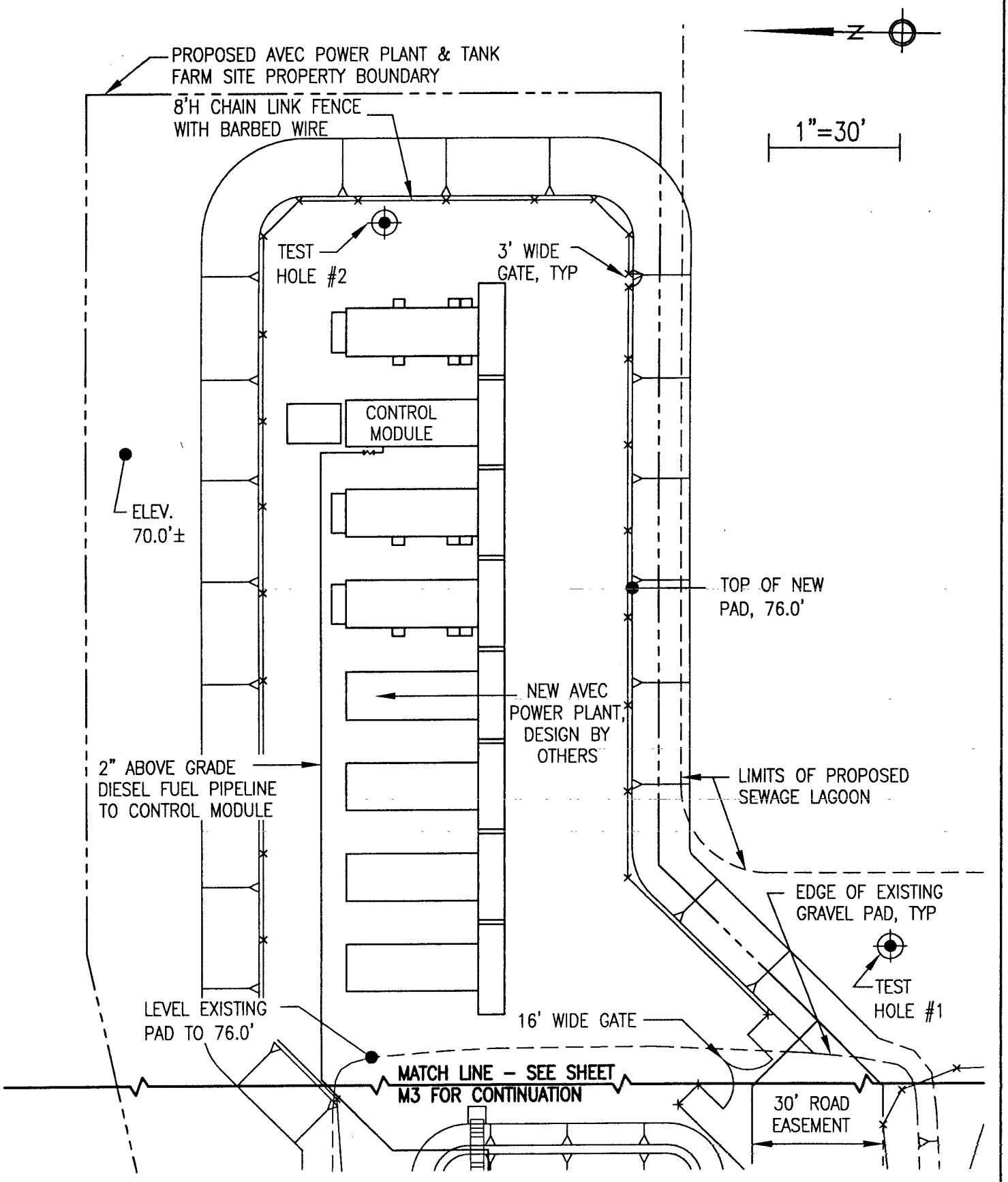
Attachments: Site Plan, Plates M1 through M7; Test Pit Logs, Plates 8 and 9; Particle Size Distribution Reports, Plates 10, 11, 12 and 13; Symbols and Terminology, Plates 14, 15 and 16. HLA Boring Log 6, Selected Digital Photo Prints.



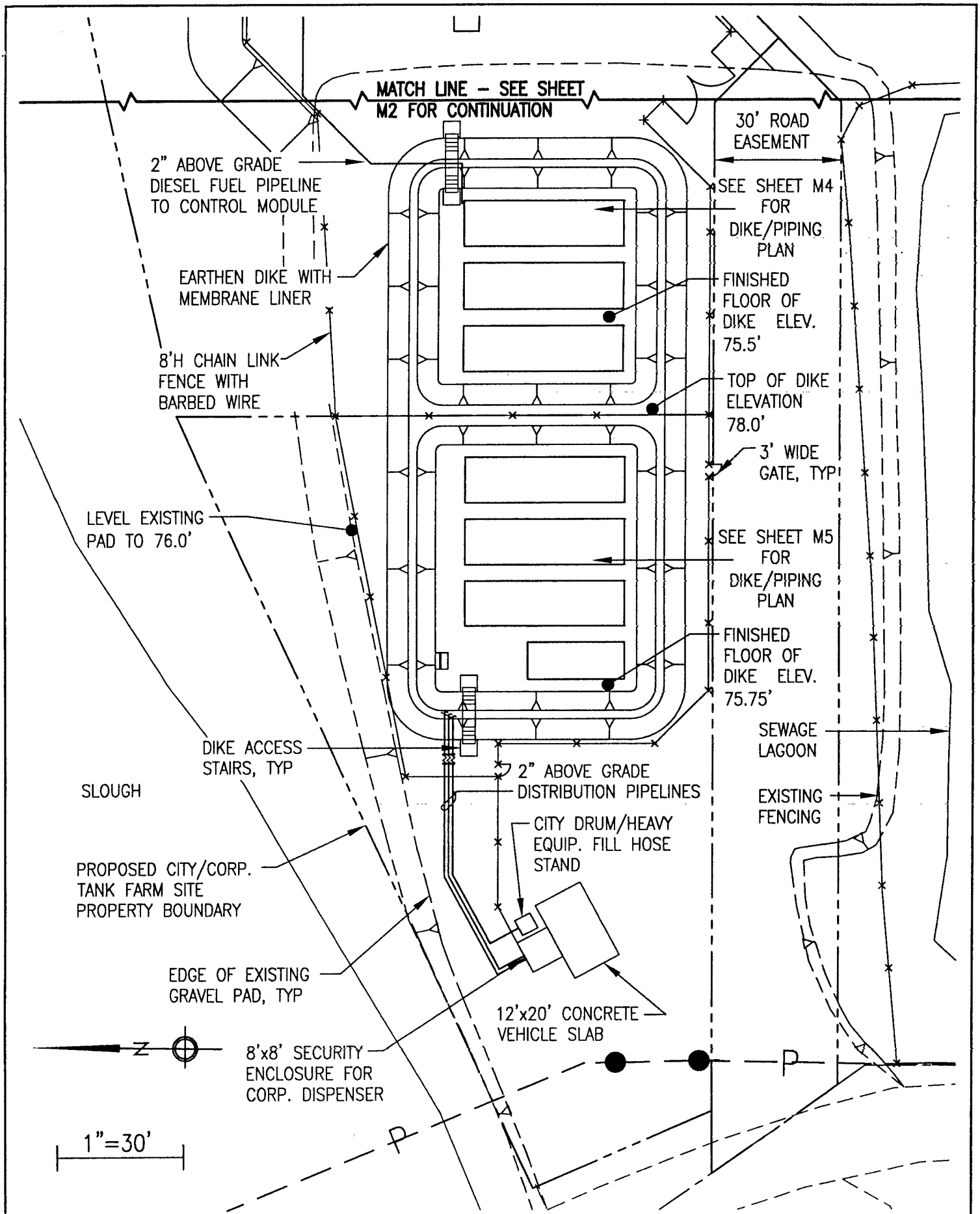
SPECIFIC NOTES:

1. 6 EA. EXISTING AVEC TANKS (57,066 GALLONS TOTAL CAPACITY), POWER PLANT, TRANSFORMERS, AND STORAGE CONTAINERS TO BE TAKEN OUT OF SERVICE.
2. 2 EA. EXISTING CITY TANKS (12,507 GALLONS TOTAL CAPACITY) TO BE TAKEN OUT OF SERVICE.
3. 4 EA. EXISTING CORP. TANKS (28,851 GALLONS TOTAL CAPACITY) TO BE TAKEN OUT OF SERVICE.
4. 9 EA. EXISTING SCHOOL TANKS (31,670 GALLONS TOTAL CAPACITY) TO BE TAKEN OUT OF SERVICE.
5. MARINE HEADER FOR SCHOOL TANK

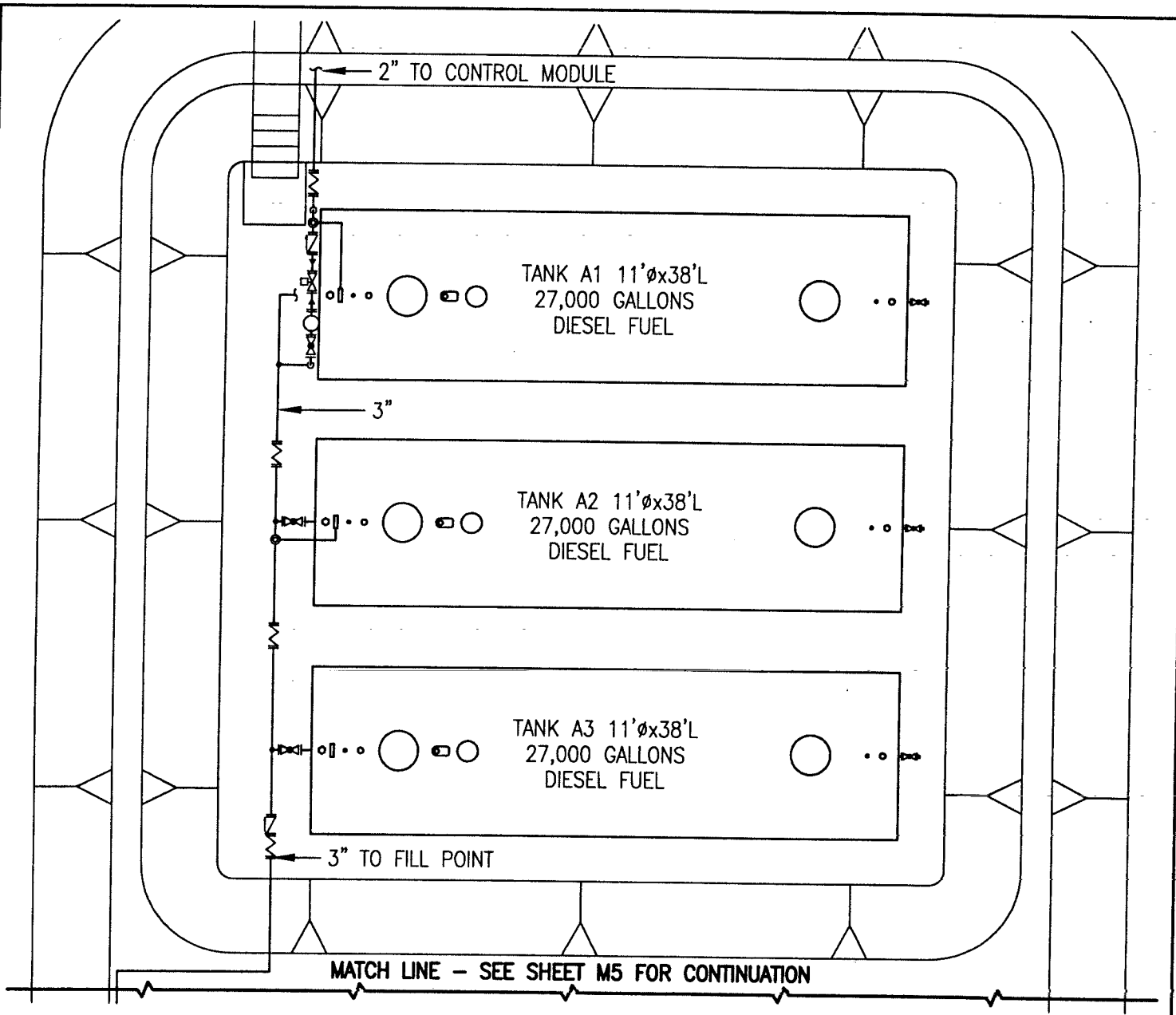
PROJECT: SHAGELUK BULK FUEL STORAGE & POWER PLANT UPGRADE	DRAWN BY: TDK	SCALE: 1"=175'	ALASKA ENERGY & ENGINEERING, INC.
	DESIGNED BY: TDK	DATE: 11/03	P.O. BOX 111405 ANCHORAGE, ALASKA 99511-1405
TITLE: OVERALL SITE PLAN	FILE NAME SHAG-CDR-M1	SHEET M1 OF 7	PHONE (907) 349-0100



PROJECT: SHAGELUK BULK FUEL STORAGE & POWER PLANT UPGRADE	DRAWN BY: TDK	SCALE: 1"=30'	ALASKA ENERGY & ENGINEERING, INC.
	DESIGNED BY: TDK	DATE: 11/03	P.O. BOX 111405 ANCHORAGE, ALASKA 99511-1405
TITLE: AVEC POWER PLANT & TANKS FARM AREA SITE PLAN	FILE NAME SHAG-CDR-M2	SHEET M2 OF 7	PHONE (907) 349-0100



PROJECT: SHAGELUK BULK FUEL STORAGE & POWER PLANT UPGRADE	DRAWN BY: TDK	SCALE: 1"=30'	ALASKA ENERGY & ENGINEERING, INC.
	DESIGNED BY: TDK	DATE: 11/03	P.O. BOX 111405 ANCHORAGE, ALASKA 99511-1405
TITLE: AVEC & CITY/CORP. TANK FARM AREA SITE PLAN	FILE NAME SHAG-CDR-M3	SHEET M3 OF 7	PHONE (907) 349-0100



N

1"=10'

TANK SCHEDULE

TANK #	NEW OWNER	NEW/ EXISTING	TYPE (2)	FUNCTION	DIESEL CAPACITY(1)	GASOLINE CAPACITY(1)
A1	AVEC	NEW	SW	BULK	27,000	
A2	AVEC	NEW	SW	BULK	27,000	
A3	AVEC	NEW	SW	BULK	27,000	
AVEC – NEW STORAGE TOTAL					**81,000**	
C1	CITY	NEW	SW	BULK	27,000	
CITY – NEW STORAGE TOTAL					**27,000**	
NC1	CORP.	NEW	SW	BULK	27,000	
NC2	CORP.	NEW	SW	BULK		27,000
NC3	CORP.	NEW	FR	DISPENSING		4,000
NC4	CORP.	NEW	FR	DISPENSING	4,000	
CORP. – NEW STORAGE TOTAL					**31,000**	**31,000**
S1	SCHOOL	NEW	DW	INTERMED.	20,000	
SCHOOL – NEW STORAGE TOTAL					**20,000**	
PROJECT STORAGE CAPACITY BY PRODUCT					**159,000**	**31,000**
PROJECT TOTAL GROSS STORAGE CAPACITY						**190,000**

NOTES: 1) ALL CAPACITIES ARE GROSS SHELL CAPACITY IN GALLONS
2) SW=SINGLE WALL, DW=DOUBLE WALL, FR=TWO-HOUR FIRE RATED

GENERAL NOTES:

1. THE AVEC NET TANK FARM DIKE CAPACITY IS 38,669 GALLONS, THE VOLUME OF THE LARGEST TANK PLUS 8" FREEBOARD FOR PRECIPITATION.

PROJECT: SHAGELUK BULK FUEL STORAGE & POWER PLANT UPGRADE

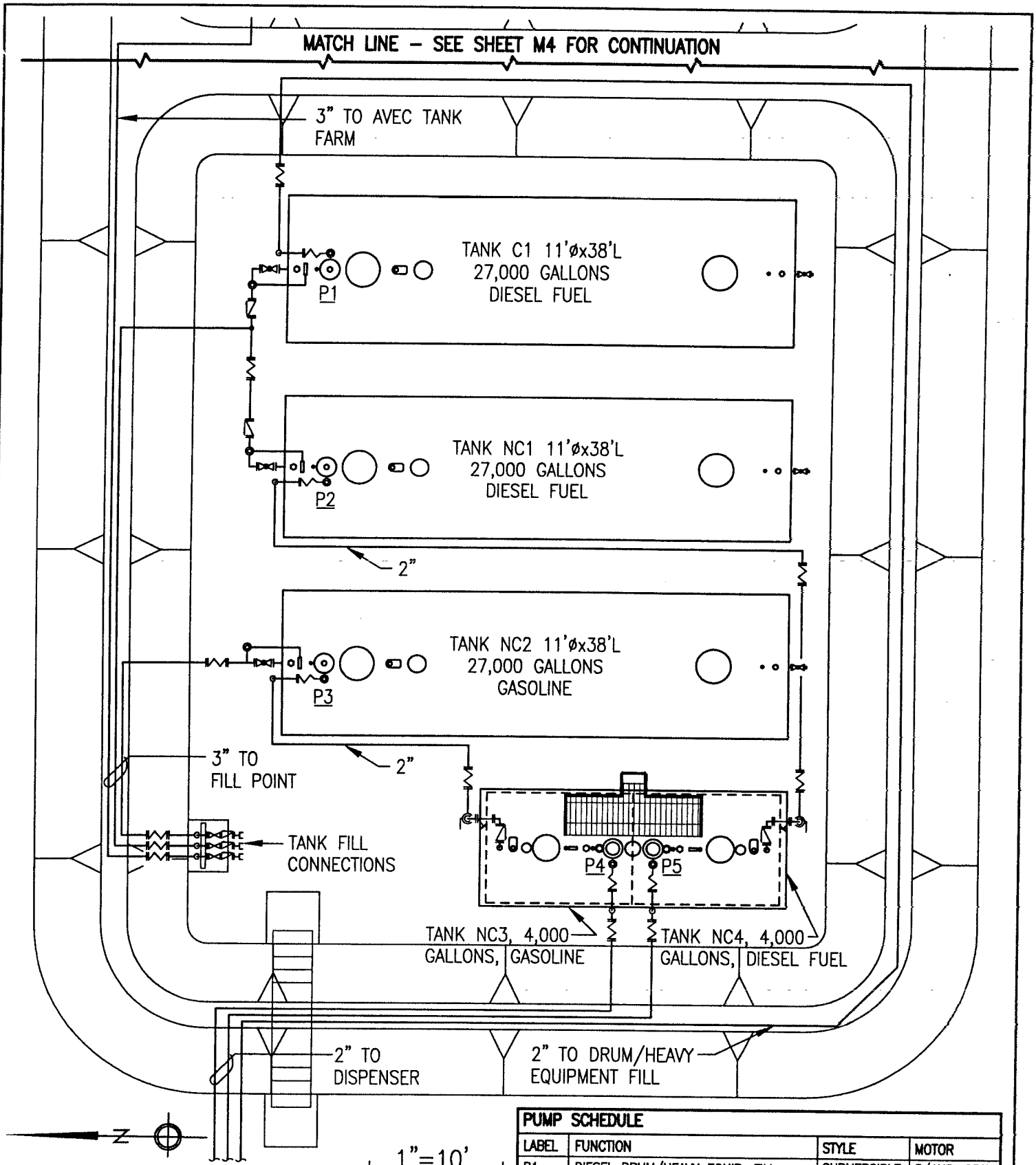
TITLE: AVEC TANK FARM PIPING PLAN & SCHEDULES

DRAWN BY: TDK | SCALE: 1"=20'

DESIGNED BY: TDK | DATE: 11/03

FILE NAME: SHAG-CDR-M4 | SHEET M4 OF 7

ALASKA ENERGY & ENGINEERING, INC.
P.O. BOX 111405 ANCHORAGE, ALASKA 99511-1405
PHONE (907) 349-0100



GENERAL NOTES:

1. THE CITY/CORP. NET TANK FARM DIKE CAPACITY IS 43,434 GALLONS, THE VOLUME OF THE LARGEST TANK PLUS 9" FREEBOARD FOR PRECIPITATION.

PUMP SCHEDULE

LABEL	FUNCTION	STYLE	MOTOR
P1	DIESEL DRUM/HEAVY EQUIP. FILL	SUBMERSIBLE	3/4HP, 230V
P2	DIESEL BULK TRANSFER	SUBMERSIBLE	3/4HP, 230V
P3	GASOLINE BULK TRANSFER	SUBMERSIBLE	3/4HP, 230V
P4	GASOLINE DISPENSING	SUBMERSIBLE	3/4HP, 230V
P5	DIESEL DISPENSING	SUBMERSIBLE	3/4HP, 230V
P6	DIESEL BULK TRANSER	SUBMERSIBLE	3/4HP, 230V

PROJECT: **SHAGELUK BULK FUEL STORAGE & POWER PLANT UPGRADE**

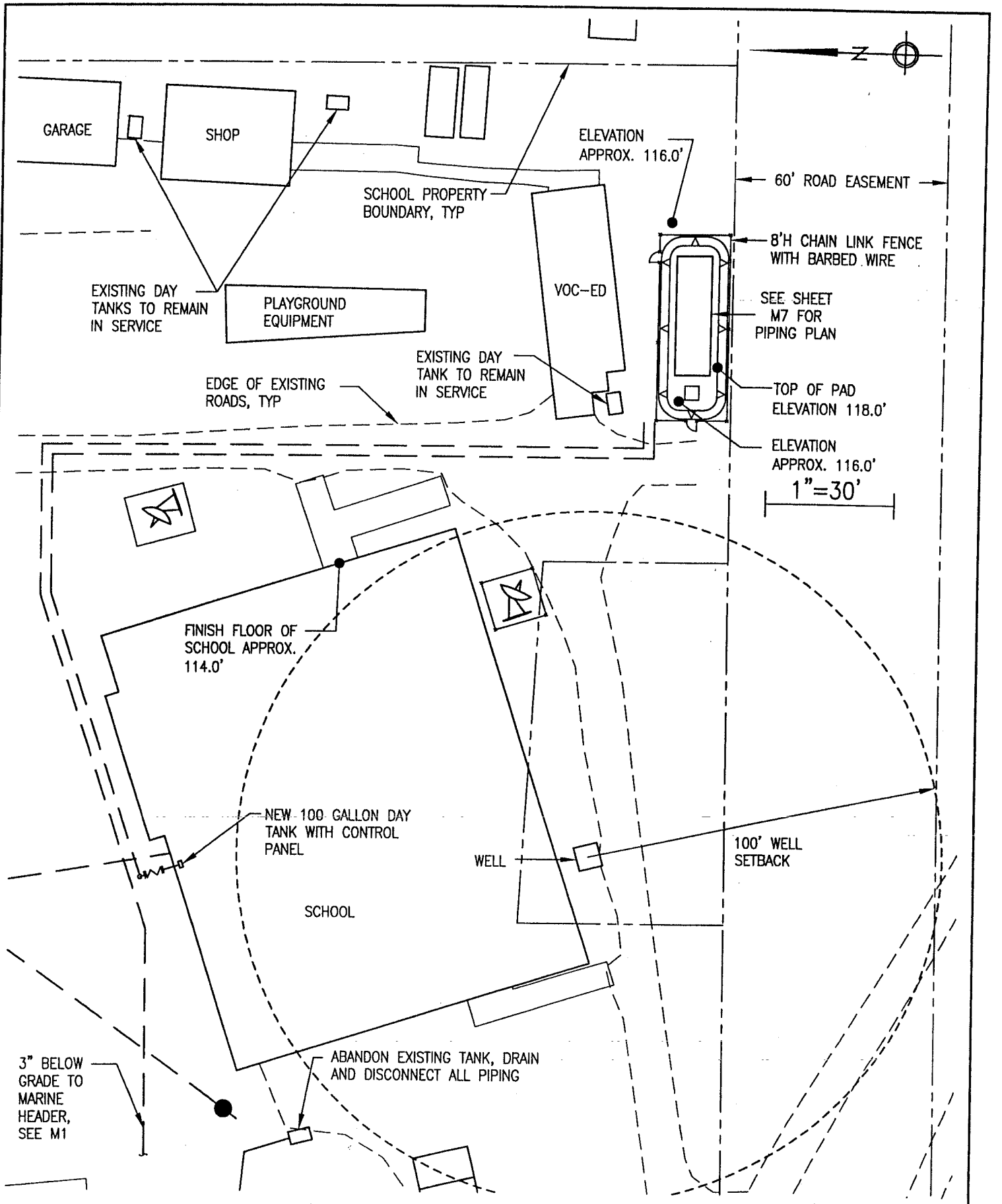
TITLE: **CITY/CORP. TANK FARM PIPING PLAN & SCHEDULES**

DRAWN BY: TDK | SCALE: 1"=20'

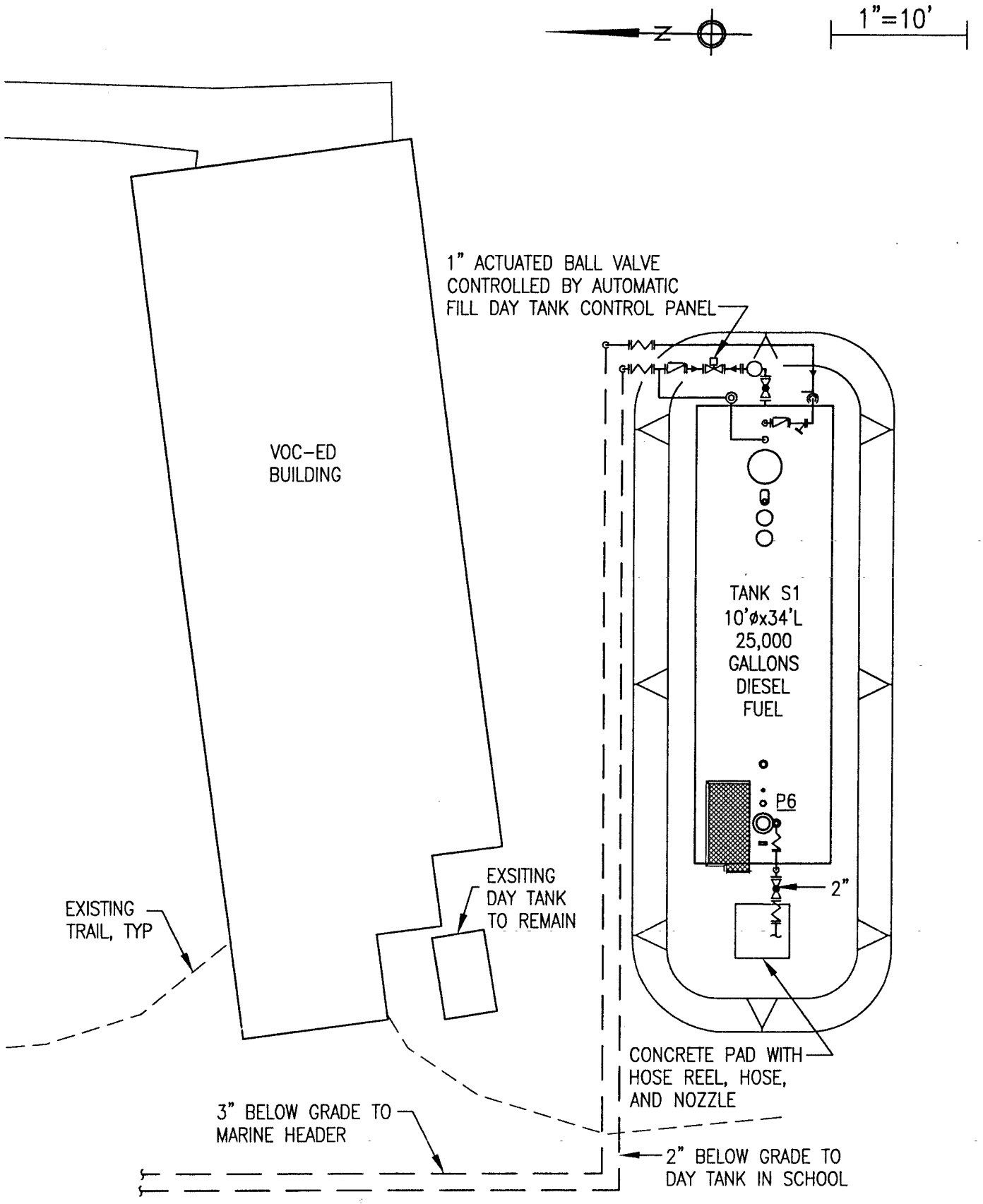
DESIGNED BY: TDK | DATE: 11/03

FILE NAME: SHAG-CDR-M5 | SHEET M5 OF 7

ALASKA ENERGY & ENGINEERING, INC.
P.O. BOX 111405 ANCHORAGE, ALASKA 99511-1405
PHONE (907) 349-0100



PROJECT: SHAGELUK BULK FUEL STORAGE & POWER PLANT UPGRADE	DRAWN BY: TDK	SCALE: 1"=30'	ALASKA ENERGY & ENGINEERING, INC.
	DESIGNED BY: TDK	DATE: 11/03	P.O. BOX 111405 ANCHORAGE, ALASKA 99511-1405
TITLE: SCHOOL TANK FARM AREA SITE PLAN	FILE NAME SHAG-CDR-M6	SHEET M6 OF 7	PHONE (907) 349-0100



PROJECT: SHAGELUK BULK FUEL STORAGE & POWER PLANT UPGRADE	DRAWN BY: TDK	SCALE: 1"=10'	ALASKA ENERGY & ENGINEERING, INC.
	DESIGNED BY: TDK	DATE: 11/03	P.O. BOX 111405 ANCHORAGE, ALASKA 99511-1405
TITLE: SCHOOL TANK FARM PIPING PLAN	FILE NAME SHAG-CDR-M7	SHEET M7 OF 7	PHONE (907) 349-0100

LOG OF BORING / TEST PIT# 1

EQUIPMENT: JD 350 CE Excavator

ELEVATION: 68.0' DATE: 8/29/03

LABORATORY TESTS	TEMP (°F)	GROUP	BLOWS/FT	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	DEPTH (FT)	SAMPLE	SYMBOL	FROZEN	
						0				Organics, Forest Litter Cans/Bottles on Surface
						1				Silt with Sand (ML), gray/brown, wet
Particle Size Frost Class				41.1		2				Silt with Sand (ML), brown, moist Frost Class F 4
						3				
						4				
						5				
Particle Size Frost Class				33.2		6				Silt with Sand (ML), brown, moist Frost Class F 4 Total Depth 6.5'
						7				

A.W. Murfitt Company
CONSULTING ENGINEERS & TESTING

JOB NO.: 03-313.12

APPR.: AWM DATE: 11/13/2003

LOG OF BORING / TEST PIT #1

Alaska Energy and Engineering, Inc.
Shageluk Bulk Fuel Storage
Shageluk, Alaska

PLATE

8

LOG OF BORING / TEST PIT# 2

EQUIPMENT: JD 350 CE Excavator

ELEVATION: 68.0' DATE: 8/29/03

LABORATORY TESTS	TEMP (°F)	GROUP	BLOWS/FT	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	DEPTH (FT)	SAMPLE	SYMBOL	FROZEN	
						0				Organics, Refuse
						1				Sandy Silt (ML), gray/brown, wet
Particle Size Frost Class				34.3		2				Sandy Silt (ML), brown, moist Frost Class F 4
						3				
						4				
						5				
Particle Size Frost Class				35.6		6				Silt (ML), gray/brown, moist Frost Class F 4 Total Depth 6.5'
						7				

A.W. Murfitt Company
CONSULTING ENGINEERS & TESTING

JOB NO.: 03-313.12

APPR.: AWM DATE: 11/13/2003

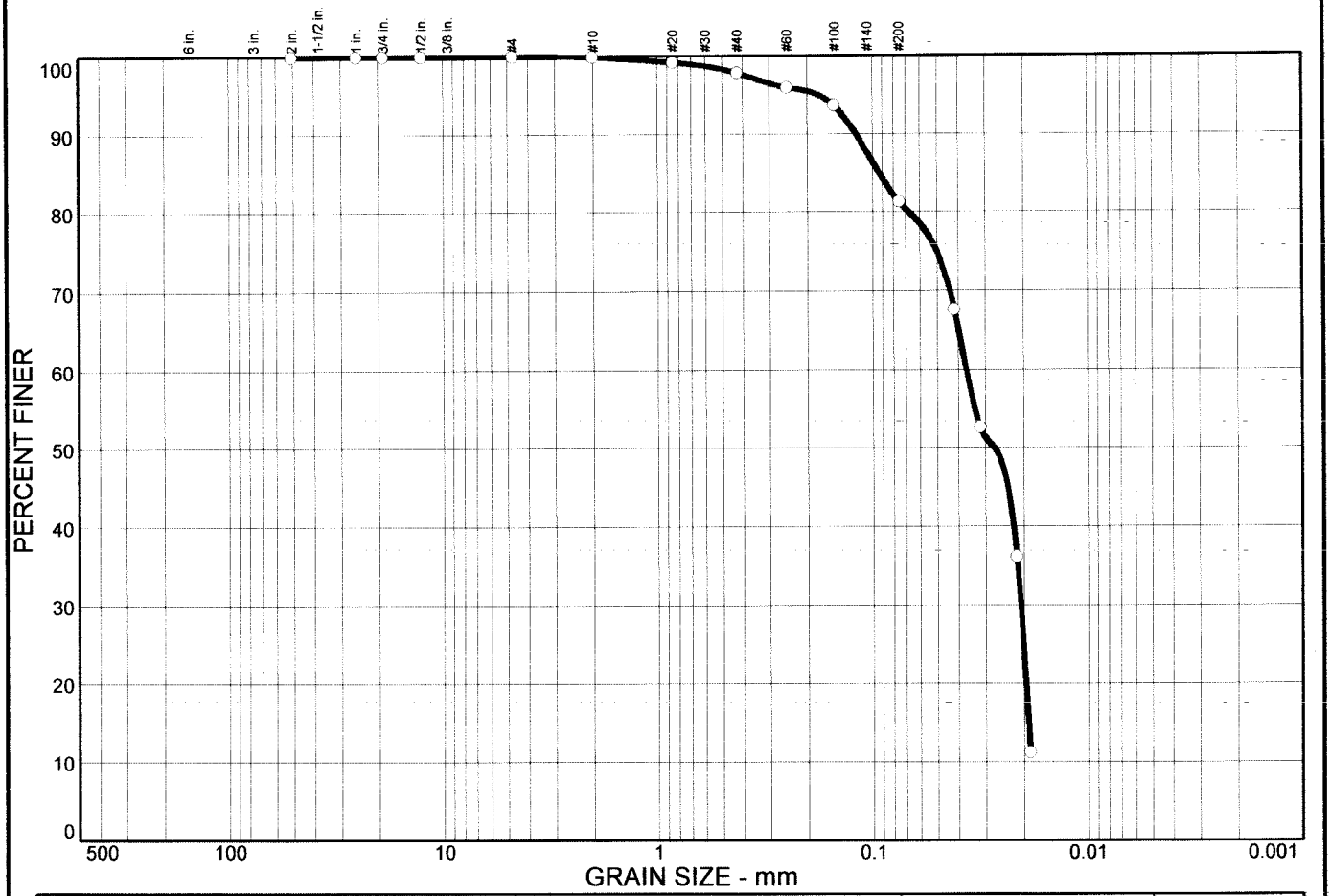
LOG OF BORING / TEST PIT #2

Alaska Energy and Engineering, Inc.
Shageluk Bulk Fuel Storage
Shageluk, Alaska

PLATE

9

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	18.7	81.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2 in.	100.0		
1 in.	100.0		
.75 in.	100.0		
.5 in.	100.0		
#4	100.0		
#10	99.9		
#20	99.2		
#40	97.9		
#60	96.0		
#100	93.7		
#200	81.3		

* (no specification provided)

Soil Description

Silt with sand
24.5% finer than 0.02mm
Frost Class F 4

Atterberg Limits

PL= NP LL= NV PI=

Coefficients

D_{85}= 0.0928 D_{60}= 0.0368 D_{50}= 0.0274
D_{30}= 0.0207 D_{15}= 0.0190 D_{10}=
C_u= C_c=

Classification

USCS= ML AASHTO=

Remarks

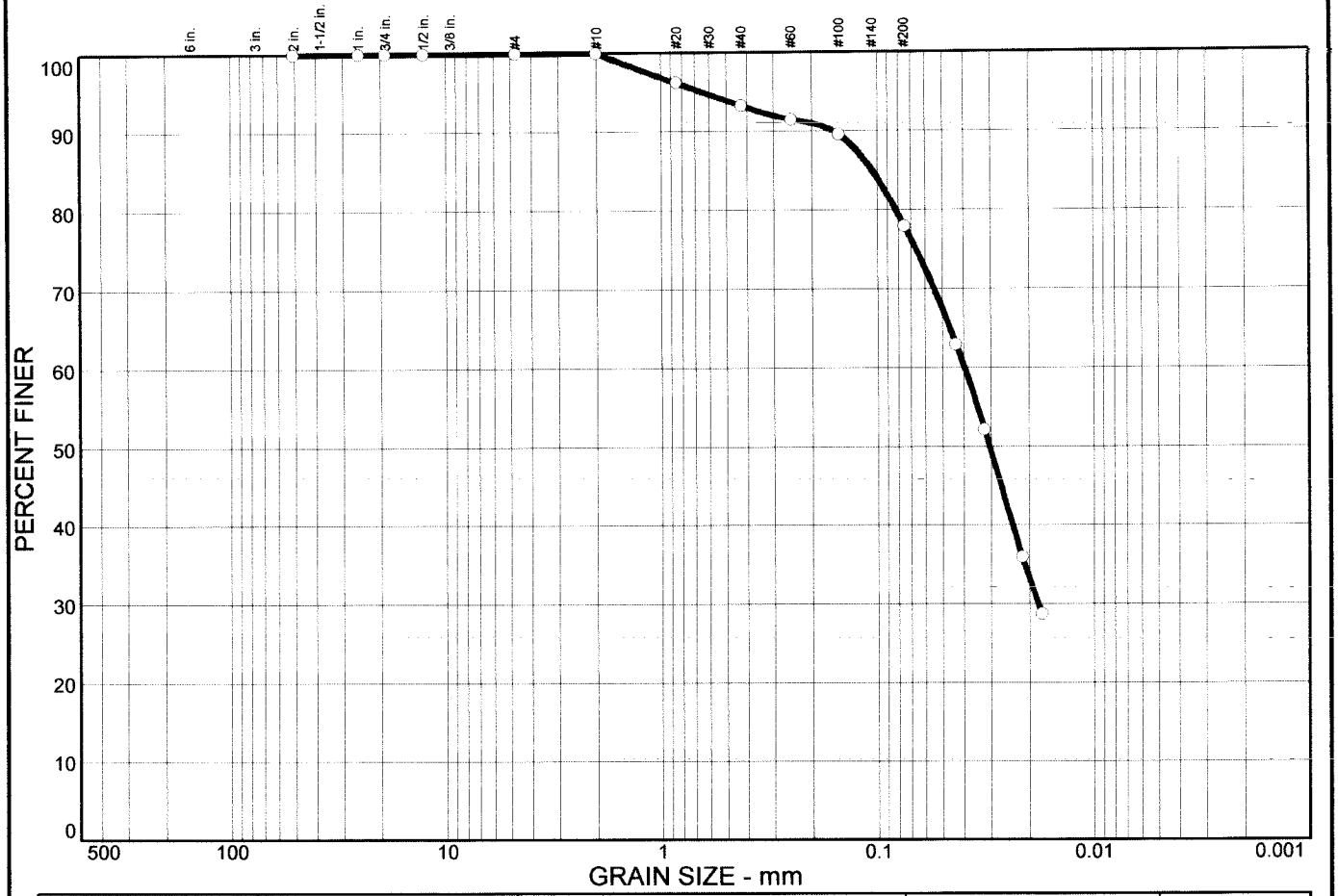
Natural Moisture 41.1%

Sample No.: 1A **Source of Sample:** **Date:** 9/03/03
Location: Test Pit 1 **Elev./Depth:** 2'

A.W. Murfitt Company

Client: Alaska Energy and Engineering, Inc.
Project: Shageluk Bulk Fuel Storage
Shageluk, Alaska
Project No: 03-313.12 **Figure** 10

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	22.0	78.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2 in.	100.0		
1 in.	100.0		
.75 in.	100.0		
.5 in.	100.0		
#4	100.0		
#10	100.0		
#20	96.2		
#40	93.3		
#60	91.5		
#100	89.6		
#200	78.0		

* (no specification provided)

Soil Description

Silt with sand
33.2% finer than 0.02mm
Frost Class F 4

Atterberg Limits

PL= NP LL= NV PI=

Coefficients

D_{85}= 0.105 D_{60}= 0.0397 D_{50}= 0.0304
D_{30}= 0.0182 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= ML AASHTO=

Remarks

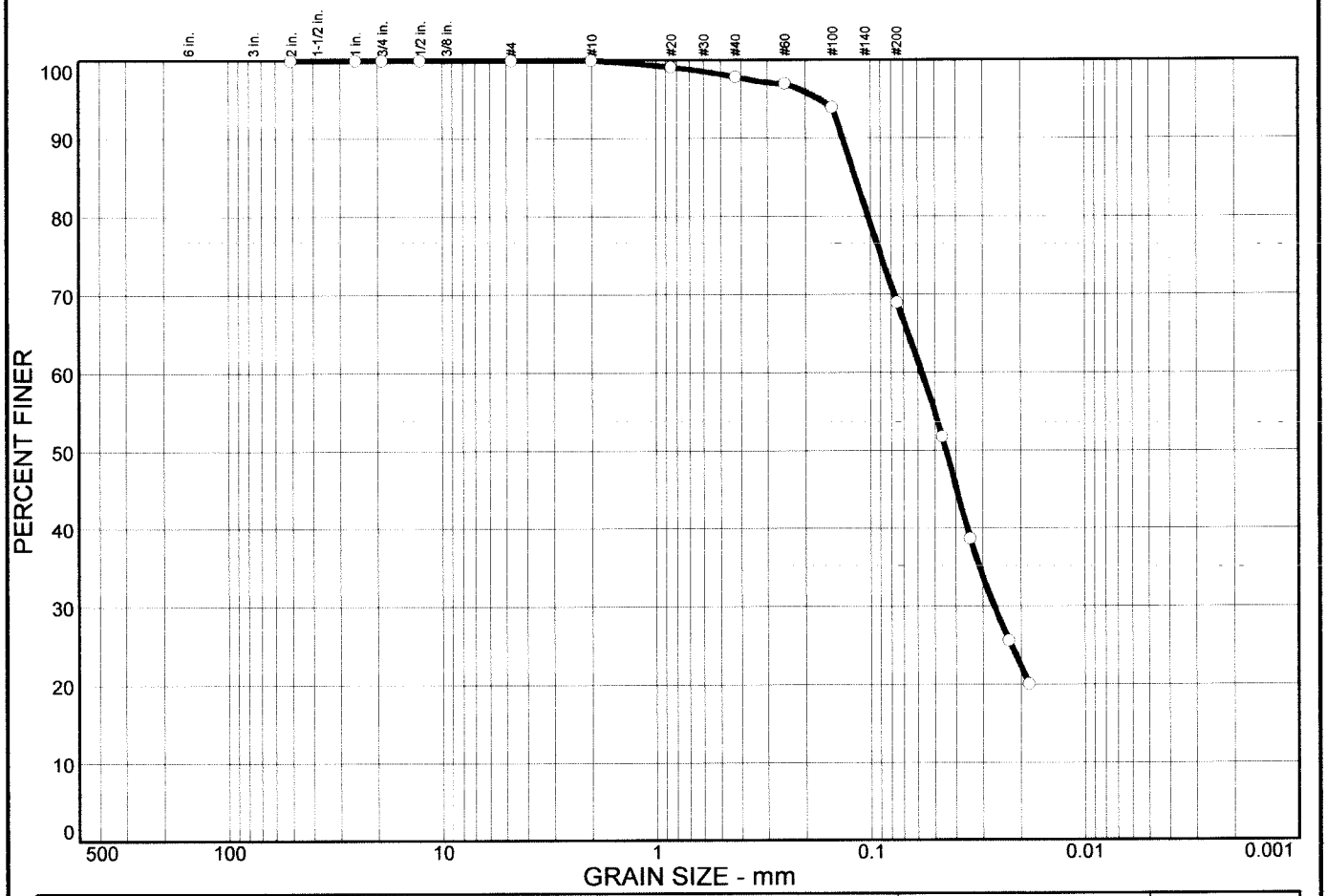
Natural Moisture 33.8%

Sample No.: 1B **Source of Sample:** **Date:** 9/03/03
Location: Test Pit 1 **Elev./Depth:** 6'

A.W. Murfitt Company

Client: Alaska Energy and Engineering, Inc.
Project: Shageluk Bulk Fuel Storage
Shageluk, Alaska
Project No: 03-313.12 **Figure** 11

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	31.1	68.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2 in.	100.0		
1 in.	100.0		
.75 in.	100.0		
.5 in.	100.0		
#4	100.0		
#10	100.0		
#20	99.1		
#40	97.9		
#60	97.0		
#100	94.0		
#200	68.9		

* (no specification provided)

Soil Description

Sandy silt
22.4% finer than 0.02mm
Frost Class F 4

Atterberg Limits

PL= NP LL= NV PI=

Coefficients

D_{85}= 0.117 D_{60}= 0.0576 D_{50}= 0.0444
D_{30}= 0.0266 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= ML AASHTO=

Remarks

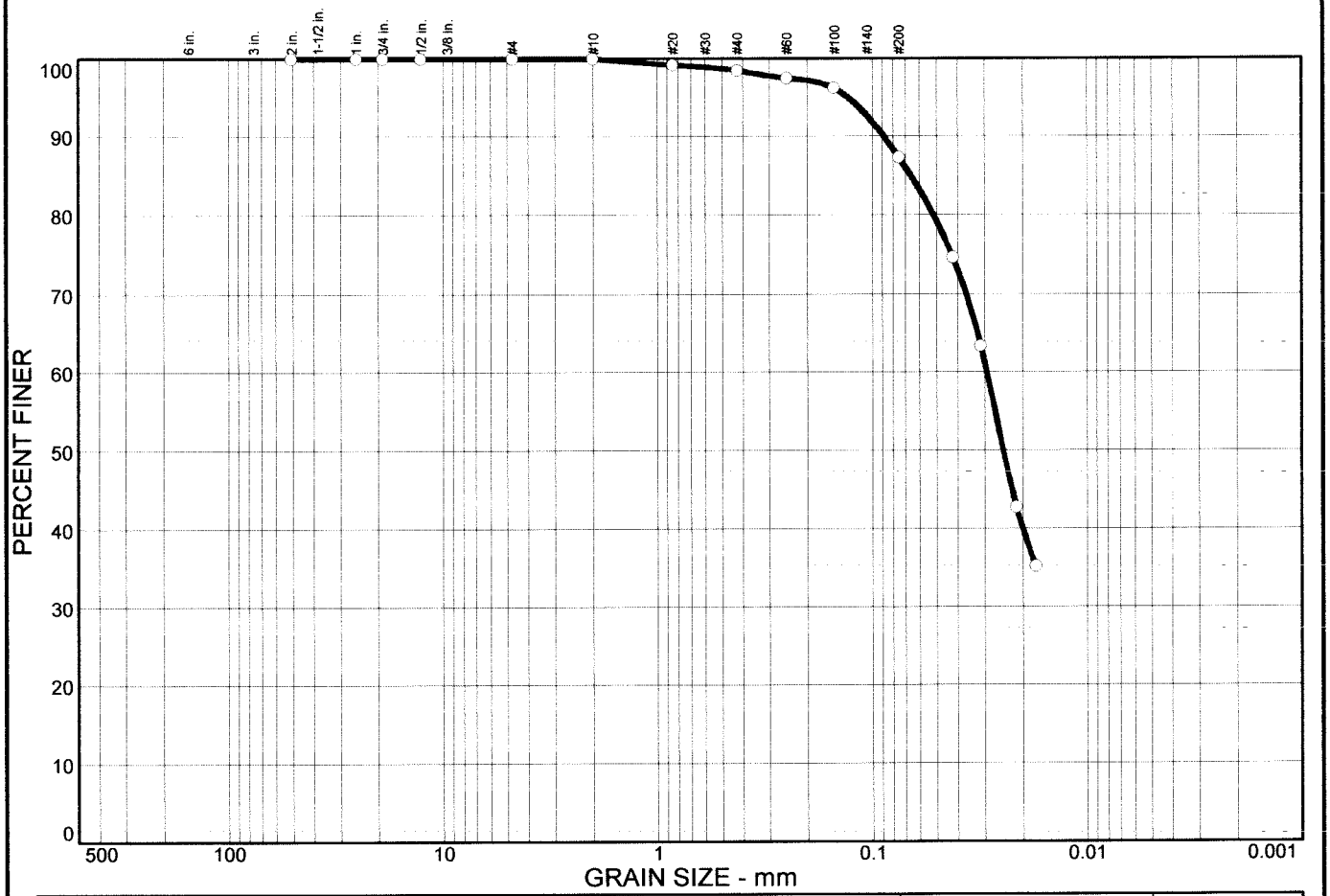
Natural Moisture 34.3%

Sample No.: 2A **Source of Sample:** **Date:** 9/03/03
Location: Test Pit 2 **Elev./Depth:** 2'

A.W. Murfitt Company

Client: Alaska Energy and Engineering, Inc.
Project: Shageluk Bulk Fuel Storage
Shageluk, Alaska
Project No: 03-313.12 **Figure** 12

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	12.7	87.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2 in.	100.0		
1 in.	100.0		
.75 in.	100.0		
.5 in.	100.0		
#4	100.0		
#10	100.0		
#20	99.2		
#40	98.5		
#60	97.5		
#100	96.2		
#200	87.3		

* (no specification provided)

Soil Description

Silt
39.9% Finer than 0.02mm
Frost Class F 4

Atterberg Limits

PL= NP LL= NV PI=

Coefficients

D_{85}= 0.0659 D_{60}= 0.0294 D_{50}= 0.0247
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= ML AASHTO=

Remarks

Natural Moisture 35.6%

Sample No.: 2B **Source of Sample:** **Date:** 9/03/03
Location: Test Pit 2 **Elev./Depth:** 6'

A.W. Murfitt Company

Client: Alaska Energy and Engineering, Inc.
Project: Shageluk Bulk Fuel Storage
Shageluk, Alaska
Project No: 03-313.12 **Figure** 13

UNIFIED SOIL CLASSIFICATION SYSTEM

Major Divisions					Typical Names
COARSE GRAINED SOILS (MORE THAN HALF IS LARGER THAN #200 SEIVE)	GRAVELS (MORE THAN HALF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE SIZE)	CLEAN GRAVELS WITH LITTLE OR NO FINES	GW		WELL GRADED GRAVELS, GRAVEL - SAND MIXTURES
			GP		POORLY GRADED GRAVELS, GRAVEL - SAND MIXTURES
		GRAVELS WITH OVER 12% FINES	GM		SILTY GRAVELS, POORLY GRADED GRAVEL - SAND - SILT MIXTURES
			GC		CLAYEY GRAVELS, POORLY GRADED GRAVEL - SAND - CLAY MIXTURES
	SANDS (MORE THAN HALF COARSE FRACTION IS SMALLER THAN NO. 4 SEIVE SIZE)	CLEAN SANDS WITH LITTLE OR NO FINES	SW		WELL GRADED SAND, GRAVELLY SANDS
			SP		POORLY GRADED SANDS, GRAVELLY SANDS
		SANDS WITH OVER 12% FINES	SM		SILTY SANDS, POORLY GRADED SAND - CLAY MIXTURES
			SC		CLAYEY SANDS, POORLY GRADED SAND - CLAY MIXTURES
FINE GRAINED SOILS (MORE THAN HALF IS SMALLER THAN #200 SEIVE)	SILTS AND CLAYS (LIQUID LIMIT LESS THAN 50)		ML		INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS, OR CLAYEY SILTS WITH SLIGHT PLASTICITY
			CL		INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY GLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS.
			OL		ORGANIC CLAYS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS (LIQUID LIMIT GREATER THAN 50)		MH		INORGANIC SILTS MICACEOUS OR DIATOMACIOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS
			CH		INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
			OH		ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS			Pt		PEAT AND OTHER HIGHLY ORGANIC SOILS

KEY TO TEST DATA

Consol	—	Consolidation	
LL	—	Liquid Limit (in %)	
PI	—	Plastic Limit (in %)	
Gs	—	Specific Gravity	
SA	—	Sieve Analysis	
	—	"Undisturbed" Sample	
	—	Bulk Sample	

Shear Strength, psf

Confining Pressures, psf

*Tx	320	(2600)	Unconsolidated Undrained Triaxial
TxCU	320	(2600)	Consolidated Undrained Triaxial
DS	2750	(2000)	Consolidated Drained Direct Shear
FVS	470		Field Vane Shear
*UC	2000		Unconfined Compression
LVS	700		Laboratory Vane Shear

Notes: (1) All strength tests on 2.8" or 2.4" diameter samples unless otherwise indicated.
(2) *Indicates 1.4" diameter sample.

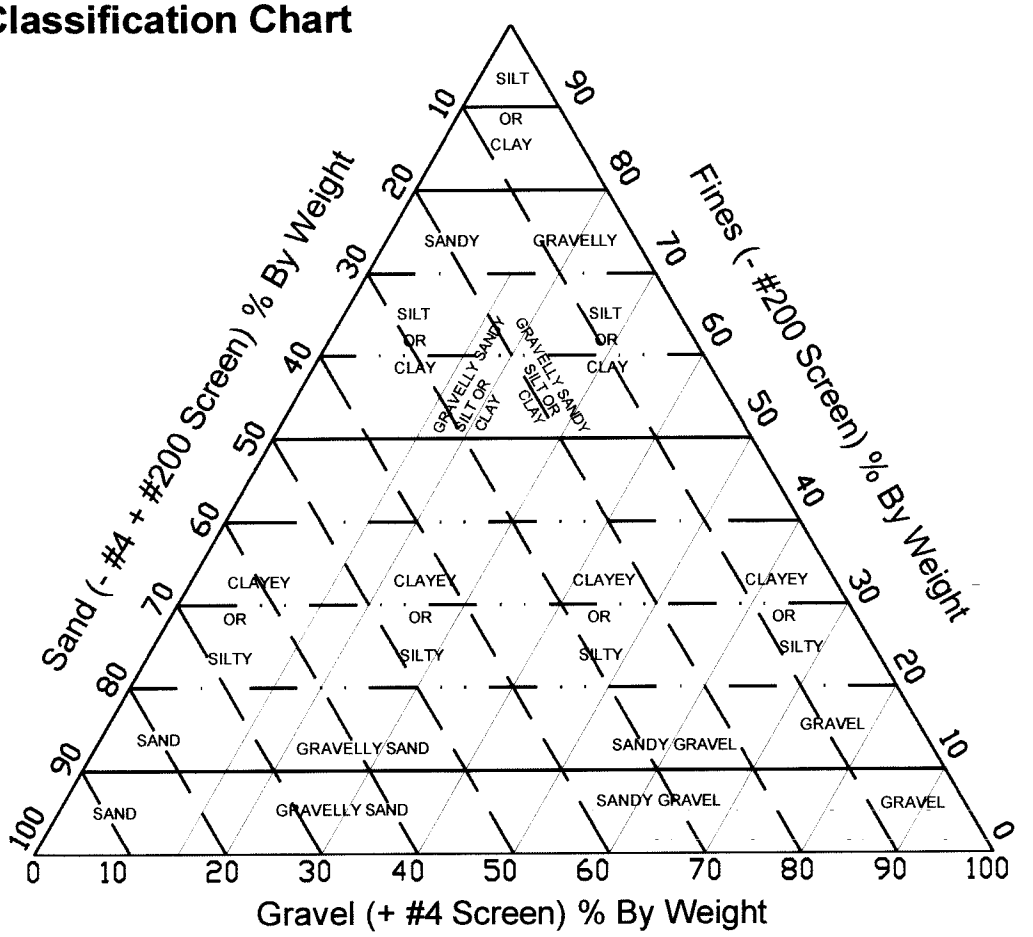
Consulting Engineers and Testing
A. W. Murfitt Company
13810 Venus Way Anchorage, AK 99515
(907) 345-2737 Fax: (907) 345-3264

Job No. 03-313.12 Date: 11/13/03

SOIL CLASSIFICATION CHART AND KEY TO TEST DATA

PLATE 14

Soil Classification Chart



Corps of Engineers Frost Design Soil Classification and USCS Equivalent Grouping

Frost Group	Kind of Soil	Percentage finer than 0.02 mm by weight	Typical soil types under Unified Soil Classification System
NFS*	(a) Gravels Crushed Stone Crushed Rock	0-1.5	GW, GP
	(b) Sands	0-3	SW, SP
PSF**	(a) Gravels Crushed Stone Crushed Rock	1.5-3	GW, GP
	(b) Sands	3-10	SW, SP
S1	Gravelly Soils	3-6	GW, GP, GW-GM, GP-GM
S2	Sandy Soils	3-6	SW, SP, SW-SM, SP-SM
F1	Gravelly Soils	6 to 10	GM, GW-GM, GP-GM
F2	(a) Gravelly Soils	10 to 20	GM, GW-GM, GP-GM
	(b) Sands	6 to 15	SM, SW-SM, SP-SM
F3	(a) Gravelly Soils	Over 20	GM, OC
	(b) Sands, except for very silty sands	Over 15	SM, SC
	(c) Clays, PI>12	--	CL, CH
F4	(a) All silts	--	ML, MH
	(b) Very fine silty sands	Over 15	SM
	(c) Clays, PI>12	--	CL, CL-ML
	(d) Varved clays and other fine-grained, banded sediments	--	CL and ML; CL, ML, and SM; CL, CH, and ML; CL, CH, ML and SM

* Non-frost-susceptible.
**Possibly frost-susceptible, but requires laboratory test to determine frost design soils classification.

Consulting Engineers and Testing
A. W. Murfitt Company
13810 Venus Way Anchorage, AK 99515
(907) 345-2737 Fax: (907) 345-3264

Job No. 03-313.12 Date: 11/13/03

Textural and Frost Design Soil Classification

PLATE 15

ICE DESCRIPTIONS
Ice Not Visible

GROUP SYMBOL	SUBGROUP		ICE VISIBILITY & CONTENT
	DESCRIPTION	SYMBOL	
N	Poorly Bonded or Friable	Nf	Segregated Ice not visible by eye
	No Excess Ice Well Bonded Excess Ice	Nb (Nbn / Nbe)	

ICE DESCRIPTIONS
Ice Visible - Less Than 1 Inch Thick

GROUP SYMBOL	SUBGROUP		ICE VISIBILITY & CONTENT
	DESCRIPTION	SYMBOL	
V	Individual Ice Crystal or Inclusions	Vx	Segregated ice is visible by eye Ice one inch or less in thickness
	Ice Coatings on Particles	Vc	
	Random or Irregularly Oriented Ice Formations	Vr	
	Stratified or Distinctly Oriented Ice Formations	Vs	

Ice Visible - Greater Than 1 Inch Thick

ICE	Ice with Soil Inclusions	ICE + Soil Type	Ice greater than one inch in thickness
	Ice without Inclusions	ICE	

DEFINITIONS:

1 Ice Coatings on Particle - discernable layers of ice found on or below the larger soil particles in a frozen soil mass.

2 Ice Crystal - a very small individual ice particle visible in the face of a soil mass. Crystals may be present alone or in combination with other ice formations.

3 Clear Ice - ice that is transparent and contains only a moderate number of air bubbles.

4 Cloudy Ice - ice that is translucent or relatively opaque due to the content of air or for other reasons, but which is essentially sound and nonpervious.

5 Porous Ice - ice that contains numerous voids, usually interconnected and usually resulting from melting at air bubbles or along crystal interfaces from presence of salt or other materials in the water, or from the freezing of saturated snow. Though porous, the mass retains its structural unity.

6 Candled Ice - ice that has rotted or otherwise formed into long columnar crystals, very loosely bonded together.

7 Granular Ice - ice that is composed of coarse, more or less equidimensional crystals weakly bonded together.

8 Ice Lenses - lenticular ice formations in soil occurring essentially parallel to each other, generally normal to the direction of heat loss, and commonly in repeated layers.

9 Ice Segregation - the growth of ice within soil in excess of the amount that may be produced by the in-pace conversion of the original void moisture to ice. Ice segregation occurs most often as distinct lenses, layers, veins, and masses, commonly, but not always, oriented normal to the direction of heat loss.

10 Well Bonded - a condition in which the soil particles are strongly held together by the ice so that the frozen soil possess relatively high resistance to chipping or breaking.

11 Poorly Bonded - a condition in which the soil particles are weakly held together by the ice so that the frozen soil has poor resistance to chipping and breaking.

12 Thaw Stable - the characteristics of frozen soils that, upon thawing, do not show loss of strength in comparison to normal, long-time thawed values nor produce detrimental settlement.

Consulting Engineers and Testing
A. W. Murfitt Company
13810 Venus Way Anchorage, AK 99515
(907) 345-2737 Fax: (907) 345-3624

Job No. 03-313.12 Date: 11/13/03

SOIL ICE CLASSIFICATION AND DEFINITIONS

PLATE 16

LOG OF BORING 6

Equipment: Texoma Disc Auger

Elevation: 498' Date Drilled: 4/11/87

Laboratory Tests	Moisture Content (%)	Frozen	Depth (ft)	Samples	
			0		GRAY and BROWN SILT (ML, V_X) becomes gray
	40.1		5		unbonded at 3.5' to 4.0'
					GRAY SILT (ML, V_X) very small visible ice crystals
	47.0		10		abundant wood fragments
					becomes brown at 12.5'
	31.2		15		well bonded, very little visible ice, with occasional orange inclusions
			20		ORANGE and YELLOW HIGHLY WEATHERED SANDSTONE and SHALE ROCK with sparce very fine ice crystals
FPD=-0.00°C	29.6		25		drilling becoming harder
			30		
			35		
			40		

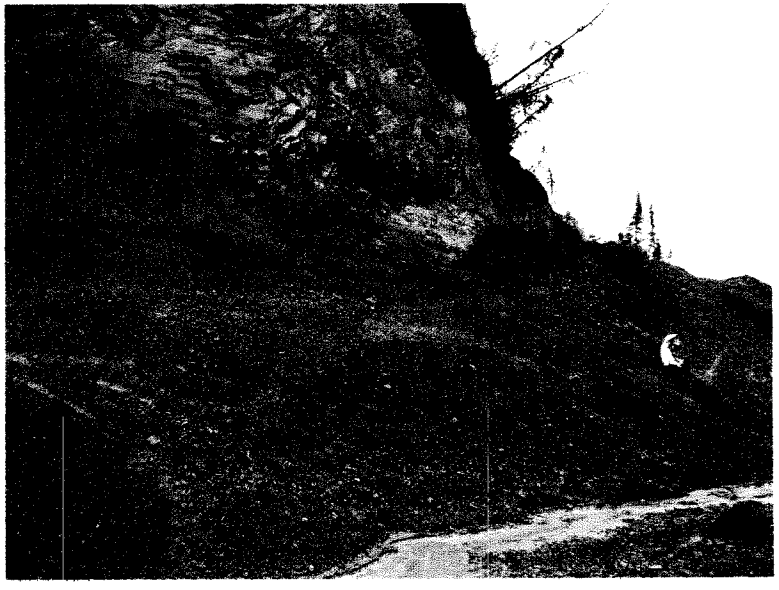
Harding Lawson Associates
Engineers, Geologists & Geophysicists

Log of Boring 6
Inoko River School
Shageluk, Alaska

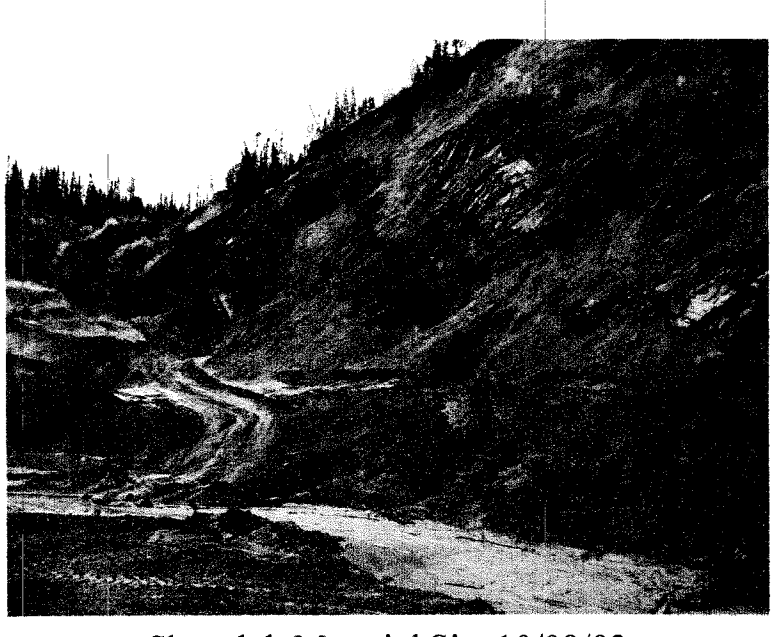
PLATE 7

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
	9653,003.08		4/87		

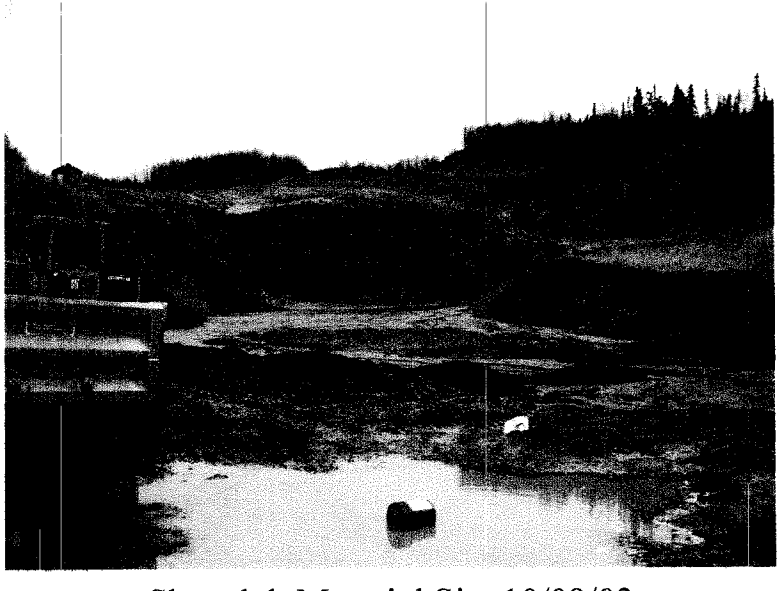
Shageluk Material Site 10/09/03



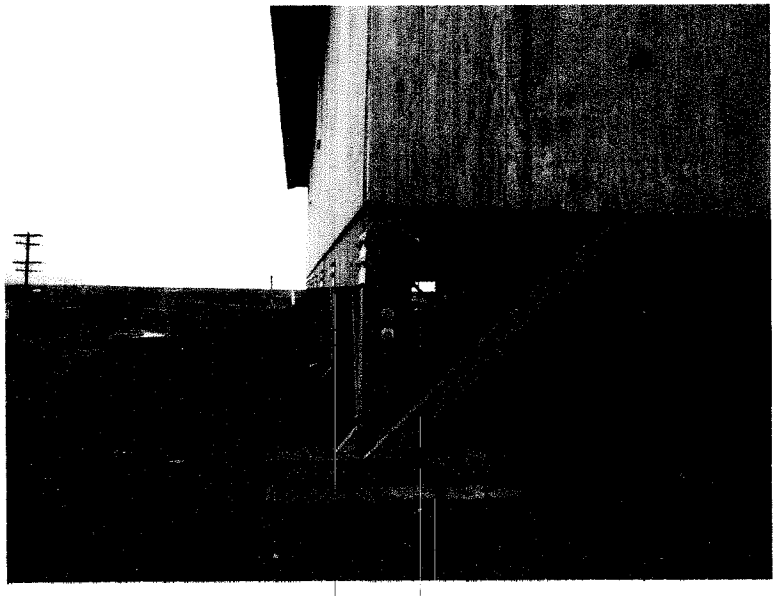
Shageluk Material Site 10/09/03



Shageluk Material Site 10/09/03



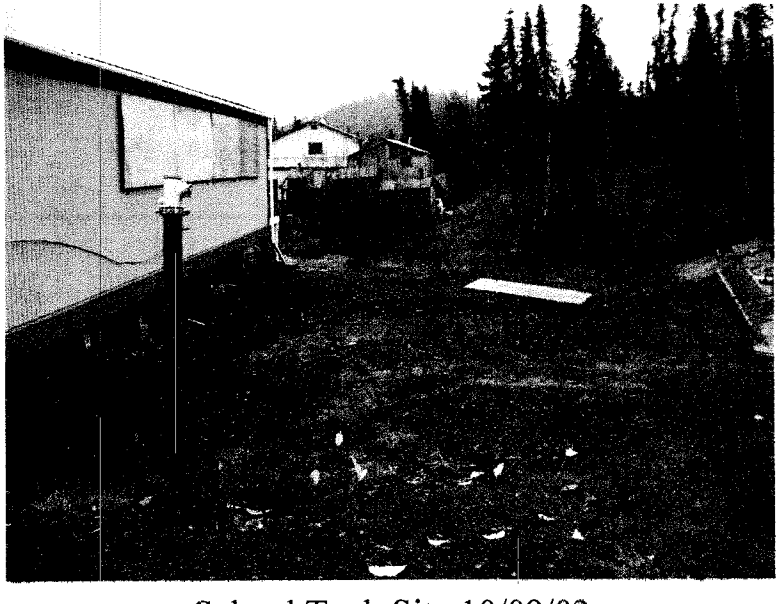
Shageluk Material Site 10/09/03



Teacher Residence Foundation Near Site 10/09/03

School Tank Site 10/09/03

School Tank Site 10/09/03



School Tank Site 10/09/03

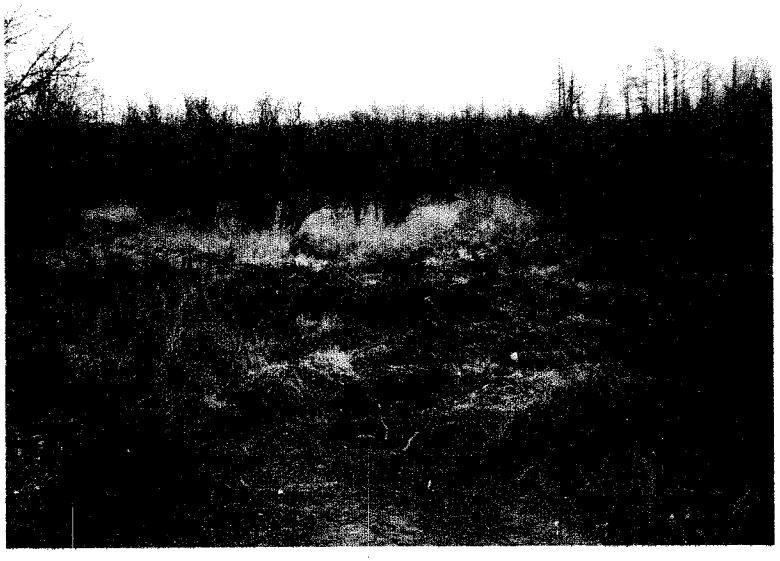
School Tank Site Drainage to the East 10/09/03

Existing Power Plant Tank Farm 10/09/03

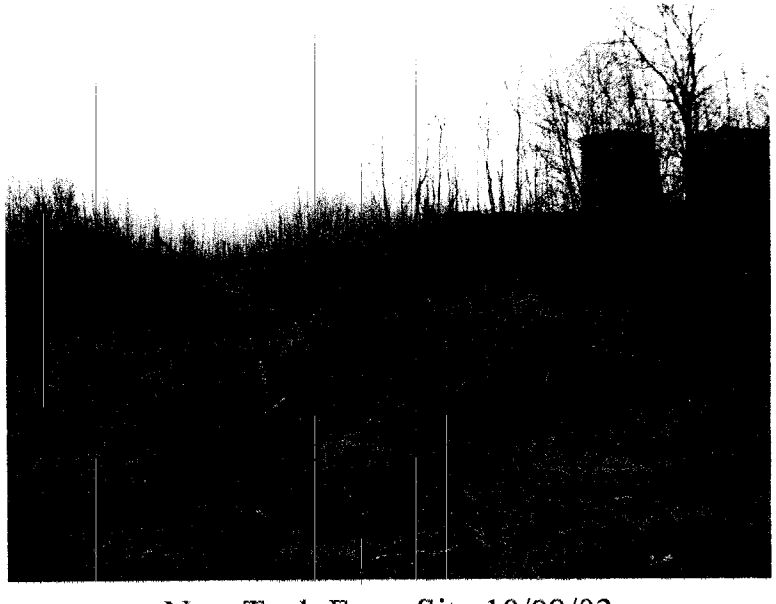
Existing Power Plant Tank Farm 10/09/03

Existing Power Plant Tank Farm 10/09/03

New Tank Farm Site 10/09/03



New Tank Farm Site 10/09/03



New Tank Farm Site 10/09/03

APPENDIX E

MEETING SUMMARY LETTERS

Alaska Energy and Engineering, Inc.
Mailing Address - P.O. Box 111405
Anchorage, AK 99511-1405
(907) 349-0100, Fax (907) 349-8001

September 8, 2003

5 pages total sent via fax to:

- Betty Howard, Mayor, City of Shageluk, 473-8220
- Alden Walker, Sr., President, ZHO-TSE, Inc., 473-8217
- Dave Shelborne, Buildings & Grounds, Iditarod Area School District, 524-3933
- Molly Sheldon, AVEC, 561-2388

Re: Shageluk Bulk Fuel & Power Plant Upgrade
Site Investigation Summary and Preliminary Recommendations

Steve Stassel and Trevor Krupa of Alaska Energy and Engineering (AE&E) were in Shageluk August 28th through 30th, 2003, to perform a site investigation for the proposed bulk fuel and power plant upgrade project. Molly Sheldon of the Alaska Village Cooperative (AVEC) arrived on August 29th and a community meeting was held that evening to discuss the project. Local citizens along with the following City council and ZHO-TSE board members attended the meeting:

- Betty Howard, Shageluk City Council
- Brenda Goldie, Shageluk City Council
- Harvey Benjamin, Shageluk City Council
- Myrtle Benjamin, Shageluk City Council
- Kathy Workman, Shageluk City Council
- Alden Walker, Sr., ZHO-TSE President
- David Walker, ZHO-TSE Board
- Frank Benjamin, ZHO-TSE Board

During the meeting, the following issues were identified and discussed:

1) Denali Commission Project Requirements
2) Project annual fuel use and anticipated tank capacity requirements
3) Site location
4) Description of consolidated facility bulk fuel and power plant facilities
5) Local gravel sources

This letter is provided to summarize the community meeting and the site investigation and to present some issues that need to be resolved prior to the final concept design.

1) Denali Commission Project Requirements

AVEC is actively engaged as a partner with the Denali Commission to upgrade energy and bulk fuel facilities in villages throughout Alaska. During the community meeting, Molly Sheldon with AVEC presented highlights of the Denali Commission Project Requirements for bulk fuel and energy projects. These highlights were summarized in a handout and distributed before her presentation. The City and ZHO-TSE were also provided with a complete version of the Denali Commission policies. Some of the presented highlights include:

- The Community must assign a primary contact person for the project.
- Project participants (City, ZHO-TSE, IASD) will need to provide Council/Board resolutions supporting the project and providing site control/Right-of-Entry.
- Local entities such as the City or Corporation typically provide land, gravel and equipment for the project, as a Contribution-in-aid-of-Construction.

- The Community will be requested to review and approve the Concept Design Report, preliminary design, final design, and Business Plan.
- Projects must comply with Denali Commission cost containment guidelines/policies.
- A concept design and draft Business Plan must be complete and agreed to by the project participants before the final design will be funded by the Denali Commission.
- Local participant (City) must be willing and able to become the primary operator of the fuel facility.
- As part of the Business Plan, forecasts of annual maintenance and operating costs, insurance, and renewals and replacements must be determined and included in the wholesale price per gallon of fuel.
- The Commission will not authorize construction funding prior to the completion of final design, establishing project site control, and signing of the final Business Plan.
- The project participants through separate grants or entities must arrange existing tank cleanup or disposal.

2) Projected Annual Fuel Use and Anticipated Tank Capacity Requirements

Diesel fuel is used to heat various city buildings (post office, preschool, teen center, washeteria, city office, clinic), the school, and residential homes. Diesel fuel is also used to generate electricity and to fuel the City's heavy equipment. All gasoline is for retail sales for use in vehicles, four wheelers, and private boats. Current consumption quantities are based on fuel delivered to the community by Yukon Fuels for the prior two years.

Planned infrastructure improvements within 5 to 10 years that are anticipated to increase local fuel consumption include the possible addition of one new house, one new duplex at the school (under construction), and a future water and sewer project. Additional capacity will be included in the new tank farm to meet the anticipated increase in the local fuel consumption caused by these projects. With the exception of the school, individual project participants proposed annual fuel consumption has been rounded up to the next whole 27,000-gallon tank. The following table compares the estimated consumption versus proposed capacity of each product to the proposed net usable tank capacity for the new facility:

SHAGELUK ESTIMATED CONSUMPTION VERSUS PROPOSED CAPACITY

Project Participant (Product)	Current Peak Annual Use in Gallons	Estimated Future Peak Annual Use in Gallons (1)	Proposed Net Capacity in Gallons (2)	Proposed Gross Capacity in Gallons
AVEC (Diesel)	35,394	64,825	72,900	81,000
ZHO-TSE (Diesel)	11,889	12,889	27,900	31,000 (3)
ZHO-TSE (Gasoline)	17,500	19,552	27,900	31,000 (3)
City of Shageluk (Diesel)	11,010	19,010	24,300	27,000
IASD (Diesel)	15,006	18,006	18,000	20,000
		Proposed Total	**171,000**	**190,000**

(1) Estimated future use based on planned development.
(2) Net capacity (90% of gross shell capacity).
(3) Includes the bulk storage tank and fire rated dispensing tank.

3) Site Location

Due to limited available land within the community, the best option for the new consolidated tank farm and power plant appears to be the existing AVEC plant site and the adjoining City property to the northeast. This option was presented at the community meeting with no objection from community members. During the community meeting, it was suggested that elders be consulted in regards to past flooding at the proposed project site.

The existing AVEC parcel is a 0.862-acre lot within block 10 of the Shageluk Townsite Survey, U.S. Survey 4493, as shown on plat 85-4 and recorded in the Mt. McKinley recording district. The existing AVEC pad appears to be elevated approximately 6' above the surrounding terrain, which is above all flood occurrences over the past 20+/- years.

A new pad would be extended to the east of the existing AVEC pad, north of the proposed new sewage lagoon location. The top of the pad will be elevated above the estimated 100-year flood plain. Two test holes were dug beneath the proposed new pad, and soil samples were taken for analysis. The top approximately 6" of test hole #2 showed evidence of an abandoned landfill (tin cans). Community members indicated that an old landfill existed beneath the current AVEC pad, but were unable to confirm how far east of the AVEC plant site it extended. A geotechnical investigation is planned to confirm the proposed site is suitable for construction. The proposed project location is shown on the attached site plan sheet SH1.

4) Description of Consolidated Facility

The proposed tank farm facility will consolidate AVEC, City, and ZHO-TSE tanks onto the existing AVEC pad. The proposed design will provide for a two-cell dike to contain all of the tanks in accordance with Fire Code and EPA requirements. Though joined by a common full height dike wall, two separate lined and fenced earthen containment cells will be constructed.

The City & ZHO-TSE cell will contain three 27,000-gallon single wall bulk storage tanks, and one 8,000-gallon dual compartment fire rated dispensing tank. The City will own and operate one diesel bulk tank, and ZHO-TSE will own and operate one diesel bulk tank, one gasoline bulk tank, and a dual product dispensing tank. The AVEC cell will contain three 27,000-gallon single wall bulk storage tanks. The AVEC bulk tanks will be piped to a day tank at the power plant facility. Each dike cell will be fenced with a chain link fence and topped with barbed wire.

A service station style dual product dispenser with a gravel turnaround area will be located adjacent to the new tank farm west of the existing AVEC power plant. The dispenser will be owned and operated by ZHO-TSE for the retail sales of diesel fuel and gasoline. The dispenser will be installed in a lighted and fenced security enclosure. The Corporation requested the dispenser be equipped with an inventory control system. The City drum/heavy equipment fueling station will be adjacent to the Corporation retail sales facility.

The power plant facility will consist of 8 modular buildings, including 3 generator modules, 1 control module, 3 storage modules, and 1 housing module. The power plant facility will be fenced with a chain link fence and topped with barbed wire.

Due to the distance from the school to the proposed tank farm location, a 20,000-gallon double wall tank will be provided adjacent to the school located on a gravel pad. The double wall tank will be fenced with a chain link fence and topped with barbed wire. The existing auto-fill day tank in the school mechanical room will be refurbished and equipped with redundant overfill protective devices to comply with regulations.

The proposed tank farm and power plant facilities are shown on the attached site plan sheet SH1.

5) Local Gravel Source and Alternatives

A suitable borrow source for the project needs to be confirmed for the project. Two borrow sources were identified, though neither were investigated during this site visit.

There is an existing borrow source located in the community approximately 200' southwest of the school on City property. During the community meeting, residents indicated they thought the borrow source was depleted. Residents also expressed concerns about developing this pit further due to its proximity to the cemetery located on the hill to the west. This borrow source should be examined during a geotechnical investigation to determine the quantity and quality of the material, and the feasibility of extracting material without causing additional risk to the cemetery.

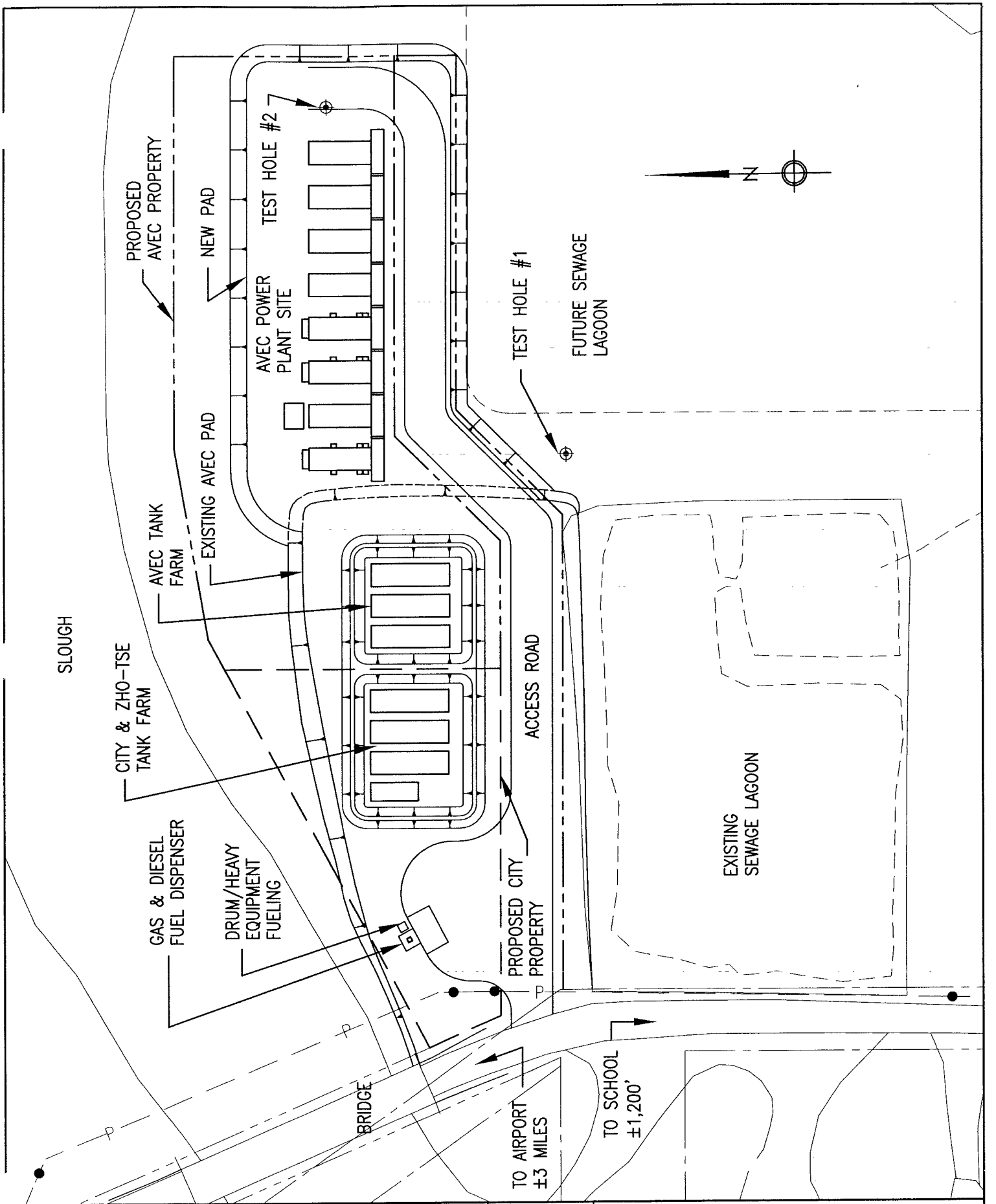
There is an additional borrow source located approximately 4 miles upriver of the airport. Residents indicated this borrow source is located on Doyon land. The surface and subsurface rights to this borrow source need to be confirmed. This borrow source should be examined during a geotechnical investigation to determine the quantity and quality of material available. Should this borrow source be used for the project, it will likely require a winter haul when the river is frozen. During the community meeting, residents indicated the Department of Transportation was planning to mine this source for an airport road realignment project, possibly in 2007. The D.O.T. project engineer (Adam Umholtz) will be contacted to determine the scope and timing of the airport road realignment project.

The above represents our understanding of the information discussed during the community meeting. We will proceed with the bulk fuel and power plant project concept design report based on this understanding. If any of the above is incorrect or incomplete, please provide comments no later than Friday, September 12, 2003. I can be reach at (907) 349-0100, or by fax at (907) 349-8001.

Sincerely,
Alaska Energy and Engineering, Inc.

Trevor D. Krupa, P.E.
Mechanical Engineer

Enclosures: Site Plan



PROJECT: SHAGELUK BULK FUEL & POWER PLANT UPGRADE	DRAWN BY: TDK	SCALE: 1"=60'	ALASKA ENERGY & ENGINEERING, INC.
	DESIGNED BY: TDK	DATE: 9/8/03	P.O. BOX 111405 ANCHORAGE, ALASKA 99511-1405
TITLE: TANK FARM & POWER PLANT PROPOSED PROPERTY PLAN	FILE NAME	SHEET SH1 OF 1	PHONE (907) 349-0100

APPENDIX F

EXISTING AND PROPOSED TANKAGE

EXISTING AND PROPOSED TANKAGE
Shageluk, Alaska

Tank No.	Owner	Purpose	Config. (Vert/Horiz)	Size (dia.X l / h)	Fuel Oil - Gallons Total (Gross)	Fuel Oil - Gallons Usable (net)	Gasoline - Gallons Total (Gross)	Gasoline - Gallons Usable (net)	TOTAL CAPACITY - Gallons Total (Gross)	TOTAL CAPACITY - Gallons Usable (net)
EXISTING TANK STORAGE CAPACITY										
AVEC Tank Farm										
1	AVEC	Bulk	V	11.0' dia X 14'	9,953	8,958				
2	AVEC	Bulk	V	10.5' dia X 14'	9,069	8,162				
3	AVEC	Bulk	V	11.0' dia X 14'	9,953	8,958				
4	AVEC	Bulk	V	10.5' dia X 14'	9,069	8,162				
5	AVEC	Bulk	V	11.0' dia X 14'	9,953	8,958				
6	AVEC	Bulk	V	10.5' dia X 14'	9,069	8,162				
AVEC Tank Farm Sub-Total =					**57,066**	**51,360**			**57,066**	**51,360**
IASD Tank Farm										
1	IASD	Contingency	V	9.0' dia X 14'	0	0				
2	IASD	Bulk	V	8.5' dia X 14'	5,943	5,349				
3	IASD	Bulk	V	8.0' dia X 14'	5,265	4,738				
4	IASD	Bulk	V	7.5' dia X 14'	4,627	4,164				
5	IASD	Contingency	V	9.0' dia X 14'	0	0				
6	IASD	Bulk	V	8.5' dia X 14'	5,943	5,349				
7	IASD	Bulk	V	8.0' dia X 14'	5,265	4,738				
8	IASD	Bulk	V	7.5' dia X 14'	4,627	4,164				
9	IASD	Intermediate	H	3.8' dia X 6.2'	526	473				
IASD Tank Farm Sub-Total =					**32,196**	**28,975**			**32,196**	**28,975**
CORP. Tank Farm										
1	CORP.	Bulk	H	8.0' dia X 21.3'	8,021	7,219				
2	CORP.	Bulk	H	8.0' dia X 22'			8,273	7,446		
3	CORP.	Bulk	H	6.3' dia X 18.3'			4,189	3,770		
4	CORP.	Bulk	H	8.0' dia X 22.3'			8,367	7,530		
CORP. Tank Farm Sub-Total =					**8,021**	**7,219**	**20,829**	**18,746**	**28,850**	**25,965**
CITY Tank Farm										
1	CITY	Bulk	V	7.5' dia X 13.3'	4,379	3,941				
2	CITY	Bulk	V	10.0' dia X 13.8'	8,126	7,313				
CITY Tank Farm Sub-Total =					**12,505**	**11,254**			**12,505**	**11,254**
TOTAL EXISTING CAPACITY =					**109,788**	**98,808**	**20,829**	**18,746**	**130,617**	**117,554**

EXISTING AND PROPOSED TANKAGE
Shageluk, Alaska

Tank No.	Owner	Purpose	Config. (Vert/Horiz)	Size (dia.X l / h)	Fuel Oil - Gallons Total (Gross)	Fuel Oil - Gallons Usable (net)	Gasoline - Gallons Total (Gross)	Gasoline - Gallons Usable (net)	TOTAL CAPACITY - Gallons Total (Gross)	TOTAL CAPACITY - Gallons Usable (net)
PROPOSED TANK STORAGE CAPACITY (NEW TANKS)										
AVEC Tank Farm										
A1	AVEC	Bulk	H	11.0' dia X 38'	27,000	24,300				
A2	AVEC	Bulk	H	11.0' dia X 38'	27,000	24,300				
A3	AVEC	Bulk	H	11.0' dia X 38'	27,000	24,300				
	AVEC Tank Farm Sub-Total =				**81,000**	**72,900**			**81,000**	**72,900**
IASD Tank Farm										
S1	IASD	Intermediate	H	10.0' dia X 34'	20,000	18,000				
	IASD Tank Farm Sub-Total =				**20,000**	**18,000**			**20,000**	**18,000**
CORP. Tank Farm										
NC1	CORP.	Bulk	H	11.0' dia X 38'	27,000	24,300				
NC2	CORP.	Bulk	H	11.0' dia X 38'			27,000	24,300		
NC3	CORP.	Bulk	H	8.5' dia X 11'			4,000	3,600		
NC4	CORP.	Bulk	H	8.5' dia X 11'	4,000	3,600				
	CORP. Tank Farm Sub-Total =				**31,000**	**27,900**	**31,000**	**27,900**	**62,000**	**55,800**
CITY Tank Farm										
C1	CITY	Bulk	H	11.0' dia X 38'	27,000	24,300				
	CITY Tank Farm Sub-Total =				**27,000**	**24,300**			**27,000**	**24,300**
	TOTAL PROPOSED CAPACITY =				**159,000**	**143,100**	**31,000**	**27,900**	**190,000**	**171,000**

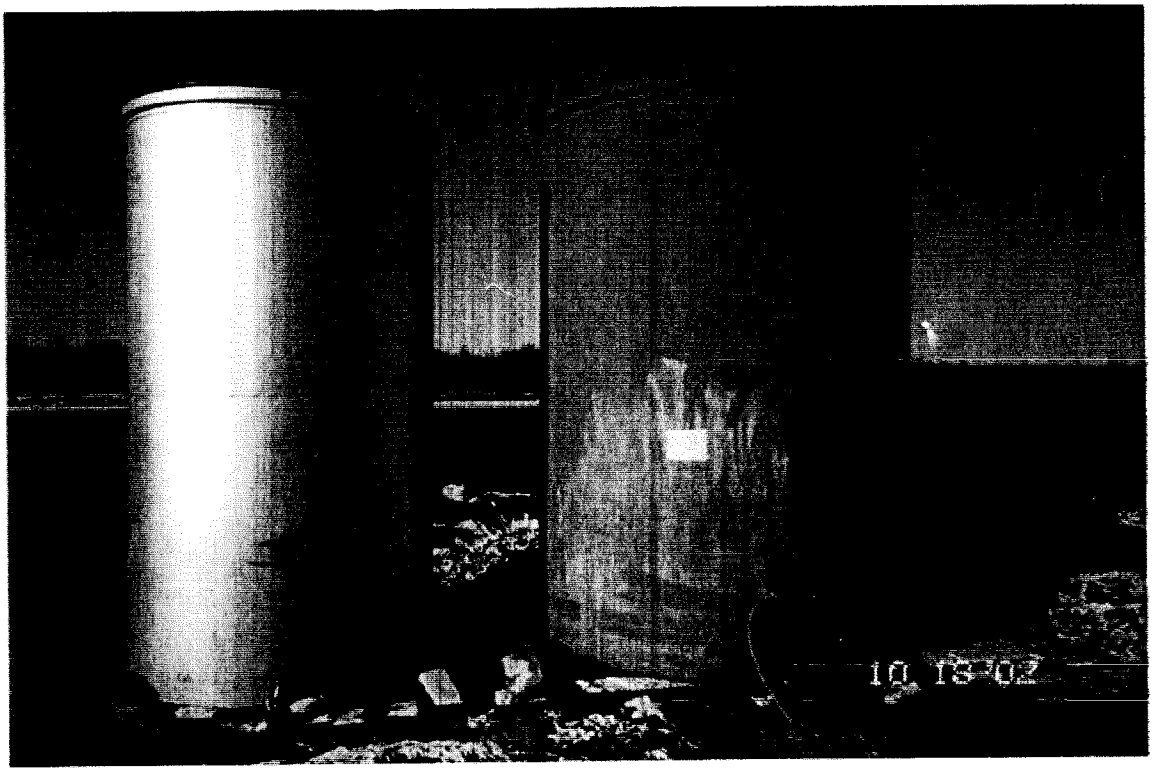
PERCENTAGE INCRS TO TOTAL GROSS CAPACITY: **45%**

AVEC PERCENTAGE OF TOTAL PROPOSED CAPACITY: **43%**

APPENDIX G

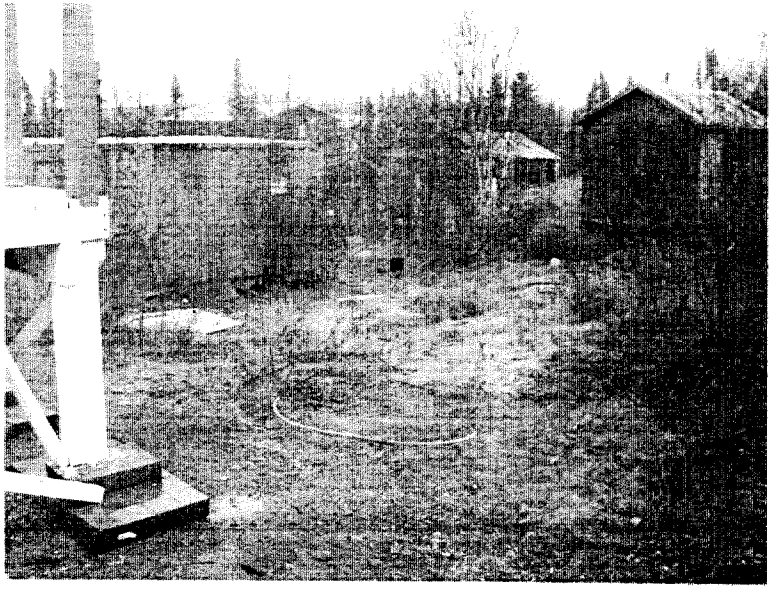
PHOTOS

Existing CORP. tanks and dispensing pump shed 10/17/02

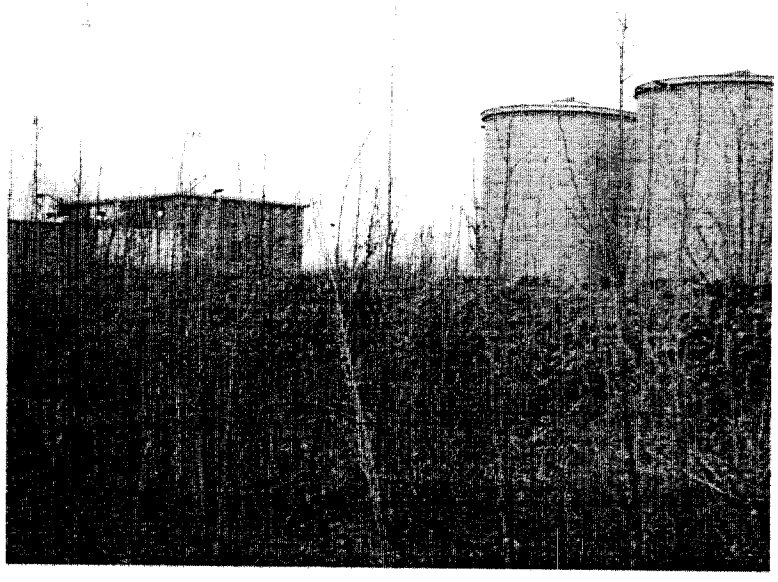


Existing CITY tanks 10/18/02

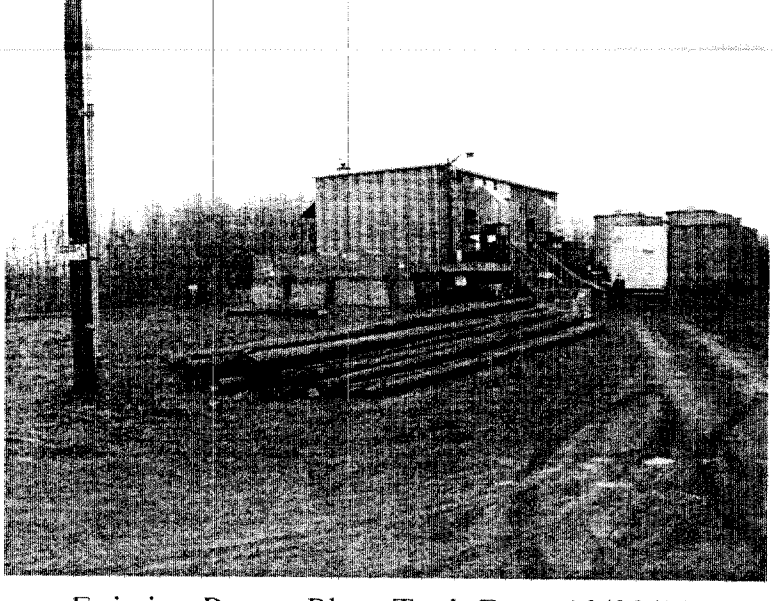
Existing AVEC tanks 10/18/02



School Tank Site Drainage to the East 10/09/03



Existing Power Plant Tank Farm 10/09/03

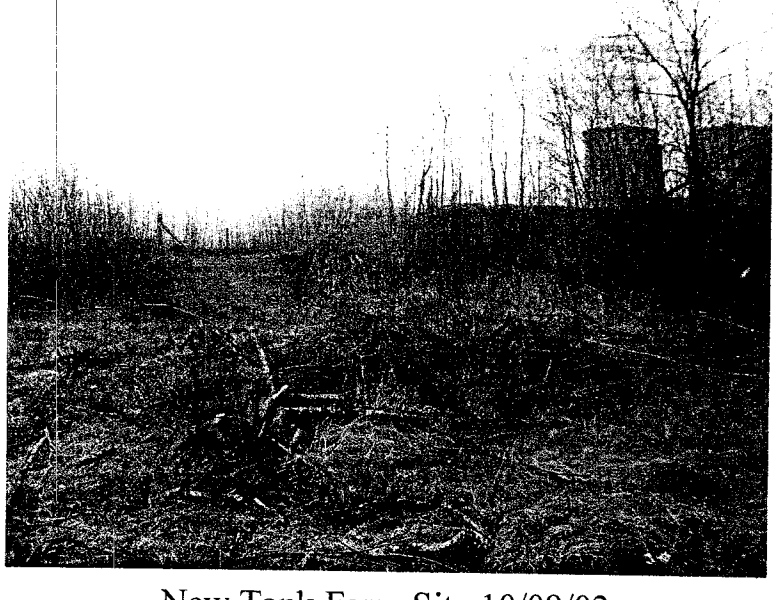


Existing Power Plant Tank Farm 10/09/03

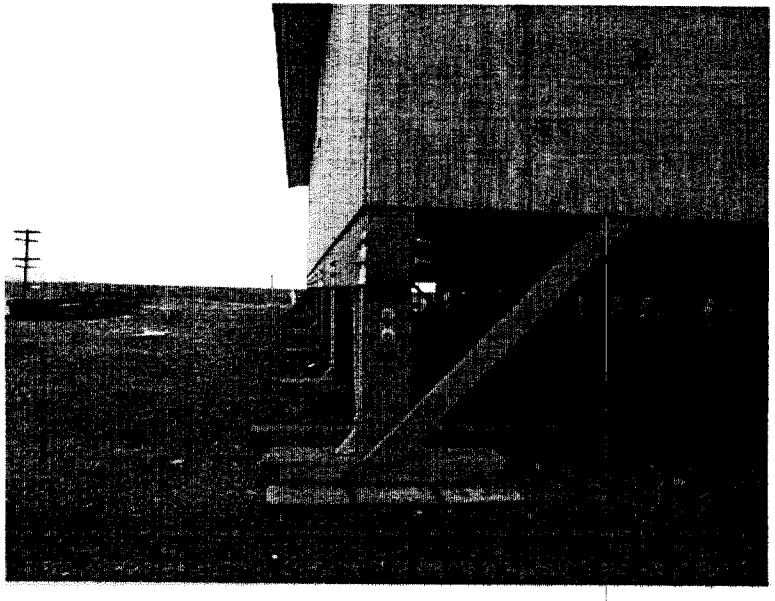
Existing Power Plant Tank Farm 10/09/03

New Tank Farm Site 10/09/03

New Tank Farm Site 10/09/03



New Tank Farm Site 10/09/03

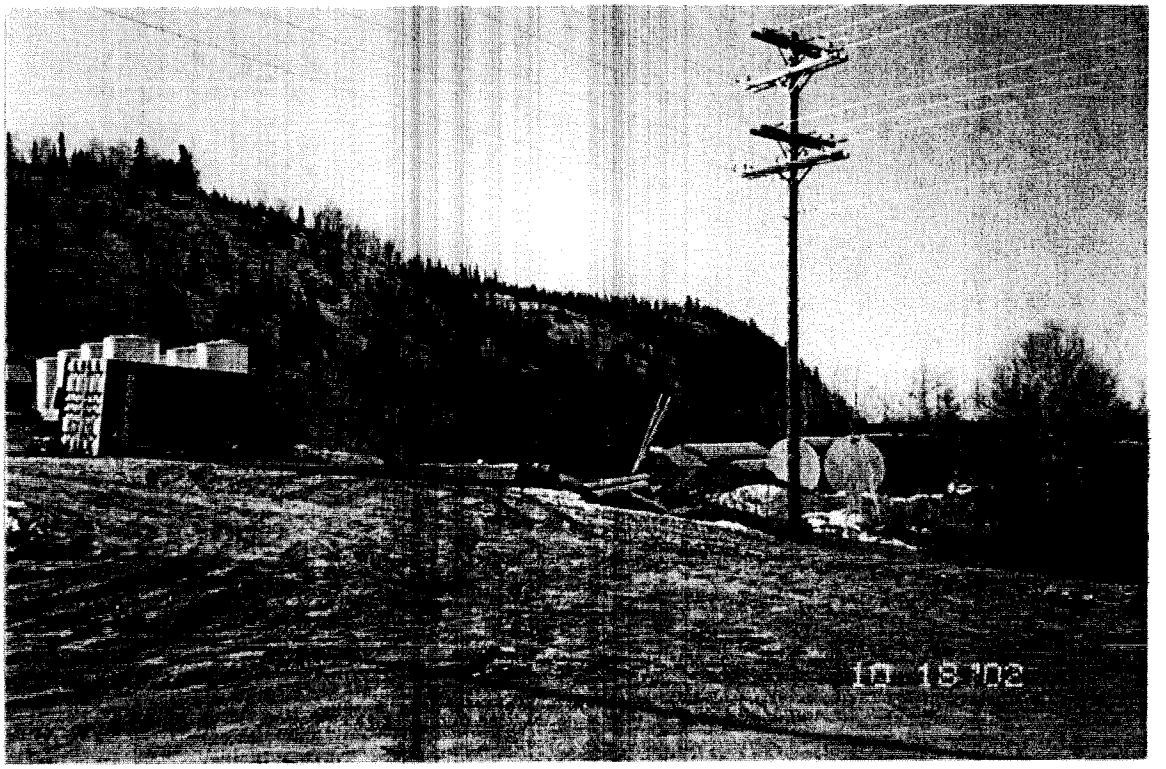


Teacher Residence Foundation Near Site 10/09/03

School Tank Site 10/09/03

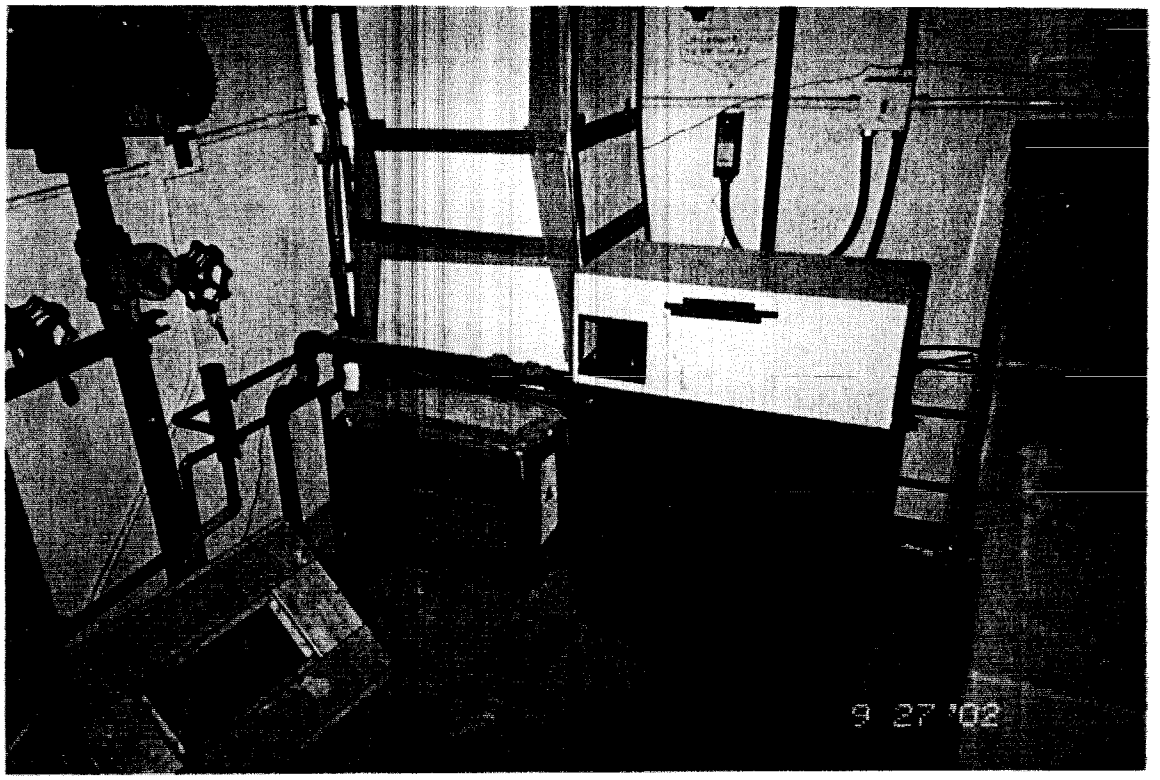
School Tank Site 10/09/03

School Tank Site 10/09/03



Existing IASD tanks to left, existing CORP. tanks to right 10/18/02

Existing IASD intermediate tank 10/17/02



Existing IASD day tank in School 9/27/02

APPENDIX H

HISTORICAL DATA

(The data in the following Appendix H was provided by AVEC to be included in this Concept Design Report.)

SHAGELUK

Equipment Data

Position	Engine Mfr.	Engine Model	Generator Mfr.	Generator Model	Set Rating (KW)
1	Cummins	LTA-10	Kato	6P4-1050	142
2	Allis Chalmers	3500	Kato	125SX9E	70
3	Allis Chalmers	3500	Kato	125SX9E	70

Generating Voltage 208\120 GRD Y Three Phase

Number of Remote Radiators 1

Number of Sectionalizing Switches 2

Existing Engine Jacket Water Heat Recovery System No

Operating Data

Peak Demand Recorded to Date (KW) 77

Date Recorded Dec '94, Jan, Feb, Dec '99, Jan '00

Projected 2001 Peak Demand (KW) 77

1999 Adjusted Generating Efficiency (KWH/Gal) 10.83

1999 Adjusted System Losses 7.07 %

Overall average station service load in 1999 (KW) 1.6

Overall average plant load in 1999 (KW) 40

Tank Farm and Fuel Data

Useable Fuel Storage Capacity (Gal) 52,435

1999 Adjusted Fuel Consumption (Gal) 32,339

Welded\Flanged Bulk Fill Line - No
Welded\Flanged Manifold - No
Welded\Flanged Daytank Line - No
Fenced Power Plant Site - No
Impermeable Liner - Yes
Used Oil Blending System - No

Narrative

Potential Shortcomings

Only one remote radiator
Single engine dependent during peak load periods
Threaded tank farm manifold
No fence around power plant site
No hydronically-heated storage facilities
208 volt generation
Two non-manufactured AC 3500's
No "used lubricating oil" blending system
No fireproof generator set enclosure
Large fuel adjustment in 1999
Fluctuating pattern of adjusted generating efficiency
Fluctuating pattern of system losses
Fluctuating pattern of adjusted overall operating efficiency

Existing Features

Impermeable liner underneath tank farm
Overhead distribution system
3-in-1 panel
Five year pattern of improving unadjusted overall operating efficiency
Four years of low station energy consumption
Two year pattern of increasing unadjusted generating efficiency
Reported average total hours of interruption time per customer in 1999 of only 4 hours
Good margin of fuel storage capacity
Only 10 power plant shutdowns during 1999

The Shageluk power plant is currently equipped with only one peak load generator set capable of individually meeting the current peak load requirements. The unit is a relatively high-efficiency 1200 RPM Cummins LTA10. However it is somewhat oversized for this application. The next highest-output units are no-longer-manufactured Allis Chalmers 3500's. Based upon the 1998 peak load projection from the latest Power Requirements Study, the power plant will remain single-engine dependent over the next two years. To correct this, the installation of a higher-capacity generator set inside the power plant is planned for the current two-year period of this construction work plan. The unit will be a Caterpiller 3304 retired from Russian Mission. The Shageluk power plant is only equipped with one remote radiator which does not provide redundant cooling capacity. There is no heat exchanger or hydronic heating system for transfer of heat to plant storage facilities. The Shageluk tank farm has more than adequate useable fuel storage capacity to meet the annual requirements of the next two-year period. The major system improvement planned for the Shageluk generation and distribution system during the current two-year construction work plan period include completion of the replacement of one of the Allis Chalmers 3500 powered generator set with a Caterpiller 3304 powered generator set.

Graph of Peak Load and Average Load by Year, Projections with and without PCE, and Existing Generating Capacity

This graph shows a number of key information items. It shows the peak generating capacity of each of the existing units, any proposed upgrades/conversions of existing units or any new proposed units. It shows the historical peak recorded loads.

The earlier peak loads may have been the average over a 15 minute period while the latest figures indicate the highest average load over a 1 minute period. The graph shows two projections for peak loads in the future assuming the continuance of the Power Cost Equalization Program. The graph shows two projections for peak loads in the future assuming the end of the Power Cost Equalization Program. The graph shows the historical average annual loads. The graph shows two projections for average annual loads in the future assuming the continuance of the Power Cost Equalization Program. The graph shows two projections for average annual loads in the future assuming the end of the Power Cost Equalization Program.

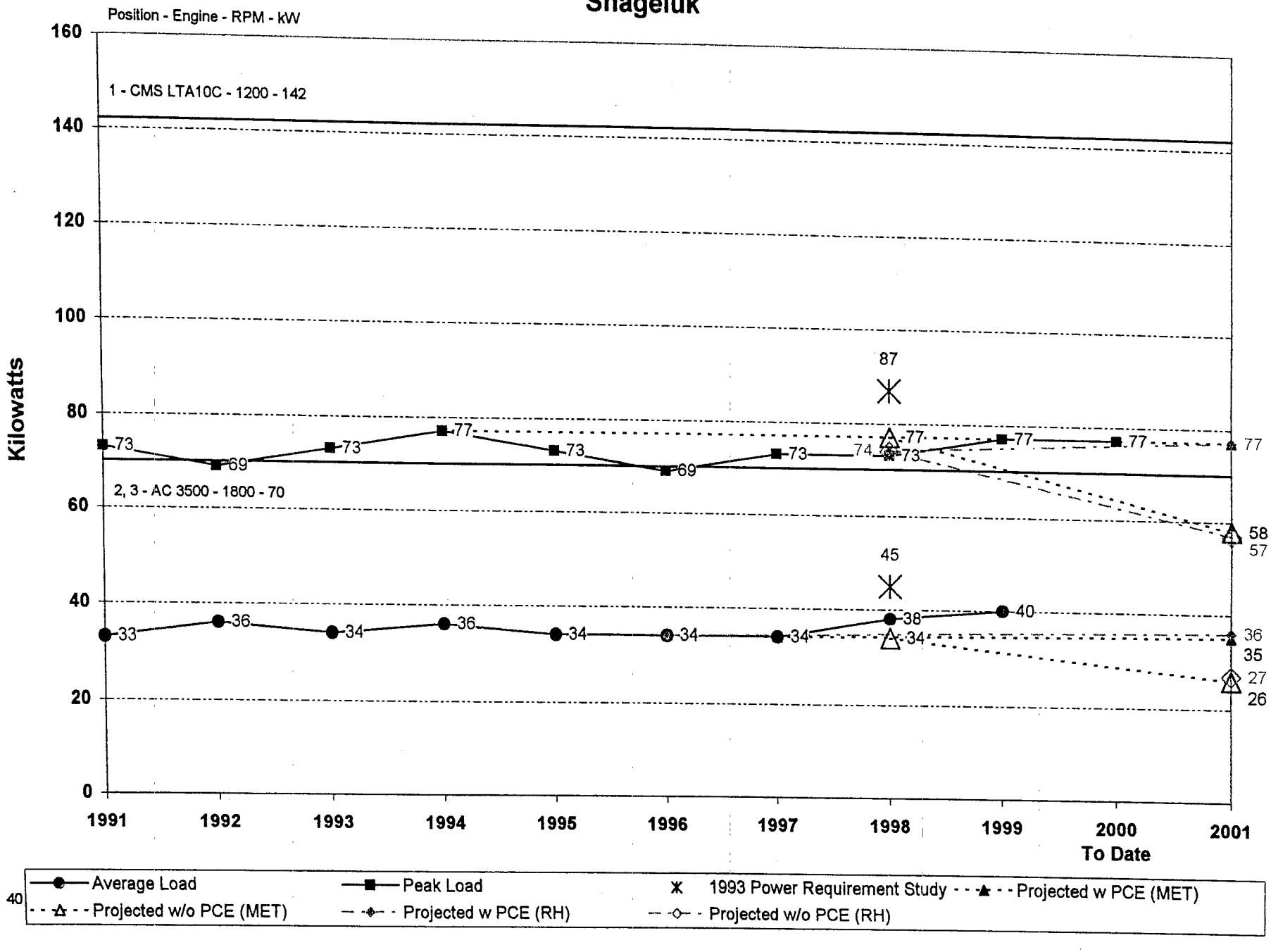
And finally the graph shows the projections of peak load and average load for 2001 made four years earlier based upon 1997 data.

Alaska Village Electric Cooperative

Peak Load and Average Load by Year.

Projections with and without PCE and Existing Generating Capacity.

Shageluk



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Graph of Adjusted vs Unadjusted Generating Efficency by Year

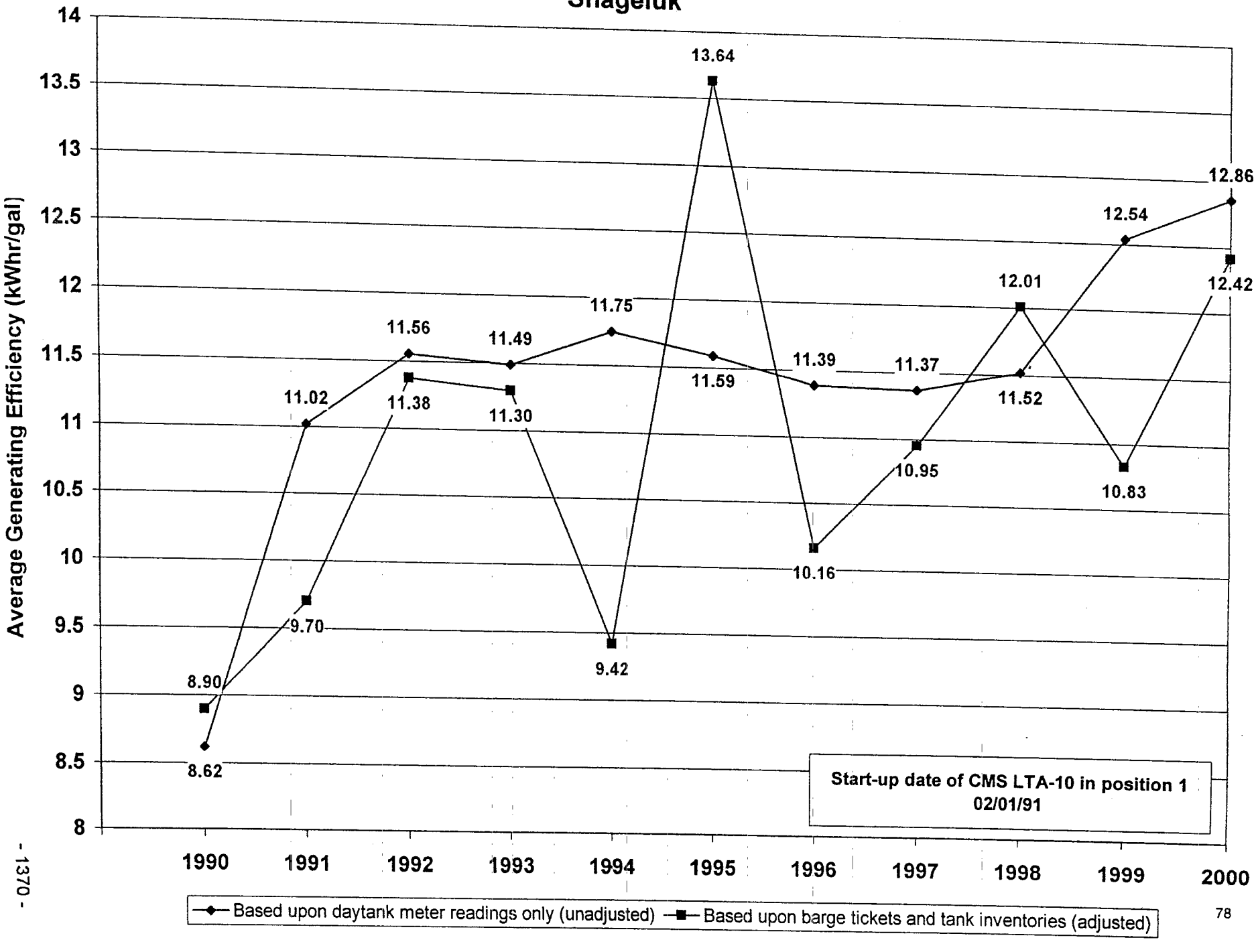
AVEC records two different figures for fuel consumption. One is based strictly on the daytank fuel meter (the unadjusted figure). The other is based upon an actual inventory of fuel remaining in the fuel storage tanks combined with quantity of fuel reported to be delivered by the fuel supplier to AVEC's tanks. This is the adjusted figure. When the total electric energy generated with the total quantity of fuel is compared a number showing the generating efficiency of the power plant is expressed in terms of average kilowatt-hours generated for every gallon of fuel. This graph shows historical generating efficiency, both unadjusted and adjusted.

It is AVEC's goal to increase the generating efficiency where it is economically feasible. Please remember that AVEC uses primarily #1 Arctic Grade Diesel which has a lower BTU value per unit volume than #2 diesel fuel.

Alaska Village Electric Cooperative

Adjusted vs. Unadjusted Generating Efficiency by Year

Shageluk



Graph of Total Fuel Consumption by Year

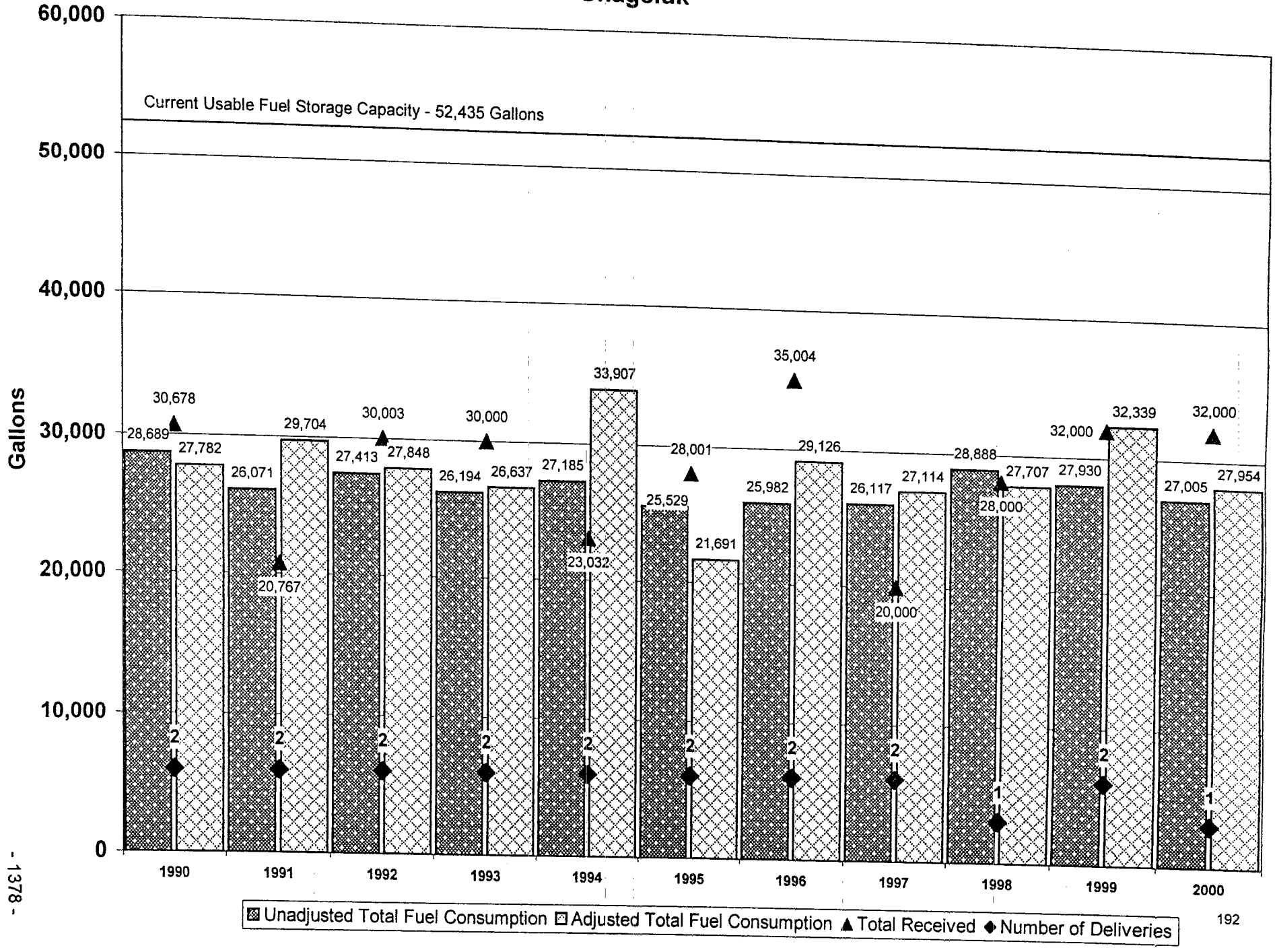
Because of the remote Arctic environment in which AVEC operates, an entire year's fuel supply must be delivered during a very short time window. In most cases, this requires that the onsite fuel storage capacity must exceed the annual consumption. This graph shows the relationship between useable fuel storage capacity and annual unadjusted and adjusted fuel consumption by year.

Note that the useable fuel storage capacity figure is the quantity of fuel that can be drained from the tank farm without extraordinary measures such as tipping of the individual tanks or special pumping from the individual tanks.

Alaska Village Electric Cooperative

Total Fuel Consumption by Year

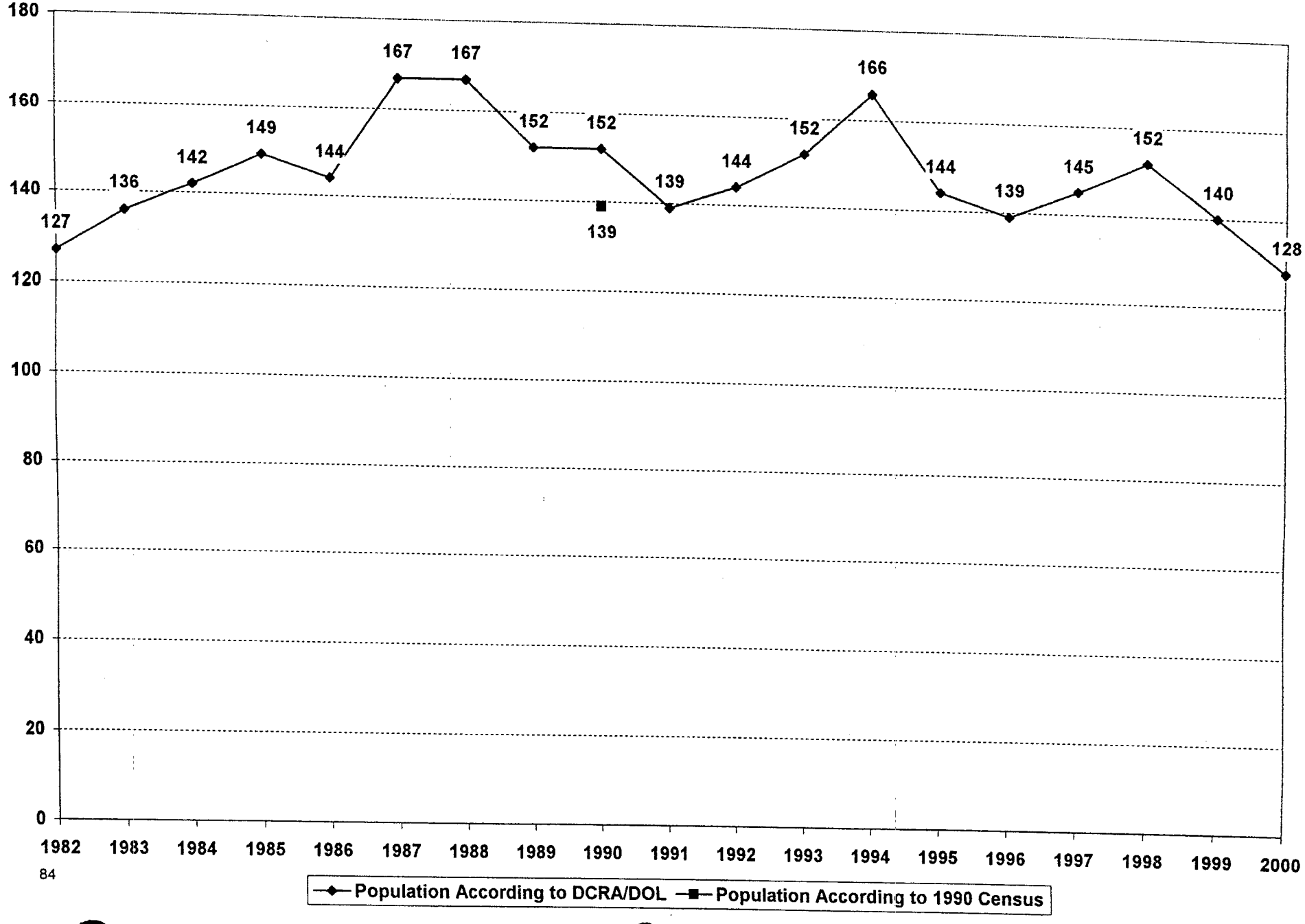
Shageluk



Alaska Village Electric Cooperative

Population History

Shageluk



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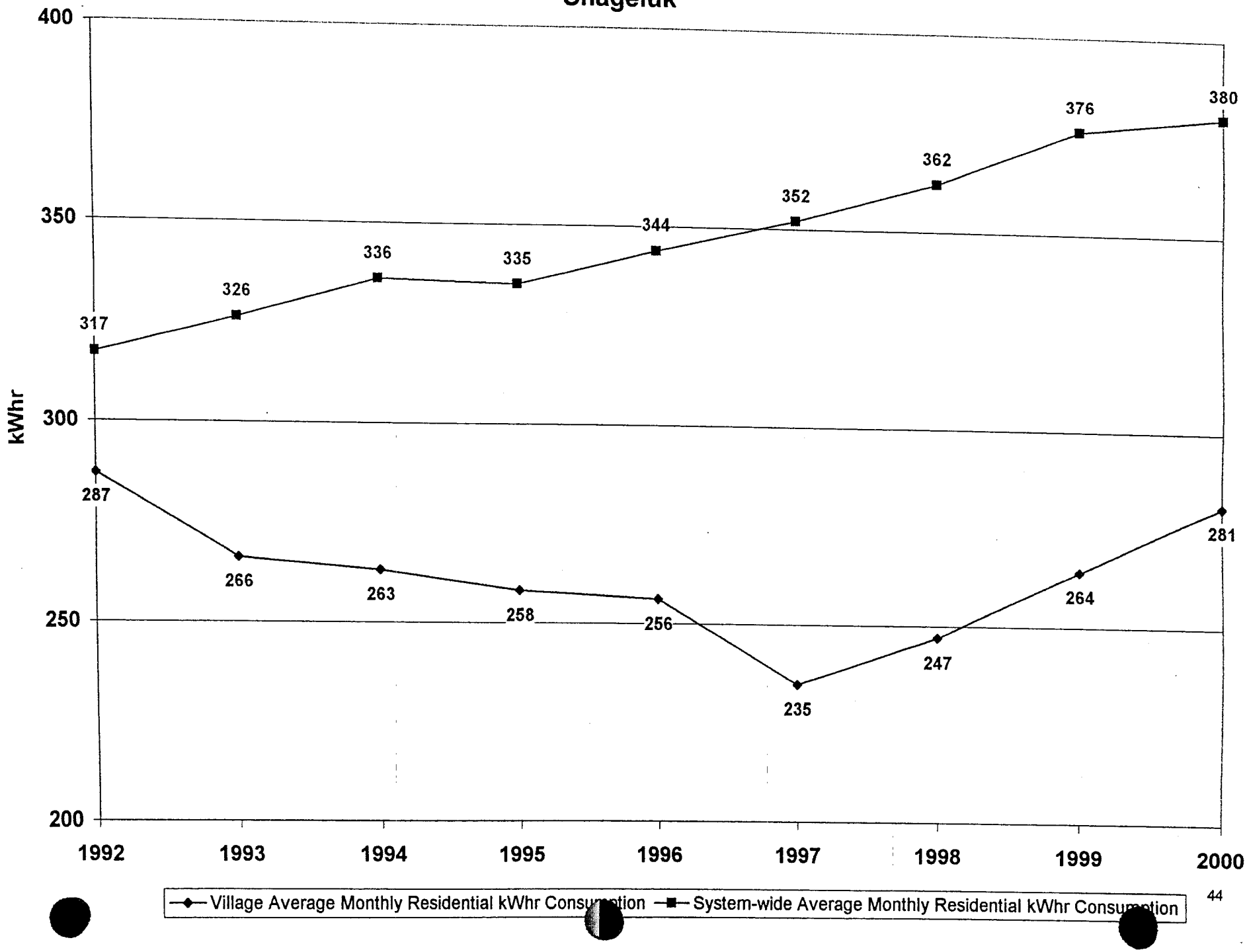
Average Monthly kWhr Consumption for Residential Class

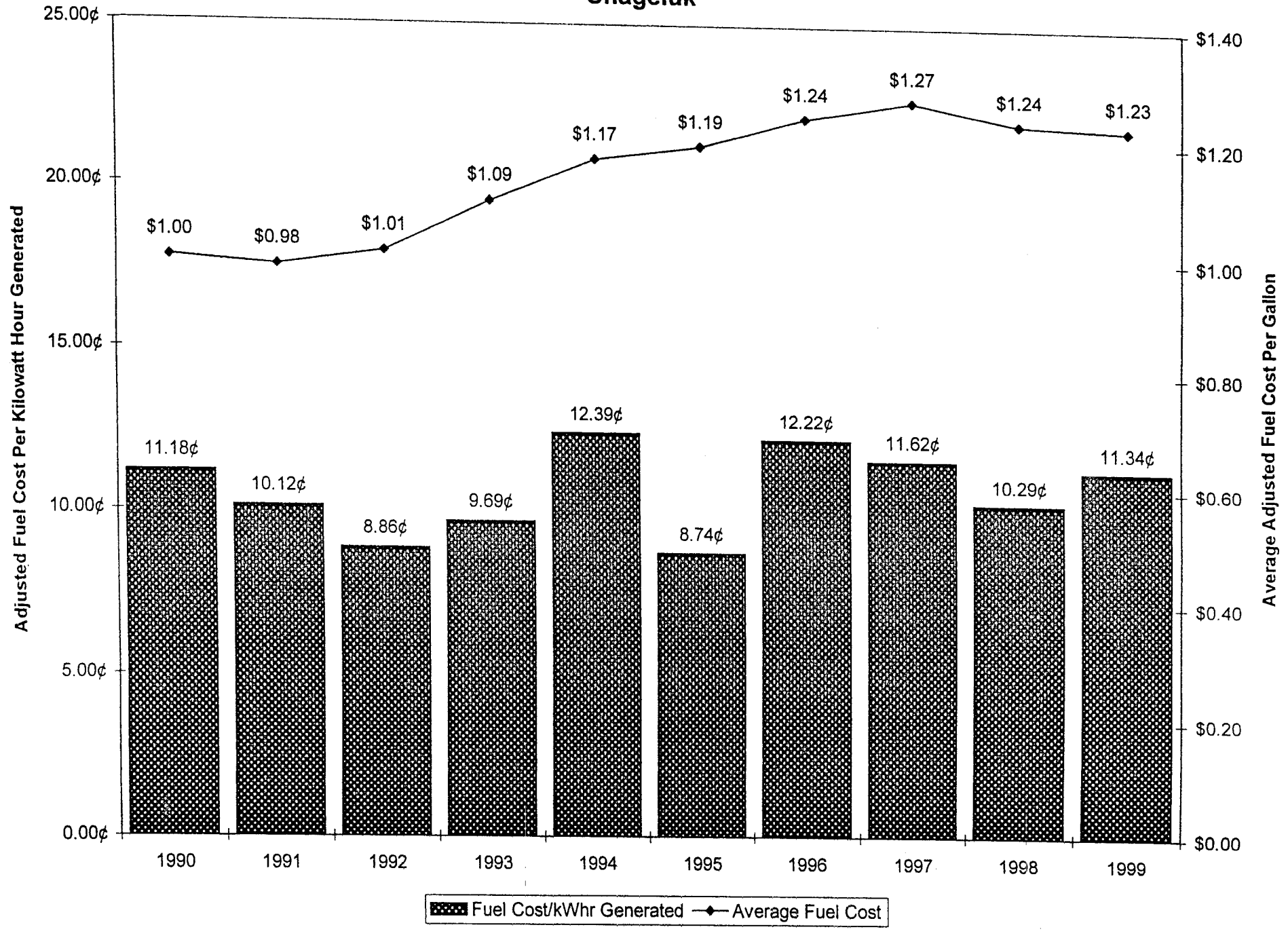
Shageluk



Alaska Village Electric Cooperative

Average Fuel Cost of Generating a Kilowatt-hour of Energy vs. Average Fuel Cost by Year

Shageluk



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