
Department of Environmental Conservation
Division of Water

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Environmental Assessment

*Unalakleet, Replacement of the Water
Distribution System and Water Service Lines*

Village Safe Water
The City of Unalakleet, Alaska
May 2025

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Acronyms and Abbreviations

ADEC	Alaska Department of Environmental Conservation
ADFG	Alaska Department of Fish and Game
ANTHC	Alaska Native Tribal Health Consortium
APDES	Alaska Pollutant Discharge Elimination System
bgs	below ground surface
BMP	Best Management Practices
CEQ	Council on Environmental Quality
CGP	Construction General Permit
DCCED	Department of Commerce, Community and Economic Development
EA	Environmental Assessment
EO	Executive Order
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Agency
MBTA	Migratory Bird Treaty Act
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
PM ₁₀	Particulate matter with a diameter of 10 microns or less
SHPO	State Historic Preservation Officer
SWPPP	Stormwater Pollution Prevention Plan
USACE	United States Army Corps of Engineers
USC	United States Code
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFWS	United States Fish and Wildlife Service

1.0 Purpose of and Need

The City of Unalakleet (the City) is located at the mouth of the Unalakleet River about 148 miles Southeast of Nome and 395 miles Northwest of Anchorage (DCCED 2023). Unalakleet is a traditional Yup'ik Eskimo community with a history of diverse cultures and trade activity. Unalakleet has long been a major trade center as the terminus for the Kaltag Portage, an important winter travel route connecting to the Yukon (DCCED 2023). The State of Alaska owns and maintains the gravel airstrip. Cargo is lightered from Nome; there is a dock. Local overland travel is mainly by ATVs, and snow machines and dogsleds in winter (DCCED 2023). Figure 1 includes a vicinity map and shows the location of the village.

Unalakleet is a community of approximately 700 residences along the east coast of Norton Sound (Figure 1). The community's water system was initially constructed in the 1960s with the latest construction in the late 1980s. There are five water main loops. The water mains are buried arctic insulated pipe. FAA Loop and West Loop are six-inch pipes with three inches of insulation and corrugated metal pipe (CMP) jacket. School Loop, North Loop (Happy Valley), and West Loop are four-inch pipes with three inches of insulation and CMP jacket. The school loop has been abandoned and buildings previously served by the school loop are now served by the FAA loop. (Kuna, 2020a)

In accordance with the National Environmental Policy Act (NEPA) of 1969, as amended (42 U. S. Code [USC] §4321-4347), environmental concerns are considered during the decision making process. Federal funding for the project requires administering agency programs to comply with the requirements of NEPA and manage projects to protect and enhance the environment. This Environmental Assessment (EA) was prepared to comply with NEPA.

1.1 Project Description

The City of Unalakleet proposes a complete replacement of the current water distribution system and water service lines. The proposed project is shown on Figures 2 and 3.

The proposed project will replace all water mains and service lines. All four currently active water main loops will be replaced with 6-inch HDPE Arctic pipe. Portions of the mains for each loop will be rerouted from their existing layout in order to lie within established rights-of-way (ROW). All water main valves and hydrants along the mains will be replaced as well as the flow meter, temperature and pressure gauges, and pressure booster pumps for each water loop. The service line work will replace all service lines with one-inch HDPE and carrier pipes with four-inch HDPE Arctic pipe. The proposed project will also repair or replace arctic boxes and install or replace circulation pumps in all homes.

Water main loops will all be replaced with six-inch HDPE pipe with three inches of insulation and a 13-inch HDPE jacket. The replacement mains will follow the same alignment as the existing mains, except where they need to be relocated within the ROW. Only one water loop flow meter and one booster pump work. There are currently 22 hydrants within the community. Typically, hydrants are placed at intervals between 400 and 600 feet. Hydrants placement is determined by routing. 49 new hydrants will be installed. Hydrants will be used periodically to flush the water mains. (Kuna, 2020a)

The current service lines consist of two one-inch copper lines; supply and one return. The two-lines are inside a four-inch carrier pipe. The carrier pipe includes insulation and a CMP pipe jacket. Service lines would be replaced with one-inch non-copper pipe, such as HDPE or PEX pipes. Due to the age and deterioration of existing carrier pipes, carrier pipes would be replaced with four-inch HDPE pipe. The carrier pipe would have three inches of insulation and an 11-inch HDPE jacket. (Kuna, 2020a).

1.2 Purpose and Need

The purpose of the proposed project is to address deficiencies with the water distribution system and reduce impacts on local health and safety caused by the existing system that is deteriorating.

The water distribution pipes have deteriorated over time, and deterioration has accelerated in recent years, making the pipe brittle and more susceptible to freezing. Between September 2019 and July 2020, there were 11 major leaks in the mains resulting in the shutdown of at least one loop. There was a total of 30 days without water service for a significant portion of the community. Due to leaking, there was five separate boil-water notices issued that totaled 86 days. The community has extended periods of water conservation due to water main breaks. The copper water lines are heavily corroded, resulting in pipe wall failure, decreased circulation, and increased freezing. Since August 2019, there have been 17 water services that have failed and required replacement. The deterioration of the copper has also increased the copper levels in the water over EPA action levels (Kuna, 2020)

2.0 Alternatives Evaluated Including Proposed Action

This section describes the Proposed Action and No Action alternatives under consideration and evaluation in this EA. These alternatives represent an acceptable range of reasonable alternatives.

2.1 Proposed Action

The Proposed Action is to replace all water mains and service lines. All four water main loops will be replaced with 6-inch HDPE Arctic pipe. Portions of the mains for each loop will be rerouted from their existing layout in order to lie within established rights-of-way. All water main valves and hydrants along the mains will be replaced as well as the flow meter, temperature and pressure gauges, and pressure booster pumps for each water loop. The service line work will replace all service lines with one-inch HDPE and carrier pipes with four-inch HDPE Arctic pipe. The proposed project will also repair or replace arctic boxes and install or replace circulation pumps in all homes.

2.2 Other Alternatives Evaluated

Kuna prepared a Preliminary Engineering Report (Appendix A) to evaluate all options. The PER identified four potential alternatives, including the proposed action and the no action alternative. The two other alternatives included service line rehabilitation and the addition of a corrosion inhibitor.

2.2.1 Service Line Rehabilitation

Service line rehabilitation was considered during the PER. This alternative would focus on rehabilitating the system by systematically replacing all copper service lines with non-copper piping over multiple years. Data indicate that houses which have the copper service lines replaced no longer have elevated copper levels and freezing problems. This alternative could be constructed as a single capital project or multiple capital projects phased over several years. This alternative was overlooked due to it not addressing the issue of the mains still leaking and freezing.

2.2.2 Addition of a Corrosion Inhibitor

Addition of a corrosion inhibitor in the treatment train was considered during the PER. This alternative would combat the high levels of copper, but would not include rehabilitation or replacement of water loops or services lines. A desktop study was conducted and is available within the PER that looked at different options for corrosion control, specifically soda ash dosage, soda ash with 2 mg/l Phosphate, and addition of Polyphosphates. It is mentioned in the PER that the community is changing their water source and with the change, the addition of a corrosion inhibitor may be unnecessary. This alternative was overlooked due to the potential of the water source changing and the fact that it would not fix the existing damage.

2.3 No Action Alternative

The No Action alternative is to do nothing to the water distribution or the water treatment. The copper levels would remain above the 1.3 milligrams per liter (mg/L) action level. The existing copper service lines would continue to degrade and be replaced individually by homeowners as they fail. Reports indicate that 10 to 12 water services would have to be replaced each year. The water mains would also require increased repair work because of the regular freezing leaks (Kuna, 2020).

In January 2020, there was a boil water notice for three weeks due to water main leaks. The existing condition of the water mains is financially burdensome to the community, decreases access to drinking water, and increases health risks. The community is very concerned about the elevated copper levels and the poor conditions of the water distribution system (Kuna, 2020)

The No Action alternative does not meet the purpose and need of the project.

3.0 Affected Environment and Environmental Consequences

This section of the EA discusses the existing conditions and environmental impacts of the alternatives described in Section 2.0. This section also addresses issues identified through early agency coordination and the public scoping process (Council on Environmental Quality [CEQ] §1501.7 Scoping). The impact analysis is organized by relevant resource areas as they relate to each alternative and identified measures proposed to mitigate adverse environmental impacts of the alternatives (CEQ §1508.20 Mitigation).

3.1 Land Use

3.1.1 Affected Environment

The village was incorporated as a second-class city in 1974. The City owns and maintains a water treatment and garage facility, a four-plex housing apartment, office rental buildings, a storage facility, the community library, equipment rentals, and land within the community. The City owns and maintains the water and sewer distribution systems, which includes the mains. The mains are located within easements owned by the City. The individual water and sewer services are owned by the homeowner or user. The City obtains temporary construction access to replace or repair service lines. The Proposed Action would construct a complete replacement of the current water distribution system and water service lines. There is no local zoning in Unalakleet. The project is completely within the city limits of Unalakleet. All the water treatment plant, utility easements, ROW, are owned by the City. The proposed project is compatible with land uses in the project area. (Kuna, 2020)

There are no Prime or Unique farmlands in the State of Alaska or Farmlands of Statewide Importance (NRCS 2023). The project will not convert agricultural lands to non-agricultural uses. There are no formally classified lands in Unalakleet including parkland, other public lands, or areas of recognized scenic or recreational value. Unalakleet is not located near a National Wildlife Refuge or in a wilderness area (Wilderness Connect 2023). A portion of the Unalakleet River is classified as a Wild and Scenic River but is far upstream from the City of Unalakleet (Rivers 2023). The Iditarod National Historic Trail runs through Unalakleet (NPS 2025). There are no Coastal Barrier Resources Areas in Alaska (USFWS 2023a). There are no sole source aquifers in Alaska (USEPA 2023a).

3.1.2 Environmental Consequences

There will be temporary impacts to land use associated with the construction easements needed to complete the Proposed Action. Under the No Action alternative, the water distribution system will continue to deteriorate, causing frequent repairs and boil water notices, additionally the copper levels in the water will continue to be over EPA action levels.

3.1.3 Mitigation

The Proposed Action will require the City to obtain temporary construction easements for each water service. No Action alternatives would not require any mitigation.

3.2 Floodplains

Executive Order (EO) 11988 reinforces the need to (1) strengthen Federal policies to reduce the risk of flood losses; (2) minimize the effect of floods on human safety, health, and welfare; and (3) restore and preserve natural floodplain values. To meet these objectives, the EO requires federal agencies to:

- Recognize floodplains have unique and significant public values.
- Consider the natural and beneficial values of floodplains and the public benefits derived from floodplain restoration or preservation.
- Avoid, to the extent possible, the short- and long-term adverse effects associated with occupancy and modification of floodplains.
- Avoid direct and indirect support of floodplain development.

3.2.1 Existing Conditions

The Federal Emergency Management Agency (FEMA) has not mapped floodplains in Unalakleet (FEMA 2023). The community is subject to coastal flooding and stream overflow. The City's location on a gravel spit, combined with high tides in Norton Sound and onshore winds, creates a flood hazard potential. Floods occurred in 1968, 1971, and 1974. It is likely that the whole community is within the 100-year floodplain, but that most of the building elevations are above the 100-year floodplain. (Kuna, 2020)

The Unalakleet River is also subject to ice-jams and stream overflow flooding. The USACE has reported a low frequency of flooding at Unalakleet and has found Unalakleet to be in a low flood hazard area. Residents report that some areas along the river are subject to river flooding. (Kuna, 2020)

3.2.2 Environmental Consequences

Since the community does not participate in the National Flood Insurance Program (NFIP) and has not been mapped as a special flood hazard area, neither FEMA nor local permits are needed for construction within the floodplain. All project improvements will be buried and will not impact the floodplain. All piping will be away from the 50-year erosion estimates. There is minimal or no risk of erosion or flood damage.

3.2.3 Mitigation

No impacts to floodplains are associated with the proposed action, and no mitigation is proposed.

3.3 Wetlands

EO 11990, issued in 1977, requires federal agencies to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands. The Clean Water Act (33 USC Â§1344 - Section 404) establishes a discharge permit program for placement of dredge or fill material into waters of the U.S.

3.3.1 Affected Environment

Unalakleet does not have any USFWS National Wetlands Inventory mapping (USFWS 2023e) though the surrounding area is anticipated to be wetland.

3.3.2 Environmental Consequences

The Proposed Action is estimated to impact less than 0.1 acre of wetlands. The No Action alternative would not have any impact on wetlands.

3.3.3 Mitigation

The Proposed Action would follow USACE Nationwide Permit #58 for Utility Line Activities. Due to the small estimate of impact no pre-construction notification would be necessary.

3.4 Water Resources

3.4.1 Affected Environment

Unalakleet has Norton Sound to the West and the Unalakleet River to the South and East. Groundwater is found at varying depths within the developed area of Unalakleet. Logs are available for twenty-seven wells with depths ranging from 24 to 403 feet below the ground surface (bgs) (WELTS 2023). The Unalakleet Water Treatment System is a class 2 and is groundwater under the direct influence of surface water. The existing landfill is located over 2.5 miles Northeast of Unalakleet on a hillside. The current permit expires in October 2026 (Solid Waste Permit No. SW3A051-26, attached). According to the DEC Drinking Water Protection Areas map, there are 5 Community Water System Groundwater wells for Unalakleet.

There are no sole source aquifers in Alaska (USEPA 2023a). There are no impaired waterbodies listed under the Clean Water Act (CWA) Section 303(d) near Unalakleet. Several rivers within surrounding areas are listed as Category 3 (not enough information) (ADEC 2023b).

3.4.2 Environmental Consequences

The Proposed Action would improve the water distribution system within Unalakleet. The groundwater wells are also to the Northeast of the community and would not be impacted by the Proposed Action.

Under the No Action alternative, the community would continue to experience issues with leaks and freezing of their water distribution system.

3.4.3 Mitigation

An Alaska Pollutant Discharge Elimination System (APDES), Construction General Permit (CGP) and Stormwater Pollution Prevention Plan (SWPPP) are required for construction. Best management practices to control stormwater would be implemented during construction.

3.5 Coastal Resources

3.5.1 Affected Environment

Unalakleet is located on the inner coast of Norton Sound. The City is included in the Bering Strait Coastal Resources Service Area. Development in Unalakleet may be subject to the Bering Strait Coastal Management Plan developed in 1989. The Alaska Coastal Management Program expired on July 1, 2011 (76 FR 39857). There are no coastal barrier resources in Alaska (USFWS 2023a).

3.5.2 Environmental Consequences

There are no impacts to coastal resources associated with the Proposed Action or No Action alternative.

3.5.3 Mitigation

There are no impacts to coastal resources, and mitigation is not proposed. The Bering Strait Coastal Management Plan will be observed.

3.6 Biological Resources

3.6.1 Affected Environment

Unalakleet is located on a sand and gravel spit four miles long on Norton Sound near the Nulato Hills, at the mouth of the Unalakleet River. The spit rises about 14 feet above sea level and is separated from the mainland by Kouwegok Slough and the tidelands of the Unalakleet River. The community is situated along the highest grounds of the formation. The spit is composed of sand with gravelly sand layers to approximately 15 feet below, and silt below that. Unalakleet's wide, gently sloping beach is mostly sand. The beach further north has gravel with rock up to two inches in diameter. Unalakleet is in a zone of discontinuous permafrost, with little or no permafrost under the spit. The area inland from Unalakleet is hilly and covered with spruce trees. Soils in the surrounding area are poorly drained loam with an organic surface layer. The inland slopes are generally less than 12 percent and have a moderate potential for erosion. (Kuna, 2020a)

Local vegetation consists of grasses, shrubs, and wet, moist tundra at lower elevations. Along the riverbanks are willow, dwarf birch, alpine spruce, shrubs, and grasses. Dense, mixed spruce and hardwood lay along the upper reaches of drainage channels in the hills and alpine tundra at the higher elevations. (Kuna, 2020a)

The Endangered Species Act (ESA, 16 USC §1531 et seq.) of 1973 provides for the conservation of threatened and endangered plants and animals and their habitat. Two mammal and three bird species are listed as threatened or endangered species that may be in the area of Unalakleet. The Polar Bear (*Ursus maritimus*) is listed as threatened and has final critical habitat in the area. Wood Bison (*Bison bison athabasca*) is also listed as threatened but does not have designated critical habitat. Short-tailed Albatross (*Phoebastria [=Diomedea] albatrus*) is listed as Endangered but has no designated critical habitat. Spectacled Eider (*Somateria fischeri*) is listed as Threatened and has final critical habitat in the area of the proposed project. Steller's Eider (*Polysticta stelleri*) is listed as Threatened and has final critical habitat, but not in the area of the proposed project. (USFWS 2023b)

Migratory birds protected under the Migratory Bird Treaty Act (MBTA) occur in the project area (USFWS 2023c). According to the National Audubon Society, there are no important bird areas in or near Unalakleet (Audubon 2023).

The community sits at the mouth of the Unalakleet River, an anadromous fish stream. Species present at the mouth of the River include Chinook salmon (*Oncorhynchus tshawytscha*), coho salmon (*Oncorhynchus kisutch*), chum salmon (*Oncorhynchus keta*), pink salmon (*Oncorhynchus gorbuscha*), sockeye salmon (*Oncorhynchus nerka*), Dolly Varden (*Salvelinus malma malma*), and whitefishes (undifferentiated) (ADFG 2023).

3.6.2 Environmental Consequences

The Proposed Action would take place primarily in already disturbed ROW. Sections that need to be relocated to be within the ROW will result in impacts to an estimated half-acre of wetland. The entirety of the proposed project will take place within the City. ESA consultation utilized Consultation 07CAAN00-2018-I-0145 (Appendix B).

The consultation analysis follows as: 1. B. No, the project is not in a location listed in table 3. 2. B. No, the project does not occur in Atkasuk, Kaktovik, Nuiqsut, Point Lay, Utqiagvik (Barrow), or Wainwright and is therefore located south of 69.90 00' N latitude on the North Slope of Alaska. 3. B. No, the project does not occur outside of the specified timing window (May through September). 4. A. Yes, the project occurs within the village footprint as defined. Listed species are not expected to be found within the village footprint. Therefore, you can reasonably make a determination the project **“may affect, but is not likely to adversely affect”** listed species or critical habitat. In such instances, given the project meets the criteria listed above, the Service (USFWS) concurs with your determination. Based on the USFWS concurrence, both VSW and USFWS have completed our section 7 requirements and there is no need for further consultation.

Construction activities such as vegetation clearing and grubbing or other site preparation activities would not impact MBTA-listed migratory birds, their eggs, feathers, or nests if conducted before May 20 or after July 20 (USFWS 2022). If eagles were present, clearing would occur before March 1 or after August 31 to avoid impacts (USFWS 2022).

Runoff during the construction phase would not impact fish habitat with the implementation of best management practices (BMPs) for stormwater management. Based on the abundance of nearby available habitat, impacts would be de minimis to plant and animal species.

There would be no impacts to ESA-listed species, critical habitat, or other biological resources from the Proposed Action or No Action alternatives.

3.6.3 Mitigation

Vegetation clearing for the proposed action will take place outside of the bird nesting season. Temporarily disturbed areas would be revegetated immediately following construction. Best management practices would be utilized to minimize erosion, sedimentation, and transfer of any material away from the project location. The USFWS Land Clearing Timing Guidance for Alaska will be used. If any threatened or endangered species are seen within the project area work will be stopped and consultation will happen immediately.

3.7 Cultural Resources and Historic Properties

National Historic Preservation Act (NHPA; 54 USC 306100) of 1966 requires federal agencies to take into account the effect of its actions on historic properties.

3.7.1 Affected Environment

The State Historic Preservation Office (SHPO) was consulted and concurred with a finding of no historic properties affected by the Proposed Action (2023).

3.7.2 Environmental Consequences

VSW presented a finding of No Historical Properties Adversely Affected and the proposed project is unlikely to have an adverse effect on historic properties. SHPO concurred with a finding of No Historic Properties Affected.

3.7.3 Mitigation

Stop work and report any previously unknown cultural resources to the VSW and SHPO immediately if discovered during construction.

3.8 Aesthetics

3.8.1 Affected Environment

The Proposed Action will take place entirely within the community of Unalakleet. The community is a typical Alaska Native coastal community. There is a mix of homes, public buildings, businesses, and facilities. There are both paved and dirt roads.

3.8.2 Environmental Consequences

All components of the proposed project will be buried, so there will be limited effect to the aesthetic of the community. In some areas the mains will need to be relocated within the ROW, so new areas will have disturbance. The Proposed Action would create no impacts to aesthetics.

3.8.3 Mitigation

No mitigation is proposed.

3.9 Air Quality

3.9.1 Affected Environment

In accordance with the Clean Air Act (42 USC 85), the U.S. Environmental Protection Agency sets National Ambient Air Quality Standards (NAAQS) for six criteria pollutants to protect public health. Unalakleet is in attainment for all criteria pollutants (ADEC 2023c). Dust can be highly impactful in Alaska's rural communities. According to ADEC, sources of dust in rural villages include traffic on dirt roads, exposed river beds, unvegetated lots, gravel pits, stockpiles and unpaved runways (ADEC 2023d). DEC has conducted Rural Dust Surveys in 2007, 2010, 2011, and 2016. Unalakleet is not identified as one of the communities where people report they are highly affected by dust.

3.9.2 Environmental Consequences

Under the Proposed Action, each loop would have temporary impacts from construction, from equipment working in the area, and adjusted traffic patterns. Impacts from dust associated with proposed project construction would be short-term, temporary and would not exceed NAAQS for PM₁₀.

The No Action alternative would have no impacts to the dust levels in Unalakleet.

3.9.3 Mitigation

Mitigation will include watering any open construction areas as needed.

3.10 Social Impact Assessment/Environmental Justice

This section analyzes the effects of the project on population, employment, housing and public services. Additionally, EO 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (59 FR 7629), directs federal agencies to identify and address disproportionately high and adverse human health and environmental effects of their actions on minority and low-income populations.

3.10.1 Affected Environment

Unalakleet is located in the Nome Census Area. The Native Village of Unalakleet is the Federally Recognized Tribe. The Unalakleet Native Corporation is the Native Village Corporation. Bering Straits Native Corporation is the Alaska Native Regional Corporation and Kawerak, Incorporated is the Alaska Native non-profit. The community is in an unorganized census area, and the city and tribal organizations provide community services (DCCED 2023).

The 2020 population is 765 and 64% identify as Alaska Natives (US Census 2023). About 67 percent are in the labor force (US Census 2023). Most full-time employment is with local, state and federal government. The median household income is \$83,750 and about 10 percent of the population is below the poverty level (US Census 2023). The Unalakleet School services kindergarten through 12. The enrollment for the 2021-2022 school year was 181 students (DCCED 2023).

Unalakleet has a history of diverse cultures and trade activity. The local economy is the most active in Norton Sounds, along with a traditional Unaligmuit Yup'ik subsistence lifestyle. Fish, seal, caribou, moose, and bear are utilized. (DCCED 2023).

3.10.2 Environmental Consequences

The Proposed Action would have a beneficial impact on the City of Unalakleet and residents. It would benefit the community by providing a reliable water distribution system. Replacing the water mains and service lines would decrease the amount of boil water notices and decrease the amount of copper in the water. Subsistence use would continue as it currently does, and there would be no adverse impacts from the Proposed Action.

Construction would create minor, short-term beneficial impacts to the community through local employment and business revenue opportunities. Local workers would be hired during the construction phase. Housing, goods, and services would be procured during construction.

The Proposed Action would not cause disproportionately high or adverse effects on any minority or low-income populations in accordance with the provisions of EO 12898. No further Environmental Justice analysis is required. The community has been consulted and is in support of the project.

Under the No Action alternative, the community would continue to have issues with freezing and leaks within their water distribution system, as well as copper exceedances. There would be no change to socioeconomic conditions. Construction, operations, and management jobs would continue at the current level.

3.10.3 Mitigation

No adverse socioeconomic or Environmental Justice impacts would occur under the Proposed Action; therefore, mitigation is not proposed.

3.11 Miscellaneous Issues

3.11.1 Noise

There is no noise ordinance in Unalakleet. The city typically experiences noise from airplane landings and overflights, boat motors, ATVs, snow machines and heavy equipment operation.

Under the Proposed Action, construction noise would be heard within the community. All construction noise would be short-term lasting the duration of construction. Construction of the proposed project would occur during daytime hours. No long-term impacts would occur from the proposed project. Community noise levels would not be adversely impacted under the Proposed Action.

3.11.2 Transportation

Unalakleet has a state-owned gravel runway and a gravel strip. There are regular flights to Anchorage. Cargo is lightered from Nome; there is a dock. Local overland travel is mainly by ATVs, snow machines, and dogsleds in winter. As all the work for the proposed action will be within the community, some road access will likely be impacted temporarily by construction activities. No permanent changes to transportation are anticipated.

3.12 Health and Human Safety

This section evaluates the potential for the Proposed Action and No Action alternative to cause adverse effects on public health and safety.

3.12.1 Affected Environment

No electrical equipment, transmission line, cells, or microwave towers are proposed as part of the project. The project will not create electromagnetic fields. No hazardous materials will be used to construct the proposed project.

There are three active contaminated sites in Unalakleet, the ADOT&PF SREB - Unalakleet (Hazard ID 4109), the Unalakleet Native Corporation Gas Spill (Hazard ID 806), and Unalakleet NALEMP Kotongan Lake AST (Hazard ID 26159). There are 5 Cleanup complete sites listed within Unalakleet. There are 4 underground storage tanks in Unalakleet. Two appear to be at the airport and two are 3.5 miles North of Unalakleet. There are no Superfund sites in Unalakleet (USEPA 2023b). The Toxic Release Inventory does not identify any sites in Unalakleet (USEPA 2023c).

3.12.2 Environmental Consequences

The Proposed Action does not create electromagnetic fields; therefore, no health impacts would occur. There are known contaminated sites within areas of the Proposed Action and workers within the area should be aware.

3.12.3 Mitigation

Under the Proposed Action, proper personal protective equipment (PPE) will be worn at all times when operating heavy equipment or working in areas of known contamination. Areas should be clearly marked on the plan sets.

4.0 Cumulative Effects

CEQ regulations stipulate the cumulative effects analysis in an EA should consider the potential environmental effects resulting from "... the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions." "Cumulative impacts can result from individually minor, but collectively significant actions taking place over a period of time" (40 CFR 1508.7).

For the purpose of this Cumulative Effects analysis, the geographic area is defined as the City of Unalakleet and adjacent areas. The time frame for consideration of future cumulative impacts is five years. Five years was chosen to reasonably reflect projects in the planning stages. Projects beyond five years are speculative and are not reasonably foreseeable.

Present actions are identified within the temporal and geographic boundaries of the project analysis, which are identified in Table 1. No past or future actions were identified.

Table 1. Projects in the Area with Potential to Contribute to Cumulative Impacts

Lead Agency	Fiscal Year	Description/Scope	Impacts	Agency Cost (\$)
Alaska Department of Transportation (ADOT) Airport Capital Improvement Program	2027	Unalakleet Pavement Markings and Crack Seal: Surface preservation maintenance to extend lifecycle of the runway, taxiway, and apron surfaces. Repair and replace markings and clean and crack seal on runways, taxiways, and aprons.	Noise and Traffic – short-term and minor lasting the duration of construction. Social - Beneficial impacts from hiring local workers and procuring goods and services locally during construction.	\$93,750
Alaska Department of Transportation (ADOT) Airport Capital Improvement Program	2027	Unalakleet Towed Broom: replace towed runway broom with a new towed runway broom.	Social – Beneficial impacts from the airport having updated and functional equipment.	\$450,000

Table 1. Projects in the Area with Potential to Contribute to Cumulative Impacts

Lead Agency	Fiscal Year	Description/Scope	Impacts	Agency Cost (\$)
DEC	2025	Complete replacement of the covenant lift station. The new lift station would include chopper pumps and rail systems to adequately pump incoming sewage, an overhead crane to raise and lower the pumps, and a heating and ventilation system.	Noise and Air Quality – short-term and minor lasting the duration of construction. Social - Beneficial impacts from hiring local workers and procuring goods and services locally during construction.	~2.5 million
DEC	2025	Solid Waste Baler and other upgrades: Provide an appropriately sized baler to reduce the waste volume and return the landfill to its intended bale-fill operations. Purchase ten 8-yard front load bins to meet current need.	Social – Beneficial impact from the community having updated and functional equipment.	\$532,133

Proposed Action: Impacts to the physical environment are limited to short-term noise and dust from the operation of construction equipment within the community. Beneficial long-term impacts would occur throughout the community due to the Proposed Action. Additionally, jobs and the purchase of goods and services during construction would have a short-term, minor beneficial impact on the community.

Unalakleet Airport Capital Improvement Program: The ADOT projects would likely create short-term noise and traffic impacts lasting the duration of construction. The project benefits residents by increasing airport and air traffic safety. There would likely be minor, short-term beneficial impacts from providing local jobs and procuring goods and services during construction. There are long-term beneficial impacts to air traffic safety associated with the projects.

Unalakleet DEC Projects: The DEC projects would likely create short-term noise and air quality impacts lasting the duration of construction. The project benefits residents by increasing safety and sanitation. There would likely be minor, short-term beneficial impacts from providing local jobs and procuring goods and services during construction.

Based on the analysis, beneficial cumulative impacts from the Proposed Action, past and reasonably foreseeable future projects would result from the overall improvement to the human environment including long-term improved sanitation and health, increased airport safety, and additional short-term job opportunities and the purchase of goods and services during construction. Table 2 summarizes the impacts and cumulative effects.

Table 2: Qualitative Cumulative Impact Assessment					
Resource	Past Actions	Present Actions	Proposed Action	Future Actions	Cumulative Effect
Aesthetics	None	None	Temporary impacts during construction	None	No cumulative impacts
Air Quality	None	Dust - short-term visibility affected during construction	Dust - short-term visibility affected during construction	None	Dust - short-term, minor impacts from dust lasting the duration of construction
Biological	None	None	Minor temporary impacts to migratory birds, eagles, and raptors from construction within the community	None	No cumulative impacts
Cultural Resources	None	No impacts to cultural resources	No impacts to cultural resources	None	No cumulative impacts
Floodplains	None	None	Lines will be buried so floodplain impacts will be minimal	None	No cumulative impacts
Land Use	None	Temporary impacts during construction	Temporary construction easements	None	No cumulative impacts
Noise	None	Construction equipment – temporary during construction.	Construction equipment - temporary during construction	None	Short-term temporary impacts from equipment noise during construction
Health and Human Safety	None	Beneficial impacts throughout the community	Beneficial impacts to improving the water distribution within the community	None	Beneficial impacts throughout the community

Table 2: Qualitative Cumulative Impact Assessment					
Resource	Past Actions	Present Actions	Proposed Action	Future Actions	Cumulative Effect
Socio-economic	None	Minor, short-term beneficial impacts from hiring local workers and procuring goods and services locally during construction	Benefits to community members from the proposed action; minor, short-term beneficial impacts from hiring local workers and procuring goods and services locally during construction	None	Beneficial impact to overall health and sanitation in the community, beneficial monetary impacts to residents, and goods and services providers
Water Quality/ Resources	None	Beneficial impacts throughout the community	Beneficial impacts to improving the water distribution within the community	None	No cumulative impacts
Wetlands	None	None	Minor impacts from slight main adjustments	None	No cumulative impacts

4.1.1 Unavoidable Adverse Impacts

The only unavoidable impact within the context of NEPA compliance caused by the Proposed Action would be the loss of an estimated 0.1 acre of wetlands. The No Action alternative would not include any unavoidable impacts, but the issues the community experiences with its water distribution system would persist and continue to worsen over time.

4.1.2 Irreversible and Irretrievable Impacts

NEPA requires a review of significant irreversible and irretrievable effects occurring from development of the Proposed Action (40 CFR 1502.16). An irreversible commitment of resources is defined as the loss of future options, and applies primarily to non-renewable resources, such as minerals or cultural resources, and to those factors that are renewable only over long periods, such as soil productivity. Irretrievable commitments represent the loss of production, use, or commitment of renewable natural resources for the period of the Proposed Action (e.g., timber loss or forest productivity). These decisions are reversible, but the foregone utilization opportunities are irretrievable.

Irreversible and irretrievable commitment of resources for the Proposed Action are related to construction activities. Resources consumed during construction including gravel used for fill and other construction materials, would be committed for the life of the project.

5.0 Mitigation Summary

Table 3 contains the mitigation summary for each resource impacted by the project.

Table 3: Mitigation Summary		
Resource	Impact	Mitigation
Land Use	Temporary impacts during construction	• Temporary construction easements will be acquired for service connections
Floodplains	No impact	• Lines will be buried
Wetlands	Less than 0.1 acres	• NWP #58 for Utility Lines Services will be followed
Water Resources	Potential stormwater impacts	• SWPPP and obtain ADEC APDES, CGP for construction • Best management practices used to control stormwater during construction • Permanent stormwater management included in design
Biological	Migratory birds, eagles, and raptors	• Observe timing windows for land disturbance and vegetation clearing • Revegetate temporarily disturbed areas • Sweep equipment tracks to prevent spread of invasive plants • Do not disturb active eagle or raptor nests
Cultural Resources & Historic Properties	Cultural Resources	• Stop work and report any previously unknown cultural resources to the DEC and SHPO immediately if discovered during construction.
Visual	Temporary impacts during construction	• Community outreach
Air Quality	Dust from construction	• Watering or application of binding solutions for dust suppression • Apply properly-graded gravel to driving surfaces • Impose slower speed limits • Revegetate disturbed areas immediately after construction
Noise	Construction equipment and gravel hauling	• Operate equipment during daytime hours
Transportation	Temporary impacts during construction	• Community outreach
Health and Human Safety	Beneficial impacts from Proposed Action	• Construction personnel will wear proper PPE at all times

6.0 Coordination, Consultation and Correspondence

In accordance with CEQ Regulations §1501.7, the following project scoping was conducted.

- Public and Tribal Council meeting (Appendix D)
- USACE consultation on wetland impacts and permitting (Appendix D)
- ADOT consultation on future projects within the community (Appendix D)
- Community comments on the PER and ER
- In compliance with NHPA, SHPO and the Tribe were consulted and concurred with a Finding of No Effect (Appendix D).

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8.0 List of Preparers

Table 4. List of Authors, Agencies and Persons Contacted		
Organization	Key Personnel	Contribution
Village Safe Water (VSW)	Adele Fetter	Lead Author
Village Safe Water (VSW)	Becca Olson	Author, QA/QC Review
Village Safe Water (VSW)	Aaron Wheatall	VSW Project Manager

Appendix A

Unalakleet Water Service Improvements Preliminary Engineering Report

Appendix B

Consultation 07CAAN00-2018-I-0145

Appendix C

Supporting Documentation

Appendix C

Consultation and Coordination

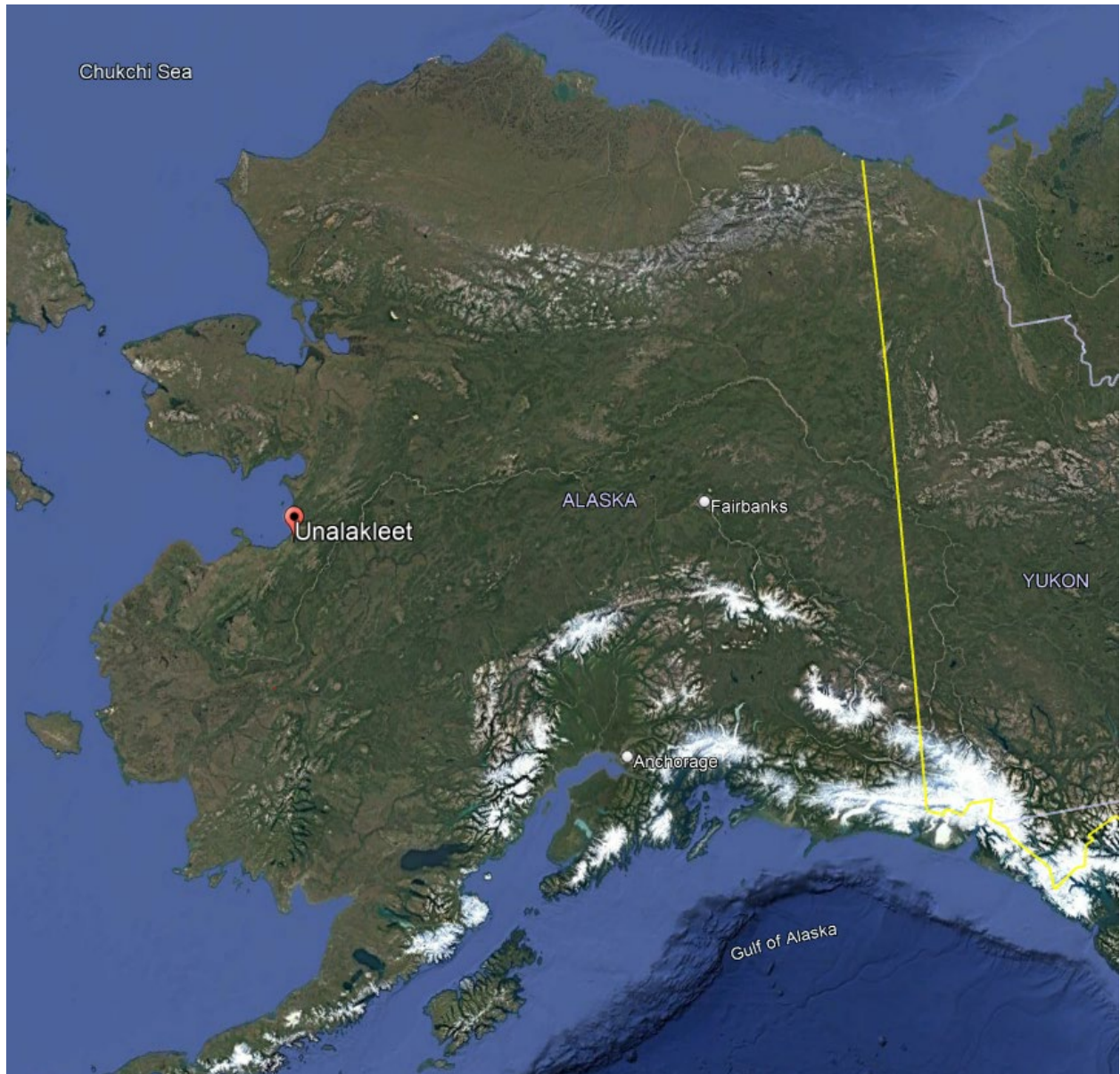


Figure 1. Unalakleet Location Map

Figure 2.

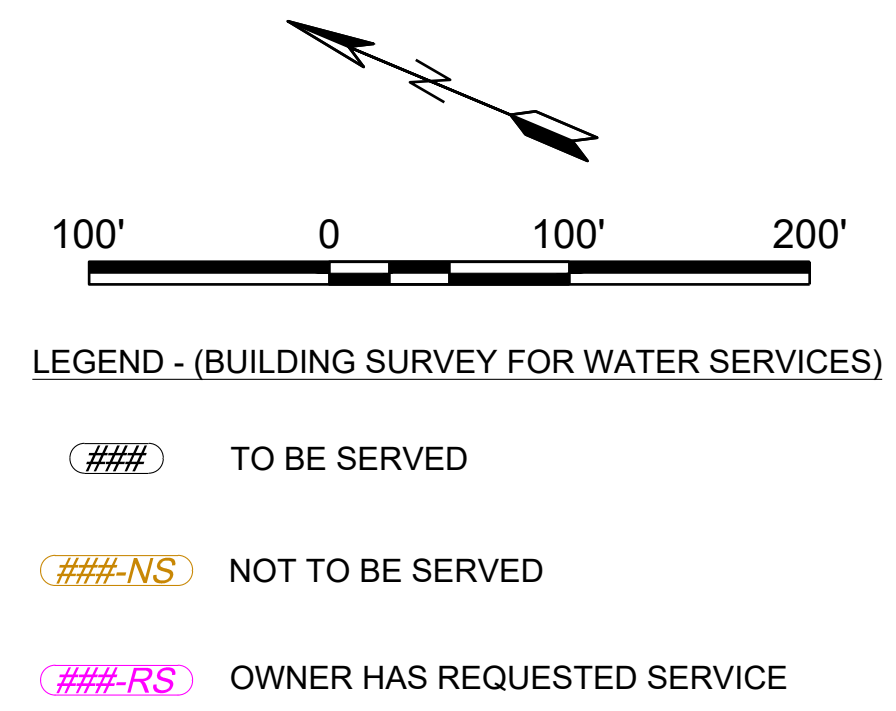
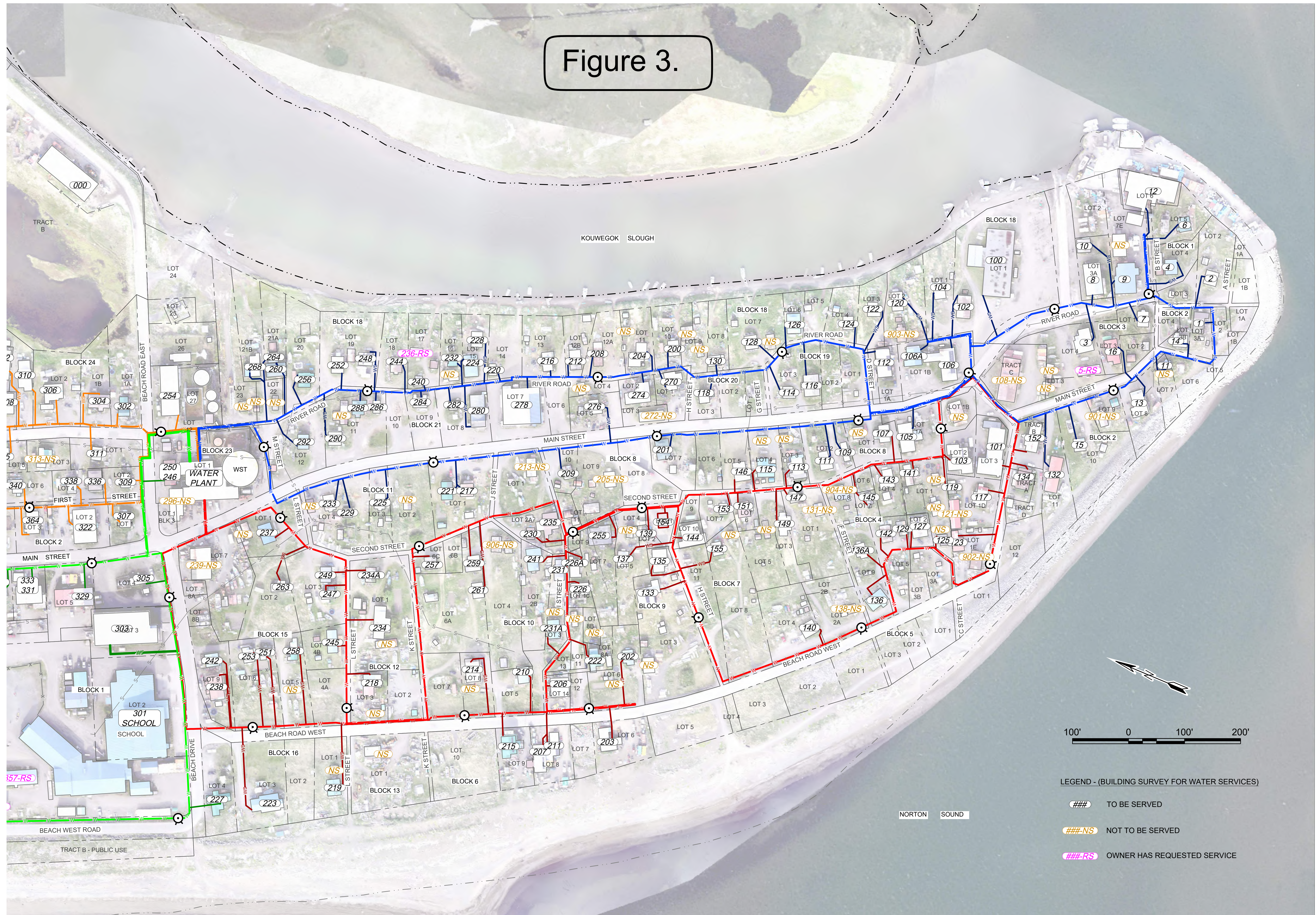


Figure 3.



NO.	REVISION	BY	DATE
A	35% DESIGN SUBMITTAL	SH	06/2022
B	65% DESIGN SUBMITTAL	SH	10/2022
C	95% DESIGN SUBMITTAL	SH	04/2023

Plot Date	APRIL 2023
Designed	MRE
Drawn	CM
Approved	MRE

Appendix A

Unalakleet Water Service Improvements Preliminary Engineering Report

Water Service Improvements Preliminary Engineering Report Unalakleet, Alaska

**Owner**

City of Unalakleet
P.O. BOX 28
Unalakleet, Alaska 99684

Funding Agencies

Village Safe Water
555 Cordova Street, 4th Floor
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USDA Rural Utility Services
800 Evergreen Avenue, Suite 200
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Prepared By

Kuna Engineering
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FINAL REPORT
November 23, 2020

Water Service Improvements Preliminary Engineering Report Unalakleet, Alaska



Owner

City of Unalakleet
P.O. BOX 28
Unalakleet, Alaska 99684

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FINAL REPORT
November 23, 2020

Executive Summary

I. Purpose

Unalakleet is a community of approximately 700 residences along the east coast of the Norton Sound, in western Alaska. The community's water system was initially constructed in the 1960s with the latest construction in the late 1980s. The water distribution is aged and is experiencing major failures in the mains. The old copper water services are extremely corroded. These failures routinely cause for community wide boil water and water conservation notices to be issued. In addition, since 2014 Unalakleet's 90-percentile copper level results have been above the action levels of the United States Environmental Protection Agency. Residents are extremely concerned about the failures and the health issues associated with high copper levels.

II. Alternatives

This PER is looking at four alternatives:

1. Do Nothing-What is the impact of doing nothing?
2. Service Line Rehabilitation-Upgrading old water services from copper/PVC to HDPE or PEX.
3. Water Distribution Replacement-Replacing all mains and water services.
4. Addition of a Corrosion Inhibitor-Changing the water treatment to reduce corrosion.

Below is a summary of the costs.

Costs	Alternatives			
	1-Do Nothing	2-Service Line Rehabilitation	3-Water Distribution Replacement	4-Additional of Corrosion Inhibitors
Construction (Capital) Costs	\$0	\$6,875,600	\$15,663,600	\$39,000
Non-Construction Costs	\$0	\$8,722,980	\$8,772,980	\$73,720
Total Project Cost	\$0	\$10,897,692	\$24,436,580	\$112,720
O&M Costs (Annual)	\$216,000	\$196,000	\$145,000	\$221,000
Life Cycle Costs	\$4,688,460	\$11,156,388	\$13,898,838	\$4,604,976

III. Recommended Alternative

Alternative 3: Water Distribution Replacement is the recommended alternative. It is the only one that addresses all the issues. It has the highest capital costs but the lowest O&M cost. Its Life Cycle Cost is only slightly higher than Alternative 2. Alternative 3 also has the highest community support. In addition, Alternative 4 is a long-term solution for the health issues but the already damaged water mains and services would have to be replaced. The community is in the process of securing a new water source that would make an inhibitor obsolete.

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Acronyms and Abbreviations

ADEC	Alaska Department of Environmental Conservation
ANCSA	Alaska Native Claims Settlement Act
ANTHC	Alaska Native Tribal Health Consortium
ASLS	Alaska State Land Survey
BIA	Bureau of Indian Affairs
BSRHA	Bering Strait Regional Housing Authority
CMP	Corrugated Metal Pipe
CPD	Community Planning and Development
Cu	Copper
DCRA	Division of Community and Regional Affairs
EPA	Environmental Protection Agency
ER	Environmental Report
F	Fahrenheit
ft	feet
gpcd	Gallons Per Capita Per Day
gpd	Gallons per Day
gpm	Gallons per Minute
GWUDI	Ground Water Under the Direct Influence
HDPE	High-Density Polyethylene
kW	Kilowatt
kWh	Kilowatt per hour
LEDP	Local Economic Development Plan
LF	Linear Feet
LS	Lump Sum
mg/L	milligrams per Liter
MWh	Megawatt per hour
µg/L	micrograms per Liter
NFIP	National Flood Insurance Program
O&M	Operations and Maintenance
Pb	Lead
PCE	Power Cost Equalization
PER	Preliminary Engineering Report
PEX	Cross-linked polyethylene
pH	Potential Hydrogen
POE	Point of Entry
POU	Point of Use
psi	Pounds per Square Inch
psig	Pounds per Square Inch Gauge
PVC	polyvinyl chloride
ROW	Right of Way
RUBA	Rural Utilities Business Advisor
SHPO	State Historical Preservation Office

Preliminary Engineering Report
Water Service Improvements

Unalakleet, Alaska

UNC

Unalakleet Native Corporation

USACE

United States Army Corps of Engineers

USDA-RUS

United States Department of Agriculture-Rural Utilities Service

USGS

United States Geological Survey

UVEC

Unalakleet Valley Electric Cooperative

VSW

Village Safe Water

W

Watt

WST

Water Storage Tank

WTP

Water Treatment Plant

1.0 PROJECT PLANNING

Village Safe Water (VSW) and the City of Unalakleet contracted with Kuna Engineering in August 2019 to develop a Preliminary Engineering Report (PER) and Environmental Report (ER) for the improvement of the community water service compliance of the public water system. The project was funded by United States Department of Agriculture, Rural Utilities Service (USDA-RUS) and the State of Alaska. This PER was prepared using USDA-RUS Bulletin 1780-2.

This PER is an engineering assessment of the existing water situation, which assesses needs, evaluates improvement alternatives, selects a preferred alternative, develops a project plan, and provides recommendations for the chronic failure of water services.

The PER was developed with help from the following participants:

- Susan Stinnett (City of Unalakleet, Past City Manager)
- Davida Hanson (City of Unalakleet, City Manager)
- Dwayne Johnson (City of Unalakleet, Public Works Director)
- John Halleran (City of Unalakleet, Deputy Public Works Director)
- Brad Badger (City of Unalakleet, Utility Superintendent)
- Aaron Wheattall (VSW, Project Manager)
- Doug Poage (VSW, Lead Engineer)
- Sean Lee (Norton Sound Health Corporation, Project Manager)
- Daniel Nichols, P.E. (Kuna Engineering, Project Manager)

a. Location

Unalakleet is a city in the Nome census area of Alaska in the western part of the state, along the coast of the Norton Sound. It is the eastern-most community of the ten towns and villages that rim the Norton Sound, immediately next to the mouth of the Unalakleet River, with trees, tundra, and hills behind it. Unalakleet is located 148 miles southeast of Nome and 395 miles northwest of Anchorage. The Inupiaq village is located at the far west end of the Unalakleet-Kaltag Portage, an important winter travel route between Norton Sound and the Yukon River.

The Public Land Survey System description of Unalakleet is Section 33, Township 19S, Range 11W and Section 34, Township 18S, Range 11W of the Kateel River Meridian, Alaska United States Geological Survey (USGS) quadrangle “UNALAKLEET D-4” in the Alaska NOME RECORDING DISTRICT. The Alaska Nautical Chart depicts Unalakleet within sub-region AK15 Northern Coast, chart number 16200.¹

Unalakleet is off the road system and is only accessible by plane or boat. It is a central hub for outlying villages providing air cargo and air taxi services through the Unalakleet Airport. Boats provide access in the summer and winter travel is possible with snow-machines. Barges also service the community in the summer months, but cargo must be lightered the last one-half mile to shore because of shallow waters.

The project area covers the homes and facilities that are connected to the public water system. The water treatment plant is located at 63°52'44"N 160°47'23"W.

¹ Office of Coast Survey – Nautical Chart Catalog, Alaska – Northern Coast, Norton Sound; Golovin Bay, website www.nauticalcharts.noaa.gov.

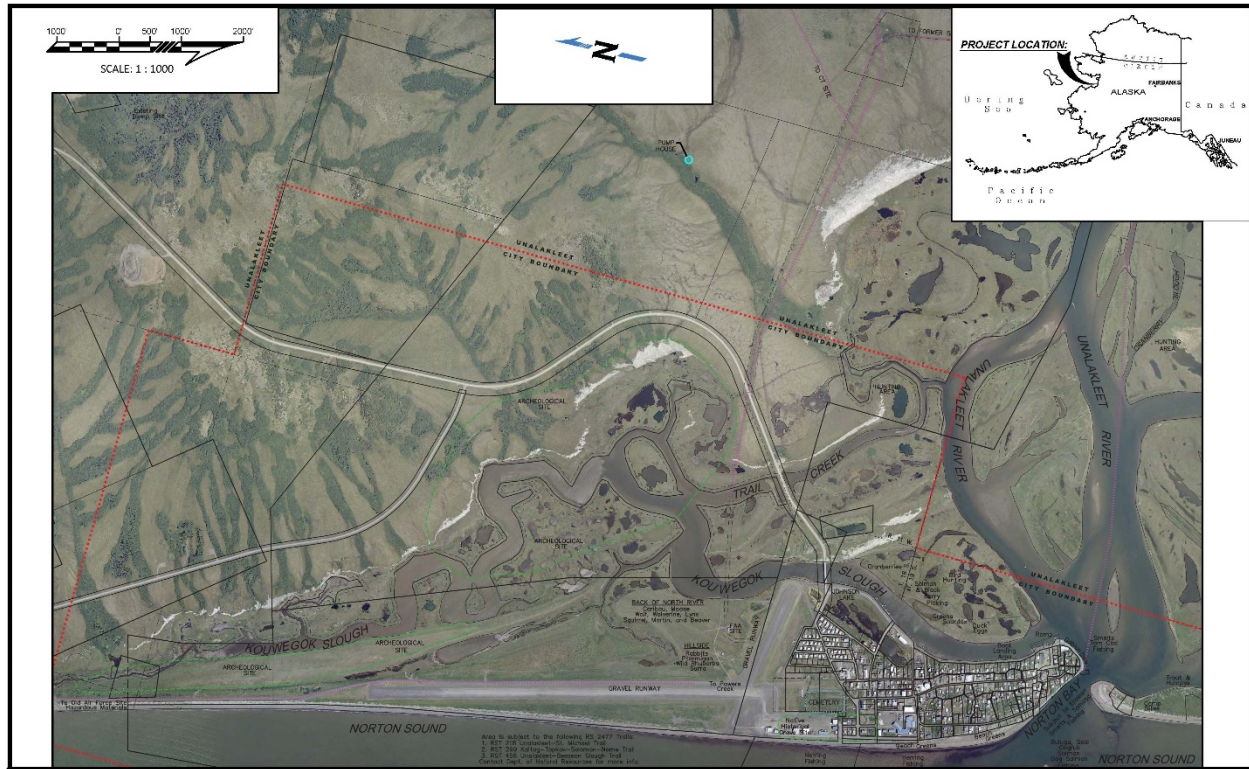


Figure 1.1: Community Map

i. Land Ownership

The Unalakleet IRA Council, which is recognized by the Bureau of Indian Affairs (BIA), manages community and tribal services. The Unalakleet Native Corporation (UNC) manages land and the City of Unalakleet manages infrastructure.

The IRA Council conducts tribal government affairs for the Native Village of Unalakleet. The functions of the Native Village include but are not limited to housing, environmental, and fisheries management, child welfare services, and coordination of other activities. The village owns and maintains an office rental building, a community memorial hall, the fishery cannery, storage buildings, and land within the community.

The UNC is a for-profit corporation owned by the shareholders awarded stock in the Alaska Native Claims Settlement Act (ANCSA) of 1971. They ultimately received surface title to 161,280 acres of land around the village under ANCSA.² The corporation, with a nine-member board, owns a fourteen-plex, an eight-plex, a five-plex, and residential housing rentals. Additionally, the corporation owns apartments and office buildings in Anchorage.

The village was incorporated as a second-class city in 1974. The City of Unalakleet owns and maintains a water treatment and garage facilities, a four-plex housing apartment, office rental buildings, a storage facility, the community library, equipment rentals, and land within the community.

² Unalakleet-Community Plan-2000.

According to the United States Fish and Wildlife Service, Unalakleet is not located near a National Wildlife Refuge. Twenty miles east is the Unalakleet River, classified as a Wild and Scenic River, according to the United States National Park Service. Unalakleet is included in the Bering Strait Coastal Resource Service Area. Development in Unalakleet may be subject to the Bering Strait Coastal Management Plan Developed in 1989. State land includes the airport and some areas around the City of Unalakleet beyond the UNC land areas.

Surveys: There are a few surveys done within the project vicinity, including USS No. 1535 and 3553. An Alaska Tideland Survey No. 1466 was completed just outside the border of the vicinity. These plats contain a multiple number of tracts. The State of Alaska Department of Natural Resources, Division of Land completed an Alaska State Land Survey (ASLS) No. 91-215, but this survey is outside of the project area.

State Plats: There are multiple State of Alaska Plats in the project area. Most of the project is within Unalakleet Townsite Plat No. 87-11 and Unalakleet Townsite Additional No. 1 Plat No. 88-08.

State Land: State land includes the airport and some areas around the City of Unalakleet beyond the UNC land areas.

UNC Owned Lots: UNC is a corporation that owns and manages a lot of land within the community. Most of the land the corporation owns is donated, leased, or designated for public use.

Restricted Deeds: There are no restricted deeds.

Homestead: There are no homesteads.

ANCSA Land: There is a State of Alaska Plat for land owned by ANCSA, Plat No. 19-10, Lots 3 & 12. This land is located outside of the project vicinity.

Native Allotments: In the wild river corridor and below the Chirosky River, there are individual native allotments which are private. These allotments are outside the project area.³ There are no native allotments within the city limits.

Leases: There are multiple properties leased in this area mainly for housing through the Bering Strait Regional Housing Authority (BSRHA) and for public use like the United States Postal Service, the Bering Strait School District, and the City of Unalakleet.

Public Easements: There are numerous utility and public use easements throughout the Unalakleet community. Public easements have been granted and defined for the water distribution system, water storage tank, and wellhouse. A public easement provides access through State of Alaska lands to access the water storage tank and wellhouse. There are also public easements granted for access trail and road to and from the community.⁴ The public use easements are owned by the City of Unalakleet as shown on Plat No. 87-11.

³ "Unalakleet National Wild River Recreation Management Area" U.S Dept. of the Interior, Bureau of Land Management

⁴ "Unalakleet_2004_Area_Map_24x36.pdf," Unalakleet Corrosion Study PER, Kuna Engineering Group, 2004

b. Environmental Resources Present

i. Climate

The area has a subarctic climate with considerable maritime influences. Winters are cold and dry. Average summer temperatures range from 47 degrees Fahrenheit (F) to 62 degrees F and range from minus 40 degrees F to 11 degrees F in the winter. Annual precipitation averages are 14 inches rain and 41 inches of snow. The predominant wind is from the east with an average velocity of 11 knots. Wind speed up to 56 knots has been recorded from the northeast, although speed reported by residents has been higher. The tidal range can be as much as five feet, and persistent onshore winds can cause storm surges much higher than the high tide level.

Table 1.1: Climate Data for Unalakleet, Alaska.

Annual (1987-2012)	Values
Average Precipitation (inches)	14
Average Rainfall (inches)	12.47
Average Snow Fall (inches)	41
Mean Annual Temperature (°F)	27.3
Lowest Recorded Temperature (°F)	-58
Highest Recorded Temperature (°F)	88

ii. Topography, Geology, and Soils

Unalakleet is located on a sand and gravel spit four miles long on Norton Sound near the Nulato Hills, at the mouth of the Unalakleet River. The spit rises about 14 feet above sea level and is separated from the mainland by Kouwegok Slough and the tidelands of the Unalakleet River. The community is situated along the highest grounds of the formation. The spit is composed of sand with gravelly sand layers to approximately 15 feet below, and silt below that. Unalakleet's wide, gently sloping beach is mostly sand. The beach further north has gravel with rock up to two inches in diameter. Unalakleet is in a zone of discontinuous permafrost, with little or no permafrost under the spit. The area inland from Unalakleet is hilly and covered with spruce trees. Soils in the surrounding area are poorly drained loam with an organic surface layer. The inland slopes are generally less than 12 percent and have a moderate potential for erosion.

Local vegetation consists of grasses, shrubs, and wet, moist tundra at lower elevations. Along the riverbanks are willow, dwarf birch, alpine spruce, shrubs, and grasses. Dense, mixed spruce and hardwood lay along the upper reaches of drainage channels in the hills and in alpine tundra at the higher elevations.

iii. Wetlands

Alaska's wetlands occupy 43.3 percent of its total 403,247,700 acres. Aquatic habitats in the project area include rivers, ponds, sloughs, marches, bogs, and wetlands within the Unalakleet River drainage. Kouwegok Slough is a major aquatic feature near Unalakleet. The wet tundra areas adjacent to Kouwegok Slough, the mouth of the Unalakleet River, and the Norton Sound consists of sedges and grasses. Wetlands and wet and shrub tundra cover nearly 70 percent of the Unalakleet basin.

Conifer/deciduous forest, indicative of areas free of permafrost, covers only about two percent of the basin.⁵

iv. History and Cultural

Archaeologists have dated house remnants along the beach ridge from 200 B.C. to 300 A.D. The name Unalakleet means “from the southern side.” Unalakleet has long been a major trade center as the terminus for the Kaltag Portage, an important winter travel route that connects to the Yukon River. Alaska Native Indians on the upper river were considered “professional” traders with a monopoly on the Indian-Eskimo trade across Kaltag Portage. The Russian-American Company built a post here in the 1830s. In 1898, reindeer herders from the Lapland region of Finland were brought to Unalakleet to establish sound herding practices. In 1901, the Army Signal Corps built over 605 miles of telegraph line from Saint Michael to Unalakleet, over the portage to Kaltag and Fort Gibbon. The city was incorporated in 1974.

Unalakleet has a history of diverse cultures and trade activity. The local economy is the most active in Norton Sound, along with traditional Unaligmiut Eskimo subsistence lifestyle that includes fish, seal, caribou, moose, and bear. Fishing is a major industry in Unalakleet. Locals carve, skin-sew, and make other traditional crafts. Children learn to sew and make crafts in grade school.

Missionary efforts to convert locals to Christianity resulted in native cultural traditions like dance and language becoming less prominent but not entirely lost. Multiple dialects of Yupik and Inupiaq are spoken by locals. About 30 Elders are fluent in their native languages. Their children can understand them but do not speak their native languages fluently. The school and bilingual class are trying to bring the native language and dance back.⁶

v. Wildlife

The Unalakleet area is rich in fish and wildlife, most of which is used as local subsistence resources. The general location of the species harvested by Unalakleet residents may vary recognizing that the distribution may be different beyond the local area of subsistence activity.

During the summer, the river in Unalakleet is home to all the species of pacific salmon. There are two species of anadromous char, Arctic char and Dolly Varden (locally known as trout), grayling, whitefish, lingcod, tomcod, and smelt inhabiting all or portions of the river throughout the year. The eastern portion of the Norton Sound in the vicinity of the city has diverse marine mammal populations, including spotted hair, ringed, and bearded seal (locally called oogruk), beluga, mink, gray, and killer whales, and walrus. Herring, clams, crabs, mussels, and shrimp are also found along the shores close to Unalakleet.

The land around Unalakleet is similarly rich in wildlife. Brown and black bear thrive on fish and local berries. Moose inhabit the willow stands and sedges along the river and streams system. Caribou are found in the tundra and snowshoe and Arctic hare inhabit the lower wet tundra zones. Fur bearing

⁵ “Hydrologic Reconnaissance of the Unalakleet River Basin, Alaska,” By Charles E. Sloan, Donald R. Kernodle, Ronald Huntsinger, 1982-83
https://books.google.com/books?id=F_V3rvTg62sC&pg=PA3&lpg=PA3&dq=Unalakleet+wetlands&source=bl&ots=Qv_8GkvTb2&sig=ACfU3U1O2D7ZLYmGyBjFT9MinEHvyl9Gw&hl=en&sa=X&ved=2ahUKEwiFu5q6qqDnAhVQ7J4KHV3sDZQQ6AEwChOECAkQAQ#v=onepage&q=Unalakleet%20wetlands&f=false

⁶ “Unalakleet Local Economic Development Plan” Community Planning & Development, Kawerak, Inc., 2014-19

animals found in the river drainage includes beaver, marten, mink, muskrat, wolverine, lynx, fox, ermine, and otter. Bird species are important to subsistence and include ptarmigan, grouse, and waterfowl such as geese, ducks, cranes, and swans mostly taken along the river and in the tundra around the community. The coast and the surrounding marsh provide exceptional nesting habitat for many species of birds, giving the residents the ability to harvest the eggs in the early summer. No critical habitat areas, refuges, or sanctuaries are listed in the area surrounding the community. No known endangered species habitat is located within the planning area. There is a problem occasionally with beavers damming the rivers. There are noticeable climate and wildlife changes such as more algae in the rivers and fewer king salmon.

Much of the local diet is food that residents hunt and harvest from the wild. In Alaska, the state's perspective on subsistence refers to the practice of taking fish, wildlife, or other wild resources for one's sustenance for food, shelter, or other personal or family needs. In the native culture, subsistence is much more than that. It is part of the identity of Native Alaskans; one does not exist without the other.⁷

vi. Floodplains, Erosion, and Seismic Hazards

Flood

Unalakleet is subject to coastal flooding and stream overflow. The city's location on a gravel spit, combined with high tides in Norton Sound and onshore winds, creates a flood hazard potential. Floods occurred in 1968, 1971, and 1974. Most of the community is within the 100-year floodplain. Most building first floor elevations are above the 100-year floodplain.

Unalakleet is also subject to ice-jams and stream-overflow flooding from the Unalakleet River. The United States Army Corps of Engineers (USACE) has reported a low frequency of flooding at Unalakleet and has found Unalakleet to be in a low flood hazard area. Residents report that some areas along the river are subject to river flooding.

Unalakleet does not participate in the National Flood Insurance Programs (NFIP) and has not been mapped as a special flood hazard area. Since the community does not participate in NFIP, neither Federal Emergency Management Agency nor local permits are needed for construction within the floodplain. Any new construction will need to be protected from flooding by locating it outside the 100-year floodplain or having a finished floor elevation above the recommended flood elevation.

Erosion

Beach erosion is an ongoing process on the Unalakleet spit. Wave action is widening the spit on its western side and depositing sand and gravel along the beach. Erosion at the mouth of the Unalakleet River threatens several homes on the spit. The continued ocean erosion for the community is a major concern to the residents for both the immediate and near-term future.

Many of Alaska's coastal communities are in similar danger from erosion and funding is limited. The rural location and relatively low population of Unalakleet makes it difficult to compete for funding and convince outside agencies of the severity of the problem.⁸

⁷ "Unalakleet Local Economic Development Plan" Community Planning & Development, Kawerak, Inc., 2014-19

USACE has done erosion modeling. Erosion has damaged the raw water transmission line in the past and it is still at risk. The 2054 predicted shorelines will not impact the water treatment plant or the water distribution system.⁸ This project should not be impacted by erosion.

Seismic Hazards

Unalakleet lies in a seismic risk zone three, subject to earthquake of magnitude 6.0 or greater. There is no record of damage in Unalakleet from earthquakes or tsunamis.

c. Populations Trends

The following population data are from the 2010 United States Census, unless otherwise stated. Additional detail is available from the Alaska Department of Labor and Workforce Development, Census and Geographic Information Network and the United States Census Bureau's American Fact Finder.

Table 1.2 shows a racial population value of 14.97 percent white, 77.32 percent Alaska Native or American Indian, 6.4 percent mixed race individuals, and less than one percent of other races. About 52 percent of the population is male as shown in Figure 1.2, population by gender pie chart. Figure 1.3, population by age bar graph, shows that 25 percent of residents are under the age of 15, 21 percent are between the ages of 15 and 29, 17 percent are between ages 30 and 44, 22 percent are between ages 45 and 59, 11 percent are between ages 60 and 74, and four percent are over the age of 74.

Table 1.2: Population Trends⁹

Population by Race	Population
Population in 2010	688
White	103
Alaska Native or American Indian	532
Black	4
Asian	4
Other Races	1
Two or More Races	44

Population by Gender



Figure 1.2: Population by Gender

⁸ USACE. "AVETA Report Summary-Unalakleet, Alaska, Alaska Baseline Erosion Assessment." 2004.

⁹ State of Alaska. Department of Community and Regional Affairs Community Database, Unalakleet. Retrieved May 11, 2020.

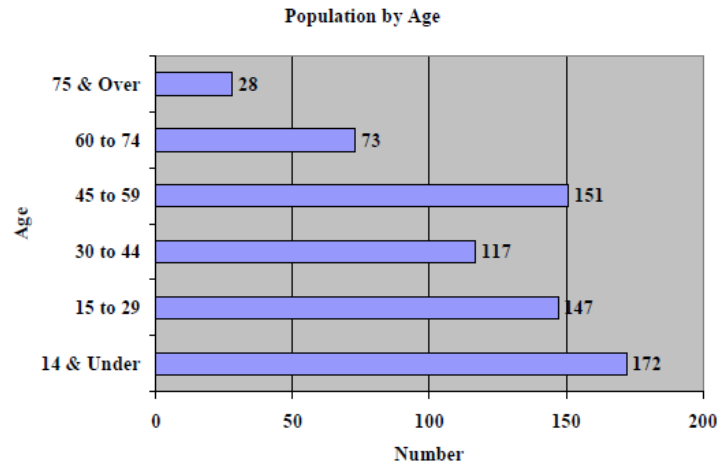


Figure 1.3: Population by Age¹⁰

According to the Department of the Interior Census Office, Bureau of the Census Library Report on Population and Resources of Alaska, Unalakleet first appeared on the 1880 United States Census as the unincorporated Inuit village of “Oonalakleet.” All 100 residents were listed as Inuit. It returned in 1890 as “Unalaklik.” Of its 175 residents, 170 were listed as Native, three were Creole (mixed Russian and Native) and two were listed as White. It again returned in 1900 and in 1910 under that name, though it also gave the alternative name of Unalakleet in the latter census. Beginning in 1920, it returned under its present name, Unalakleet, in every successive census. It was formally incorporated in 1974. Figure 1.4, The Census History line graph, shows the populations dated all the way back to 1880 and for every ten years up until 2010. Table 1.3 shows the population estimates for every year from 2010 to 2018.

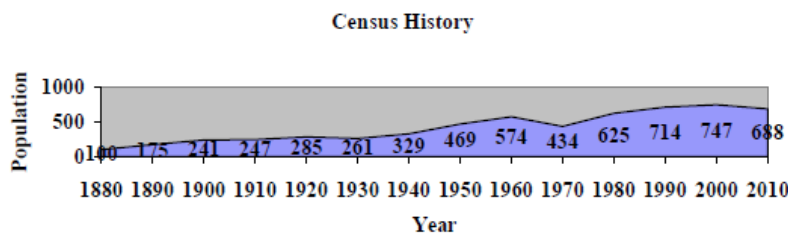


Figure 1.4: Census History

As of the 2010 census of the United States Census Bureau and American Fact Finder, there were 688 people, 225 households, and 172 families residing in the city. The population density was 237.2 people per square mile. There were 268 housing units at an average density of 92.4 per square mile. One hundred percent of the homes in Unalakleet have water and sewer service provided and maintained by the City. The average household size is four people per house. Table 1.4 summarizes the housing characteristics of Unalakleet based on the 2010 United States Census, unless otherwise noted. As of the 2018, most current population count on record for Unalakleet, is 686 people.

¹⁰ State of Alaska. Department of Community and Regional Affairs Community Database, Unalakleet. Retrieved May 11, 2020.

Table 1.3: Housing Characteristics

Housing Characteristics	Units
Total Housing Units	268
Occupied Housing (Households)	225
Vacant Housing	43
Vacant Due to Seasonal Use	10
Owner-Occupied Housing	138
Renter-Occupied	87
Avg. Household Size	4
Family Households	172
Non-Family Households	53
Pop. Living in Households	688

d. Community Engagement

Kawerak's Community Planning and Development program (CPD) worked with the community of Unalakleet in developing past Local Economic Development Plans (LEDP). LEDPs analyze local conditions, identify problems and opportunities, and develop goals, strategies, and outcomes to address community issues, ongoing development, and future development.

The new raw water line is one of the major accomplishments toward these goals since Unalakleet's last LEDP was created in 2009. The City is working with VSW to improve the raw water line. They are developing a plan to run a new raw water line from the pump house to protect water and power from shore erosion, moving it 100 yards inland.

In August 2019, Daniel Nichols (Kuna Engineering), DJ Paterson (Kuna Engineering), and Sean Lee (VSW) traveled to Unalakleet. They met with City staff, reviewed existing utilities, and collected water samples.

In January 2020, Sean Lee traveled to Unalakleet. He met with City staff and held a public meeting.

In 2019, seven new drinking water tests well were drilled east of the intersection of Landfill Road and Kanagyagat Road. Pump testing was conducted between January and March 2020. The intent of the project is to replace the existing Powers Creek surface water source with new groundwater.

In 2020, upgrades to the WTP heating and emergency power generation are schedule for construction.

c. Condition of Existing Facilities

The community water system is named Unalakleet City Water Supply. The water system number is AK2340387. The initial water system was constructed in the 1960s.

Water Source

Unalakleet obtains its drinking water from an infiltration gallery near Powers Creek about five miles north of the village. Because of permafrost and the low permeability of bedrock in most of the area, the system is classified as groundwater under the direct influence of surface water (GWUDI).

Surface-water drainage from the Nulato Hills north and east of Unalakleet enters the North River, Powers Creek, and Unalakleet River, which flow to the southwest and west respectively. An alluvial aquifer in this setting probably would be confined to the area between these hills and the coast.¹¹

Repeatedly since the 1980s, the Powers Creek source has frozen. Several of these freeze ups resulted in the City being without water for months and required emergency declarations to obtain repair funding.

In 2017 and 2018, there were water shortages due to Power Creek freezing.

There is a current project to replace the drinking water source with groundwater. Test wells have been drilled and long-term pump testing occurred between January and March 2020. The wells are located east of the intersection of Landfill Road and Kanagyagat Road.

Raw Water Transmission

Water is collected from an infiltration gallery near Powers Creek at the pump house located approximately five miles north of the community. Water is heated at the pump house and transported to the water treatment plant through a buried pipe. The heating system has failed, and the transmission pipe has frozen in recent years.

Water Treatment Plant

The 7,176 square foot WTP was constructed in 1965 and houses the water treatment plant, three garages for city vehicles, and an apartment currently occupied by the city manager. The building is in operation every day from 8:00a.m to 5:00p.m. with a one-hour lunch break. Typical operations include one water treatment plant operator and two to three maintenance workers for the city vehicles. There are additional city workers that routinely work in the building for short periods of time during the day.

Upon entering the water treatment plant, the raw water is heated and injected with chemicals before being filtered and stored in the water storage tank. The water is injected with ferric chloride, which acts as a coagulant during the filtration process, soda ash, which maintains the acidity of the water, and

¹¹ "Overview of Environmental and Hydrogeological Conditions at Unalakleet, AK", U.S. Geological Survey, Joseph M. Dorava, 1995.

chlorine, which treats the water. After being stored in the one-million-gallon water storage tank, the water is then distributed to the community through five distribution loops.¹² The inline potential hydrogen (pH) meters were not operation during the site visit. Soda ash was being added manually periodically to the finished water to regulate the pH.

Water Usage

Water usage generally is reported as gallons per capita day (gpcd). Gpcd is not the average use of an individual, but all water-use by a community divided by the population. This includes commercial, residential, seasonal, leakage, etc. Gpcd is used because total gallons used varies with population but the gpcd does not change with an increase or decrease in population. This allows extrapolation of water usage over time and changes in population.

The average domestic water demand for Unalakleet, with a population of 688 people, is 85 gpcd. The domestic water usage is 58,000 gallons per day (gpd). The processing plant also uses 58,000 gpd at its peak daily use in the summer. The total daily average water use for the community is 117,000 gpd.

Water Storage Tank

The existing steel WST holds 1,000,000 gallons, measuring 78 feet in diameter and 28 feet in height. The WST provides the required chlorine contact time for disinfection. To get adequate disinfection, the tank must maintain a minimum of 320,000 gallons. 320,000 gallons is approximately five feet of water. The effective usable storage volume is 680,000 gallons. This equates to six days of water usage.

¹² "Comprehensive Energy Audit for Unalakleet Water Treatment Plant", Kevin Ulrich & Martin Wortman, March 9, 2017.

Table 2.1: Summary of Existing Design Conditions

Criteria	Value
Design Population (2031)	849
Current Population	722
Current Residential Water Services	268
Current Commercial Water Services	26
Per Capita Usage (gpcd)	85
Design Domestic Daily Usage (gpd)	72,165
Processing Plant Peak Summer Use (gpd)	58,000
Design Total Daily Water Usage (gpd)	130,165
Daily Average Design Flowrate (gpm)	90
Maximum Day Demand (gpm)	180
Peak Hourly Flow Rate (gpm)	270
Total Water Storage (gallons)	1,000,000
Minimum Storage Required for Chlorine Contact Time (gallons)	320,000
Useable Water Storage (gallons)	680,000
Days of Storage	6

Distribution

Unalakleet has a piped water system with five buried, insulated, circulating water loops.¹³ The water is distributed to the community through four distribution loops, the fifth loop is for the school campus. The loop information is listed below:¹⁴

1. FAA Loop (1980s)

- Four-inch Buried Steel Pipe
- Temperatures – 42 degrees F supply, 36 degrees F return
- Pressure – 34 pounds per square inch (psi)
- Flow Rate (Meter Broken) – Estimated 75 gallons per minute (gpm) supply

2. Southeast Loop (1960s)

- Four-inch Buried Steel Pipe
- Temperatures – 42 degrees F supply, 42 degrees F return
- Pressure – 47 psi
- Flow Rate – 195 gpm supply

3. West Loop (1960s)

- Four-inch Buried Cast Iron
- Temperatures – 53 degrees F supply, 38 degrees F return
- Pressure – 47 psi
- Flow Rate – 225 gpm return

¹³ “Business Plan, Water, Sewer, and Solid Waste Utilities” City of Unalakleet, 2007.

¹⁴ “Comprehensive Energy Audit for Unalakleet Water Treatment Plant”, Kevin Ulrich & Martin Wortman, March 9, 2017.

4. Northeast Loop/Happy Valley Loop (1991)

- Four-inch Polyvinyl chloride (PVC)
- Temperatures – Readings were inaccurate
- Pressure – 36 psi
- Flow Rate – 60 gpm return

5. School Loop (1980s)

- Four-inch and six-inch PVC
- Flow Rate-Both supply and return meters broken.

The loops were installed between 1960 and 1991. Northeast Loop/Happy Valley Loop and School Loop have older style PVC pipes which becomes extremely brittle over time. It has become increasingly difficult to repair the mains because the existing pipes are not structurally competent. The older PVC is more susceptible to breaking when frozen, resulting in frequent breaks.

Due to most of the flow meters not working, it is not possible to determine flow rate for each individual water loop.

Water Services

The typical water service line consists of one-inch copper supply and return lines inside an insulated carrier pipe. The water service lines freeze-protection includes insulation, heat trace, interior circulation pump, and copper pitorifices. Due to age and corrosion, the water services lines have been experiencing an increase in leaks and freezing. When a water service fails, the old copper piping is pulled out and new high-density polyethylene (HDPE) or Cross-linked polyethylene (PEX) piping is pushed through the carrier pipe. The pulled copper piping shows signs of heavy pitting, corrosion, and pipe wall thinning. The copper pitorifices spurs are often corroded off with wall-thinning around the corporation stop. These failures reduce recirculation through the pipes and increase freezing. Copper pipe is more rigid than HDPE or PEX piping and splits when frozen. Multiple water service lines are replaced or repaired each winter.



Figure 2.2: Pitorifices and Piping Typical Failures

Figure 2.2 shows examples of copper piping and pitorifices that were removed during a water service repair. Note the pitorifices spurs have completely corroded away from the corporation stops. The copper piping has failed around the corporation stops due to corrosion. Local operators report that this is typical of the pipes they pull out of the service lines. Operators also report that existing carrier pipe and insulations are also deteriorating.

Hydrants

There are 22 hydrants located throughout the community with most of the water system being four-inch mains. The hydrants are used to flush out the water mains.

Operations

The Spring 2020 Best Practices Score of the water system was 87 of a possible 100, which is an increase from the 2019 scores. Best Practice Scores are used by the Alaska Department of Environmental Conservation (ADEC) to assess operation and maintenance capacity of rural water utilities. The operation is fully compliant with Rural Utilities Business Advisor Program (RUBA) management practices. The Best Practice Score summary lists the following recommended improvements:

Technical: Operator Certification – Primary operator has the correct level of certification, but the backup operator does not hold the correct certification level.

Compliance – The utility had 11 Drinking Water Monitoring and Reporting Violations in 2019.

The water system received full scores for managerial and financial practices. No improvements were recommended.

Bulk Fuel

There are two commercial fuel distributors servicing different consumers. The UNC provides residential and commercial gas and home heating fuel to the community. West Coast Aviation Services provides fuel to the airlines that service the community and surrounding areas. Fuel supplies are all stored in the recently installed tank farm one-mile northeast of the village.

Electric

The average monthly residential electric bill is \$200. The community installed six wind-turbines just outside of town. There is also a new diesel generator. The wind/diesel-integrated system has challenges that are being worked out. Initially, there were frequent blackouts due to it. More wind-power is required to continue reducing the dependency on fossil fuels. Below is the information for the electric system:¹⁵

Unalakleet Valley Electric Cooperative (UVEC)

- Power source: wind-turbine/diesel-generator
- Net Generation by Oil, megawatt per hour (MWh): 3,498
- Net Generation by Wind, MWh: 921
- Related Wind Capacity Kilowatts: 600
- Total kilowatt per hour (kWh) Capacity: 2,600
- Power Cost Equalization (PCE) Eligible: Yes
- Residential Rate (dollar per kWh): \$0.39
- PCE Reimbursement Rate (dollar per kWh): \$0.20
- Residential Rate after PCE (dollar per kWh): \$0.19

d. Financial Status of any Existing Facilities

The City of Unalakleet is a second-class city and has tax authority. It collects sales, bed, and alcohol taxes. There is no property tax. The City also collects revenue from State, Federal, Bingo, and utility fees.

Table 2.2: Tax Revenue

Tax	Rate (Percent)
Property Tax	0
Sales Tax	5
Bed tax	5
Alcohol Tax	5

¹⁵ “Unalakleet Local Economic Development Plan” Community Planning & Development, Kawerak, Inc., 2014-19

UVEC provides electricity to the community through wind turbines and diesel generators. The community participates in the State of Alaska PCE program. UNC operates a bulk fuel tank farm for retail sale.

Table 2.3: Energy Costs¹⁶

Energy Costs	
Heating Oil (per gallon)	\$5.25
Gasoline (per gallon)	\$5.25
Diesel (per gallon)	\$4.34
Residential Electric Rate (per kWh)	\$0.39
PCE Reimbursement Rate (per kWh)	\$0.20
Residential Rate after PCE (per kWh)	\$0.19

In 2019, the City's total revenue was \$1,518,100 and total expenditures was \$1,332,701. The yearend balance was \$185,399. The yearend balance of the water utility was \$102,000.

e. Water/Energy/Waste Audits

A Comprehensive Energy Audit for the Unalakleet Water Treatment Plant was conducted in March of 2017. The report was prepared by Kevin Ulrich and Marti Wortman from the Alaska Native Tribal Health Consortium (ANTHC) for the City of Unalakleet. An additional audit was developed for the Unalakleet Pump House, which supports the contents of this energy audit.

Based on 2017 electricity and fuel oil prices in effect at the time of the audit, the predicted energy costs total \$78,213 per year. Electricity represents the largest portion of the energy cost with an annual cost of approximately \$63,471. This includes \$29,162 paid by the City and \$34,309 paid by the PCE program through the State of Alaska. Fuel oil represents another significant portion of the energy costs with an annual cost of approximately \$14,721. The Water Treatment Plant also uses a heat recovery system that yields an annual cost of \$5,820.

The State of Alaska PCE program provides a subsidy to rural communities across the state to lower electricity costs and make energy affordable in rural Alaska. At the time of the report the cost of electricity without PCE is \$0.37 per kWh and the cost of electricity with PCE is \$0.17 per kWh. Table 2.3 has the current PCE rates.

¹⁶ Prices collected from Division of Community and Regional Affairs (DCRA) Community Database entry for Unalakleet. Retrieved March 2020.

3.0 NEED FOR PROJECT

a. Health, Sanitation, and Security

There are 268 water services connected to the water system. The United States Environmental Protection Agency (EPA) classifies the system as a community water system.

Sanitation

Each year the community deals with multiple water main leaks. These leaks often result in water shortages. The WST is part of the water disinfection process and provides the necessary chlorine contact time. When the WST levels drop below five feet, the community must issue a boil water notice, because there is not adequate disinfection. The water levels drop because the water treatment cannot keep up with the water loss.

Five community-wide boil water notices have been officially issued by ADEC in between August 2018 and July 2020 due to leaks. These total 86 days over 22 months. The notices were:

- July 4 through July 16, 2020 (13 days)
- June 1 through June 26, 2020 (26 days)
- December 28, 2019 through January 17, 2020 (21 days)
- November 29 through December 20, 2018 (21 days)
- August 18 through August 22, 2018 (5 days)

Between August 12 and August 19, 2019, a cautionary recommendation was issued by the City to not drink the water until testing confirmed water quality was safe. This was due to an accidental high dosage of ferric chloride at the WTP. The testing confirmed the water quality was safe.

Health

There are no documented cases of waterborne illnesses within the community. During community meetings, some residents have expressed concerns about high copper levels and accidental high dosage of ferric chloride.

During public meetings, community members have testified to high ferric chloride dosage events. There have been two confirmed events when high dosages of ferric chloride were accidentally added during water treatment. Several residents expressed concerns over the water safety due to these events.

One resident testified that their son was diagnosed with liver cancer and liver cirrhosis in 2014 at age nine. They stated that their doctor said there was a potential it was caused by the water. It should be noted that ferric chloride was introduced to the system in 2014. Ferric chloride is listed as safe by EPA for water use and this application was approved by ADEC. Acute high dosages of ferric chloride may cause abnormal liver function with a variety of symptoms. It can also cause mouth and stomach irritation at high concentrations. Its carcinogenicity has not been classified.

There have been high copper level results within the community but in 2014 there was a significant increase in copper levels. Since then, the ninety-percentile copper level results have been above 1.3 mg/L. A result of 1.3 mg/L is considered the actionable level by the EPA and communities must develop a plan to reduce copper concentrations below the recommended levels of 1.0 mg/L. Lead levels have also risen during this time but the ninety-percentile lead level results have not consistently been above the maximum contamination level of 0.015 mg/L.

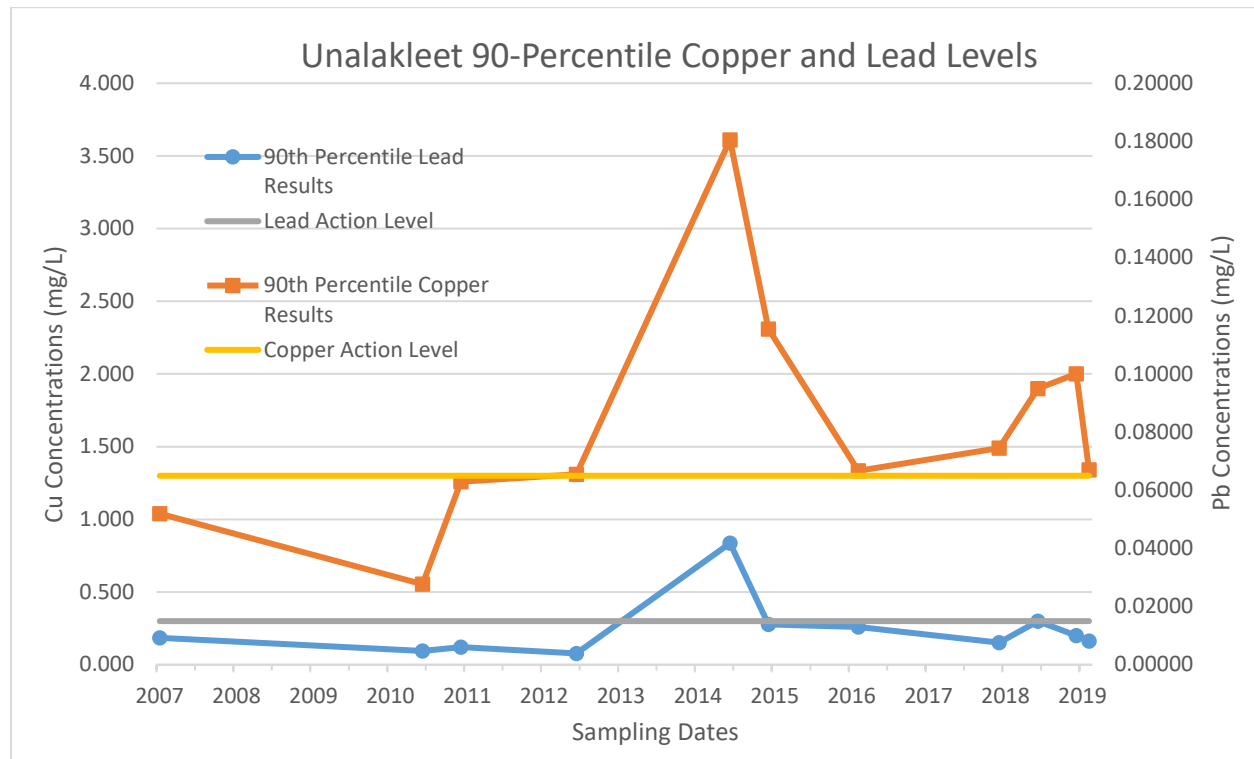


Figure 3.1: Unalakleet 90-Percentile Copper and Lead Level Results

The increase in copper and lead levels coincide with the 2014 addition of ferric chloride to the treatment train. A 2020, desktop corrosion study concluded that the increase of ferric chloride could easily bring copper levels above 1.3 mg/L and as high as 3.9 mg/L. A copy of the study is attached in the appendix. After 2014, the City saw an increase in leaks, freeze incidents, and corrosion in copper water service lines. Since then, the City has replaced several of the water service lines, which were part of the copper sampling plan, with PEX piping. Those houses saw an immediate reduction in copper levels. This explains why there has been a decrease in copper levels from the high in 2014. The levels are still elevated throughout the water system but several of the homes in the copper sample plan have been fixed, resulting in a lower 90-percentile concentration. The community should update the sampling plan to not include houses with new PEX service lines. This would provide a better picture of the copper levels in the community.

Security

Access to clean water has been a major issue for Unalakleet. When the WST levels drop below 10 feet, the City issues water conservation notices. Between August 2018 and July 2020, 12 water conservation notices went out. The longest one occurred in January 2020 and lasted for more than 21 days.

b. Aging Infrastructure

The water mains regularly must be shut down to repair leaks. These leaks are directly due to water main deterioration from age. The leaks are detected when there is a significant increase in water usage. During these events leaks account for more than 20 percent of average daily production. The oldest water loops are 50 to 60 years old and the newest water loop is 30 years old. Below is the list of service interruptions due to repairs in 2019 and 2020.

Table 3.1: Water Service Interruptions

Dates	Days without Service	Loop Affected	Approximate Number of Services Impacted
6/2-3/2020	2	Happy Valley Loop	80
6/2/2020	1	FAA loop	25
5/28/2020	1	West Loop	60
5/16 to 5/18/2020	3	West Loop	60
5/11/2020	1	FAA Loop	25
5/5/2020	1	West Loop	60
4/8/2020	1	FAA Loop	25
1/1/ to 1/17/2020	17	FAA Loop	25
12/13/2019	1	Southeast Loop	95
10/22/2019	1	Happy Valley Loop	80
9/15/2019	1	Southeast Loop	95

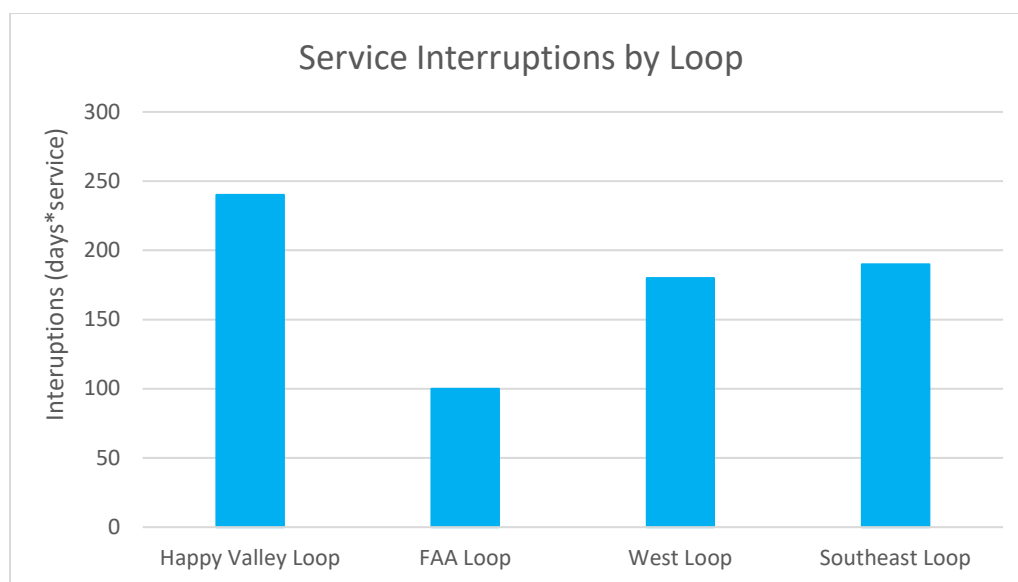


Figure 3.2: Service Interruptions by Loop

In January 2020, the FAA Loop pipe broke. The leak was noticed when WST levels began dropping at an estimated 500 gallons per minute. This resulted in a system-wide pressure drop and a community-wide boil water notice. Due to frozen ground and snow cover, the leak location was not found for over two weeks when a sound-wave detector could be flown in and the break location estimated. The FAA Loop was then isolated. Repairs took approximately two more weeks. The community was on boil water notice for approximately one month.

In March 2020, multiple leaks were detected because of rapid drop in the WST levels. On March 10, 2020, a community notice for water conservation was issued due to WST levels near five feet. Once the water levels drop below five feet, a boil water notice is issued. Again, on March 24, 2020, the City issued another notice for water conservation.

In June 2020, a minimum of 6 leaks were detected using leak detection equipment. Water loss was estimated at 100 gpm for approximately three days. The leaks were on Happy Valley and FAA Loops. The leaks resulted in water levels dropping below five feet. Boil water and water conservation notices were issued and lasted for 12 days.

Between August 2019 and March 2020, 17 water service lines failed due to corrosion and freezing. The previous years there were approximately 10 failures.

c. Reasonable Growth

Between 1880 and 2010, census data have shown a steady increase of 4.5 percent annually. The population peak in 2000 with 747. Between 2000 and 2010 censuses, the population dropped to 688. State of Alaska population estimates since 2010 has shown a steady increase with the population recovering to 722 by 2018 at an approximate rate of one percent.

A design rate of one percent appears to be a reasonable growth rate for the next 20 years. This equates to a design population of 866.

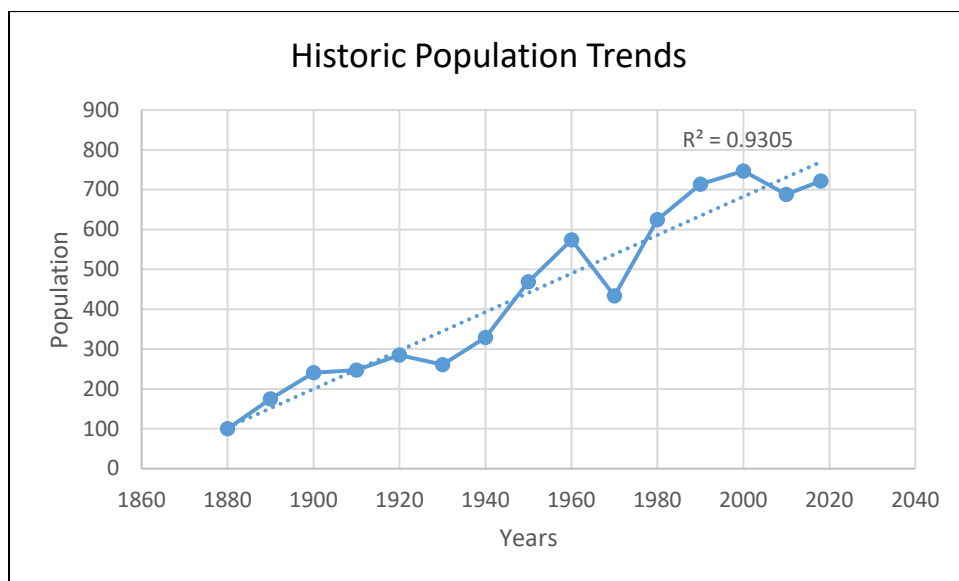


Figure 3.3: Historic Population Trends

4.0 ALTERNATIVES CONSIDERED

a. Alternatives

In reviewing the project needs and consulting with the community and agencies, the following alternatives were initially considered:

1. Do nothing
2. Replacement of In-house Copper Piping
3. Point-of-Entry (POE) treatment
4. Point-of-Use (POU) treatment
5. Service Line Rehabilitation
6. Water Distribution Replacement
7. Addition of a Corrosion Inhibitor

b. Unfeasible

After an initial review, the following alternatives were deemed unfeasible for a variety of reasons.

- *Replacement of In-house Copper Piping.* It appears that copper is entering the drinking water due to copper water service lines and not inhouse piping. Replacing inhouse piping would not reduce the copper levels.
- *Point of Entry Treatment:* POE treatment would require each house to be tested for copper levels to determine which houses were over actionable limits. A POE would be installed at each house to remove copper, but these are often not reliable. These systems would have to be owned and maintained by the City and would result in a significant Operations and Maintenance (O&M) effort. Public POE systems are very difficult to get approvals for and require routing sampling at every POE. This would neither be an efficient nor effective way to remove copper.
- *Point of Use Treatment:* POU treatment would require each house to be tested for copper levels to determine which houses are over actionable limits. POU systems would have to be installed at one or two fixtures within a house, such as a kitchen or bathroom sink. Typically, this is an under-sink filtration system. These systems would only decrease copper levels for drinking water. These systems would have to be owned by the homeowner and would require regular maintenance, such as replacing filters. Without regular maintenance these systems will fail within months. POU systems would increase the homeowner's O&M burden and costs. POU systems would provide a lower level of service and reliability while increasing homeowner burden.

4.1. Alternative 1: Do Nothing

a. Description

Alternative 1 evaluates doing nothing to the water distribution or water treatment. The copper levels would remain above the 1.3 milligrams per liter (mg/L) action level. The existing copper service lines would continue to degrade and be replaced individually by homeowners as they fail. Reports indicate that 10 to 12 water services lines would have to be replaced each year. The water mains would also require increased repair work because of the regular freezing and leaks.

In January 2020, there was a boil water notices for three weeks due to water main leaks. This existing condition of the water mains is financially burdensome to the community, decreases access to drinking water, and increases health risks.

The community is very concerned about the elevated copper levels and the poor conditions of the water distribution system.

Additional descriptions of the existing conditions are described in Section 3.0 Need for Project.

b. Design Criteria

There is no design or construction with Alternative 1. Table 4.1 compares the original design criteria with the recommended design criteria for current conditions. The existing water system meets or exceeds the recommended design criteria.

Table 4.1: Alternative 1-Do Nothing Design Criteria

Criteria	Value
Current Population	722
Current Residential Water Services	268
Current Commercial Water Services	26
Per Capita Usage (gpcd)	85
Domestic Daily Usage (gpd)	61,000
Processing Plant Peak Summer Use (gpd)	58,000
Total Daily Water Usage (gpd)	119,000
Total Water Storage (gallons)	1,000,000
Minimum Storage Required (gallons)	320,000
Useable Water Storage (gallons)	680,000
Days of Storage	6

c. Map

Location maps are included in Appendix A.

d. Environmental Impacts

- No impact to contaminated sites as there will be no excavation activities.
- No impact to cultural or archeological resources.
- No risk of flooding or erosion.
- No ground disturbance.
- No air pollution emissions.
- Frequent repairs and service lines are creating additional construction waste.

e. Land Requirements

The existing WTP is on City owned lot. No additional land purchase, easements, or easements are required.

f. Potential Construction Problems

Alternative 1 does not include any construction.

g. Sustainability Considerations

i. *Water and Energy Efficiency*

The current water distribution system experiences between 10 and 12 freeze-up incidents, leaks, or breaks per year. There is a significant amount of water loss due to leaks each year. In January 2020, there was a main line leak on the FAA Loop. It required continuous water treatment to maintain tank levels. Alternative 1: Do Nothing will continue to waste a significant amount of water each year.

ii. *Green Infrastructure*

Not applicable.

iii. *Other*

A significant O&M effort is necessary each year to continuously replace and repair water services and leaks.

h. Cost Estimate

There are no suggested improvements for Alternative 1 so there are no construction or non-construction costs. The O&M costs are for the existing water system.

Table 4.2: Alternative 1-Do Nothing Cost Estimates

Item	Cost
Construction (Capital) Costs	\$0
Non-Construction Costs	\$0
Total Project Costs	\$0
O&M Costs (Annual)	\$216,000

4.2. Alternative 2: Service Line Rehabilitation

a. Description

Alternative 2 would focus on rehabilitating the system by systematically replacing all copper service lines with non-copper piping over multiple years. The sampling data indicate that houses which have the copper service lines replaced no longer have elevated copper levels and freezing problems. This alternative could be constructed as a single capital project or multiple capital projects phased over several years.

The current service lines consist of two one-inch copper lines; one supply and one return. The two lines are inside a four-inch carrier pipe. The carrier pipe includes insulation and a CMP pipe jacket.

This alternative would replace the copper water lines with one-inch non-copper pipe, such as HDPE or PEX pipes. For cost estimating purposes, HDPE was the assumed water service pipe material. Due to the age and deterioration of existing carrier pipes, carrier pipes would be replaced with four-inch HDPE pipe. The carrier pipe would have three inches of insulation and a 11-inch HDPE jacket. The HDPE jacket provides a better water seal than CMP.

In addition to insulation, water service lines use pitorifices, heat trace, and circulation pumps to protect against freezing.

The service lines connect at the water main with copper pitorifices. The intent of the pitorifices is to provide passive circulation between the main and house. In the water services lines that have been replaced, the copper pitorifices are heavily corroded and are not providing circulation. Some communities are phasing out using pitorifices as pitorifices require higher velocities in the main to provide circulation and can snag up jetting or thawing equipment. This alternative would remove the existing pitorifices and would replace them with standard water service saddles. Circulation would be provided by a small inline circulation pump located in the house. The design velocities along the water main could be reduced to 1.5 feet per second, reducing pumping costs.

Most water services have heat trace within the carrier pipe. Typically, self-limiting, 5-Watt per foot, 120-volt heat trace is used. This alternative would include new heat trace.

Most houses have an inline circulation pump. The pump actively circulates the water between the house and the main. The circulation pumps are located in the house and are maintained by the homeowner. This alternative would not replace existing circulation pumps. If a house does not have a circulation pump or the existing pump is non-functioning, a pump would be installed. For estimation purposes, it is assumed that 25 percent of services require a new pump.

This alternative would replace the water service from the water main saddle to the connection of the house plumbing in the arctic box. Due to the age of system and houses, some arctic boxes would need to be replaced. For estimation purposes, it is assumed that 25 percent of service require new arctic boxes.

This alternative would not make any changes to the water treatment.

Table 4.3: Alternative 2-Service Line Rehabilitation Major Components

Alternative 2: Major Components
241 New Water Services
241 6-inch Saddles
36,150 feet 1-inch HDPE (service lines)
18,075 feet 4-inch x 11-inch HDPE Insulated Carrier Pipe
60 1/25 HP-3-Speed Circulation Pumps
18,075 feet 120-volt Heat Trace
60 Arctic Boxes

Phased Construction

This alternative has a significant capital cost. It could be broken into multiple projects and phased by water loop. The following table ranks the water loops by priority. The loops are prioritized using operator input and loop age.

Table 4.4: Water Services Rehabilitation Priority

Priority	Water Loops	Approximate Services
1	West Loop	60
2	Southeast Loop	81
3	North Loop (Happy Valley)	75
4	FAA Loop	20
5	School Loop	5
Total Replaced Services		241

b. Design Criteria

Table 4.5 contains the design criteria for Alternative 2.

Table 4.5: Alternative 2 Service Line Rehabilitation Design Criteria

Design Criteria	
Design Life (years)	20
Water Services (total)	241
Water Service Sizing (inches)	1
Average Water Service Length (feet)	75
Heat Trace (watt per foot)	5
Heat Trace Electrical Needs (volts)	120
Pipe Insulation (inches)	3
Pipe Material (type)	HDPE
Burial Depth (feet)	4

c. Map

Location maps are in Appendix A.

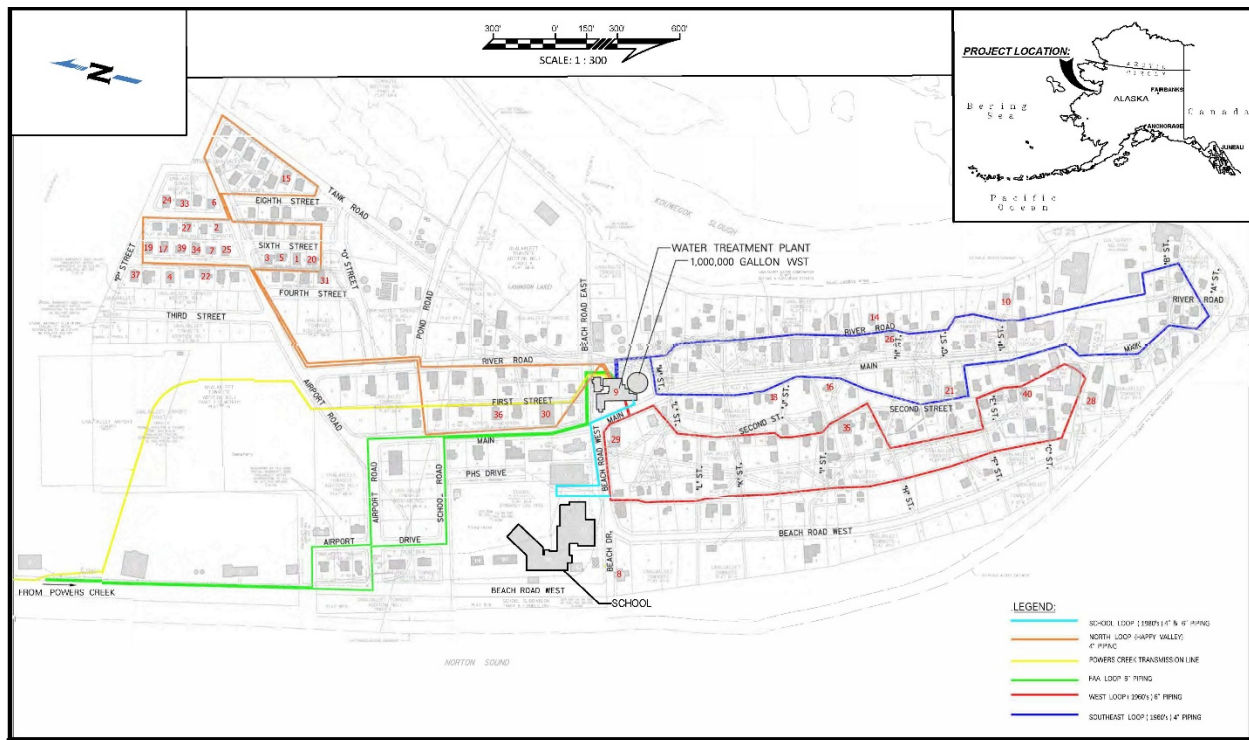


Figure 4.1: Alternative 2-Water Service Line Rehabilitation

d. Environmental Impacts

- There are several contaminated sites within the community. The excavations will be limited to disturbed sites and will follow existing water service lines. The risk is low but contingency plans for dealing with contaminated soils should be included as part of the design.
- There are multiple cultural and historic resources within the community. This alternative will minimize any impact since this is a rehabilitation of existing infrastructure. Nevertheless, the archeological impact should be studied during the preliminary engineering phase and a State Historical Preservation Office (SHPO) agreement needs to be obtained.
- No increased risk of flooding or erosion.
- The project area has not had a wetlands delineation. The water mains will parallel existing pipes. Excavations outside disturbed area will be less than 0.5 acres. A USACE Nationwide Permit will mostly likely need to be obtained.
- No air pollution emissions.
- This alternative would create construction waste. Construction waste would be disposed of in the landfill or back hauled by the contractor to an approved landfill.
- Approvals to Construct and Operate need to be obtained from ADEC.

e. Land Requirements

Work along the mains would occur in City-owned right-of-way (ROW). No additional ROW is anticipated.

Water service lines are on private property. Each homeowner would need to sign an agreement with the City to allow the contractor to work on their property and water service.

f. Potential Construction Problems

Construction risk is defined as a potential problem that could negatively affect the project feasibility, scope, schedule, or budget. The main construction risks for Alternative 2 include:

- *Deteriorated Mains.* Some of the water mains are between 30 and 60 years old. Sections are deteriorated, but since the lines are buried it is very difficult to estimate how much. There is a high probability that sections may have to be replaced to attach a new saddle for the water service.
- *Contaminated Soils.* There are three active contaminated soil sites within the project area. Two are along North Loop at tank farms. These will probably not impact the project since there are no water services in the area. One is along the FAA Loop near the FAA station. There may be one water service in the area. A contingency plan to deal with contaminated soil should be developed during the design phase.
- *Connection at House.* Each rehabilitated service will need to connect into an existing arctic box and house plumbing. The arctic boxes and plumbing conditions are unknown. There may need to be repairs or replacement of arctic boxes that are damaged or no longer structurally sound. If housing plumbing entering the arctic box is in poor condition it may need to be replaced. If it is odd sized or materials, additional fitting or material may be needed to attach the new piping.
- *Unexcepted Archeological Issues.* There are known cultural and archeological resources in the area. Though the project will be replacing existing infrastructure in disturbed areas additional archeological resources may be encountered. This should be mitigated with archeological action plan between the State, Tribe, funding agencies, and the City.

g. Sustainability Considerations

ii. Water and Energy Efficiency

The current water distribution system experiences between 10 and 12 freeze-ups, leaks, or breaks per year. There is a significant amount of water loss due to leaks each year. This alternative will reduce leaks and breaks over time, reducing the water loss.

iii. Green Infrastructure

Not applicable

iv. Other

This alternative will reduce O&M costs in the long run by decreasing the amounts of leaks. Once completed, it will reduce the amount of lead and copper sampling needed.

h. Cost Estimates

A detailed cost estimate is found in the Appendices.

Table 4.6: Alternative 2-Service Line Rehabilitation Cost Estimates

Item	Cost
Construction (Capital) Costs	\$6,875,600
Non-Construction Costs	\$3,678,312
Total Project Costs	\$10,553,912
O&M Costs (Annual)	\$196,000

4.3. Alternative 3: Water Main and Service Line Replacement

a. Description

This alternative is similar to Alternative 2 but would expand it to include replacement of the water mains. Depending on funding, this alternative could be completed in multiple projects phased by each water service loop or as a single project. This alternative would increase the life of the entire water distribution system.

Water Main Loops Replacement

There are five water main loops. The mains were constructed in between the 1960s and 1991. The water mains are buried arctic insulated pipe. FAA Loop and West Loop are six-inch pipes with three inches of insulation and corrugated metal pipe (CMP) jacket. School Loop, North Loop (Happy Valley), and West Loop are four-inch pipes with three inches of insulation and CMP jacket.

The water main loops will all be replaced with six-inch HDPE pipe with three inches of insulation and a 13-inch HDPE jacket. The replacement mains will follow the same alignment as the existing mains.

Only one water loop flow meter and one booster pump work. The flow meter, temperature gauges, pressure gauges, and pressure booster pumps for each water loop will be replaced. All water main valves would also be replaced.

The hydrants along the mains will need to be replaced with the mains. There are currently 22 hydrants within the community. Typically, hydrants are placed at intervals between 400 and 600 feet. Hydrant placement also is determined by routing. This estimate assumed that 35 new hydrants will be installed. These hydrants would be used to flush the water mains periodically.

Service Line Replacement

The current service lines consist of two one-inch copper lines; one supply and one return. The two lines are inside a four-inch carrier pipe. The carrier pipe includes insulation and a CMP pipe jacket.

This alternative would replace the copper water lines with one-inch non-copper pipe, such as HDPE or PEX pipes. For cost estimating purposes, HDPE was the assumed water service pipe material. Due to the age and deterioration of existing carrier pipes, carrier pipes would be replaced with four-inch HDPE pipe. The carrier pipe would have three inches of insulation and a 11-inch HDPE jacket. The HDPE provides a better water seal than CMP.

In addition to insulation, water service lines use pitorifices, heat trace, and circulation pumps to protect against freezing.

The service lines connect at the water main with copper pitorifices. The intent of the pitorifices is to provide passive circulation between the main and house. In the water services lines that have been replace, the existing copper pitorifices are heavily corroded and are not providing circulation. Some communities are phasing out using pitorifices. Pitorifices require higher velocities at the main to circulation and can snag up jetting or thawing equipment. This alternative would remove the pitorifices and would replace them with standard water service saddles. Circulation would be provided by a small inline circulation pump. The design velocities along the water main could be reduced to 1.5 feet per second, reducing pumping costs.

Most water services have heat trace within the carrier pipe. Typically, self-limiting, 5-Watt per foot, 120-volt heat trace is used. This alternative would include new heat trace.

Most houses have an inline circulation pump. The pump actively circulates the water between the house and the main. The circulation pumps are located in the house and are maintained by the homeowner. This alternative would not replace existing circulation pumps. If a house does not have a circulation pump or the existing pump is non-functioning, a pump would be installed. For estimation purposes, it is assumed that 25 percent of services require a new pump.

This alternative would replace the water service from the water main saddle to the connection of the house plumbing in the arctic box. Due to the age of system and houses, some arctic boxes would need to be replaced. For estimation purposes, it is assumed that 25 percent of service require new arctic boxes.

This alternative would not make any changes to the water treatment.

Table 4.7: Alternative 3 Water Main and Service Line Replacement Major Components

Alternative 3: Major Components
26,000 feet 6-inch x 13-inch Insulated HDPE (water mains)
10 Flow Meters
10 Pressure Booster Pumps
35 New Hydrants
241 New Water Services
241 6-inch Saddles
36,150 feet 1-inch HDPE (service lines)
18,075 feet 4-inch x 11-inch HDPE Insulated Carrier Pipe
60 1/25 HP-3 Speed Circulation Pumps
18,075 feet 120-volt Heat Trace
60 Arctic Boxes

Phased Construction

This alternative has a significant capital cost. It could be broken into multiple projects and phased by water loop. The following table ranks the water loops by priority. The loops are prioritized using operator input and loop age.

Table 4.8: Water Loop Replacement Priority

Priority	Loops	Approximate Feet	Services
1	West Loop	5,100	60
2	Southeast Loop	5,600	81
3	North Loop (Happy Valley)	7,500	75
4	FAA Loop	6,400	20
5	School Loop	1,400	5
Totals		26,000	241

b. Design Criteria

Table 4.9 contains the design criteria.

Table 4.9: Alternative 3-Water Main and Service Line Replacement Design Criteria

Design Criteria	
Design Life (years)	30
Water Mains	
Water Main Size (inches)	6
Water Main Pipe Insulation (inches)	3
Water Main Pipe Material	HDPE
Minimum Pipe Velocities (feet per second)	1.5
Water Pressure Range (psi)	40-60
Service Lines	
Water Services	241
Water Service Sizing (inches)	1
Average Water Service Length (feet)	75
Heat Trace (watt per foot)	5
Heat Trace Electrical Needs (volts)	120
Service Pipe Insulation (inches)	3
Pipe Material	HDPE
Burial Depth (foot)	4

c. Map

Location maps are in Appendix A.

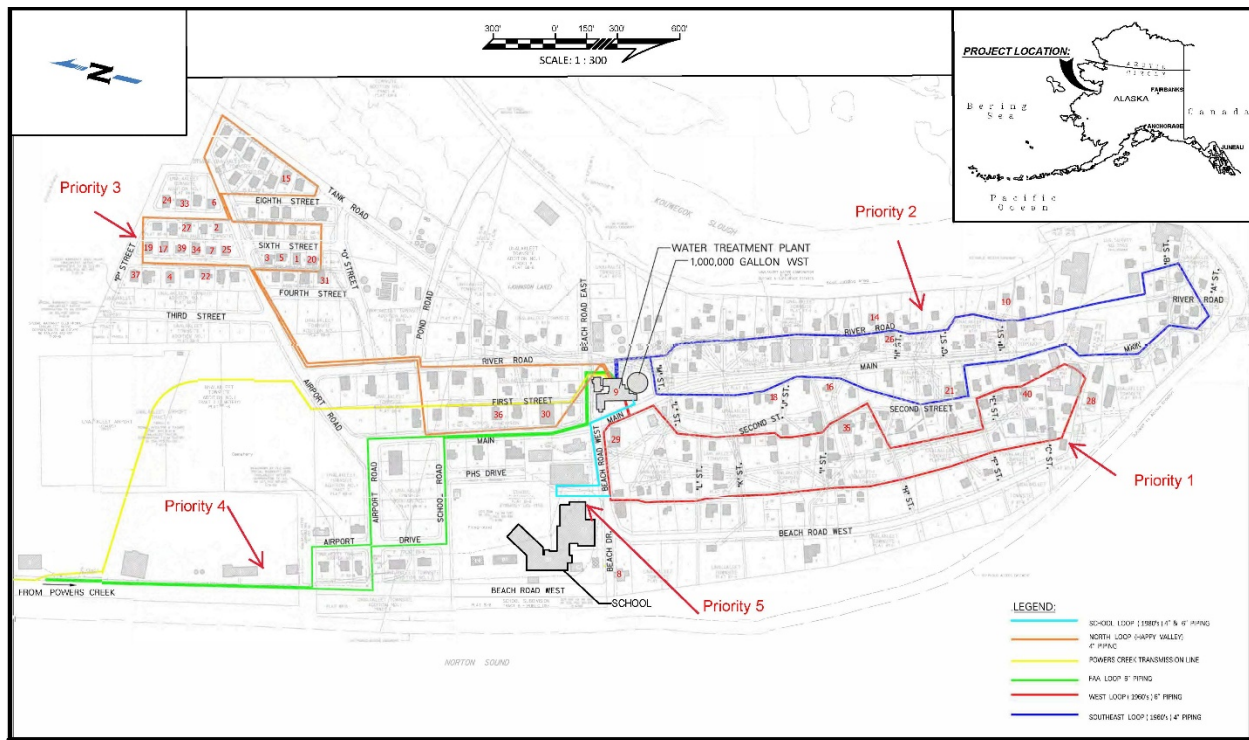


Figure 4.2: Alternative 3-Water Main Replacement and Priority

d. Environmental Impacts

- There are several contaminated sites within the community. The excavations will be limited to disturbed sites and will follow existing water main and service line routes. The risk is low but contingency plans for dealing with contaminated soils should be included as part of the design.
- There are multiple cultural and historic resources within the community. This alternative will minimize any impact since this is a rehabilitation of existing infrastructure. Nevertheless, the archeological impact should be studied during the preliminary engineering phase and a SHPO agreement needs to be obtained.
- No increased risk of flooding or erosion.
- The project area has not had a wetlands delineation. The water mains will parallel existing pipes. Excavations outside disturbed area will be less than 0.5 acres. A USACE Nationwide Permit will mostly likely need to be obtained.
- No air pollution emissions.
- This alternative would create construction waste. Construction waste would be disposed of in the landfill or back hauled by the contractor to an approved landfill.
- Approvals to Construction and Operate need to be obtained from ADEC.

e. Land Requirements

Work along the mains would occur in City owned ROW or utility easement. Previously the City has obtained utility easements for existing mains outside public ROW. In some areas West Loop and Southeast Loop may not be within those easements. A thorough easement search should be done during preliminary engineering and the budget should include contingency for easement acquisition.

Water service lines are on private property. Each homeowner would need to sign an agreement with the City to allow the contractor to work on their property and water service.

f. Potential Construction Problems

Construction risk is defined as a potential problem that could negatively affect the project feasibility, scope, schedule, or budget. The main construction risks for Alternative 3 include:

- **Contaminated Soils.** There are three active contaminated soil sites within the project area. Two are along North Loop at tank farms. These will probably not impact the project since there are no water mains or service lines in the area. One is along the FAA Loop near the FAA station. There may also be one water service in the area. A contingency plan to deal with contaminated soil should be developed during the design phase.
- **Connection at House.** Each rehabilitated service will need to connect into an existing arctic box and house plumbing. The arctic boxes and plumbing conditions are unknown. There may need to be repairs or replacement of arctic boxes that are damaged or no longer structurally sound. If housing plumbing entering the arctic box is in poor condition it may need to be replaced. If it is odd sized or materials, additional fitting or material may be needed to attach the new piping.
- **Lack of Record Drawings.** There is a lack of reliable record drawings for the water loops, particularly the older loops. There may be areas where existing water main goes outside the utility easement or ROW. There may be areas where buildings encroach on the existing water loops requiring new mains to be rerouted outside an existing easement. An extensive utility locate should be done during the survey efforts. This may include exploratory excavations or non-ground disturbing technologies.
- **Unexcepted Archeological Issues.** There are known cultural and archeological resources in the area. Though the project will be replacing existing infrastructure in disturbed areas additional archeological resources may be encountered. This should be mitigated with archeological action plan between the State, Tribe, funding agencies, and the City.

g. Sustainability Considerations

i. Water and Energy Efficiency

The current water distribution system experiences between 10 and 12 freeze up, leaks, or breaks per year. There is a significant amount of water loss due to leaks each year. This alternative will reduce leaks and breaks over time, reducing the water loss.

ii. Green Infrastructure

Not applicable.

iii. Other

This alternative will reduce O&M costs in the long run by decreasing the amounts of leaks. Once completed, it will reduce the amount of lead and copper sampling needed.

h. Cost Estimates

A detailed cost estimate is found in the Appendices.

Table 4.10: Alternative 3-Water Main and Service Line Replacement Cost Estimates

Item	Cost
Construction (Capital) Costs	\$15,663,600
Non-Construction Costs	\$7,989,800
Total Project Costs	\$23,653,400
O&M Costs (Annual)	\$145,000

4.4. Alternative 4: Addition of a Corrosion Inhibitor

a. Description

This alternative would combat the high levels of copper by adding a corrosion inhibitor in the treatment train. This alternative does not include rehabilitation or replacement of water loops or service lines.

Currently, water is treated with a coagulant, ferric chloride, to remove a large portion of the organics which are present in the raw water. The organic concentrations change the year. This requires the operator to routinely check ferric chloride dosages using a Streaming Current Detector and manually adjust the dosage. Ferric chloride is very acidic and soda ash is added to compensate for the low pH. Soda ash dosage is adjusted manually through use of a pH probe to get the correct pH. Operators report using 4-5 mg/L of soda ash, though this varies (e.g. changes in flows, seasonally, etc.).

A desktop corrosion study was performed by GV Jones & Associates. The full study can be found in Appendix D. The study indicated that existing raw water and treatment would result in a lead and copper level well above action limits. This verifies what is being seen in the field with copper samples over actionable limits since 2014.

The study looked at a variety of ways to control corrosion. They included:

- Soda Ash Dosage
- Soda Ash Dosage with 2 mg/L Phosphate
- Addition of polyphosphates

The study showed that soda ash dosage could reduce copper below actionable levels but only with dosages increase, 20 to 30 mg/L more than currently being used. This approximately 5 times the current average dosage. Increasing soda ash alone would not reduce lead below actionable levels.

Next the study added 2 mg/L of orthophosphate with the soda ash. The addition of orthophosphate was dramatic. The copper concentrations were brought below 0.5 mg/L without the addition of any soda ash. Soda ash would still be needed for pH control, but at lower levels.

The study found that polyphosphate should not be used at this facility. It could increase lead levels. Since the lead levels are already elevated but below actionable levels, this would be a risky option.

The study provided the following recommendations for corrosion control strategy.

1. Verify that the existing pH probe used to control soda ash dosages is calibrated and functioning properly. This may involve independent verification of the pH with a secondary pH meter, the replacement of the existing meter, or both.
2. Increase the dosage of soda ash in the potable water distribution system and measure the effects of that change on the concentrations of lead and copper in the finished water.
3. Examine available sections (if any) of copper piping removed from the distribution system for signs of pitting corrosion. If significant pitting corrosion is observed, consider conducting pipeline replacements in conjunction with water treatment process changes to correct corrosion problems.
4. Conduct bench scale dosing experiments with soda ash to determine the pH-dose relationship for the Unalakleet treated water.
5. Continue to add soda ash to treated water and adjust its dosage as needed to sustain the set point target finished water pH.
6. Initiate addition of orthophosphate as disodium phosphate at an initial dose of 5 to 6 mg/L PO_4 to establish that residual concentration throughout the distribution system. Then back off the dose to maintain a 2 to 3 mg/L phosphate (PO_4^{3-}).
7. Follow-up monitoring for lead, copper, pH, alkalinity and orthophosphate concentration should be conducted at a minimum of 20 locations in the distribution system on monthly intervals for the first six months following establishing a distribution-wide phosphate residual of 5 to 6 mg/L as PO_4^{3-} . Based on the results of these samples, the orthophosphate dose can be further adjusted.

Health and Safety

Approximately 65 percent of all WTP in the United States use orthophosphate or other phosphates. Orthophosphates breakdown to hydrogen and phosphates. The hydrogen become water and the phosphates coat the pipes to prevent leaching of lead and copper. Very little phosphate ends up in the water at the tap. EPA approves the use of orthophosphate for drinking water and in recent years has considered requiring all WTP to use some form of phosphates to protect against lead¹⁷. The Federal Department of Agriculture considers phosphates to be safe for human consumption and are found in many foods. The amount of phosphates that will end up in the water would be 100 times less than found in typical human diet. For example, it would take 2.5 to 4 gallons of water to equal the same amount of phosphate in one can of soda.

Limitations

Corrosion inhibitors do not repair damaged pipes. Existing corrosion damaged is extensive and existing pipes will still need to be replaced. Corrosion inhibitors would only reduce future damage to pipes.

¹⁷ LCR Federal Consolation, 2018. <https://www.epa.gov/sdwa/lcr-federalism-consultation> (retrieved 5/18/2020).

The desktop study is only applicable to the existing water source and current treatment system. Any change to the water source or treatment process would impact the need for corrosion inhibitors. The community is currently changing its water source to groundwater. In March 2020, pump tests were completed for the new community well system. The groundwater does not appear to be corrosive and ferric chloride will not be needed in the treatment. Once the community changes to the new water source no corrosion inhibitors will be needed.

Table 4.11: Alternative 4-Addition of Corrosion Inhibitor Major Components

Major Components
Calibrate Existing pH Probes
Soda Ash and pH Bench Study
Orthophosphate Injection System

b. Design Criteria

The following table contains the design criteria.

Table 4.12: Alternative 4-Addition of Corrosion Inhibitor Design Criteria

Criteria	Value
Design Life (years)	20
Per Capita Usage (gpcd)	85
2018 Domestic Daily Usage (gpd)	61,000
Processing Plant Peak Summer Use (gpd)	58,000
2018 Total Daily Water Usage (gpd)	119,000
Daily Average Design Flow Rate (gpm)	90
Maximum Day Demand Factor	2
Peak Hourly Flow Rate Factor	3
Treatment Objectives	
Lead (µg/L)	<15.0
Copper (mg/L)	< 1.0
pH Range	6.7-7.4

c. Map

Location maps are in Appendix A.

d. Environmental Impacts

A review of the environmental impacts of Alternative 4 found the following items:

- No contaminated sites would be impacted.
- No impact to cultural or archeological resources.
- No risk of flooding or erosion.
- No ground disturbance.
- No air pollution emissions.

- Addition of orthophosphate to the treatment process. Though orthophosphates can cause skin irritation, it is relatively safe and stable. It does not require special disposal and poses no toxicity for the environment.
- Approvals to Construct and Operate need to be obtained from ADEC.

e. Land Requirements

All improvements would be within the WTP. No additional land or ROW needed.

f. Potential Construction Problems

Construction risk is defined as a potential problem that could negatively affect the project feasibility, scope, schedule, or budget. The main construction risks for Alternative 4 include:

- *Pipe Replacement Required.* Corrosion inhibitors will stop or reduce future corrosion but if corrosion is causing pitting or pipe failures, those pipes will need to be replaced. There is a high likelihood that pipe replacement will continue to be required, even with corrosion inhibitors, though that could be done over time.
- *Change in Water Source.* The study only applies to the existing water source, which is a surface water. If the water source is changed during or after construction, the entire water treatment system, including the corrosion control system, would need to be reevaluated. Each source water is different, and the equipment, chemicals, and procedures may need to be changed. If the new water source is groundwater, then it is likely that no corrosion inhibitor will be necessary. The community is currently testing new drinking water wells for a new water source.

g. Sustainability Considerations

i. Water and Energy Efficiency

The current water distribution system experiences between 10 and 12 freeze up, leaks, or breaks per year. There is a significant amount of water loss due to leaks each year. This alternative will reduce future corrosion which will decrease leaks and breaks over time, reducing the water loss.

ii. Green Infrastructure

Not applicable

iii. Other

Alternative 4 would increase the O&M efforts and costs with the introduction of an additional chemical. This should be offset by the reduction in corrosion related leaks and testing.

h. Cost Estimates

See attached cost estimate for details.

Table 4.13: Alternative 4-Stick-Built WTP Cost Estimates

Item	Cost
Construction (Capital) Costs	\$39,000
Non-Construction Costs	\$71,770
Total Project Costs	\$110,770
O&M Costs (Annual)	\$221,000

5.0 SELECTION OF AN ALTERNATIVE

This section analyzes the alternatives in a systematic manner using both monetary and non-monetary factors. Monetary factors include construction costs, non-construction costs, O&M costs, and life cycle costs. Non-monetary factors may include health, social, economic, environmental, sustainability, or risks.

From this analysis, an alternative is selected for recommendation. The recommended alternative is then developed into a project described in Section 6.0.

a. Life Cycle Costs Analysis

A life cycle cost analysis for each alternative is presented in Table 5.1. The analysis includes construction costs, non-construction costs, O&M costs, and short-lived assets costs. O&M costs include annual cost for the entire design life. Short-lived assets include costs associated with disposable items or replacement parts needed throughout the design life. All costs are shown at present values.

Table 5.1: Life Cycle Costs Analysis

Costs	Alternatives			
	1-Do Nothing	2-Service Line Rehabilitation	3-Water Main and Service Line Replacement	4-Additional of Corrosion Inhibitors
Construction (Capital) Costs	\$0	\$6,875,600	\$15,663,600	\$39,000
Non-Construction Costs	\$0	\$3,678,312	\$7,989,800	\$71,770
Total Project Cost	\$0	\$10,553,912	\$23,653,400	\$110,770
O&M Costs (Annual)	\$216,000	\$196,000	\$145,000	\$221,000
Life Cycle Costs	\$4,668,460	\$11,156,388	\$13,838,838	\$4,604,976

Notes:

1. Alternative 1-Do Nothing has no project costs. Annual O&M costs taken from 2018 financial reports.
2. O&M are based on 2020 budget and 2019 actuals, with costs added for water service repairs, then adjusted for project specific details.

b. Non-Monetary Factors

Non-monetary factors have a significant impact on the success of a project. Table 5.2 quantifies the identified non-monetary factors. The engineer—in consultation with the owner, community, and agencies—assigns a numerical value to each factor from 1 to 5, with 1 being the most desirable alternative and 5 being the least desirable alternative. The alternative with the lowest overall score is the most desirable non-monetarily.

Table 5.2: Quantitative Analysis of Non-Monetary Factors

Alternatives	1-Do Nothing	2-Service Line Rehabilitation	3-Water Main and Service Line Replacement	4-Addition of Corrosion Inhibitor
Quality of Life	5	2	1	3
O&M Effort	5	2	1	3
Safety and Water Security	5	2	1	3
Easements/Land Requirements	1	2	2	1
Permitting Effort	1	2	3	3
Construction Risks	1	3	4	4
Community Support	5	2	1	2
Totals	23	15	12	19

Note:

1. Lowest score for each factor is in bold.

The non-monetary factors are defined as follows:

- **Quality of Life:** How much does the alternative affect health and hygiene within the community? How likely is it to reduce lead and copper levels?
- **O&M Effort:** The relative effort and difficulty for the community to operate and maintain the alternative. How much extra effort will it take? Will it decrease leaks and breaks?
- **Easements/Land Requirements:** How much easement must be obtained? What is the level of effort required to obtain it?
- **Permitting Effort:** How many permits will be required? What is the complexity of the ADEC approvals? Will special permits or variances be required?
- **Construction Risks:** The design is not completed and there are lots of unknowns. What is the likelihood that issues with design or construction would increase the costs or schedule? How difficult is the alternative to construct?
- **Community Support:** Does the community want the alternative? Which alternative is preferred? Is there an alternative that the community does not support?

The following tables summarizes the advantages and disadvantages of each alternative for comparison

Table 5.3: Alternatives Pros and Cons Summary

Alt	Description	Advantages	Disadvantages
1	Do Nothing	No capital costs	- Continued leaks and breaks - Continued water shortages - Highest O&M costs - Copper above action levels - Frequent service interruptions - Community wants change
2	Service Line Rehabilitation	- Increases level of service - New service lines - Decrease O&M Costs - Decrease Copper levels	- Mains still leak and freeze - High costs
3	Water Main and Service Line Replacement	- Highest level of service - Highest community support - New mains/service lines - Lowest O&M and repairs - Decrease Copper levels	- Highest costs - High risk construction
4	Addition of Corrosion Inhibitor	- Reduces Copper levels - Reduces future corrosion - Short construction period - Low capital costs	- Increases O&M effort - Does not fix existing damage - Unnecessary if water source changes

6.0 PROPOSED PROJECT (RECOMMENDED ALTERNATIVE)

This section provides recommendations for which alternatives should be implemented. The selected alternative is developed into a proposed project. The proposed project is a road map for Unalakleet and VSW to guide them from planning through construction. This section summarizes the project plan.

a. Preliminary Project Design

The recommend alternative is Alternative 3: Water Main and Service Line Replacement.

The proposed project would replace the water mains, distribution pumps, and water service lines.

There are five water main loops, constructed in between the 1960s and 1980s. The water main loops will all be replaced with six-inch HDPE pipe with three inches of insulation and a HDPE jacket. The flow meter, temperature gauges, pressure gauges, and pressure booster pumps for each water loop will be replaced. All the hydrants and water main valves would also be replaced.

The current services lines consist of two one-inch copper lines; supply and return in an insulated pipe. The proposed project would replace the water service lines with one-inch HDPE or PEX pipes. The carrier pipe would be replaced with four-inch insulated HDPE pipe. The proposed project would remove the existing pitorifices and would replace them with standard water service saddles. Without the pitorifices, the design velocities along the water main could be reduced to 1.5 feet per second, reducing pumping costs. Heat trace would be installed along each water service.

The proposed project would replace the water service from the water main saddle to the connection of the house plumbing in the arctic box. Due to the age of system and houses, some arctic boxes and interior circulation pumps would need to be replaced. For estimation purposes, it is assumed that 25 percent of services will require new arctic boxes and circulation pumps.

No changes would be made to the water treatment.

Table 6.1: Preferred Alternative-Water Main and Service Line Replacement Major Components

Alternative 3: Major Components
26,000 feet 6-inch x 13-inch Insulated HDPE (water mains)
10 Flow Meters
10 Pressure Booster Pumps
35 New Hydrants
241 New Water Services
241 6-inch Saddles
36,150 feet 1-inch HDPE (service lines)
18,075 feet 4-inch x 11-inch HDPE Insulated Carrier Pipe
60 1/25 HP-3 Speed Circulation Pumps
18,075 feet 120-volt Heat Trace
60 Arctic Boxes

b. Project Schedule

The proposed project schedule is outlined in the Gantt chart in the Appendices Table 6.2 summarizes the project schedule. This schedule assumes a single construction contract over multiple years of construction.

Table 6.2: Preferred Alternative-Water Main and Service Line Replacement Project Schedule

Proposed Project Schedule Summary	
Secure Funding	June 2020-September 2021
Preliminary Engineering	September 2021-October 2021
Engineering Design	September 2021-March 2022
Bidding	March-April 2022
Construction Schedule	June 2022-September 2026
Construct West Loop	August-October 2022
West Loop Services Construction	June-August 2023
Southeast Loop Construction	July-October 2023
Southeast Services Construction	June-September 2024
North Loop Construction	July-October 2024
North Loop Services Construction	June-September 2025
FAA Loop Construction	July-September 2025
School Loop Construction	September-October 2025
FAA Loop Services Construction	June-July 2026
School Loop Services Construction	July-August 2026
Project Completion Date	November 2026

c. Permit Requirements

The following permits and agency approvals are anticipated to be required for the project:

- ADEC Water Approval to Construct
- ADEC Water Interim Approval to Operate
- ADEC Water Final Approval to Operate
- USACE Nationwide Permit

d. Sustainability Considerations

i. Water and Energy Efficiency

The current water distribution system experiences between 10 and 12 freeze up, leaks, or breaks per year. There is a significant amount of water loss due to leaks each year. The proposed project will reduce future corrosion which will decrease leaks and breaks over time, reducing the water loss.

ii. Green Infrastructure

Not applicable

iii. Other

Replacing aged infrastructure will reduce the leaks and freeze across the system. This will make the entire water system more resilient and stable. It will free up O&M staff from emergency repairs and allow them to focus on operational and preventative maintenance.

e. Total Project Cost Estimate (Engineer's Opinion of Proposal Costs)

The following tables summarize the construction and non-construction costs for the proposed project.

Table 6.3: Preferred Alternative-Water Main and Service Line Replacement Construction Costs

Construction (Capital) Costs				
Item	No.	Unit	Cost	Total
Mob and Demob	1	LS	\$1,500,000	\$1,500,000
Homeowner Coordination	241	EA	\$500	\$120,500
Maintaining Water Service	1	LS	\$30,000	\$30,000
Construction Survey	1	LS	\$100,000	\$100,000
Archeological Control	306	DAY	\$1,200	\$367,200
SWPPP and Erosion Control	1	LS	\$20,000	\$20,000
Water Services				
Connection to Main	241	EA	\$1,500	\$361,500
1-inch HDPE Supply/Return Lines	36,150	FT	\$10	\$361,500
4-inch x 12-inch HDPE Insulation Pipe	18,075	FT	\$200	\$3,615,000
Heat Trace (5w per ft, 120v)	18,075	FT	\$12	\$216,900
Connection to House	241	EA	\$1,000	\$241,000
Circulation Pumps (limited to 25 percent)	60	EA	\$500	\$30,000
Arctic Box Repair (limited to 25 percent)	60	EA	\$5,000	\$300,000
House Plumbing Repair (limited to 25 percent)	60	EA	\$5,000	\$300,000
Water Mains				
6-inch x 14-inch HDPE Insulated Pipe	26,000	FT	\$250	\$6,500,000
Valves	50	EA	\$5,000	\$250,000
Insulated Valve Boxes	50	EA	\$10,000	\$500,000
Hydrants	35	EA	\$15,000	\$525,000
Water Treatment Plant				
Pressure Booster Pumps	10	EA	\$15,000	\$150,000
Flow Meters	10	EA	\$5,000	\$50,000
Miscellaneous WTP Piping Work	1	LS	\$50,000	\$50,000
Miscellaneous Gauges/Sensors/Controls	1	LS	\$50,000	\$50,000
Start Up and Commissioning	1	LS	\$25,000	\$25,000
Total			\$15,663,600	

Table 6.4: Preferred Alternative-Water Main and Service Line Replacement Non-Construction Costs

Non-Construction Costs				
Item	No.	Unit	Cost	Total
Survey/Utility Locates	1	LS	\$75,000	\$75,000
Geotechnical	1	LS	\$8,000	\$8,000
ROW/Easement Research Acquisition	1	LS	\$40,000	\$40,000
Archeological Agreements/Plan	1	LS	\$15,000	\$15,000
Engineering	10%	OF	\$15,663,600	\$1,566,360
Permitting	1	LS	\$20,000	\$20,000
Resident Project Representative	5%	OF	\$15,663,600	\$783,180
Construction Administration	12%	OF	\$15,663,600	\$1,879,632
Project Administration	8%	OF	\$15,663,600	\$1,253,088
Project Contingency	15%	OF	\$15,663,600	\$2,349,540
Total			\$7,989,800	

Table 6.5: Preferred Alternative-Water Main and Service Line Replacement Project Cost Summaries

Item	Cost
Construction (Capital) Costs	\$15,663,600
Non-Construction Costs	\$7,989,800
Total Project Costs	\$23,653,400
O&M Costs (Annual)	\$145,000

Phased Construction

There are cost savings to constructing the proposed project under one construction contract. However, that may not be feasible due to funding restrictions. In that case the proposed project could be constructed in phases. Each water main loop, and associated services, has been separated into phases, which would be constructed independently of each other. The community has prioritized the phases. The Table 6.6 summarizes the costs associated with each phase.

Table 6.6: Project Costs by Phases

Costs	Phases by Priority				
	1 - West Loop	2 - Southeast Loop	3 - North Loop (Happy Valley)	4 - FAA Loop	5 - School Loop
Construction (Capital) Costs	\$3,469,500	\$4,119,500	\$4,549,000	\$2,789,500	\$1,102,000
Non-Construction Costs	\$1,892,750	\$2,217,750	\$2,432,500	\$1,552,750	\$709,000
Total Project Cost	\$5,362,250	\$6,337,250	\$6,981,500	\$4,342,250	\$1,811,000

f. Annual Operating Budget

The annual operating budget was estimated using the FY2019 budget actuals and the FY2020 budget. The FY2020 budget was approved by the City council by Ordinance No. 2019-03.

Historically the water system has been self-sufficient. Collection of water rates has paid for O&M costs with reserves. The water system's FY2019 budget actuals reflected a net income of \$102,000.

The proposed annual operating budget could result in a net income of \$135,000. This could allow the system to build a reserve for emergency repairs and future capital projects or it could allow rate reductions.

Table 6.7: Annual Operating Budget Summary

Annual Operating Budget Summary	
Income	\$280,000
Expenses (O&M Costs)	(\$145,000)
Net Income	\$135,000

i. Income

Income was estimated using the FY2020 budget which was approved by Ordinance No. 2019-03. Current water rates are \$63 per month with a senior rate of \$42 per month. FY2019 actual revenue for the water utility was \$280,000. The FY2020 budget revenue is \$280,000. This project will not add or subtract services. No changes to the water rates are recommended.

ii. Annual O&M Costs

Table 6.7 summarizes the proposed budget. O&M costs for the system used the FY2020 budget which was approved by Ordinance No. 2019-03. FY2019 actual expenses for the water utility was \$178,000. The FY2020 budget expenses is \$178,000. The proposed budget is modified to reflect the proposed improvements. Electricity costs would be reduced due to the more efficient replacement pumps. Parts, supplies, and freight costs were reduced by 50 percent to reflect improvements to the mains and pumps. Repairs and Replacement was reduced by 66 percent due to the decrease in freezing and leaks.

Table 6.8: Preferred Alternative-Water Main and Service Line Replacement Annual O&M Budget

Operations and Maintenance Costs (Annual)				
Item	No.	Unit	Cost	Total
Salary and Payroll Benefits	1	LS	\$60,000	\$60,000
Travel and Per Diem	1	LS	\$5,000	\$5,000
Fuel Oil and Gas	1	LS	\$10,000	\$10,000
Electricity	1	LS	\$30,000	\$30,000
Parts, Supplies, and Freight	1	LS	\$20,000	\$20,000
Repairs and Replacement	1	LS	\$4,000	\$4,000
Insurance	1	LS	\$4,000	\$4,000
Fees	1	LS	\$10,000	\$10,000
Other	1	LS	\$2,000	\$2,000
Total			\$145,000	

iii. Debt Repayment

This project is expected to be funded through grants. Loans will not be used to finance these improvements; therefore, debt repayment is not anticipated.

iv. Reserves

Debt Service Reserve: This project will be funded through grants. There is no requirement for a General Obligation bond, loan security, or cash reserves.

Short-Lived Asset Reserves: A list of short-lived assets is included in the appendix. The proposed annual operating budget has an estimate net income of \$135,000. These funds could cover the costs of the short-lived assets.

7.0 CONCLUSIONS AND RECOMMENDATIONS

VSW and City of Unalakleet contracted with Kuna Engineering in August 2019 to develop a PER for improvements to the water distribution system and compliance to the Lead and Copper Rule. The project was funded by USDA-RUS and the State of Alaska. The PER was prepared using the USDA-RUS Bulletin 1780-2.

The City of Unalakleet is located in the western part of Alaska along the coast of the Norton Sound. It is the eastern-most community of the ten towns and villages that rim the Norton Sound, immediately next to the mouth of the Unalakleet River, with trees, tundra, and hills behind it. Unalakleet is located 148 miles southeast of Nome and 395 miles northwest of Anchorage. The community is located off the road system and is only accessible by airplane or boat. The Inupiat community has a 2018 estimate population of 686 with approximately 268 housing units.

The water system is one of the oldest in rural Alaska. It was initially constructed in the 1960s. There are five circulating water main loops. Most of the loops are constructed of steel or PVC insulated pipe. The water services are mostly circulating one-inch copper piping. The copper piping in a four-inch insulated carrier pipe. There has not been a significant upgrade to the water system since 1991. A detailed description of the system is found in Section 2.0.

The distribution system's pipes have deteriorated over time, which has accelerated in recent years, making the pipe brittle and more susceptible to freezing. Between September 2019 and August 2020 there were eleven major leaks in the mains resulting in the shutdown of at least one loop. There was a total of 30 days without water service for a significant portion of the community. Due to leaking there was five separate boil water notices issued that totaled 86 days. The community has extended periods of water conservation due to water main breaks. The copper water lines are heavily corroded resulting in pipe wall failure, decreased circulation, and increased freezing. Since August 2019, there have been 17 water services that have failed and required replacement. The deterioration of the copper has also increased the copper levels in the water over EPA action levels. A detailed description of the project needs is found in Section 3.0.

In reviewing the project needs and consulting with the community and agencies, this PER analyzed the following alternatives:

1. Do Nothing (no improvements)
2. Water Service Rehabilitation
3. Water Main and Service Line Replacement
4. Addition of a Corrosion Inhibitor

After reviewing and analyzing the alternatives, Alternative 3: Water Main and Service Line Replacement is recommended as the best alternative to meet the needs of the community. The community and VSW concur with the recommendation. A detailed description of the recommended alternative is found in Section 4.0 and a description of the proposed project plan is found in Section 6.0.

Proposed Project: Water Main and Service Line Replacement

The proposed project includes the replacement of Unalakleet's five circulating water main loops, distribution pumps, and water service lines. Each water main loop will be replaced along the same route. The new mains will be six-inch insulated HDPE pipe. All associated valves and hydrants will also be replaced. The existing distribution pumps will be replaced. All associated flow meters, pressure gauges, temperate gauges, controls, and other instrumentations will also be replaced.

The water service lines within the system will be replaced. The new water service lines will consist of one-inch HDPE or PEX supply and return lines. The lines will be in a four-inch insulation HDPE pipe. The services will include new water service saddles, heat trace, and connection at the arctic box. Due to the age and conditions of the system it is assume that 25 percent of the water services will need new arctic boxes and circulation pumps.

The proposed project will not make any changes to the water source, water treatment, or water storage.

Table 7.1: Proposed Project Cost Summary

Proposed Project Cost Summary	
Construction Costs	\$15,663,600
Non-Construction Costs	\$7,989,800
Total Project Cost	\$23,653,400

Table 7.2: Annual Proposed Budget Summary

Annual Proposed Budget Summary	
Revenue	\$280,000
O&M Costs	\$145,000
New Annual Budget	\$135,000

Table 7.3: Proposal Project Schedule Summary

Proposed Project Schedule Summary	
Secure Funding	September 2020-September 2022
Engineering	September 2022-March 2023
Construction Schedule	June 2023-September 2027
Construct West Loop	August-October 2023
West Loop Services Construction	June-August 2024
Southeast Loop Construction	July-October 2024
Southeast Services Construction	June-September 2025
North Loop Construction	July-October 2025
North Loop Services Construction	June-September 2026
FAA Loop Construction	July-September 2026
School Loop Construction	September-October 2026
FAA Loop Services Construction	June-July 2027
School Loop Services Construction	July-August 2027
Project Completion Date	November 2027

APPENDICES

Appendix A: Maps and Figures

- A1: Community Map
- A2: Project Area
- A3: Water Distribution Loops
- A4: Water Distribution Loops Priority

Appendix B: Reports and Photos

- 2017 ADEC Copper Exceedance Letter
- 2020 Best Management Plan
- 2020 VSW Trip Report

Appendix C: Copper Sampling

Appendix D: Desktop Corrosion Study

- Unalakleet Desktop Corrosion Study. GV Jones & Associates. March 2, 2020.

Appendix E: Cost Estimates & Financial Documents

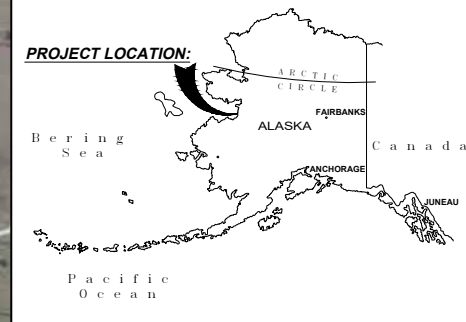
- Detailed Cost Estimates
- Life Cycle Cost Estimates
- Cost Summary
- Proposed Project Phases: Detail Cost Estimates
- City of Unalakleet FY2020 Budget
- 2017 Comprehensive Energy Audit for Unalakleet Water Treatment Plant

Appendix F: Propose Project Schedule

Appendix G: Approvals

Appendix A: Maps and Figures

- A1: Community Map
- A2: Project Area
- A3: Water Distribution Loops
- A4: Water Distribution Loops Priority



WATER SERVICE IMPROVEMENTS

UNALAKLEET, ALASKA

PRELIMINARY ENGINEERING REPORT

PROJ. NO.	165.030153
DRAWN	FRW
CHECKED	DEN
DATE	02/04/20



4300 B Street, Ste 605
Anchorage, AK 99503
907-339-6500 Fax 907-339-5327
www.kunaeng.com License #: AELS129381

COMMUNITY MAP

A1



WATER SERVICE IMPROVEMENTS UNALAKLEET, ALASKA PRELIMINARY ENGINEERING REPORT

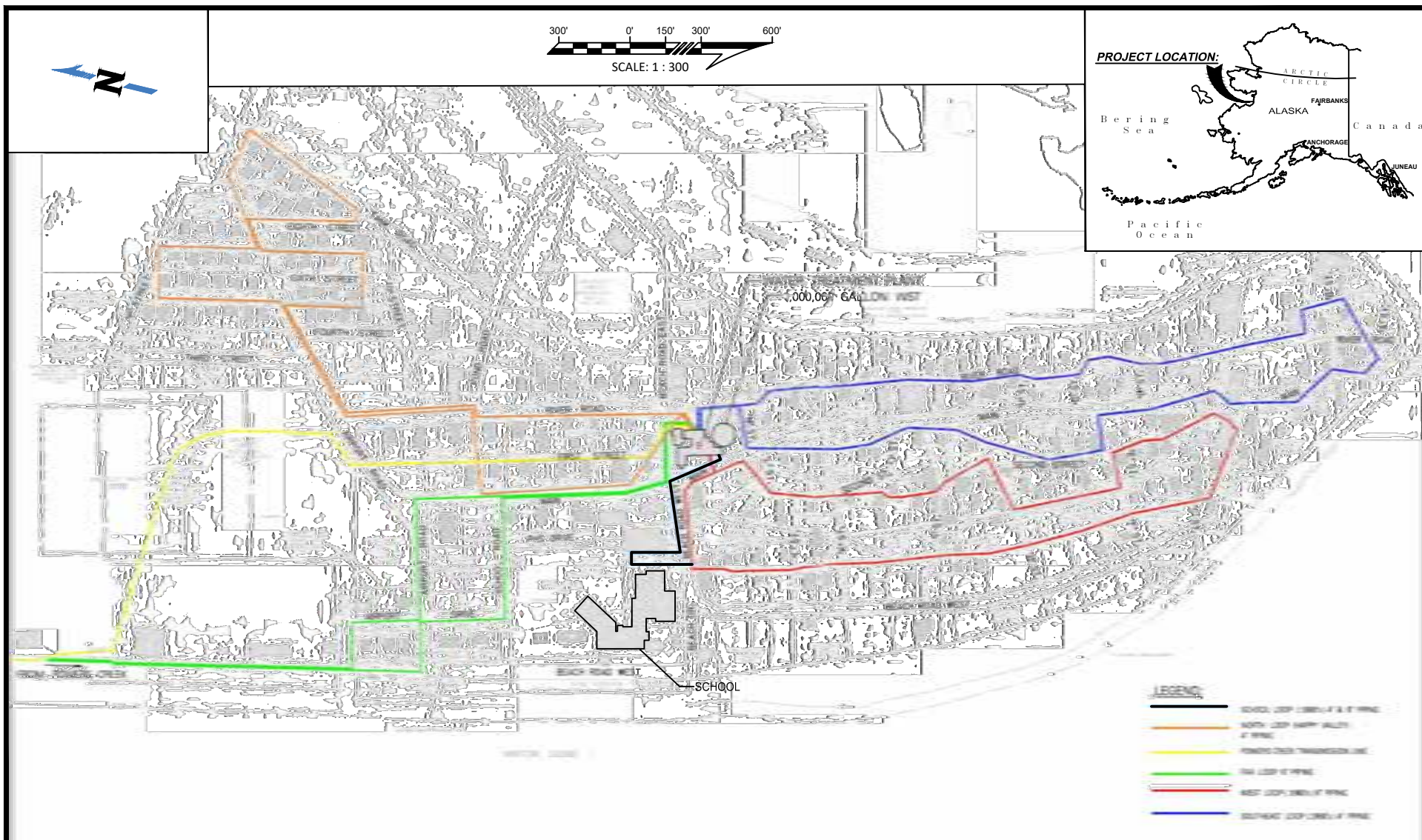
PROJ. NO.	165.030153
DRAWN	FRW
CHECKED	DEN
DATE	02/04/20



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**PROJECT
AREA**

A2



WATER SERVICE IMPROVEMENTS **UNALAKLEET, ALASKA** **PRELIMINARY ENGINEERING REPORT**

PROJ. NO.	165.030153
DRAWN	FRW
CHECKED	DEN
DATE	02/04/20



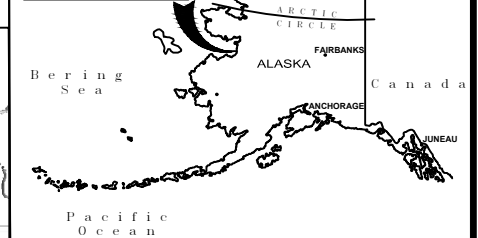
4300 B Street, Ste 605
 Anchorage, AK 99503
 907-339-6500 Fax 907-339-5327
 www.kunaeng.com License #: AE129381

WATER **DISTRIBUTION** **LOOPS**

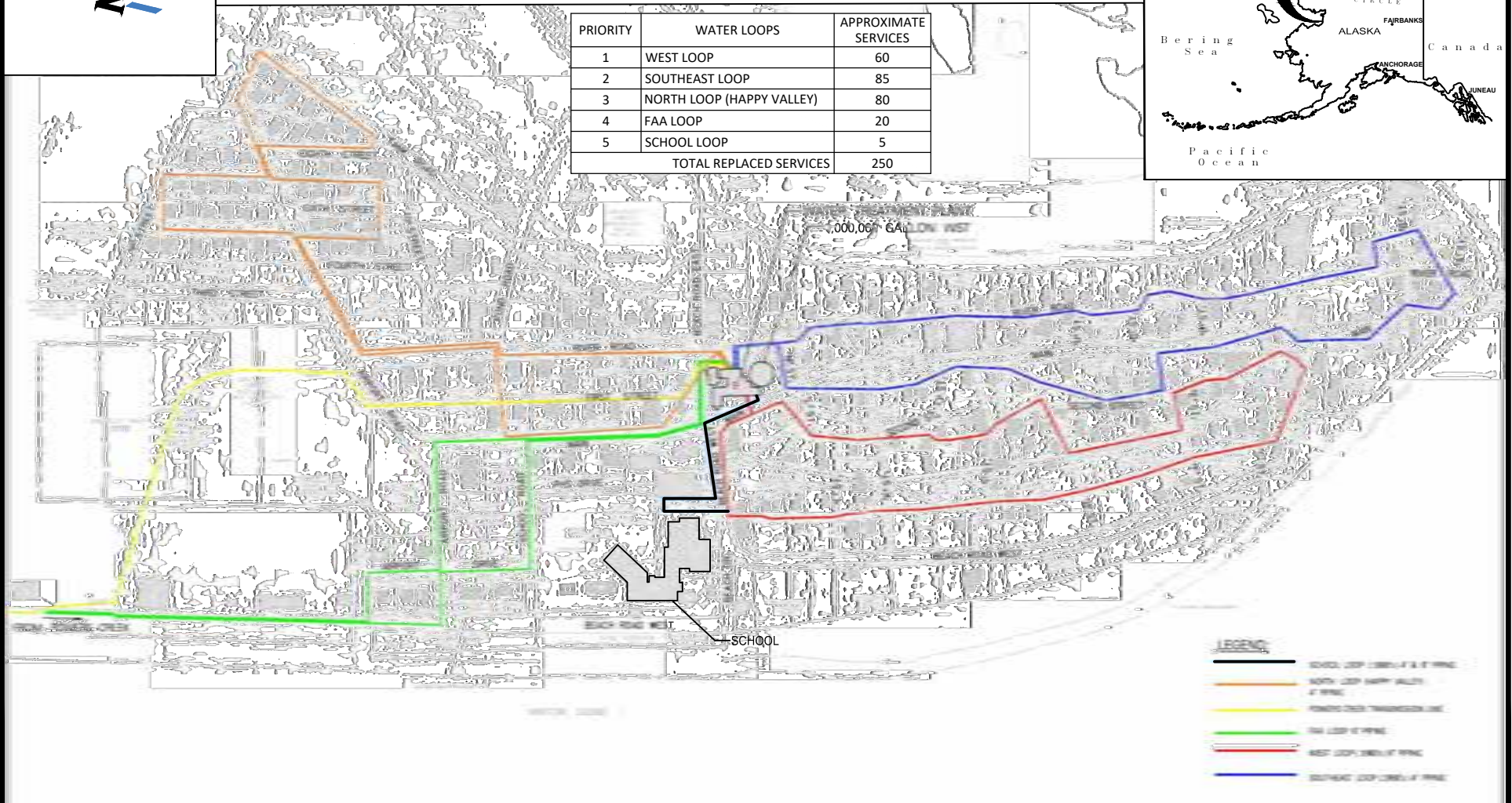
A3



PROJECT LOCATION:



PRIORITY	WATER LOOPS	APPROXIMATE SERVICES
1	WEST LOOP	60
2	SOUTHEAST LOOP	85
3	NORTH LOOP (HAPPY VALLEY)	80
4	FAA LOOP	20
5	SCHOOL LOOP	5
TOTAL REPLACED SERVICES		250



WATER SERVICE IMPROVEMENTS

UNALAKLEET, ALASKA

PRELIMINARY ENGINEERING REPORT

PROJ. NO.	165.030153
DRAWN	BJL
CHECKED	DEN
DATE	05/19/20



4300 B Street, Ste 605
Anchorage, AK 99503
907-339-6500 Fax 907-339-5327
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WATER DISTRIBUTION LOOPS PRIORITY

A4

Appendix B: Reports and Photos

- 2017 ADEC Copper Exceedance Letter
- 2020 Best Management Plan
- 2020 VSW Trip Report



THE STATE
of **ALASKA**
GOVERNOR BILL WALKER

Department of Environmental
Conservation

DIVISION OF ENVIRONMENTAL HEALTH
Drinking Water Program

610 University Avenue
Fairbanks, Alaska 99709-3643
Main: 907.451.2108
Toll free: 800.770.2137
Fax: 907.451.2188

File Number: 630.07.001

CERTIFIED MAIL - RETURN RECEIPT REQUIRED: 7016 2140 0000 1907 6639

June 30, 2017

Mayor Leona Grishkowsy
City of Unalakleet
P.O. Box 28
Unalakleet, AK 99684

Re: Unalakleet City Water Supply Copper Action Level Exceeded
PWS ID#: 340387

Dear Mayor Grishkowsy:

The Department received lead and copper monitoring results for your public water system on March 11, 2016. Under the Lead and Copper Rule, if the 90th percentile of lead and copper samples exceed certain "action levels" (0.015 mg/L for lead and 1.3 mg/L for copper), the system is required to take regulatory actions to remain in compliance. While lead results were below the action level, the action level for copper was exceeded. The 90th percentile of the 20 samples taken on 02/17/2016 was 2.3 mg/L, which is above the action level of 1.3 mg/L.

The purpose of this letter is to outline the regulatory actions that must be taken as a result of the copper action level exceedance. An action level exceedance is not a violation but does trigger other system requirements.

You are required to complete corrosion control treatment steps which include water quality parameters monitoring, source water sampling and submission of an optimal corrosion control treatment recommendation. You may choose alternate activities equivalent to the corrosion control steps applicable to your water system, such as replacement of faucets or other plumbing fixtures. If you choose this option you will need to provide a letter to DEC describing your suggested plan to reduce Lead and Copper levels in your drinking water. If you choose alternate activities equivalent to the corrosion control steps applicable to your water system and the system continues to exceed the action level for lead or

ema-ld 06/30/17

copper, it may be necessary for you to begin the process of corrosion control. Those requirements will be sent to you under separate cover after the requirements listed below have been completed. The required corrosion control steps and deadlines will be based on several factors including the water quality and source water results.

The first requirements you will need to complete are outlined below:

Date Action Level Exceeded – June 30, 2016 (overdue)

Date is the last day of the 6 month monitoring period or 3 year period that the action level was exceeded.

Lead Consumer Notice – Due by April 7, 2016 and completed on December 8, 2016

Within 30 days of learning the results, all systems must provide individual lead tap results to people who receive water from sites that were sampled, regardless of whether the results exceed the lead action level. 40 CFR 141.83(d).

Provide a letter to the Department outlining alternate activities- June 30, 2016 (overdue)

You may choose alternate activities equivalent to the corrosion control steps applicable to your water system, such as replacement of faucets or other plumbing fixtures, you will need to provide a letter to DEC describing your suggested measures to reduce Lead and Copper levels in your drinking water for approval.

Water Quality Parameter (WQP) Testing – Due by June 30, 2016 (overdue)

Within the same monitoring period that the action level was exceeded WQP testing is required. WQP testing includes pH, alkalinity, calcium, conductivity, and temperature.

Monitoring requirements for water quality parameters:

1. Systems shall collect two tap samples from two site location for applicable water quality parameters during each monitoring period specified under 40 CFR 141.87 paragraphs (b) through (e). Tap samples shall be representative of water quality throughout the distribution system taking into account the number of persons served, the different sources of water, the different treatment methods employed by the system, and seasonal variability. Tap sampling under this section is not required to be conducted at taps targeted for lead and copper sampling under § 141.86(a). [Note: Systems may find it convenient to conduct tap sampling for water quality parameters at sites used for coliform sampling.]

2. Systems shall collect at the entry point(s) to the distribution (EPTDS) samples from locations representative of each source after treatment. If a system draws water from more than one source and the sources are combined before distribution, the system must sample at an entry point to the distribution system during periods of normal operating conditions (i.e., when water is representative of all sources being used).

Source Water Testing– Due by December 31, 2016 (overdue)

One sample must be taken at each EPTDS to determine how much lead and/or copper is coming from the water source. The source water test is required within 6 months after the end of the monitoring period in which the lead and/or copper action level was exceeded. 40 CFR 141.88

Once the above steps are complete, our office will notify you of any additional requirements. Please note that water systems can conduct additional rounds of first draw lead and copper tap water samples every six months, while working toward Optimum Corrosion Control Treatment (OCCT). You may want to continue to monitor for lead and copper every six months; although this is not required. If lead and copper levels do not exceed the 90th percentile after collecting samples during July 1, 2017 through December 31, 2017 and January 1, 2018 through June 30, 2018 monitoring periods; you will not be required to continue with corrosion control treatment steps and installation. If two consecutive six month monitoring periods are below the action levels the steps listed above would be suspended and the water system would return to routine monitoring. However, if the system was to exceed again, they would be required to commence the OCCT steps.

If you have any questions or require any assistance, please contact me at (907) 451-2137 or 1-800-770-2137, or via e-mail at clarissa.bearden@alaska.gov.

Sincerely,



Clarissa T. Bearden
Environmental Program Specialist
Drinking Water Program, Fairbanks Office

Encl.: Lead Consumer Notices

Lead and Copper Result Worksheet

Lead and Copper Materials Evaluation and Sampling Pool Template

**Best Practices Score
Unalakleet
SPRING 2020**

Category		O&M Scoring Criteria		Possible	Score	Explanation of Score	How to Improve Score	Contact	
Technical	Operator Certification	Utility has more than one operator certified to the level of the water system		10	7	System Classification: Water Treatment 2 Primary Operator: <i>Dwayne Johnson</i> Certification Level: <i>WT 2</i> Backup Operator: <i>George Turner</i> Certification Level: <i>Small Treated</i> Dwayne Johnson holds the correct level of certification. George Turner hold certification but not at the correct level.	Dwayne Johnson needs 0.15 CEUs before 12/31/2021 to renew his WT 2 certificate. George Turner has the required CEU to renew his ST certificate before 12/31/20. George needs to take and pass the WT 1 exam. Please see the enclosed flier with more information about certification.	ADEC Operator Certification Program 465-1139	
		Primary operator is certified to the level of the water system and the backup operator holds some level of certification in water treatment or distribution		7					
		Primary operator is certified to the level of the water system and the backup operator holds no certification or there is no backup operator		5					
		Utility has one or more operators certified at some level in water treatment or distribution		3					
		Utility has no certified operators		0					
	Preventive Maintenance Plan	Utility has a written PM plan; PM is performed on schedule; records of completion are submitted on a quarterly basis and have been verified		25	25	The operator is performing important maintenance on a regular basis and keeping records. Each month, the operator is submitting maintenance records to the assigned RMW.	Full points have been awarded in this category. Continue to perform maintenance according to the PM plan and send monthly records to the assigned RMW.	Stosh Labinski NSHC RMW 443-3273	
		Utility has a written PM plan; performance of PM and record keeping are not consistent		15					
		Utility has no PM plan or performs no PM		0					
	Compliance	Utility had no Monitoring and Reporting violations during the past year		10	0	The utility had 11 Drinking Water Monitoring and Reporting violations in 2018.	The Drinking Water Program provides you with an Annual Monitoring Summary with all of the required samples for your water system. All samples and reports must be collected and submitted in a timely manner.	Dawnn Bodyfelt ADEC Drinking Water Program 451-2170	
		Utility had up to five Monitoring and Reporting violation during the past year		5					
		Utility had more than five Monitoring and Reporting violation during the last year		0					
Managerial	Utility Management Training	A person who holds a position of responsibility for management of the utility has completed a DCRA approved Utility Management course or other utility management training course within the last five years		5	5	Davida Hanson attended Financial training on 12/4/2017.	To maintain the full points in this category, consider sending someone to one of the free RUBA trainings each year.	Lena Mathlaw DCRA RUBA Program 443-5457	
	Meetings of the Governing Body	The utility owner's governing body meets routinely consistent with the local ordinance/bylaw requirements and receives a current report from the operator		5	5	The city holds regular council meetings at least once a month per AS 29.20.160. Codebook of ordinances should be amended to include a chapter on council meetings. June - Nov meeting minutes submitted. Utility reports provided to governing body.	To maintain full points, the governing body must continue to meet according to ordinance and provide RUBA with meeting minutes.		
		The utility owner's governing body meets routinely consistent with the local ordinance/bylaw requirements		2					
		The utility owner's governing body does not meet		0					
Financial	Budget	Utility owner and the Utility have each adopted a realistic budget and budget amendments are adopted as needed; Accurate monthly budget reports are prepared and submitted to the governing body		15	15	Overall, the budget has revenues meeting expenses. Utility/water budget has expenses meeting revenue. Monthly financials for July - Oct submitted and documented in meeting minutes. Budget amendments to be completed as necessary	Full points have been awarded. Continue to provide monthly financial reports to RUBA for verification.		
		Either the Utility or the Utility owner has adopted and implemented a budget, the other has not		13					
		Either the Utility or the Utility owner has adopted a budget, but it is not being implemented		10					
		Utility owner and the Utility have not adopted a budget		0					
	Revenue	Utility is collecting revenue sufficient to cover the Utility's operating expenses and to contribute to a repair and replacement account		20	20	Monthly and year to date revenue meets expenses. Utility/water repair and replacement line item in monthly financial reports.	Full points have been awarded. Keep up the great work.		
		Utility is collecting revenue sufficient to cover expenses		15					
		Utility has a fee schedule and a collection policy that is followed		5					
		Utility has no fee structure or collection policy		0					
	Worker's Compensation Insurance	Utility has had a worker's compensation policy for all employees for the past two years and has a current policy in place		5	5	Current policy verified 12/31/2019.	Full points have been awarded. Maintain active Worker's Compensation policy to continue receiving these points.		
		Utility has a current worker's compensation policy in place for all employees		2					
		Utility has no worker's compensation policy		0					
	Payroll Liability Compliance	Utility has no past due tax liabilities and is current with all tax obligations		5	5	Current on all payroll tax liabilities.	Full points have been awarded. Continue to submit timely reports and payments to maintain these points.		
		Utility owes back taxes, but has a signed payment agreement, is current on that agreement, and is up-to-date with all other tax obligations		2					
Utility is not current with its tax obligations and/or does not have a signed repayment agreement for back taxes owed		0							
CIP O&M Score		27	SDS O&M Score	14	TOTAL SCORE		87		



Village Safe Water Trip Report

*Alaska Department of Environmental Conservation
Division of Water - Facility Construction & Operation
555 Cordova Street; Anchorage, AK 99501
(907) 269-7554 ph; (907) 269-7509 fax*

TRIP DATE(S): 1/13/2020 – 1/15/2020

REPORTER: Sean Lee, E.I.T.

LOCATION: Unalakleet, Alaska

PROJECT NO: 17RQ09/17AP64-5/19RR02

Accompanied By:

- Jim Munter, C.P.G., Munter Senior Hydrologist
- Karl Hulse, P.E., CRW Project Manager
- Kelly Yanoshek, E.I.T., CRW Engineer
- Kris Westberg, Vice-President M.W. Drilling
- Ian deMello, M.W. Drilling

Contacts:

- Susana Stinnett, City of Unalakleet Administrator (Apparently resigned 1/15/2020)
- Davida Hanson, City of Unalakleet Mayor
- Dwayne Johnson, City of Unalakleet Public Works Director
- Tom Perkins, VSW Foreman
- Buck Amadon, VSW Electrician

Purpose of Trip:

- Accompany CRW Engineering and Jim Munter to present findings of the 2019 well field drilling operations, results, and plan for 2020 Pump Test Operations
- Conduct inspection of the Happy Valley Lift Station
- Obtain additional data for on-going Corrosion Control, Distribution Replacement, and service line replacement.
- Review entire community sanitation deficiencies for documentation into the Sanitation Deficiency System (SDS).

Summary:

The community meeting regarding potential new well water source drilled in 2019 at 7:00 was overall positive. The community had few concerns regarding the pump testing that will start shortly to establish capability of 2019 well field to be used as a year-round municipal water supply. The main questions relative to the water source project were (answers):

1. Necessity of obtaining well data loggers from surrounding privately owned wells pre and post pump testing, (necessary to make determinations about effects of pump testing on surrounding wells);
2. What is the overall benefit to well water vs. current surface water

- source (lower operation and maintenance cost, potentially more secure water supply, lower treatment requirements, move away from Ferric Chloride Treatment, ability for existing treatment equipment to be utilized for ground water treatment if necessary));
3. What is the chemistry of the different waters (Ground water has no organics requiring removal, surface water requires higher levels of treatment to remove the organics relative to Disinfection Byproduct Removal [purpose of installation of the 2013/2014 water upgrade construction project]);
 4. What is the chemical testing that will be conducted on the wells (standard Class A municipal water tests for heavy metals, VOC's, and primary/secondary contaminants);
 5. What is the likelihood of salt-water intrusion from these deep wells (not likely); and
 6. What is the testing timeline, report timeline, and construction timeline of the test is successful (testing will end by March 2020, the report is expected to be concluded in July of 2020. Design ideally complete by Jan 2021 for bid for majority of project. May be Multi-year phased construction).

A very concerned citizen was worried about the existing treatment using Ferric Chloride. He stated that it is poisoning people, the operator was overdosing the chemicals, and the overdosing is causing rapid deterioration of the existing infrastructure. See more in [Concerned Community Member:](#)

A second concerned resident, Teri Paniptchuk, City Council Member (for the sole purpose of seeing positive change for the community's health), said her son was diagnosed with Liver Cancer and Liver Cirrhosis at age 9 in 2014. She stated she has been to several doctors in Anchorage on a monthly basis to no avail of a cause or cure. She asked the doctors if water could be a potential cause of this disease. She reported the doctors said yes. She requested that we follow up any way possible, including with NSHC, to see if there is a correlation between the symptoms experienced and the events that have transpired since the installation and operation of the new water treatment equipment.

The inspection of the Happy Valley Lift Station was positive. The project should have the system operational within a week. The electrical is nearing completion. The workers are slated to leave on Jan 24, 2020. There will be some additional work to complete Pumps were bump-tested on 1/15/2020 and worked properly. Need 1-2 days until switchover from bypass to new pumps. Electrician will be on site for 2 days to ensure functional operation after raw sewage flowing.

Pump test well thawing operations began and some dataloggers were successfully retrieved. 7 were downloaded, 3 were unable to be retrieved, and one fell down the hole (at the Elder's Housing). Weather has been cooperative and there is little snow on the ground.

I conducted an in-depth walk through of the water and waste system with the Public Works Director Dwayne. There are several malfunctioning meters or pumps in the water plant, many of which are planned for replacement in the new WTP upgrade project expected for 2020 construction. The heat exchanger from the UVEC power plant (UVEC side) has been down since this summer. This potentially exacerbated line freeze-ups because colder water has been entering storage tank (40°F instead of 50°F).

The coagulant dosage system is currently being mixed by "eyeballing" the mixture until the SCD point hits the -10 set point value (per the O&M manual). There is no mechanism to transfer neat (35%-45%) FeCl to the mixed tank properly. I observed water production with the measured Streaming Current Detector value meeting the setpoint of -10 per the O&M manual. When I observed the treated water, it appeared clear. At my room, the water was clear and did not have a red tint, no taste of iron, and did not smell overly of chlorine.

Inspection of other lift stations showed varying degrees of deficiency. Two need rehab, one is suggested for complete replacement. One rehab is due to due to safety and horrible O&M conditions imposed upon operators after pump failure. No lift station observed had two functioning pumps. All are in need of replacement or rehab of some form.

1/13/2020:

Arrived in UNK at 4:00PM. Went to lodging at Maggie's Hotel, and prepared for the community meeting at 7.

Community Meeting:

The community meeting was to discuss the well-field drilling in 2018 which yielded low-quantity low-quality water. Secondary location in the vicinity was identified and subsequently drilled in 2019 (foot hills). 7 wells were drilled. Total of ~ 200gpm from all wells during initial pump testing (April - June). Three high producing wells, 3, 6, and 8 are targets for pump testing from Jan 2020 - March 2020. All surrounding wells, where practical, have data loggers to measure response of the potential municipal source to privately owned wells. See attachments for overview picture of the newly drilled wells and wells that are to be monitored.

A discussion of project history was given: 2010-2012 PER to evaluate secure water source. North River was identified. High capital cost drove decision making to attempt ground water source. 2017-2018 efforts on well field 1 were unsuccessful. 2019 well drilling showed promising results. Necessary to pump test new wells in Jan 2020 when local homeowners report wells run dry to ensure these new wells will suffice for quantity of water, both winter and summertime demand. The ground formation here is a

highly-faulted shale/greywacke formation which requires good technical analysis to validate aquifer parameters unlike sedimentary formations which are easy to predict.

It was emphasized that the results so far are promising, but not diagnostic of viability as a new water source. This is the goal of the 2020 pump testing, to verify year round, long term use of the aquifer. Due to the cold winter so far in 2019/2020, the testing will be indicative of worst-case scenario due to the frozen ground not allowing for recharge. Previous winters have been somewhat warmer.

CRW needs to send out (in short time) forms for private well owners to document the effects of the pump testing as well as when time/date when individual wells stop producing. This data is necessary for full evaluation of the new field.

CRW and MW Drilling will be on site to retrieve data loggers installed in 2019 (13 in private wells), download data, and re-install to evaluate effects on near-by wells during pump testing.

Citizens questioned when well chemistry would be tested. A full suite of Class A municipal water source tests will be conducted on all wells planned for future municipal use (7 wells). The new wells pass all primary regulatory sampling, however some slightly exceed secondary iron and manganese levels but not at undrinkable or un-treatable levels. Several methods of Fe and Mn removal were discussed such as green sand filters with oxidative recharge and also air sparging.

It was emphasized that the new well water would be less costly to treat, and that FeCl would not be an added coagulant chemical due to lower treatment requirements of ground water.

Karl H. explained the difference between VOC's and naturally occurring organics; VOC's are manmade synthetics which are generally not economically treatable, which preliminary tests show are not extant in this field. Naturally occurring organics, such as humics, tannins, and other constituents are what cause Disinfection Byproducts after introduction of Chlorine; DPB reduction is a regulatory requirement. Tests prior to implementation of the WTP upgrade in 2013/2014 showed that FeCl was the coagulant of choice for this particular water chemistry.

Community members expressed interest in obtaining well data-logger information. CRW will provide this to the City and interested community members. The final report will have a "hydrogeological cross section" of the area.

One resident on a well stated they experience a very fine, gooey black substance at the bottom of their holding tank. This is likely due to the fractured shale rock water-bearing layers. This is not an uncommon

occurrence to have sediment settle at bottom of holding tanks from residential wells, especially for this given shale bedrock formation.

Residents were concerned about salt-water intrusion from the new ground water sources; not likely due to the nature of ground water hydrology flowing down-hill. Water in a well would have to be drawn down to the water bearing layers and a major flood event would have to occur simultaneously. Other risks exist, but not likely. Conductivity meters will be used to test for brackish water during pump tests. See attachments for picture representation of the drilled wells and water bearing layers and water levels that were observed in 2019.

Residents were encouraged to visit the pump testing when started.

Residents asked about installing a watering point station at one of the newly developed wells so they could obtain non-treated water.

Jim Munter gave a brief overview of water rights. He encouraged residents on wells to apply to DNR for water rights, especially when use is in excess of residential demand such as large gardens. He also mentioned that some low producing wells could be fracked to increase productivity due to the nature of the bedrock formation.

Total discharge of the pump testing is expected to be about 2.5M gallons. Precautionary measures will be in place to ensure that breaching of the nearby road doesn't occur. Discharge will be routed accordingly. If danger occurs, pump testing will cease.

A timeline for the project was presented as follows:

Complete Pump Test Report: Summer 2020, If Successful:

Design: Late Summer 2020 - January 2021

Construction: Likely Phased, begin 2021 via mostly bid, potentially some force account, complete by 2023 at the latest.

The city has an asphalt reclaimer so any construction requiring road work can be patched up.

A backup plan if the aquifer failed was not discussed. I have high hopes for this pump testing to be successful. Additional wells in this field may be a viable option due to the high variability of the depth to water bearing layers, with multiple layers in some wells.

Concerned Community Member:

Chuck Melin expressed significant concern over state of the water system. He claims that the operator has been negligent and allowed multiple overdoses of the Ferric Chloride into the system. He was claiming that the water in the city is no good, that it was unhealthy due to the Ferric Chloride, that people are losing their hair, that people are getting

blisters from skin exposure to it, that the water is corroding away the existing system since changeover to FeCl for treatment, that the chlorine levels were too high, that we shouldn't be spending money on a new water source when there are other issues at stake, wondered why we are using FeCl instead of Nalco in the past, why is this system the only one in the region that is using Ferric Chloride, that the previous coagulant (Nalco 8185) didn't destroy the system, and wondered if another Jar Test could be conducted to determine if another chemical would be more suited for the system given the concerns stated. He would like us to compare the DOC results to the Shaktoolik plant.

Karl stated that the new treatment system was put in place to comply with drinking water regulations, specifically targeting Disinfection By-Products. Jar testing indicated that FeCl was the coagulant of choice. Chuck asked if another Jar Test could be conducted to switch off of the FeCl. This would require operational approval to make this change if the jar tests showed different results.

I stated that part of the purpose of my trip was to evaluate developments since our last visit which was primarily aimed at looking at the corrosion of the system. I stated that part of the on-going PER is to make recommendations to mitigate corrosion, have a phased plan for service line replacement, and also to evaluate the replacement of the distribution mains system. I also stated that I was here to address any sanitation deficiencies to add to the funding databases for consideration in April. I stated the target completion for the PER was around March in time for all project entries into the funding system, including necessary corrosion mitigation, replacement of service lines, replacement of the very old (first) circulating water distribution system in the State of Alaska, lift stations, and anything else that comes up during my site visit.

1/14/2020:

Happy Valley Lift Station Inspection

Karl Hulse and I inspected the lift station in the early morning. The majority of the work has been completed.

Work remaining prior to winter DeMobe: The heater needs to be installed (requires extra manpower given the weight), transducer needs to be installed, explosion proof enclosures need sealant, temporary bypass needs to be disconnected and connected to the force main. The temp bypass pump in the manhole will remain in case there is an emergency (there is sufficient flow and heat through the manhole to keep it from freezing, storage would be more difficult).

I asked Karl if there was a way to test the air tightness of the room. He will check with the mechanical to devise a testing plan. We want to ensure that the two rooms are sealed off so sewage smell doesn't penetrate control room.

Morning Meeting at City

Karl, Jim, Dwayne, Susana, and I met in the early AM to discuss the well project, the water distribution deficiencies, and the corrosion control project. It is very important that the community keeps record of service line freeze-ups of which about 20 (see attachments) have occurred this month. There has been a cold snap, water main breaks, service line breaks, and the city has been struggling to keep water in the storage tank about BWN levels. They tank level is over 8 feet and the city attempted to send the Bact samples to the lab but they arrived frozen via Ravn today. Samples will be re-sent today.

We discussed the copper sampling that has occurred from 1/1/2007 through 12/1/2018 (See attachments for preliminary compilation of existing copper sampling). There is a spike in copper levels during the 2013/2014 timeframe, which coincides with the startup of the new WTP filtration equipment introducing FeCl and Soda Ash into the system. Please see the attachments section for data.

Inspection of Community Infrastructure:

WTP Overview

Storage tank level was observed at 8ft. Temperature was ~ 50°F. Raw water booster pump has failed. Control panel for it indicates alarm. Raw water heat exchanger has been inoperable all winter because pump on UVEC side is leaky. Dwayne reports that they have the part ready to install.

Raw water cartridge filters are not used. Harmsco 170/100 filters. Operators state they are too time consuming to use so don't. Raw water SC100 Turbidimeter reading panel stopped working ~ 1 month ago. Needs replacement. Turbidimeter likely functioning. Suggest calibrating all Turbidimeters in plant at once.

Dwayne stated the SCD probe was replaced sometime in summer of 2019. Set point values while making water on target (-10.0).

Transfer pump for neat FeCl vat to neat storage tank is broken and on order. Neat tank pumping to stock solution (dilute) tank rate is unknown. The FeCl mixing manifold is not in operation. O&M operations state the neat should be pumped at 18.8 Liters/Hr mixed with 2 gpm water. Operators are eyeballing adding water to stock solution tank which is supposed to be 6% FeCl. They do this by adding water until the SCD reaches its target set point of -10.0. Pumping rate of stock solution is .248 gph to 0.272 gph. No way to verify the stock solution strength.

The new pH probe installed summer 2019 needs to be calibrated. Model Rosemount 3900. Current reading is 7.97pH. Uncertain if soda ash is being injected at the proper rate.

Air scour unit is reported operational. Did not observe a backwash. Flow meters on many loops are broken. The only pair (supply and return) that was functional was on west loop.

West Loop:

Supply: 100gal/26.32s x60 = 227 GPM - 64 psi - No Temp (broken)
(waterlogged meter, accuracy in question)

Return: 100gal/30.75s x60 = 195 GPM - 47 psi - No Temp (broken)

Happy Valley Loop:

Supply: Flow meter broken, 70 psi - No Temp (broken)

Return: 100gal/59.28s x60 = 101 GPM - 40 psi - No temp (broken)

South-East Loop:

Supply: Flow meter broken, 47 psi, No Temp (broken)

Return: Flow meter broken, 24 psi, No Temp (broken)

FAA Loop:

Supply: Flow meter broken, 41 psi - Temp 35°F (broken?)

Return: Flow meter broken, 37 psi - Temp 38°F

Only one of the pressure booster pumps for the system is operational. Cl grab sample of treated water from tank was 0.95 mg/L. Operators do not have a measured way to create Cl stock solution. They add a few scoops to water. This needs to be clarified.

FAA Lift Station

No rails, have to use a temporary pump (110v) with temporary float switches (110v) with a temporary hose. See figure 28 for configuration. All pumps in the station are broken. All power controls are in the wetwell room - no control panel / power room. Control panels and pumps are reported to not work since as long as Dwayne has been with the city (4.5 years).

There is water seeping into the manhole from an unknown source. It only seeps through on the entrance doors side. See figure 27. This lift station apparently has a dual hatch utilidor (did not observe) that drains into the wetwell. Reported that when there was a service line leak in the vicinity, it overflowed the utilidor. Dwayne reported a fuel smell when it overflowed. This is likely due to an improperly abandoned fuel line. This leak has not been located and fixed; turning the FAA loop water pressure down caused the manholes to no longer overflow. The fuel smell is gone and not observed; this is likely due to whatever residual was in the line being flushed during the flooding but not conclusive. Recommend that this lift station be replaced, not rehabilitated.

Terminal Lift Station

Pump support broke during lifting of the pump on one side due to the chain breaking and dropping the pump on its supports. Likely broke the bottom support. Pump is also broken. This side of the wetwell cannot support a pump. Rails are OK.

There is some minor structural damage on top side the corner east of the entrance, See figure 29.

Control Panel Room has electrical issues. Colt Garvey did a diagnostic site visit (est. 2018), written on the control panel is that Pump #1 needs a new starter coil and pump. Rest of the control panel room seems in OK Shape.

Recommend minor rehab of this lift station, as it is newer. It needs to get both pumps operational, fix the potentially broken pump support (opposite entrance), and the control panel issues. Power junction boxes should be relocated out of the wetwell, see figure 32. A spare pump is on site.

Covenant Lift Station

Rail supports are corroded, every time operators pull a pump, the top rail supports buckle a bit. This causes a problem when pumps are pulled out; the top support buckles and often causes rails to come out. Lack of support at top rail means the pump can potentially jog rails out of their supports. Putting the rails back in place can take anywhere from 1-6 hours. Rails are evidently only supported on the bottom by a guide hole. Only one set of rails are attached.

Anytime a clog occurs, operators choose to turn the pumps on and off multiple times to clear it instead of pulling the pumps to inspect.

Water heater to heat glycol in slab has failed. It is turned off. O&M on this lift station is dangerous. In order to switch a pump out, the operator must stand on a corroded steel beam while inside the wetwell to re-do the wiring figure 38. They also must stand on this precarious beam to try to re-set the rails if they come loose.

Controls are reportedly good for two pumps.

Recommend rehab of the wetwell section of this lift station. Supports need to be redone so that it can accommodate two sets of rails and two pumps. Add active ventilation to the wetwell side. Replace heating system in both sides (potentially re-use glycol in slab if working, better to use dedicated heaters in each room). Electrical system needs to be verified for functionality.

1/15/2020:

Inspection of HVLS – Testing of Pumps

Dwayne and I arrived at the HVLS at 10:00AM to inspect progress. Coming along nicely.

Dwayne and I returned at 2:00 PM where Buck and Tom were ready to “Bump” test the pumps. There was successful rotation of pump 1, and pump 2. The system appears ready for sewage to enter the lift station and to be pumped

to the junction past the terminal force main where this lift station ties in. The pumps have a 5 second lag before turning on. The lead-lag configuration was confirmed working during dry run. Passcode to the Pump control panel is 1234.

After crew debmobes, the following items will need to be completed:

- There is a temporary connection (grey flex hose, see Figure 44, that will need to be removed and the pumps hard piped to the outlet. Temporary lift station bypass will be disconnected.
- Vent package will be installed
- Metal hatch cover will be installed (on order)
- Install 200-amp meter box where existing 125-amp meter box is, pull new wire.
- Paint soffits
- Plate for pulling chain did not come with pump package. This device drops down to "catch" the handle of the pump so the chain hook can be set easily.
- Need oil for chain (very squeaky)

Continued Inspection of Community Infrastructure

Items Observed:

- Slough Bypass – this above ground pipe is in place to pump slough (brackish) water to the WTP when conditions are dire (low tank level) to ensure that the community distribution system does not freeze. This is not optimal. Brackish water is not potable. It is a last-resort measure to save the distribution and service lines from freezing. It takes 3-5 days (according to operators) to flush the system of brackish water after fresh raw water is available for treatment in sufficient quantities. See figure 55.
- Unalakleet City Tank Farm – Fuel levels can be observed by frost levels at this time (see figure 50).
- 6 Windmills – 3 were operating on this day. Three were not. I am unsure how this is connected to the community infrastructure but if fuel is being used, more wind turbines should be operational to lower fuel requirements. Potentially needs some electrical adjustment to ensure maximum renewable energy is sent to the community instead of community relying on boilers for heating water. Not sure how this electricity is diverted to town (just to UVEC power plant?)

Items not observed:

- Lagoon and Forcemain to Lagoon – Conditions Unknown
 - o This includes the tie in between Happy Valley Lift Station (current project) to force main downstream of terminal lift station.

- o A second visit when things are thawed will be required to evaluate this infrastructure as it is mostly buried underground and access to any valves is buried by snow.
- Power's Creek Infiltration Gallery (current water source) – Road (4.5miles) was in progress of being plowed and we did not have time to inspect the infiltration gallery. Due to the malfunctioning heat exchanger on UVEC side, to warm Raw Water the operator placed an electric heater (unknown date) to warm water sent to the WTP.
 - o The boilers in the WTP are both running at full capacity to keep up with the heating demand. I observed tank temperatures of 48°F this date. It was reported the tank temperatures were as low as 35°F during this last cold snap in December, 2019.

Water Well Pump Testing

Dwayne and I went to the construction site of the Elder's Housing to view data logger placement activities. This particular logger was lost during retrieval. The crew was having difficulty setting a new data logger into this well past the water level. Something kept "catching". It should be noted that there is no hatch in the roof at this well house to allow for pump removal.

We viewed wells #8 and #5. Well #8 was strangely not frozen when the crew arrived onsite. Well 8 is slated for the 30-day pump down test, Wells #3 and #6 are slated for a 72-hour pump down test. See attachments for picture description.

The crew was expressing difficulty in thawing some of the slated test wells.

Other:

Operators were dealing with 20+ service line freeze ups in the months of December (cold snap) through January (warmer). Operators were diligently working on jetting frozen service lines and replacing service lines when necessary, at homeowner expense. See attachments for list.

Several water service line breaks have caused major leaks. Operators deal with them promptly. There is/are still unidentified leaks in the system, keeping tank levels from filling at an appropriate rate. Tank level was 8ft when I was on site.

There has been no log kept by the city of times when FeCl has overdosed in the system. The only report is the one stated to DEC in 2019. Several individuals claimed that the water at many times has been over dosed with FeCl and could be as orange/red as ketchup, staining fixtures, clothing, and other items.

- Many residents retrieve drinking and cooking water from various wells in the foothills area. There is a resident that leaves his garage with open access for anyone to bring jugs to fill. Many

people source water this way.

Anecdotal statements of operator turning off various loops at different times in an effort to conserve water, may have contributed to freeze ups. Was not verifiable.

Operator did state the FAA Loop pressure was reduced in an effort to raise water tank level.

The city would like to see all pit orifices replaced with HDPE (cost unknown, no wide spread use is known at this time) or Stainless Steel (~10x expensive as copper).

Follow Up:

- CRW: Send out individual homeowner well forms to captures events, such as when well runs dry, time, any adverse impacts from testing, etc.
- VSW/City: Determine any additional homeowners needing scattered sites applications for well hookup and septic system; or individual service line connections.
- CRW: Provide City and interested homeowners with well data-logger so far (1-2 weeks).
- CRW to discuss method of testing air tightness between the electrical control room and the wet well room.
- CRW to discuss whether metal pipe protruding at top of wet well needs to be dealt with (unlikely). Also needs to discuss whether to two poly pipes located higher in the square section of the wetwell needs to be removed/plugged. (see pic X)
- City: Begin log of FeCl overdoses; retrieve documented cases of FeCl overdoses to the system with dates and times {Note - Overdose means more FeCl than recommended in the O&M manual}
- VSW: Determine feasibility of installing a watering point at the new well field. This would require power, a well shack, heat, and maintenance. Needs to be engineered and approved, not simply installed. If pump tests yield positive results, this would be a wasted effort.
- CRW: Obtain well log for Elders Home for part of pump test analysis
- VSW: Obtain Terminal Lift Station diagnostic report from ANTHC's Colt Garvey
- pH meter needs to be calibrated
- All turbidimeters need calibration
- Is another Jar Test Warranted?
- Follow up with operator on necessary mixing ratio of water to Cl power.

- Follow up with concerned citizen regarding the state of existing system.
- Compare DOC/TOC test results from 2013/2014 to Shaktoolik results (relatively new VSW WTP)

CC:

Carrie Bohan, DEC Facilities Program Manager

Young Ha, VSW Program Manger

Doug Poage, P.E., VSW Lead Engineer

Katie Winter, P.E., VSW Engineer

Aaron Wheataall, VSW Engineer Assistant

Macro Acuña, VSW Construction Observer

Tammy Helms, TAF Program Manager

John Johnson, RMW Program Manager

Cindy Christian, DEC Drinking Water Program Manager

Lee Johnson, P.E., DEC Drinking Water Engineer Supervisor (FBX Region)

Johnny Mendez, P.E., DEC Drinking Water Engineer (FBX Region)

Racheal Lee, NSHC Director of Environmental Health

Karl Hulse, P.E., CRW Engineering

Jim Munter, C.P.G. (Subconsultant to CRW)



Figure 1 - HVLS Pump VFD Control Panels



Figure 2 - Karl Hulse (Left) and Buck Amadon (Right) using Fluke meter to simulate transducer and show well control panel functionality.



Figure 3- Well Pump Control Panel Level



Figure 4 - DCVR 1 - Well Control Junctions changed from 1 box to 2 individual runs



Figure 5 - Wet Well Heater Mounting Brackets

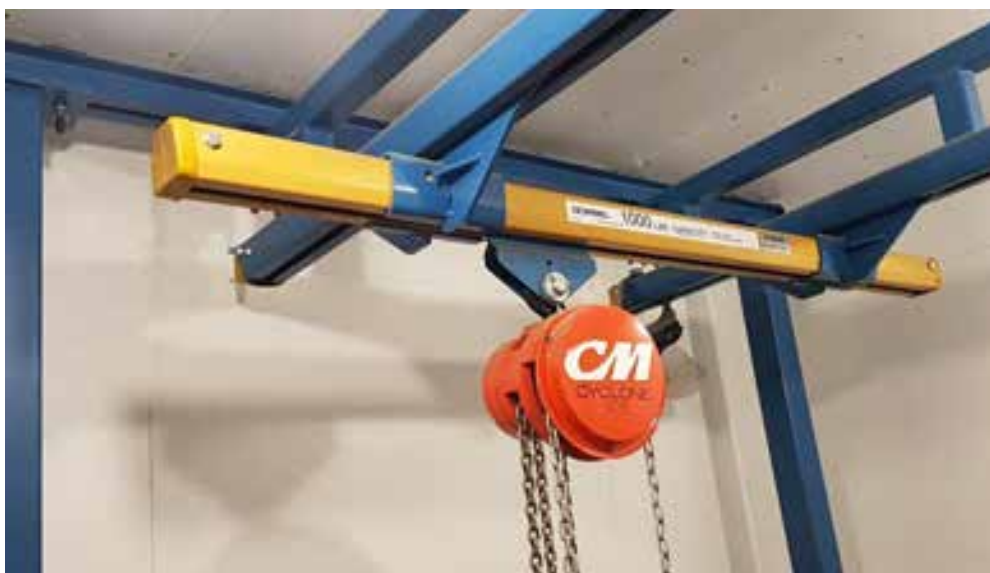


Figure 6 – Chain hoist



Figure 7 - "Sparkless" control panel box wiring



Figure 8 - Transducer ready for installation



Figure 9 - Interior View of Temporary Lift Station Bypass



Figure 10 - Exterior View of HVLS



Figure 11 - Exterior connection of temporary bypass to building



Figure 12 - Another view of the temporary lift station bypass



Figure 13 - 125 amp meter base needing replacement with 200 amp meter base



Figure 14 - Strength of Neat FeCl at plant

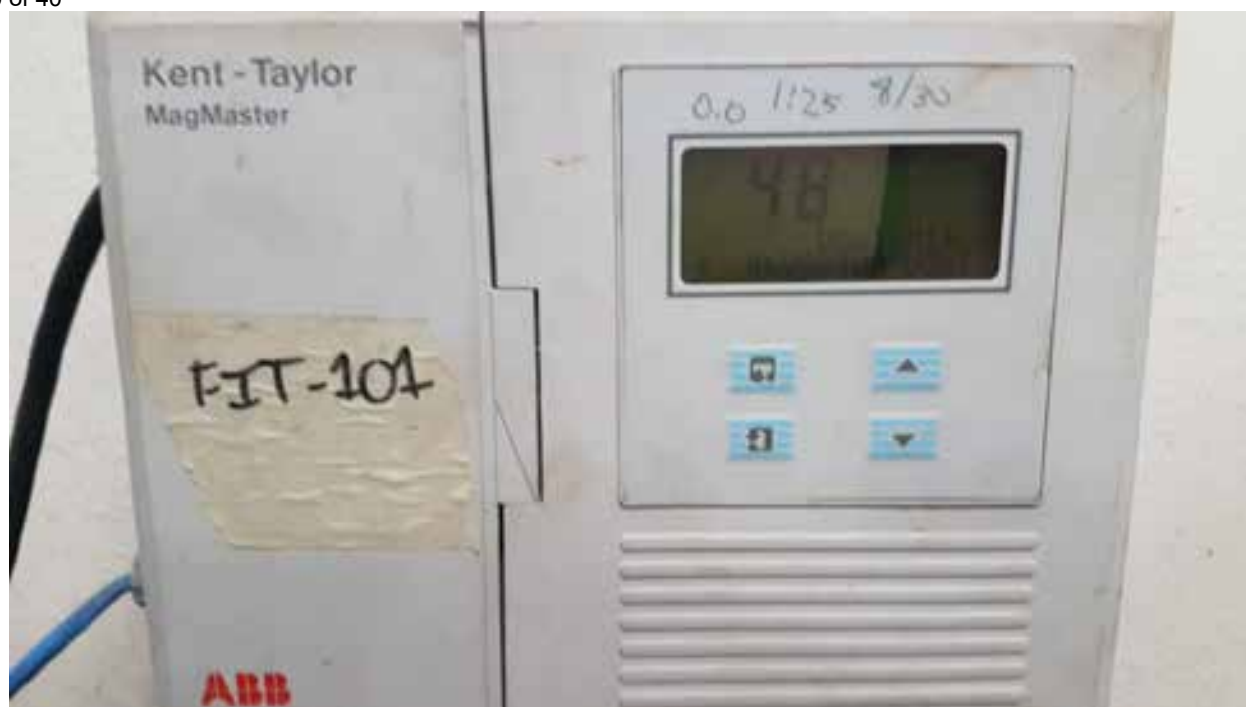


Figure 15 - Raw water Flow Meter in plant - Operator reports that it is in line with the flow meter at the Powers Creek inlet.



Figure 16 pH meter of treated water - Probe needs calibration – Sensor located on treated water to tank line



Figure 17 - SCD showing setpoint value is met during treatment



Figure 18 - Entrance to FeCl room



Figure 19 Neat FeCl transfer pump is broken. Crew used temporary valve which corroded away within 20 to 30 minutes.



Figure 20 FeCl Neat Tank to Stock Solution tank mixing manifold. This needs some repairs.

UNALAKLEET WATER TREATMENT PLANT

Desired Solution Strength (%)	Water Flowrate (gpm)	Ferric Pumping Rate* L/hr
1%	2	3.1
2%	2	6.3
3%	2	9.4
4%	2	12.5
5%	2	15.7
6%	2	18.8
7%	2	21.9
8%	2	25.1
9%	2	28.2
10%	1.90	29.8

*Maximum pump capacity 30 L/hr

CRW Engineering Group, LLC
(907) 582-3252

2/4/2014

Figure 21 - Chart showing FeCl mixing ratios



Figure 22 - Chlorine vats - Only one operational pump - Crew swaps pump between tanks as needed.



Figure 23 - Plant Booster Pumps - right pump working, left malfunctioning



Figure 24 - New Heater in HVLC Control Room - Functioning



Figure 25 - Wiring in Pump Control Panel - single phase to three phase converters for VFDs



Figure 26 - FAA Lift station Exterior



Figure 27 - FAA Lift station - Water seeping through wet-well, especially when utilidors are flooded



Figure 28 - FAA Lift station - Temporary 110v pump and hose connection with temp 110v float switches.



Figure 29 - Terminal Lift Station Exterior - Note Damage on Top Right Exterior



Figure 30 - Terminal Lift Station Control Panel - Recommended parts for functionality



Figure 31 - Terminal Lift Station wiring - Interior looks good, only one picture to show general condition



Figure 32 - Terminal Lift Station - Show of wet well. Functioning pump is on entrance side. Power junction boxes should be taken out of the wet well, and new ones placed above with conduit running down into wetwell.



Figure 33 - Terminal Lift Station - Rails intact - side closes to picture is where pump was reportedly dropped and broke the bottom supports.



Figure 294 - Terminal Lift Station - Spare Pump - Could be installed if supports were fixed properly.



Figure 35 - Covenant Lift Station exterior



Figure 36 - Covenant Lift Station - Wet Well Room Interior



Figure 37 - Covenant Lift Station - Rail mounting brackets have been jacking up. They buckle when operators try to pull pump. Operators would rather "jog" the pumps over and over instead of risking losing the support bracing.



Figure 3830 - "Support" bar that operators must stand on to re-align pump rails when they dislodge, as well as re-wire a new pump when one fails. Bar is angled behind the set of functioning pump rails (left) to the concrete wetwell behind the shadow of the chain.



Figure 39 - Covenant Lift Station - Vent Package Removed. Boarded Up



Figure 3140 - Covenant Lift Station - Interior "Passive" ventilation



Figure 41 - Covenant Lift Station - Outside shot of "interior passive ventilation"



Figure 42- Covenant lift station - Broken water/glycol heater for slab, control panel on right



Figure 323 - covenant lift station - Pump control panel.



Figure 334 - HVLS Looking down well after all pump cables and power have been set. Temporary connection hose is routed around the ladder (grey)



Figure 45 - HVLS wet well hatch existing - requires demolition prior to installation of new hatch



Figure 46 - HVLS Existing Wet Well hatch - interior shot showing hinge and how angle iron is set in concrete



Figure 47 - Elders Home under Construction



Figure 48 - Elders Home Pump House - attempting to set new data logger after existing one fell down during removal



Figure 49 - Top of Well #8 that will be pump tested for 30 days



Figure 50 - City tank fuel farm, levels are easy to see because of frost.



Figure 341 - HVLS Daytime shot of temp bypass.



Figure 52 - HVLS with pump power cables running through conduit - suggest future orders for pump power cables to longer than necessary.



Figure 53- Dwayne assisting with testing the pumps. We pulled the pumps up 1 foot to check rotation of the rotor.



Figure 54 - Buck showing Dwayne how the lift station panel works.



Figure 55 - Slough Bypass for freeze prevention of system.

Attachments:

Well Logs and Pump Test Results (2019)



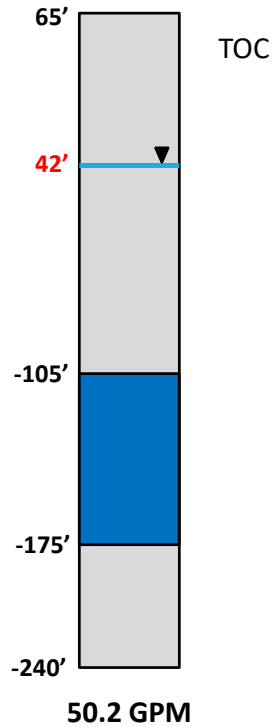
Water Bearing Zones



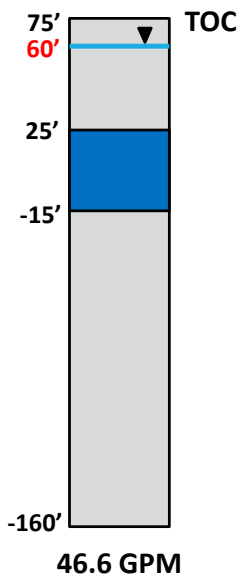
Static Water Level

TOC Top of Casing

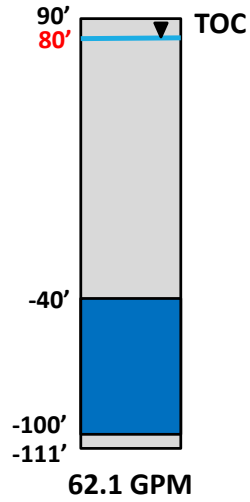
Well 3



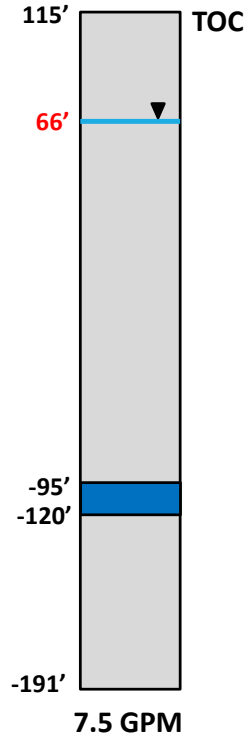
Well 6



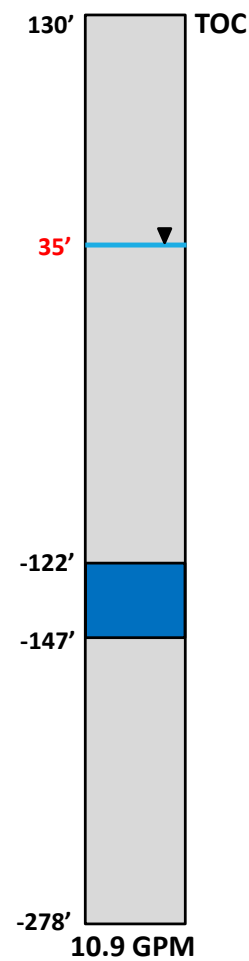
Well 8



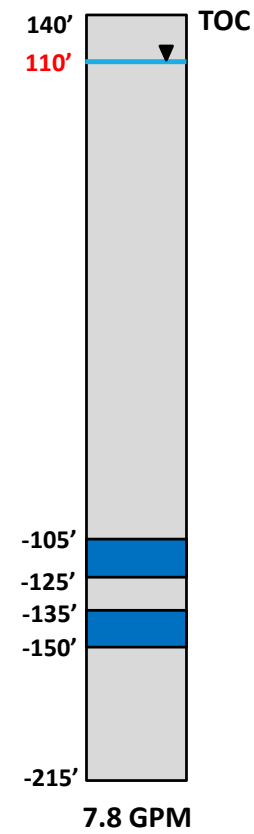
Well 5



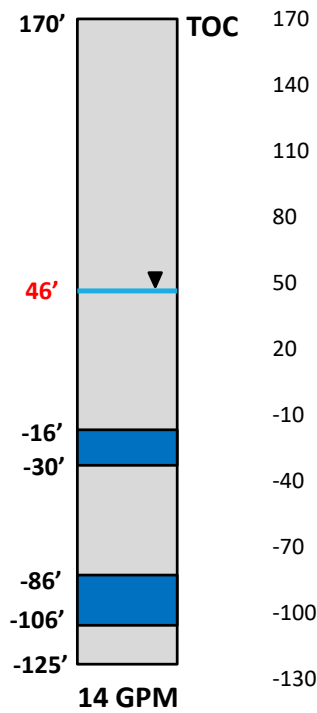
Well 1



Well 7



Well 4



Elevation (ft)

200

170

140

110

80

50

20

-10

-40

-70

-100

-130

-160

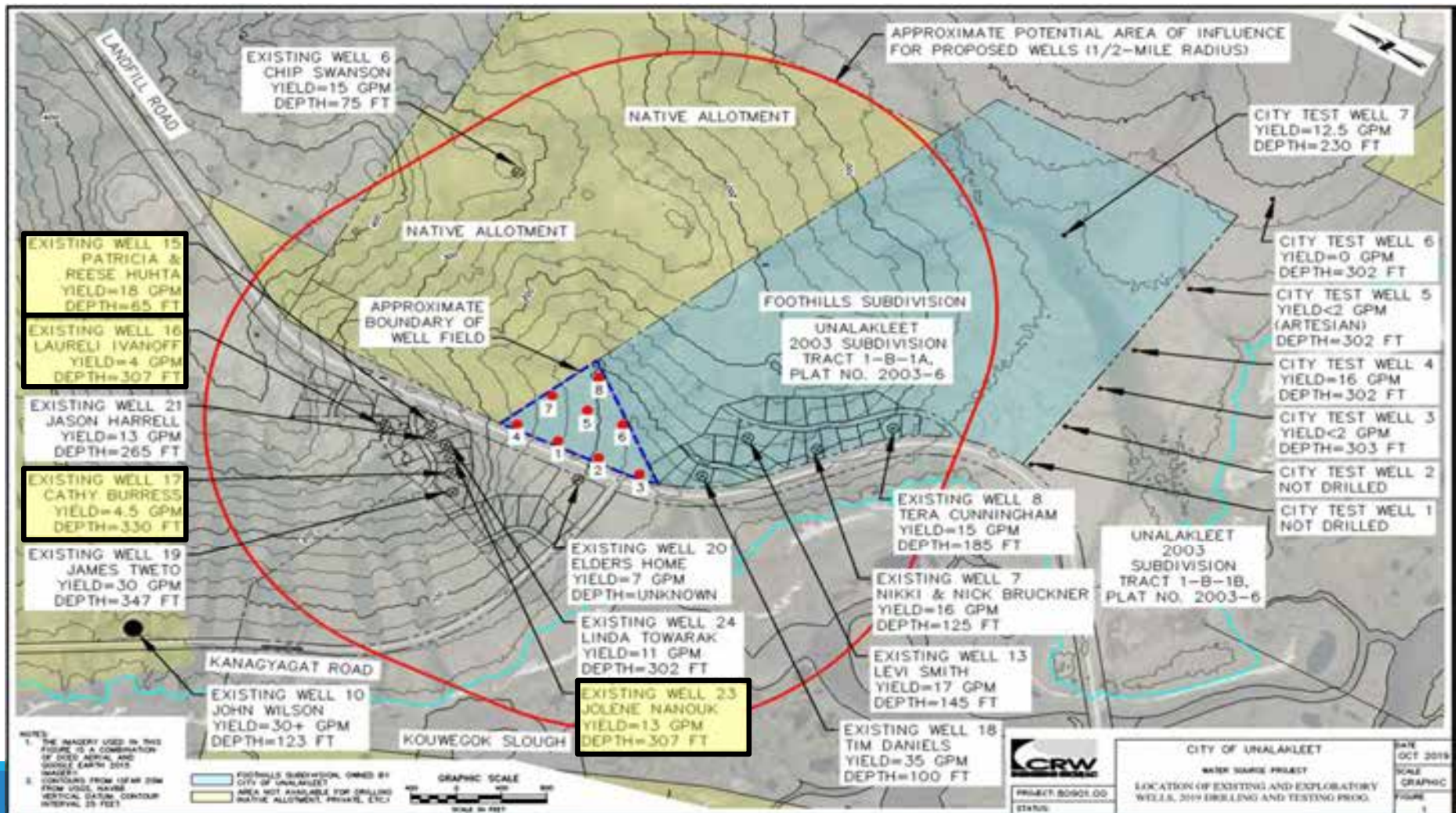
-190

-220

-250

-280

Well Locations



City of Unalakleet

JANUARY 2020

Calls of Service (Water/Sewer Freeze-up, etc.)

Done	NAME	PHONE	Service Needed
☒	1. Velma Johnson	624-3667 625-1080	No water, Dwayne J.
☒	2. Harris Ivanoff		No water Dwayne J.
☐	3. Marilyn Oyoumick		No water/backup Dwayne J.
☒	4. Millie Katongan	625-1184	No water Dwayne J.
☒	5. Ricky Ivanoff	744-2161	No water Dwayne J.
☒	6. Ebba Ivanoff	625-1891	No water
☒	7. Jerry Arca	625-1293	Possibly no water
☒	8. Covenant Church	Thomas	Water box behind Sanctuary
☐	9. Lester Bahr Sr		Frozen water
☐	10. Percy Nakarala		No Water
☒	11. Bruce Johnson		No water
☒	12. Harris Ivanoff Sr		Frozen water Best
☒	13. Ellen Slwooko		No Water/Frozen
☒	14. Wasillie Soxie	625-1990	request for disconnection
☒	15. Chester Millett		disconnected/ ^{Frozen} leaking
☒	16. Bebucks Ivanoff		Frozen water
☒	17. Millie Ivanoff		Leak
☐	18. Lorraine Ivanoff		Frozen
☐	19. Teeda Katongen		Frozen
☒	20. RAYN		Frozen
☒	21. Ray Dröby	624-5432	Frozen Sewer
☐	22. Mary Jane Anagick		Frozen
	Clarence Panipetuk		Froze Sewer

UNALASKLET COPPER SAMPLING

Map #	Sample Location	Sampling Dates											
		1/3/2007	6/23/2010	12/1/2010	6/1/2012	6/1/2014	12/1/2014	2/1/2016	6/1/2017	12/1/2017	12/1/2018	6/1/2018	
1	Axel (Al)/Mabel Oyoumick	0.330	0.330	0.530	1.000	2.200	3.510	3.100	2.000		2.000	2.000	
2	Allen Savetikk	0.408	0.39	0.47	0.620	3.260	1.240	0.360			4.300		
3	Alvin Katchatag	0.252	0.050	0.210	0.16	0.390	0.595						
4	Anna Pehle	0.458	0.18	0.45	0.970	1.100	1.780	0.850	0.610	0.640		0.610	
5	Arthur/Shane Johnson ⁶			1.26	1.380	1.380	2.040	0.380	0.690			0.690	
6	Bill Koutchuk	0.445	0.150	0.180	0.190	0.140	0.275	0.350	0.060		0.084	0.060	
7	Bruce Johnson	0.364	0.1	0.35	0.360	3.200	1.400	0.950	0.310		1.200	0.310	
8	City Office										0.170		
9	City Shop (WTP)										0.015		
10	Clarence Panipchuk			0.800	0.110	0.220	0.182	0.290					
11	David Katongan	0.98											
12	E.M. Haugen	0.5	0.87	0.22	0.35								
13	Frank Katchatag	0.26	0.06										
14	Gary Eckenweiler							2.900	1.900			1.900	
15	Harris Ivanoff			0.180	0.200	0.430	0.281	0.330	0.230		0.380	0.230	
16	Henry Nanook								0.880	0.380	1.900	0.880	
17	Henry Oyoumick	1.750	0.240	0.000	1.230	4.230	3.420	2.800	1.900	1.800		1.900	
18	James Cragle										0.500		
19	Janelle Katongan ⁶	0.339	0.080	0.460	0.890	3.610	0.835	0.460					
20	Joseph Katchatag								0.400	0.640	0.190	0.400	
21	Kathy Rodriguez	0.588	0.31	0.43	0.590	1.970	1.410	1.300	1.000		1.400	1.000	
22	Larry Ivanoff ⁶	0.328	0.09	0.41	1.310	2.430	1.750	0.400	0.420		0.880	0.420	
23	Lenord Brown		0.37										
24	Leister Bahr	0.858	0.080	0.970	0.130	0.500	0.246	0.440					
25	Lila Nashalook								2.000	0.780	1.300	2.000	
26	Loerena Panipchuk								0.120		0.044	0.120	
27	Lonnie/Walter Ivanoff	0.437	0.54	1.66	1.630	2.830	2.310	0.790	1.200		3.400	1.200	
28	Lucy Ivanoff					3.840	0.275	1.700					
29	Marlene Haugen						0.869	0.770	0.490		0.600	0.490	
30	Martin Panipchuk			4.050	0.21	0.590	1.100						
31	Mary Ann Haugen					0.970							
32	Millie Katongan		0.17										
33	Ricky Ivanoff	1.1	0.21						0.690	0.870	0.350		
34	Ruth Blatchford							1.700					
35	Sheldon Katchatag										0.044		
36	Theresa Nanook								1.800			1.800	
37	Tracy Cooper	0.442	0.280	0.300	0.220	0.200	0.697	0.520	0.140	0.140	0.160	0.140	
38	Ursula Nashalook	0.922	0.58	1.23	0.06								
39	Wesley/Francis Ivanoff	0.353	0.130	0.630	0.360	2.400	1.640	2.100	0.600		0.540	0.600	
90th Percentile		1.04	0.554	1.26	1.31	3.160	2.310	2.300	2.300	1.490	2.000	1.900	

Note:

1. Secondary Standard copper levels is 1.0 mg/L. The copper Action Level is 1.3 mg/L.
2. Samples above secondary standards are yellow. Samples above action levels are orange.
3. k value is the percentile times the number of samples, $k = (90\% * n)$
4. Copper analytical results are evaluated against an Action Level not a Maximum Contamination Level (MCL). No copper MCL exists.
5. Copper levels were rising but spiked in 6/2014 samples. In winter 2013/2014 the WTP filters and chemicals were changed.
6. Copper levels dropped below Action Level after old copper service line was replaced with HDPE.



1. Ident. by house w/ replaced service lines OR Interior Plumbing

RANK OF INCREASE

Unalakleet 90-Percentile Copper Calculations

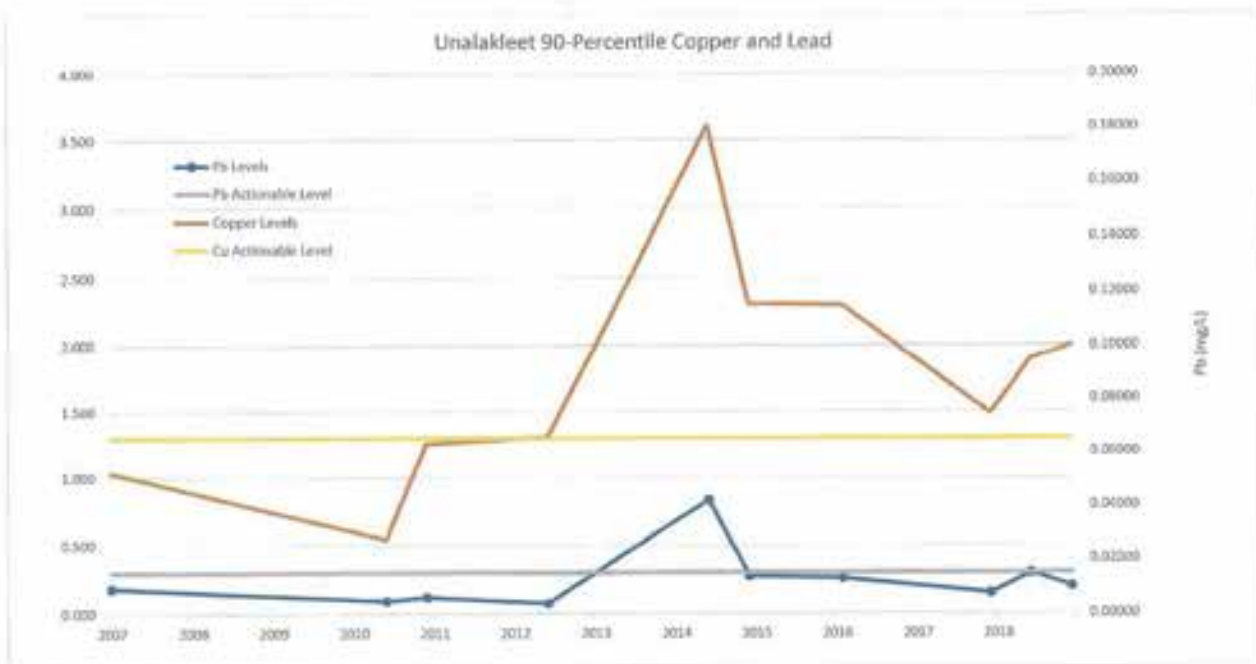
#	Sampling Date										
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1	0.252	0.080	0.000	0.060	0.140	0.182	0.290	0.060	0.140	0.090	0.015
2	0.260	0.060	0.180	0.110	0.200	0.246	0.330	0.120	0.380	0.120	0.044
3	0.328	0.080	0.180	0.130	0.220	0.275	0.850	0.140	0.640	0.140	0.044
4	0.330	0.080	0.210	0.160	0.390	0.275	0.360	0.230	0.640	0.230	0.084
5	0.339	0.080	0.220	0.190	0.430	0.281	0.380	0.310	0.780	0.310	0.160
6	0.353	0.100	0.300	0.200	0.590	0.595	0.400	0.400	0.870	0.400	0.170
7	0.364	0.130	0.350	0.210	0.590	0.697	0.440	0.420	1.800	0.420	0.190
8	0.408	0.150	0.410	0.220	0.970	0.835	0.460	0.400		0.490	0.350
9	0.437	0.170	0.430	0.350	1.100	0.869	0.520	0.600		0.600	0.380
10	0.442	0.180	0.450	0.360	1.380	1.100	0.770	0.610		0.610	0.500
11	0.445	0.210	0.460	0.360	1.870	1.240	0.790	0.690		0.690	0.540
12	0.458	0.240	0.470	0.590	3.200	1.400	0.830	0.690		0.880	0.600
13	0.500	0.280	0.530	0.620	2.400	1.410	0.950	0.880		1.000	0.880
14	0.588	0.310	0.630	0.890	2.480	1.640	1.300	1.000		1.200	1.200
15	0.858	0.330	0.800	0.970	2.830	1.750	1.700	1.200		1.800	1.500
16	0.922	0.370	0.970	1.000	3.300	1.780	1.700	1.800		1.900	1.400
17	0.980	0.390	1.250	1.230	3.260	2.040	2.100	1.900		1.900	1.900
18	1.100	0.540	1.260	1.310	3.610	2.310	2.300	1.900		2.000	2.000
19	1.750	0.580	1.890	1.880	3.840	3.420	2.800	2.000		2.000	3.400
20		0.870	4.050	1.630	4.230	3.510	3.100	2.000			4.300
90th (mg/l)	1.04	0.554	1.25	1.31	3.160	2.310	2.300	2.300	1.490	1.900	2.000

Note:

1. Secondary Standard copper levels is 1.0 mg/l. The copper Action Level is 1.3 mg/l.
2. Samples above secondary standards are yellow. Samples above action levels are orange.
3. k value is the percentile times the number of samples, k = (50%*n)
4. Copper analytical results are evaluated against an Action Level not as Maximum Contamination Level (MCL). No copper MCL exists.
5. After 6/1/2014 sampling the City began replaced several copper service lines with HDPE which lowered those house's copper levels.
6. Sampling size is too small to be conclusive.



- Reformat w/ homeowner name OR MAIL NUMBER (TO DO)



- Needs Reformat - Is it Average?
- Need Lead Table

Appendix C: Copper Sampling

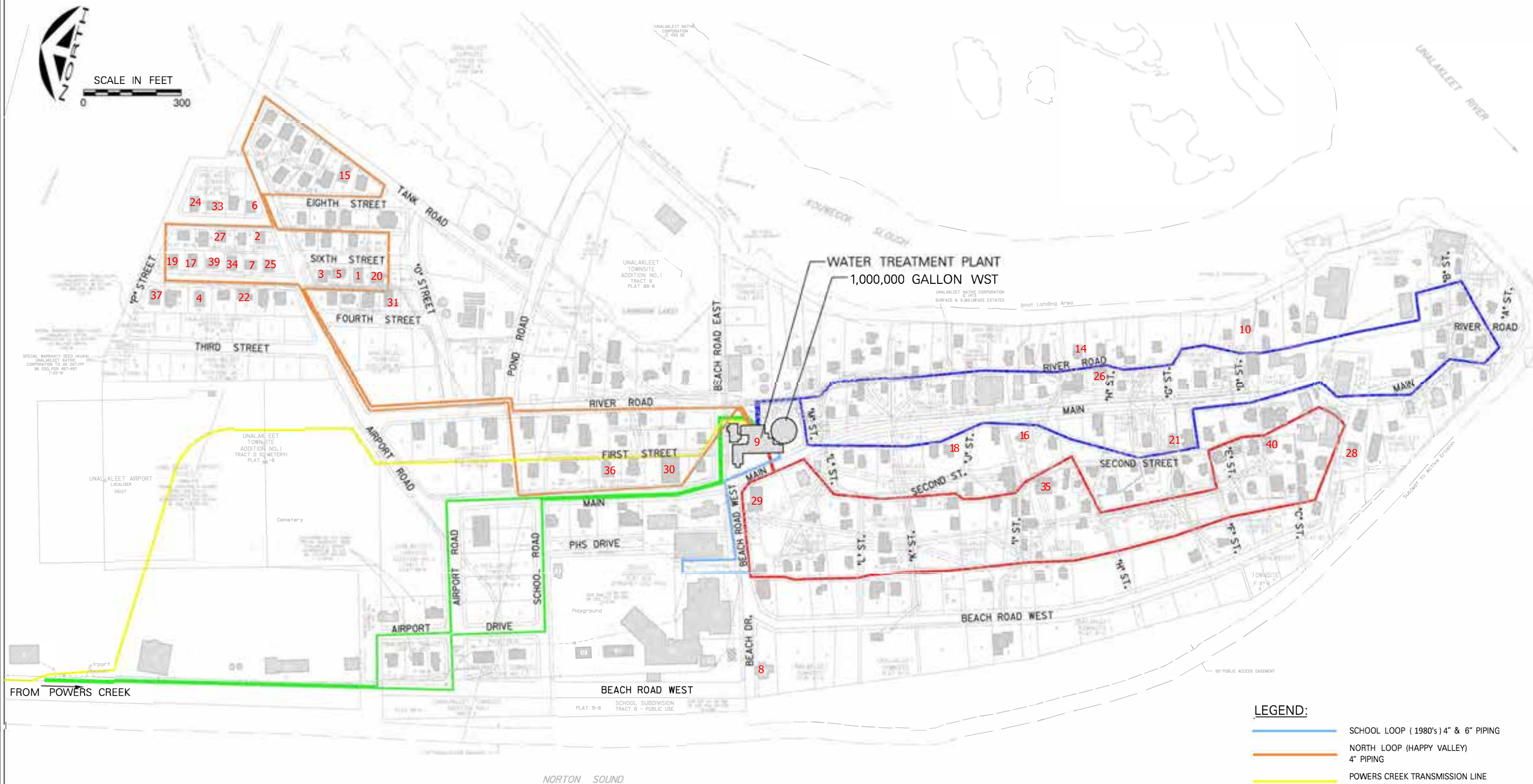
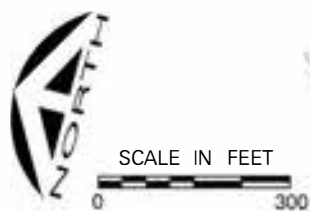
UNALAKLEET COPPER SAMPLING SUMMARY

Map #	Sample Location	Sampling Dates									
		1/1/2007	6/23/2010	12/1/2010	6/1/2012	6/1/2014	12/1/2014	2/1/2016	12/1/2017	6/1/2018	12/1/2018
1	Axel (Al)/Mabel Oyoumick	0.333	0.330	0.530	1.000	2.200	3.510	3.100		2.000	2.000
2	Allen Savetilik	0.408	0.39	0.47	0.620	3.260	1.240	0.360			4.300
3	Alvina Katchatag	0.252	0.050	0.210	0.16	0.390	0.595				
4	Anna Pehle	0.458	0.18	0.45	0.970	1.100	1.780	0.850	0.640	0.610	
5	Arthur/Shane Johnson ⁶			1.26	1.380	0.90	2.040	0.380		0.690	
6	Bill Koutchak	0.445	0.150	0.180	0.190	0.140	0.275	0.350		0.060	0.084
7	Bruce Johnson	0.364	0.1	0.35	0.360	3.200	1.400	0.950		0.310	1.200
8	City Office										0.170
9	City Shop (WTP)										0.015
10	Clarence Paniptchuk			0.800	0.110	0.220	0.182	0.290			
11	David Katongan	0.98									
12	E.M Haugen	0.5	0.87	0.22	0.35						
13	Frank Katchataq	0.26	0.06								
14	Gary Eckenweiler							2.300		1.900	
15	Harris Ivanoff			0.180	0.200	0.430	0.281	0.330		0.230	0.380
16	Henry Nanook								0.380	0.880	1.900
17	Henry Oyoumick	1.750	0.240	0.000	1.230	4.230	3.420	2.800	1.800	1.900	
18	James Cragle										0.500
19	Janelle Katongan ⁶	0.339	0.080	0.460	0.890	3.610	0.835	0.460			
20	Joseph Katchatag								0.640	0.400	0.190
21	Kathy Rodriguez	0.588	0.31	0.43	0.590	1.970	1.410	1.300		1.000	1.400
22	Larry Ivanoff ⁶	0.328	0.09	0.41	1.310	2.430	1.750	0.400		0.420	0.880
23	Lenord Brown		0.37								
24	Lester Bahr	0.858	0.080	0.970	0.130	0.500	0.246	0.440			
25	Lila Nashalook								0.780	2.000	1.300
26	Loerena Paniptchuk									0.120	0.044
27	Lonnice/Walter Ivanoff	0.437	0.54	1.69	1.630	2.830	2.310	0.790		1.200	3.400
28	Lucy Ivanoff					3.840	0.275	1.700			
29	Marlene Haugen							0.770		0.490	0.600
30	Martin Paniptchuk			4.050	0.21	0.590	1.100				
31	Mary Ann Haugen					0.970	0.869				
32	Millie Katongan		0.17								
33	Ricky Ivanoff	1.1	0.21						0.870	0.690	0.350
34	Ruth Blatchford							1.700			
35	Sheldon Katchatag										0.044
36	Theresa Nanook									1.800	
37	Tracy Cooper	0.442	0.280	0.300	0.220	0.200	0.697	0.520	0.140	0.140	0.160
38	Ursula Nashalook	0.922	0.58	1.23	0.06						
39	Wesley/Francis Ivanoff	0.353	0.130	0.630	0.360	2.400	1.640	2.100		0.600	0.540
90th Percentile		1.040	0.554	1.260	1.310	3.610	2.310	2.300	1.335	1.900	2.000

Note:

1. Secondary Standard copper levels is 1.0 mg/L. The copper Action Level is 1.3 mg/L.
2. Samples above secondary standards are yellow. Samples above action levels are orange.
3. k value is the percentile times the number of samples, k = (90%*n)
4. Copper analytical results are evaluated against an Action Level not an Maximum Contamination Level (MCL). No copper MCL exists.
5. Copper levels were rising but spiked in 6/2014 samples. In winter 2013/2014 the WTP filters and chemicals were changed.
6. Copper levels dropped below Action Level after old copper service line was replaced with HDPE.





LEGEND:

- SCHOOL LOOP (1980's) 4" & 6" PIPING
- NORTH LOOP (HAPPY VALLEY) 4" PIPING
- POWERS CREEK TRANSMISSION LINE
- FAA LOOP 6" PIPING
- WEST LOOP (1960's) 6" PIPING
- SOUTHEAST LOOP (1960's) 4" PIPING

Unalakleet 90-Percentile Copper Calculations

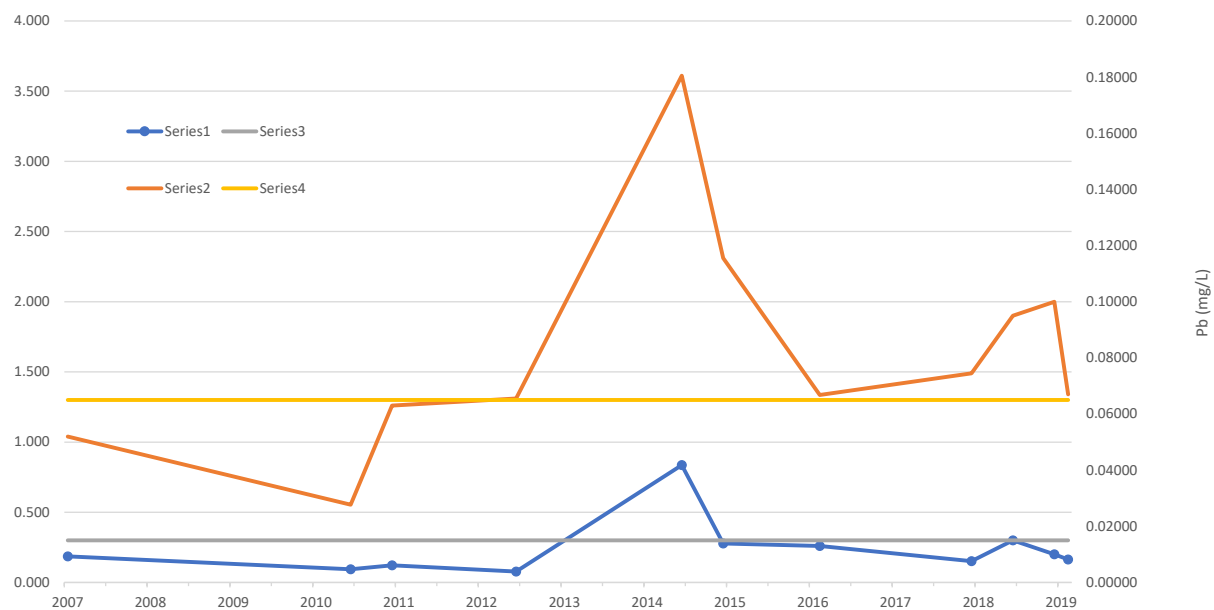
#	Sampling Date									
	1/1/2007	6/23/2010	12/1/2010	6/1/2012	6/1/2014	12/1/2014	2/1/2016	12/1/2017	6/1/2018	12/1/2018
1	0.252	0.050	0.000	0.060	0.140	0.182	0.290	0.140	0.060	0.015
2	0.260	0.060	0.180	0.110	0.200	0.246	0.330	0.380	0.120	0.044
3	0.328	0.080	0.180	0.130	0.220	0.275	0.350	0.640	0.140	0.044
4	0.333	0.080	0.210	0.160	0.390	0.275	0.360	0.640	0.230	0.084
5	0.339	0.090	0.220	0.190	0.430	0.281	0.380	0.780	0.310	0.160
6	0.353	0.100	0.300	0.200	0.500	0.595	0.400	0.870	0.400	0.170
7	0.364	0.130	0.350	0.210	0.590	0.697	0.440	1.800	0.420	0.190
8	0.408	0.150	0.410	0.220	0.970	0.835	0.460		0.490	0.350
9	0.437	0.170	0.430	0.350	1.100	0.869	0.520		0.600	0.380
10	0.442	0.180	0.450	0.360	1.380	1.100	0.770		0.610	0.500
11	0.445	0.210	0.460	0.360	1.970	1.240	0.790		0.690	0.540
12	0.458	0.240	0.470	0.590	2.200	1.400	0.850		0.690	0.600
13	0.500	0.280	0.530	0.620	2.400	1.410	0.950		0.880	0.880
14	0.588	0.310	0.630	0.890	2.430	1.640	1.300		1.000	1.200
15	0.858	0.330	0.800	0.970	2.830	1.750	1.700		1.200	1.300
16	0.922	0.370	0.970	1.000	3.200	1.780	1.700		1.800	1.400
17	0.980	0.390	1.230	1.230	3.260	2.040	2.100		1.900	1.900
18	1.100	0.540	1.260	1.310	3.610	2.310	2.300		1.900	2.000
19	1.750	0.580	1.690	1.380	3.840	3.420	2.800		2.000	3.400
20		0.870	4.050	1.630	4.230	3.510	3.100		2.000	4.300
90th (mg/l)	1.04	0.554	1.26	1.31	3.610	2.310	2.300	1.335	1.900	2.000

Note:

1. Secondary Standard copper levels is 1.0 mg/L. The copper Action Level is 1.3 mg/L.
2. Samples above secondary standards are yellow. Samples above action levels are orange.
3. k value is the percentile times the number of samples, k = (90%*n)
4. Copper analytical results are evaluated against an Action Level not an Maximum Contamination Level (MCL). No copper MCL exists.
5. After 6/1/2014 sampling the City began replaced several copper service lines with HDPE which lowered those house's copper levels.
6. 12/1/2017 Sampling size is too small to be conclusive. ADEC lists 90th as 1.149 which appears to be a typo.
7. When there is less than 10 samples, the two highest samples are averaged together for the 90th.
8. The 2017 sample size is too small for an accurate determination of 90th-percentile.



Unalakleet 90-Percentile Copper and Lead



Unalakleet pH and Temperature Measurements

Map #	Name	Water Loop	Cold Water		Hot Water	
			pH	°F	pH	°F
10	Raw Water	WTP	6.9	48.9	n/a ³	n/a ³
10	Point of Entry ¹	WTP	6.5	54	n/a ³	n/a ³
14	Gary Eckenweiler	Southeast	6.7	53.4	6.2	90.7
36	Theresa Nanook	Happy Valley	6.7	56.6	6.2	106.3
1	Axel Oyamick	Happy Valley	6.8	56.8	6.5	80.8
17	Henry Oyoumick	Happy Valley	6.6	58.3	6.3	91.8
40	Kenny Richard	West Loop	6.8	58.3	n/a ³	n/a ³

Notes:

- 1. Samples taken on September 18, 2019 as part of a desk top corrosion study.*
- 2. Operator stated that soda ash amounts were adjusted the night before.*
- 3. The house or WTP isn't plumbed for hot water.*

ADEC Drinking Water Watch
Copper Sample Summary Results

Data Retrived: 3/11/2020

Monitoring Date		Number of Samples	Measure (mg/L)	Water System ID	Analyte
Begin	End				
1/1/2019	12/31/2019	20	1.34	DS001	Copper
1/1/2018	12/31/2018	40	2	DS001	Copper
7/1/2017	12/31/2017	7	1.149	DS001	Copper
1/1/2016	6/30/2016	20	2.3	DS001	Copper
7/1/2014	12/31/2014	20	2.31	DS001	Copper
1/1/2014	12/31/2016	20	3.61	DS001	Copper
1/1/2012	12/31/2012	20	1.31	DS001	Copper
7/1/2010	12/31/2010	20	1.26	DS001	Copper
1/1/2010	6/30/2010	20	0.544	DS001	Copper
7/1/2006	12/31/2006	19	0.009	DS001	Copper

Note: 7/1/2-12/31/2017 measured appears to be a typo since it doesn't match raw data on Drinking Water Watch. Real value should be 1.335 mg/L.

Appendix D: Desktop Corrosion Study

- Unalakleet Desktop Corrosion Study. GV Jones & Associates. March 2, 2020.



1200 E 76th Avenue, Suite 1207
Anchorage, Alaska 99518
Phone: (907) 346-4123
FAX: (907) 346-4124

MEMORANDUM

To: Mr. Daniel Nichols, P.E. Kuna Engineering
From: Andrew Jones, P.E. GV Jones & Associates Inc.
Subject: Unalakleet Desktop Corrosion Study
Date: March 3, 2020

Background

Unalakleet has a piped water system which was originally constructed in the 1960s. The system has approximately 250 service connections and is buried, which makes leaks and breaks difficult to locate.

Currently the community draws raw water from nearby Powers Creek. Due to the age of the distribution system & the corrosivity of source water from Powers Creek, many of the copper water service lines to the homes are reported to have failed. Speculation that the water might be corrosive is based on the high measured levels of dissolved copper found in the community drinking water and on the number of reported pitorifices which have corroded to the point that they were rendered ineffective.

Unalakleet's water exceeded allowable copper limits in 2012, 2014, 2016, and again in 2018. In 2017, DEC sent the City a letter outlining regulatory actions related to copper exceedances. Adverse health impacts associated with high copper concentrations include vomiting, diarrhea, cramps, nausea, liver damage and kidney disease.

Kuna Engineering (Kuna) is preparing a preliminary engineering report for upgrades to the City's water utility and has requested that GV Jones and Associates, Inc. (GVJ&A) perform a desktop evaluation of pipe corrosion potential using a computer equilibrium model based on water quality information collected in the field. The following report details how that model was prepared, describes the results of the modeling effort, and suggests potential measures which might be applied to correct the corrosion problem.

Raw Water Source and Current Operation

Based on information provided by the City, under the current operation, raw water is drawn from Powers Creek and flows through a pipeline until it reaches the water treatment plant. The water is then treated with a coagulant, ferric chloride, to remove a large portion of the organics which are present in the water. The concentration of organics changes over time; either because of short term changes in the characteristics of the river or due to seasonal variations. This requires the operator to routinely check his dosage of ferric chloride using a Streaming Current Detector. After determining the dosage he then manually adjusts the dosage of ferric chloride.

Because ferric chloride is highly acidic, supplemental chemical alkalinity must be added to the water to compensate for the alkalinity consumed and the pH depression resulting from its use. This is accomplished by adding soda ash to the treated water. A pH probe located downstream of soda ash

addition controls the soda ash dosing pump and its rate of soda ash addition to meet a setpoint pH of the finished water desired by the operator.

Water Quality Data

Table 1 summarizes the commercial laboratory test results for water quality samples collected by Kuna for this project. Some of the values in **Table 1** were utilized to conduct equilibrium modeling and corrosion control strategy evaluation. The pH and temperature data used in the model are the average pH and temperature of the finished water measured and reported by Kuna during a recent site visit. Alkalinity data were obtained from the ADEC Alaska Water Watch database website. The concentrations of Calcium, Magnesium, Chloride, Sulfate and Total Dissolved Solids used in the model were obtained from laboratory analyzed samples of finished water.

Table 1 – Water Quality Parameters

Parameter	
pH	6.72
Alkalinity, mg/l	44
Temperature, degree C	12.8
Calcium, mg/l	19.2
Chloride, mg/l	22.0
Sulfate, mg/l	1.7
Magnesium, mg/l	3.0
Total Dissolved Solids, mg/l	82

Desktop Evaluation Corrosion Indicators

To evaluate the corrosive character of the raw and treated water for Unalakleet and the effectiveness of various corrosion control alternatives, water quality parameters were calculated using a combination of proprietary and commercially available numerical models. Water quality data summarized in Table 1 were used as the input for these models. A brief description of these parameters is provided below to explain the utility and, as importantly, the limitation of each parameter. It is important to note that these parameters are theoretical calculations based on assumed equilibrium and thermodynamic constants. Corrosion is a complicated, multivariate process and actual values of specific water quality parameters will likely vary from the model results. Nonetheless, these parameters are useful, semi-quantitative indicators of corrosion reactions that occur in the field and how different corrosion control strategies may impact lead and copper levels.

Dissolved Inorganic Carbon (DIC) is a measure of the total amount of inorganic carbon present in the water. DIC is composed of carbon from carbonate species (e.g., CO_3^{2-} , HCO_3^- , H_2CO_3^* , any carbonate complexes). DIC is calculated from the pH and alkalinity data. DIC is an important parameter in determining the solubility of lead and copper and in determining the speciation of the carbonate films that precipitate in distribution systems.

Calcium carbonate precipitation potential (CCPP) is a measure of the amount of calcium carbonate (CaCO_3) that will theoretically precipitate from solution. A negative CCPP implies that the water is undersaturated with respect to calcium carbonate and as a result, CaCO_3 present in solution will dissolve. A positive CCPP implies that CaCO_3 will precipitate. Waters with an excessively high CCPP are prone to excessive scale buildup in the distribution system and especially in the water heaters and boilers.

Dissolved carbon dioxide (CO_2) is the amount of the CO_2 present in solution at the reported pH and alkalinity. High concentrations of dissolved CO_2 often occur in groundwater, although elevated concentrations are possible in surface water. For systems with high concentrations of dissolved CO_2 , air stripping can often elevate the pH and reduce the corrosive nature of the water.

The theoretical copper solubility is calculated by assuming that water in the distribution system is in equilibrium with cupric hydroxide ($\text{Cu}(\text{OH})_2(\text{s})$). Research on copper corrosion has identified $\text{Cu}(\text{OH})_2(\text{s})$ as a major species in the films that form on copper pipe (Edwards, et al., 1996). By assuming the water in the distribution system is in equilibrium with this precipitate, an estimate of the amount that could theoretically be present in solution can be obtained. In addition, the changes in copper solubility caused by changes in pH, alkalinity and any supplemental corrosion inhibitor dose can be evaluated using this approach. It is important to note that this approach is a simplification of the actual system (i.e., species besides $\text{Cu}(\text{OH})_2(\text{s})$ can form in copper pipes) and their presence may change the copper concentration that can be in solution.

The theoretical lead solubility is calculated by assuming that water in the distribution system is in equilibrium with lead carbonate ($\text{PbCO}_3(\text{s})$) (cerussite). Research on lead corrosion has identified cerussite as a major species in the films that form in water distribution systems containing lead pipes and solder (AWWA, 1990; Schock, 1996). As with copper, by assuming the water in the distribution system is in equilibrium with this precipitate, an estimate of the amount that could theoretically be present in solution can be obtained. In addition, the changes in lead solubility caused by changes in pH, alkalinity, and inhibitor dose can also be evaluated using this approach.

Finally, the Langlier Index (LI) has been included only because it is a frequently cited parameter which is commonly used to describe the corrosivity of a given water source. The LI is the difference in the pH of a solution in equilibrium with $\text{CaCO}_3(\text{s})$ and the actual pH of solution. Although it is a widely used indicator of corrosive water, it has no direct relationship to lead and copper solubility. In other words, a negative LI does not guarantee that lead and copper concentrations will be above action limits, nor does a positive LI guarantee that lead and copper concentrations will be below action limits.

Caveats for Modeling Results and Corrective Action

Equilibrium Model Conditions vs. Field Conditions

The desktop water chemistry corrosion model relies on an assumption of chemical equilibrium to estimate the quantities of lead and copper which might be present in the analyzed water. The assumption of equilibrium allows for mathematical approximations of chemical phenomena to be analyzed and compared for varying conditions. However, in many water treatment and water distribution scenarios, the amount of time required for the water to approach an equilibrium condition is much longer than the amount of time the water spends in the piped water system.

The result is that in many cases the equilibrium estimates of lead and copper corrosion reported in the model are greater than the concentrations observed in the field and the modelling effort is generally conservative in that it tends to overestimate the amount of corrosion which is occurring. This is especially true with lead because in most cases there is not a significant amount of lead present in the wetted pipe surfaces and there is little opportunity for the concentration of lead in the water piping to approach a full equilibrium level.

Potential Presence of Corrosion Pits

One complicating factor in modeling the amount of lead and copper corrosion in the drinking water piping is non-uniform corrosion. One example of this is the phenomenon of pitting corrosion in copper piping. The concentrations of lead and copper described by the water quality computer model are the

equilibrium concentrations of those ions which would dissolve into the water if the residence time of the water in the piping was enough to bring the system to full equilibrium. The model holds true in systems where the corrosion of the piping is occurring uniformly and where sufficient time is available for the system to approach equilibrium.

However, in some cases, the corrosion of copper piping tends occur in localized areas (or ‘corrosion cells’) where the corrosion byproducts act as a catalyst for further corrosion to occur. This leads to accelerated corrosion in localized pockets on the inside surface of the piping. In extreme cases, these localized pockets create weak points in the wall of the piping. These areas are then more vulnerable to breakages if freezing occurs. If the corrosion continues until the pipe wall is breached, then the localized corrosion results in the formation of a pinhole leak.

Once a pit is established in the piping it can be hard to stop the mechanism of the ‘corrosion cell’ and the corrosion of the pipe wall at the location of the cell can accelerate. In extreme cases of copper pipe pitting corrosion, it may not be possible to stop the corrosion even if the water quality were adjusted to a less ‘aggressive’ level or a corrosion inhibitor chemical were added to the water.

Erosive Wear Corrosion

In some cases, a corrosive water chemistry combined with an extremely high velocity in water piping can lead to excessive wear on the pipe fittings and appurtenances. The desktop corrosion modeling undertaken cannot account for lead and copper which might be present in the Unalakleet water system due to erosive wear. Any damages observed due to a combination of erosion and corrosion are best dealt with by addressing the corrosive water chemistry and taking steps to reduce the velocity of the water moving through the piping (if possible).

Specific Applicability of Modeling Results to Existing River Water Source

These water quality results and conclusions are unique to the water source currently being used and to the treatment process currently being applied. If an alternative water source were to be used, such as a well, or if an alternative coagulant was applied during the treatment process, then this analysis would have to be repeated. For instance, a groundwater often has more alkalinity and more hardness than a surface water which can have significant effects on the corrosive potential of that water.

Importance of Verifying Instrumentation Performance

The function of the existing water treatment system relies on a dosage of soda ash to counteract the alkalinity consuming and pH depressing effects of the ferric chloride coagulant which is added to the process. The amount of soda ash added to the finished water depends on the pH measured and reported by an online pH probe. These probes require frequent calibration, maintenance, and cleaning. If these measures are not undertaken regularly then the data provided by the meter can be significantly different than the true conditions. If the soda ash dosage provided to the finished water is significantly less than the amount required to counteract the effects of the ferric chloride, then acidic and corrosive water may be released to the distribution system.

Results of Corrosion Modeling

Table 2 summarizes modeling results for the Unalakleet water sampled from the potable water distribution system. These results indicate that equilibrium lead and copper levels would be well above the action limits at equilibrium conditions. Actual field data for copper are slightly lower than the model predicted values, but this may be due to non-equilibrium conditions in the system.

Table 2 Modeling Results - Water Quality Parameters for Unalakleet

Parameter	Unalakleet Dist. System Potable Water	Notes
DIC (mg/L as C)	15.81	Model Result
Dissolved CO ₂ (mg CO ₂ /L)	19.20	Model Result
CCCP (mg/L as CaCO ₃)	-39.86	Model Result
Theoretical Cu ⁺² in equilibrium with Cu(OH) ₂ (s) (mg/L)	3.97	Model Result
Theoretical Pb ⁺² in equilibrium with PbCO ₃ (s) (mg/L)	0.348	Model Result
Langelier Index	-1.80	Model Result

Figure 1 plots data from simulations conducted to determine the theoretical equilibrium lead and copper concentrations as a function of soda ash added for the treated water in Unalakleet. Soda ash doses (x-axis values) ranging from 0 to 30 mg/L were investigated. Orthophosphate was not added during this run of the model. **Figure 2** depicts the effect of the added soda ash on the finished water pH. This model shows that for significantly increased dosages of soda ash that the equilibrium concentration of copper can be brought to a level below the regulatory MCL of 1.3 mg/L. However, the equilibrium concentration of lead could not be brought close to the regulatory MCL of 0.015 mg/L regardless of the soda ash dosage.

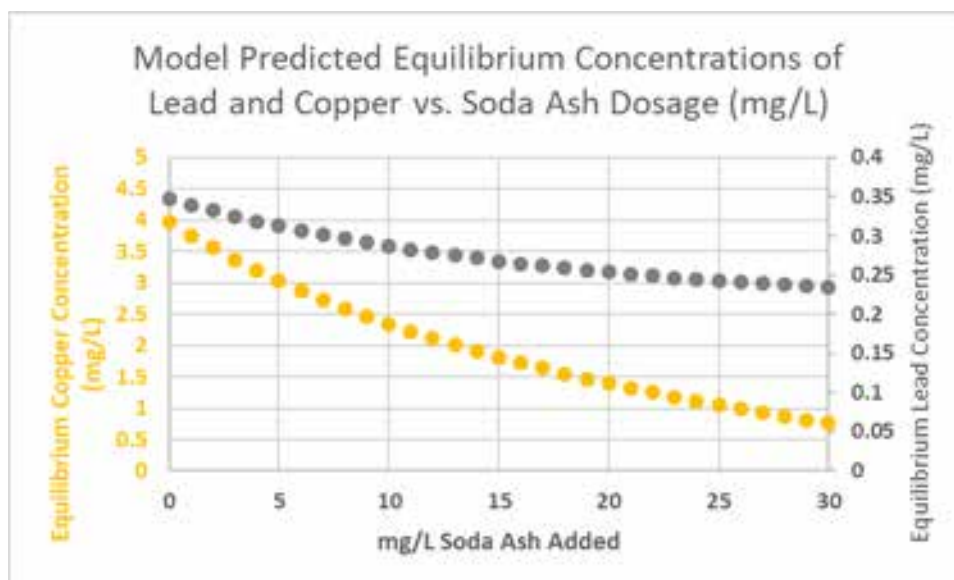


Figure 1 – Soda Ash Addition Corrosion Modelling Results

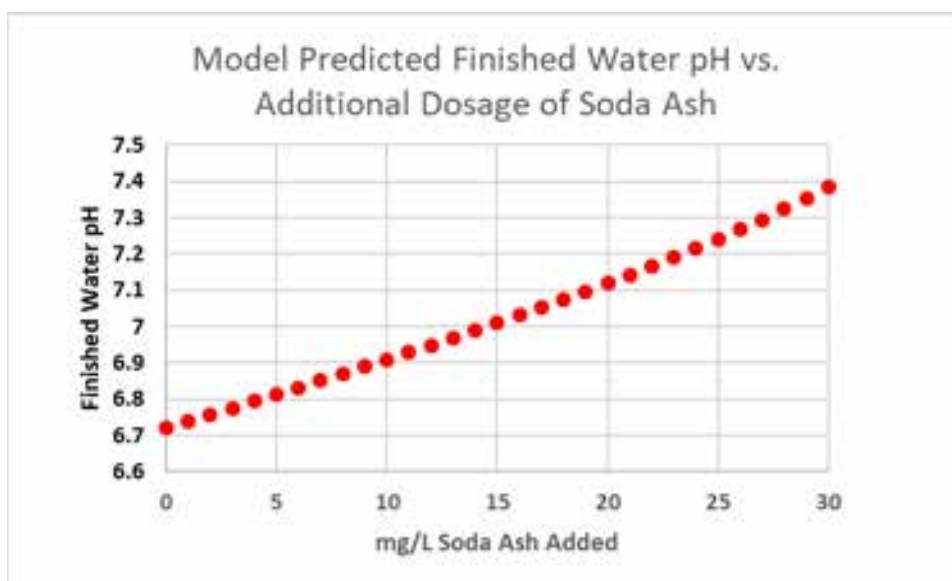


Figure 2 – Soda Ash Addition pH Modelling Results

Figure 3 plots data from model simulations conducted to determine the theoretical equilibrium lead and copper concentrations as a function of soda ash for the treated water in Unalakleet. Soda ash doses (x-axis values) ranging from 0 to 30 mg/L were investigated. Orthophosphate was added during this run of the model at a concentration of only 2 mg/L and the effect on the equilibrium concentrations of lead and copper were dramatic. The copper concentration was brought well below the MCL of 1.3 mg/L without any additional soda ash. However, neither the addition of soda ash nor orthophosphate could bring the equilibrium concentration of lead below the regulatory limit of 0.015 mg/L. However, because the likelihood of the water remaining in the piped water distribution system long enough to achieve full equilibrium with lead is very low, the combination of soda ash and a low dose of orthophosphate appears to be potentially capable of bringing both lead and copper into compliance.

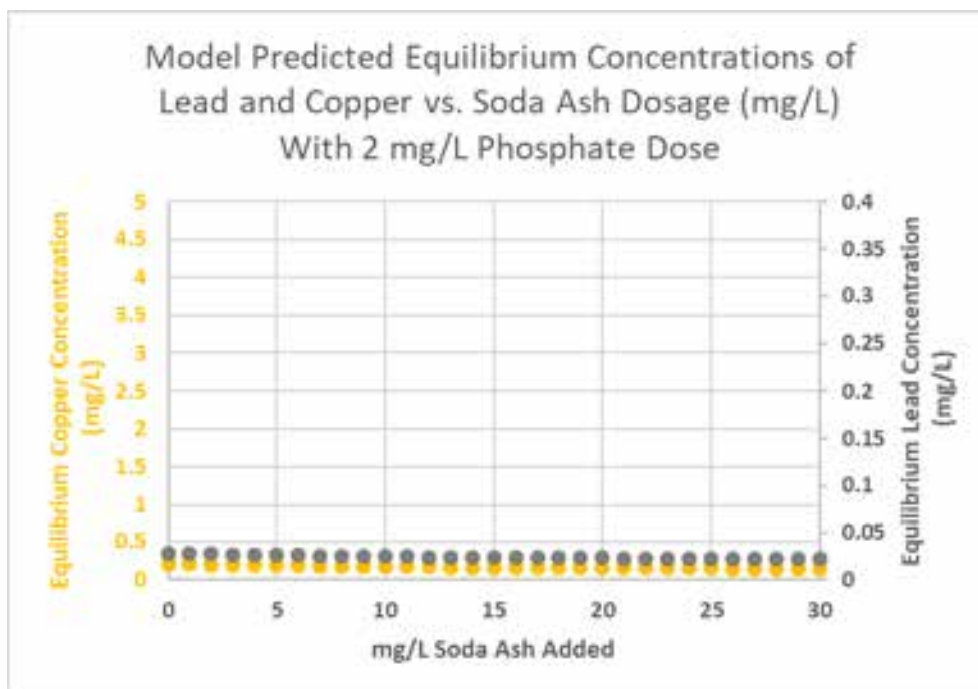


Figure 3 – Soda Ash and Phosphate Addition Corrosion Modelling Results

Corrosion Control Options

The corrosion control options summarized in this section were developed assuming that the chemistry of the water produced for Unalakleet must be adjusted to mitigate lead and copper corrosion. Lead and copper corrosion control in the distribution system is based on the formation of passivating lead and copper carbonate and phosphate films on the pipe surfaces.

Research indicates that these films will readily dissolve if water without the proper chemistry is introduced into the system for even short periods of time (Shock, 1989). Failure to maintain consistent corrosion inhibitor residual and target pH in the distribution system can degrade passivating films leading to failure to meet lead and copper limits even though the corrosion control strategy may be optimized. Analysis of the current treated water chemistry indicates that the addition of a corrosion inhibitor will be required to reliably mitigate lead release. Potential corrosion control strategies of increasing the soda ash dosage alone as well as increasing both the soda ash dosage while also adding a dosage of orthophosphate were investigated. Although other chemicals could be used for corrosion control, the relatively simple equipment (chemical tank and dosing pump) required to deliver these chemicals makes implementation of a corrosion control strategy relatively straightforward. **Appendix A** contains a summary of the data used to generate the figures discussed in the following paragraphs.

Corrosion Control Options

Based on the results of the equilibrium modeling efforts, the historical water quality and past corrosion control practices, we believe that a slight increase in pH and the addition of an orthophosphate inhibitor is the best option for controlling lead and copper corrosion.

An orthophosphate corrosion inhibitor and not polyphosphate or polyphosphate blend should be used at the facility. Substantial evidence exists in the literature that suggests the use of polyphosphate compounds (including the chemical sodium hexametaphosphate (SHMP)) can actually increase lead, and in some cases copper, concentrations in solution (Holm and Schock, 1991; Cantor et al., 2000; Edwards and McNeil, 2002). Polyphosphates frequently act as chelating agents (i.e., compounds that bind with metal ions), which can increase the metal solubility and concentration in solution. Polyphosphates can also inhibit or poison the crystallization process thus reducing the tendency of water to form a scale. These properties have resulted in widespread use of polyphosphate compounds in boiler water and in potable water systems to control the staining and taste problems associated with high iron and manganese concentrations. However, these two properties, the ability to bind metals and to inhibit scale formation, are undesirable in terms of lead and copper corrosion control because they prevent the formation of the insoluble films required for most corrosion control strategies.

In contrast, the addition of orthophosphate promotes the formation of sparingly soluble lead and copper films. Substantial evidence exists that promoting the formation of these films is an effective corrosion control strategy. Under certain circumstances, polyphosphate compounds will revert (i.e., convert spontaneously from the polyphosphate to orthophosphate forms) and provide corrosion control. However, this reversion reaction varies with water quality. Rather than rely on the reversion of polyphosphates to orthophosphate, a better strategy may be to add orthophosphate directly. Orthophosphate options commonly available in Alaska include zinc orthophosphate and disodium phosphate. Zinc orthophosphate (Nalco 7390) at 100% solution concentration has a pH of approximately 0.7 and a 1% solution concentration has a pH of 1.9. Disodium phosphate at 1% solution concentration has a pH of 8.7 – 9.6.

In selecting orthophosphate compounds, the pH of the solution need be considered. Zinc orthophosphate can drop the pH of the treated water and reduce the effectiveness of inhibitor addition. Disodium phosphate would tend to slightly increase the treated water pH and as such may be an effective inhibitor

choice. Prior to selecting a final inhibitor, benchtop laboratory experiments should be conducted with treated water and a variety of chemicals to determine the pH-dose response.

Corrosion Control Chemical Injection Method

Since the suggested corrosion control strategy relies on the formation of insoluble lead and copper precipitates, the importance of maintaining a stable orthophosphate residual and pH in the distribution system cannot be overemphasized. The formation of these precipitates can be readily disrupted by even short duration changes in water quality (Reiber et al., 1997). Maintaining a consistent distribution system water quality can be achieved when corrosion control chemicals are dosed continuously at a rate proportional to the demand of the system (flow paced) and well mixed. In addition to direct flow pacing, on-line instrumentation and a control system may vary the dose to achieve a target residual in the distribution system.

Recommended Corrosion Control Strategy

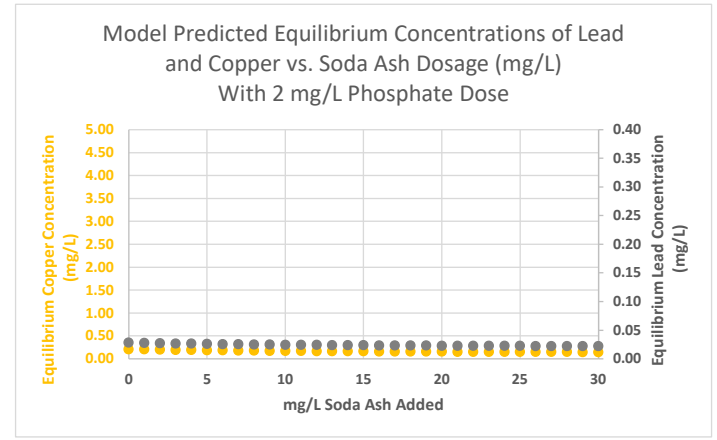
Based on the results of the water sampling and desktop analysis conducted for this study, the following are recommended corrosion control strategies.

1. Verify that the existing pH probe used to control soda ash dosages is calibrated and functioning properly. This may involve independent verification of the pH with a secondary pH meter, the replacement of the existing meter, or both.
2. Increase the dosage of soda ash in the potable water distribution system and measure the effects of that change on the concentrations of lead and copper in the finished water.
3. Examine available sections (if any) of copper piping removed from the distribution system for signs of pitting corrosion. If significant pitting is observed, consider conducting pipeline replacements in conjunction with water treatment process changes to correct corrosion problems.
4. Conduct bench scale dosing experiments with soda ash to determine the pH-dose relationship for the Unalakleet treated water.
5. Continue to add soda ash to treated water and adjust its dosage as needed to sustain the set point target finished water pH.
6. Initiate addition of orthophosphate as disodium phosphate at an initial dose of 5 to 6 mg/L PO₄ to establish that residual concentration throughout the distribution system. Then back off the dose to maintain a 2-3 mg/L phosphate (PO₄³⁻).
7. Follow-up monitoring for lead, copper, pH, alkalinity and orthophosphate concentration should be conducted at a minimum of 20 locations in the distribution system on monthly intervals for the first 6 months following establishing a distribution-wide phosphate residual of 5 to 6 mg/L as PO₄³⁻. Based on the results of these samples, the orthophosphate dose can be further adjusted.

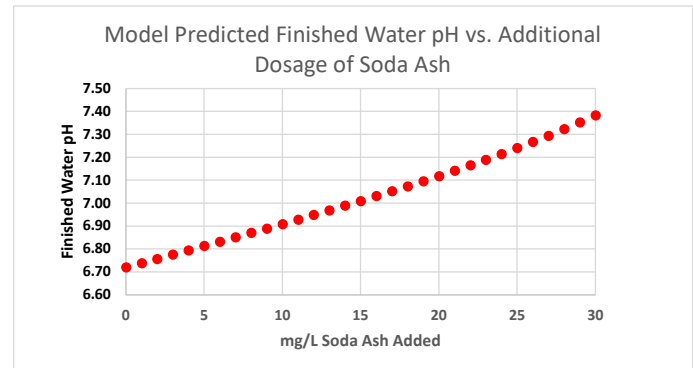
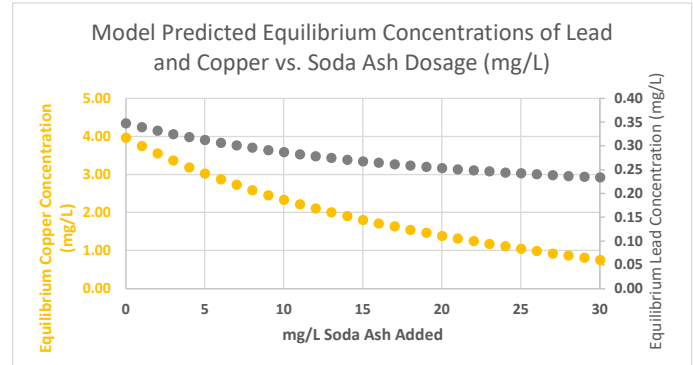
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Dose mg/L	Ortho- phosphate mg/L	pH at Field Temp.	Alkalinity as CaCO3 mg/L	DIC mg/L C	Langelier Index LI	CCPP as CaCO3 mg/L	Copper II at 25oC mg/L	Lead II at 25oC mg/L	Buffer Intensity mM/pH	CO2 mg/L	Aggressive Index AI	Ryznar Index RI
0	5	6.63	40.71	15.81	-1.93	-45.77	0.21	0.03	0.74	22.1	9.91	10.48
1	5	6.64	41.63	15.93	-1.90	-44.91	0.20	0.03	0.74	21.7	9.94	10.44
2	5	6.66	42.56	16.04	-1.87	-44.06	0.20	0.03	0.73	21.3	9.97	10.41
3	5	6.68	43.48	16.15	-1.85	-43.20	0.19	0.03	0.73	20.9	9.99	10.37
4	5	6.70	44.40	16.27	-1.82	-42.36	0.19	0.03	0.73	20.6	10.02	10.34
5	5	6.71	45.32	16.38	-1.79	-41.51	0.19	0.03	0.72	20.2	10.05	10.30
6	5	6.73	46.24	16.49	-1.77	-40.66	0.18	0.03	0.72	19.8	10.07	10.27
7	5	6.75	47.16	16.61	-1.74	-39.81	0.18	0.03	0.71	19.4	10.10	10.23
8	5	6.76	48.08	16.72	-1.72	-38.96	0.18	0.03	0.71	19	10.12	10.20
9	5	6.78	49.00	16.83	-1.69	-38.11	0.17	0.02	0.70	18.6	10.15	10.17
10	5	6.80	49.92	16.95	-1.67	-37.27	0.17	0.02	0.70	18.2	10.17	10.13
11	5	6.82	50.83	17.06	-1.64	-36.43	0.17	0.02	0.69	17.8	10.20	10.10
12	5	6.83	51.75	17.17	-1.62	-35.59	0.17	0.02	0.68	17.4	10.22	10.07
13	5	6.85	52.67	17.29	-1.59	-34.75	0.17	0.02	0.67	17	10.25	10.03
14	5	6.87	53.58	17.40	-1.57	-33.91	0.16	0.02	0.67	16.6	10.27	10.00
15	5	6.89	54.50	17.51	-1.54	-33.08	0.16	0.02	0.66	16.3	10.30	9.97
16	5	6.90	55.41	17.63	-1.52	-32.24	0.16	0.02	0.65	15.9	10.32	9.94
17	5	6.92	56.32	17.74	-1.49	-31.41	0.16	0.02	0.64	15.5	10.35	9.91
18	5	6.94	57.24	17.85	-1.47	-30.58	0.16	0.02	0.63	15.1	10.37	9.87
19	5	6.96	58.15	17.97	-1.44	-29.74	0.16	0.02	0.62	14.7	10.40	9.84
20	5	6.98	59.06	18.08	-1.42	-28.92	0.16	0.02	0.61	14.3	10.42	9.81
21	5	6.99	59.97	18.19	-1.39	-28.09	0.15	0.02	0.60	13.9	10.45	9.78
22	5	7.01	60.88	18.31	-1.37	-27.27	0.15	0.02	0.59	13.6	10.47	9.75
23	5	7.03	61.78	18.42	-1.34	-26.44	0.15	0.02	0.58	13.2	10.50	9.72
24	5	7.05	62.69	18.53	-1.32	-25.63	0.15	0.02	0.57	12.8	10.52	9.69
25	5	7.07	63.60	18.65	-1.29	-24.81	0.15	0.02	0.56	12.4	10.55	9.65
26	5	7.09	64.50	18.76	-1.27	-24.00	0.15	0.02	0.54	12	10.57	9.62
27	5	7.11	65.40	18.87	-1.24	-23.18	0.15	0.02	0.53	11.7	10.60	9.59
28	5	7.13	66.30	18.99	-1.21	-22.37	0.15	0.02	0.52	11.3	10.63	9.56
29	5	7.15	67.21	19.10	-1.19	-21.57	0.15	0.02	0.51	10.9	10.65	9.53
30	5	7.17	68.10	19.21	-1.16	-20.76	0.15	0.02	0.49	10.5	10.68	9.49



Dose mg/L	Ortho- phosphate mg/L	pH at Field Temp.	Alkalinity as CaCO3 mg/L	DIC mg/L C	Langelier Index LI	CCPP as CaCO3 mg/L	Cu Copper II at 25oC mg/L	Pb Lead II at 25oC mg/L	Buffer Intensity mM/pH	CO2 mg/L	Aggressive Index AI	Ryznar Index RI
0	0	6.72	44.00	15.81	-1.80	-39.86	3.97	0.35	0.67	19.2	10.04	10.32
1	0	6.74	44.94	15.93	-1.77	-38.97	3.75	0.34	0.67	18.8	10.07	10.28
2	0	6.76	45.89	16.04	-1.74	-38.07	3.56	0.33	0.66	18.4	10.10	10.25
3	0	6.78	46.83	16.15	-1.72	-37.18	3.37	0.33	0.66	18	10.12	10.21
4	0	6.79	47.78	16.27	-1.69	-36.28	3.19	0.32	0.65	17.6	10.15	10.17
5	0	6.81	48.72	16.38	-1.66	-35.39	3.03	0.31	0.64	17.2	10.18	10.14
6	0	6.83	49.67	16.49	-1.64	-34.50	2.88	0.31	0.63	16.8	10.20	10.10
7	0	6.85	50.61	16.61	-1.61	-33.60	2.73	0.30	0.63	16.3	10.23	10.07
8	0	6.87	51.55	16.72	-1.58	-32.71	2.59	0.30	0.62	15.9	10.26	10.03
9	0	6.89	52.50	16.83	-1.55	-31.82	2.46	0.29	0.61	15.5	10.29	10.00
10	0	6.91	53.44	16.95	-1.53	-30.93	2.34	0.29	0.60	15.1	10.31	9.96
11	0	6.93	54.39	17.06	-1.50	-30.04	2.22	0.28	0.59	14.7	10.34	9.93
12	0	6.95	55.33	17.17	-1.47	-29.14	2.11	0.28	0.58	14.3	10.37	9.89
13	0	6.97	56.28	17.29	-1.45	-28.25	2.01	0.28	0.57	13.9	10.40	9.86
14	0	6.99	57.22	17.40	-1.42	-27.36	1.91	0.27	0.56	13.4	10.42	9.82
15	0	7.01	58.17	17.51	-1.39	-26.47	1.81	0.27	0.55	13	10.45	9.79
16	0	7.03	59.11	17.63	-1.36	-25.58	1.72	0.26	0.53	12.6	10.48	9.76
17	0	7.05	60.05	17.74	-1.33	-24.69	1.64	0.26	0.52	12.2	10.51	9.72
18	0	7.07	61.00	17.85	-1.31	-23.80	1.55	0.26	0.51	11.8	10.53	9.69
19	0	7.10	61.94	17.97	-1.28	-22.91	1.47	0.26	0.49	11.4	10.56	9.65
20	0	7.12	62.89	18.08	-1.25	-22.02	1.39	0.25	0.48	11	10.59	9.61
21	0	7.14	63.83	18.19	-1.22	-21.13	1.32	0.25	0.47	10.6	10.62	9.58
22	0	7.17	64.78	18.31	-1.19	-20.24	1.25	0.25	0.45	10.1	10.65	9.54
23	0	7.19	65.72	18.42	-1.16	-19.35	1.18	0.25	0.44	9.73	10.68	9.51
24	0	7.21	66.66	18.53	-1.13	-18.47	1.12	0.24	0.42	9.32	10.71	9.47
25	0	7.24	67.61	18.65	-1.10	-17.58	1.05	0.24	0.41	8.91	10.75	9.43
26	0	7.27	68.55	18.76	-1.06	-16.69	0.99	0.24	0.39	8.49	10.78	9.39
27	0	7.29	69.50	18.87	-1.03	-15.80	0.93	0.24	0.38	8.08	10.81	9.35
28	0	7.32	70.44	18.99	-1.00	-14.92	0.87	0.24	0.36	7.67	10.85	9.31
29	0	7.35	71.39	19.10	-0.96	-14.03	0.82	0.24	0.34	7.26	10.88	9.27
30	0	7.38	72.33	19.21	-0.92	-13.15	0.76	0.23	0.33	6.85	10.92	9.23



Appendix E: Cost Estimates & Financial Documents

- Detailed Cost Estimates
- Life Cycle Cost Estimates
- Cost Summary
- Proposed Project Phases: Detail Cost Estimates
- City of Unalakleet FY2020 Budget
- 2017 Comprehensive Energy Audit for Unalakleet Water Treatment Plant

8/31/2020

Non-Construction Costs				
Item	No.	Unit	Cost	Total
Total			\$0	

Item	Cost
Construction (Capital) Costs	\$0
Non-Construction Costs	\$0
Total Project Costs	\$0
O&M Costs (Annual)	\$216,000

1. This alternative does not make any improvements to the existing water system.
2. O&M Costs are from 2020 budget and compared to 2019 actuals. Repairs & Replacement increased to reflect current efforts.
3. Water Service repairs are usually paid by home owners but are added to reflect overall system costs.

Alternative 2: Service Line Rehabilitation

8/31/2020

Construction (Capital) Costs				
Item	No.	Unit	Cost	Total
Mob & Demo	1	LS	\$1,000,000	\$1,000,000
Homeowner Coordination (90% of 268)	241	EA	\$500	\$120,500
Construction Survey	1	LS	\$25,000	\$25,000
Archeological Control	241	DAY	\$1,200	\$289,200
Maintaining Water Service	1	LS	\$15,000	\$15,000
Water Services				
Connection to Main	241	EA	\$1,500	\$361,500
1-inch HDPE Supply/Return Lines	36,150	FT	\$10	\$361,500
4" x 12" HDPE Insulated Pipe	18,075	FT	\$200	\$3,615,000
Heat Trace (5w/ft, 120v)	18,075	FT	\$12	\$216,900
Connection to House	241	EA	\$1,000	\$241,000
Circulation Pumps (limited to 25%)	60	EA	\$500	\$30,000
Arctic Box Repair (limited to 25%)	60	EA	\$5,000	\$300,000
House Plumbing Repair (limited to 25%)	60	EA	\$5,000	\$300,000
Total			\$6,875,600	

Notes:

- O&M Costs are estimated from 2020 Budgets & 2019 Actuals with changes reflectant of the decrease in leaks and service calls due to the replacement of the water services lines. O&M Costs are for when the project is completed if it takes multiple years.
- Assumed average length of services (ft) = 75
- Average cost of Service = \$28,529.46
- Archeological control assumes onsite archeologist during all excavations and one day per service.

Item	Cost
Construction (Capital) Costs	\$6,875,600
Non-Construction Costs	\$3,678,312
Total Project Costs	\$10,553,912
O&M Costs (Annual)	\$196,000

Non-Construction Costs				
Item	No.	Unit	Cost	Total
Survey	1	LS	\$40,000	\$40,000
Geotechnical	1	LS	\$8,000	\$8,000
ROW/Easement Research Acquisition	1	LS	\$20,000	\$20,000
Archeological Agreements/Plan	1	LS	\$15,000	\$15,000
Engineering	12%	OF	\$6,875,600	\$825,072
Permitting	1	LS	\$20,000	\$20,000
Resident Project Representative	5%	OF	\$6,875,600	\$343,780
Construction Administration	12%	OF	\$6,875,600	\$825,072
Project Administration	8%	OF	\$6,875,600	\$550,048
Project Contingency	15%	OF	\$6,875,600	\$1,031,340
Total			\$3,678,312	

Operations & Maintenance Costs (Annual)				
Item	No.	Unit	Cost	Total
Salary & Payroll Benefits	1	LS	\$60,000	\$60,000
Travel & Per Diem	1	LS	\$5,000	\$5,000
Fuel Oil & Gas	1	LS	\$10,000	\$10,000
Electricity	1	LS	\$35,000	\$35,000
Parts, Supplies, & Freight	1	LS	\$50,000	\$50,000
Repairs & Replacement	1	LS	\$20,000	\$20,000
Insurance	1	LS	\$4,000	\$4,000
Fees	1	LS	\$10,000	\$10,000
Other	1	LS	\$2,000	\$2,000
Total			\$196,000	

Alternative 3: Water Main and Service Line Replacement

8/31/2020

Construction (Capital) Costs				
Item	No.	Unit	Cost	Total
Mob & Demo	1	LS	\$1,500,000	\$1,500,000
Homeowner Coordination	241	EA	\$500	\$120,500
Maintaining Water Service	1	LS	\$30,000	\$30,000
Construction Survey	1	LS	\$100,000	\$100,000
Archeological Control	306	DAY	\$1,200	\$367,200
SWPPP & Erosion Control	1	LS	\$20,000	\$20,000
Water Services				
Connection to Main	241	EA	\$1,500	\$361,500
1-inch HDPE Supply/Return Lines	36,150	FT	\$10	\$361,500
4" x 12" HDPE Insulationed Pipe	18,075	FT	\$200	\$3,615,000
Heat Trace (5w/ft, 120v)	18,075	FT	\$12	\$216,900
Connection to House	241	EA	\$1,000	\$241,000
Circulation Pumps (limited to 25%)	60	EA	\$500	\$30,000
Arctic Box Repair (limited to 10%)	60	EA	\$5,000	\$300,000
House Plumbing Repair (limited to 10%)	60	EA	\$5,000	\$300,000
Water Mains				
6"x14" HDPE Insulated Pipe	26,000	FT	\$250	\$6,500,000
Valves	50	EA	\$5,000	\$250,000
Insulated Valve Boxes	50	EA	\$10,000	\$500,000
Hydrants	35	EA	\$15,000	\$525,000
Water Treatment Plant				
Pressure Booster Pumps	10	EA	\$15,000	\$150,000
Flow Meters	10	EA	\$5,000	\$50,000
Misc WTP Piping Work	1	LS	\$50,000	\$50,000
Misc Gauges/Senors/Controls	1	LS	\$50,000	\$50,000
Start Up & Commissioning	1	LS	\$25,000	\$25,000
Total			\$15,663,600	

Notes:

1. O&M Costs are estimated from 2020 Budgets & 2019 Actuals with changes reflectant of the decrease in leaks and service calls due to the replacement of all lines. O&M Costs are for when the project is completed if it takes multiple years.

2. Assumed average length of services (ft) =

75

3. Average cost of Service =

\$28,529.46

Non-Construction Costs				
Item	No.	Unit	Cost	Total
Survey/Utility Locates	1	LS	\$75,000	\$75,000
Geotechnical	1	LS	\$8,000	\$8,000
ROW/Easement Research Acquisition	1	LS	\$40,000	\$40,000
Archeological Agreements/Plan	1	LS	\$15,000	\$15,000
Engineering	10%	OF	\$15,663,600	\$1,566,360
Permitting	1	LS	\$20,000	\$20,000
Resident Project Representative	5%	OF	\$15,663,600	\$783,180
Construction Administration	12%	OF	\$15,663,600	\$1,879,632
Project Administration	8%	OF	\$15,663,600	\$1,253,088
Project Contingency	15%	OF	\$15,663,600	\$2,349,540
Total			\$7,989,800	

Operations & Maintenance Costs (Annual)				
Item	No.	Unit	Cost	Total
Salary & Payroll Benefits	1	LS	\$60,000	\$60,000
Travel & Per Diem	1	LS	\$5,000	\$5,000
Fuel Oil & Gas	1	LS	\$10,000	\$10,000
Electricity	1	LS	\$30,000	\$30,000
Parts, Supplies, & Freight	1	LS	\$20,000	\$20,000
Repairs & Replacement	1	LS	\$4,000	\$4,000
Insurance	1	LS	\$4,000	\$4,000
Fees	1	LS	\$10,000	\$10,000
Other	1	LS	\$2,000	\$2,000
Total			\$145,000	

Item	Cost
Construction (Capital) Costs	\$15,663,600
Non-Construction Costs	\$7,989,800
Total Project Costs	\$23,653,400
O&M Costs (Annual)	\$145,000

Alternative 4: Addition of Corrosion Inhibitors

8/31/2020

Construction (Capital) Costs				
Item	No.	Unit	Cost	Total
Mob & Demo	1	LS	\$10,000	\$10,000
WTP Repiping	1	LS	\$10,000	\$10,000
Chemical Dosing Pump	1	EA	\$3,000	\$3,000
Mixing Tank	1	EA	\$1,000	\$1,000
Chemical Metering Sensor	1	EA	\$1,000	\$1,000
Electrical Work	1	LS	\$2,000	\$2,000
SCADA Improvements	1	LS	\$5,000	\$5,000
Start Up & Commissioning	1	LS	\$2,000	\$2,000
Long Term Monitoring	1	LS	\$5,000	\$5,000
Total			\$39,000	

Note:

1. This alternative does not make any improvements to the existing water system.
2. O&M Costs are from 2020 budget and compared to 2019 actuals. Repairs & Replacement increased to reflect current efforts.
3. Water Service repairs are usually paid by home owners but are added to reflect overall system costs.
4. Water Service Repairs will go down over time as corrosion will be minimized, but severely damaged pipes will still need to be replaced.

Item	Cost
Construction (Capital) Costs	\$39,000
Non-Construction Costs	\$71,770
Total Project Costs	\$110,770
O&M Costs (Annual)	\$221,000

Non-Construction Costs				
Item	No.	Unit	Cost	Total
Survey	0	LS	\$0	\$0
Geotechnical	0	LS	\$0	\$0
Easement Acquisition	0	LS	\$0	\$0
Testing/Pilot Study	1	LS	\$25,000	\$25,000
Engineering	1	LS	\$25,000	\$25,000
Permitting	1	LS	\$5,000	\$5,000
Resident Project Representative	12%	OF	\$39,000	\$4,680
Construction Administration	8%	OF	\$39,000	\$3,120
Project Administration	8%	%	\$39,000	\$3,120
Project Contingency	15%	of	\$39,000	\$5,850
Total			\$71,770	

Operations & Maintenance Costs (Annual)				
Item	No.	Unit	Cost	Total
Salary & Payroll Benefits	1	LS	\$60,000	\$60,000
Travel & Per Diem	1	LS	\$5,000	\$5,000
Fuel Oil & Gas	1	LS	\$10,000	\$10,000
Electricity	1	LS	\$35,000	\$35,000
Parts, Supplies, & Freight	1	LS	\$65,000	\$65,000
Repairs & Replacement	1	LS	\$30,000	\$30,000
Insurance	1	LS	\$4,000	\$4,000
Fees	1	LS	\$10,000	\$10,000
Other	1	LS	\$2,000	\$2,000
Total			\$221,000	

Life Cycle Costs & Short Term Assets List
Alternative 1: Do Nothing

8/31/2020

Year of Repair Replacement	Item/Event ¹	2018 Federal Discount Rate Conversion Factor ³	Cost of Event in Today's Dollars	Present Value
1	Annual O&M Costs ⁴	19.3836	\$216,000	\$4,186,863
1	Immediate Repairs/Deferred Maintenance	0.9970	\$200,000	\$199,402
2		0.9940		\$0
3		0.9911		\$0
4		0.9881		\$0
5	Lab Equipment, Tools, Computer/Software	0.9851	\$5,000	\$4,926
6		0.9822		\$0
7		0.9792		\$0
8		0.9763		\$0
9		0.9734		\$0
10	Lab Equipment, Tools, Computer/Software	0.9705	\$5,000	\$4,852
10	Meters, Control Valves	0.9705	\$50,000	\$48,524
11		0.9676		\$0
12		0.9647		\$0
13		0.9618		\$0
14		0.9589		\$0
15	Lab Equipment, Tools, Computer/Software	0.9561	\$5,000	\$4,780
15	Pumps, Tank Maintenance, Power Equipment, Filters	0.9561	\$175,000	\$167,311
16		0.9532		\$0
17		0.9504		\$0
18		0.9475		\$0
19		0.9447		\$0
20	Lab Equipment, Tools, Computer/Software	0.9418	\$5,000	\$4,709
20	Meters, Control Valves	0.9418	\$50,000	\$47,092
20		0.9418		\$0
20	Project Salvage Value ⁵	-0.9418	\$0	\$0
Total Present Value				\$4,668,460

Total Construction Cost **\$0** Useful Life 20 yr
Annual O&M Costs **\$216,000** Remaining Life 0 yr
 Federal Discount Interest Rate² 0.3%

Project Present Worth (Life Cycle Cost)⁶ \$4,668,460

Notes:

- See Short Term Assets list for items.
- The Federal real discount interest rate from OMB Circular A94 for 2020. <https://www.whitehouse.gov/wp-content/uploads/2019/12/M-20-07.pdf>
- Short Lived Asset's discount in rate conversion factor is calculated by $1/(1+i)^n$
- Annual O&M costs rate determined by uniform present value formula. $[(1+i)^n - 1]/i(1+i)^n$
- Project salvage value = total construction cost x (remaining life/useful life) x (-1 x discount rate).
- Project present worth = total construction cost + total present value

SHORT LIVED ASSETS LISTING & REPLACEMENT COST

Item/Event	Frequency (yr)	Amount	Unit	Cost	Total
Immediate Repairs/Deferred Maintenance	0	1	LS	\$200,000	\$200,000
Lab Equipment, Tools, Computer/Software	5	1	LS	\$5,000	\$5,000
Meters, Control Valves	10	1	LS	\$50,000	\$50,000
Pumps, Tank Maintenance, Power Equipment, Filters	15	1	LS	\$175,000	\$175,000

Life Cycle Costs & Short Term Assets List
Alternative 2: Service Line Rehabilitation

8/31/2020

Year of Repair Replacement	Item/Event ¹	2018 Federal Discount Rate Conversion Factor ³	Cost of Event in Today's Dollars	Present Value
1	Annual O&M Costs ⁴	19.3836	\$196,000	\$3,799,190
1	Immediate Repairs/Deferred Maintenance	0.9970	\$200,000	\$199,402
2		0.9940		\$0
3		0.9911		\$0
4		0.9881		\$0
5	Lab Equipment, Tools, Computer/Software	0.9851	\$5,000	\$4,926
6		0.9822		\$0
7		0.9792		\$0
8		0.9763		\$0
9		0.9734		\$0
10	Lab Equipment, Tools, Computer/Software	0.9705	\$5,000	\$4,852
10	Meters, Control Valves	0.9705	\$50,000	\$48,524
11		0.9676		\$0
12		0.9647		\$0
13		0.9618		\$0
14		0.9589		\$0
15	Lab Equipment, Tools, Computer/Software	0.9561	\$5,000	\$4,780
15	Pumps, Tank Maintenance, Power Equipment, Filters	0.9561	\$175,000	\$167,311
16		0.9532		\$0
17		0.9504		\$0
18		0.9475		\$0
19		0.9447		\$0
20	Lab Equipment, Tools, Computer/Software	0.9418	\$5,000	\$4,709
20	Meters, Control Valves	0.9418	\$50,000	\$47,092
20		0.9418		\$0
20	Project Salvage Value ⁵	-0.9418	\$0	\$0
Total Present Value				\$4,280,788

Total Construction Cost **\$6,875,600** Useful Life 20 yr
Annual O&M Costs **\$196,000** Remaining Life 0 yr
 Federal Discount Interest Rate² 0.3%

Project Present Worth (Life Cycle Cost)⁶ \$11,156,388

Notes:

1. See Short Term Assets list for items.
2. The Federal real discount interest rate from OMB Circular A94 for 2020. <https://www.whitehouse.gov/wp-content/uploads/2019/12/M-20-07.pdf>
3. Short Lived Asset's discount in rate conversion factor is calculated by $1/(1+i)^n$
4. Annual O&M costs rate determined by uniform present value formula. $[(1+i)^n - 1]/i(1+i)^n$
5. Project salvage value = total construction cost x (remaining life/useful life) x (-1 x discount rate).
6. Project present worth = total construction cost + total present value

SHORT LIVED ASSETS LISTING & REPLACEMENT COST

Item/Event	Frequency (yr)	Amount	Unit	Cost	Total
Immediate Repairs/Deferred Maintenance	1	1	LS	\$200,000	\$200,000
Lab Equipment, Tools, Computer/Software	5	1	LS	\$5,000	\$5,000
Meters, Control Valves	10	1	LS	\$50,000	\$50,000
Pumps, Tank Maintenance, Power Equipment, Filters	15	1	LS	\$175,000	\$175,000

Life Cycle Costs & Short Term Assets List
Alternative 3: Water Main and Service Line Replacement

8/31/2020

Year of Repair Replacement	Item/Event ¹	2018 Federal Discount Rate Conversion Factor ³	Cost of Event in Today's Dollars	Present Value
1	Annual O&M Costs ⁴	19.3836	\$145,000	\$2,810,626
1		0.9970		\$0
2		0.9940		\$0
3		0.9911		\$0
4		0.9881		\$0
5	Lab Equipment, Tools, Computer/Software	0.9851	\$5,000	\$4,926
6		0.9822		\$0
7		0.9792		\$0
8		0.9763		\$0
9		0.9734		\$0
10	Lab Equipment, Tools, Computer/Software	0.9705	\$5,000	\$4,852
10	Meters, Control Valves	0.9705	\$50,000	\$48,524
11		0.9676		\$0
12		0.9647		\$0
13		0.9618		\$0
14		0.9589		\$0
15	Lab Equipment, Tools, Computer/Software	0.9561	\$5,000	\$4,780
15	Pumps, Tank Maintenance, Power Equipment, Filters	0.9561	\$175,000	\$167,311
16		0.9532		\$0
17		0.9504		\$0
18		0.9475		\$0
19		0.9447		\$0
20	Lab Equipment, Tools, Computer/Software	0.9418	\$5,000	\$4,709
20	Meters, Control Valves	0.9418	\$50,000	\$47,092
20		0.9418		\$0
20	Project Salvage Value ⁵	-0.9418	\$5,221,200	-\$4,917,583
Total Present Value				-\$1,824,762

Total Construction Cost \$15,663,600 Useful Life 30 yr
Annual O&M Costs \$145,000 Remaining Life 10 yr

Federal Discount Interest Rate² 0.3%

Project Present Worth (Life Cycle Cost)⁶ \$13,838,838

Notes:

1. See Short Term Assets list for items.
2. The Federal real discount interest rate from OMB Circular A94 for 2020. <https://www.whitehouse.gov/wp-content/uploads/2019/12/M-20-07.pdf>
3. Short Lived Asset's discount in rate conversion factor is calculated by $1/(1+i)^n$
4. Annual O&M costs rate determined by uniform present value formula. $[(1+i)^n - 1]/i(1+i)^n$
5. Project salvage value = total construction cost x (remaining life/useful life) x (-1 x discount rate).
6. Project present worth = total construction cost + total present value

SHORT LIVED ASSETS LISTING & REPLACEMENT COST

Item/Event	Frequency (yr)	Amount	Unit	Cost	Total
Immediate Repairs/Deferred Maintenance	0	0	LS	\$200,000	\$0
Lab Equipment, Tools, Computer/Software	5	1	LS	\$5,000	\$5,000
Meters, Control Valves	10	1	LS	\$50,000	\$50,000
Pumps, Tank Maintenance, Power Equipment, Filters	15	1	LS	\$175,000	\$175,000

Life Cycle Costs & Short Term Assets List
Alternative 4: Addition of Corrosion Inhibitors

8/31/2020

Year of Repair Replacement	Item/Event ¹	2018 Federal Discount Rate Conversion Factor ³	Cost of Event in Today's Dollars	Present Value
1	Annual O&M Costs ⁴	19.3836	\$221,000	\$4,283,781
1		0.9970		\$0
2		0.9940		\$0
3		0.9911		\$0
4		0.9881		\$0
5	Lab Equipment, Tools, Computer/Software	0.9851	\$5,000	\$4,926
6		0.9822		\$0
7		0.9792		\$0
8		0.9763		\$0
9		0.9734		\$0
10	Lab Equipment, Tools, Computer/Software	0.9705	\$5,000	\$4,852
10	Meters, Control Valves	0.9705	\$50,000	\$48,524
11		0.9676		\$0
12		0.9647		\$0
13		0.9618		\$0
14		0.9589		\$0
15	Lab Equipment, Tools, Computer/Software	0.9561	\$5,000	\$4,780
15	Pumps, Tank Maintenance, Power Equipment, Filters	0.9561	\$175,000	\$167,311
16		0.9532		\$0
17		0.9504		\$0
18		0.9475		\$0
19		0.9447		\$0
20	Lab Equipment, Tools, Computer/Software	0.9418	\$5,000	\$4,709
20	Meters, Control Valves	0.9418	\$50,000	\$47,092
20		0.9418		\$0
20	Project Salvage Value ⁵	-0.9418	\$0	\$0
Total Present Value				\$4,565,976

Total Construction Cost **\$39,000** Useful Life 20 yr
Annual O&M Costs **\$221,000** Remaining Life 0 yr
 Federal Discount Interest Rate² 0.3%

Project Present Worth (Life Cycle Cost)⁶ \$4,604,976

Notes:

1. See Short Term Assets list for items.
2. The Federal real discount interest rate from OMB Circular A94 for 2020. <https://www.whitehouse.gov/wp-content/uploads/2019/12/M-20-07.pdf>
3. Short Lived Asset's discount in rate conversion factor is calculated by $1/(1+i)^n$
4. Annual O&M costs rate determined by uniform present value formula. $[(1+i)^n - 1]/i(1+i)^n$
5. Project salvage value = total construction cost x (remaining life/useful life) x (-1 x discount rate).
6. Project present worth = total construction cost + total present value

SHORT LIVED ASSETS LISTING & REPLACEMENT COST

Item/Event	Frequency (yr)	Amount	Unit	Cost	Total
Immediate Repairs/Deferred Maintenance	1	1	LS	\$200,000	\$200,000
Lab Equipment, Tools, Computer/Software	5	1	LS	\$5,000	\$5,000
Meters, Control Valves	10	1	LS	\$50,000	\$50,000
Pumps, Tank Maintenance, Power Equipment, Filters	15	1	LS	\$175,000	\$175,000

Summary of Alternative Costs

8/31/2020

Costs	Alternatives			
	1-Do Nothing	2-Service Line Rehabilitation	3-Water Main and Service Line Replacement	4-Additional of Corrosion Inhibitors
Construction (Capital) Costs	\$0	\$6,875,600	\$15,663,600	\$39,000
Non-Construction Costs	\$0	\$3,678,312	\$7,989,800	\$71,770
Total Project Cost	\$0	\$10,553,912	\$23,653,400	\$110,770
O&M Costs (Annual)	\$216,000	\$196,000	\$145,000	\$221,000
Life Cycle Costs	\$4,668,460	\$11,156,388	\$13,838,838	\$4,604,976

Proposed Project: Water Main and Service Line Replacement-Phase 1 (West Loop)

8/31/2020

Construction (Capital) Costs				
Item	No.	Unit	Cost	Total
Mob & Demo	1	LS	\$300,000	\$300,000
Homeowner Coordination	60	EA	\$500	\$30,000
Maintaining Water Service	1	LS	\$6,000	\$6,000
Construction Survey	1	LS	\$20,000	\$20,000
Archeological Control	90	DAY	\$1,200	\$108,000
SWPPP & Erosion Control	1	LS	\$5,000	\$5,000
Water Services				
Connection to Main	60	EA	\$1,500	\$90,000
1-inch HDPE Supply/Return Lines	9,000	FT	\$10	\$90,000
4" x 12" HDPE Insulationed Pipe	4,500	FT	\$200	\$900,000
Heat Trace (5w/ft, 120v)	9,000	FT	\$12	\$108,000
Connection to House	60	EA	\$1,000	\$60,000
Circulation Pumps (limited to 25%)	15	EA	\$500	\$7,500
Arctic Box Repair (limited to 10%)	15	EA	\$5,000	\$75,000
House Plumbing Repair (limited to 10%)	15	EA	\$5,000	\$75,000
Water Mains				
6"x14" HDPE Insulated Pipe	5,100	FT	\$250	\$1,275,000
Valves	10	EA	\$5,000	\$50,000
Insulated Valve Boxes	10	EA	\$10,000	\$100,000
Hydrants	7	EA	\$15,000	\$105,000
Water Treatment Plant				
Pressure Booster Pumps	2	EA	\$15,000	\$30,000
Flow Meters	2	EA	\$5,000	\$10,000
Misc WTP Piping Work	1	LS	\$10,000	\$10,000
Misc Gauges/Senors/Controls	1	LS	\$10,000	\$10,000
Start Up & Commissioning	1	LS	\$5,000	\$5,000
Total	\$3,469,500			

Non-Construction Costs				
Item	No.	Unit	Cost	Total
Survey/Utility Locates	1	LS	\$75,000	\$75,000
Geotechnical	1	LS	\$8,000	\$8,000
ROW/Easement Research Acquisition	1	LS	\$40,000	\$40,000
Archeological Agreements/Plan	1	LS	\$15,000	\$15,000
Engineering	10%	OF	\$3,469,500	\$346,950
Permitting	1	LS	\$20,000	\$20,000
Resident Project Representative	5%	OF	\$3,469,500	\$173,475
Construction Administration	12%	OF	\$3,469,500	\$416,340
Project Administration	8%	OF	\$3,469,500	\$277,560
Project Contingency	15%	OF	\$3,469,500	\$520,425
Total	\$1,892,750			

Item	Cost
Construction (Capital) Costs	\$3,469,500
Non-Construction Costs	\$1,892,750
Total Project Costs	\$5,362,250

Notes:

1. Assumed average length of services (ft) = 75
2. Average cost of Service = \$28,529.46
3. Archeological control assumes onsite archeologist during all excavations and one day per service and 30 days for mains.
4. There are cost savings for constructing all one total project not realized when broken into phases.

Proposed Project: Water Main and Service Line Replacement-Phase 2 (Southeast Loop)

8/31/2020

Construction (Capital) Costs				
Item	No.	Unit	Cost	Total
Mob & Demo	1	LS	\$300,000	\$300,000
Homeowner Coordination	81	EA	\$500	\$40,500
Maintaining Water Service	1	LS	\$6,000	\$6,000
Construction Survey	1	LS	\$20,000	\$20,000
Archeological Control	111	DAY	\$1,200	\$133,200
SWPPP & Erosion Control	1	LS	\$5,000	\$5,000
Water Servcies				
Connection to Main	81	EA	\$1,500	\$121,500
1-inch HDPE Supply/Return Lines	12,150	FT	\$10	\$121,500
4" x 12" HDPE Insulationed Pipe	6,075	FT	\$200	\$1,215,000
Heat Trace (5w/ft, 120v)	12,150	FT	\$12	\$145,800
Connection to House	81	EA	\$1,000	\$81,000
Circulation Pumps (limited to 25%)	20	EA	\$500	\$10,000
Arctic Box Repair (limited to 10%)	20	EA	\$5,000	\$100,000
House Plumbing Repair (limited to 10%)	20	EA	\$5,000	\$100,000
Water Mains				
6"x14" HDPE Insulated Pipe	5,600	FT	\$250	\$1,400,000
Valves	10	EA	\$5,000	\$50,000
Insulated Valve Boxes	10	EA	\$10,000	\$100,000
Hydrants	7	EA	\$15,000	\$105,000
Water Treatment Plant				
Pressure Booster Pumps	2	EA	\$15,000	\$30,000
Flow Meters	2	EA	\$5,000	\$10,000
Misc WTP Piping Work	1	LS	\$10,000	\$10,000
Misc Gauges/Senors/Controls	1	LS	\$10,000	\$10,000
Start Up & Commissioning	1	LS	\$5,000	\$5,000
Total	\$4,119,500			

Non-Construction Costs				
Item	No.	Unit	Cost	Total
Survey/Utility Locates	1	LS	\$75,000	\$75,000
Geotechnical	1	LS	\$8,000	\$8,000
ROW/Easement Research Acquisition	1	LS	\$40,000	\$40,000
Archeological Agreements/Plan	1	LS	\$15,000	\$15,000
Engineering	10%	OF	\$4,119,500	\$411,950
Permitting	1	LS	\$20,000	\$20,000
Resident Project Representative	5%	OF	\$4,119,500	\$205,975
Construction Administration	12%	OF	\$4,119,500	\$494,340
Project Administration	8%	OF	\$4,119,500	\$329,560
Project Contingency	15%	OF	\$4,119,500	\$617,925
Total	\$2,217,750			

Item	Cost
Construction (Capital) Costs	\$4,119,500
Non-Construction Costs	\$2,217,750
Total Project Costs	\$6,337,250

Notes:

1. Assumed average length of services (ft) = 75
2. Average cost of Service = \$28,529.46
3. Archeological control assumes onsite archeologist during all excavations and one day per service and 30 days for mains.
4. There are cost savings for constructing all one total project not realized when broken into phases.

Proposed Project: Water Main and Service Line Replacement-Phase 3 (North Loop/Happy Valley)

8/31/2020

Construction (Capital) Costs				
Item	No.	Unit	Cost	Total
Mob & Demo	1	LS	\$400,000	\$400,000
Homeowner Coordination	75	EA	\$500	\$37,500
Maintaining Water Service	1	LS	\$6,000	\$6,000
Construction Survey	1	LS	\$20,000	\$20,000
Archeological Control	105	DAY	\$1,200	\$126,000
SWPPP & Erosion Control	1	LS	\$5,000	\$5,000
Water Services				
Connection to Main	75	EA	\$1,500	\$112,500
1-inch HDPE Supply/Return Lines	11,250	FT	\$10	\$112,500
4" x 12" HDPE Insulated Pipe	5,625	FT	\$200	\$1,125,000
Heat Trace (5w/ft, 120v)	11,250	FT	\$12	\$135,000
Connection to House	75	EA	\$1,000	\$75,000
Circulation Pumps (limited to 25%)	19	EA	\$500	\$9,500
Arctic Box Repair (limited to 10%)	19	EA	\$5,000	\$95,000
House Plumbing Repair (limited to 10%)	19	EA	\$5,000	\$95,000
Water Mains				
6"x14" HDPE Insulated Pipe	7,500	FT	\$250	\$1,875,000
Valves	10	EA	\$5,000	\$50,000
Insulated Valve Boxes	10	EA	\$10,000	\$100,000
Hydrants	7	EA	\$15,000	\$105,000
Water Treatment Plant				
Pressure Booster Pumps	2	EA	\$15,000	\$30,000
Flow Meters	2	EA	\$5,000	\$10,000
Misc WTP Piping Work	1	LS	\$10,000	\$10,000
Misc Gauges/Senors/Controls	1	LS	\$10,000	\$10,000
Start Up & Commissioning	1	LS	\$5,000	\$5,000
Total	\$4,549,000			

Non-Construction Costs				
Item	No.	Unit	Cost	Total
Survey/Utility Locates	1	LS	\$75,000	\$75,000
Geotechnical	1	LS	\$8,000	\$8,000
ROW/Easement Research Acquisition	1	LS	\$40,000	\$40,000
Archeological Agreements/Plan	1	LS	\$15,000	\$15,000
Engineering	10%	OF	\$4,549,000	\$454,900
Permitting	1	LS	\$20,000	\$20,000
Resident Project Representative	5%	OF	\$4,549,000	\$227,450
Construction Administration	12%	OF	\$4,549,000	\$545,880
Project Administration	8%	OF	\$4,549,000	\$363,920
Project Contingency	15%	OF	\$4,549,000	\$682,350
Total	\$2,432,500			

Item	Cost
Construction (Capital) Costs	\$4,549,000
Non-Construction Costs	\$2,432,500
Total Project Costs	\$6,981,500

Notes:

1. Assumed average length of services (ft) = 75
2. Average cost of Service = \$28,529.46
3. Archeological control assumes onsite archeologist during all excavations and one day per service and 30 days for mains.
4. There are cost savings for constructing all one total project not realized when broken into phases.

Proposed Project: Water Main and Service Line Replacement-Phase 4 (FAA Loop)

8/31/2020

Construction (Capital) Costs				
Item	No.	Unit	Cost	Total
Mob & Demo	1	LS	\$300,000	\$300,000
Homeowner Coordination	20	EA	\$500	\$10,000
Maintaining Water Service	1	LS	\$6,000	\$6,000
Construction Survey	1	LS	\$20,000	\$20,000
Archeological Control	50	DAY	\$1,200	\$60,000
SWPPP & Erosion Control	1	LS	\$5,000	\$5,000
Water Services				
Connection to Main	20	EA	\$1,500	\$30,000
1-inch HDPE Supply/Return Lines	3,000	FT	\$10	\$30,000
4" x 12" HDPE Insulated Pipe	1,500	FT	\$200	\$300,000
Heat Trace (5w/ft, 120v)	3,000	FT	\$12	\$36,000
Connection to House	20	EA	\$1,000	\$20,000
Circulation Pumps (limited to 25%)	5	EA	\$500	\$2,500
Arctic Box Repair (limited to 10%)	5	EA	\$5,000	\$25,000
House Plumbing Repair (limited to 10%)	5	EA	\$5,000	\$25,000
Water Mains				
6"x14" HDPE Insulated Pipe	6,400	FT	\$250	\$1,600,000
Valves	10	EA	\$5,000	\$50,000
Insulated Valve Boxes	10	EA	\$10,000	\$100,000
Hydrants	7	EA	\$15,000	\$105,000
Water Treatment Plant				
Pressure Booster Pumps	2	EA	\$15,000	\$30,000
Flow Meters	2	EA	\$5,000	\$10,000
Misc WTP Piping Work	1	LS	\$10,000	\$10,000
Misc Gauges/Senors/Controls	1	LS	\$10,000	\$10,000
Start Up & Commissioning	1	LS	\$5,000	\$5,000
Total	\$2,789,500			

Non-Construction Costs				
Item	No.	Unit	Cost	Total
Survey/Utility Locates	1	LS	\$75,000	\$75,000
Geotechnical	1	LS	\$8,000	\$8,000
ROW/Easement Research Acquisition	1	LS	\$40,000	\$40,000
Archeological Agreements/Plan	1	LS	\$15,000	\$15,000
Engineering	10%	OF	\$2,789,500	\$278,950
Permitting	1	LS	\$20,000	\$20,000
Resident Project Representative	5%	OF	\$2,789,500	\$139,475
Construction Administration	12%	OF	\$2,789,500	\$334,740
Project Administration	8%	OF	\$2,789,500	\$223,160
Project Contingency	15%	OF	\$2,789,500	\$418,425
Total	\$1,552,750			

Item	Cost
Construction (Capital) Costs	\$2,789,500
Non-Construction Costs	\$1,552,750
Total Project Costs	\$4,342,250

Notes:

1. Assumed average length of services (ft) = 75
2. Average cost of Service = \$28,529.46
3. Archeological control assumes onsite archeologist during all excavations and one day per service and 30 days for mains.
4. There are cost savings for constructing all one total project not realized when broken into phases.

Proposed Project: Water Main and Service Line Replacement-Phase 5 (School Loop)

8/31/2020

Construction (Capital) Costs				
Item	No.	Unit	Cost	Total
Mob & Demo	1	LS	\$200,000	\$200,000
Homeowner Coordination	5	EA	\$500	\$2,500
Maintaining Water Service	1	LS	\$6,000	\$6,000
Construction Survey	1	LS	\$20,000	\$20,000
Archeological Control	35	DAY	\$1,200	\$42,000
SWPPP & Erosion Control	1	LS	\$5,000	\$5,000
Water Servcies				
Connection to Main	5	EA	\$1,500	\$7,500
1-inch HDPE Supply/Return Lines	750	FT	\$10	\$7,500
4" x 12" HDPE Insulationed Pipe	375	FT	\$200	\$75,000
Heat Trace (5w/ft, 120v)	750	FT	\$12	\$9,000
Connection to House	5	EA	\$1,000	\$5,000
Circulation Pumps (limited to 25%)	5	EA	\$500	\$2,500
Arctic Box Repair (limited to 10%)	5	EA	\$5,000	\$25,000
House Plumbing Repair (limited to 10%)	5	EA	\$5,000	\$25,000
Water Mains				
6"x14" HDPE Insulated Pipe	1,400	FT	\$250	\$350,000
Valves	10	EA	\$5,000	\$50,000
Insulated Valve Boxes	10	EA	\$10,000	\$100,000
Hydrants	7	EA	\$15,000	\$105,000
Water Treatment Plant				
Pressure Booster Pumps	2	EA	\$15,000	\$30,000
Flow Meters	2	EA	\$5,000	\$10,000
Misc WTP Piping Work	1	LS	\$10,000	\$10,000
Misc Gauges/Senors/Controls	1	LS	\$10,000	\$10,000
Start Up & Commissioning	1	LS	\$5,000	\$5,000
Total	\$1,102,000			

Non-Construction Costs				
Item	No.	Unit	Cost	Total
Survey/Utility Locates	1	LS	\$75,000	\$75,000
Geotechnical	1	LS	\$8,000	\$8,000
ROW/Easement Research Acquisition	1	LS	\$40,000	\$40,000
Archeological Agreements/Plan	1	LS	\$15,000	\$15,000
Engineering	10%	OF	\$1,102,000	\$110,200
Permitting	1	LS	\$20,000	\$20,000
Resident Project Representative	5%	OF	\$1,102,000	\$55,100
Construction Administration	12%	OF	\$1,102,000	\$132,240
Project Administration	8%	OF	\$1,102,000	\$88,160
Project Contingency	15%	OF	\$1,102,000	\$165,300
Total	\$709,000			

Item	Cost
Construction (Capital) Costs	\$1,102,000
Non-Construction Costs	\$709,000
Total Project Costs	\$1,811,000

Notes:

1. Assumed average length of services (ft) = 75
2. Average cost of Service = \$28,529.46
3. Archeological control assumes onsite archeologist during all excavations and one day per service and 30 days for mains.
4. There are cost savings for constructing all one total project not realized when broken into phases.

BUDGET APPROPRIATIONS ORDINANCE

Ordinance No. 2019-03

AN ORDINANCE FOR THE CITY OF UNALAKLEET PROVIDING FOR THE ESTABLISHMENT AND ADOPTION OF THE BUDGET FOR FISCAL YEAR 2019/20 (FY'20)

BE IT ENACTED BY THE COUNCIL OF THE CITY OF UNALAKLEET, ALASKA.

Section 1. Classification

This is a Non-Code Ordinance

Section 2. General Provisions.

The attached document is the authorized budget of revenues and expenditures for the period July 1, 2019 through June 30, 2020 and is a matter of public record.

Section 3. Effective Date.

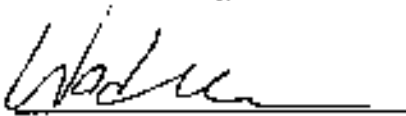
This ordinance becomes effective upon its adoption by the City Council.

Second and Final Reading:

First Reading: April 9, 2019

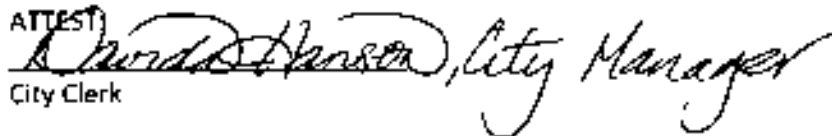
Public Hearing: April 9, 2019

ADOPTED by a duly constituted quorum of the City Council of Unalakleet, Alaska
This 17th of May, 2018.



Wade Ryan, Mayor

ATTEST:



for
City Clerk

	FY 2018 Actual	FY 2018 Amended	FY 2019 Actual	FY 2019 Amended	FY 2020 Proposed
REVENUES					
Sales Tax	390,000	425,000	410,000	410,000	415,000
Bed Tax	5,000	8,000	8,000	14,000	15,000
Alcohol Tax	6,500	6,500	10,200	10,200	10,200
Excise Tax	0	0	0		0
Shared Fisheries Tax	10,000	20,925	10,000		0
CAP-State Revenue Sharing	70,000	93,779	80,000	89,327	84,903
PILT- Federal	80,000	95,648	95,000	96,670	96,000
Elec & Tele Sharing	2,000	2,000	1,000	1,957	2,000
PERS	60,000	7,900	8,000	8,000	8,000
Water & Sewer	400,000	500,000			
Water- 70%			280,000	280,000	280,000
Sewer- 30%			120,000	120,000	120,000
Solid Waste/ Land Fill	1,000	1,000	24,000	24,000	24,000
Bidding Rentals	77,000	90,000	95,000	95,000	98,000
Equipment Rentals	5,000	5,000	5,000	500	7,000
Land Lease	2,000	2,000	2,000	1,800	1,800
Fines/Penalties	4,000	2,500	2,500	1,500	1,500
Licenses/ Permits	2,000	1,000	1,000	1,500	1,500
Road Usage			6,000	2,000	2,000
Dock Usage				22,500	50,000
NSEDC/ Community Employment Program		6,300	6,300	6,300	6,300
NSEDC-Community Benefit Share	150,000	150,000	150,000	167,000	150,000
NSEDC-Mid Year Benefit Share				133,333	0
NSEDC-Grants		8,000	10,000	14,000	15,000
Protective Custody/ 12 Hour Hold	150	2,000	2,000	600	600
Administrative Fees/ Grant Fees	4,000	0	10,000	0	0
Reimbursement/ PFD Collection	5,000	0	2,500	2,500	2,000
Library Grant				7,000	8,000
State Revenue					
Scholarships/ Training				5,000	5,000
ALPAR/ Clean-up	5,000	2,500	1,500	1,500	700
Community Donations		1,000	0	6,000	6,000
Land Sales	6,000	11,040	3,000	3,240	0
Misc	40,000	2,500	2,000	2,000	2,000
Total Revenues	1,324,650	1,442,592	1,345,000	1,527,427	1,411,503
EXPENDITURES					
Administrative					
Salaries & Payroll Benefits	190,000	130,000	190,000	150,000	160,000
Employers PERS (City's Portion)		60,000	70,000	40,000	40,000
Employers Payroll Taxes (City's Portion)		60,000	60,000	50,000	50,000
Travel & Per Diem	5,000	5,000	5,000	5,000	5,000
Fuel, Oil & Gas	1,500	2,000	2,000	4,000	5,000
Electricity	3,500	18,000	18,000	20,000	20,000
Telephone	6,000	5,000	5,000	4,000	4,000
Training/ Quick Books Support	4,000	7,000	7,000	7,000	7,000

	FY 2018 Actual	FY 2018 Amended	FY 2019 Actual	FY 2019 Amended	FY 2020 Proposed	
Supplies/Postage & Freight	16,000	10,000	8,000	8,000	8,000	
Professional fees/ Attorney		25,000	10,000	10,000	5,000	
Bank and Credit Card Fees		4,000	4,000	4,000	4,000	
Equipment (Repairs & Maintenance)	2,000	2,000	4,200	5,000	2,000	
Hillside Road Association					24,000	
Insurance /AMJLIA	17,500	18,014	18,014	18,014	18,000	
Audit/ Accounting	15,000	28,000	30,000	60,000	30,000	
Community Events		3,000	3,000	7,000	5,000	
Other	25,000	6,000	4,000	3,000	2,000	
Total General Government Admin.	260,500	383,014	438,214	395,014	399,000	
Public Works						
Public Works						
Salaries & Payroll Benefits	170,000	130,000	140,000	100,000	100,000	
Travel & Per Diem	3,000	500	1,500	3,000	3,000	
Fuel, Oil & Gas	48,000	25,000	20,000	30,000	25,000	
Electricity	10,000	6,000	7,000	8,500	6,500	
Telephone	1,400	3,000	3,000	3,000	2,000	
Training	1,200	500	1,000	2,000	1,000	
Supplies & Freight	25,000	27,000	10,000	50,000	40,000	
Equipment & Parts	15,000	25,000	10,000	25,000	20,000	
Insurance	20,900	21,016	21,016	21,016	21,000	
Other	2,000	3,000	3,000	3,000	2,000	
Total Public Works	298,500	241,016	216,516	243,516	220,500	
Public Works						
Baler & Solid Waste						
Salaries & Payroll Benefits	75,000	35,000	30,000	55,000	55,000	
Travel & Per Diem		700	1,000	500	1,000	
Fuel, Oil & Gas	5,000	1,000	4,000	6,000	5,000	
Electricity	5,000	4,000	4,000	1,700	2,000	
Supplies & Freight	2,200	2,200	2,000	10,000	8,000	
Insurance	5,838	6,004	6,004	6,004	5,004	
Repair & Maintenance	8,000	6,000	16,000	12,000	8,000	
Repair & Replacement					24,000	
Other	1,000	1,000	500	500	500	
Total PW Baler & Solid Waste	101,038	55,904	63,504	91,704	109,504	
Public Works						
Water & Sewer						
Salaries & Payroll Benefits	70,000	110,000				
Travel & Per Diem	1,200	3,000				
Fuel, Oil & Gas	45,000	20,000				
Electricity	60,000	60,000				
Parts, Supplies & Freight	25,000	60,000				
Insurance	5,838	6,004				
Fees	12,000	16,000				
Other	30,000	5,000				
TOTAL PW Water & Sewer	249,038	280,004				

	FY 2018 Actual	FY 2018 Amended	FY 2019 Actual	FY 2019 Amended	FY 2020 Proposed	
Public Works-Water						
Salaries & Payroll Benefits			70,000	50,000	60,000	
Travel & Per Diem			2,000	5,000	5,000	
Fuel, Oil & Gas			13,300	15,000	10,000	
Electricity			20,000	35,000	35,000	
Parts, Supplies & Freight			30,000	50,000	40,000	
Repair & Replacement					12,000	
Insurance			4,000	4,000	4,000	
Fees			14,000	14,000	10,000	
Other			2,500	5,000	2,000	
TOTAL Public Works-Water			155,800	178,000	178,000	
Public Works-Sewer						
Salaries & Payroll Benefits			30,000	35,000	30,000	
Travel & Per Diem			1,000	500	500	
Fuel, Oil & Gas			6,700	0	5,000	
Electricity			40,000	20,000	20,000	
Parts, Supplies & Freight			30,000	5,000	5,000	
Repair & Maintenance				6,000	10,000	
Repair & Replacement					12,000	
Insurance			2,004	2,004	2,004	
Other			2,500	500	500	
TOTAL Public Works-Sewer			112,204	69,004	85,004	
TOTAL PUBLIC WORKS	646,576	576,924	548,024	582,224	593,008	
Public Safety						
Salaries & Payroll Benefits	250,000	250,000	250,000	225,000	225,000	
Stipend/ Chief of Police		1,080	1,080	0	0	
Electricity	10,000	10,000	10,000	10,000	10,000	
Telephone	2,000	5,000	5,000	4,500	4,000	
Training/Travel Per Diem	2,500	2,500	2,500	2,500	6,000	
Supplies & Freight	8,000	4,000	4,000	10,000	8,000	
Fuel, Oil & Gas	13,000	10,000	10,000	20,000	20,000	
Insurance	48,200	49,038	49,038	49,038	49,038	
Equipment & Parts	6,000	6,000	6,000	8,000	6,000	
Other	4,000	500	500	500	500	
TOTAL Public Safety	343,700	338,118	338,118	327,538	328,538	
Library-Cultural Center						
Salaries & Payroll Benefits				3,400	3,400	
Electricity	500	400	400	450	400	
Telephone/ Internet					380	
Supplies & Freight				1,000	2,400	
Fuel, Oil & Gas				2,700	0	
Travel					2,400	
TOTAL Library	500	400	400	7,550	8,980	
Four Plex						

	FY 2018 Actual	FY 2018 Amended	FY 2019 Actual	FY 2019 Amended	FY 2020 Proposed	
Fuel, Oil & Gas	12,750	5,000	6,000	5,375	6,000	
Electricity	3,750	2,500	2,500	2,000	2,000	
Supplies & Freight	1,500	1,500	1,500	13,000	15,000	
Total Four Plex	18,000	9,000	10,000	20,375	23,000	
Total Revenue	1,335,750	1,448,633	1,346,000	1,518,100	1,411,503	
Total Expenditures	1,269,276	1,307,456	1,334,756	1,332,701	1,342,506	
Balance	66,474	138,177	11,244	185,399	68,997	
Beginning Fund Balance						
Ending Fund Balance						
Approved By						
Title						
Date						



Comprehensive Energy Audit For Unalakleet Water Treatment Plant



Prepared For
City of Unalakleet

March 9, 2017

Prepared By: Kevin Ulrich and Martin Wortman

**ANTHC-DEHE
4500 Diplomacy Dr.
Anchorage, AK 99508**

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PREFACE

This energy audit was conducted using funds provided by the United States Department of Agriculture as part of the Rural Alaskan Village Grant (RAVG) program. Coordination with the City of Unalakleet has been undertaken to provide maximum accuracy in identifying audits and coordinating potential follow up retrofit activities.

The Rural Energy Initiative at the Alaska Native Tribal Health Consortium (ANTHC) prepared this document for the City of Unalakleet, Alaska. The authors of this report are Kevin Ulrich, Assistant Engineering Project Manager and Certified Energy Manager (CEM); and Martin Wortman, Supervisor of Utility Operations.

The purpose of this report is to provide a comprehensive document of the findings and analysis that resulted from an energy audit conducted in December of 2016 by the Rural Energy Initiative of ANTHC. This report analyzes historical energy use and identifies costs and savings of recommended energy conservation measures. Discussions of site-specific concerns, non-recommended measures, and an energy conservation action plan are also included in this report.

ACKNOWLEDGMENTS

The ANTHC Rural Energy Initiative gratefully acknowledges the assistance of Water Treatment Plant Operators Dwayne Johnson and Roger Nichols, and City Manager Shannon Hough.

1. EXECUTIVE SUMMARY

This report was prepared for the City of Unalakleet. The scope of the audit focused on the Unalakleet Water Treatment Plant. The scope of this report is a comprehensive energy study, which included an analysis of building shell, interior and exterior lighting systems, HVAC systems, and plug loads. An additional energy audit report has been developed for the Unalakleet Pump House, which supports the contents of this energy audit.

Based on electricity and fuel oil prices in effect at the time of the audit, the total predicted energy costs are \$78,213 per year. Electricity represents the largest portion of the energy cost with an annual cost of approximately \$63,471. This includes \$29,162 paid by the City and \$34,309 paid by the Power Cost Equalization (PCE) program through the State of Alaska. Fuel oil represents another main portion of energy costs with an annual cost of approximately \$14,721. The Water Treatment Plant also uses a heat recovery system with a monthly flat operating charge of \$485. This yields an annual cost of \$5,820.

The State of Alaska PCE program provides a subsidy to rural communities across the state to lower electricity costs and make energy affordable in rural Alaska. In Unalakleet, the cost of electricity without PCE is \$0.37/kWh and the cost of electricity with PCE is \$0.17/kWh.

There is a heat recovery system in the power plant that transports heat from the generator cooling loops to the water treatment plant to heat the raw water as it enters the building. The heat recovery also provides heat to four unit heaters directly and ties in to a heat exchanger that delivers heat to the building hydronic heating system prior to the existing oil-fired boilers. The recovered heat is supplied by four power generators, each of which is rated for 475 kW. There is also an existing wind farm in the community with six turbines, each rated at 100 kW, that powers an electric boiler as a dump load. The electric boiler provides heat to the generator cooling loops. The heat recovery system also serves the high school and the Baler Building, which handles the garbage of the community. These two buildings are served first by the heat recovery system before the water treatment plant receives any remaining heat. As of the time of the site visit, the heat recovery system is the only source of heat to the community water supply within the water treatment plant.

Table 1.1 shows the predicted annual use of each fuel type for the Unalakleet Water Treatment Plant.

Table 1.1: Predicted Annual Fuel Use for the Unalakleet Water Treatment Plant

Predicted Annual Fuel Use		
Fuel Use	Existing Building	With Proposed Retrofits
Electricity	171,544 kWh	145,990 kWh
#1 Oil	3,392 gallons	2,135 gallons
Heat Recovery	1,462.10 million Btu	1,542.74 million Btu
Waste Oil	544 gallons	222 gallons

Benchmark figures facilitate comparing energy use between different buildings. Table 1.2 lists several benchmarks for the audited building.

Table 1.2: Building Benchmarks for the Unalakleet Water Treatment Plant

Building Benchmarks			
Description	EUI (kBtu/Sq.Ft.)	EUI/HDD (Btu/Sq.Ft./HDD)	ECI (\$/Sq.Ft.)
Existing Building	358.2	25.73	\$10.90
With Proposed Retrofits	328.0	23.56	\$8.82
EUI: Energy Use Intensity - The annual site energy consumption divided by the structure's conditioned area. EUI/HDD: Energy Use Intensity per Heating Degree Day. ECI: Energy Cost Index - The total annual cost of energy divided by the square footage of the conditioned space in the building.			

Table 1.3 below summarizes the energy efficiency measures analyzed for the Unalakleet Water Treatment Plant. Listed are the estimates of the annual savings, installed costs, and two different financial measures of investment return.

Table 1.3: Summary of Recommended Energy Efficiency Measures

PRIORITY LIST – ENERGY EFFICIENCY MEASURES							
Rank	Feature	Improvement Description	Annual Energy Savings	Installed Cost	Savings to Investment Ratio, SIR ¹	Simple Payback (Years) ²	CO ₂ Savings
1	Other Electrical: Lift Station 1 Portable Electric Heater	Unplug electric heater and use only in emergency purposes. This can only be accomplished with a repair of the electric heater in lift station 1.	\$1,571	\$500	36.90	0.3	7,216.7
2	Lighting: Exterior Lights	Replace with LED-equivalent light bulbs.	\$144	\$50	33.91	0.3	663.1
3	Setback Thermostat: Water Plant	Implement a Heating Temperature Unoccupied Setback to 50.0 deg F for the Water Plant space. This retrofit can only occur if the unit heaters and other space heating components are repaired.	\$2,606	\$1,000	33.54	0.4	16,702.2
4	Setback Thermostat: Garage/Shop Space	Implement a Heating Temperature Unoccupied Setback to 50.0 deg F for the Garage/Shop Space space.	\$1,351	\$2,000	8.69	1.5	8,654.3
5	Lighting: Middle Garage	Replace with LED-equivalent light bulbs and add an occupancy sensor.	\$1,569	\$2,760	6.50	1.8	6,436.3
6	Lighting: Chemical Room Hallway	Replace with LED-equivalent light bulbs.	\$83	\$160	5.92	1.9	337.3
7	Lighting: Water Storage Tank Alcove	Replace with LED-equivalent light bulbs.	\$83	\$160	5.90	1.9	336.4
8	Lighting: Far Garage	Replace with LED-equivalent light bulbs and add an occupancy sensor.	\$688	\$1,380	5.68	2.0	2,775.5

PRIORITY LIST – ENERGY EFFICIENCY MEASURES							
Rank	Feature	Improvement Description	Annual Energy Savings	Installed Cost	Savings to Investment Ratio, SIR ¹	Simple Payback (Years) ²	CO ₂ Savings
9	Lighting: Process Room	Replace with LED-equivalent light bulbs and add an occupancy sensor.	\$778	\$1,620	5.47	2.1	3,111.2
10	Other Electrical: Lift Station 1 Electric Water Heater	Replace thermostat in lift station and reduce temperature set point to 40 deg. F. This will allow the portable electric heater to be unplugged and used as a backup.	\$891	\$2,000	5.23	2.2	4,093.1
11	Lighting: Boiler Room	Replace with LED-equivalent light bulbs and add an occupancy sensor.	\$547	\$1,300	4.78	2.4	2,165.9
12	Lighting: Police Garage	Replace with LED-equivalent light bulbs and add an occupancy sensor.	\$540	\$1,300	4.71	2.4	2,123.2
13	Air Tightening	Add weather stripping around garage doors and man doors, replace broken windows, repair wall damage in far garage, weatherize around insulated stack holes.	\$2,590	\$5,000	4.64	1.9	16,598.7
14	Lighting: Police Garage Bench	Replace with LED-equivalent light bulbs.	\$59	\$160	4.18	2.7	234.5
15	Lighting: Office Desk Light	Replace with LED-equivalent light bulbs.	\$12	\$40	3.42	3.3	47.8
16	Lighting: Apartment Lights	Replace with LED-equivalent light bulbs.	\$117	\$480	2.74	4.1	449.0
17	Lighting: Middle Garage Bench	Replace with LED-equivalent light bulbs.	\$37	\$160	2.62	4.3	146.8
18	Setback Thermostat: Apartment Space	Implement a Heating Temperature Unoccupied Setback to 60.0 deg F for the Apartment space.	\$200	\$1,000	2.57	5.0	1,281.8
19	Lighting: Office	Replace with LED-equivalent light bulbs.	\$49	\$240	2.33	4.9	195.6
20	Lighting: Middle Garage Storage	Replace with LED-equivalent light bulbs.	\$15	\$80	2.08	5.5	58.5
21	Garage Door: Garage 2 Door (Short)	Add insulating blanket to garage door.	\$76	\$542	1.82	7.1	490.1
22	Garage 3 Door (Short)	Add insulating blanket to garage door.	\$95	\$678	1.81	7.1	611.9
23	Garage 3 Door (Tall)	Add insulating blanket to garage door.	\$137	\$976	1.81	7.1	879.8
24	Garage 1 Door	Add insulating blanket to garage door.	\$152	\$1,084	1.81	7.1	976.5
25	Garage 2 Door (Tall)	Add insulating blanket to garage door.	\$213	\$1,518	1.80	7.1	1,363.9

PRIORITY LIST – ENERGY EFFICIENCY MEASURES							
Rank	Feature	Improvement Description	Annual Energy Savings	Installed Cost	Savings to Investment Ratio, SIR ¹	Simple Payback (Years) ²	CO ₂ Savings
26	HVAC and Domestic Hot Water	Repair unit heaters in chemical room hallway, process room, and boiler room. Clean and tune boilers. Replace Boiler 1 circ. pump. Open valve from power plant to maximize heat recovery system. This is necessary for water plant operations to be sustainable.	\$297	\$8,000	1.22	26.9	8,391.4
27	Lighting: Chemical Room Lighting	Replace with LED-equivalent light bulbs.	\$38	\$400	1.10	10.5	159.4
28	Water Circulation Heating	Install Heat Exchanger to allow heat add prior to the pressure pumps to the water circulation loops. Prevents freeze-ups in the lines and lowers maintenance costs. Also replace controls and program for more efficient operations.	-\$1,856 + \$3,000 Maintenance Savings	\$15,000	0.94	13.1	- 21,911.8
29	Raw Water Heating	Replace Heat Exchanger because it is old and single-walled. Maintenance savings for cost needed to monitor water.	\$0 + \$500 Maintenance Savings	\$12,000	0.73	24.0	0.0
30	Other Electrical: Pressure Pump	Replace with new, more efficient pump.	\$444	\$11,000	0.66	24.8	1,816.8
31	Other Electrical: Northeast Loop	Replace with new, more efficient pump.	\$379	\$11,000	0.57	29.0	1,531.0
32	Other Electrical: West Loop Circulation Pump	Replace with new, more efficient pump.	\$437	\$13,000	0.55	29.8	1,762.2
33	Other Electrical: Southeast Loop Circulation Pump	Replace with new, more efficient pump.	\$290	\$10,000	0.48	34.5	1,169.1
34	Window: Process Room Windows (2)	Replace existing window with triple pane window.	\$85	\$2,966	0.45	34.8	502.7
35	Window: Boiler Room Windows (3)	Replace existing window with triple pane window.	\$119	\$4,449	0.42	37.2	703.7
36	Lighting: Restroom Lights	Replace with LED-equivalent light bulbs.	\$3	\$160	0.22	53.1	12.5
37	Lighting: Lift Station 1 Wet Side Lights	Replace with LED-equivalent light bulbs.	\$1	\$50	0.20	57.9	4.0
38	Lighting: Lift Station 4 Lighting	Replace with LED-equivalent light bulbs.	\$2	\$100	0.20	58.2	7.9
39	Lighting: Lift Station 3 Lighting	Replace with LED-equivalent light bulbs.	\$3	\$150	0.20	58.3	11.8
40	Lighting: Lift Station 2 Wet Side Lighting	Replace with LED-equivalent light bulbs.	\$3	\$200	0.19	61.3	15.0

PRIORITY LIST – ENERGY EFFICIENCY MEASURES							
Rank	Feature	Improvement Description	Annual Energy Savings	Installed Cost	Savings to Investment Ratio, SIR ¹	Simple Payback (Years) ²	CO ₂ Savings
41	Other Electrical: FAA Loop Circulation Pump	Replace with new, more efficient pump.	\$43	\$4,000	0.18	92.2	174.9
42	Lighting: Lift Station 2 Dry Side Lighting	Replace with LED-equivalent light bulbs.	\$2	\$160	0.14	86.4	8.5
43	Window: Chemical Room Window	Replace existing window with triple pane window.	\$7	\$1,483	0.08	199.4	43.8
44	Window: Apartment Windows (2)	Replace existing window with triple pane window.	\$10	\$1,968	0.08	199.3	58.2
45	Lighting: Lift Station 1 Dry Side Lights	Replace with LED-equivalent light bulbs.	\$1	\$100	0.06	198.4	2.3
	TOTAL, all measures		\$14,912 + \$3,500 Maintenance Savings	\$122,373	1.89	6.6	72,413.2

Table Notes:

¹ Savings to Investment Ratio (SIR) is a life-cycle cost measure calculated by dividing the total savings over the life of a project (expressed in today's dollars) by its investment costs. The SIR is an indication of the profitability of a measure; the higher the SIR, the more profitable the project. An SIR greater than 1.0 indicates a cost-effective project (i.e. more savings than cost). Remember that this profitability is based on the position of that Energy Efficiency Measure (EEM) in the overall list and assumes that the measures above it are implemented first.

² Simple Payback (SP) is a measure of the length of time required for the savings from an EEM to payback the investment cost, not counting interest on the investment and any future changes in energy prices. It is calculated by dividing the investment cost by the expected first-year savings of the EEM.

With all of these energy efficiency measures in place, the annual utility cost can be reduced by \$14,912 per year, or 19.1% of the buildings' total energy costs. These measures are estimated to cost \$122,373, for an overall simple payback period of 6.6 years.

Table 1.4 below is a breakdown of the annual energy cost across various energy end use types, such as Space Heating and Water Heating. The first row in the table shows the breakdown for the building as it is now. The second row shows the expected breakdown of energy cost for the building assuming all of the retrofits in this report are implemented. Finally, the last row shows the annual energy savings that will be achieved from the retrofits.

Table 1.4: Detailed Breakdown of Energy Costs in the Building

Annual Energy Cost Estimate									
Description	Space Heating	Water Heating	Ventilation Fans	Lighting	Refrigeration	Other Electrical	Raw Water Heat Add	Water Circulation Heat	Total Cost
Existing Building	\$20,076	\$467	\$3	\$9,623	\$243	\$45,870	\$1,920	\$10	\$78,213
With Proposed Retrofits	\$14,298	\$457	\$3	\$3,399	\$243	\$41,148	\$1,835	\$1,919	\$63,301
Savings	\$5,778	\$10	\$0	\$6,224	\$0	\$4,722	\$86	-\$1,908	\$14,912

2. AUDIT AND ANALYSIS BACKGROUND

2.1 Program Description

This audit included services to identify, develop, and evaluate energy efficiency measures at the Unalakleet Water Treatment Plant. The scope of this project included evaluating building shell, lighting and other electrical systems, and HVAC equipment, motors and pumps. Measures were analyzed based on life-cycle-cost techniques, which include the initial cost of the equipment, life of the equipment, annual energy cost, annual maintenance cost, and a discount rate of 3.0%/year in excess of general inflation.

2.2 Audit Description

Preliminary audit information was gathered in preparation for the site survey. The site survey provides critical information in deciphering where energy is used and what opportunities exist within a building. The entire site was surveyed to inventory the following to gain an understanding of how each building operates:

- Building envelope (roof, windows, etc.)
- Heating, ventilation, and air conditioning equipment (HVAC)
- Lighting systems and controls
- Building-specific equipment
- Water consumption, treatment (optional) & disposal

The building site visit was performed to survey all major building components and systems. The site visit included detailed inspection of energy consuming components. Summary of building occupancy schedules, operating and maintenance practices, and energy management programs provided by the building manager were collected along with the system and components to determine a more accurate impact on energy consumption.

Details collected from Unalakleet Water Treatment Plant enable a model of the building's energy usage to be developed, highlighting the building's total energy consumption, energy consumption by specific building component, and equivalent energy cost. The analysis involves

distinguishing the different fuels used on site, and analyzing their consumption in different activity areas of the building.

Unalakleet Water Treatment Plant is made up of the following activity areas:

- 1) Water Plant: 2,395 square feet
- 2) Apartment Space: 680 square feet
- 3) Garage/Shop Space: 4,101 square feet

In addition, the methodology involves taking into account a wide range of factors specific to the building. These factors are used in the construction of the model of energy used. The factors include:

- Occupancy hours
- Local climate conditions
- Prices paid for energy

2.3. Method of Analysis

Data collected was processed using AkWarm© Energy Use Software to estimate energy savings for each of the proposed energy efficiency measures (EEMs). The recommendations focus on the building envelope; HVAC; lighting, plug load, and other electrical improvements; and motor and pump systems that will reduce annual energy consumption.

EEMs are evaluated based on building use and processes, local climate conditions, building construction type, function, operational schedule, existing conditions, and foreseen future plans. Energy savings are calculated based on industry standard methods and engineering estimations.

Our analysis provides a number of tools for assessing the cost effectiveness of various improvement options. These tools utilize **Life-Cycle Costing**, which is defined in this context as a method of cost analysis that estimates the total cost of a project over the period of time that includes both the construction cost and ongoing maintenance and operating costs.

Savings to Investment Ratio (SIR) = Savings divided by Investment

Savings includes the total discounted dollar savings considered over the life of the improvement. When these savings are added up, changes in future fuel prices as projected by the Department of Energy are included. Future savings are discounted to the present to account for the time-value of money (i.e. money's ability to earn interest over time). The **Investment** in the SIR calculation includes the labor and materials required to install the measure. An SIR value of at least 1.0 indicates that the project is cost-effective—total savings exceed the investment costs.

Simple payback is a cost analysis method whereby the investment cost of a project is divided by the first year's savings of the project to give the number of years required to recover the cost of the investment. This may be compared to the expected time before replacement of the system or component will be required. For example, if a boiler costs \$12,000 and results in a savings of \$1,000 in the first year, the payback time is 12 years. If the boiler has an expected

life to replacement of 10 years, it would not be financially viable to make the investment since the payback period of 12 years is greater than the project life.

The Simple Payback calculation does not consider likely increases in future annual savings due to energy price increases. As an offsetting simplification, simple payback does not consider the need to earn interest on the investment (i.e. it does not consider the time-value of money). Because of these simplifications, the SIR figure is considered to be a better financial investment indicator than the Simple Payback measure.

Measures are implemented in order of cost-effectiveness. The program first calculates individual SIRs, and ranks all measures by SIR, higher SIRs at the top of the list. An individual measure must have an individual $SIR \geq 1$ to make the cut. Next the building is modified and re-simulated with the highest ranked measure included. Now all remaining measures are re-evaluated and ranked, and the next most cost-effective measure is implemented. AkWarm goes through this iterative process until all appropriate measures have been evaluated and installed.

It is important to note that the savings for each recommendation is calculated based on implementing the most cost effective measure first, and then cycling through the list to find the next most cost effective measure. Implementation of more than one EEM often affects the savings of other EEMs. The savings may in some cases be relatively higher if an individual EEM is implemented in lieu of multiple recommended EEMs. For example implementing a reduced operating schedule for inefficient lighting will result in relatively high savings. Implementing a reduced operating schedule for newly installed efficient lighting will result in lower relative savings, because the efficient lighting system uses less energy during each hour of operation. If multiple EEM's are recommended to be implemented, AkWarm calculates the combined savings appropriately.

Cost savings are calculated based on estimated initial costs for each measure. Installation costs include labor and equipment to estimate the full up-front investment required to implement a change. Costs are derived from Means Cost Data, industry publications, and local contractors and equipment suppliers.

2.4 Limitations of Study

All results are dependent on the quality of input data provided, and can only act as an approximation. In some instances, several methods may achieve the identified savings. This report is not intended as a final design document. The design professional or other persons following the recommendations shall accept responsibility and liability for the results.

3. Unalakleet Water Treatment Plant

3.1. Building Description

The 7,176 square foot Unalakleet Water Treatment Plant was constructed in 1965 and houses the water treatment plant, three garages for city vehicles, and an apartment currently occupied by the city manager. The building is in operation every day from 8:00AM to 5:00PM with a one-

hour lunch break. Typical operations include one water treatment plant operator and 2-3 maintenance workers for the city vehicles. There are additional city workers that routinely work in the building for short periods of time during the day.

Water is collected from Powers Creek at the pump house located approximately five miles north of the community. Water is heated at the pump house and transported to the water treatment plant through buried pipe. Upon entering the water treatment plant, the water is heated and injected with chemicals before being filtered and getting stored in the water storage tank. The water is injected with ferric chloride, which acts as a coagulant during the filtration process; soda ash, which maintains the acidity of the water; and chlorine, which treats the water. After getting stored in the one-million gallon water storage tank, the water is then distributed to the community through four distribution loops. The loop information is listed below.

FAA Loop:	Northwest area of the community. 4" Buried Steel Pipe Temperatures – 42 deg. F. supply, 36 deg. F, return Pressure – 34 psi Flow Meter Broken – Estimated 75 GPM
Southeast Loop:	Southeast area of the community. 4" Buried Steel Pipe Temperatures – 42 deg. F. supply, 42 deg. F, return Pressure – 47 psi Flow Rate - 195 GPM supply
West Loop:	West area of the community. Temperatures – 53 deg. F. supply, 38 deg. F, return Pressure – 47 psi Flow Rate - 225 GPM return
Northeast Loop:	Northeast area of the community. Temperatures – Readings were inaccurate Pressure – 36 psi Flow Rate – 60 GPM return

There are three garages that are used to store vehicles for the City as well as for repairs and maintenance to the vehicle fleet. Two large garages are dedicated to the fire department and one garage is dedicated to the police department. Maintenance workers are present year round to work on the vehicles.

There is a single apartment with two bedrooms that is used for guests related to the city operations. At the time of the site visit, the city manager was living in the apartment.

There are four lift stations in the community that are used to collect the sewage from the community and transport it to the sewage lagoon outside of town. The lift station information is listed below.

Lift Station 1 (Covenant):	Pump Rating – 3 HP Flygt Model 3085 Radiant Floor Heating with Electric Hot Water Heater – 1650 Watts Portable Electric Heater – 4000 Watts
Lift Station 2 (Midtown):	Pump Rating – 10 HP Flygt Model 3127.090.1030 Electric Heater - Broken
Lift Station 3 (FAA):	Pump – Removed for use in Lift Station 4 Previously rated for 1.5 HP Electric Heater – 3000 Watts
Lift Station 4 (Happy Valley):	Sewage Pump Rating – 1.5 HP Previously used Hydromatic 5HP pumps Flygt Grinder Pump – 550 Watts Plug-in Heater – 3000 Watts

Description of Building Shell

The exterior walls are single-stud wood-framed construction with 2x6 supports and approximately 5.5 inches of fiberglass batt insulation.

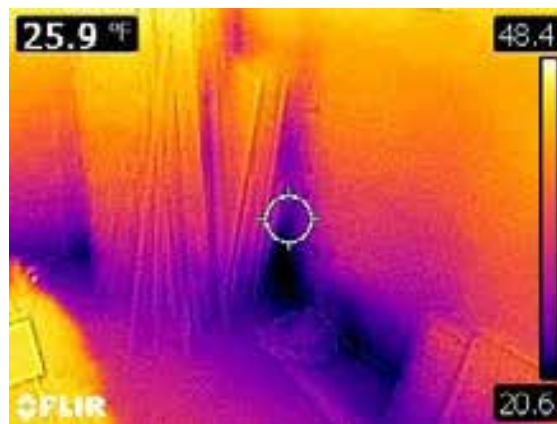


Figure 1: Thermal Image of a Damaged Wall Section in the Far Garage

The facility has cathedral ceilings throughout the building with an attic space in the apartment. The roof is constructed with single-stud wood framing with 2x6 lumber and approximately 5.5 inches of fiberglass batt insulation.

The building is constructed on grade with a concrete slab foundation. The foundation has been damaged in the garage areas from vehicle use. There was no insulation visible for the majority of the building floor.

The water treatment plant has six total windows, each of which is approximately 30"x45" with wood framing. The five windows in the process room and boiler room all have damage to the window panes or are boarded across. Additionally, the Apartment has two windows, each of which is approximately 28"x32" with wood framing.

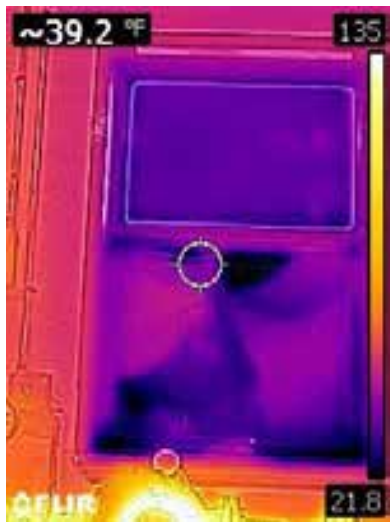


Figure 2: Thermal Images of a Broken Window and a Boarded Window in the Water Treatment Plant



There are standard-sized entrance doors in the police garage, far fire department garage, chemical room, and apartment. The police garage is used as the main entrance to the facility. The apartment is connected to the boiler room with a door that is typically locked. There are also five large garage doors present with one in the police garage and two each in both fire department garage areas.

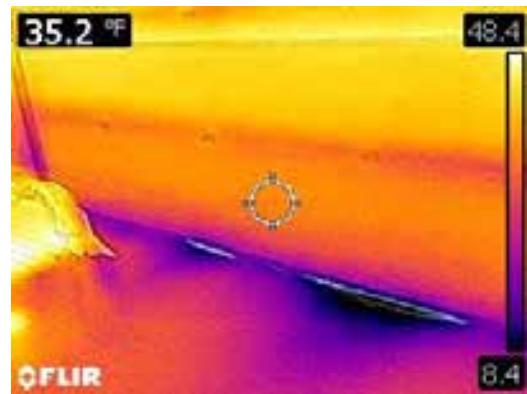
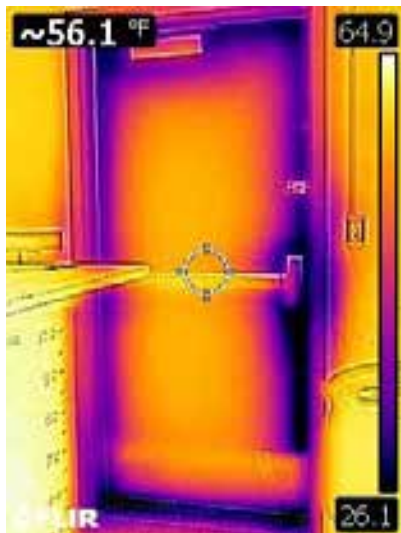
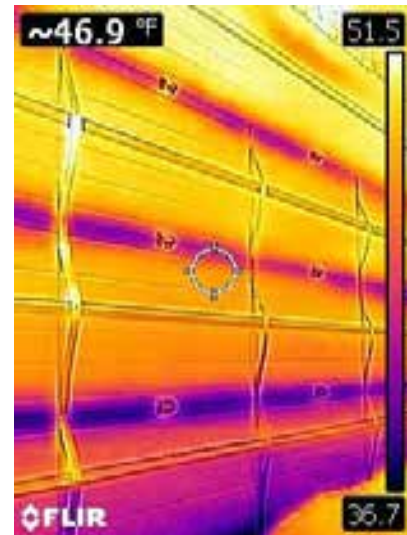


Figure 3: Thermal Images of Doors around the Water Treatment Plant and Garage Spaces.

Top Left: Main Entrance.

Top Right: Police Garage Door.

Bottom Left: Chemical Room Entrance.

Bottom Right: Middle Garage Door

Description of Heating Plants

The heating plants used in the building are:

Boiler 1

Nameplate Information:	Weil McLain Gold Model: P-WG0-6
Fuel Type:	#1 Oil
Input Rating:	184,000 BTU/hr
Steady State Efficiency:	78 %
Idle Loss:	0.5 %

Heat Distribution Type:	Glycol
Boiler Operation:	All Year
Notes:	Used for space heating, DHW, and the apartment Taco 1/25 HP Model 07-F5 Pump for circulation. Not operational.



Figure 4: Boiler 1 (Left Side)

Boiler 2

Nameplate Information:	Weil McLain Gold Model: P-WG0-6
Fuel Type:	#1 Oil
Input Rating:	184,000 BTU/hr
Steady State Efficiency:	78 %
Idle Loss:	0.5 %
Heat Distribution Type:	Glycol
Boiler Operation:	All Year
Notes:	Used for space heating, DHW, and the apartment Grundfos UP 15-42 F circulation pump



Figure 5: Boiler 2

Heat Recovery

Fuel Type:	Heat Recovery
Input Rating:	425,000 BTU/hr
Steady State Efficiency:	95 %
Idle Loss:	0 %
Heat Distribution Type:	Glycol
Boiler Operation:	All Year
Notes:	Pump located in the Power Plant This is supplied by the UVEC to the WTP after going to the school and the Baler Building



Figure 6: Heat Recovery Heat Exchanger in the Power Plant

Waste Oil Heater

Nameplate Information:	Blackgold EL-200H
Fuel Type:	Waste Oil
Input Rating:	200,000 BTU/hr
Steady State Efficiency:	70 %
Idle Loss:	1.5 %
Heat Distribution Type:	Air



Figure 7: Waste Oil Space Heater in the Middle Garage

Space Heating Distribution Systems

The building is heated by a combination of unit heaters for most of the building as well as some hydronic heating in the apartment area and a waste oil space heater in the middle garage. Information for the heating equipment is listed below:

Chemical Room Unit Heater: Modine HC 47, 30,940 BTUh, Operational

Chemical Room Hallway Unit Heater: Beacon HB 48, 30,000 BTUh, Broken

Process Room Unit Heater 1: Beacon HB 48, 30,000 BTUh, Broken

Process Room Unit Heater 2: Beacon HB 48, 30,000 BTUh, Broken

Boiler Room Unit Heater: Beacon HB 48, 30,000 BTUh, Operational

Police Garage Unit Heater: Beacon HB 48, 30,000 BTUh, Operational

Middle Garage Unit Heater 1: Beacon VB-62, 39,600 BTUh, Operational

Middle Garage Unit Heater 2: Beacon VB-62, 39,600 BTUh, Operational

Far Garage Unit Heater: Beacon VB-62, 39,600 BTUh, Operational

Domestic Hot Water System

There is a Weil McLain hot water heater with 50 gallons of storage that is used to heat water for use in the apartment and the restroom. The apartment includes a kitchen sink, restroom, and a clothes washer.

Heat Recovery Information

There is a heat recovery system in the power plant that transports heat from the generator cooling loops to the water treatment plant to heat the raw water as it enters the building. The heat recovery also provides heat to four unit heaters directly and ties in to a heat exchanger that delivers heat to the building hydronic heating system prior to the existing oil-fired boilers. The recovered heat is supplied by four power generators, each of which is rated for 475 kW. There is also an existing wind farm in the community with six turbines, each rated or 100 kW, that powers an electric boiler as a dump load. The electric boiler provides heat to the generator cooling loops. The heat recovery system also serves the high school and the Baler Building, which handles the garbage of the community. These two buildings are served first by the heat recovery system before the water treatment plant receives any remaining heat. As of the time of the site visit, the heat recovery system is the only source of heat to the community water supply within the water treatment plant.

During the site visit the heat recovery system was monitored over a few different times during the day. When school was in session, the school building received approximately 400-475 MBH of heat while the Baler Building received 15-25 MBH and the Unalakleet Water Treatment Plant received 30-40 MBH. During the evening when school was not in session, the school received 25-35 MBH, the Baler Building received 15-25 MBH, and the Unalakleet Water Treatment Plant received 350-425 MBH.

Description of Building Ventilation System

There is a small exhaust fan in the chemical room that is manually controlled whenever the operator needs to vent the room during chemical mixing. It had an estimated rating of 120 Watts, as the nameplate was not on the unit.

Lighting

Table 3.1 below shows detailed information on the lighting in the Unalakleet Water Treatment Plant as well as in the biomass building.

Table 3.1: Detailed Lighting Information for the Unalakleet Water Treatment Plant

Room	Bulb Type	Fixtures	Bulbs per Fixture	Annual Usage (kWh)
Chemical Room	Fluorescent T8	5	2	471
Office	Fluorescent T8	3	2	613
Office	Fluorescent T8	1	1	119
Chemical Room Hallway	Fluorescent T8	2	3	579
Process Room	Fluorescent T8	14	3	4,050
Water Storage Tank Alcove	Fluorescent T8	2	3	579
Boiler Room	Fluorescent T8	10	3	2,893
Restroom	Fluorescent T8	2	2	38
Police Garage	Fluorescent T8	10	3	2,893
Police Garage Bench	Fluorescent T8	2	4	346
Middle Garage	Fluorescent T8	27	3	7,811
Middle Garage Bench	Fluorescent T8	2	3	267
Middle Garage Storage	Fluorescent T8	1	4	86
Fire Department Garage	Fluorescent T8	11	4	3,168
Water Plant Exterior	Incandescent 60W	1	1	526
Apartment Lights	Fluorescent T8	6	2	1,527

Lift Station 1 – Wet Side	Incandescent 60W	1	1	3
Lift Station 1 – Dry Side	Fluorescent T8	1	3	4
Lift Station 2 – Wet Side	High Pressure Sodium 50W	4	1	12
Lift Station 2 – Dry Side	Fluorescent T8	2	4	9
Lift Station 3	Incandescent 60W	3	1	9
Lift Station 4	Incandescent 60W	2	1	6

Plug Loads

The Unalakleet Water Treatment Plant has a variety of power tools, a telephone, and some other miscellaneous loads that require a plug into an electrical outlet. The use of these items is infrequent and consumes a small portion of the total energy demand of the building.

Major Equipment

Table 3.2 shows details of major electrical equipment located in the Unalakleet Water Treatment Plant. All electrical amperage draws for pumps were measured in the field and are recorded next to the nameplate rating.

Table 3.2: Major Equipment Information for the Unalakleet Water Treatment Plant

Equipment	Rating (Watts)	Annual Usage (kWh)
Cathodic Protection Rectifier	909	7,968
Pressure Pump	1,840 (5HP)	16,130
FAA Loop Circulation Pump	368 (0.33HP)	1,627
Southeast Loop Circulation Pump	2,484 (5HP)	10,984
West Loop Circulation Pump	3,818 (7.5HP)	16,883
Northeast Loop Circulation Pump	3,312 (5HP)	14,646
Hydronic Booster Pump	85	745
Ferric Chloride Mixer	100	219
Ferric Chloride Injection Pump	24	210
Ferric Chloride Mixer (2)	640	561
Soda Ash Mixer	187	410
Soda Ash Injection Pump	39	342
Chlorine Mixers	187	410
Chlorine Injection Pump	39	342
Backwash Pump	6,210 (10HP)	326
Air Scour	4800	187
Apartment Clothes Washer	1,200	63

Apartment Clothes Dryer	3,120	163
Apartment Refrigerator	75	657

The cathodic protection rectifier is a type of corrosion protection system that works by continuously adding an electric charge to the fluid to prevent charged metal particles in the pipe to transfer to the fluid and begin the corrosion process. It is operated constantly to insure proper corrosion protection.

The pressure pump is located after the water storage tank in the water system process and is operated constantly to pressurize the system and maintain proper flow in all water distribution loops.

The loop circulation pumps operate constantly during the winter months to circulate the water in the water loops and prevent the water from freezing in the service lines.

There is some miscellaneous electrical usage in the apartment that is estimated to account for approximately 1,096 kWh of annual electrical usage.

Table 3.3 shows details of all major electrical equipment present in the four lift stations.

Table 3.3: Major Equipment Information for the Unalakleet Lift Stations

Equipment	Rating (Watts)	Annual Usage (kWh)
Lift Station 1 Electric Heater	1,650	7,296
Lift Station 1 Heating Circulation Pump	85	376
Lift Station 1 Portable Electric Heater	4,000	4,422
Lift Station 1 Sewage Pump	4,600 (7.5HP)	7,258
Lift Station 2 Electric Heater	3,600	0 (Broken)
Lift Station 2 Sewage Pump	11,000 (10 HP)	2,893
Lift Station 3 Electric Heater	3,000	5,306
Lift Station 3 Sewage Pump	1.5	*2,411*
Lift Station 4 Grinder Pump	550	4,821
Lift Station 4 Sewage Pump	1,100 (1.5HP)	9,643
Lift Station 4 Plug-in Heater	3,000	6,235

The pump in Lift Station 3 was removed in October 2016 and installed into Lift Station 4 because the existing pump was no longer functioning. As a result, Lift Station 3 currently has no operable pump and will need one installed for proper operations to resume.

3.2 Predicted Energy Use

3.2.1 Energy Usage / Tariffs

The electric usage profile charts (below) represents the predicted electrical usage for the building. If actual electricity usage records were available, the model used to predict usage was calibrated to approximately match actual usage. The electric utility measures consumption in kilowatt-hours (kWh) and maximum demand in kilowatts (kW). One kWh usage is equivalent to 1,000 watts running for one hour. One KW of electric demand is equivalent to 1,000 watts running at a particular moment. The basic usage charges are shown as generation service and delivery charges along with several non-utility generation charges.

The fuel oil usage profile shows the fuel oil usage for the building. Fuel oil consumption is measured in gallons. One gallon of #1 Fuel Oil provides approximately 132,000 BTUs of energy.

The Unalakleet Valley Electric Cooperative provides electricity to the residents of the community as well as to all commercial and public buildings.

The average cost for each type of fuel used in this building is shown below in Table 3.4. This figure includes all surcharges, subsidies, and utility customer charges:

Table 3.4: Energy Cost Rates for Each Fuel Type

Average Energy Cost	
Description	Average Energy Cost
Electricity	\$ 0.37/kWh
#1 Oil	\$ 4.34/gallons

3.2.1.1 Total Energy Use and Cost Breakdown

At current rates, City of Unalakleet pays approximately \$78,213 annually for electricity and other fuel costs for the Unalakleet Water Treatment Plant.

Figure 8 below reflects the estimated distribution of costs across the primary end uses of energy based on the AkWarm© computer simulation. Comparing the “Retrofit” bar in the figure to the “Existing” bar shows the potential savings from implementing all of the energy efficiency measures shown in this report.

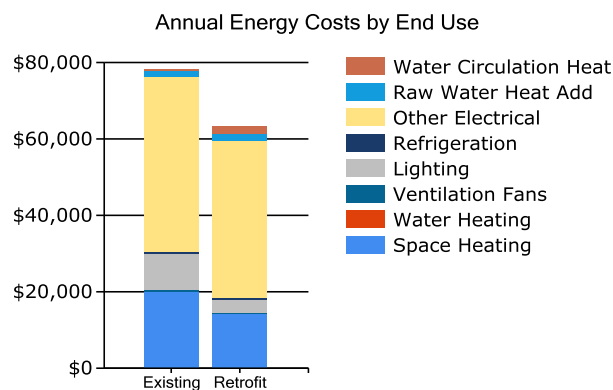


Figure 8: Annual Energy Costs by End Use

Figure 9 below shows how the annual energy cost of the building splits between the different fuels used by the building. The “Existing” bar shows the breakdown for the building as it is now; the “Retrofit” bar shows the predicted costs if all of the energy efficiency measures in this report are implemented.

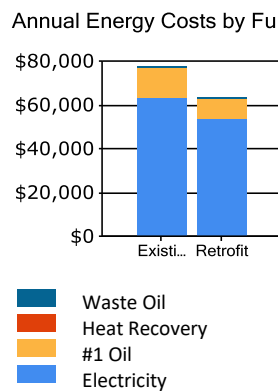


Figure 9: Annual Energy Cost by Fuel Type

Figure 10 below addresses only Space Heating costs. The figure shows how each heat loss component contributes to those costs; for example, the figure shows how much annual space heating cost is caused by the heat loss through the Walls/Doors. For each component, the space heating cost for the Existing building is shown (blue bar) and the space heating cost assuming all retrofits are implemented (yellow bar) are shown.

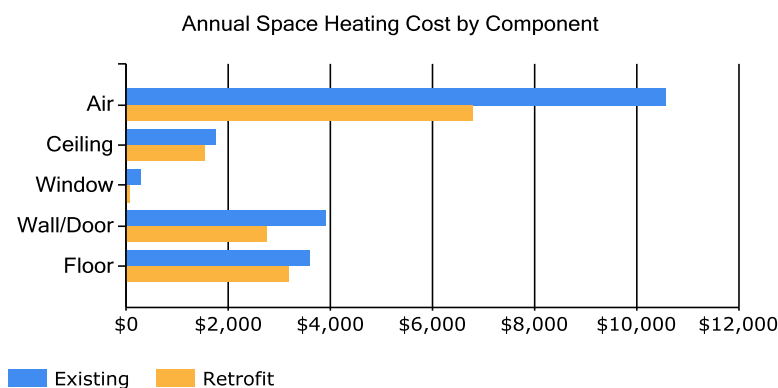


Figure 10: Annual Space Heating Costs

The tables below show AkWarm’s estimate of the monthly fuel use for each of the fuels used in the building. For each fuel, the fuel use is broken down across the energy end uses. Note, in the tables below “DHW” refers to Domestic Hot Water heating.

Table 3.5: Estimated Electrical Consumption by Category

Electrical Consumption (kWh)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Space Heating	2272	2148	2023	1568	916	368	194	250	628	1067	1526	2278
DHW	40	36	40	39	40	39	40	40	39	40	39	40
Ventilation Fans	1	1	1	1	1	1	1	1	1	1	1	1
Lighting	2207	2011	2207	2136	2207	2136	2207	2207	2136	2207	2136	2207
Refrigeration	56	51	56	54	56	54	56	56	54	56	54	56
Other Electrical	16173	14738	16173	10501	4770	4616	4770	4770	4616	11023	15651	16173
Raw Water Heat Add	910	851	902	410	0	0	0	0	0	382	784	923
Water Circulation Heat	2	2	2	2	2	2	2	2	2	2	2	2

Table 3.6: Estimated Fuel Oil Consumption by Category

Fuel Oil #1 Consumption (Gallons)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Space Heating	464	438	427	334	207	106	72	81	149	246	333	468
DHW	6	5	6	5	6	6	6	6	6	6	5	6

Table 3.7: Estimated Waste Oil Consumption by Category

Waste Oil Consumption (Gallons)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Space Heating	69	65	63	52	37	24	20	22	30	41	51	69

Table 3.8: Estimated Heat Recovery Consumption by Category

Heat Recovery Consumption (Million Btu)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Space Heating	58	55	53	42	25	13	8	9	18	30	41	59
Raw Water Heat Add	196	189	193	73	0	0	0	0	0	52	144	203

3.2.2 Energy Use Index (EUI)

Energy Use Index (EUI) is a measure of a building's annual energy utilization per square foot of building. This calculation is completed by converting all utility usage consumed by a building for one year, to British Thermal Units (Btu) or kBtu, and dividing this number by the building square footage. EUI is a good measure of a building's energy use and is utilized regularly for comparison of energy performance for similar building types. The Oak Ridge National Laboratory (ORNL) Buildings Technology Center under a contract with the U.S. Department of Energy maintains a Benchmarking Building Energy Performance Program. The ORNL website determines how a building's energy use compares with similar facilities throughout the U.S. and in a specific region or state.

Source use differs from site usage when comparing a building's energy consumption with the national average. Site energy use is the energy consumed by the building at the building site only. Source energy use includes the site energy use as well as all of the losses to create and distribute the energy to the building. Source energy represents the total amount of raw fuel that is required to operate the building. It incorporates all transmission, delivery, and

production losses, which allows for a complete assessment of energy efficiency in a building. The type of utility purchased has a substantial impact on the source energy use of a building. The EPA has determined that source energy is the most comparable unit for evaluation purposes and overall global impact. Both the site and source EUI ratings for the building are provided to understand and compare the differences in energy use. The site and source EUIs for this building are calculated as follows. (See Table 3.9 for details):

$$\text{Building Site EUI} = \frac{(\text{Electric Usage in kBtu} + \text{Fuel Usage in kBtu})}{\text{Building Square Footage}}$$

$$\text{Building Source EUI} = \frac{(\text{Electric Usage in kBtu} \times \text{SS Ratio} + \text{Fuel Usage in kBtu} \times \text{SS Ratio})}{\text{Building Square Footage}}$$

where "SS Ratio" is the Source Energy to Site Energy ratio for the particular fuel.

Table 3.9: Unalakleet Water Treatment Plant EUI Calculations

Energy Type	Building Fuel Use per Year	Site Energy Use per Year, kBTU	Source/Site Ratio	Source Energy Use per Year, kBTU
Electricity	171,544 kWh	585,480	3.340	1,955,502
#1 Oil	3,392 gallons	447,745	1.010	452,222
Heat Recovery	1,462.10 million Btu	1,462,097	1.280	1,871,484
Waste Oil	544 gallons	75,084	1.010	75,835
Total		2,570,405		4,355,043
BUILDING AREA		7,176	Square Feet	
BUILDING SITE EUI		358	kBTU/Ft ² /Yr	
BUILDING SOURCE EUI		607	kBTU/Ft²/Yr	
* Site - Source Ratio data is provided by the Energy Star Performance Rating Methodology for Incorporating Source Energy Use document issued March 2011.				

Table 3.10: Building Benchmarks for the Unalakleet Water Treatment Plant

Building Benchmarks			
Description	EUI (kBtu/Sq.Ft.)	EUI/HDD (Btu/Sq.Ft./HDD)	ECI (\$/Sq.Ft.)
Existing Building	358.2	25.73	\$10.90
With Proposed Retrofits	328.0	23.56	\$8.82
EUI: Energy Use Intensity - The annual site energy consumption divided by the structure's conditioned area. EUI/HDD: Energy Use Intensity per Heating Degree Day. ECI: Energy Cost Index - The total annual cost of energy divided by the square footage of the conditioned space in the building.			

3.3 AkWarm© Building Simulation

An accurate model of the building performance can be created by simulating the thermal performance of the walls, roof, windows and floors of the building. The HVAC system and central plant are modeled as well, accounting for the outside air ventilation required by the building and the heat recovery equipment in place.

The model uses local weather data and is trued up to historical energy use to ensure its accuracy. The model can be used now and in the future to measure the utility bill impact of all

types of energy projects, including improving building insulation, modifying glazing, changing air handler schedules, increasing heat recovery, installing high efficiency boilers, using variable air volume air handlers, adjusting outside air ventilation and adding cogeneration systems.

For the purposes of this study, the Unalakleet Water Treatment Plant was modeled using AkWarm© energy use software to establish a baseline space heating energy usage. Climate data from Unalakleet was used for analysis. From this, the model was be calibrated to predict the impact of theoretical energy savings measures. Once annual energy savings from a particular measure were predicted and the initial capital cost was estimated, payback scenarios were approximated.

Limitations of AkWarm© Models

- The model is based on typical mean year weather data for Unalakleet. This data represents the average ambient weather profile as observed over approximately 30 years. As such, the gas and electric profiles generated will not likely compare perfectly with actual energy billing information from any single year. This is especially true for years with extreme warm or cold periods, or even years with unexpectedly moderate weather.
- The heating load model is a simple two-zone model consisting of the building's core interior spaces and the building's perimeter spaces. This simplified approach loses accuracy for buildings that have large variations in heating loads across different parts of the building.

The energy balances shown in Section 3.1 were derived from the output generated by the AkWarm© simulations.

4. ENERGY COST SAVING MEASURES

4.1 Summary of Results

The energy saving measures are summarized in Table 4.1. Please refer to the individual measure descriptions later in this report for more detail.

PRIORITY LIST – ENERGY EFFICIENCY MEASURES							
Rank	Feature	Improvement Description	Annual Energy Savings	Installed Cost	Savings to Investment Ratio, SIR¹	Simple Payback (Years)²	CO₂ Savings
1	Other Electrical: Lift Station 1 Portable Electric Heater	Unplug electric heater and use only in emergency purposes. This can only be accomplished with a repair of the electric heater in lift station 1.	\$1,571	\$500	36.90	0.3	7,216.7
2	Lighting: Exterior Lights	Replace with LED-equivalent light bulbs.	\$144	\$50	33.91	0.3	663.1

PRIORITY LIST – ENERGY EFFICIENCY MEASURES							
Rank	Feature	Improvement Description	Annual Energy Savings	Installed Cost	Savings to Investment Ratio, SIR ¹	Simple Payback (Years) ²	CO ₂ Savings
3	Setback Thermostat: Water Plant	Implement a Heating Temperature Unoccupied Setback to 50.0 deg F for the Water Plant space. This retrofit can only occur if the unit heaters and other space heating components are repaired.	\$2,606	\$1,000	33.54	0.4	16,702.2
4	Setback Thermostat: Garage/Shop Space	Implement a Heating Temperature Unoccupied Setback to 50.0 deg F for the Garage/Shop Space space.	\$1,351	\$2,000	8.69	1.5	8,654.3
5	Lighting: Middle Garage	Replace with LED-equivalent light bulbs and add an occupancy sensor.	\$1,569	\$2,760	6.50	1.8	6,436.3
6	Lighting: Chemical Room Hallway	Replace with LED-equivalent light bulbs.	\$83	\$160	5.92	1.9	337.3
7	Lighting: Water Storage Tank Alcove	Replace with LED-equivalent light bulbs.	\$83	\$160	5.90	1.9	336.4
8	Lighting: Far Garage	Replace with LED-equivalent light bulbs and add an occupancy sensor.	\$688	\$1,380	5.68	2.0	2,775.5
9	Lighting: Process Room	Replace with LED-equivalent light bulbs and add an occupancy sensor.	\$778	\$1,620	5.47	2.1	3,111.2
10	Other Electrical: Lift Station 1 Electric Water Heater	Replace thermostat in lift station and reduce temperature set point to 40 deg. F. This will allow the portable electric heater to be unplugged and used as a backup.	\$891	\$2,000	5.23	2.2	4,093.1
11	Lighting: Boiler Room	Replace with LED-equivalent light bulbs and add an occupancy sensor.	\$547	\$1,300	4.78	2.4	2,165.9
12	Lighting: Police Garage	Replace with LED-equivalent light bulbs and add an occupancy sensor.	\$540	\$1,300	4.71	2.4	2,123.2
13	Air Tightening	Add weather stripping around garage doors and man doors, replace broken windows, repair wall damage in far garage, weatherize around insulated stack holes.	\$2,590	\$5,000	4.64	1.9	16,598.7

PRIORITY LIST – ENERGY EFFICIENCY MEASURES							
Rank	Feature	Improvement Description	Annual Energy Savings	Installed Cost	Savings to Investment Ratio, SIR ¹	Simple Payback (Years) ²	CO ₂ Savings
14	Lighting: Police Garage Bench	Replace with LED-equivalent light bulbs.	\$59	\$160	4.18	2.7	234.5
15	Lighting: Office Desk Light	Replace with LED-equivalent light bulbs.	\$12	\$40	3.42	3.3	47.8
16	Lighting: Apartment Lights	Replace with LED-equivalent light bulbs.	\$117	\$480	2.74	4.1	449.0
17	Lighting: Middle Garage Bench	Replace with LED-equivalent light bulbs.	\$37	\$160	2.62	4.3	146.8
18	Setback Thermostat: Apartment Space	Implement a Heating Temperature Unoccupied Setback to 60.0 deg F for the Apartment space.	\$200	\$1,000	2.57	5.0	1,281.8
19	Lighting: Office	Replace with LED-equivalent light bulbs.	\$49	\$240	2.33	4.9	195.6
20	Lighting: Middle Garage Storage	Replace with LED-equivalent light bulbs.	\$15	\$80	2.08	5.5	58.5
21	Garage Door: Garage 2 Door (Short)	Add insulating blanket to garage door.	\$76	\$542	1.82	7.1	490.1
22	Garage 3 Door (Short)	Add insulating blanket to garage door.	\$95	\$678	1.81	7.1	611.9
23	Garage 3 Door (Tall)	Add insulating blanket to garage door.	\$137	\$976	1.81	7.1	879.8
24	Garage 1 Door	Add insulating blanket to garage door.	\$152	\$1,084	1.81	7.1	976.5
25	Garage 2 Door (Tall)	Add insulating blanket to garage door.	\$213	\$1,518	1.80	7.1	1,363.9
26	HVAC and Domestic Hot Water	Repair unit heaters in chemical room hallway, process room, and boiler room. Clean and tune boilers. Replace Boiler 1 circ. pump. Open valve from power plant to maximize heat recovery system. This is necessary for water plant operations to be sustainable.	\$297	\$8,000	1.22	26.9	8,391.4
27	Lighting: Chemical Room Lighting	Replace with LED-equivalent light bulbs.	\$38	\$400	1.10	10.5	159.4
28	Water Circulation Heating	Install Heat Exchanger to allow heat add prior to the pressure pumps to the water circulation loops. Prevents freeze-ups in the lines and lowers maintenance costs. Also replace controls and program for more efficient operations.	-\$1,856 + \$3,000 Maintenance Savings	\$15,000	0.94	13.1	- 21,911.8

PRIORITY LIST – ENERGY EFFICIENCY MEASURES							
Rank	Feature	Improvement Description	Annual Energy Savings	Installed Cost	Savings to Investment Ratio, SIR ¹	Simple Payback (Years) ²	CO ₂ Savings
29	Raw Water Heating	Replace Heat Exchanger because it is old and single-walled. Maintenance savings for cost needed to monitor water.	\$0 + \$500 Maintenance Savings	\$12,000	0.73	24.0	0.0
30	Other Electrical: Pressure Pump	Replace with new, more efficient pump.	\$444	\$11,000	0.66	24.8	1,816.8
31	Other Electrical: Northeast Loop	Replace with new, more efficient pump.	\$379	\$11,000	0.57	29.0	1,531.0
32	Other Electrical: West Loop Circulation Pump	Replace with new, more efficient pump.	\$437	\$13,000	0.55	29.8	1,762.2
33	Other Electrical: Southeast Loop Circulation Pump	Replace with new, more efficient pump.	\$290	\$10,000	0.48	34.5	1,169.1
34	Window: Process Room Windows (2)	Replace existing window with triple pane window.	\$85	\$2,966	0.45	34.8	502.7
35	Window: Boiler Room Windows (3)	Replace existing window with triple pane window.	\$119	\$4,449	0.42	37.2	703.7
36	Lighting: Restroom Lights	Replace with LED-equivalent light bulbs.	\$3	\$160	0.22	53.1	12.5
37	Lighting: Lift Station 1 Wet Side Lights	Replace with LED-equivalent light bulbs.	\$1	\$50	0.20	57.9	4.0
38	Lighting: Lift Station 4 Lighting	Replace with LED-equivalent light bulbs.	\$2	\$100	0.20	58.2	7.9
39	Lighting: Lift Station 3 Lighting	Replace with LED-equivalent light bulbs.	\$3	\$150	0.20	58.3	11.8
40	Lighting: Lift Station 2 Wet Side Lighting	Replace with LED-equivalent light bulbs.	\$3	\$200	0.19	61.3	15.0
41	Other Electrical: FAA Loop Circulation Pump	Replace with new, more efficient pump.	\$43	\$4,000	0.18	92.2	174.9
42	Lighting: Lift Station 2 Dry Side Lighting	Replace with LED-equivalent light bulbs.	\$2	\$160	0.14	86.4	8.5
43	Window: Chemical Room Window	Replace existing window with triple pane window.	\$7	\$1,483	0.08	199.4	43.8
44	Window: Apartment Windows (2)	Replace existing window with triple pane window.	\$10	\$1,968	0.08	199.3	58.2
45	Lighting: Lift Station 1 Dry Side Lights	Replace with LED-equivalent light bulbs.	\$1	\$100	0.06	198.4	2.3
	TOTAL, all measures		\$14,912 + \$3,500 Maintenance Savings	\$122,373	1.89	6.6	72,413.2

4.2 Interactive Effects of Projects

The savings for a particular measure are calculated assuming all recommended EEMs coming before that measure in the list are implemented. If some EEMs are not implemented, savings for the remaining EEMs will be affected. For example, if ceiling insulation is not added, then savings from a project to replace the heating system will be increased, because the heating system for the building supplies a larger load.

In general, all projects are evaluated sequentially so energy savings associated with one EEM would not also be attributed to another EEM. By modeling the recommended project sequentially, the analysis accounts for interactive affects among the EEMs and does not “double count” savings.

Interior lighting, plug loads, facility equipment, and occupants generate heat within the building. Lighting-efficiency improvements are anticipated to slightly increase heating requirements. Heating penalties were included in the lighting project analysis.

4.3 Building Shell Measures

4.3.1 Window Measures

Rank	Location	Size/Type, Condition			Recommendation	
34	Window/Skylight: Process Room Windows (2)	Glass: No glazing - broken, missing Frame: Wood\Vinyl Spacing Between Layers: Half Inch Gas Fill Type: Air Modeled U-Value: 0.94 Solar Heat Gain Coefficient including Window Coverings: 0.11			Replace existing window with triple pane window.	
Installation Cost		\$2,966	Estimated Life of Measure (yrs)	20	Energy Savings (\$/yr)	\$85
Breakeven Cost		\$1,346	Simple Payback (yrs)	35	Energy Savings (MMBTU/yr)	2.9 MMBTU
			Savings-to-Investment Ratio	0.5		
Auditors Notes: Replacing the window will reduce air penetration and prevent further heat loss from the building.						

Rank	Location	Size/Type, Condition			Recommendation	
35	Window/Skylight: Boiler Room Windows (3)	Glass: No glazing - broken, missing Frame: Wood\Vinyl Spacing Between Layers: Half Inch Gas Fill Type: Air Modeled U-Value: 0.94 Solar Heat Gain Coefficient including Window Coverings: 0.11			Replace existing window with triple pane window.	
Installation Cost		\$4,449	Estimated Life of Measure (yrs)	20	Energy Savings (\$/yr)	\$119
Breakeven Cost		\$1,885	Simple Payback (yrs)	37	Energy Savings (MMBTU/yr)	4.1 MMBTU
			Savings-to-Investment Ratio	0.4		
Auditors Notes: Replacing the window will reduce air penetration and prevent further heat loss from the building.						

Rank	Location	Size/Type, Condition	Recommendation		
43	Window/Skylight: Chemical Room Window	Glass: Double, glass Frame: Wood\Vinyl Spacing Between Layers: Half Inch Gas Fill Type: Air Modeled U-Value: 0.51 Solar Heat Gain Coefficient including Window Coverings: 0.46	Replace existing window with triple pane window.		
Installation Cost	\$1,483	Estimated Life of Measure (yrs)	20	Energy Savings (\$/yr)	\$7
Breakeven Cost	\$117	Simple Payback (yrs)	199	Energy Savings (MMBTU/yr)	0.3 MMBTU
		Savings-to-Investment Ratio	0.1		
Auditors Notes: Replacing the window will reduce air penetration and prevent further heat loss from the building.					

Rank	Location	Size/Type, Condition	Recommendation		
44	Window/Skylight: Apartment Windows (2)	Glass: Double, glass Frame: Wood\Vinyl Spacing Between Layers: Half Inch Gas Fill Type: Air Modeled U-Value: 0.51 Solar Heat Gain Coefficient including Window Coverings: 0.46	Replace existing window with triple pane window.		
Installation Cost	\$1,968	Estimated Life of Measure (yrs)	20	Energy Savings (\$/yr)	\$10
Breakeven Cost	\$156	Simple Payback (yrs)	199	Energy Savings (MMBTU/yr)	0.3 MMBTU
		Savings-to-Investment Ratio	0.1		
Auditors Notes: Replacing the window will reduce air penetration and prevent further heat loss from the building.					

4.3.2 Door Measures

Rank	Location	Size/Type, Condition			Recommendation	
21	Garage Door: Garage 2 Door (Short)	Door Type: Sectional, EPS core, 1-3/4", thermal break Insulating Blanket: None Modeled R-Value: 3.2			Add insulating blanket to garage door.	
Installation Cost		\$542	Estimated Life of Measure (yrs)	15	Energy Savings (\$/yr)	\$76
Breakeven Cost		\$984	Simple Payback (yrs)	7	Energy Savings (MMBTU/yr)	3.4 MMBTU
			Savings-to-Investment Ratio	1.8		
Auditors Notes: Insulating the garage door will reduce heat loss and air penetration into the building.						

Rank	Location	Size/Type, Condition			Recommendation	
22	Garage Door: Garage 3 Door (Short)	Door Type: Sectional, EPS core, 1-3/4", thermal break Insulating Blanket: None Modeled R-Value: 3.2			Add insulating blanket to garage door.	
Installation Cost		\$678	Estimated Life of Measure (yrs)	15	Energy Savings (\$/yr)	\$95
Breakeven Cost		\$1,229	Simple Payback (yrs)	7	Energy Savings (MMBTU/yr)	4.3 MMBTU
			Savings-to-Investment Ratio	1.8		
Auditors Notes: Insulating the garage door will reduce heat loss and air penetration into the building.						

Rank	Location	Size/Type, Condition			Recommendation	
23	Garage Door: Garage 3 Door (Tall)	Door Type: Sectional, EPS core, 1-3/4", thermal break Insulating Blanket: None Modeled R-Value: 3.2			Add insulating blanket to garage door.	
Installation Cost		\$976	Estimated Life of Measure (yrs)	15	Energy Savings (\$/yr)	\$137
Breakeven Cost		\$1,767	Simple Payback (yrs)	7	Energy Savings (MMBTU/yr)	6.1 MMBTU
			Savings-to-Investment Ratio	1.8		
Auditors Notes: Insulating the garage door will reduce heat loss and air penetration into the building.						

Rank	Location	Size/Type, Condition			Recommendation	
24	Garage Door: Garage 1 Door	Door Type: Sectional, EPS core, 1-3/4", thermal break Insulating Blanket: None Modeled R-Value: 3.2			Add insulating blanket to garage door.	
Installation Cost		\$1,084	Estimated Life of Measure (yrs)	15	Energy Savings (\$/yr)	\$152
Breakeven Cost		\$1,961	Simple Payback (yrs)	7	Energy Savings (MMBTU/yr)	6.8 MMBTU
			Savings-to-Investment Ratio	1.8		
Auditors Notes: Insulating the garage door will reduce heat loss and air penetration into the building.						

Rank	Location	Size/Type, Condition	Recommendation			
25	Garage Door: Garage 2 Door (Tall)	Door Type: Sectional, EPS core, 1-3/4", thermal break Insulating Blanket: None Modeled R-Value: 3.2	Add insulating blanket to garage door.			
Installation Cost		\$1,518	Estimated Life of Measure (yrs)	15	Energy Savings (\$/yr)	\$213
Breakeven Cost		\$2,739	Simple Payback (yrs)	7	Energy Savings (MMBTU/yr)	9.5 MMBTU
			Savings-to-Investment Ratio	1.8		
Auditors Notes: Insulating the garage door will reduce heat loss and air penetration into the building.						

4.3.3 Air Sealing Measures

Rank	Location	Existing Air Leakage Level (cfm@50/75 Pa)		Recommended Air Leakage Reduction (cfm@50/75 Pa)		
13		Air Tightness estimated as: 12134 cfm at 50 Pascals		Add weather stripping around garage doors and man doors, replace broken windows, repair wall damage in far garage, weatherize around insulated stack holes.		
Installation Cost		\$5,000	Estimated Life of Measure (yrs)	10	Energy Savings (\$/yr)	\$2,590
Breakeven Cost		\$23,213	Simple Payback (yrs)	2	Energy Savings (MMBTU/yr)	115.8 MMBTU
			Savings-to-Investment Ratio	4.6		
Auditors Notes: There are significant air leaks in the garage areas from air gaps in the garage door, wall damage in the far garage, and broken windows. Reducing the air leakage through weatherization and through replacement of the windows.						

4.4 Mechanical Equipment Measures

4.4.1 Heating /Domestic Hot Water Measure

Rank	Recommendation				
26	Repair unit heaters in chemical room hallway, process room, and boiler room. Clean and tune boilers. Replace Boiler 1 circ. pump. Open valve from power plant to maximize heat recovery system. This is necessary for water plant operations to be sustainable.				
Installation Cost	\$8,000	Estimated Life of Measure (yrs)	20	Energy Savings (\$/yr)	\$297
Breakeven Cost	\$9,788	Simple Payback (yrs)	27	Energy Savings (MMBTU/yr)	112.0 MMBTU
		Savings-to-Investment Ratio	1.2		
Auditors Notes: Many of the unit heaters were missing a fan blade and had no controls for operation. This makes the heat circulate without being dispersed efficiently and instead through line loss. Repairing these unit heaters will allow for more efficient heat distribution.					
The Boiler 1 circulation pump is not operating and needs replaced. Currently, the boiler will heat the glycol to a high temperature without the ability to distribute it properly. Replacing the pump will reduce the runtime of the boilers.					
The heat recovery system has a valve in the power plant that is used to control the flow to the water plant. The valve was not open fully during the site visit. After opening the valve and monitoring the behavior of the system it was determined that a fully opened valve would improve the heat delivery of the heat recovery system.					

4.4.2 Night Setback Thermostat Measures

Rank	Building Space			Recommendation		
3	Water Plant			Implement a Heating Temperature Unoccupied Setback to 50.0 deg F for the Water Plant space.		
Installation Cost		\$1,000	Estimated Life of Measure (yrs)	15	Energy Savings (\$/yr)	\$2,606
Breakeven Cost		\$33,542	Simple Payback (yrs)	0	Energy Savings (MMBTU/yr)	116.5 MMBTU
			Savings-to-Investment Ratio	33.5		
Auditors Notes:						

Rank	Building Space	Recommendation			
4	Garage/Shop Space	Implement a Heating Temperature Unoccupied Setback to 50.0 deg F for the Garage/Shop Space space.			
Installation Cost	\$2,000	Estimated Life of Measure (yrs)	15	Energy Savings (\$/yr)	\$1,351
Breakeven Cost	\$17,380	Simple Payback (yrs)	1	Energy Savings (MMBTU/yr)	60.4 MMBTU
		Savings-to-Investment Ratio	8.7		
Auditors Notes:					

Rank	Building Space	Recommendation			
18	Apartment Space	Implement a Heating Temperature Unoccupied Setback to 60.0 deg F for the Apartment Space space.			
Installation Cost	\$1,000	Estimated Life of Measure (yrs)	15	Energy Savings (\$/yr)	\$200
Breakeven Cost	\$2,574	Simple Payback (yrs)	5	Energy Savings (MMBTU/yr)	8.9 MMBTU
		Savings-to-Investment Ratio	2.6		
Auditors Notes:					

4.5 Electrical & Appliance Measures

4.5.1 Lighting Measures

The goal of this section is to present any lighting energy conservation measures that may also be cost beneficial. It should be noted that replacing current bulbs with more energy-efficient equivalents will have a small effect on the building heating loads. The building heating load will see a small increase, as the more energy efficient bulbs give off less heat.

4.5.1a Lighting Measures – Replace Existing Fixtures/Bulbs

Rank	Location	Existing Condition	Recommendation		
2	Exterior Lights	INCAN A Lamp, Std 60W	Replace with an LED-equivalent light bulbs.		
Installation Cost	\$50	Estimated Life of Measure (yrs)	15	Energy Savings (\$/yr)	\$144
Breakeven Cost	\$1,695	Simple Payback (yrs)	0	Energy Savings (MMBTU/yr)	1.3 MMBTU
		Savings-to-Investment Ratio	33.9		
Auditors Notes: There is a single incandescent light bulb to be replaced.					

Rank	Location	Existing Condition	Recommendation		
5	Middle Garage	27 FLUOR (3) T8 4' F32T8 25W Energy-Saver Instant EfficMagnetic	Replace with LED-equivalent light bulbs.		
Installation Cost	\$2,760	Estimated Life of Measure (yrs)	15	Energy Savings (\$/yr)	\$1,569
Breakeven Cost	\$17,952	Simple Payback (yrs)	2	Energy Savings (MMBTU/yr)	-0.6 MMBTU
		Savings-to-Investment Ratio	6.5		
Auditors Notes: The room has 27 fixtures with three bulbs in each fixture to be replaced with two LED equivalent light bulbs in each fixture for a total of 54 light bulbs to replace.					

Rank	Location	Existing Condition	Recommendation			
6	Chemical Room Hallway	2 FLUOR (3) T8 4' F32T8 25W Energy-Saver Instant EfficMagnetic	Replace with LED-equivalent light bulbs.			
Installation Cost		\$160	Estimated Life of Measure (yrs)	15	Energy Savings (\$/yr)	\$83
Breakeven Cost		\$947	Simple Payback (yrs)	2	Energy Savings (MMBTU/yr)	-0.1 MMBTU
			Savings-to-Investment Ratio	5.9		
Auditors Notes: The room has two fixtures with three bulbs in each fixture to be replaced with two LED equivalent light bulbs in each fixture for a total of four light bulbs to replace.						

Rank	Location	Existing Condition		Recommendation		
7	Water Storage Tank Alcove	2 FLUOR (3) T8 4' F32T8 25W Energy-Saver Instant EfficMagnetic		Replace with LED-equivalent light bulbs.		
Installation Cost		\$160	Estimated Life of Measure (yrs)	15	Energy Savings (\$/yr)	\$83
Breakeven Cost		\$945	Simple Payback (yrs)	2	Energy Savings (MMBTU/yr)	-0.1 MMBTU
			Savings-to-Investment Ratio	5.9		
Auditors Notes: The room has two fixtures with three bulbs in each fixture to be replaced with two LED equivalent light bulbs in each fixture for a total of four light bulbs to replace.						

Rank	Location	Existing Condition			Recommendation	
8	Far Garage	11 FLUOR (4) T8 4' F32T8 25W Energy-Saver Instant EfficMagnetic			Replace with LED-equivalent light bulbs and add an occupancy sensor.	
Installation Cost		\$1,380	Estimated Life of Measure (yrs)	15	Energy Savings (\$/yr)	\$688
Breakeven Cost		\$7,841	Simple Payback (yrs)	2	Energy Savings (MMBTU/yr)	-1.2 MMBTU
			Savings-to-Investment Ratio	5.7		
Auditors Notes: The room has 11 fixtures with four bulbs in each fixture to be replaced with two LED equivalent light bulbs in each fixture for a total of 22 light bulbs to replace.						

Rank	Location	Existing Condition			Recommendation	
9	Process Room	14 FLUOR (3) T8 4' F32T8 25W Energy-Saver Instant EfficMagnetic			Replace with LED-equivalent light bulbs and add an occupancy sensor.	
Installation Cost		\$1,620	Estimated Life of Measure (yrs)	15	Energy Savings (\$/yr)	\$778
Breakeven Cost		\$8,854	Simple Payback (yrs)	2	Energy Savings (MMBTU/yr)	-1.9 MMBTU
			Savings-to-Investment Ratio	5.5		
Auditors Notes: The room has 14 fixtures with three bulbs in each fixture to be replaced with two LED equivalent light bulbs in each fixture for a total of 28 light bulbs to replace.						

Rank	Location	Existing Condition	Recommendation		
11	Boiler Room	10 FLUOR (3) T8 4' F32T8 25W Energy-Saver Instant EfficMagnetic	Replace with LED-equivalent light bulbs and add an occupancy sensor.		
Installation Cost	\$1,300	Estimated Life of Measure (yrs)	15	Energy Savings (\$/yr)	\$547
Breakeven Cost	\$6,211	Simple Payback (yrs)	2	Energy Savings (MMBTU/yr)	-1.8 MMBTU
		Savings-to-Investment Ratio	4.8		
Auditors Notes: The room has 10 fixtures with three bulbs in each fixture to be replaced with two LED equivalent light bulbs in each fixture for a total of 20 light bulbs to replace.					

Rank	Location	Existing Condition		Recommendation		
12	Police Garage	10 FLUOR (3) T8 4' F32T8 25W Energy-Saver Instant EfficMagnetic		Replace with LED-equivalent light bulbs and add an occupancy sensor.		
Installation Cost		\$1,300	Estimated Life of Measure (yrs)	15	Energy Savings (\$/yr)	\$540
Breakeven Cost		\$6,125	Simple Payback (yrs)	2	Energy Savings (MMBTU/yr)	-2.1 MMBTU
			Savings-to-Investment Ratio	4.7		
Auditors Notes: The room has 10 fixtures with three bulbs in each fixture to be replaced with two LED equivalent light bulbs in each fixture for a total of 20 light bulbs to replace.						

Rank	Location	Existing Condition		Recommendation		
14	Police Garage Bench	2 FLUOR (4) T8 4' F32T8 25W Energy-Saver Instant EfficMagnetic		Replace with LED-equivalent light bulbs.		
Installation Cost		\$160	Estimated Life of Measure (yrs)	15	Energy Savings (\$/yr)	\$59
Breakeven Cost		\$668	Simple Payback (yrs)	3	Energy Savings (MMBTU/yr)	-0.2 MMBTU
			Savings-to-Investment Ratio	4.2		
Auditors Notes: The room has two fixtures with four bulbs in each fixture to be replaced with two LED equivalent light bulbs in each fixture for a total of four light bulbs to replace.						

Rank	Location	Existing Condition		Recommendation		
15	Office Desk Light	FLUOR T8 4' F32T8 25W Energy-Saver Instant EfficMagnetic		Replace with LED 17W Module StdElectronic		
Installation Cost		\$40	Estimated Life of Measure (yrs)	15	Energy Savings (\$/yr)	\$12
Breakeven Cost		\$137	Simple Payback (yrs)	3	Energy Savings (MMBTU/yr)	0.0 MMBTU
			Savings-to-Investment Ratio	3.4		
Auditors Notes: There is a single light bulb to be replaced with an LED light bulb equivalent.						

Rank	Location	Existing Condition		Recommendation		
16	Apartment Lights	6 FLUOR (2) T8 4' F32T8 25W Energy-Saver Instant EfficMagnetic		Replace with LED-equivalent light bulbs.		
Installation Cost		\$480	Estimated Life of Measure (yrs)	15	Energy Savings (\$/yr)	\$117
Breakeven Cost		\$1,315	Simple Payback (yrs)	4	Energy Savings (MMBTU/yr)	-0.6 MMBTU
			Savings-to-Investment Ratio	2.7		
Auditors Notes: There are six fixtures with two light bulbs in each fixture for a total of 12 light bulbs to be replaced.						

Rank	Location	Existing Condition		Recommendation		
17	Middle Garage Bench	2 FLUOR (3) T8 4' F32T8 25W Energy-Saver Instant EfficMagnetic		Replace with LED-equivalent light bulbs.		
Installation Cost		\$160	Estimated Life of Measure (yrs)	15	Energy Savings (\$/yr)	\$37
Breakeven Cost		\$419	Simple Payback (yrs)	4	Energy Savings (MMBTU/yr)	-0.1 MMBTU
			Savings-to-Investment Ratio	2.6		
Auditors Notes: The space has two fixtures with three bulbs in each fixture to be replaced with two LED equivalent light bulbs in each fixture for a total of four light bulbs to replace.						

Rank	Location	Existing Condition	Recommendation			
19	Office	3 FLUOR (2) T8 4' F32T8 25W Energy-Saver Instant EfficMagnetic	Replace with LED-equivalent light bulbs.			
Installation Cost		\$240	Estimated Life of Measure (yrs)	15	Energy Savings (\$/yr)	\$49
Breakeven Cost		\$559	Simple Payback (yrs)	5	Energy Savings (MMBTU/yr)	-0.1 MMBTU
			Savings-to-Investment Ratio	2.3		
Auditors Notes: There are three fixtures with two light bulbs in each fixture for a total of six light bulbs to be replaced.						

Rank	Location	Existing Condition		Recommendation		
20	Middle Garage Storage	FLUOR (4) T8 4' F32T8 25W Energy-Saver Instant EfficMagnetic		Replace with LED-equivalent light bulbs.		
Installation Cost		\$80	Estimated Life of Measure (yrs)	15	Energy Savings (\$/yr)	\$15
Breakeven Cost		\$167	Simple Payback (yrs)	5	Energy Savings (MMBTU/yr)	0.0 MMBTU
			Savings-to-Investment Ratio	2.1		
Auditors Notes: There is a single fixture with four light bulbs to be replaced with two light bulbs for a total of two light bulbs to install.						

Rank	Location	Existing Condition		Recommendation		
27	Chemical Room Lighting	5 FLUOR (2) T8 4' F32T8 25W Energy-Saver Instant EfficMagnetic		Replace with LED-equivalent light bulbs.		
Installation Cost		\$400	Estimated Life of Measure (yrs)	15	Energy Savings (\$/yr)	\$38
Breakeven Cost		\$439	Simple Payback (yrs)	10	Energy Savings (MMBTU/yr)	0.0 MMBTU
			Savings-to-Investment Ratio	1.1		
Auditors Notes: There are five fixtures with two light bulbs in each fixture for a total of ten light bulbs to be replaced.						

Rank	Location	Existing Condition	Recommendation		
36	Restroom Lights	2 FLUOR (2) T8 4' F32T8 25W Energy-Saver Instant EfficMagnetic	Replace with LED-equivalent light bulbs.		
Installation Cost	\$160	Estimated Life of Measure (yrs)	15	Energy Savings (\$/yr)	\$3
Breakeven Cost	\$35	Simple Payback (yrs)	53	Energy Savings (MMBTU/yr)	0.0 MMBTU
		Savings-to-Investment Ratio	0.2		
Auditors Notes: There are two fixtures with two light bulbs in each fixture for a total of four light bulbs to be replaced. One fixture has four-ft light bulbs and one fixture has three-ft. light bulbs					

Rank	Location	Existing Condition			Recommendation	
37	Lift Station 1 Wet Side Lights	INCAN A Lamp, Std 60W			Replace with LED-equivalent light bulbs.	
Installation Cost		\$50	Estimated Life of Measure (yrs)	15	Energy Savings (\$/yr)	\$1
Breakeven Cost		\$10	Simple Payback (yrs)	58	Energy Savings (MMBTU/yr)	0.0 MMBTU
			Savings-to-Investment Ratio	0.2		
Auditors Notes: There is a single incandescent light bulb to be replaced.						

Rank	Location	Existing Condition		Recommendation	
38	Lift Station 4 Lighting	2 INCAN A Lamp, Std 60W		Replace with LED-equivalent light bulbs.	
Installation Cost	\$100	Estimated Life of Measure (yrs)	15	Energy Savings (\$/yr)	\$2
Breakeven Cost	\$20	Simple Payback (yrs)	58	Energy Savings (MMBTU/yr)	0.0 MMBTU
		Savings-to-Investment Ratio	0.2		
Auditors Notes: There are two incandescent light bulbs to be replaced.					

Rank	Location	Existing Condition		Recommendation	
39	Lift Station 3 Lighting	3 INCAN A Lamp, Std 60W		Replace with LED-equivalent light bulbs.	
Installation Cost	\$150	Estimated Life of Measure (yrs)	15	Energy Savings (\$/yr)	\$3
Breakeven Cost	\$30	Simple Payback (yrs)	58	Energy Savings (MMBTU/yr)	0.0 MMBTU
		Savings-to-Investment Ratio	0.2		
Auditors Notes: There are three incandescent light bulbs to be replaced.					

Rank	Location	Existing Condition		Recommendation	
40	Lift Station 2 Wet Side Lighting	4 HPS 50 Watt StdElectronic		Replace with LED-equivalent light bulbs.	
Installation Cost	\$200	Estimated Life of Measure (yrs)	15	Energy Savings (\$/yr)	\$3
Breakeven Cost	\$38	Simple Payback (yrs)	61	Energy Savings (MMBTU/yr)	0.0 MMBTU
		Savings-to-Investment Ratio	0.2		
Auditors Notes: There are four HPS light bulbs to be replaced.					

Rank	Location	Existing Condition		Recommendation	
42	Lift Station 2 Dry Side Lighting	2 FLUOR (4) T8 4' F32T8 25W Energy-Saver Instant StdElectronic		Replace with LED-equivalent light bulbs.	
Installation Cost	\$160	Estimated Life of Measure (yrs)	15	Energy Savings (\$/yr)	\$2
Breakeven Cost	\$22	Simple Payback (yrs)	86	Energy Savings (MMBTU/yr)	0.0 MMBTU
		Savings-to-Investment Ratio	0.1		
Auditors Notes: There are two fixtures with four light bulbs each to be replaced with two light bulbs in each fixture for a total of four light bulbs to be installed.					

Rank	Location	Existing Condition		Recommendation	
45	Lift Station 1 Dry Side Lights	FLUOR (3) T8 4' F32T8 25W Energy-Saver Instant StdElectronic		Replace with LED-equivalent light bulbs.	
Installation Cost	\$100	Estimated Life of Measure (yrs)	15	Energy Savings (\$/yr)	\$1
Breakeven Cost	\$6	Simple Payback (yrs)	198	Energy Savings (MMBTU/yr)	0.0 MMBTU
		Savings-to-Investment Ratio	0.1		
Auditors Notes: There is a single fixture with three light bulbs in the fixture that will be replaced with two light bulbs.					

4.5.2 Other Electrical Measures

Rank	Location	Description of Existing	Efficiency Recommendation
1	Lift Station 1 Portable Electric Heater	Electric Heater	Unplug electric heater and use only in emergency purposes.
Installation Cost	\$500	Estimated Life of Measure (yrs)	15
Breakeven Cost	\$18,450	Simple Payback (yrs)	0
		Savings-to-Investment Ratio	36.9
Auditors Notes: There is an electric water heater that heats a radiant floor system in the lift station. This portable electric heater is not needed for freeze protection and should be only used when the existing heating system is unable to keep the space above 40 deg. F.			

Rank	Location	Description of Existing	Efficiency Recommendation
10	Lift Station 1 Electric Water Heater	Radiant Floor Heating	Replace thermostat in lift station and lower temperature to 40 deg. F.
Installation Cost	\$2,000	Estimated Life of Measure (yrs)	15
Breakeven Cost	\$10,464	Simple Payback (yrs)	2
		Savings-to-Investment Ratio	5.2
Auditors Notes: The thermostat for the electric water heater was not functioning and the heater was attempting to heat the space to 60 deg. F. Replacing the thermostat and lowering the set point will allow the heater to prevent freezing without using any excess electricity.			

Rank	Location	Description of Existing	Efficiency Recommendation
30	Pressure Pump	Pressure Pump	Replace with new, energy-efficient pumps
Installation Cost	\$11,000	Estimated Life of Measure (yrs)	25
Breakeven Cost	\$7,314	Simple Payback (yrs)	25
		Savings-to-Investment Ratio	0.7
Auditors Notes: The existing pump is very old and not in good condition. Replacing the pump will improve efficiency and stabilize operations in the water plant. The existing pump conditions are listed below. Unimount Model B073A 5.0 HP Rating 460V/9.4 FI Amp rating, measured at 4 Amps in the field. This is constantly operating to boost the pressure and flow in all the circulation loops coming from the water storage tank.			

Rank	Location	Description of Existing	Efficiency Recommendation
31	Northeast Loop	Circulation Loop	Replace with new, energy-efficient pumps
Installation Cost	\$11,000	Estimated Life of Measure (yrs)	25
Breakeven Cost	\$6,220	Simple Payback (yrs)	29
		Savings-to-Investment Ratio	0.6
Auditors Notes: The existing pump is very old and not in good condition. Replacing the pump will improve efficiency and stabilize operations in the water plant. The existing pump conditions are listed below.			

Rank	Location	Description of Existing	Efficiency Recommendation			
32	West Loop Circulation Pump	Circulation Pump	Replace with new, energy-efficient pumps			
Installation Cost		\$13,000	Estimated Life of Measure (yrs)	25	Energy Savings (\$/yr)	\$437
Breakeven Cost		\$7,164	Simple Payback (yrs)	30	Energy Savings (MMBTU/yr)	-0.7 MMBTU
			Savings-to-Investment Ratio	0.6		
Auditors Notes: The existing pump is very old and not in good condition. Replacing the pump will improve efficiency and stabilize operations in the water plant. The existing pump conditions are listed below.						

Rank	Location	Description of Existing	Efficiency Recommendation			
33	Southeast Loop Circulation Pump	Circulation Loop	Replace with new, energy-efficient pumps			
Installation Cost		\$10,000	Estimated Life of Measure (yrs)	25	Energy Savings (\$/yr)	\$290
Breakeven Cost		\$4,755	Simple Payback (yrs)	34	Energy Savings (MMBTU/yr)	-0.5 MMBTU
			Savings-to-Investment Ratio	0.5		
Auditors Notes: The existing pump is very old and not in good condition. Replacing the pump will improve efficiency and stabilize operations in the water plant. The existing pump conditions are listed below.						

Rank	Location	Description of Existing	Efficiency Recommendation			
41	FAA Loop Circulation Pump	Circulation Loop Pump	Replace with new, energy-efficient pumps			
Installation Cost		\$4,000	Estimated Life of Measure (yrs)	25	Energy Savings (\$/yr)	\$43
Breakeven Cost		\$711	Simple Payback (yrs)	92	Energy Savings (MMBTU/yr)	-0.1 MMBTU
			Savings-to-Investment Ratio	0.2		
Auditors Notes: The existing pump is very old and not in good condition. Replacing the pump will improve efficiency and stabilize operations in the water plant. The existing pump conditions are listed below.						

4.5.3 Other Measures

Rank	Location	Description of Existing	Efficiency Recommendation			
28		Water Circulation Heating	Install Heat Exchanger to allow heat add prior to the pressure pumps to the water circulation loops. Prevents freeze-ups in the lines and lowers maintenance costs.			
Installation Cost		\$15,000	Estimated Life of Measure (yrs)	15	Energy Savings (\$/yr)	-\$1,856
Breakeven Cost		\$14,045	Simple Payback (yrs)	13	Energy Savings (MMBTU/yr)	-247.9 MMBTU
			Savings-to-Investment Ratio	0.9	Maintenance Savings (\$/yr)	\$3,000
Auditors Notes: There is currently no method to heat the water for the circulation loops after it has left the water storage tank. Piping is available to provide heat after the water storage tanks prior to the pressure pumps if a heat exchanger is installed in an available spot for use by the heat recovery system. This would allow for more efficient heat distribution and reduce the freeze-ups in the service lines. There are existing heat recovery circulation pumps that would be used with the heat exchanger. They are detailed below.						
Heat Recovery Circulation Pumps: Aurora Model 5VF56T17D5523B D						

Rank	Location	Description of Existing	Efficiency Recommendation			
29		Raw Water Heating		Replace Heat Exchanger because it is old and single-walled. Maintenance savings for cost needed to monitor water.		
Installation Cost		\$12,000	Estimated Life of Measure (yrs)	25	Energy Savings (\$/yr)	\$
Breakeven Cost		\$8,707	Simple Payback (yrs)	24	Energy Savings (MMBTU/yr)	0.0 MMBTU
			Savings-to-Investment Ratio	0.7	Maintenance Savings (\$/yr)	\$500
Auditors Notes: The existing heat exchanger is original to the plant and is need of a replacement for maintenance purposes. It is also of concern because it is single-walled, which provides less protection to the raw water in the event of a break in the piping. Replacing this heat exchanger will reduce labor costs in the water plant and improve the heat recovery system operation.						

5. ENERGY EFFICIENCY ACTION PLAN

Through inspection of the energy-using equipment on-site and discussions with site facilities personnel, this energy audit has identified several energy-saving measures. The measures will reduce the amount of fuel burned and electricity used at the site. The projects will not degrade the performance of the building and, in some cases, will improve it.

Several types of EEMs can be implemented immediately by building staff, and others will require various amounts of lead time for engineering and equipment acquisition. In some cases, there are logical advantages to implementing EEMs concurrently. For example, if the same electrical contractor is used to install both lighting equipment and motors, implementation of these measures should be scheduled to occur simultaneously.

In the near future, a representative of ANTHC will be contacting the City of Unalakleet to follow up on the recommendations made in this report. Funding has been provided to ANTHC through a Rural Alaska Village Grant and the Denali Commission to provide the community with assistance in understanding the report and implementing the recommendations. ANTHC will work to complete the recommendations in the 2017.

APPENDICES

Appendix A – Energy Audit Report – Project Summary

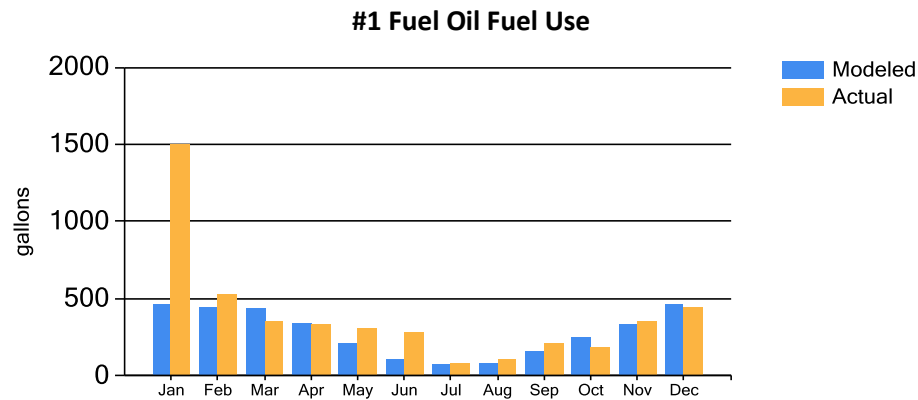
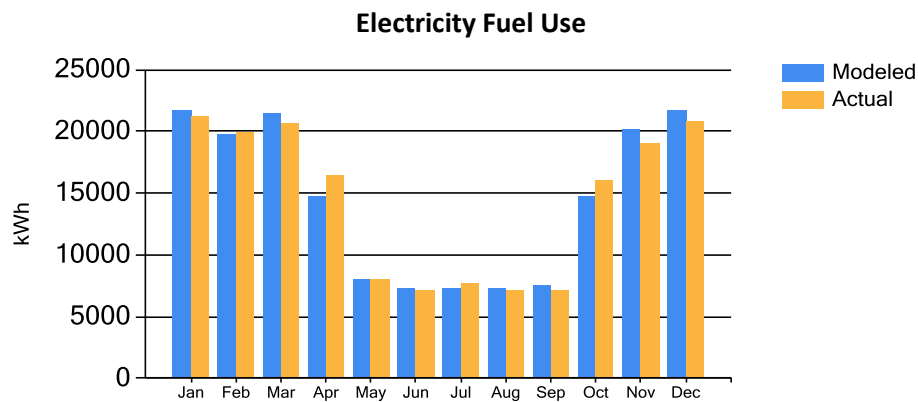
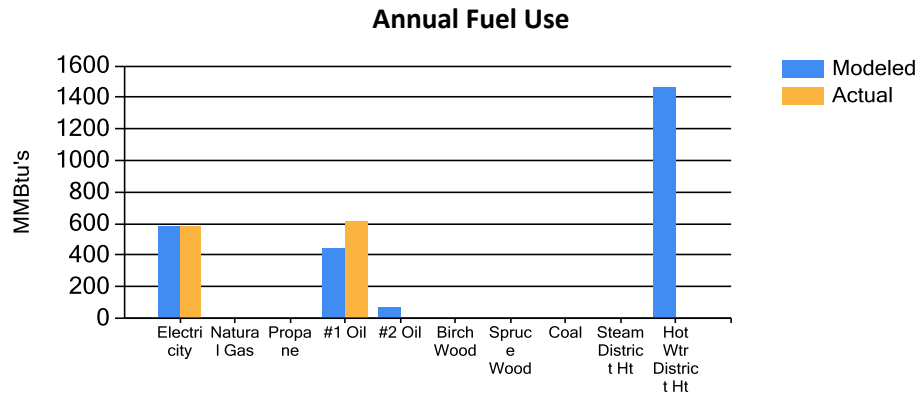
ENERGY AUDIT REPORT – PROJECT SUMMARY	
General Project Information	
PROJECT INFORMATION	AUDITOR INFORMATION
Building: Unalakleet Water Treatment Plant	Auditor Company: ANTHC-DEHE
Address: P.O. Box 28	Auditor Name: Kevin Ulrich, Martin Wortman
City: Unalakleet	Auditor Address: 4500 Diplomacy Dr.
Client Name: Dwayne Johnson, Roger Nichols	Anchorage, AK 99508
Client Address: P.O. Box 28	Auditor Phone: (907) 729-3237
Unalakleet, AK 99684	Auditor FAX:
Client Phone: (907) 624-3531	Auditor Comment:
Client FAX:	
Design Data	
Building Area: 7,176 square feet	Design Space Heating Load: Design Loss at Space: 177,869 Btu/hour with Distribution Losses: 222,337 Btu/hour Plant Input Rating assuming 82.0% Plant Efficiency and 25% Safety Margin: 338,928 Btu/hour Note: Additional Capacity should be added for DHW and other plant loads, if served.
Typical Occupancy: 4 people	Design Indoor Temperature: 65.3 deg F (building average)
Actual City: Unalakleet	Design Outdoor Temperature: -34 deg F
Weather/Fuel City: Unalakleet	Heating Degree Days: 13,919 deg F-days
Utility Information	
Electric Utility: Unalakleet Valley Elec. Coop.	Average Annual Cost/kWh: \$0.37/kWh

Annual Energy Cost Estimate									
Description	Space Heating	Water Heating	Ventilation Fans	Lighting	Refrigeration	Other Electrical	Raw Water Heat Add	Water Circulation Heat	Total Cost
Existing Building	\$20,076	\$467	\$3	\$9,623	\$243	\$45,870	\$1,920	\$10	\$78,213
With Proposed Retrofits	\$14,298	\$457	\$3	\$3,399	\$243	\$41,148	\$1,835	\$1,919	\$63,301
Savings	\$5,778	\$10	\$0	\$6,224	\$0	\$4,722	\$86	-\$1,908	\$14,912

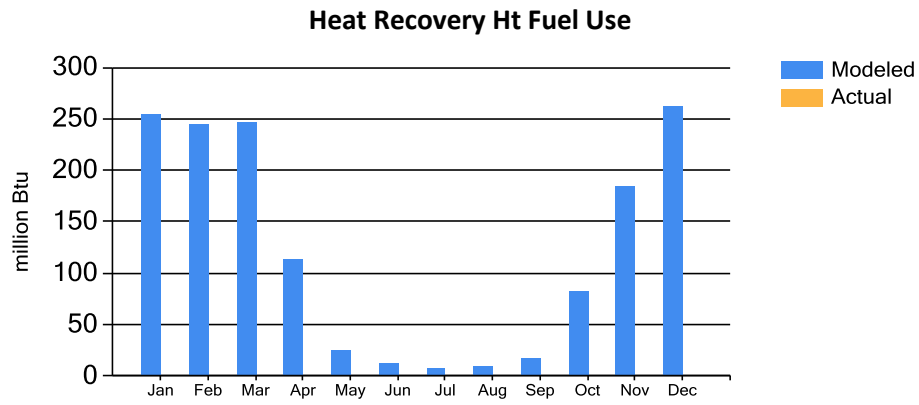
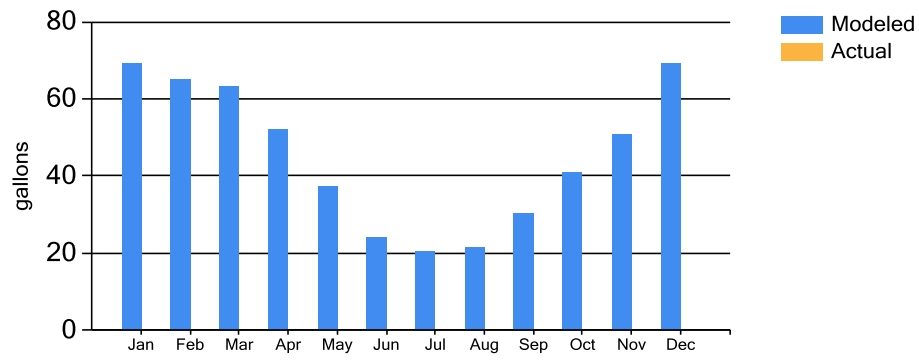
Building Benchmarks			
Description	EUI (kBtu/Sq.Ft.)	EUI/HDD (Btu/Sq.Ft./HDD)	ECI (\$/Sq.Ft.)
Existing Building	358.2	25.73	\$10.90
With Proposed Retrofits	328.0	23.56	\$8.82
EUI: Energy Use Intensity - The annual site energy consumption divided by the structure's conditioned area. EUI/HDD: Energy Use Intensity per Heating Degree Day. ECI: Energy Cost Index - The total annual cost of energy divided by the square footage of the conditioned space in the building.			

Appendix B – Actual Fuel Use versus Modeled Fuel Use

The graphs below show the modeled energy usage results of the energy audit process compared to the actual energy usage report data. The model was completed using AkWarm modeling software. The orange bars show actual fuel use, and the blue bars are AkWarm's prediction of fuel use.



Waste Oil Fuel Use

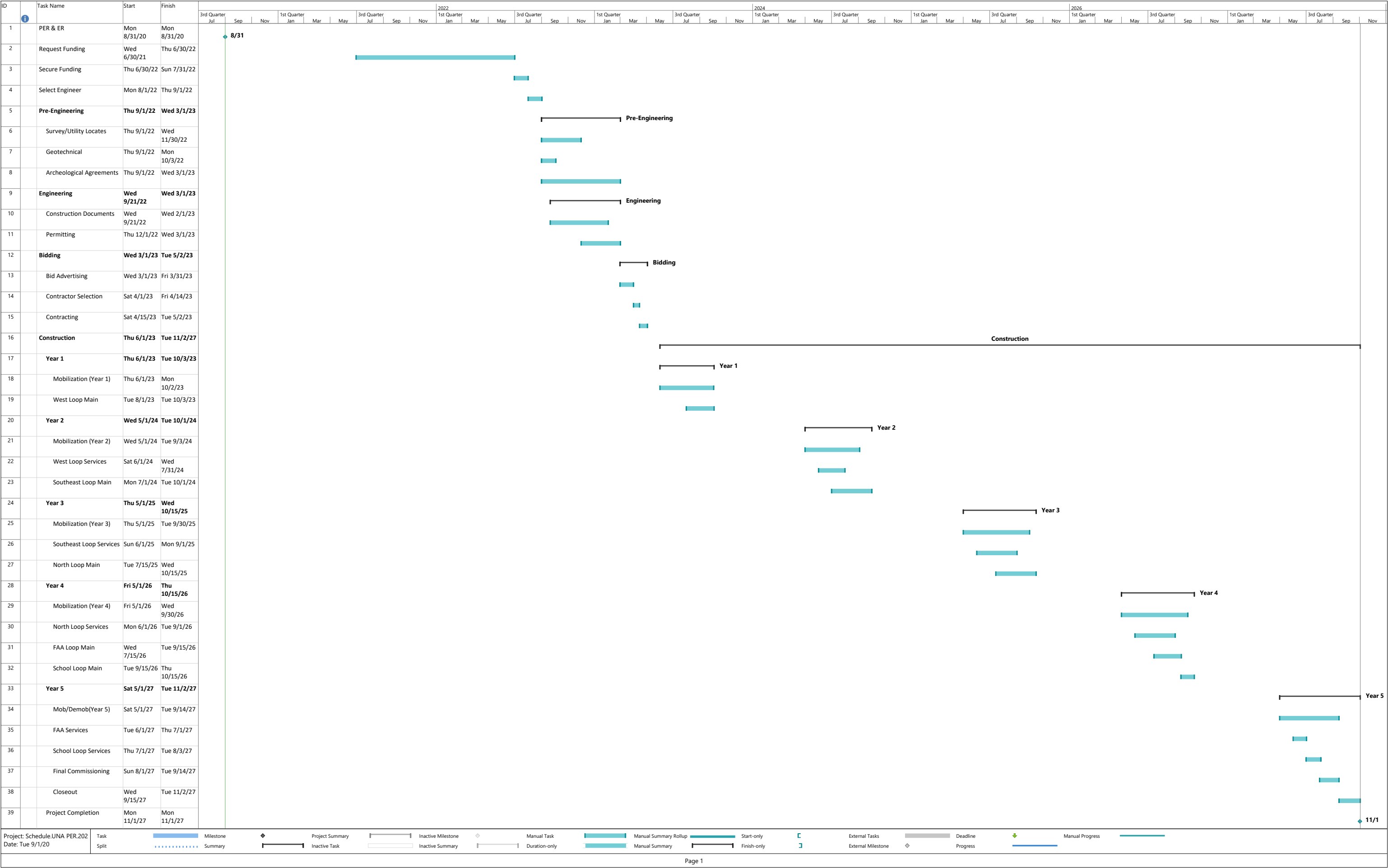


Appendix C - Electrical Demands

Estimated Peak Electrical Demand (kW)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Current	38.0	38.1	37.5	29.3	19.4	18.4	18.0	18.2	18.9	28.5	36.6	38.0
As Proposed	32.0	32.2	31.4	23.8	14.8	13.8	13.4	13.5	14.4	22.8	30.3	32.0

AkWarmCalc Ver 2.6.1.0, Energy Lib 8/9/2016

Appendix F: Propose Project Schedule



Appendix G: Approvals

Appendix B

Consultation 07CAAN00-2018-I-0145



IN REPLY REFER TO:
FWS/AFES/AFWCO

United States Department of the Interior

U.S. FISH AND WILDLIFE SERVICE
Anchorage Fish and Wildlife Conservation Office
4700 BLM Road
Anchorage, Alaska 99507-2546



August 7, 2018

Ms. Karen Brown, Environmental Manager
Alaska Native Tribal Health Consortium
Department of Environmental Health and Engineering
4500 Diplomacy Drive, Suite 454
Anchorage, Alaska 99508

Subject: Endangered Species Act Section 7 Consultation for Native Alaskan Village Upgrades
(Consultation 07CAAN00-2018-I-0145)

Dear Ms. Brown:

Thank you for requesting consultation with the U.S. Fish and Wildlife Service (Service), pursuant to section 7 of the Endangered Species Act of 1973 (16 U.S.C. 1531 et seq., as amended; ESA) by correspondence received March 20, 2018. The Alaska Native Tribal Health Consortium (ANTHC) proposes projects within native communities throughout the state of Alaska. You are seeking our assistance in developing a programmatic approach to making your ESA-determinations for a broad suite of projects and their effects on federally threatened and endangered species and their designated critical habitats (Table 1, enclosed).

In Alaska, the Service has two Fish and Wildlife Conservation Offices (FWCO) responsible for section 7 consultations under the ESA (Figure 1, enclosed). The Fairbanks FWCO is responsible for the interior, northwestern, and far northern portions of Alaska. The Anchorage FWCO is responsible for the Aleutian Islands, south-western and south-central Alaska to the Yakutat forelands, and south-east Alaska and the protected waters thereof.

Species Protected Under ESA

A complete list of federally-listed threatened and endangered species and their designated critical habitats found in Alaska is provided in Table 2, enclosed.

Procedure for Section 7 Determination

Section 7(a) of the ESA directs all Federal agencies to conserve species listed as threatened or endangered. Those agencies, in consultation with the Service, must ensure that their actions will not jeopardize the continued existence of any ESA-listed species. Before starting an action, the Federal agency, or their non-federal representative, obtains a list of threatened, endangered, proposed, and candidate species and their designated critical habitat that may be present in the project action area. Based on its analysis, the Federal agency, or their non-Federal representative, makes one of three determinations of effect for listed species.

- **“No effect”** is the appropriate conclusion if the action agency determines the proposed action will not affect a listed species or designated critical habitat. If a “no effect” determination is made, the lead Federal agency or their non-federal representative is not required to contact the Service for concurrence.
- **“May affect, is not likely to adversely affect”** is the appropriate conclusion when an action agency determines the proposed action may result in an effect to listed species or critical habitat, but that effect is expected to be discountable or insignificant, or completely beneficial. Beneficial effects are contemporaneous positive effects without any adverse effects to the species or critical habitat. Insignificant effects relate to the size of the impact and should never reach the scale where take occurs. Discountable effects are those that are extremely unlikely to occur. These are cases when, based on best judgement, a person would not 1) be able to meaningfully measure, detect, or evaluate insignificant effects, or 2) expect discountable effects to occur. If a “may affect, not likely to adversely affect” determination is made, the Federal agency or their non-federal representative should seek written concurrence from the Service that the action “is not likely to adversely affect” listed species or designated critical habitat.
- **“May affect, is likely to adversely affect”** is the appropriate conclusion when the action agency determines it is likely that any adverse effect to listed species or critical may occur as a direct or indirect result of the proposed action or its interrelated or interdependent actions, and the effect is not discountable, insignificant, or beneficial. A determination of “is likely to adversely affect” requires formal section 7 consultation.

The Service has worked with ANTHC to identify projects most commonly undertaken in rural communities that lend themselves to the programmatic framework for section 7 consultation. In order to assist ANTHC make their section 7 determination for each of their projects, we developed a series of questions, with additional section 7 guidance based on the answer to these questions. Regardless of ANTHC’s section 7 determination, the Service recommends maintaining a complete record of evaluation in the project file.

1. Is the project located within a community outside the range of listed or candidate species or within designated critical habitat? (Review Table 3, enclosed, and choose the appropriate response below).

A. **Yes, the project is in a location listed in Table 3** and is therefore outside the range of listed species and outside the boundaries of any designated critical habitat. If no listed species or designated critical habitat are present, it is reasonable for ANTHC to make a determination the project will have “**no effect**” on listed species or designated critical habitat. For projects that will have no effect on listed species or critical habitat, there is no need to consult with the Service. Based on your determination of “no effect,” you have fulfilled your section 7 requirements.

B. **No, the project is not in a location listed in Table 3** (go to step 2).

2. The project location is not listed in Table 3, therefore, it is within the range of listed species. Depending on the location of the community where the project occurs, it may require further consultation. Is the project located in a community north of 69.9° 00' N latitude on the North Slope of Alaska? (Choose the appropriate response below.)

A. **Yes, the project occurs in the community of Atqasuk, Kaktovik, Nuiqsut, Point Lay, Utqiagvik (Barrow), or Wainwright** and is therefore located north of 69.9° 00' N latitude on the North Slope of Alaska. Projects in these locations have the potential to require wetland fill, and cumulative effects of small-scale routine actions upon threatened or endangered species may occur in these areas. The Service recommends you request individual section 7 consultation for projects in these areas with the Fairbanks FWCO (Table 4, enclosed).

B. **No, the project does not occur in Atqasuk, Kaktovik, Nuiqsut, Point Lay, Utqiagvik (Barrow), or Wainwright** and is therefore located south of 69.9° 00' N latitude on the North Slope of Alaska (go to step 3).

3. Will the project take place outside of the May through September timing window for nesting eiders? (Choose the appropriate response below.)

A. **Yes, the project occurs outside of the specified timing window** (May through September). Therefore, you can reasonably make a determination the project “**may affect, but is not likely to adversely affect**” listed species or critical habitat. In such instances, the Service concurs with your “**may affect, but not likely to adversely affect**” determination, because we expect few, if any, listed species to be present. Based on our concurrence with your determination, ANTHC and the Service have both completed our section 7 requirements and there is no need for further consultation.

B. **No, the project does not occur outside of the specified timing window** (May through September) (go to step 4).

4. Does the project occur within the existing village footprint? We define the existing village footprint as all areas of a village's existing road network and all areas within a 200 meter buffer of existing village structures and all connected outlying, existing development. If a new road is constructed to access a site and extends beyond the existing village perimeter, then the site is considered outside the existing village footprint and not covered by this programmatic section 7 consultation.

A. **Yes, the project occurs within the village footprint** as defined. Listed species are not expected to be found within the village footprint. Therefore, you can reasonably make a determination the project “**may affect, but is not likely to adversely affect**” listed species or critical habitat. In such instances, given the project meets the criteria listed above, the Service concurs with your “**may affect, but is not likely to adversely affect**” determination. Based on our concurrence with your determination, ANTHC and the Service have both completed our section 7 requirements and there is no need for further consultation.

B. No, the project does not occur within the village footprint (go to step 5).

5. Depending on the nature of the project, it may require further consultation. Will new groundbreaking activities (specifically gravel fill or gravel pad fill) take place?

A. **Yes, new groundbreaking or ground disturbance activities may occur** as part of the project proposal (e.g., gravel fill or gravel pad fill). The Service recommends you request individual section 7 consultation for projects in these areas with the appropriate FWCO (see Figure 1 and Table 4).

B. **No, new groundbreaking activities such as gravel fill or new gravel pad construction will not occur** as part of the project proposal (e.g., gravel fill or gravel pad construction). Therefore, you can reasonably make a determination the project “**may affect, but is not likely to adversely affect**” listed species or critical habitat. In such instances, given the project meets the criteria listed above, the Service concurs with your “**may affect, but is not likely to adversely affect**” determination. Based on our concurrence with your determination, ANTHC and the Service have both completed our section 7 requirements and there is no need for further consultation.

In the event your project does not meet the criteria discussed above, you should request an individual section 7 consultation with the appropriate FWCO (see Figure 1 and Table 4). It is likely that further review of your project will result in a determination that the project “may effect, but is not likely to adversely affect” listed species. In such cases, the section 7 consultation for the project will remain informal and relatively simple. In the rare case where a project “may effect, is likely to adversely affect” listed species, and formal consultation is required, you should prepare a Biological Assessment prior to initiating consultation. A Biological Assessment contains the following elements: 1) project description, 2) site specific information, 3) effects of the action, 4) anticipated incidental take, 5) conservation measures, and 6) an effects determination.

For an explanation of these elements please refer to:

<https://www.fws.gov/alaska/fisheries/endangered/consultation.htm>
<https://www.fws.gov/endangered/esa-library/pdf/Attachment-4.pdf>
https://www.fws.gov/endangered/esa-library/pdf/esa_section7_handbook.pdf

You may wish to contact the appropriate FWCO for technical assistance in your effects determination. Please see Figure 1 and Table 4 for contact information.

Reinitiation

This programmatic section 7 consultation addressing municipal construction activities for ANTHC is valid through September 1, 2023. However, if new species are listed that may be affected by projects covered under this programmatic consultation or additional information on listed or proposed species becomes available, then this programmatic consultation should be reinitiated. After September 1, 2023, ANTHC should contact the staff at the Anchorage FWCO for programmatic review at (907) 271-1467.

This letter relates only to federally listed or proposed species and/or designated or proposed critical habitat under jurisdiction of the Service. It does not address species under the jurisdiction of the National Marine Fisheries Service, or other legislation or responsibilities under the Fish and Wildlife Coordination Act, Migratory Bird Treaty Act, Marine Mammal Protection Act, Clean Water Act, National Environmental Policy Act, or Bald and Golden Eagle Protection Act.

Annual Reporting

The Service requests ANTHC submit annual reports, documenting the number and types of projects covered by this programmatic consultation, by location, for each calendar year January 1 to December 31, by March 31 of the following year. The purpose of the reporting is to inform future renewals and management of section 7 programmatic consultations.

Annual reports may include information such as:

- A summary of project types with components during the previous year (e.g., energy project including a new biomass boiler in prefab building on new or existing pad, underground piping).
- A summary of all community/village location where project(s) occurred during the previous year.
- Notable events. For example, the occurrence of, or conflict with, any threatened or endangered species.

Electronic mail reports can be submitted to Anchorage FWCO wildlife biologist Mr. Kevin Foley at kevin_foley@fws.gov or to the Anchorage FWCO general delivery mailbox at ak_fisheries@fws.gov. Please include the term “annual report” and the consultation number “07CAAN00-2018-I-0145” in the subject line of the correspondence.

Additional Considerations

The Service recommends the following voluntary measures to reduce or minimize negative effects to threatened or endangered species in areas where they occur. Eiders may be attracted to lights on or near the coastline, especially at night or during periods of low visibility.

- To avoid attracting birds towards landward structures, consider down-shielding lights to reduce visibility and possible attraction of birds in flight for projects or activities in communities located within 200 meters of the Alaska coastline or other waterbody.
- To prevent birds from colliding with power lines, transmission lines, and guy wires, consider attaching bird deterrents.

Thank you for your cooperation in meeting our joint responsibilities under the ESA and protecting our fish and wildlife resources. If you have any questions, please contact Endangered Species Biologist Mr. Kevin Foley at (907) 271-2788 or kevin_foley@fws.gov, and refer to consultation number 07CAAN00-2018-I-0145.

Sincerely,



for

Douglass M. Cooper
Ecological Services Branch Chief

Enclosures

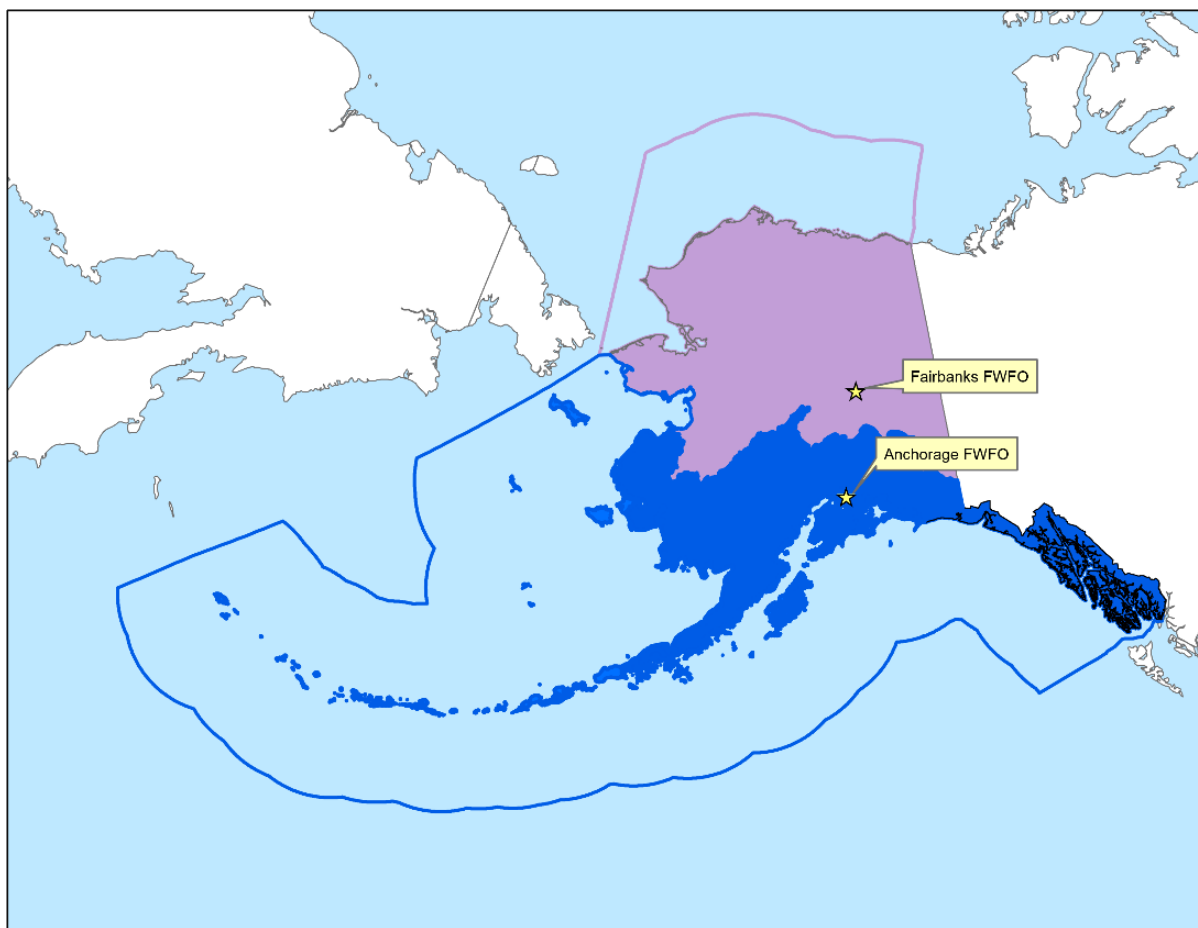


Figure 1. Areas of jurisdiction for each U.S. Fish and Wildlife Service Fish and Wildlife Conservation Office in Alaska.

Table 1. Projects likely to have limited effects on listed species and their critical habitat.

Project Type	Project Description
Community buildings (water/wastewater treatment plants, washeterias, lift stations), tribal offices, multi-purpose centers, clinics, hospitals, daycare facilities, housing	New construction or repair, rehabilitation, replace, upgrade or modify existing buildings, boardwalks, decks, steps, landings, room additions, holding tanks and new construction of gravel pads within the existing village footprint*
Energy	Install waste heat recovery connection between power plant and public facilities (trenched or aboveground water and electrical lines); install new or rehabilitate thermosiphons for active cooling (excavate and retrofit); install biomass boiler in prefab building on new or existing pad and piping (trenched or aboveground); install solar photovoltaic systems on existing structures within the existing village footprint* or adjacent to existing facilities
Erosion and Permafrost Mitigation	Repair and rehabilitate footings and foundations; fill and contour soils for proper drainage and revegetate; remove and replace gabion baskets; install new or rehabilitate thermosiphons for active cooling within the existing village footprint* or adjacent to existing facilities*
Fuel Tanks	New or rehabilitate, replace, repair, or upgrade fuel tanks for residential and public facilities; new foundation, gravel pad, and containment basin within the existing village footprint*
Health Facilities	Replace or rehabilitate existing building, construct gravel pads and new buildings or building additions, provide buried electric power, sewer and water service lines; upgrade fire alarm, lighting, ventilation or mechanical systems within the existing village footprint*
* Existing Village Footprint: All areas within a villages existing road network and all areas within a 200 m buffer of existing village structures and all connected outlying, existing development. If a new road is constructed to access a site and extends beyond the existing village perimeter, then the site is considered outside the existing village footprint and not covered by this programmatic section 7 consultation.	

Table 1 (continued). Projects likely to have limited effects on listed species and their critical habitat.

Roads and boardwalks	New or upgrade, replace, or maintain within the existing village footprint*
Sanitation	Water and sewer lines and utilidors new/replace/repair (mains, distribution and transmission, trenched or aboveground); backwash basins (Water Treatment Plant adjacent); lift stations (new, repair/replace); septic systems (excavate, bedding, install septic tank and drain field, backfill, revegetate); potable water wells (drill or excavate) for residential, commercial and public facilities within the existing village footprint*
Sewage Lagoon Upgrades	Expand, repair, rehabilitate, or fence existing facility
Water Reservoir	Non-fenced to allow flightless birds to enter and exit; within existing village footprint* Cleanout sediment and repair/upgrade existing water impoundments
Water Storage Tank	Rehabilitate, replace, and new construction; new foundation within the existing village footprint*
* Existing Village Footprint: All areas within a villages existing road network and all areas within a 200 m buffer of existing village structures and all connected outlying, existing development. If a new road is constructed to access a site and extends beyond the existing village perimeter, then the site is considered outside the existing village footprint and not covered by this programmatic section 7 consultation.	

Table 2. Threatened and endangered species and their designated critical habitats in Alaska.

SPECIES AND STATUS	CRITICAL HABITAT DESIGNATION DATE	LEAD OFFICE	RANGE IN ALASKA
Endangered			
Short-tailed albatross (<i>Phoebastria albatrus</i>)	n/a	Anchorage	U.S. Territorial waters, Gulf of Alaska, Aleutian Islands, Bering Sea Coast, Japan, Russia, high seas
Eskimo curlew (<i>Numenius borealis</i>)	n/a	Fairbanks	Has not been reported in Alaska since 1987
Aleutian shield fern (<i>Polystichum aleuticum</i>)	n/a	Anchorage	Adak Island
Threatened			
Spectacled eider (<i>Somateria fischeri</i>)	2/6/01	Fairbanks	Western and Northern Alaska (coastal)
Steller's eider (<i>Polysticta stelleri</i>)	2/2/01	Fairbanks	Southwestern, Western and Northern Alaska
Northern Sea otter (<i>Enhydra lutris kenyoni</i>) (Southwest Alaska DPS)	10/8/09	MMM ¹	Aleutian Islands, Alaska Peninsula, Kodiak Island
Polar bear (<i>Ursus maritimus</i>)	11/24/2010	MMM ¹	On sea ice and coastline of Chuckchi and Beaufort seas
Wood bison (<i>Bison bison athabasca</i>)	None in AK 10(j) NEP Rule 5/7/14	Anchorage	Lower Innoko / Yukon River areas

¹Marine Mammals Management, FWS Alaska (Region 7) Regional Office

Table 3. Communities in Alaska that are outside the range of listed species and critical habitats.

Akiachak	Crooked Creek	Hyder
Akiak	Cube Cove	Igiugig
Alatna	Delta Junction	Juneau
Alcan	Denali Borough	Kake
Aleknagik	Dillingham	Kalskag
Algaaciq	Dora Bay	Kaltag
Allakaket	Dot Lake	Kasaan
Ambler	Eagle	Kasigluk
Anaktuvuk_Pass	Eagle Village	Kasilof
Anchorage	Edna Bay	Kennicott
Anderson	Eek	Kenny Lake
Angoon	Eielson AFB	Kern
Aniak	Eklutna	Ketchikan
Annette	Ekuk	King Island
Annette Island	Ekwok	Klawock
Anvik	Ester	Klukwan
Arctic Village	Evansville	Kobuk
Atmautluak	Fairbanks	Kokhanok
Beaver	Ferry	Koliganek
Bethel	Flat	Koyukuk
Bettles	Fort Greely	Kupreanof
Big Lake	Fort Yukon	Kwethluk
Birch Creek	Freshwater Bay	Labouchere Bay
Bird	Gakona	Lake Minchumina
Cantwell	Galena	Larsen Bay
Central	Game Creek	Lignite
Chalkyitsik	Girdwood	Lime Village
Chickaloon	Glennallen	Livengood
Chicken	Goodnews Bay	Long Island
Chignik Lake	Grayling	Lower Kalskag
Chuathbaluk	Gulkana	Lower Tonsina
Chugiak	Harding Lake	Lutak
Circle	Healy	Manley Hot Springs
Circle Hot Springs	Healy Lake	Manokotak
Clarks Point	Holbart Bay	Marshall
Coffman Cove	Holy Cross	Mary's Igloo
Copper Center	Hope	McCarthy
Cordova	Houston	McGrath
Council	Huslia	McKinly Park
Craig	Hydaburg	Mekoryuk

Table 3 (continued). Communities in Alaska that are outside the range of listed species and critical habitats.

Mendeltna	Petersville	Stony River
Mentasta	Pile Bay	Susitna
Mentasta Lake	Pilot Station	Takotna
Metlakatla	Pitkas Point	Talkeetna
Meyers Chuck	Point Baker	Tanacross
Minto	Polk Inlet	Tanana
Moose Creek	Poorman	Tatitlek
Moose Pass	Port Alexander	Tazlina
Mosquito Lake	Port Alsworth	Telida
Mountain Village	Port Clarence	Tenakee Springs
Napaimute	Port Protection	Tetlin
Napakiak	Portage	Thorne Bay
Napaskiak	Portage Creek	Togiak
Naukati	Quinhagak	Tonsina
Naukati West	Rampart	Trapper Creek
Nenana	Red Devil	Tuluksak
New Stuyahok	Rowan Bay	Tuntutuliak
Newhalen	Ruby	Twin Hills
Nikolaevsk	Russian Mission	Two Rivers
Nikolai	Saint Mary	Tyonek
Nondalton	Salcha	Ugashik
North Pole	Saxman	Upper Kalskag
Northway	Seward	Valdez
Northway Junction	Shageluk	Venetie
Northway Village	Shungnak	Wasilla
Nulato	Sitka	Whale Pass
Nunapitchuk	Skagway	White Mountain
Ophir	Slana	Whitestone Logging
Oscarville	Sleetmute	Whittier
Palmer	Soldotna	Willow
Paxson	Solomon	Wiseman
Pedro Bay	St Mary's	Wrangell
Pelican	Stevens River	Yakutat
Petersburg	Stevens Village	

Table 4. Consultation contact information for the U.S. Fish and Wildlife Service.

	Office	Address	Telephone Number	Fax Number
FFWCO	Fairbanks Fish and Wildlife Conservation Office	101 12 th Ave. Room 110 Fairbanks, Alaska 99701	907-456-0203	907-456-0208
AFWCO	Anchorage Fish and Wildlife Conservation Office	4700 BLM Rd. Anchorage, Alaska 99507	907-271-2888	907-271-2786

Appendix C

Supporting Documentation



▼ Find a wilderness or place 🔍



Wilderness Areas (in view)

0

Total Acreages (in view)

0

Largest Wilderness (in view)

0

Smallest Wilderness (in view)

0

Summary



75°F Sunny



11:44 AM
7/21/2023

40

UNALAKLEET RIVER, ALASKA



[+ View larger map](#)

Managing Agency:

Bureau of Land Management, Anchorage Field Office

Designated Reach:

December 2, 1980. The segment of the main stem from the headwaters in T12S, R3W, Kateel River meridian, downstream to the western boundary of T18S, R8W.

Classification/Mileage:

Wild — 80.0 miles; Total — 80.0 miles.



87°F Sunny



2:56 PM
7/21/2023

Unalakleet River

The clear, smooth waters of the Unalakleet River originate in the rolling Nulato Hills, which divide rainfall and snowmelt between the Norton Sound and the Yukon River Basin. The river starts out channelized and running swiftly. Downstream of the designated section, it meanders across the arctic tundra 10 miles to the seaside village of Unalakleet, located on Norton Sound. For most of its length, the river has a varying pool/riffle nature, which offers a great diversity of river characteristics and boating and fishing opportunities.

"Unalakleet" is Inupiat for "place where the east wind blows," named by a people who have lived in the area for centuries. Early settlements were often located on rivers or along the coast because fishing and hunting opportunities were abundant, and rivers provided an excellent way to travel between distant villages. The Unalakleet River was a major avenue of trade in the 19th century, connecting coastal Eskimos, Yukon River interior peoples and Russian merchants. In 1898, reindeer herders from Lapland settled along the river, and shortly thereafter, prospectors seeking gold on the nearby Seward Peninsula traveled over the Kaltag Portage and downriver to the coast. Subsequent changes included a telegraph line and associated cabins along the river and establishment of a mail route.

The Iditarod National Historic Trail, which runs alongside the Unalakleet River to the Bering Sea coast, follows the trail once used by Alaska Native hunters, Russian explorers and gold seekers.

Fish & Wildlife

The Unalakleet River supports a salmon fishery which in the past has produced 100,000 fish. Chinook, coho, pink and chum salmon spawn here. Annual runs provide income for both local inhabitants and sportfishing businesses. Arctic grayling, arctic char and whitefish are important subsistence species. Wildlife are important as commercial, subsistence and recreation resources. Moose, caribou and bear are the primary species of interest for the sport hunting trade. Trapping of marten, lynx, fox, wolf, beaver and muskrat supports the local economy.

Scenic

The scenery along the Unalakleet is subdued. The Nulato Hills are low and round-topped; prominent hills can be seen through breaks in the vegetation and along the long, straight sections. Largely, the views are pleasing combinations of plants, clear water, gravel bars, cut banks, inflowing streams and driftwood. Old Woman Mountain is the most dominant feature for five to six miles above and below the confluence with the Old Woman River. The aesthetic qualities of the diverse plant communities add immeasurably to the overall river environment.

BASEMAPS 

MAP LAYERS 

☒ CBRS Units 

Click [here](#) to learn more about CBRS Units.



Measure



LEGEND

CBRS Units

-  CBRS Buffer Zone
-  CBRS Prohibitions
-  Otherwise Protected Area
-  System Unit

1:36,112
63.866 | -160.824

Map by: I. Ferri, HERE, Garmin, I. Ferri, HERE, U.S. Fish and Wildlife Service, Coastal Barrier Resources Act Program

+

-

▼

Find address or place

Q

Grid icon

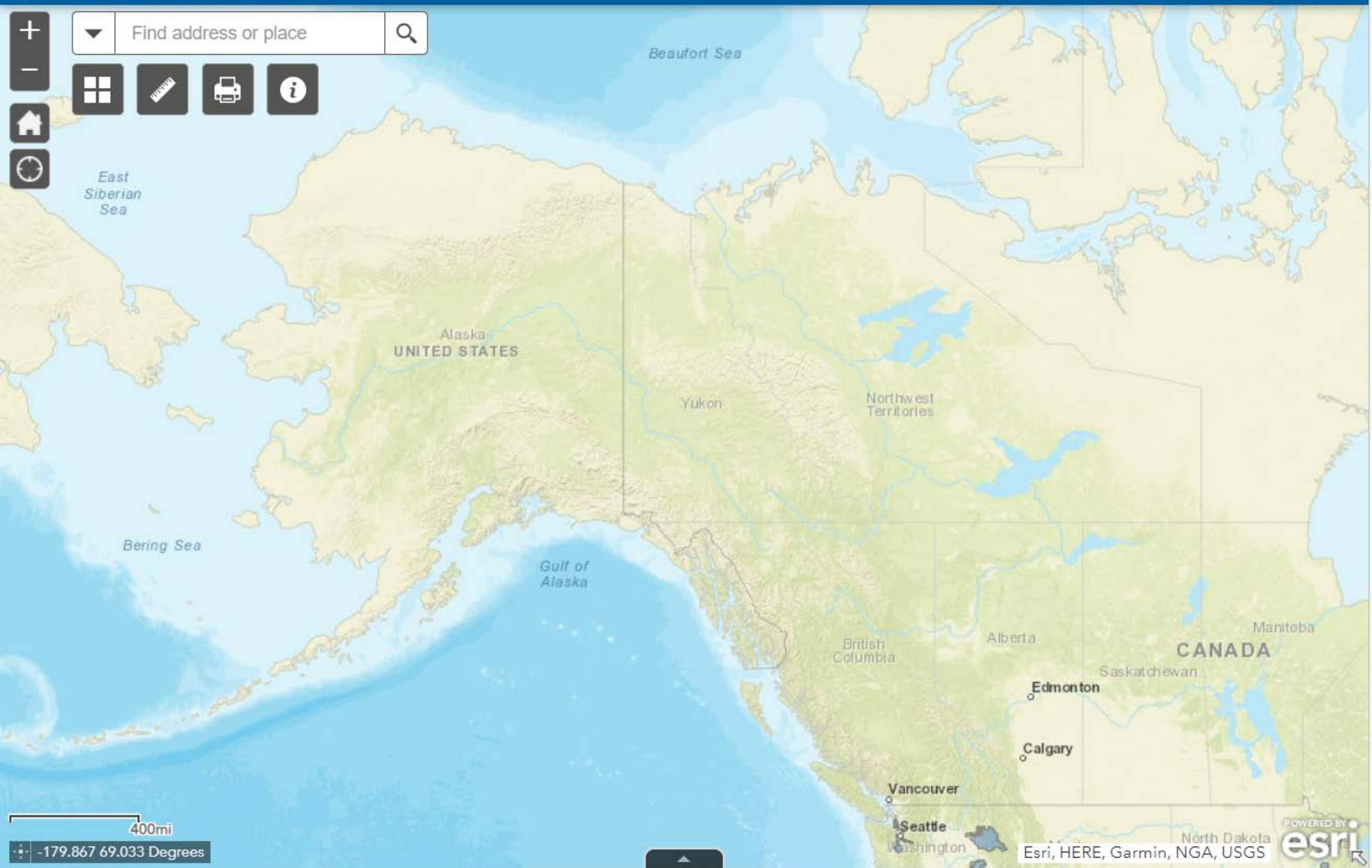
Measure icon

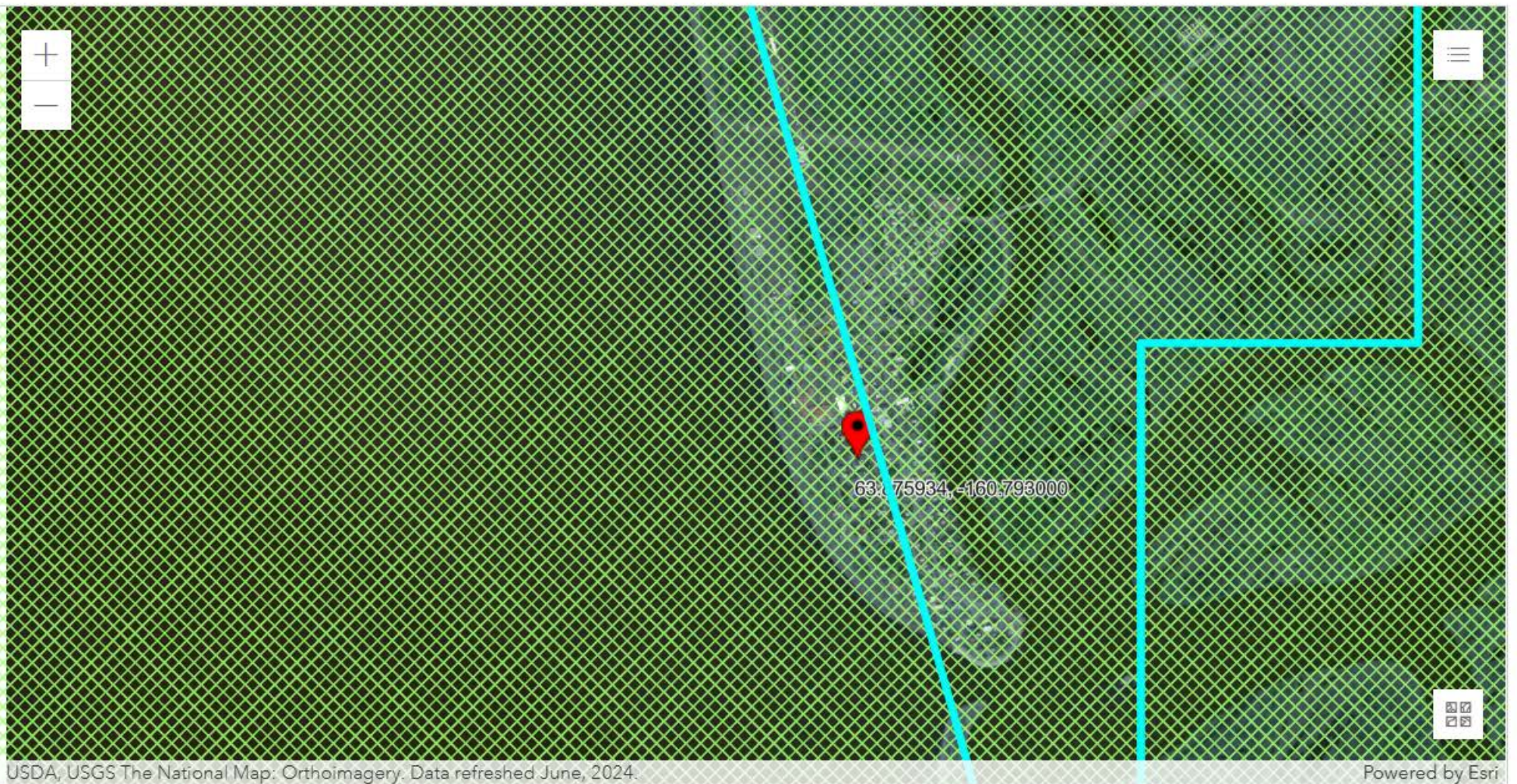
Print icon

Info icon

Home icon

History icon





PIN

Approximate location based on user input and does not represent an authoritative property location

MAP PANELS

Selected FloodMap Boundary

Digital Data Available

No Digital Data Available

Unmapped

NO SCREEN Area of Minimal Flood Hazard *Zone X*

Effective LOMRs

SPECIAL FLOOD HAZARD AREAS

Without Base Flood Elevation (BFE)
Zone A, V, A99

With BFE or Depth

Regulatory Floodway *Zone AE, AO, AH, VE, AR*

OTHER AREAS OF

0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*

Future Conditions 1% Annual Chance Flood Hazard *Zone X*

Area with Reduced Flood Risk due to Levee. See Notes, *Zone X*

OTHER FEATURES

Cross Sections with 1% Annual Chance Water Surface Elevation

Coastal Transect

Base Flood Elevation Line (BFE)

Limit of Study

Jurisdiction Boundary

Coastal Transect Baseline

Profile Baseline

Hydrographic Feature

GENERAL STRUCTURES

Channel, Culvert, or Storm Sewer

Levee, Dike, or Floodwall

[BASEMAPS >](#)[MAP LAYERS >](#)

- ☒ Wetlands ⓘ ?
- ☒ Riparian ⓘ ?
- ☐ Riparian Mapping Areas ⓘ ?
- ☒ Data Source ⓘ ?
 - ☐ Source Type
 - ☐ Image Scale
 - ☐ Image Year
- ☐ Areas of Interest ⓘ
- ☐ FWS Managed Lands ⓘ ?
- ☐ Historic Wetland Data ⓘ ?

[Measure](#)[LEGEND](#)

1:72,224
63.893 | -160.819

Unalakleet

Unalakleet River

U.S. Fish and Wildlife Service, National Standards and Support Team, ...

POWERED BY
esri



THE STATE
of **ALASKA**
GOVERNOR MIKE DUNLEAVY

Department of Environmental
Conservation

DIVISION OF ENVIRONMENTAL HEALTH
Solid Waste Program

610 University Avenue
Fairbanks, Alaska 99709-3643
Main: 907.451.2108
Fax: 907.451.2188
www.dec.alaska.gov

October 8, 2021

Certified Mail #7021 1970 001 0575 8607
Return Receipt Requested

File Number: 630.15.001

Moe Zamarron, City Manager
City of Unalakleet
P.O. Box 28
Unalakleet, AK 99684-0028

RE: Unalakleet Municipal Solid Waste Landfill, Solid Waste Permit No. **SW3A051-26**

Dear Mr. Zamarron:

The Alaska Department of Environmental Conservation (ADEC) has completed its evaluation of Unalakleet's permit renewal application, dated September 2, 2021, and is issuing the attached permit for the Class III Community Landfill at Unalakleet, Alaska. Please review the conditions and stipulations in the permit and ensure that they are understood. This permit is being issued in accordance with Alaska Statute (AS) 46.03; Title 18, Chapter 15 of the Alaska Administrative Code (18 AAC 15); and the Solid Waste Regulations (18 AAC 60).

Any person who disagrees with this decision may request an adjudicatory hearing in accordance with 18 AAC 15.195 - 18 AAC 15.340, or an informal review by the Division Director in accordance with 18 AAC 15.185. **Informal review requests** must be delivered to the Director, Division of Environmental Health, ADEC, 555 Cordova Street, Anchorage, AK 99501 within 20 days of the permit decision. **Adjudicatory hearing requests** must be delivered to the Commissioner of the Department of Environmental Conservation, P.O. Box 111800, Juneau, Alaska 99811, within 30 days of the permit decision. If a hearing is not requested within 30 days, the right to appeal is waived. More information regarding submitting a request for an informal review or adjudicatory hearing may be found at <http://dec.alaska.gov/commish/review-guidance>. Even if an adjudicatory hearing has been requested and granted, all permit conditions remain in effect unless a stay has been granted.

Please contact Trisha Bower at (907) 451-2174 or by email at trisha.bower@alaska.gov if you have any questions or require any additional information.

Sincerely,

A handwritten signature in blue ink that reads "Douglas Buteyn".

Douglas Buteyn
Northern/Southeastern Regional Program Manager

Enclosure: Permit #SW3A051-26, expiring on **October 10, 2026**

STATE OF ALASKA
DEPARTMENT OF ENVIRONMENTAL CONSERVATION
610 University Avenue
Fairbanks, AK 99709

SOLID WASTE DISPOSAL PERMIT

Permit No. **SW3A051-26**

Date Effective: October 10, 2021

Date Expires: October 10, 2026

The Alaska Department of Environmental Conservation (ADEC), under authority of AS 46.03 and 18 AAC 60, issues a solid waste disposal permit to:

City of Unalakleet
P.O. Box 28
Unalakleet, AK 99684-0028

and designated representatives for the management and operation of a Class III municipal solid waste disposal facility. It authorizes operation of a baler, bale storage, and the disposal of an annual average of less than 5 tons per day of domestic and commercial refuse at the community 10-acre site. The baler facility is located five miles from the landfill.

The landfill is located outside Unalakleet, Alaska in Section 23, Township 18 South, Range 11 West, Kateel River Meridian, while the baler facility is within Unalakleet, Alaska, in section 3, Township 19 South, Range 11 West, Kateel River Meridian.

The permit holder shall manage and operate the facility in accordance with:

- Title 18, Chapter 60 of the Alaska Administrative Code (18 AAC 60); and
- ADEC Class III Landfill Permit Application and Operations Plan, both dated September 2, 2021

In addition, the following permit conditions are required:

Specific Conditions

1. Signs.
 - a. Erect and maintain readily visible signs at the entrances to the baler trash collection site and the landfill with the following information legibly printed:

Facility Operator Identification
Operator/Owner Name
Conditions for Use
Emergency Phone Numbers

- b. At the baler trash collection site and at the entrance to the landfill site, erect and maintain signs that list items that may not be disposed such as: acids, corrosives, solvents, oily wastes, explosives, lead-acid batteries, animal carcasses, hazardous wastes, radioactive wastes, or unsterilized medical waste.
 - c. Erect and maintain visible signs at the baler building and landfill directing users to the various disposal areas (e.g., the active disposal area, the salvage area) and listing pertinent rules for public use.

- d. Maintain the signage at the balefill that prohibits burning and trespassing.
2. Prohibit disposal of medical waste, asbestos-containing materials, used oil, oily waste, polluted soil, hazardous waste, lead-acid batteries, polychlorinated biphenyls (PCBs), septage or sewage solids, and bulk liquids (greater than 1 gallon).
3. Remove household hazardous waste, pressurized gas canisters, and any other materials that might cause a hazard to staff or the baler prior to baling waste.
4. In accordance with the Unalakleet Solid Waste Operations Plan, prevent and prohibit all burning of waste at the balefill.
5. Ensure that the balefill gate remains locked and that only authorized users have access to the balefill.
6. Maintain separate and designated working faces for baled waste and inert waste at the landfill. Consolidate and compact waste regularly to keep the working faces manageable and reduce infiltration of water.
7. Cover waste with a minimum of 6 inches of soil at regular intervals as needed to control attraction of wild and domestic animals, windblown litter, and odor. Cover any areas that will not receive waste for 90 days with at least 12 inches of soil material. Grade cover to prevent water from ponding.
8. Pick up litter or improperly disposed waste in and around the facility in a timely manner and place it into the active cell. If appropriate, gather litter and transport to the baler facility to be incorporated into the next bale. If the volume of litter is minimal, place the litter underneath of the next bale on the next day of operation.
9. Do not dispose of waste in water. Remove any waste that is disposed in water and place it at the working face, or an appropriate dry area. Work to grade the surfaces of the landfill so water does not create ponds.
10. Separate special wastes such as electronics, lead-acid batteries, and fluorescent bulbs from normal household waste and store them in an enclosed area so that they will not be damaged. When possible, transport these wastes out of the community to proper recycling/disposal facilities.
11. Keep the designated salvage area at the landfill and/or baler facility orderly. Prohibit any salvaging within the active cell or from the active area around the baler. Materials in the salvage area that do not have any further salvage or recycle value should be placed at the working face and buried or, if appropriate, baled and buried.
12. Remove refrigerant from vehicles, refrigerators, freezers and any other refrigerant-containing units prior to disposal, or ship the items out of the community for proper disposal.
13. Complete a visual inspection of the landfill each month. Complete the Visual Inspection Checklist in Appendix A of the permit and retain the completed reports in the landfill operation record for at least 5 years.

14. Maintain a landfill operation record at the Unalakleet City office containing the ADEC permit application, current ADEC solid waste disposal permit, operator training records, previous inspection reports, current operations plan, monthly visual monitoring records, police reports related to burning or trespass incidents, and as-built drawings.
15. Encourage landfill operators and pertinent staff to attend solid waste trainings such as Rural Alaska Landfill Operator (RALO), Solid Waste Boot Camp, Tanana Chiefs Conference Solid Waste Class, or Kawerak Solid Waste & Backhaul 101 Class to ensure the landfill is operated in accordance with best management practices

General Conditions

1. Access and inspection - The Permittee shall allow the Commissioner or his representative access to the permitted facilities at reasonable times to conduct scheduled or unscheduled inspections or tests to determine compliance with this permit, State laws, and regulations.
2. Information access - Except for information relating to confidential processes or methods of manufacture, all records and reports submitted in accordance with the terms of this permit shall be available for public inspection at the State of Alaska, Department of Environmental Conservation, 610 University Avenue, Fairbanks, AK 99709.
3. Civil and criminal liability - Nothing in this permit shall relieve the Permittee from civil or criminal penalties for noncompliance, whether or not such noncompliance is due to factors beyond his control, including, but not limited to, accidents, equipment breakdowns, or labor disputes.
4. Availability - The Permittee shall post or maintain a copy of this permit available to the public at the disposal facility.
5. Adverse impact - The Permittee shall take all necessary means to minimize any adverse impacts to the receiving waters or lands resulting from noncompliance with any limitation specified in this permit, including any additional monitoring needed to determine the nature and impact of the noncomplying activity. The Permittee shall clean up and restore all areas adversely impacted by the noncompliance.
6. Cultural or paleontological resources - Should cultural or paleontological resources be discovered as a result of this activity, work which would disturb such resources is to be stopped, and the State Historic Preservation Office, Division of Parks and Outdoor Recreation, Department of Natural Resources, is to be notified immediately (907-269-8721).
7. Applications for renewal - In accordance with 18 AAC 15.100(d), applications for renewal or amendment of this permit must be made no later than 30 days before the expiration date of the permit or the planned effective date of the amendment.
8. Other legal obligations - The requirements, duties, and obligations set forth in this permit are in addition to any requirements, duties, or obligations contained in any permit that the Alaska Department of Environmental Conservation or the U.S. Environmental Protection Agency has issued or may issue to the Permittee. This permit does not relieve the Permittee from the duty to obtain any and all necessary permits and to comply with the requirements contained in any such permit or with applicable state and

federal laws and regulations. All activities conducted by the Permittee pursuant to the terms of this permit and all plans implemented by the Permittee pursuant to the terms of this permit shall comply with all applicable state and federal laws and regulations.

9. Pollution prevention - In order to prevent and minimize present and future pollution, when making management decisions that affect waste generation, the Permittee shall consider the following order of priority options: waste source reduction; recycling of waste; waste treatment; and waste disposal.

This permit expires on **October 10, 2026** and may be revoked or amended in accordance with 18 AAC 60.260. The permit can be renewed if the facility will operate beyond this date. To avoid expiration of this permit, a renewal application must be submitted to ADEC at least 30 days before the expiration date, as set forth in 18 AAC 15.110.



Douglas Buteyn
Northern/Southeastern Regional Program Manager
Solid Waste Program

APPENDIX A

Unalakleet Class III Landfill Visual Monitoring Form

Inspector: _____

Weather Conditions: _____

Date: _____

Temperature: _____

Wind: _____

	Yes/No	Comments/Corrective Action
Access Control:		
Is access road in good condition?		
Is there litter on the road to the landfill?		
Is the entrance gate locked?		
Are fence and gate in good condition?		
Landfill:		
Are signs in good condition?		
Is waste deposited in designated area?		
Is the working face a manageable size?		
Does part of the landfill need to be compacted, consolidated, and covered with cover material?		
Are there any household hazardous waste (HHW) items that need to be removed from working face?		
Is there excessive litter in the landfill?		
Is there excessive odor, noise or dust coming from the landfill?		
Is there any dumping in unauthorized areas?		
Is there any evidence of target shooting?		
Is there damage to the structural integrity of a containment structure, retaining wall, erosion control, or diversion structure?		

APPENDIX A
Unalakleet Class III Landfill Visual Monitoring Form

	Yes/No	Comments/Corrective Action
Unauthorized Burning:		
Is there evidence of open burning (on the ground) inside the landfill or near the fence outside the landfill?		
Was the gate locked?		
Is the lock intact?		
Is there evidence of trespass?		
Are the signs prohibiting burning intact?		
Is there evidence of fire or combustion in the working face (i.e. hot ash smoldering, smoke from the waste, etc.)?		
Water Impacts:		
Is there any standing water in the landfill?		
Has there been water in the landfill for more than 30 days?		
Are there signs of settlement, water ponding, leakage, thermal instability, frost action, or erosion?		
Are there signs of leachate outside the landfill? (Leachate is liquid that has passed through waste and contains harmful materials from the waste.)		
Environmental Impacts:		
Is there evidence of death or stress to fish, wildlife, or vegetation that might be caused by the landfill?		
Is there evidence of wildlife (birds, bears, etc.) in the landfill?		
Permit:		
Are there any violations of the permit's Specific Conditions?		
Water Monitoring (if applicable):		
Are there any signs of damage or potential damage to any of the monitoring devices?		

Other Comments or Concerns:



Legend



Boundaries



Seafood Project Area ZOD Polygon



Alaska DEC Solid Waste Sites

Solid Waste Sites



Undefined



Active



Closed



Inactive



Removed

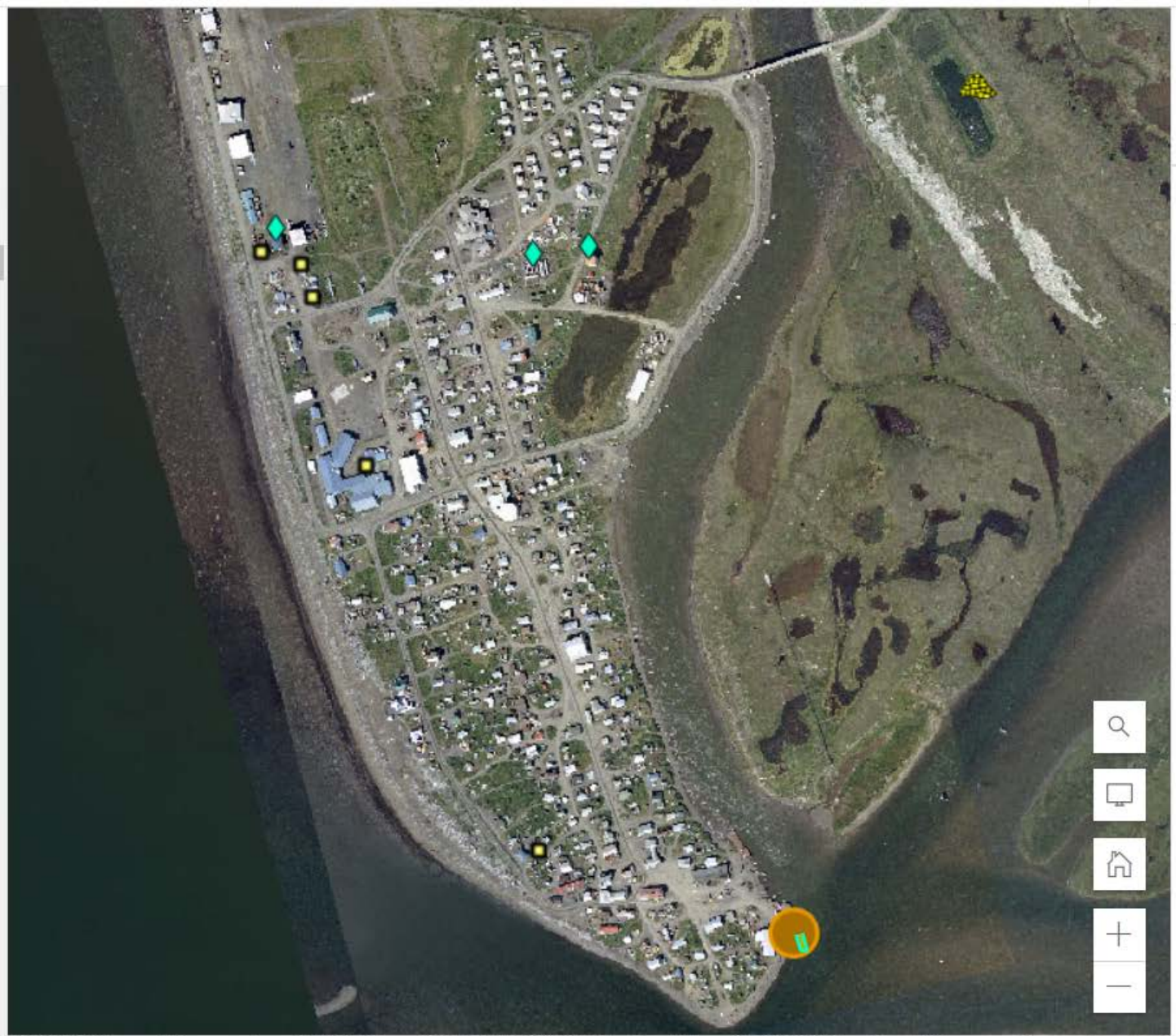


Retired

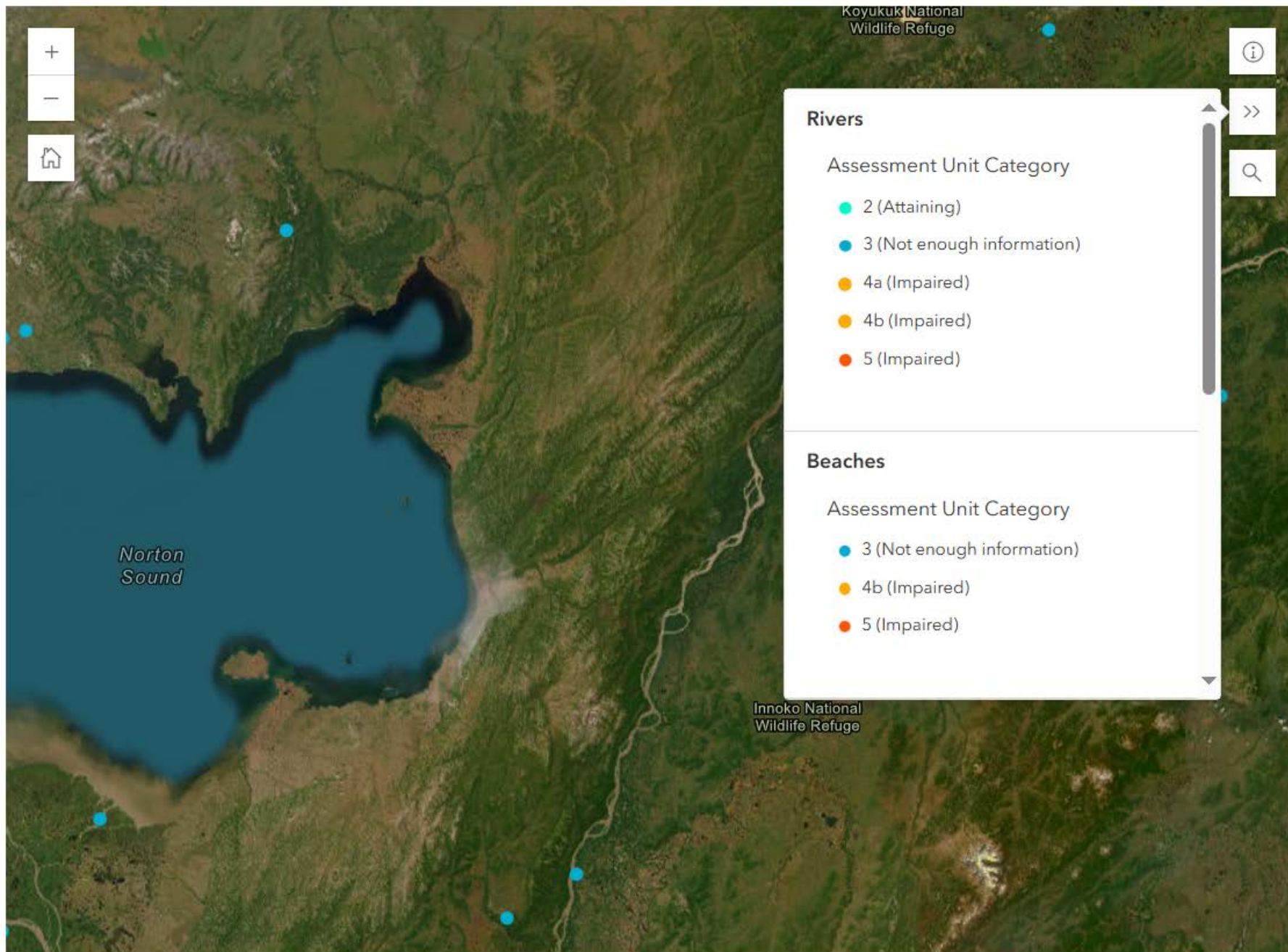


Under Construction

Solid Waste Site Boundaries



2024 Integrated Report Assessed Waters





United States Department of the Interior

FISH AND WILDLIFE SERVICE
Northern Alaska Fish & Wildlife Field Office
101 12th Avenue
Room 110
Fairbanks, AK 99701-6237
Phone: (907) 456-0203 Fax: (907) 456-0208



In Reply Refer To:

July 21, 2023

Project Code: 2023-0107750

Project Name: Unalakleet Water Distribution and services replacement

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2))

(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

<http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF>

Migratory Birds: In addition to responsibilities to protect threatened and endangered species under the Endangered Species Act (ESA), there are additional responsibilities under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA) to protect native birds from project-related impacts. Any activity, intentional or unintentional, resulting in take of migratory birds, including eagles, is prohibited unless otherwise permitted by the U.S. Fish and Wildlife Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). For more information regarding these Acts see <https://www.fws.gov/birds/policies-and-regulations.php>.

The MBTA has no provision for allowing take of migratory birds that may be unintentionally killed or injured by otherwise lawful activities. It is the responsibility of the project proponent to comply with these Acts by identifying potential impacts to migratory birds and eagles within applicable NEPA documents (when there is a federal nexus) or a Bird/Eagle Conservation Plan (when there is no federal nexus). Proponents should implement conservation measures to avoid or minimize the production of project-related stressors or minimize the exposure of birds and their resources to the project-related stressors. For more information on avian stressors and recommended conservation measures see <https://www.fws.gov/birds/bird-enthusiasts/threats-to-birds.php>.

In addition to MBTA and BGEPA, Executive Order 13186: *Responsibilities of Federal Agencies to Protect Migratory Birds*, obligates all Federal agencies that engage in or authorize activities that might affect migratory birds, to minimize those effects and encourage conservation measures that will improve bird populations. Executive Order 13186 provides for the protection of both migratory birds and migratory bird habitat. For information regarding the implementation of Executive Order 13186, please visit <https://www.fws.gov/birds/policies-and-regulations/executive-orders/e0-13186.php>.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Code in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Note: IPaC has provided all available attachments because this project is in multiple field office jurisdictions.

Attachment(s):

- Official Species List
 - USFWS National Wildlife Refuges and Fish Hatcheries
 - Migratory Birds
 - Marine Mammals
 - Wetlands
-

OFFICIAL SPECIES LIST

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Northern Alaska Fish & Wildlife Field Office

101 12th Avenue

Room 110

Fairbanks, AK 99701-6237

(907) 456-0203

This project's location is within the jurisdiction of multiple offices. However, only one species list document will be provided for all offices. The species and critical habitats in this document reflect the aggregation of those that fall in each of the affiliated office's jurisdiction. Other offices affiliated with the project:

Anchorage Fish & Wildlife Field Office

4700 Blm Road

Anchorage, AK 99507

(907) 271-2888

PROJECT SUMMARY

Project Code: 2023-0107750

Project Name: Unalakleet Water Distribution and services replacement

Project Type: Federal Grant / Loan Related

Project Description: as described

Project Location:

The approximate location of the project can be viewed in Google Maps: <https://www.google.com/maps/@63.8765028,-160.7914911297729,14z>



Counties: Nome County, Alaska

ENDANGERED SPECIES ACT SPECIES

There is a total of 5 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries¹, as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

-
1. [NOAA Fisheries](#), also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

MAMMALS

NAME	STATUS
Polar Bear <i>Ursus maritimus</i> There is final critical habitat for this species. Your location overlaps the critical habitat. <i>This species is also protected by the Marine Mammal Protection Act, and may have additional consultation requirements.</i> Species profile: https://ecos.fws.gov/ecp/species/4958	Threatened
Wood Bison <i>Bison bison athabasca</i> No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/8362	Threatened

BIRDS

NAME	STATUS
Short-tailed Albatross <i>Phoebastria (=Diomedea) albatrus</i> No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/433	Endangered
Spectacled Eider <i>Somateria fischeri</i> There is final critical habitat for this species. Your location overlaps the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/762	Threatened
Steller's Eider <i>Polysticta stelleri</i> Population: AK breeding pop. There is final critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/1475	Threatened

CRITICAL HABITATS

There are 2 critical habitats wholly or partially within your project area under this office's jurisdiction.

NAME	STATUS
Polar Bear <i>Ursus maritimus</i> https://ecos.fws.gov/ecp/species/4958#crithab	Final
Spectacled Eider <i>Somateria fischeri</i> https://ecos.fws.gov/ecp/species/762#crithab	Final

USFWS NATIONAL WILDLIFE REFUGE LANDS AND FISH HATCHERIES

Any activity proposed on lands managed by the [National Wildlife Refuge](#) system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGE LANDS OR FISH HATCHERIES WITHIN YOUR PROJECT AREA.

MIGRATORY BIRDS

Certain birds are protected under the Migratory Bird Treaty Act¹ and the Bald and Golden Eagle Protection Act².

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implementing appropriate conservation measures, as described [below](#).

There are migratory birds in your project area. Please refer to [Alaska's Bird Nesting Season](#) for recommendations to minimize impacts to migratory birds, including eagles.

-
1. The [Migratory Birds Treaty Act](#) of 1918.
 2. The [Bald and Golden Eagle Protection Act](#) of 1940.
 3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

The birds listed below are birds of particular concern either because they occur on the [USFWS Birds of Conservation Concern \(BCC\)](#) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ [below](#). This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the [E-bird data mapping tool](#) (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found [below](#).

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Aleutian Tern <i>Sterna aleutica</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9599	Breeds May 1 to Aug 31
Bald Eagle <i>Haliaeetus leucocephalus</i> This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds Feb 1 to Sep 30

NAME	BREEDING SEASON
Black Scoter <i>Melanitta nigra</i> This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds elsewhere
Black-legged Kittiwake <i>Rissa tridactyla</i> This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds elsewhere
Common Eider <i>Somateria mollissima</i> This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds Jun 1 to Sep 30
Hudsonian Godwit <i>Limosa haemastica</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 15 to Jul 31
Lesser Yellowlegs <i>Tringa flavipes</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9679	Breeds May 1 to Aug 15
Long-tailed Duck <i>Clangula hyemalis</i> This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/7238	Breeds elsewhere
Red-breasted Merganser <i>Mergus serrator</i> This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds elsewhere
Red-necked Phalarope <i>Phalaropus lobatus</i> This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds elsewhere
Red-throated Loon <i>Gavia stellata</i> This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds elsewhere
White-winged Scoter <i>Melanitta fusca</i> This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds elsewhere

PROBABILITY OF PRESENCE SUMMARY

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is $0.25/0.25 = 1$; at week 20 it is $0.05/0.25 = 0.2$.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

Breeding Season (■)

Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)

Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

No Data (—)

A week is marked as having no data if there were no survey events for that week.

Survey Timeframe

Non-BCC
Vulnerable

Additional information can be found using the following links:

- Birds of Conservation Concern <https://www.fws.gov/program/migratory-birds/species>
- Measures for avoiding and minimizing impacts to birds <https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds>
- Nationwide conservation measures for birds <https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf>

MIGRATORY BIRDS FAQ

Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

[Nationwide Conservation Measures](#) describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. [Additional measures](#) or [permits](#) may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the list of migratory birds that potentially occur in my specified location?

The Migratory Bird Resource List is comprised of USFWS [Birds of Conservation Concern \(BCC\)](#) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the [Avian Knowledge Network \(AKN\)](#). The AKN data is based on a growing collection of [survey, banding, and citizen science datasets](#) and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle ([Eagle Act](#) requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the [Rapid Avian Information Locator \(RAIL\) Tool](#).

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the [Avian Knowledge Network \(AKN\)](#). This data is derived from a growing collection of [survey, banding, and citizen science datasets](#).

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering or migrating in my area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may query your location using the [RAIL Tool](#) and look at the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are [Birds of Conservation Concern](#) (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the [Eagle Act](#) requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the [Northeast Ocean Data Portal](#). The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the [NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf](#) project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the [Diving Bird Study](#) and the [nanotag studies](#) or contact [Caleb Spiegel](#) or [Pam Loring](#).

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to [obtain a permit](#) to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

MARINE MAMMALS

Marine mammals are protected under the [Marine Mammal Protection Act](#). Some are also protected under the Endangered Species Act¹ and the Convention on International Trade in Endangered Species of Wild Fauna and Flora².

The responsibilities for the protection, conservation, and management of marine mammals are shared by the U.S. Fish and Wildlife Service [responsible for otters, walruses, polar bears, manatees, and dugongs] and NOAA Fisheries³ [responsible for seals, sea lions, whales, dolphins, and porpoises]. Marine mammals under the responsibility of NOAA Fisheries are **not** shown on this list; for additional information on those species please visit the [Marine Mammals](#) page of the NOAA Fisheries website.

The Marine Mammal Protection Act prohibits the take of marine mammals and further coordination may be necessary for project evaluation. Please contact the U.S. Fish and Wildlife Service Field Office shown.

-
1. The [Endangered Species Act](#) (ESA) of 1973.
 2. The [Convention on International Trade in Endangered Species of Wild Fauna and Flora](#) (CITES) is a treaty to ensure that international trade in plants and animals does not threaten their survival in the wild.
 3. [NOAA Fisheries](#), also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

NAME

Polar Bear *Ursus maritimus*

Species profile: <https://ecos.fws.gov/ecp/species/4958>

WETLANDS

Impacts to [NWI wetlands](#) and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local [U.S. Army Corps of Engineers District](#).

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

THERE ARE NO WETLANDS WITHIN YOUR PROJECT AREA.

IPAC USER CONTACT INFORMATION

Agency: Alaska Department of Environmental Conservation
Name: Adele Fetter
Address: 555 Cordova Street
City: Anchorage
State: AK
Zip: 99501
Email: adele.fetter@alaska.gov
Phone: 9072697428

LEAD AGENCY CONTACT INFORMATION

Lead Agency: Environmental Protection Agency

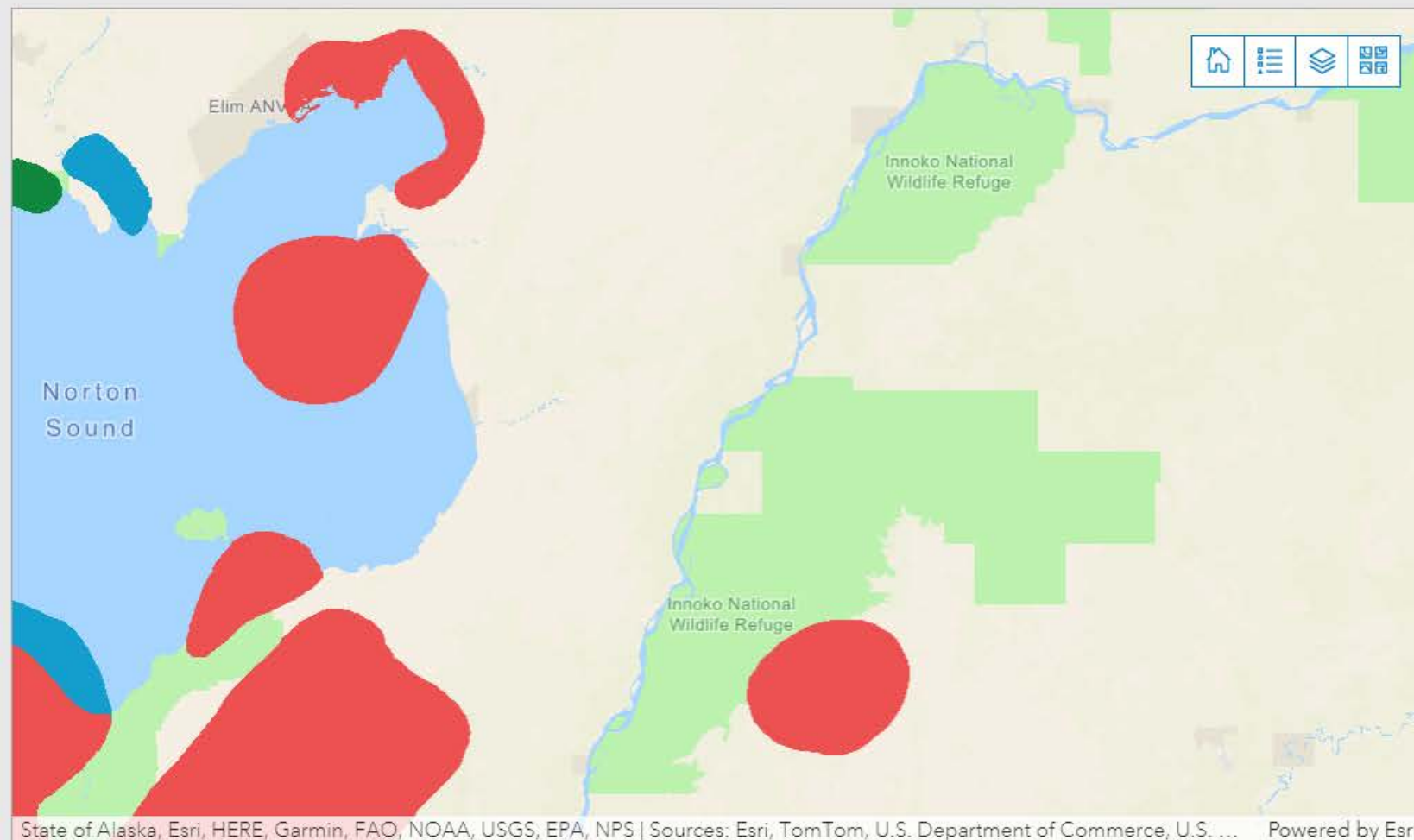


Important Bird Areas - National Audubon Society

[Home](#)[IBA Explorer](#)[Public Reports](#)

** Select

** Selection required

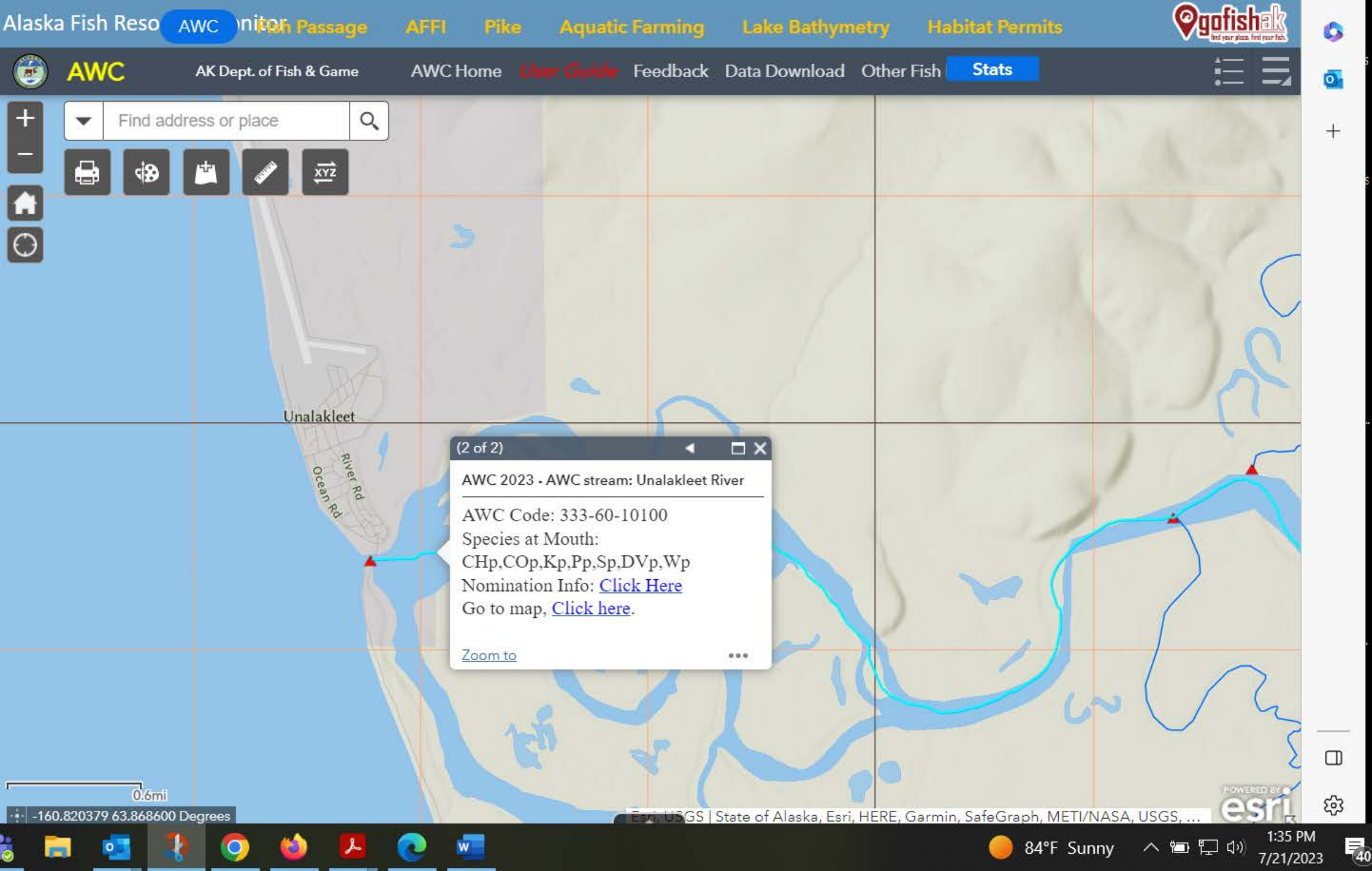


IBA Sites

Site Name: Andreafsky Wilderness
Site ID: 1032
Status: Recognized
Priority: Global
eBird Link: [View](#)
State: [Alaska](#)
Download Site Report: [View](#)

Site Name: Bluff Colonies
Site ID: 1069
Status: Recognized
Priority: State
eBird Link: [View](#)
State: [Alaska](#)
Download Site Report: [View](#)

Site Name: East Norton Sound
Site ID: 1030
Status: Recognized
Priority: Global
eBird Link: [View](#)
State: [Alaska](#)
Download Site Report: [View](#)





Legend



Contaminated Sites

- Active
- Cleanup Complete
- Cleanup Complete - Institutional Controls
- Informational

Groundwater Plumes

- Petroleum Contaminants
- Chlorinated Solvents
- PFAS Compounds
- Other
- Metals

Tax Parcels

Kenai Peninsula Borough
Assessor's parcel set

txparcels



Facilities Summary

Releases

Waste Managed

Pollution Prevention

Potential Risk

Chemicals

Open full version of

TRI Toxics Tracker

with more data and
expanded capabilities.Most Recent Reporting
Year: 2021

Facility locations may not fall exactly within the boundary of your selected location. To view data about an individual facility, click on the facility location and then the green checkmark button. Next, select "Facilities Summary" from the left menu to find basic facility information, an EJ report and demographic statistics.

Total Releases by
Facility in 2021

- ☐ 0 lb
- ☐ >0 - 100 lb
- ☐ 101 - 10,000 lb
- ☐ 10,001 - 100,000 lb
- ☐ 100,001 - 1,000,000 lb
- ☐ >1,000,000 lb

Dot size represents:

- ☒ Releases (lb)
- ☐ Potential Risk Score

Dot color represents:

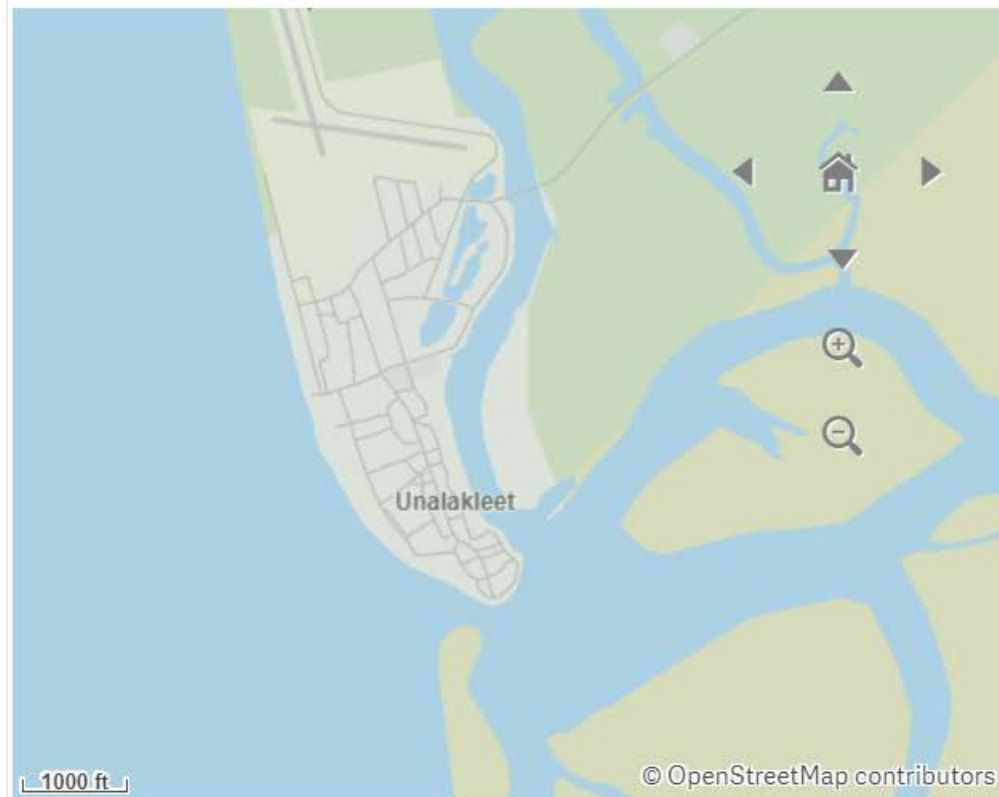
- ☒ Releases (lb)
- ☐ Industry Sector

Map Options

- ☐ Show other EPA-regulated facilities
- ☐ Show demographic data

Default View

Satellite View



Appendix D

Consultation and Coordination



Design Kickoff Meeting

Date: May 9, 2022
Project: Village Safe Water – Unalakleet Water Main Replacement Project
Project No: CRW# 31309.00
Subject: Kickoff Meeting

1. Team

Attendees	Role
Aaron Wheatall	VSW Project Manager
Moe Zamarron	Unalakleet City Manager
Sean Lee	NSHC Sanitation Manager/RMW Supervisor
Karl Hulse	Contract Manager/Back-up Project Manager/QC Review
Steven Hebnes	Project Manager & Construction Manager
Susan Mitchell	CE2 Project Manager
Mike Erdman	Civil – Water Services / Home Connections (CE2)

2. Project Description

The City of Unalakleet (City) was one of the first rural Alaska communities to receive piped water and sewer in the 1960s and now is in dire need of a new water distribution system. The existing system consists of five circulating, insulated arctic pipe loops constructed in phases over the last 50+ years; it includes 26,000 linear feet of buried mainline and 250 residential service connections. Service lines are a combination of copper and plastic within insulated arctic pipe ducts (copper lines are replaced as they freeze/fail). Many service lines were originally designed to circulate via the use of pit orifices; over time, these have corroded or eroded, reducing circulation to the extent the lines regularly freeze and break. Further, Unalakleet's corrosive water eats away at the copper service lines causing pitting and endless leaks, a major threat to the water system and public health.

Key Initial Project Tasks:

- Schedule Discussion
- Review/propose water main replacement alignment.
- 35% Design based on DAR recommended alignment.
- Develop a community survey/Locate existing buried utilities along the proposed alignment.
- Building service connection assessment and inspections.

3. Deliverables

- Design Analysis Report
- 35% Design Drawings
- 65% Design Drawings and Draft 49 division CSI specifications.
- 65% Construction cost estimate.

May 9, 2022
Village Safe Water – Unalakleet Water Main Replacement Project
Kickoff Meeting

- 95% Design Plans and Final Specifications
- Fire marshall, ADEC plan review submittals at 95% Design
- 100% Plans/IFC & Specifications

4. Schedule

See attached draft.

From: [Wheatall, Aaron B \(DEC\)](#)
To: [Olson, Becca K \(DEC\)](#)
Cc: [Fetter, Adele J \(DEC\)](#)
Subject: FW: Unalakleet Corps Permit Info
Date: Tuesday, November 19, 2024 9:12:18 AM
Attachments: [image001.png](#)

Hello Becca and Adele,

Please see email below from Solstice determining a core permit was not necessary.

Thanks,



[Aaron Wheatall, E.I.T.](#)

Village Safe Water Engineering Associate
555 Cordova Street, 4th Floor
Anchorage, AK 99501-2617
Work: 907-269-4967
<http://dec.alaska.gov/water/village-safe-water>

From: Karl Hulse <Karl.Hulse@crweng.com>
Sent: Monday, November 18, 2024 4:59 PM
To: Wheatall, Aaron B (DEC) <aaron.wheatall@alaska.gov>
Subject: FW: Unalakleet Corps Permit Info

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Aaron- See input from Solstice below.

Thanks,

Karl

From: Robin Reich <robin@solsticeak.com>
Sent: Monday, November 18, 2024 4:48 PM

To: Karl Hulse <Karl.Hulse@crweng.com>

Subject: RE: Unalakleet Corps Permit Info

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Karl-

As mentioned on the phone, we found that the project falls under the Corps of Engineers' nationwide permit #58. Utility Line Activities for Water and Other Substances (<https://www.poa.usace.army.mil/Portals/34/docs/regulatory/2024/NWP/NWP%2058.pdf>). Because the footprint of the project within wetlands is less than 0.1 acres, we assert that no pre-construction notification (PCN) is needed. This is further supported because the project has National Historic Preservation Act Section 106 concurrence from the State Historic Preservation Act, and since it has a National Environmental Policy Act (NEPA) document completed, it must have no adverse effect on species listed under the Endangered Species Act.

I will send more formal memorandum, but it looks like the project should be good to go.

It would be helpful to get the ESA consultation proof from VSW, but I can ask Adele, if that is easier.

Robin Reich
Solstice Alaska Consulting, Inc.
Office: 907.929.5960
Cell: 907.903.0597



THE STATE
of **ALASKA**
GOVERNOR MICHAEL J. DUNLEAVY

8.1.23

2023 00889 / 330-2R DEC
**Department of Environmental
Conservation**

DIVISION OF WATER

555 Cordova Street
Anchorage, Alaska 99501
Main: 907.269.7502
Fax: 907.269.7509
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20 July 2023

Ms. Judith E. Bittner
State Historic Preservation Officer
Office of History and Archeology, Department of Natural Resources
550 West 7th Avenue, Suite 1310
Anchorage, AK 99501

Re: Unalakleet Replacement of the Water Distribution System and water service lines project

Dear Ms. Bittner:

The Alaska Department of Environmental Conservation (DEC) Village Safe Water (VSW) program is proposing to replace the water distribution system and service lines in Unalakleet, Alaska. Funding for this project is from the Environmental Protection Agency. Pursuant to 36 CFR 800.4(d)(1), implementing regulations of Section 106 of the National Historic Preservation Act, DEC, acting as the lead agency, finds that there would be no adverse impact from the proposed project.

The proposed project will replace all water mains and service lines. All 5 water main loops will be replaced with 6-inch HDPE Arctic pipe. Portions of the mains for each loop will be re-routed from their existing layout in order to lie within established easements and rights-of-way. All water main valves and hydrants along the mains will be replaced as well as the flow meter, temperature and pressure gauges, and pressure booster pumps for each water loop. The service line work will replace all service lines with one-inch HDPE and carrier pipes with 4-inch HDPE Arctic pipe. The project will also repair or replace Arctic boxes and install or replace circulation pumps in all homes. The Area of Potential Effect is shown on the attached figures.

DEC has researched the online Alaska Heritage Resources Survey (AHRS) database and found the Bureau of Indian Affairs (BIA) Unalakleet School (UKT-00055) as well as the Unalakleet-Nome Trail (UKT-00030) are in the area of the proposed project. The BIA Unalakleet school is listed as 108-NS on the attached figure. The building does not appear to have service currently, and therefore is not planned to receive service. Based on the mapping and the use of rights-of-ways, little to none of the Unalakleet-Nome Trail may be in the area of the proposed project. Based on this information DEC concludes that the proposed project will not have an adverse effect on Historic Properties. Please contact adele.fetter@alaska.gov or at the address above with your concurrence or comments.

Sincerely,

Adele Fetter
Environmental Impact Analyst, DEC, Division of Water

Attached: Project Figures



From: [Frank Wayne. Katchatag](#)
To: [Fetter, Adele J \(DEC\)](#)
Subject: 2022-05-09
Date: Friday, July 21, 2023 11:11:54 AM

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Sent from my iPhone. Thank you Adele
I agree that there is no impacts to the Nome trail.