Appendix B:
2005 USDA RD Preliminary Engineering Report

PRELIMINARY ENGINEERING REPORT

Completion of
Tuluksak Piped Water and Sewer System

Prepared for

U.S. Department of Agriculture, Rural Utilities Services

By

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1.0 INTRODUCTION

The community of Tuluksak is a village of approximately 470 people (2004 State Demographer estimate) located on the south bank of the Tuluksak River at its junction with the Kuskokwim River. In 1995, the State of Alaska Village Safe Water (VSW) Program completed the ***Sanitation Facilities Preliminary Engineering Study*** for the community. At that time, the community did not reach a consensus on the best option for improved sanitation. Both a truck haul system and piped utilities were considered. In 1999, CE2 Engineers, Inc. (CE2) completed ***Supplement #1 To Sanitation Facilities Preliminary Engineering Study***. The Supplement presented alternatives for community sanitation including a truck haul system, piped utilities, and individual on-site wells and septic tanks. The truck haul system and piped utilities were examined in detail in the Supplement. The on-site wells and septic tanks were rejected due to the small lot sizes, the existence of active and abandoned honey bucket pits, the relatively shallow depth to groundwater, the thickness of the relatively impermeable surface silt layer, and the potential for flooding. Based on the increased customer convenience and greater health benefit afforded by the piped system over a truck haul system, the community selected the piped water and sewer system. A seven-year phased development program was proposed to complete construction of the piped utility system.

Phase 1 of the project consisted of construction of a honey bucket dump site adjacent to the proposed sewage lagoon site; close-out of an existing septage disposal pit and scattered honey bucket bunkers; upgrades to the existing water treatment plant (WTP); two new wells, a WTP/storage tank pad, and development of support facilities. Phase 1 is complete.

Phase 2 components include the design and construction of a new WTP, water storage tank, water circulation loop from the WTP to the existing washeteria, and a new sewage lagoon. Phase 2 is funded for design and construction.

Phase 3 consists of a community lift station, force main, and the installation of the piped water and sewer mains and service lines to approximately 100 homes and the school, and other public facilities. Phase 3 is partially funded.

Phase 4, which is unfunded to date, includes the Solid Waste Landfill, which the community approved for location adjacent to the sewage lagoon.

1.1 USDA Funding Involvement in Scope of Work

As shown below in Table 1, USDA has funded $5,470,200 for project Phases 1, 2, and 3 of the total $10,766,682 funded for the project to date.

Table 1
Tuluksak Water & Sewer Funding Sources

	Funding Source					
Grant Identifer	RD	VSW	ANTHC	EPS / ISA	DOT RSA	TOTAL
Feasibility/Engr. Studies		50,000				50,000
88502 & 88505				588,262		588,262
CIP 03 88504		591,100				591,100
CIP 03 RD 02 88504	1,773,000					1,773,000
AN02-N09			1,112,100			1,112,100
DOT RSA					10,000	10,000
AN03-N30			512,520			512,520
CIP 04 VSW		500,000				500,000
CIP 04 RD	1,500,000					1,500,000
AN04-N70			1,200,000			1,200,000
CIP 05 VSW		732,500				732,500
CIP 05 RD	2,197,200					2,197,200
Total Funding: Phases 1, 2, & 3	**5,470,200**	**1,873,600**	**2,824,620**	**588,262**	**10,000**	**$10,766,682**

Table 2 describes individual agency funding for project components in Phases 2 and 3, and notes that Phase 4, the solid waste landfill, is unfunded. USDA funding totals $2,148,000 for Phase 2, and $2,534,700 for Phase 3.

Table 2

TULUKSAK WATER & SEWER PROJECT COMPONENTS & FUNDING SOURCES PHASES 2, 3, & 4					
Primary Component	**Funding Source**				**Total Funding**
	RD	**VSW**	**ANTHC**	**EPS/ISA**	
Phase 2					
Water Treatment Plant	1,723,155	574,745	302,100		2,600,000
Water Storage Tank			512,520		512,520
Raw Water Line	113,000	37,000			150,000
Lagoon	311,845		1,458,000	104,355	1,874,200
Phase 2 Agency Totals	**2,148,000**	**611,745**	**2,272,620**	**104,355**	**5,136,720**
Phase 3 (partially funded)					
Force Main and Lift Station	337,500	112,500			450,000
W&S Mains	2,197,200	732,500			2,929,700
Phase 3 Agency Totals	**2,534,700**	**845,000**	-	-	**3,379,700**
Phase 4 (Unfunded)					
Solid Waste Landfill	-	-	-	-	-
Phase 4 Agency Totals	-	-	-	-	-
Total Funding: Phases 2,3,4	**4,682,700**	**1,456,745**	**2,272,620**	**104,355**	**8,516,420**

2.0 PROJECT PLANNING AREA

2.1 Location

Tuluksak lies on the south bank of the Tuluksak River approximately 1.5 miles upstream of its junction with the Kuskokwim River. The village is 35 miles northeast of Bethel (Sec. 27, T012N, R066W, Seward Meridian). See Figure 1 - Location & Vicinity Map, on the next page. It lies at approximately 61.1025° North Latitude and 160.96167° West Longitude and is located in the Bethel Recording District. The area encompasses 3.1 square miles of land and 0.1 square miles of water. Annual precipitation averages 16 inches in this area, with snowfall of 50 inches. Summer temperatures range from 62° to 42° Fahrenheit; winter temperatures can be 19° to -2°.

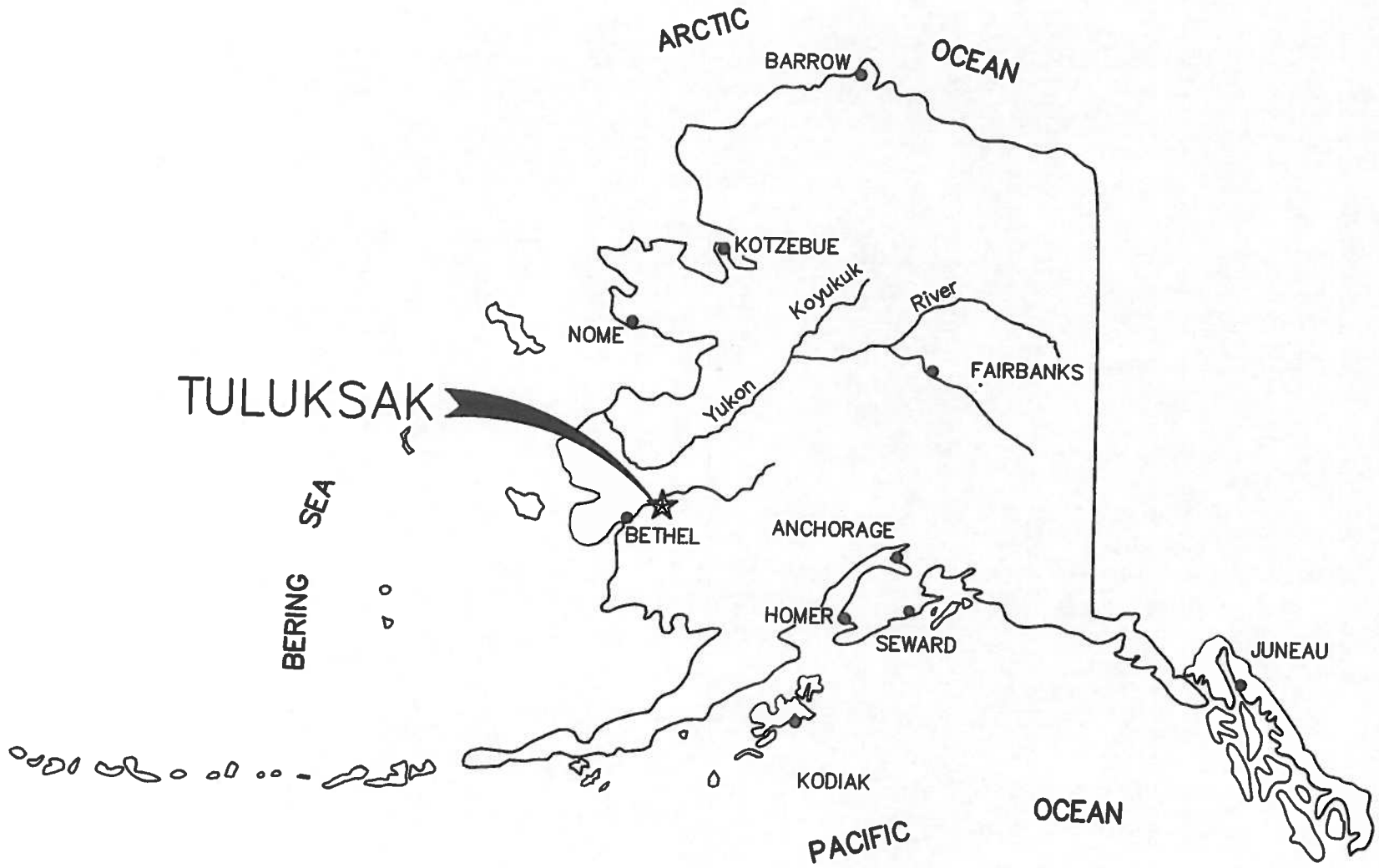
Tuluksak is a traditional Yup'ik Eskimo village with a fishing and subsistence livelihood. The sale, importation or possession of alcohol is banned in the village. The primary employers are the school, village government, and services. Some commercial fishing also occurs, with 29 residents holding commercial fishing permits. Subsistence activities provide most food.

2.2 Environmental Resources

2.2.1 Land Use/Ownership

Land use in the project area is primarily residential with some public facilities, such as the school and clinic, and a few commercial establishments. Land use is in conformance with the ***Tuluksak Community Plan*** prepared by David Nairnie + Associates in March 2001.

Major land owners in the community include Tulkisarmute, Incorporated, the Alaska Native Claims Settlement Act (ANCSA) village corporation; Tuluksak Native Community (TNC), the Bureau of Indian Affairs (BIA) recognized local governing body; and the Moravian Church. The Alaska Department of Transportation & Public Facilities (ADOT&PF) holds title to the Tuluksak Airport, a large tract of land directly adjacent to the developed community. ADOT&PF is currently in the conceptual planning phase for moving the airport to an area southeast of the community.



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LOCATION AND VICINITY MAP
TULUKSAK, ALASKA

FIG.1

2.2.2 Wetlands

Wetlands have not been mapped in or near Tuluksak; however the United States Army Corps of Engineers (USACE) assumes that they exist in much of the community. Therefore, the proposed action entails wetlands permitting by the USACE. The complete project, through Phase 4, has undergone review and permitting by the USACE Regulatory Division. USACE permit number 4-2001-0198 was issued in July of 2001 for Phase 1 activities, including construction of a common building pad for the WTP and adjacent water storage tank, and the access road for the WTP and sewage lagoon/landfill area. The USACE issued a permit modification to permit number POA-2001-198 on April 19, 2005, authorizing "a minor shift in project alignment and a time extension for work associated with construction" of a foundation pad for the water treatment plant and water storage tank. The time limit for completing the work authorized ends on April 30, 2008. USACE Permit number POA-2003-604-4 was issued on July 20, 2005, "to construct a community piped water and sewer system, a sewage lagoon, and a solid waste landfill". This permit expires on January 31, 2008.

2.2.3 Floodplains

According to the USACE flood hazard data for Tuluksak, the community is subject to flooding. The worst floods remembered by residents were those of the 1970's. The flood of record was based on water marks on the pilings under the school with an elevation measured at 3.9'. The USACE recommended building elevation is 5.9'. The community does not participate in the National Flood Insurance Program.

2.2.4 Endangered Species

The Tuluksak study area is not known to contain any threatened or endangered species and is not located within a designated critical habitat area. In a letter dated December 23, 2004, the U.S. Fish and Wildlife Service confirmed that the project does not require a biological assessment or further consultation under section 7 of the Endangered Species Act (consultation number 2005-046).

2.2.5 Historic Sites

An archaeological survey of the affected area conducted in May 2003 concluded that "no historic properties that would have been potentially eligible for inclusion on the National Register of Historic Places or any other cultural indicators other than those associated with the modern occupation of the village were observed anywhere in the project's area of potential effect." The Alaska State Historic Preservation Officer (SHPO) concurred with the assessment that no historic properties would be affected by the project.

2.3 Growth Areas and Population Trends

2.3.1 Areas of Growth

Community growth will likely be predominantly residential; additional homes were identified as a community need in the ***Tuluksak Community Plan*** (*DNA, March 2001*). The Tuluksak Youth Center/Multi-Purpose Facility is currently under construction and will house a youth center room, social services offices, and the local Post Office. A new clinic was built in 2003, and a new K-12 school was completed in 2004. An upgraded bulk fuel facility has also been identified as a community need.

2.3.2 Present and Projected Population

The population history (from the U.S. Census) for Tuluksak is provided below.

Year	Population
1880	150
1890	62
1900	0
1910	0
1920	73
1930	96
1940	88
1950	116
1960	137
1970	195
1980	235
1990	358
2000	428

The average annual growth rate over the past five decades has been 2.5%. The annual growth in the last decade has been 1.6%. The highest growth rate occurred between 1960 and 1970; during that decade the average annual growth rate was 4.2%. The population is 94.2% Alaska Native, 5% white, and 0.8% Asian. There are a total of 86 households in the community, 76 are family households with an average family size of 4.98 persons. Ten households are classified as non-family households.

Growth is expected to continue at an average annual rate of 1.5% throughout the 20-year planning period. Recent population projections made in consultation with TNC and the Alaska Department of Community and Economic Development are provided below.

Year	Projected Population
2010	497
2015	535
2020	576
2025	620

3.0 EXISTING FACILITIES

3.1 Location Map

Figure 2, on the next page, shows the location of existing facilities in Tuluksak.

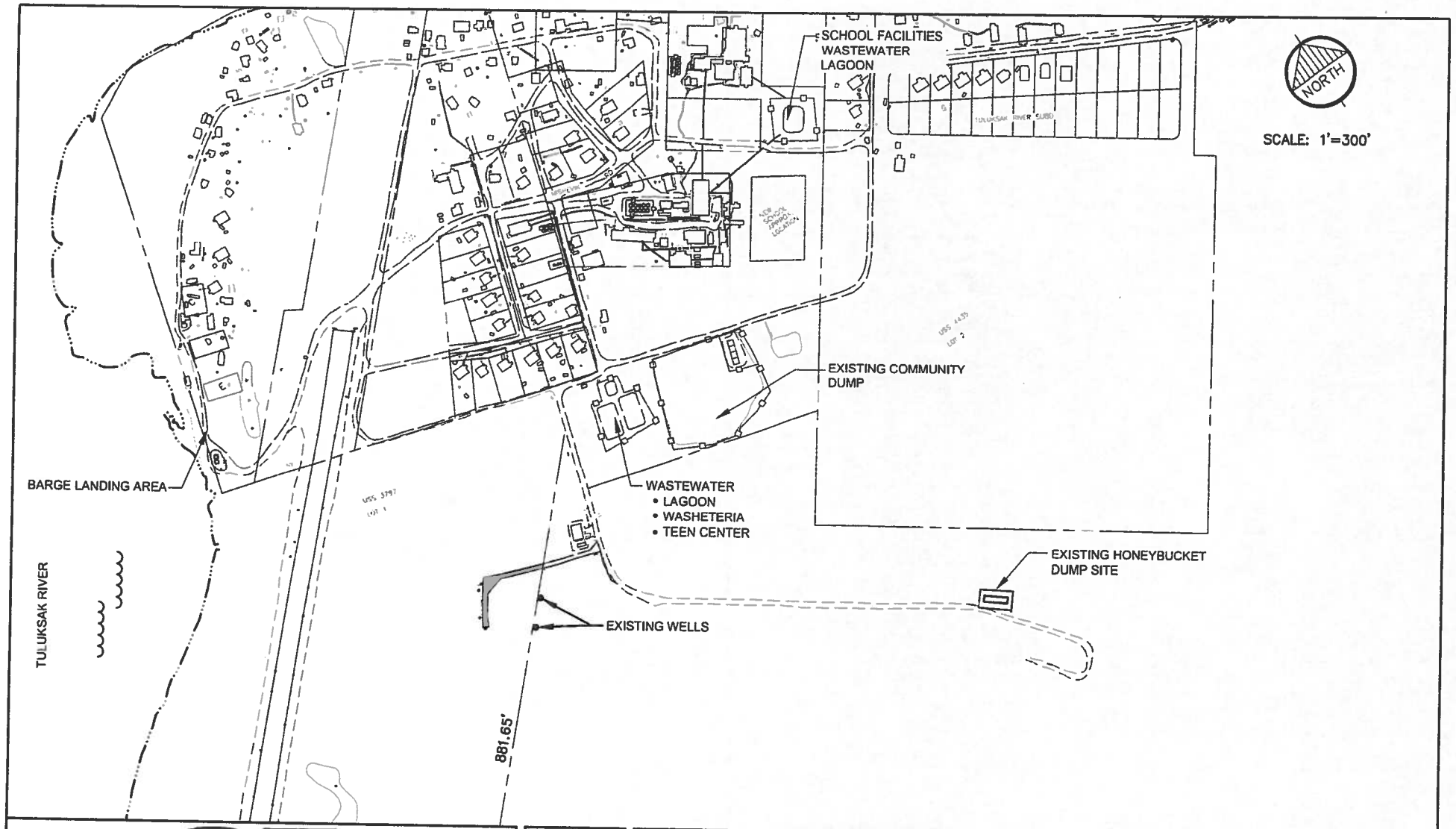
3.2 History of Facilities

A Public Health Service (PHS) project, started in 1961 and completed in 1967, provided a well, watering point, individual sewage disposal facilities (pit privies and seepage pits), individual home sink units and a community refuse disposal facility. The water supply portion of this project failed due to flooding, electrical failures, and inadequate operation and maintenance (O&M), which resulted in freezing and contamination of the well. The well was abandoned in 1970.

Another PHS project was initiated in 1980 to construct sanitation facilities to serve 27 new Department of Housing and Urban Development (HUD) units and the 39 pre-existing homes. This project, completed in 1982, provided a well and a washeteria/WTP, including a central watering point. Water hauling and storage containers were provided to each homeowner. A 150 foot by 150 foot lagoon was constructed southwest of the washeteria/WTP for wastewater discharge from the facility through a 665 linear foot, four-inch arctic pipe transmission line. Two 7,500-gallon fuel storage tanks were also provided. Seven sewage disposal bunkers were constructed throughout the community. A solid waste disposal site was developed south of the community.

In 1994, the last five sewage disposal bunkers were decommissioned (two of the bunkers were previously buried). The bunkers had been reported full for several years. Temporary individual household honey bucket disposal pits were constructed the same year.

In June 1995, the State of Alaska VSW Program completed the ***Sanitation Facilities Preliminary Engineering Study*** for Tuluksak. The study explored alternatives for improved sanitation, including piped water and sewer and a truck haul system. As a community consensus was not reached with the 1995 study, ***Supplement #1 - Sanitation Facilities Preliminary Engineering Study*** was completed in 1999 by CE2, providing additional technical information and presenting three options to the community for a public water and sewer system. The three options included a piped water and sewer system; truck haul water and sewer system; and on-site wells and septic systems.



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TULUKSAK PIPED WATER AND SEWER SYSTEM IMPROVEMENTS
EXISTING FACILITIES MAP
TULUKSAK, ALASKA

FIG. 2

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The community selected to proceed with the piped water and sewer system. In the meantime, an interim honey bucket lagoon was constructed in 2003, adjacent to the site of the sewage lagoon proposed in ***Supplement #1*** *(CE2, 1999).*

The WTP, water storage tank, water circulation loop, water and sewer mains in central Tuluksak, force main, and sewage lagoon presented in this Preliminary Engineering Report are necessary components of the planned piped water and sewer system. In the fall of 2000, TNC approved a plan to co-locate their power plant, bulk fuel storage, community water source, water treatment plant, and water storage tank on an area approximately one-quarter mile south of the community. This area is known as the "Utility Core Site."

Currently, TNC owns and operates the well and the washeteria/WTP and watering point. Piped water is supplied to the school complex and a construction camp. A new clinic was completed in March 2003, but is not connected to the piped water and sewer facilities. A new school was completed in 2004, and a Youth/Multi-Purpose facility is currently under construction, which will also be connected to piped water and sewer.

All other users obtain water for in-home use by hauling it in buckets from the community watering point, or from natural water sources; many collect rainwater. Laundry and shower facilities are available at the community washeteria, which was rehabilitated in 1996 but still is in poor condition.

Wastewater from the school complex is piped to a fenced lagoon east of the elementary school. Wastewater from the washeteria is piped to a second fenced lagoon on the south edge of the community. Human wastes generated in the home are collected in "honey buckets" (five gallon plastic pails lined with plastic bags). The community has a honey bucket collection service and a central honey bucket disposal facility that was constructed in 2003 to replace the temporary individual household pits on each lot. The temporary pits were full at the time of replacement.

Solid waste is hauled by individuals to an uncontrolled dump located south of the community, adjacent to the school site.

3.3 Condition of Facilities

Existing sanitation facilities in the community are substandard at best. The washeteria watering point was constructed in 1982 and is reaching the end of its design life. To extend the

useful life of the facility, flexible liners were placed in the water storage tanks in 2003. Corrosion of the tanks had caused them to leak. However, placement of the liners reduced the storage volume of the tanks. As the community has grown and a new school was placed in service last year the capacity of the water treatment plant is no longer adequate. The twenty-year plus facility no longer treats the water to EPA primary and secondary drinking water standards. The arsenic content of the raw water exceeds the current EPA maximum contaminant level (MCL) and is not removed by the current process.

3.4 Financial Status of Existing Facilities

3.4.1 Current Rate Schedules

The current rate schedule is $40 per household per month for use of the watering point at the washeteria and the honey bucket haul service. The Yupiit School District provides manpower to the operation and maintenance of the water treatment plant in lieu of any financial contribution to TNC.

3.4.2 Annual O&M Costs

Annual O&M costs for the existing washeteria and honey bucket haul service total $70,090. These costs are included in the 2004 TNC financial statement provided in Appendix A.

3.4.3 Capital Improvement Programs

The Tuluksak community has been an integral part of the water and sewer planning process, in partnership with the State of Alaska Village Safe Water program, since 1995. This process has resulted in a capital improvement program which includes the two preliminary engineering studies previously cited in this report and the Phase 1 water and sewer improvements, and will continue with Phases 2 through 4 and beyond to the funding and construction of a new solid waste landfill.

3.4.4 Existing Debts and Required Reserve Account Status

The existing system has no debts and no reserves. The O & M budget for the proposed system includes a reserve account line item.

3.4.5 User Tabulation by Monthly Usage Category for FY 06

Public Facility Users, Water & Sewer: 1 (Tuluksak School, Yupiit School District). The school district complex includes twelve teacher residences and one building which houses the kindergarten through 12th grade.

Household Users, Watering Point and Honey Bucket Haul: 75 households.

4.0 NEED FOR PROJECT

The project under consideration for funding will improve health and safety conditions and meet anticipated growth for a 20-year planning period.

4.1 Health, Sanitation, and Security

4.1.1 Health and Sanitation Issues

Many residents currently obtain drinking water by collecting rainwater or from other natural sources. Sampling studies in other rural Alaska communities have found alarming degrees of bacteria, and specifically E.coli bacteria, when home drinking water supplies are analyzed. Water source, handling procedures, lack of disinfection, and storage vessel cleanliness are the most likely factors leading to contamination of the resident's drinking water. One can make the assumption that if a home water sampling study was conducted in Tuluksak, similar results would be found.

Residential wastewater is disposed of by honey bucket haul, which entails homeowners walking or utilizing an all-terrain vehicle (ATV) or snowmachine to haul their honey bucket contents to honey bucket collection stations scattered throughout the community. This system is fraught with opportunity for spillage and mishandling resulting in contamination of skin, clothing, shoes, and ultimately, homes. Honey bucket waste is then collected, as required, by TNC and transported in custom trailers to the honey bucket disposal lagoon.

The existing sewage lagoons are both well fenced but are located directly in the community and create an odiferous nuisance

4.1.2 Regulatory Compliance Concerns

The current WTP, built in 1982, does not effectively remove heavy metal contaminants such as arsenic as required by the Federal Drinking Water Standards. The high iron content, 70 parts per million (ppm) and color (organic contaminants) are listed as Secondary Contaminants and are not reduced to recommended levels by the existing WTP.

The existing school and washeteria wastewater lagoons are located within the developed community and are too small to comply with current regulations for the proposed piped water and sewer system.

4.2 System Operations and Maintenance

4.2.1 Management Adequacy

The most recent State of Alaska Rural Utility Business Advisor (RUBA) Status Report, dated 10/7/2005, shows that the Tuluksak utility system meets all RUBA essential and sustainable indicators for management capacity. A copy of the status report is provided in Appendix B.

4.2.2 Design Efficiency/Inefficiency

The existing WTP built in 1982 uses outdated technology to accomplish the treatment process. New technology will provide superior levels of treatment of greater volumes of water at a lower cost. Not only the outdated technology but the age of the equipment causes more frequent breakdowns than will occur at a new WTP. The introduction of new technology utilizing new equipment will have the greatest impact on the ability to provide adequate volumes of treated water to the community. This technology will insure the community meets current EPA treatment standards. And should result in improved health status of the residents.

4.2.3 Problem Elimination Prior to Capacity Expansion

It is not possible to reduce or eliminate water treatment and storage deficiencies prior to capacity expansion in a cost effective manner. The cost of upgrading the existing water treatment plant, which does not have adequate capacity, cannot be justified. In addition, the community has completed a number of previous upgrades to increase the efficiency of their water treatment process and add storage capacity and have exhausted this option. The wastewater lagoons are operating above design capacity and do not meet current ADEC regulations.

4.3 Growth

4.3.1 Growth Capacity for Planning Period

The planned water and sewer utility will be constructed in multiple phases with complete build-out anticipated in the year 2012. Major infrastructure components include the WTP, water storage tank, and sewage lagoon, followed by the community-wide piped water and sewer components. Funds are in place for the water treatment plant, water storage tank, and sewage lagoon. The community wide piped utility system is only partially funded. A solid waste landfill has been included in the site planning, however, funds are not available at this time to design or construct the facility.

4.3.2 Phased Capacity Increases

It was estimated in ***Supplement #1 – Sanitation Facilities Preliminary Engineering Study*** *(CE2, 1999)* that improvements to provide a complete piped water distribution and wastewater collection system for the community, including landfill construction, will require a minimum of seven years to construct under favorable funding and construction circumstances.

Phase 2, the first major construction phase, will provide water supply, water treatment, water storage and a water distribution loop to serve the existing school, clinic and multipurpose center and piped utilities to the central area of the community, encompassing approximately 20 homes. This phase will also construct the primary wastewater disposal facility. Phase 2 is funded at $5,137,350. A Phase 2 limited option would be to operate the water and sewer system in a limited mode, at approximately 5,000 gallons per day, which would provide water and sewer services to the school, clinic, and washeteria, but not the 20 homes located in the central area of the community.

Phases 3 will provide water distribution, house plumbing, and wastewater collection to approximately 80 homes, providing a completed system for each area. Phase 3 is currently funded at $3,379,700.

Phase 4, the solid waste landfill, is not currently funded.

4.3.3 Estimate of New Utility Customers

The 2000 U.S. Census data for Tuluksak shows that 86 percent of the 86 households in Tuluksak do not have complete plumbing facilities installed. Thus, a minimum of 75 households will become new utility customers when the water and sewer facilities are completed. This estimate does not take into account homes that may be built by TNC before the water and sewer project reaches full build-out.

5.0 ALTERNATIVES CONSIDERED

Three alternatives have been investigated for this report:

- No-Build
- Truck Haul and Core Facilities
- Piped Water and Sewer and Core Facilities

The truck haul and piped water and sewer alternatives have been extensively studied and presented in the two previous studies referenced throughout this report: the ***Sanitation Facilities Preliminary Engineering Study*** *(VSW, 1995)* and ***Supplement #1 – 'Sanitation Facilities Preliminary Engineering Study*** *(CE2, 1999)*. The second and third alternatives are based on replacement and upgrade of existing facilities that the community has outgrown due to population, community facility growth, and the age of the existing water and wastewater facilities.

5.1 Project Design Criteria

Applicable Federal, State, and local design standards are adhered to for all alternatives addressed by this Report.

5.1.1 Water Distribution Design Criteria

- Water mains are sized for peak daily demand in the year 2025 (65 gpcd), plus a minimum fire flow of 500 gpm in the area affected by new construction.
- Provisions have been made to accommodate future development of additional housing.
- All appropriate materials will be approved by the National Sanitation Foundation for potable water use.
- Only lead-free solder will be used.
- Direct buried arctic water main shall be a composite section consisting of SDR 11 HDPE carrier pipe foamed inside a circular 16 gauge corrugated aluminum jacket. The annular space between the carrier pipe and the jacket shall be filled with a minimum of 3 inches of closed cell polyurethane foam insulation (3.0-4.0 pound

per cubic foot density). Carrier pipe joints shall normally be thermally butt fused. When mechanical joints are required, joints shall be made with approved fittings rated for a minimum operating pressure of 150 psi.

- Fire hydrants shall have circulating thaw legs.
- Water main shall be installed to provide 10 feet of horizontal separation (measured between the outside edges of the carrier pipes) and 18 inches of vertical separation from sanitary sewers and storm drains, wherever these conduit cross.
- Minimum burial depth for arctic water main shall be 4 feet.
- Pipe installation requirements will address overexcavation of frost susceptible soils and measures to prevent the longitudinal movement of groundwater through backfilled pipe trenches.

5.1.2 Wastewater Collection Design Criteria

- Gravity sewers are sized for projected instantaneous peak flows in the year 2025, assuming full development of affected drainage cells in accordance with projected development patterns. Minimum size shall be 8-inch.
- Provisions have been made to accommodate future development of additional housing.
- Gravity sewers will be installed on a grade that insures a minimum flow velocity of 2 ft/sec when the pipe is flowing full.
- Sewer service lines shall be a minimum diameter of 4 inches, placed at a minimum grade of 2%.
- Direct buried arctic sewer main and service pipe shall be a composite section consisting of SDR 17 HDPE carrier pipe foamed inside a circular 16 gauge corrugated aluminum jacket. The annular space between the carrier pipe and the jacket shall be filled with a minimum of 3 inches of closed cell polyurethane foam insulation (3.0-4.0 pound per cubic foot density). Carrier pipe joints shall be made with gasketed couplings. Saddles and other fittings shall be rated for a minimum operating pressure of 4 psi.

- Manholes shall be placed at intervals not exceeding 400 feet. All manholes shall be precast concrete and have a minimum inside diameter of 48 inches. Manhole penetrations shall be gasketed. Manhole bases shall be insulated with 4 inches of polyurethane foam and coated with 50 mils of elastomer to a height of 24 inches above the crown of the highest incoming pipe. A 2-inch thick flexible foam frost cover, enclosed in impermeable fabric, shall be installed inside the manhole on a horizontal bracket system anchored to the inside wall of the manhole, 18 inches above the crown of the highest incoming pipe.
- Minimum burial depth for sewer mains shall be 5 feet.
- Pipe installation requirements will address overexcavation of frost susceptible soils and measurements to prevent the longitudinal movement of groundwater through backfilled pipe trenches.

5.2 Preliminary Description: No-Build Alternative

The no-build alternative would give the community no option but to retain the existing facilities. The community well, washeteria, water treatment plant, watering point, and honey bucket pick-up would all continue in operation. Piped water would continue to be supplied to the school complex, however, the clinic and the 75 existing homes, and any new housing, would remain without piped water and sewer.

All other users would continue to obtain water by hauling it in buckets from the community water point, from natural water bodies, or by collecting rainwater. Wastewater from the school complex would continue to be piped to the fenced lagoon east of the elementary school and wastewater from the washeteria to the lagoon on the south edge of the community. Human wastes generated in homes, the clinic, and youth/multi-purpose facility would continue to be collected in honey buckets. The community's honey bucket collection service and central honey bucket disposal facility would continue to be used.

5.2.1 Design Criteria

No design criteria are necessary with the no-build alternative.

5.2.2 Map/Schematic layout

Figure 2 – Map of Existing Facilities, on page 10, shows the layout for this alternative.

5.2.3 Environmental Impacts

Environmental impacts would consist of the currently occurring impacts, i.e. continued threat of contamination due to potential leaking and spillage from transported honey bucket bags.

5.2.4 Land Requirements

Under the no-build alternative, no additional land would be required.

5.2.5 Construction Issues

Under the no-build alternative, no construction would take place.

5.2.6 Cost Estimate

Under the no-build alternative, no construction costs would be incurred, therefore no construction cost estimate is included. Annual operations and maintenance costs would continue in the current range of $70,000 (see 2004 Financial Statement in Appendix A), and increase annually as costs for items such as fuel, salaries, and insurance grow. A cost estimate for future year's operations and maintenance costs is presented in Table 3.

Table 3

Tuluksak Existing Sanitation System Estimated Annual O&M Costs

ITEM	ANNUAL COST
Salaries (Fully Burdened)	$ 59,270
Vehicle Expense	$ 641
Electricity	$ 2,355
Heating Fuel	$ 2,285
Water Plant Equipment Repairs and Maintenance	$ 2,240
Office and Administrative Costs	$ 730
Travel	$ 2,580
Total Existing System O&M Costs	$ 70,101

5.2.7 Advantages/Disadvantages

There are no advantages to the no-build alternative; the existing substandard conditions and facilities would remain, creating major disadvantages. The community would not experience the beneficial health and environmental effects associated with those of a piped water and sewer system with a functional and properly sized WTP, water storage tank, and sewage lagoon, including benefits associated with fire protection.

5.3 Preliminary Description: Truck Haul and Core Facilities Alternative

The Truck Haul and Core Facilities alternative consists of the following components:

- Two wells
- Raw water transmission line from wells to Utility Building
- Utility Building consisting of: a water treatment plant (WTP), washeteria with shower facilities, and a Vehicle Storage Building to garage a 1,000-gallon water delivery truck and an 800-gallon truck mounted with vacuum sewage collection equipment
- 50,000-gallon insulated water storage tank
- 1,000-gallon truck mounted water tanker operating on 14,650 linear feet (lf) of reconstructed road
- In-house plumbing consisting of a 200-gallon water holding tank, pressurization pump, hydropneumatic tank, water heater, lavatory, low water use toilet, outdoor 400-gallon wastewater holding tank
- 800-gallon truck-mounted vacuum trailer operating on 14,650 lf of reconstructed road
- 4 x 12 force main from the washeteria to the wastewater lagoon
- Two-cell facultative lagoon sized for 10,000 gallons per day (gpd)

5.3.1 Design Criteria

Design criteria used in investigating the truck haul system for the community of Tuluksak focused on the level of operational complexity, annual operation and maintenance cost, and the

corresponding quality of service that could be delivered by the system. The design population is 620 for the year 2025.

Design considerations for the utility building, including the water treatment plant and washeteria, include: size considerations for the washeteria; equipment storage capacity; and the water treatment system, anticipating the need to remove metal contaminants (iron, manganese, and arsenic) and color and provide the required disinfection.

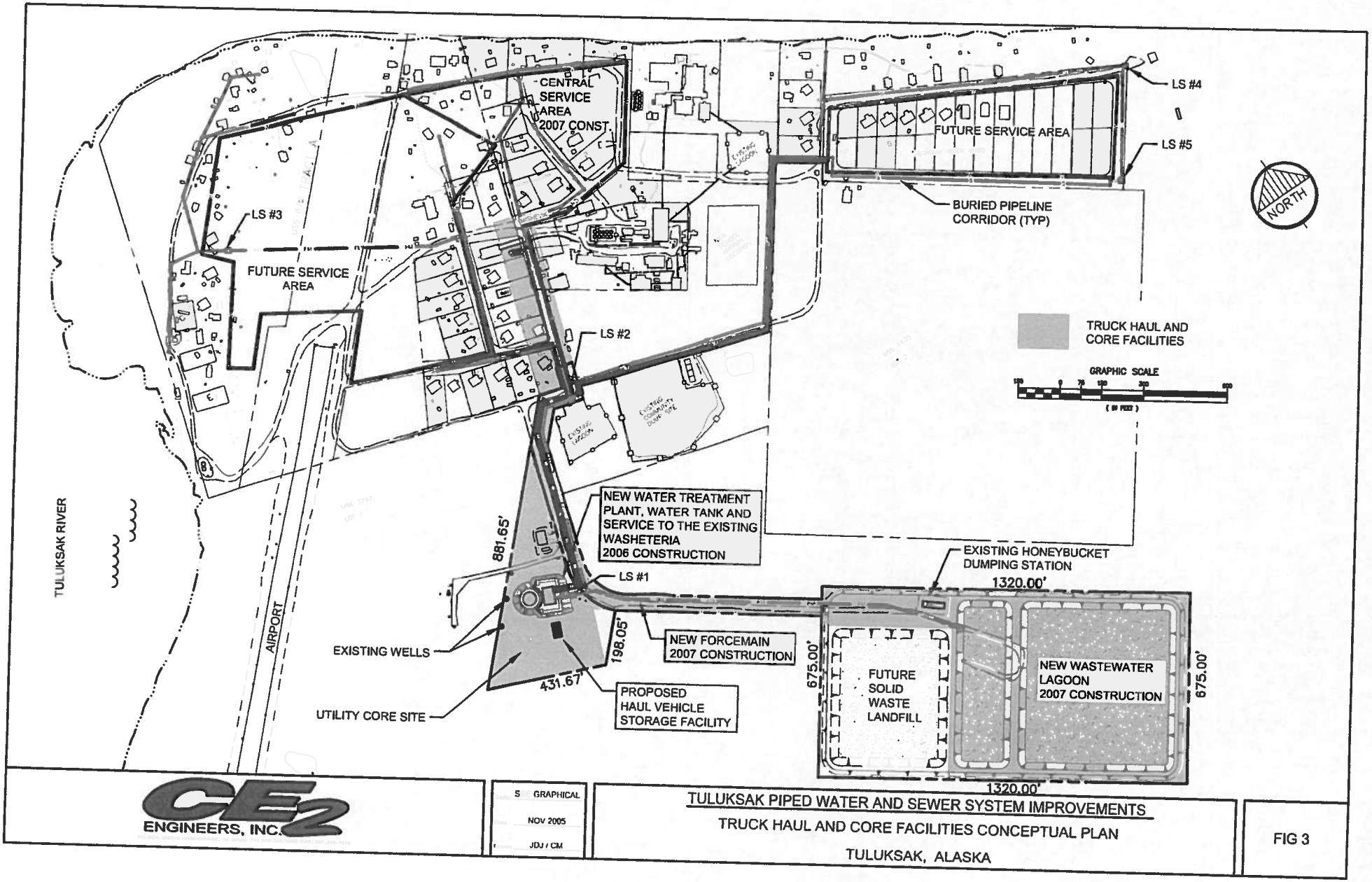
Criteria for the two wells include a location near both the known high quality ground water and the water treatment plant, which works to minimize the length of raw water piping required. Additional siting considerations include maintaining an adequate wellhead location from the proposed wastewater force main, the existing power plant fuel tank, and the proposed bulk fuel facility.

Sewage lagoon design criteria include regulatory requirements for lagoon cell sizing to accommodate the amount of wastewater produced by the truck haul system and the design population and the geotechnical constraints of the area. Siting criteria included the availability of thawed ground for disposal of treated wastewater effluent, and ground elevation sufficient to achieve sufficient separation distance between the bottom of the unlined cell and the water table and to manage site drainage. It is necessary that the site be a sufficient distance from lakes, streams and waterways, and a sufficient distance from development to minimize odors, yet close enough to the community to minimize access costs (both development and O&M).

The truck haul system design criteria include the capacity to deliver three gallons per person per day of fresh water generating, two gallons per person per day of wastewater; noting that the water delivery and sewage collection would require improved roads from the holding tanks at each home to the treatment lagoon.

5.3.2 Map/Schematic Layout

A conceptual layout of the Truck Haul and Core Facilities is shown on the next page in Figure 3.



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TULUKSAK PIPED WATER AND SEWER SYSTEM IMPROVEMENTS

TRUCK HAUL AND CORE FACILITIES CONCEPTUAL PLAN

TULUKSAK, ALASKA

FIG 3

5.3.3 Environmental Impacts

Potential environmental impacts of the truck haul and core facilities alternative are depicted on the matrix below.

Potential Environmental Impact	Mitigation Measures
Impacts to Public Health	The truck haul and core facilities alternative would have a moderate beneficial impact to public health; however, would require more sewage handling by humans than the piped water and sewer alternative.
Wetlands Impact	No wetlands mapping of the community exists. The U.S. Army Corps of Engineers considers the entire community as wetlands, which generally include tundra, permafrost areas, swamps, marshes, bogs, and similar areas. The proposed utility building, wells, raw water transmission line, water storage tank, forcemain from the washeteria to the lagoon, the lagoon, and road reconstruction work would all require wetlands permitting.
Cultural resources and artifact impacts	The preferred alternative has received concurrence from the State Historic Preservation Officer that the project would have no adverse affect to historic properties. The Truck Haul and Core Facilities and Piped Water & Sewer and Core Facilities alternatives are similar enough in scope that it can be assumed that the Truck Haul and Core Facilities alternative would receive concurrence of no adverse affect to historic properties.
Air Quality Impacts	Fugitive dust from construction activities may be an issue and would be mitigated by watering and other dust control measures as required.
Noise Impacts	Noise levels associated with construction would be minimal and of a temporary nature.
Impacts from Transportation diversion and interruption	Traffic detours and interruptions would be publicly noticed ahead of time and marked with traffic cones and signage during construction and after-hours.
Impacts to Endangered and Threatened Species	The Tuluksak area is not known to contain any threatened or endangered species and is not located within a designated critical habitat area.
Other potential environmental impacts	The project would follow established response procedures. Obtain additional assistance from the State of Alaska Department of Environmental Conservation as prudent.

5.3.4 Land Requirements

Land would be required for locating the wells, raw water transmission line, utility building, water treatment plant, water storage tank, and sewage lagoon. TNC and the ANSCA village corporation, Tulkisarmute, Inc., have entered into lease agreements for the water

treatment plant and water storage tank site and the sewage lagoon / landfill site. The leases are interim measures, recognizing that the land will eventually be conveyed to the TNC under the provisions of Section 14(c)(3) of ANSCA.

Road reconstruction work would take place within platted road rights of way. In-house plumbing and the outdoor holding tank would be installed on the individual properties that are served. Homeowner service agreements would be required.

5.3.5 Construction Issues

Construction issues include areas of discontinuous permafrost underlying the utility core site, which require precise locations for the utility building and water storage tank pads to assess the possibility of near surface permafrost at the pad locations. Construction issues also include designating locations for the indoor water holding tank and the outdoor wastewater holding tank on each house that would facilitate ease of operations in delivering water and collecting wastewater.

5.3.6 Cost Estimate

5.3.6.1 Construction

The Truck Haul and Core Facilities alternative construction cost is estimated at $9,220,760. A detailed construction cost estimate is presented in Table 4, on page 27.

5.3.6.2 Non-Construction

Non-Construction costs include site control costs, which are minimal as the land for the utility building and the lagoon/landfill site have been leased to TNC by Tulkisarmute Inc. for the sum of $1.00 per year each, for thirty years or until the Alaska Native Claims Settlement Act (ANSCA) 14(c)(3) land conveyances have been accomplished.

It may be necessary to obtain property easements for delivery of water and collection of wastewater to individual houses. Obtaining such easements can be an expensive and lengthy process on residential property that has been conveyed by restricted native trustee deeds.

5.3.6.3 Annual O&M Costs

Annual O&M costs are estimated to be $132,536. A detailed annual O & M cost estimate is provided in Table 5, on page 28.

Table 4

TULUKSAK WATER & SEWER TRUCK HAUL AND CORE FACILITIES CONSTRUCTION COST ESTIMATE					
ITEM	ACTIVITY	UNIT	UNIT PRICE	QTY	COST
1	Water Well	EA.	$75,000	2	$ 150,000
2	Water Transmission Line	LF	$130	1,600	$ 208,000
3	Water treatment plant, washeteria, haul vehicle garage, force main to lagoon	EA.	$1,750,000	1	$ 1,750,000
4	Water storage tank (50,000 gallons)	EA	$100,000	1	$ 100,000
5	Road Reconstruction (including right of way acquisition)	LF	$100	14,650	$ 1,465,000
6	Snow removal equipment	LS	$150,000	1	$ 150,000
7	1,000 gallon truck mounted all-weather water tanker	LS	$75,000	1	$ 75,000
8	House plumbing, 200 gal water holding tank, 400 gal wastewater holding tank and appurtenances	EA	$33,000	100	$ 3,300,000
9	800 gallon truck mounted all-weather vacuum wastewater hauler	EA	$90,000	1	$ 90,000
10	Dual cell wastewater lagoon	EA	$250,000	1	$ 250,000
11	Close out existing lagoon	LS	$20,000	1	$ 20,000
				Subtotal	$ 7,558,000
				Engineering & Administration (10%)	$ 755,800
				Construction Administration (8%)	$ 906,960
	*2005 dollars assuming force account construction / local wages			**Project Total Cost**	**$ 9,220,760**

Table 5

TULUKSAK WATER & SEWER TRUCK HAUL AND CORE FACILITIES ESTIMATED ANNUAL O&M COSTS	
Item	**Cost**
Water treatment operator – 709 hr/yr @ $23/hr (fully burdened)	16,307
Water/waste haul operator – 1,835 hr/yr @ $15.60/hr (fully burdened)	28,907
Snow removal operator - 200 hr/yr @ $15.60/hr (fully burdened)	3,120
Road maintenance operator – 70 hr/yr @ $15.60/hr (fully burdened)	1,092
Mechanic - 120 hr/yr @ $21.60/hr (fully burdened)	2,592
Vehicle and heavy equipment fuels, lubes, and consumables	8,000
Vehicle and heavy equipment parts	15,000
Electricity, water plant and garage (35,400 kwh @ $0.42/kw)	14,868
Heating fuel - water plant and garage (4,550 gal @ $4.00/gal)	18,200
Treatment Chemicals, supplies, and consumables	3,200
Water plant equipment repairs and maintenance	2,650
Office and administrative costs	10,600
Short Lived Asset Reserve	8,000
Total Estimated O&M Costs	$ 132,536

REVENUE REQUIREMENT**		
Estimated Total Annual Operations & Maintenance Expense	$	132,536
Estimated Number of Customers (Residential and Commercial) at Completion of Construction:		100
Estimated Annual Average Cost per customer (Without Subsidy) at Completion of Construction		$1,325
Estimated Monthly Average Cost Per customer		$ 110

*The O&M cost for the washeteria is not included in this analysis; it is assumed that the washeteria user fees will generate enough revenue to support its operation.

**Note that the School District facilities will not be served by the haul system and will not contribute to the support of the haul system.

5.3.7 Advantages/Disadvantages

Advantages:

- The truck haul and core facilities alternative provides running water and flush toilets to the home, an improvement over the self-haul water and honey bucket pick up currently in place in the community;
- Requires less treatment plant operating skill than the piped water and sewer alternative;
- Would allow for disconnection of nonpaying customers; which the current system does not allow.

Disadvantages:

- The truck haul and core facilities alternative does not provide piped water and sewer services to the school complex or clinic.
- Only a limited amount of delivered water is affordable; that amount is less than most customers would prefer or could afford.
- House modification costs are high. Household floor space required to install in-house plumbing is greater than the piped utility system would require. Space must be available (or must be added) to install the typical plumbing fixtures plus a holding tank, pressure pump, pressure tank, etc.
- The community would still require a washeteria as laundry facilities and showers would not be available in the home; the system would not provide enough water for these functions to be operable or affordable in the home.
- The truck haul system requires greater mechanical skill to maintain the washeteria equipment, in-home pressure systems and haul vehicle equipment.
- The truck haul system is more labor intensive and expensive to maintain and operate than the piped water and sewer system.
- Residents in other communities have supplemented expensive, delivered water with self-collected water, leading to contamination of water storage systems in the house. We expect this to be true at Tuluksak.

5.4 Preliminary Description: Preferred Alternative, Piped Water & Sewer and Core Facilities System

The preferred alternative, piped water and sewer and core utilities system, would be constructed in two phases. Phase 2 entails the construction of a 40' x 60' water treatment plant, 200,000-gallon water storage tank, a buried water circulation loop from the proposed WTP to the existing washeteria (also serving the clinic, school, multi-purpose building and 20 homes in central Tuluksak), and a two-celled sewage lagoon (a lined settling cell and a percolation cell). Phase 3 would be completion of the community-wide piped water and sewer system, serving an additional 80 homes. A Phase 2-limited option would supply piped water and sewer in a limited mode to the school, washeteria, and clinic, leaving the 20 homes in central Tuluksak to be serviced in Phase 3.

Phase 3, the community-wide piped water and sewer system, received the most community scrutiny and discussion with regards to possible alternatives. Phase 2 consists of the core utility components that would be necessary regardless of whether the community decision-making process settled on the truck haul system or the piped water and sewer system. However, note that there are differences between the core facilities as considered for the truck haul system versus the piped water and sewer system. See Section 5.4 for a comparison of core facility alternatives.

5.4.1 Design Criteria

Design criteria used in selecting an appropriate water and sewer sanitation system for the community of Tuluksak focused on the level of operational complexity, annual operation and maintenance cost, and the corresponding quality of service delivered by each alternative. Environmental and geotechnical considerations also played a role in further refining the process of alternative selection. The design population is 620 for the year 2025.

Design considerations for the water treatment plant include size considerations for equipment storage capacity and the water treatment system, anticipating the need to remove metal contaminants (iron, manganese, and arsenic) and color and provide the required disinfection. Considerations for the water treatment plant include appropriate sizing to provide 2.5 days of water storage, while also reserving a fire flow rate of 500 gpm for 4 hours.

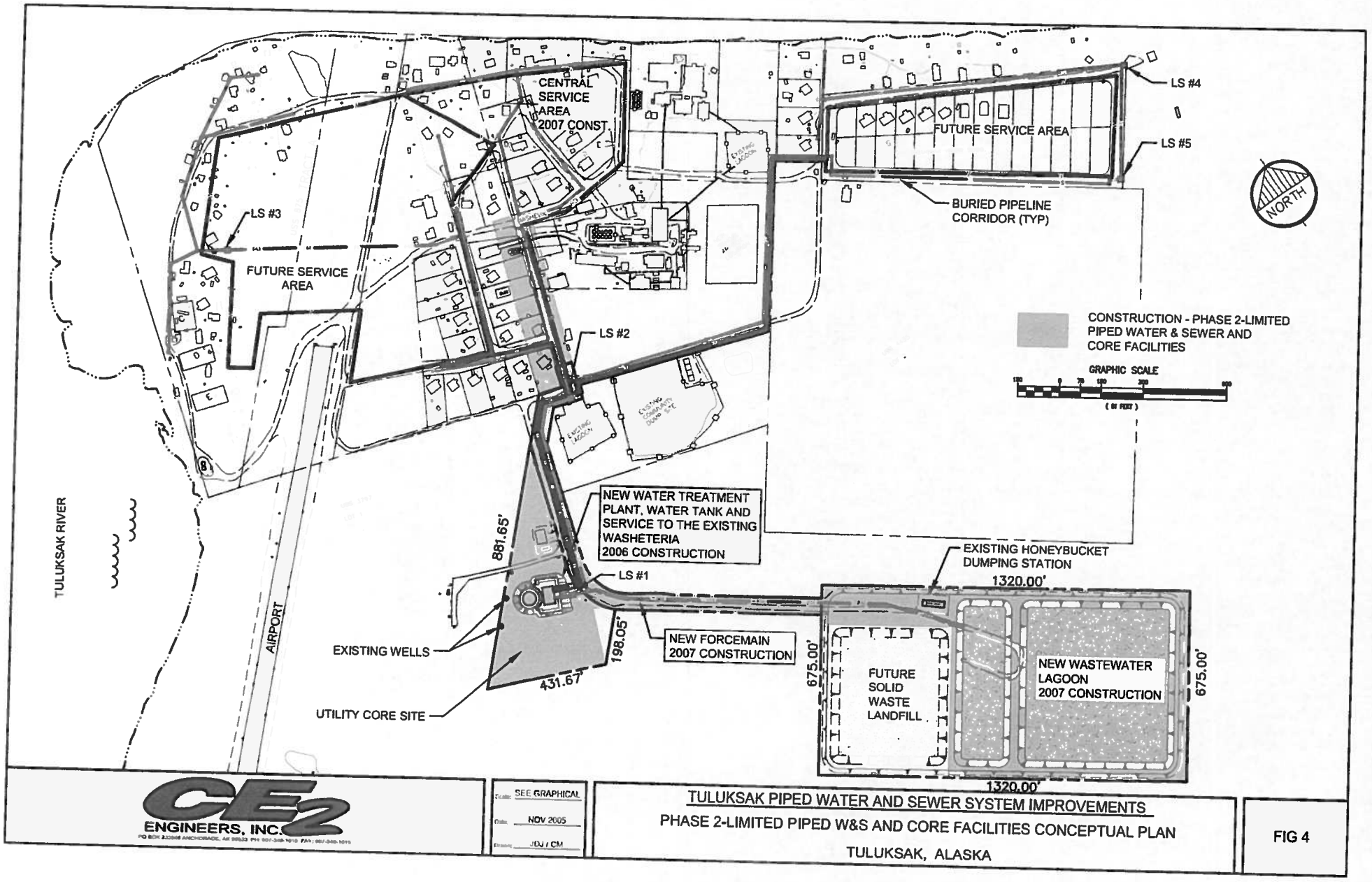
Criteria for the two wells include a location near both the known high quality ground water and the water treatment plant, which works to minimize the length of raw water piping required. Additional siting considerations include maintaining an adequate wellhead location from the proposed wastewater force main, the existing power plant fuel tank, and the proposed bulk fuel facility.

Sewage lagoon design criteria include regulatory requirements for lagoon cell sizing to accommodate the amount of wastewater produced by the design population and the geotechnical constraints of the area. Siting criteria included the availability of thawed ground for disposal of treated wastewater effluent; and, ground elevation sufficient to achieve sufficient separation distance between the bottom of the unlined cell and the water table and to manage site drainage. It is also necessary that the site be a sufficient distance from lakes, streams and waterways, and a sufficient distance from development to minimize odors, yet close enough to the community to minimize access development costs and O&M costs.

Piped water and sewer system design criteria include the capacity to deliver 65 gallons of water per person per day.

5.4.2 Map/Schematic layout

Figures 4, 5, and 6 on pages 32, 33, and 34 show the layout of the preferred alternatives as Phase 2-Limited Piped Water & Sewer and Core Facilities Conceptual Plan, Phase 2 Piped Water & Sewer and Core Facilities Conceptual Plan, and Phase 3 Community Wide Water & Sewer System Conceptual Plan.



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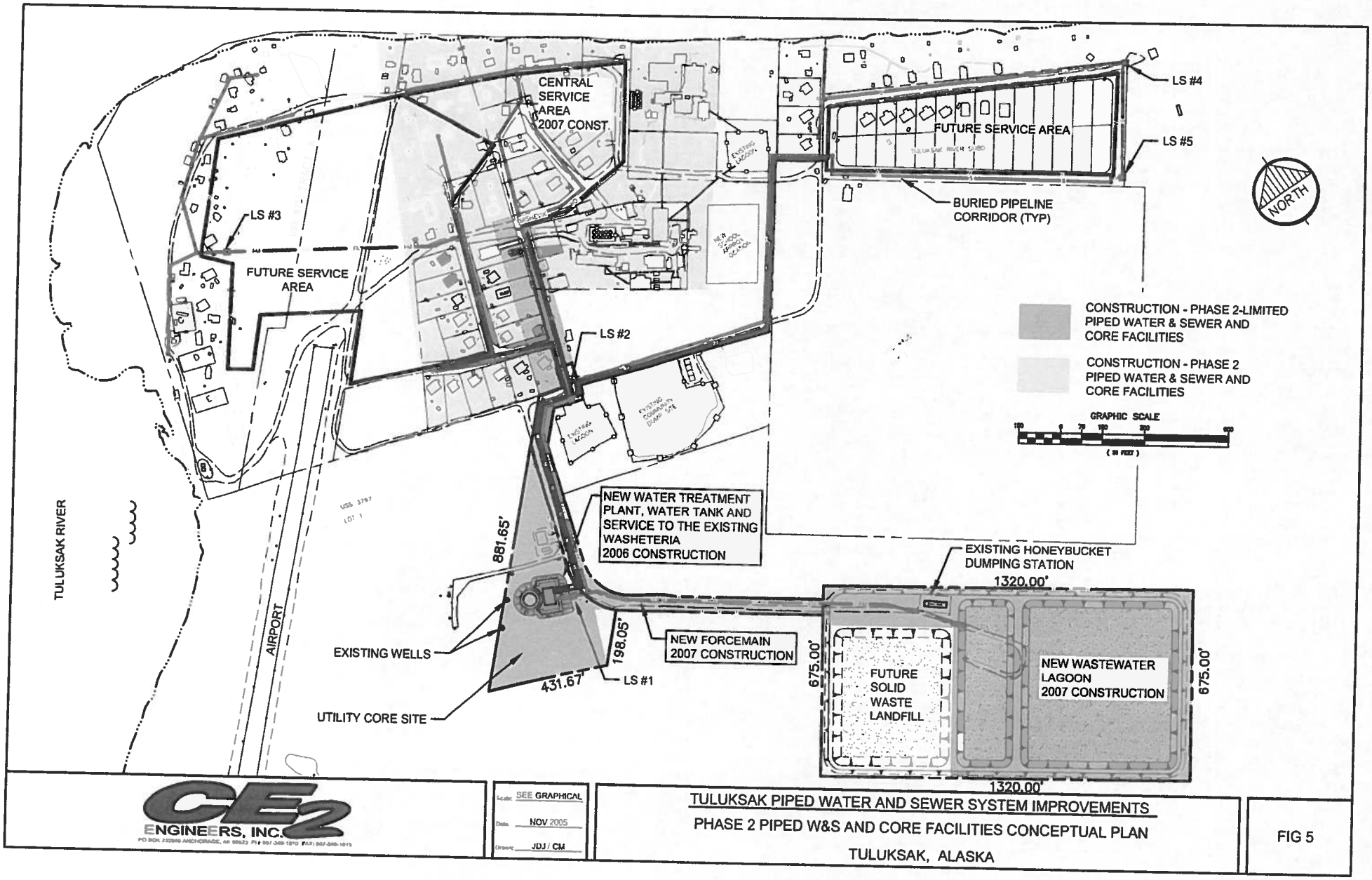
TULUKSAK PIPED WATER AND SEWER SYSTEM IMPROVEMENTS

PHASE 2-LIMITED PIPED W&S AND CORE FACILITIES CONCEPTUAL PLAN

TULUKSAK, ALASKA

FIG 4



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TULUKSAK PIPED WATER AND SEWER SYSTEM IMPROVEMENTS

PHASE 2 PIPED W&S AND CORE FACILITIES CONCEPTUAL PLAN

TULUKSAK, ALASKA

FIG 5

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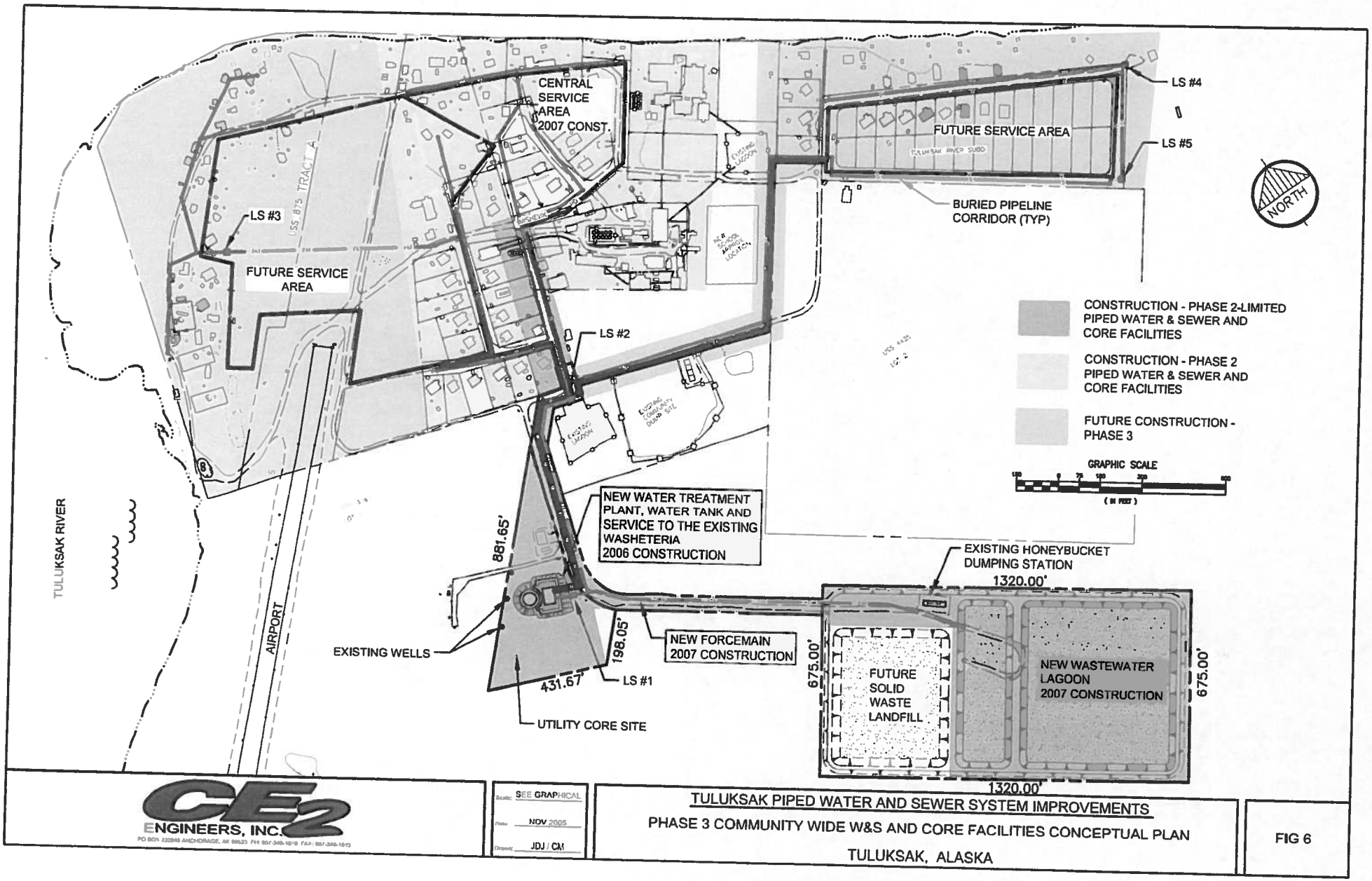

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TULUKSAK PIPED WATER AND SEWER SYSTEM IMPROVEMENTS

PHASE 3 COMMUNITY WIDE W&S AND CORE FACILITIES CONCEPTUAL PLAN

TULUKSAK, ALASKA

FIG 6

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5.4.3 Environmental Impacts

An Environmental Report has been prepared for the Preferred Alternative. The proposed construction and the alternative explored will have very few negative impacts on the environment. Potential impacts and proposed mitigation measures include the following:

Potential Environmental Impact	Proposed Mitigation Measures
Wetlands Impact	All work in wetlands is permitted by the U.S. Army Corps of Engineers
Discovery of unexpected archaeological artifacts	Stop all work completely, contact officials of TNC and the State Archaeologists' office and follow their recommended procedures.
Air Quality	Fugitive dust from construction activities will be mitigated by watering and other dust control measures as required.
Noise	Mufflers will be maintained on all construction equipment. Normal work hours will be 7:00 a.m. to 6:30 p.m., Monday through Saturday.
Transportation diversion and interruption	Traffic detours and interruptions will be publicly noticed ahead of time and marked with traffic cones and signage during construction and after-hours.
Accidental discharge of heavily chlorinated liquids from disinfection of new waterlines	Dam and contain the liquids, then dechlorinate with sodium thiosulfate prior to discharge into a sewer or to surface water.
Other potential environmental impacts	Follow established response procedures. Obtain additional assistance from the State of Alaska Department of Environmental Conservation as prudent.

5.4.4 Land Requirements

Land is required for locating the water treatment plant, water storage tank, and sewage lagoon. TNC and Tulkisarmute, Inc., the ANSCA village corporation, have entered into lease agreements for the water treatment plant and water storage tank site and the sewage lagoon / landfill site. The leases are interim measures, recognizing that the land will eventually be conveyed to the community under the provisions of Section 14(c)(3) of ANSCA. The recorded leases are included in the Site Control Documents, provided in Appendix C. The lease for the sewage lagoon and solid waste landfill site may need to be revised to include a larger site, depending on the final approved design of the lagoon.

Water and sewer system mains will be installed within platted road rights of way; service lines will be installed on the individual properties that are being served.

5.4.5 Construction Issues

Construction issues include areas of discontinuous permafrost underlying the utility core site. These require precise location of the water treatment and water storage tank pads to alleviate the possibility of near surface permafrost at the pad locations.

5.4.6 Cost Estimate

5.4.6.1 Construction

Phase 2 construction costs are estimated to be $5,137,350. A detailed construction cost estimate can be found in Table 6 on page 37. Phase 2-Limited construction costs are estimated to be $2,675,964. A detailed construction cost estimate is provided in Table 7 on page 38. Phase 3 construction costs are estimated at $5,848,080 for the community-wide piped water and sewer mains and service lines, and in-house plumbing. A detailed construction cost estimate for Phase 3 construction is provided in Table 8 on page 39.

5.4.6.2 Non-Construction

Non-Construction costs include site control costs, which are minimal as the land for the Utility Core and the Lagoon/Landfill site has been leased to TNC by Tulkisarmute Inc. for the sum of $1.00 per year each, for thirty years or until the ANSCA 14(c)(3) land conveyances have been accomplished.

5.4.6.3 Annual Operations and Maintenance

Annual O&M costs are estimated to be $128,640 for Phase 2 facilities. Phase 2-Limited option O&M costs are estimated to be $123,640. When Phase 3 facilities come on line, annual O& M costs for the complete system are estimated to be $165,140. Detailed annual O&M cost estimates for Phase 2, Phase 2-Limited and for Phase 3 can be found in Tables 9, 10, and 11 on pages 40, 41, and 42, respectively.

Table 6

TULUKSAK WATER & SEWER
PHASE 2 PIPED WATER & SEWER AND CORE FACILITIES
CONSTRUCTION COST ESTIMATE

ITEM	ACTIVITY	UNIT	UNIT PRICE	QTY	COST
1	Raw water transmission line	LF	$130	175	$ 22,750
2	Elevated structural pad for WTP and WST	CY	$18	7500	$ 135,000
3	Water treatment plant 40' X 60'	SF	$400	2400	$ 960,000
4	Insulated, bolted steel water storage tank	Gallon	$2	200,000	$ 400,000
5	Backwash lift station	EA	$50,000	1	$ 50,000
6	Backwash forcemain to existing lagoon	LF	$130	900	$ 117,000
7	Looped water distribution - 6" x 12" buried, insulated arctic pipe (two pipes per trench)	LF	$190	1,500	$ 285,000
8	1" Circulating water service	EA	$7,000	20	$ 140,000
9	House Plumbing	EA	$16,000	20	$ 320,000
10	4" gravity sewer services	EA	$7,000	20	$ 140,000
11	8 x 15 Gravity sewer	LF	$160	5,250	$ 840,000
12	Manholes	EA	$7,000	26	$ 182,000
13	Lift Stations	EA	$75,000	2	$ 150,000
14	Force Main	LF	$130	1,400	$ 182,000
15	Existing washeteria plumbing improvements	EA	$45,000	1	$ 45,000
16	Water treatment plant waste heat recovery system	LS	$40,000	1	$ 40,000
17	Recirculated leg fire hydrant	EA	$7,000	2	$ 14,000
18	Removal of unusable organics, grading for lagoon	CY	$5	10,000	$ 50,000
19	Lagoon berm construction, two celled.	EA	$250,000	1	$ 250,000
20	Lagoon control structures	EA	$8,000	2	$ 16,000
21	8 ft Chain link fence	LF	$35	2000	$ 70,000
22	Close-out Existing Lagoon	LS	$20,000	1	$ 20,000
				Subtotal	$ 4,428,750
				Engineering & Administration (10%)	$ 442,875
				Construction Administration (8%)	$ 265,725
				Project Total Cost	**$ 5,137,350**

*2005 dollars assuming force account construction / local wages

Table 7

TULUKSAK WATER & SEWER
PHASE 2-LIMITED WATER & SEWER AND CORE FACILITIES
CONSTRUCTION COST ESTIMATE

ITEM	ACTIVITY	UNIT	UNIT PRICE	QTY	COST
1	Raw water transmission line	LF	$130	175	$ 22,750
2	Elevated structural pad for WTP and WST	CY	$18	8000	$ 144,000
3	Water treatment plant 40' X 60'	SF	$400	2400	$ 960,000
4	Insulated, bolted steel water storage tank	EA	$200,000	1	$ 200,000
5	Backwash lift station	EA	$50,000	1	$ 50,000
6	Backwash forcemain to existing lagoon	LF	$130	900	$ 117,000
7	Looped water distribution - 6" x 12" buried, insulated arctic pipe (two pipes per trench)	LF	$190	1,500	$ 285,000
8	Existing washeteria plumbing improvements	EA	$45,000	1	$ 45,000
9	Water treatment plant waste heat recovery system	LS	$40,000	1	$ 40,000
10	Recirculated leg fire hydrant	EA	$7,000	2	$ 14,000
12	Removal of unusable organics, grading for lagoon	CY	$5	10,000	$ 50,000
13	Lagoon berm construction, two celled	EA	$250,000	1	$ 250,000
14	Lagoon control structures	EA	$8	2	$ 16
15	8 ft Chain link fence	LF	$35	2000	$ 70,000
16	Close-out Existing Lagoon	LS	$20,000	1	$ 20,000
				Subtotal	$ 2,267,766
				Engineering & Administration (10%)	$ 226,777
				Construction Administration (8%)	$ 181,421
				Project Total Cost	**$ 2,675,964**

*2005 dollars assuming force account construction / local wages

Table 8

TULUKSAK WATER & SEWER
PHASE 3 COMMUNITY-WIDE WATER & SEWER
CONSTRUCTION COST ESTIMATE

ITEM	ACTIVITY	UNIT	UNIT PRICE	QTY	COST
1	6 x 12 Water distribution loop piping	LF	$ 130	8200	$ 1,066,000
2	1" Circulating water service	EA	$ 7,000	80	$ 560,000
3	House plumbing	EA	$ 16,000	80	$ 1,280,000
4	4" gravity sewer services	EA	$ 7,000	80	$ 560,000
5	8 x 15 gravity sewer	LF	$ 160	6300	$ 1,008,000
6	Manholes	EA	$ 7,000	20	$ 140,000
7	Lift Stations	EA	$ 75,000	3	$ 225,000
8	Force main (various sizes)	LF	$ 130	900	$ 117,000
				Subtotal	$ 4,956,000
				Engineering & Administration (10%)	$ 495,600
				Construction Administration (8%)	$ 396,480
				Project Total Cost	**$ 5,848,080**

*2005 dollars assuming force account construction / local

Table 9

TULUKSAK WATER & SEWER PHASE 2 PIPED WATER & SEWER AND CORE FACILITIES ESTIMATED ANNUAL O&M COSTS	
Item	**Cost**
Lead Operator (fully burdened)	$ 36,000
Backup Operator (fully burdened)	$ 10,000
Electricity (45,000 kwh @ $0.42/kwh	$ 17,640
Heating Fuel (7,000 gal/yr @ $4.00/gal)	$ 28,000
Treatment Chemicals, supplies, and expendables	$ 10,000
Vehicle Expense	$ 6,000
Office & Administrative Costs	$ 3,000
Short Lived Asset Reserve	$ 8,000
Capital Replacement Reserve	$ 10,000
Total Existing O&M Costs	$ 128,640

REVENUE REQUIREMENT

Estimated Total Annual Operations & Maintenance Expense	$	128,640
Estimated Revenue from School District	$	30,000
Estimated Revenue from Clinic	$	10,000
Estimated Revenue from Youth Center	$	2,400
Subtotal	$	86,240
Estimated Number of Residential Customers*		75
Estimated Annual Average Cost Per residential customer (Without Subsidy) at Completion of Construction	$	1,150
Estimated Monthly Average Cost Per residential customer	$	96

*Residential customers would still use existing water haul & honey bucket pick up system

Table 10

TULUKSAK WATER & SEWER PHASE 2- LIMITED PIPED WATER & SEWER AND CORE FACILITIES* ESTIMATED ANNUAL O&M COSTS	
Item	**Cost**
Lead Operator (fully burdened)	$ 36,000
Backup Operator (fully burdened)	$ 10,000
Electricity (45,000 kwh @ $0.42/kwh	$ 17,640
Heating Fuel (8,000 gal/yr @ $4.00/gal)	$ 32,000
Treatment Chemicals, supplies, and expendables	$ 10,000
Vehicle Expense	$ 7,000
Office & Administrative Costs	$ 3,000
Short Lived Asset Reserve	$ 8,000
Capital Replacement Reserve	$ -
Total Existing O&M Costs	$ 123,640

REVENUE REQUIREMENT

Estimated Total Annual Operations & Maintenance Expense	$	123,640
Estimated Revenue from School District	$	30,000
Estimated Revenue from Clinic	$	10,000
Estimated Revenue from Youth Center	$	2,400
Subtotal	$	81,240
Estimated Number of Residential Customers		20
Estimated Annual Average Cost Per residential customer (Without Subsidy) at Completion of Construction	$	4,062
Estimated Monthly Average Cost Per residential customer	$	339

*Phase 2-Limited consists of the water treatment plant, water storage tank, water circulation loop to existing washeteria (serving the school, clinic, and youth center), and two celled lagoon

Table 11

TULUKSAK WATER & SEWER PHASE 3 COMMUNITY WIDE PIPED WATER & SEWER ESTIMATED ANNUAL O&M COSTS	
Item	**Cost**
Lead Operator (fully burdened)	$ 46,000
Backup Operator (fully burdened)	$ 15,000
Electricity (42,000 kwh @ $0.42/kwh	$ 17,640
Heating Fuel (7,000 gal/yr @ $4.00/gal)	$ 28,000
Treatment Chemicals, supplies, and expendables	$ 10,000
Vehicle Expense	$ 7,000
Office & Administrative Costs	$ 6,500
Short Lived Asset Reserve	$ 10,000
Capital Replacement Reserve	$ 25,000
Total Existing O&M Costs	$ 165,140

REVENUE REQUIREMENT

Estimated Total Annual Operations & Maintenance Expense	$	165,140
Estimated Revenue from School District	$	30,000
Estimated Revenue from Clinic	$	10,000
Estimated Revenue from Youth Center	$	2,400
Subtotal	$	122,740
Estimated Number of Residential Customers		100
Estimated Annual Average Cost Per residential customer (Without Subsidy) at Completion of Construction	$	1,227
Estimated Monthly Average Cost Per residential customer	$	102

5.4.7 Advantages/Disadvantages

Advantages:

- The Phase 2 water treatment plant and water transmission loop will allow the new clinic, multi-purpose building, and school access to piped water
- Residents will have access to piped water at the washeteria without the current problem of limited supply with Phase 2 facilities
- Phase 3 will provide the entire community with a complete, modern, sanitary system which is beneficial to human and environmental health
- Bathtubs and/or showers would installed in each home with Phase 3
- Laundry facilities would be feasible to be installed in homes, thus negating the need for washeteria improvements with Phase 3
- The household cost for a gallon of water is less expensive with the piped water and sewer alternative than the truck haul alternative

Disadvantages:

- Requires more treatment plant operating skill and a greater knowledge of process control
- Requires conscientious operator attention to avoid catastrophic failure; but failures are extremely rare in well-designed systems which utilize modern materials

5.4 Comparison of Alternatives

The following is a chart of assumptions for the Core Facilities and Truck Haul alternative and the Core Facilities and Piped Water and Sewer alternative, which includes project components and features of both types of systems that the community used to reach their decision to pursue a piped water and sewer system.

Project Component	Truck Haul	Piped Water & Sewer
Water Supply	Two wells, both high in iron	Two wells, both high in iron
Water Treatment	Batch oxidation, sedimentation treatment for removal of iron and manganese	Flow through oxidation, coagulation, sedimentation treatment plant for removal of iron and manganese
Water Storage	50,000 gallon ground level, insulated tank	250,000-gallon ground level, insulated tank
Laundry & Shower Facilities	Washeteria to be built in conjunction with water treatment plant	None needed, showers at home, most families would buy washers and dryers to do laundry.
Water Distribution	Trunk mounted 1,000-gallon water tanker with pump (requires road upgrades and a vehicle storage garage to be built as part of the water plant, washeteria complex	4" buried, insulated, circulating distribution loops with circulating 1" service lines
In-House Plumbing	200-gallon water holding tank, pressurization pump, hydropneumatic tank, water heater, lavatory, low water use toilet, outside 400-gallon wastewater holding tank	Flush toilet, lavatory, water heater, bathtub and/or shower, kitchen sink
Wastewater Collection	Truck mounted 800-gallon vacuum tanker (requires road upgrades and vehicle storage garage, part of water plant/ washeteria complex	4" buried, insulated gravity sewer service lines; 8" buried insulated, gravity sewer mains; manholes, lift stations, and 6" buried and insulated force main

6.0 SELECTION OF ALTERNATIVE

6.1 Life Cycle Cost Analysis for each alternative

LIFE CYCLE COST =INITIAL COST + (ANNUAL COSTS x PROJECT LIFE x DISCOUNT FACTOR)

Cost Analysis	System Type	
	Piped (Phases 2 & 3)	Haul System
Initial Cost	$10,985,430	$9,220,760
Annual Costs	$165,140.00	$132,536
Project Life	25	25
Discount Factor (@2.8%)*	0.5014	0.5014
Annual O&M	$165,140	$132,536
Life Cycle Cost	**$13,055,401.77**	**$10,882,052.11**

*Interpolated nominal interest from Circular OMB-A94, January 2005.

Life Cycle Cost analysis is most appropriate when applied to projects to be purchased, owned, and operated by the same entity. While the piped system has a greater initial cost as well as a higher annual maintenance cost, it also generates the greatest revenues. O & M will be funded by the TNC, and is not a part of the costs to the funding agencies. Furthermore, the health benefits of a piped system far outweigh the initial difference in the cost.

6.2 Non-Monetary Factors Considered in Selecting Alternative

The two previous studies, the ***Sanitation Facilities Preliminary Engineering Study*** *(VSW, 1995)* and ***Supplement #1 To Sanitation Facilities Preliminary Engineering Study*** *(CE2, 1999),* analyzed in depth the health and safety aspects of various sanitation alternatives. The community considered the alternatives at length and the majority indicated the monetary cost of a piped system was acceptable to provide a sanitation system with the largest health and safety benefits.

A matrix evaluation of the piped water and sewer and truck haul alternatives follows. Evaluation criteria are listed in the left hand column along with the "relative weight" assigned to each criterion. Each alternative is scored from 1 to 10 based on the criteria, with 10 being the

highest ranking. The numbers in parentheses represent the raw score multiplied by the ranking. The total of the weighted scores appear at the bottom of each column.

Evaluation Criteria	Weighting (100 Total)	Piped Water & Sewer	Truck Haul with Holding Tanks
Engineering Feasibility (given constraints imposed by the physical setting)	15	7 (105)	7 (105)
Cost of service to the customer	20	5 (100)	6 (120)
Relative health benefit associated with the completed system	20	10 (200)	5 (100)
Convenience to the customer	15	10 (100)	6 (60)
Susceptibility to failure / Reliability of service	10	8 (80)	4 (40)
Skill required to operate and maintain	10	5 (50)	6 (60)
System potential to provide fire protection	5	10 (50)	5 (25)
Time to implement	5	4 (20)	6 (30)
Weighted Total Score		705	540

7.0 PROPOSED PROJECT (RECOMMENDED ALTERNATIVE)

7.1 Detailed Water and Wastewater Project Description/Design

7.1.1 Water Supply

Water will be supplied from groundwater sources. Two six-inch diameter wells will be drilled to depths of approximately 200 feet near the proposed water treatment plant. It is estimated that the water source will be able to provide over 160 gallons per minute on a sustained basis.

7.1.2 Water Treatment

The proposed water treatment plant will have the capacity to provide 50,000 gallons of treated water per day to satisfy the estimated design year usage. The design of the facility will provide for the removal of contaminates in the water supply. These are: iron, manganese, arsenic and color. Specific treatment processes will be tailored to the water quality tested in the new water wells.

7.1.3 Water Storage

Considerations for the water storage tank include appropriate sizing to provide 2.5 days of water storage, while also reserving a fire flow rate of 500 gpm for 4 hours. An insulated, bolted steel water storage tank with a 200,000-gallon capacity is proposed to be located near the water treatment plant.

7.1.4 Water Distribution

The initial water distribution loop will be constructed from the new water treatment plant to the existing washeteria. The initial loop will also serve the school, clinic and new multipurpose building. Pumps to circulate the water and boilers to provide heat will be constructed in the new WTP for this and future distribution loops.

Phase 3 water distribution will consist of 4" buried, insulated, circulating distribution loops with circulating 1" service lines for the entire community.

7.1.5 Wastewater Collection System Layout

The Phase 3 wastewater collection system will consist of 4" buried, insulated, gravity sewer service lines; 8" buried, insulated, gravity sewer mains; manholes, lift stations, and force main.

7.1.6 Wastewater Pumping Stations

Each wastewater pumping station will consist of:

- Six foot diameter wet well
- Two effluent pumps
- Heated access building over the wet well
- Secondary vault with valves

The heated building will protect the electrical circuits as well as provide protection from the elements should the operator need to make repairs during inclement weather.

7.1.7 Wastewater Lagoon: Treatment

This Preliminary Engineering Report proposes to construct the wastewater lagoon. The initial design proposes a two-cell lagoon with the second cell designed as a percolation cell. Initial soil tests in the proposed lagoon area indicate both the lack of permafrost and soils that have a percolation rate to allow the design of a percolation lagoon. A Soils report is provided in Appendix D.

7.2 Project Cost Estimate for Water & Wastewater System

7.2.1 Cost Estimate

The Phase 2 project cost is estimated at $5,137,150. The detailed project cost estimate is on provided in Table 6 on page 37. The Phase 3 project cost is estimated at $5,848,080. The detailed project cost estimate is provided in Table 8 on page 39. The combined cost for Phases 2 and 3 total $10,985,430.

7.2.2 Funding Sources

Funding sources for Phases 2 and 3 of the project include grants from USDA Rural Development, State of Alaska Village Safe Water Program, and the Indian Health Service,

administered through the Alaska Native Tribal Health Consortium (ANTHC). Funding sources and the primary project components funded by each source are detailed in Section 1.1 on pages 2 and 3 of this report.

7.3 Annual Operating Budget for Water & Wastewater System

7.3.1 Income

Income will be derived from washeteria and honey bucket haul users and the piped water and sewer system users, including the Yupiit School System, the Clinic, and the Youth Center/Multi-Purpose Building. Total income is estimated at $56,800, consisting of $14,400 from honey bucket haul users ($20/month for 12 months per 75 households at an 80% collection rate; the Yupiit School District at $30,000; the Clinic at $10,000; and the Youth Center/Multi-Purpose building at $2,400.

7.3.2 Operations & Maintenance

O & M costs for Phase 2 are estimated at $128,640, and are detailed in Table 9 on page 38 of this report. With the implementation of Phase 3 the total system O & M costs will rise to $165,140, and are detailed in Table 10 on page 39.

7.3.3 Reserves

7.3.3.1 Short Lived Asset Reserve

A budgetary line item for short-lived asset reserves in the amount of $8,000 has been included in the O & M cost estimate for Phase 2. The budgetary amount for Phase 3 is $10,000.

7.3.3.2 Capital Replacement Reserve

Accumulation of reserves for the eventual replacement of the entire system was not considered as part of any of the preferred alternatives. The expectation is that capital construction of any of the alternatives would be accomplished strictly from grant funds. The economic capacity of the community precludes the replacement of the system with reserves.

However, reserves can be used to accomplish maintenance and repairs during the life of the system. Major repairs or replacement will require grant funds.

7.3.4 Debt Repayments

Phases 2 and 3 have presently have confirmed and appropriated project financing for the project elements as detailed in Section 7.1. Phase 2 is completely funded and Phase 3 is partially funded. However, expectations are for full funding of Phase 3. Grants comprise all of the funds. A cost estimate for all project elements funded to date is included in this Report. There is no expectation that any portion of the utility will be funded through loans.

8.0 CONCLUSIONS AND RECOMMENDATIONS

8.1 Conclusions

Even with the changes already made to sanitation facilities at Tuluksak, the system is inadequate. The present system cannot be modified reasonably to meet current sanitation and treatment standards. The present system does not protect health, but poses a health and environemental hazard for the community.

A haul system costs less than a piped system for the whole community; it costs approximately 17% less than a piped system (using the LCC comparison). However, a piped system has health and safety benefits that are difficult to quantify.

The ***Preliminary Engineering Study*** *(VSW, 1995)* suggested alternative systems for the community. Initial projects included closing the five remaining honey bucket bunkers, and temporary individual household pit construction. These pits were closed in 2003 and a honey bucket haul system was instituted. Following adoption of ***Supplement #1 - Sanitation Facilities Preliminary Engineering Study*** *(CE2, 1999),* the community has been moving toward installation of their preferred alternative: a complete piped water and sewer installation with a new water treatment plant, water storage tank, and sewage lagoon. Grant funding requests and appropriations to date have been directed toward the construction of the piped water and sewer facilities. The project is funded through Phase 2; Phase 3 is partially funded and there is an expectation that funding will be obtained to complete the entire sanitation system. Phase 4, the solid waste landfill, is not funded.

8.2 Recommendations

It is the recommendation of this report that the community of Tuluksak maintains project momentum by continuing to improve business management practices, and building Phase 2 and Phase 3 project components as proposed in this report. It is also recommended that the community initiate, as soon as possible, a plan to obtain funding to complete Phase 3. Additionally, the community needs to keep in mind the solid waste landfill project and apply for funding as it becomes available to construct the landfill.

Appendix A: Tuluksak Native Community 2004 Financial Statement

Appendix B: RUBA Status Report (10/07/2005)

Appendix C: Site Control Documents

Appendix D: Soils Report