Washeteria Replacement

Preliminary Engineering Report

Beaver, Alaska

Owner:
Beaver Village
P.O. Box 24029
Beaver, Alaska 99724

Prepared for:
Village Safe Water
555 Cordova Street, 4th Floor
Anchorage, Alaska 99501

Prepared by:
Kuna Engineering
3111 C Street, Suite 300
Anchorage, Alaska 99503

FINAL REPORT
May 21, 2019

STATE OF ALASKA
49TH
DANIEL E. NICHOLS
CE 11012
5/21/2019
REGISTERED PROFESSIONAL ENGINEER

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ABBREVIATIONS

ADA ..... Americans with Disabilities Act
ADEC..... Alaska Department of Environmental Conservation
BIA ..... Bureau of Indian Affairs
CYD ..... Cubic Yards
DCCED ..... Department of Commerce, Community, and Economic Development
EA ..... Each
EPA ..... Environmental Protection Agency
ft ..... Feet
GFCI ..... Ground Fault Circuit Interrupter
gpcd ..... Gallons per Capita Per Day
gpd ..... Gallons per Day
gpm ..... Gallons per Minute
In ..... Inch
kWh ..... Kilowatt Hour
lbs ..... Pounds
LS ..... Lump Sum
mg/l ..... milligrams per liter
n/a ..... Not Applicable
No ..... Number
O&M ..... Operations and Maintenance
PER ..... Preliminary Engineering Report
PVC ..... Polyvinyl Chloride
ROW ..... Right of Way
RUBA ..... Rural Utility Business Advisor
SHPO ..... State Historical Preservation Office
SQFT ..... Square Foot
TCC ..... Tanana Chiefs Conference
UBC..... Unformed Building Code
USACE..... US Army Corps of Engineers
USDA-RUS..... US Department of Agriculture-Rural Utilities Service
USFWS..... US Fish and Wildlife Service
VOC ..... Volatile Organic Compounds
VSW..... Village Safe Water
WTP ..... Water Treatment Plant
°F ..... Degrees Fahrenheit

1.0 PROJECT PLANNING

Village Safe Water (VSW) and Beaver Village contracted with Kuna Engineering on March 14, 2018 to develop a Preliminary Engineering Report (PER) for improving the water treatment plant (WTP), washeteria, and utilidor. The community's current washeteria has deteriorated significantly enough to endanger community access to safe sanitation. The project was funded by the US Environmental Protection Agency (EPA) and the State of Alaska. This PER was prepared using US Department of Agriculture, Rural Utilities Service (USDA-RUS) Bulletin 1780-2.

The purpose of the PER is to provide an engineering assessment of the existing WTP/washeteria, assess needs, evaluate improvement alternatives, select a preferred alternative, develop a project plan, and provide recommendations.

The PER was developed with the help of the following participants:

- Daniel Nichols, P.E. (Kuna Engineering, Project Manager)
- Susan Randlett (VSW, Project Manager)
- Rhonda Pitka (Beaver Village, Tribal Chief)
- Aaron Petruska (Beaver Village, Assistant Water Treatment Operator)
- Selina Petruska (Beaver Village, Utility Clerk)
- Paul Williams, Jr. (Beaver Village, Cultural Specialist)
- Paul Williams, Sr. (Beaver Village, Elder/Past Tribal Chief)
- Wesley Shales (Tanana Chiefs Conference, Remote Maintenance Worker)
- Brian Bearden (Tanana Chiefs Conference, Remote Maintenance Work Program Manager)

a. Location

Beaver is located along the north bank of the Yukon River, approximately 60 air miles southwest of Fort Yukon and 110 miles north of Fairbanks, at 66.3593° N Latitude and 147.3974° W Longitude. Its Public Land Survey System description is Section 30, Township 18N, Range 02E of the Fairbanks Meridian, Alaska (United States Geological Survey [USGS] quadrant map Fort Yukon B-6).

Beaver is off the road system and is only accessible by air and water. There is a state-maintained public airport with a 4,600-foot by 150-foot gravel runway. There are daily flights from Fairbanks. There is no dock but there is occasional barge service in the summer months. The Yukon River is ice-free from mid-June to mid-October.

Figure 1.1: Location Map

b. Environmental Resources

i. Climate

Beaver is located within the continental subarctic climate zone, characterized by extreme temperature differences. This is typical for Interior Alaska. The average high temperature for July is 65-72 °F. The average low temperature in January is below zero. Extended periods of -50 to -60 °F are common. Record highs have reached 90 °F and record lows have reached -70 °F, making it one of the coldest locations in Alaska.

ii. Topography, Geology, and Soils

The community sits on a bluff approximately 20 feet above the Yukon River. The highest elevations are around the water treatment plant, the washeteria, and the power plant. There is a slough directly east of the community and low-lying areas surrounding the community.

The Yukon Flats region around Beaver consists of deep alluvial floodplain deposits. Alluvial sediment depths in Beaver are unknown but are estimated to be 400 to 500 feet. There are many low-lying areas, swales, and oxbow lakes within the area. These are silt filled and organic rich. Silt deposits of this kind are laterally discontinuous and vary in depth.

The area is subarctic with discontinuous permafrost. There is no permafrost data within the community but maximum depths in the area exceed 200 feet. The active layer, the layer that freezes and thaws

seasonally, varies depending on ground cover and snow depth. It can be two to four feet in undisturbed areas and ten feet in areas such as roads, which are kept clear of snow and vegetation.

No geotechnical investigations have been found within the project area. It is assumed that undisturbed sites within the community would have a thin organic mat over organic silts overlaying sandy silts and silty sands. Geotechnical reports in the area report similar conditions; 0-5 feet of organics and silty sands over sandy gravel layer more than 30 feet thick. A geotechnical investigation should be done at the proposed site prior to any new construction.

One material site has been in use for various local projects for several years. The source consists of gravel deposits on the north side of the Yukon River, east of Joe Guay Slough. Access is along the existing trail following the bank of the Yukon River from Second Avenue. The source is located approximately {5,000 feet) west of the Second Avenue terminus and trail head. The maximum travel distance, to the road terminus at the landfill site, would be about 4.3 kilometers (2.7 miles).

In 2005, a gravel source was developed adjacent to the airport as part of the lagoon construction project north of the community. This potential source would entail a shorter travel distance and minimal access improvements to facilitate transport, as it is located centrally to the road alignment. The gravel appears to be adequate as structural fill. All mineral resources in the area are owned by Doyon, Ltd. Doyon, Ltd. expects that there are additional gravel deposits adjacent to the airport. Doyon, Ltd. typically sells gravel to its tribes at a minimal price. A geotechnical investigation should confirm gravel sites around the airport. Permitting may be required if a gravel source is developed.

The community well, located along the river bank, provides some soil information. The well log shows silt to six feet deep, then gravels to 70 feet where permafrost was found.

During the 2018 site visit, two holes were drilled using a two-inch hand auger. The holes were similar. Silts and silty sands were found to a depth of five feet when gravel was encountered. The auger could not advance into the gravel due to the rock size. Locals report they find permafrost approximately six feet deep in the cemetery.

iii. Wetlands

The US Fish and Wildlife Service (USFWS) National Wetlands Inventory map shows wetlands around the community. The Yukon River and a slough east of the community are listed as Riverine wetlands. The community is surrounded by freshwater ponds, freshwater emergent wetlands, and forested/shrub wetlands. There are no mapped wetlands within the community or around the project area.

There is a potential of wetlands in several of the undeveloped lots within the community. Any new construction in an undeveloped area will have to be evaluated for wetland impact.

Any proposed project would be under ¼ acre and would have minimal impact to the surrounding wetlands.

iv. History and Culture

Gold discoveries in the Chandalar region in 1907 led to the founding of Beaver. It was established as the Yukon River terminus for miners heading north to the gold fields. The Alaska Road Commission built a trail from Beaver north to Caro on the Chandalar River around 1907, and three freight companies operated on the trail, commonly known as Government Road. In 1910, Thomas Carter and H.E. Ashelby established a store at Beaver. In 1911, about the time the gold rush was over, Frank Yasuda, a Japanese immigrant who had traded at Point Barrow and prospected in the Brooks Range, arrived with a group of Eskimos and became a partner in the trading post. They served the remaining mines in the region, supplied riverboats with firewood, and traded with Eskimo and Indian fur trappers. A post office was established in 1913, and a second trading post opened in the early 1920s. The first Beaver school opened in 1928, and an airstrip was built in the 1930s. Beaver's population remained stable from 1950 through the 1970s. In 1974, the village council purchased the local store and set it up as a cooperative, with villagers holding shares of stock. The population of Beaver is predominantly mixed Gwitchin/Koyukuk Athabascan and Inupiat Eskimo. Subsistence is an important source of food items.[1]

Beaver Village is a federally recognized tribe. The Village Corporation is Beaver Kwit'chin Corporation and Doyon, Limited is the Alaska Native Corporation for the region. Beaver is part of the Tanana Chiefs Conference (TCC).

In 2003, an archaeological survey of the community was conducted[2]. The survey found two potential historic buildings. The first is Frank Yasuda's house built around 1912. The 12- by 16-foot log structure with a sod roof is likely eligible under 36 CFR 60.4(c) because it is "associated with the lives of persons significant to our past." The sod roof has since collapsed and there are no plans to repair the structure. The second is the old Bureau of Indian Affairs (BIA) school built in 1928. The two-story, wood-frame building is likely eligible under 36 CFR 60.4(a) because it is "associated with events that have made a significant contribution to the broad patterns of our community."

Frank Yasuda's trading post was not listed but is also a potential historic building. It is a log structure with a sod roof. The building walls and roof are deteriorating, and it is unsafe to enter. The building would be eligible under 36 CFR 60.4(b).

During the 2018 site visit, another potential site was observed. There is a 15-foot by 30-foot hole, sloping down to a depth of approximately two feet. It is located about 30 feet east of WTP's northeast corner. The shape suggests a building footprint. There are two deeper holes within that hole. One is approximately three feet deeper and the top of a 55-gallon steel drum is visible at the bottom. The other hole opens into an underground chamber. The chamber appears to be approximately five feet deep. Exposed insulation board and chicken wire were visible within the chamber. It appears to be manmade and may be a cellar that is collapsing.

Several elders and the community cultural specialists were consulted. No one remembered a building in that location or knew what its use may have been.

[1] DCRA Information Portal, *Beaver, Alaska Culture and History*. https://dcced.maps.arcgis.com. Accessed February 6, 2019

[2] Walking Dog Archaeology. 2003 Archaeological Survey of the Sanitation Improvement Project Area in Beaver, Alaska (VSW Project 16306/CRW No. 9966). November 2003.

v. Wildlife

The USFWS Threatened and Endangered Species List indicates that there are no threatened or endangered species in the project area.

Beaver is surrounded by the Yukon Flats National Wildlife Refuge. The proposed project is not anticipated to negatively impact the refuge.

vi. Floodplains, Erosion, and Seismic Hazards

Flood

There is flooding from the Yukon River. The US Army Corps of Engineers (USACE) flood of record was in 1964 and reached an elevation of 362.5 feet. The door sill of the west side of the current school serves as the high-water mark for the 362.5-foot elevation. The entire community, except for along C Street between 1st and 2nd Avenues, was flooded. The finished floor elevation of any new construction should be above the 362.5-foot elevation.

Erosion

There are no erosion issues that would affect the project.

Seismic Hazards

Beaver is in the Yukon Flats area which is a Seismic Zone 3 in the Uniform Building Code (UBC). The largest earthquakes in this zone could have a magnitude greater than 6.0 on the Richter scale, with a potential for major damage to structures. However, according to the Tectonic Map of Alaska, there are no major mapped faults in the Yukon Flats Region.

c. Populations Trends

The population of Beaver has varied between 84 and 103 for the last 80 years of census data. The population was stable from 1950s through 1970s. The population has stayed steady at 84 for the last two US censuses. In 2017, the State of Alaska Department of Labor estimated a population of 63, but this isn't an official US census count.

Table 1.1: Population Trends

Year	Population
1930	103
1940	88
1950	101
1960	101
1970	101
1980	66
1990	103
2000	84
2010	84
2017	63

d. Community Engagement

VSW has periodically engaged the community and tribal council on water and wastewater issues. VSW initiated the project at the request of the Tribal Council.

On October 2, 2018, Daniel Nichols met with the Tribal Chief to discuss the project and get input on alternatives and site selection. Tribal Chief selected the preferred site and alternative. The Tribe reviewed and comment on PER submittals. The Tribal Council approved the preferred alternative and proposed project. Community resolutions and agency approvals are found in the appendix.

2.0 EXISTING FACILITIES

a. Location Map

Full size location maps of the project area are found in Appendix A. Photographs of the area are in Appendix B.

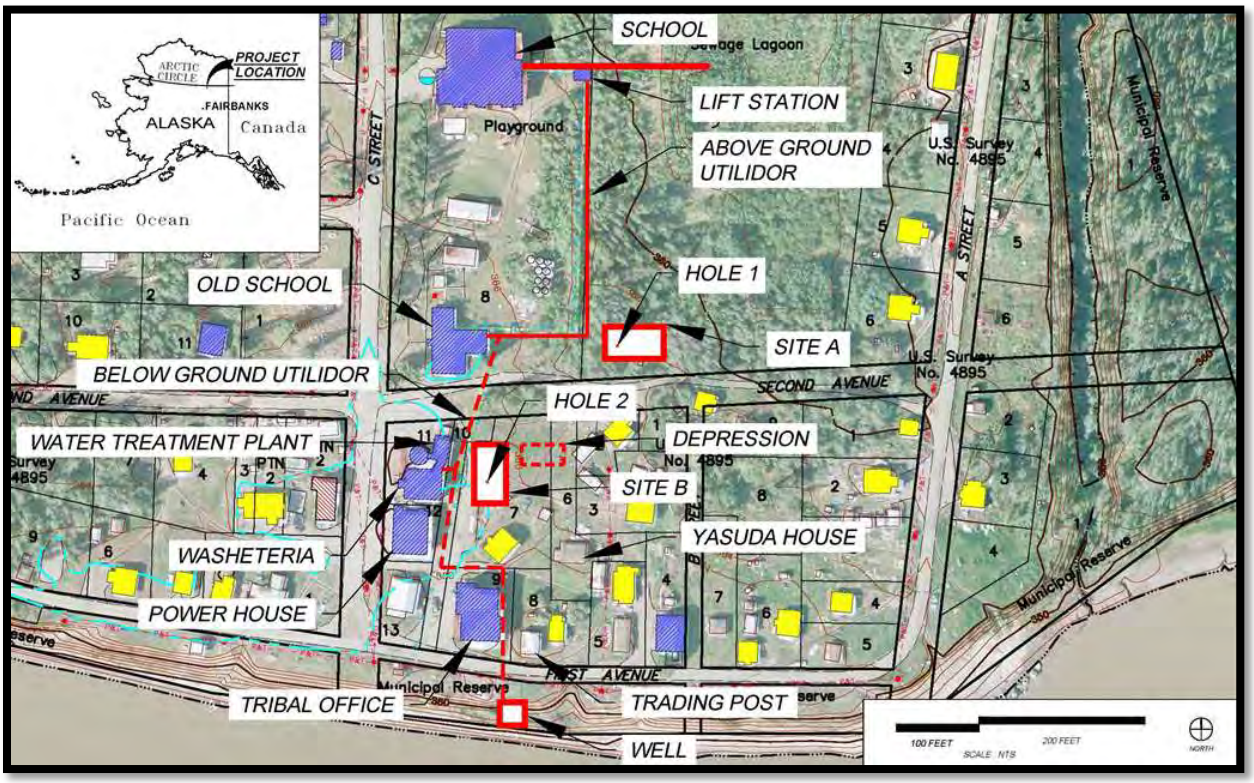


Figure 2.1: Project Area

b. Facilities History

- In 1976, the WTP/washeteria was constructed. Since then it has been rehabilitated and upgraded over the years to be become the existing WTP/washeteria.
- In 1985, when the new school was built, the utilidor between the current village office/clinic and the School was built to tie the School into the water system.
- In 1995, a new well was drilled between two previous wells. It is located along the shore of the Yukon River. The water is high in iron (10-14 milligrams per liter [mg/l]) and slightly high in manganese (approximately 1.15 mg/l).
- In 1996, part of the utilidor was replaced between the WTP and the current village office/clinic.
- In 1999, the washeteria had a limited remodel to comply with Americans with Disabilities Act (ADA) requirements.
- In 2005, a sewage lagoon for honey buckets was constructed.
- In 2006, improvements were made to the wellhead. These included raising the wellhead casing aboveground, filling around it with gravel, and constructing a wellhouse. The Alaska Department of Environmental Conservation (ADEC) then determined the well to be groundwater.

- In 2006, a 66,000-gallon water storage tank was built.
- In 2008, the water treatment system was rehabilitated.
- Around 2014, the WTP/washeteria was converted from oil-fired boilers to heat recovery from the power plant located next door. The two large boilers were removed and only a smaller backup boiler remains. The village reports saving approximately 11,600 gallons of fuel oil per year. This is an Operations and Maintenance (O&M) savings for the WTP/washeteria of $40,000 per year.

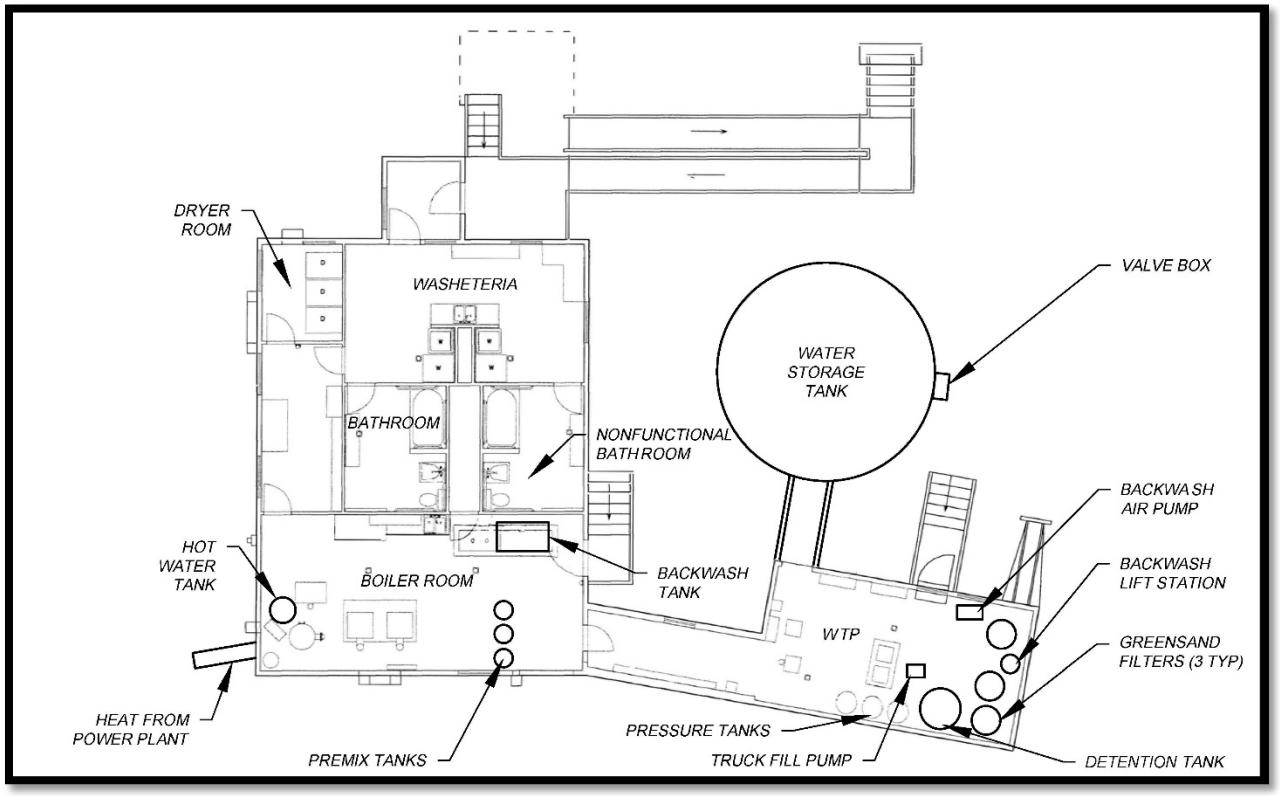


Figure 2.2: Existing WTP/Washeteria

c. Conditions of Existing Facilities

Raw Water Piping: The current water source is the well by the river. The well is connected to the WTP by a 400-foot underground utilidor. This underground utilidor runs past the office and power plant. It carries the raw water from the well to the WTP as well as carrying water service and sewer lines for the power plant, office and washeteria. It ends at the junction box near the old school. It is heated by glycol lines from the WTP.

Water Distribution: The washeteria is connected to the WTP through a corridor. There are only three water services: the power plant, the village office/clinic, and the school. The village office/client and school have circulating water pipes, but the power plant does not circulate. There is a water point at the WTP. Residents are served by a water haul system. Houses have buried sewage tanks and interior water cisterns.

Sewer Distribution: Outside the washeteria, there are only two sewer services; the power plant and village office/clinic. Both buildings have their own interior lift stations to pump sewage into the force sewer main at the washeteria. There is a sewage lagoon behind the school. All sewage is pumped into a terminal lift station before it goes into the lagoon. The lift station and lagoon are located on village land. The school sewage dumps directly into the terminal lift station through its own piping. Most residents have sewage holding tanks. The village pumps the tanks and hauls sewage to a sewage lagoon outside the village.

Aboveground Utilidors There is a 500-foot above-ground utilidor that runs between the WTP/washeteria and the lagoon, which begins at the junction box near the old school. This utilidor has circulating water mains for the school and a sewer force main. The above-ground utilidor is heated by glycol lines from the new school. The utilidor is a plywood insulated box and rests directly on the ground.

Belowground Utilidor: There is a 400-foot buried utilidor that runs between the well and the WTP/washeteria. This section contains the water raw pipe, circulating water service lines, force sewer service lines, and glycol lines. The utilidor then continues underground for 200-feet until the junction box at the old school. It contains the school circulating water service, force sewer main, and glycol lines. The utilidor is a plywood insulated box with 4-5 feet of cover. The village heats this utilidor by glycol lines from the WTP/washeteria.

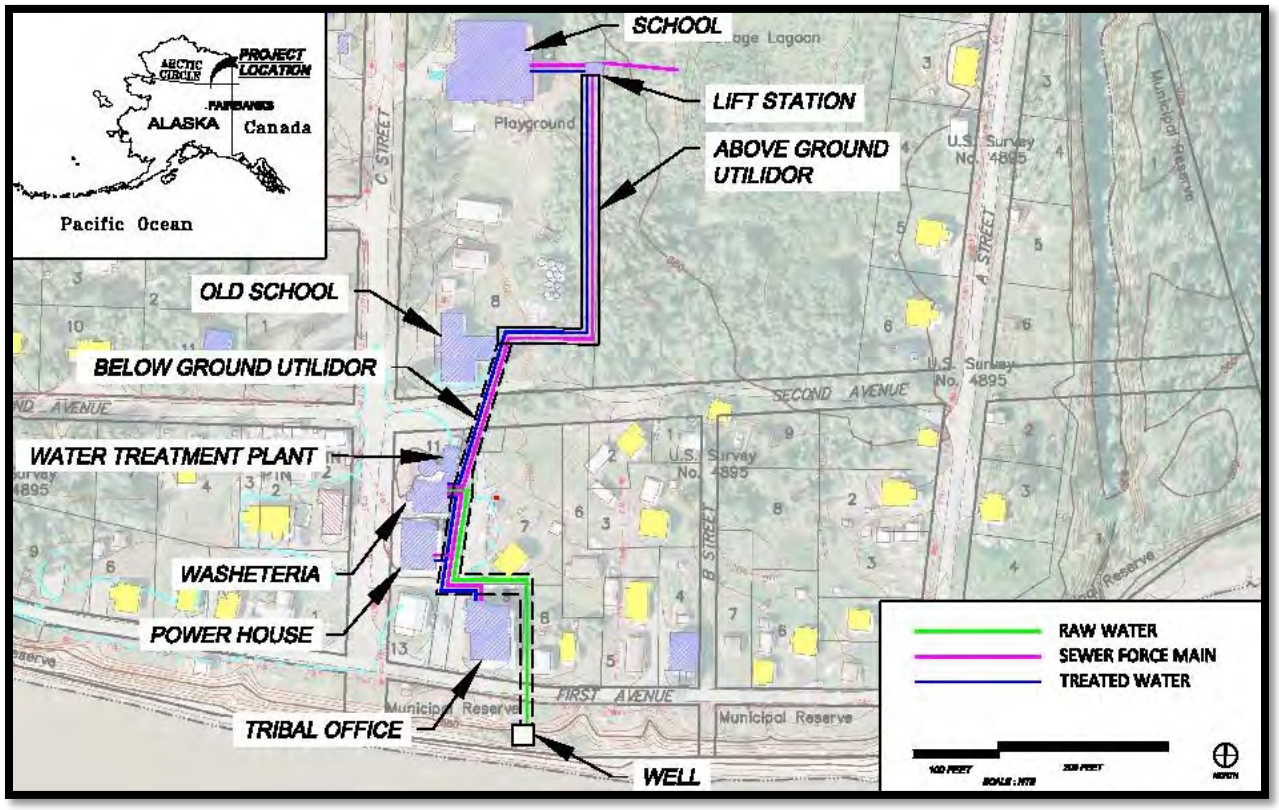


Figure 2.3: Existing Utilidor Routing

Waste Heat System: The power plant provides waste heat to the WTP/washeteria. It also provides to circulating waste heat lines for the belowground utilidor. One line is in the utilidor from the WTP/washeteria to the well. The other line is from the WTP/washeteria to junction box at the old school. There appears to have significant available waste heat for proposed WTP/washeteria alternatives.

WTP: Raw water is pretreated with potassium permanganate and calcium hypochlorite to oxidize iron. It then goes to a detention tank. The water is then filtered through three greensand filters. The water is again chlorinated and piped into the water storage tank. Water is treated in three-hour batches, typically two batches at a time. All treatment processes are in the WTP building except for the chemical mixing tanks, backwash tank, and lift station, which are in the washeteria's boiler room.

Table 2.1: Summary of Existing Design Conditions

Existing Design Criteria	Value
Current Services	3
Current Population	84
Design Population	138
Daily Design Demand (gallons per day [gpd])	11,200
Maximum Day Water Demand (gallons per minute [gpm])	19.4
Peak Hour Water Demand (gpm)	38.9
Water Storage (gallons)	66,000
Current Days of Storage	5
Well Capacity (gpm)	30
Aboveground Utilidor (feet)	500
Belowground Utilidor (feet)	600
WTP/Washeteria Size (sqft)	2,000

Washeteria: The washeteria is open 24 hours a day, seven days a week. It has a laundry, bathrooms, and showers. The laundry has four washers and three dryers. During the 2018 site visit, only one dryer and washer were working. There are two bathrooms but only one was functional. There are four showers but only one is functional.

WTP/Washeteria Building: In 2014, a structural assessment was performed on the WTP/washeteria. It was noted that a hole was forming underneath the washeteria and due to settlement, there was damage to the foundation and walls. At that time, the damage was minimal. Since then, the hole and settlement have increased significantly. There is now structural damage to the building's foundation and separation of walls from the foundation. The building has settled so much that the service lines had to be cut and shortened. During the 2018 site visit, the extent of the hole and settlement was documented in detail in the trip report.

Sanitation Survey: In July 2017, the latest sanitary survey was performed. It found the WTP to be functioning with minimal issues. In August 2017, a TCC Rural Maintenance Worker visited the site and repaired several of the items found in the sanitary survey.

A detailed description of deficiencies is found in Section 3.0.

d. Financial Status of any Existing Facilities

In 2005, VSW working with the village completed the Beaver Water and Wastewater Utility Business Plan. The plan describes the then current utility management, accounting system, and fiscal controls. It developed key financial estimates for revenues, O&M costs, future capital construction costs, and fee structures. This plan was used to estimate O&M costs and develop rates for the proposed project. A copy of the business plan is found in the appendix. No additional business plans or current financial status reports were found.

The Rural Utility Business Advisor (RUBA) Fall 2018 Best Management Practices score for Beaver was 35 out of 100. They scored 30 out 45 for technical capacity, 5 out 10 for managerial capacity, and 0 out of 45 for financial capacity. Since 2015, the semiannual scores have ranged from 32 to 54.

The monthly water rate for the school is $1,800 per month. There is no charge for the power plant or village office/clinic. Residential water delivery rates are $20 per month. Other usage rates are:

- Small washers-$2 per load
- Large washers-$4 per load
- Dryers-$2 per 15 minutes cycle
- Showers-$5

There is no charge for self-haul from the WTP watering point.

e. Water/Energy/Waste Audits

A Comprehensive Energy Audit of the Beaver WTP/washeteria was completed in 2014. The audit found energy costs were around $39,000 for electricity and heating fuel. Its recommendations included installing LED lights, replacing windows and doors, and HVAC improvements. It estimated the recommendations would save $10,500 per year with a simple payback of three years. The only completed improvements were the resizing of the boilers and use of waste heat from the power plant.

A copy of the report can be found in the appendix.

The following table provides current energy costs in Beaver.

Table 2.2: Energy Costs

Energy Costs	
Heating Oil ($/gallon)[3]	$3.83
Gasoline ($/gallon)	6.00
Residential Electrical Rate ($/kWh)	0.32

[33] Beaver, Alaska. Alaska Community Database Online. Beaver. https://dcra-cdo-dcced.opendata.arcgis.com. Retrieved February 27, 2019.

3.0 NEED FOR PROJECT

a. Health, Sanitation, and Security

Most residents have sewage holding tanks and water cisterns. The cisterns only hold 100 gallons of water. Residents use the water for hand washing, dishes, toilet, and cooking. The high water use activities of showering and laundry are still done at the washeteria. All interviewed residents stated they shower multiple times each week at the washeteria. The washeteria has the only laundry facility and the entire community uses it for laundry. The washeteria is critical to maintaining health and sanitation in the community. There was a significant increase in level of service and quality of life when residents received sewage holding tanks and cisterns, but the washeteria is still critical to the community. Without the washeteria, most residents would have a difficult time regularly washing themselves and doing laundry. The community is worried that the deteriorating condition of the washeteria will soon make it inoperable. Not having a washeteria will greatly decrease residents' ability to shower and wash clothing. It will have a negative impact on the level of service and quality of life.

The washeteria has several severe problems. First, its foundation is settling. In a 2014 structural report, the settlement was documented but the damage was merely cosmetic. The next year, a hole appeared under the raised building. Since that time, the hole has rapidly increased. It is currently approximately ten feet in diameter and a minimum of two feet deep. There is evidence of water ponding in the hole. There are shear failure cracks around the hole indicating it is expanding. Several footings along the center line have been undercut and are failing.

The cause of the hole is unclear. The floor drains all drain directly to the ground beneath the floor. It is reported that four years ago the boilers were flushed. A large quantity of hot glycol and water was flushed through floor drains. The hole is directly beneath the floor drain near the boilers. It appears the hole is caused by thawing of permafrost or ice lenses. As the hole expands it traps more water which increases the thaw rate. This would explain the rapid acceleration of expansion. Once permafrost has begun to melt it is nearly impossible to stop it.

The building now has severe settlement damage. The building has settled approximately four to five inches on one side. There are one- to two-inch gaps along the internal walls where the ceiling has pulled away from the walls. Winter 2017/2018, daylight was visible inside the building due to the gaps. Summer 2018, the building settlement was so great the sewer service broke. Maintenance staff had to cut off several inches of the pipe to reconnect it because the building had settled so much. The community was without access to the washeteria for approximately two days. Interior plumbing also had to be adjusted.

The second issue is the sewer service from the washeteria to the sewage lagoon. The WTP backwash water also discharges in this sewer service. The service is a force main in a PVC insulated pipe which is in the utilidor. Winter 2017/2018, the pipe froze at least three times, shutting down the WTP/washeteria for about two days each time. This left the residents without access to wash facilities and the WTP couldn't treat water. Luckily, the community did not run out of water because the water storage tank had been sufficiently full to handle the multiple days of water demand. Repeated attempts at freeze protection have not stopped the freezing. The pipe is reported to have multiple repairs and patches due to the many breakages. The deformation of the pipe through thawing and repairs is the likely cause of recent freeze up.

The third issue is the emergency power. The WTP/washeteria does not have its own emergency generator. The WTP/washeteria is hooked up to the school's emergency generator system. The size of the school's generator and its electrical loads are not known. The WTP/washeteria maintenance staff report that there is only enough emergency power capacity to keep some of the lights on. All dryers, washers, and treatment equipment are not powered in an emergency. Last year, the power went out for extended periods two or three times. Each time the WTP/washeteria had to be shut down.

The fourth issue is the interior lift station. The lift station collects all washeteria wastewater and WTP backwash water. The lift station is corroded and regularly fails. It is also undersized for backwash flows. An operator must stand next to the lift station to prevent overflow. The lift station was fixed several times, shutting down the WTP/washeteria until repairs were completed.

In total, the residents lost access to the washeteria and wash facilities for approximately 12 days in the last eight months. Nine of those days also shut down the WTP.

b. Aging Infrastructure

During the 2018 site visit, a condition survey was done on the WTP/washeteria. A detailed deficiency list was created and is found in the trip report. The trip report with photos is included in the appendix.

Washeteria: The original washeteria building was constructed in 1976. The last major upgrade, which only brought the building up to ADA regulations, was performed in 1999. The washeteria building is 43 years old, past a typical 25-year design life, and failing. The damage to the building's foundation, roof, walls, and exterior is significant. It is not practical to repair since the settlement and soil subsidence is ongoing. It is in bad enough shape that it would be impractical to move the building. Logistically, it would be very difficult due to the building's older construction and lack of available equipment.

There are also some noted life and safety issues. The fire alarms and emergency lighting were expired and inoperative. The fire extinguishers need recharging. This is a violation of International Building Code chapters 906, 907, and 1011. There was no ventilation in the building, except for windows, and all windows were no longer operable. This is a violation of International Mechanical Code Chapter 504. There are no ground fault circuit interrupter (GFCI) outlets or breakers in the washeteria. This is a violation of National Fire Protection Association Chapter 70 code and is a life safety issue.

WTP: Most of the WTP is in fair condition, which require some repairs or modifications. There are some miscellaneous leaky valves should be replaced. When static head is high in the storage tank, it causes leaks. The storage tank level sensors are not functioning, and operators must estimate tank levels by pressure gauges. The watering point doesn't have a backflow preventer valve, which is required. The water point continues to dribble out water for a few minutes after use. This causes glaciation around the watering point.

The detention tank piping is plumbed incorrectly with water entering from top instead of the bottom, decreasing the detention time. There is no record of the filter medium being replaced. The medium is probably expired and should be replaced. The backwash air blower is not functional. There is no air scouring during backwashing. This decreases the effectiveness of the backwash. The operators report they can filtrate raw water for about 3 hours before there is noticeable change in the water quality. At that point, they need to backwash. Current filter efficiency is unknown. Similar filter systems have been observed to run 8 hours before needing to be backwashed.

The water quality is generally good. There is a slight iron taste to the water. Some residents use Britta-style filters for drinking water. Fixing the above treatment issues should reduce the iron taste.

Sewer Main: The sewer force main is a four-inch PVC pipe which is about 700 feet long. The sewer main is buried for 200 feet until it connects to the aboveground utilidor at the old school. The repeated and regular thawing efforts have damaged the aboveground section of the pipe. There are aboveground sections of pipe where the cross section is no longer round but deformed into a squashed oval. Each time it freezes, joints and couplings break. The repeated repairs and patching have weakened those connections resulting in increased failures. The pipe is known to leak. The aboveground pipe needs to be replaced.

Raw Water Supply: The raw water pipe in the belowground utilidor between the well and washeteria, originally constructed in 1995, is failing. It is heated by a glycol loop of waste heat from the Power Plant. The pipe is HDPE. Its pipe cross section has been deformed due to it being heated and repeatedly thawed. The pipe needs to be replaced.

Belowground Utilidor: The belowground utilidor is in fair condition. It appears it is functioning adequately. The raw water pipe within the utilidor needs replacing.

Aboveground Utilidor: The aboveground utilidor is failing. The force main pipe within the utilidor needs replacing. A 2016 Beaver-Utilidor Upgrade outlined the deteriorating insulation and plywood rot. The utilidor is not providing adequate freeze protect, which is indicated by the repeated freeze up of piping within the utilidor. A copy of the 2016 PER is found in the appendix.

c. Reasonable Growth

The population has bounced between 80 to 100 people since 1930. The 2010 census reported 84 residents in 36 homes. The last two censuses have remained 84 since the high of 103 in 1990. A reasonable 20-year design population would be 100.

4.0 ALTERNATIVES CONSIDERED

a. Alternatives

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

- Do Nothing
- Rehabilitation
- New Washeteria
- New Modular Washeteria

After the initial review it was determined that two of the alternatives were not feasible or practical. They are:

- Do Nothing. The washeteria foundation is failing and damaging the building. The utilidor is also failing. Many of the WTP's components are failing. Doing nothing will only decrease the community's access to clean drinking water and decrease health and safety. For this reason, this alternative is not feasible.
- Rehabilitation. The washeteria foundation is failing due to settlement. It also needs extensive repairs. The utilidor is failing and needs to be replaced. To rehabilitate these facilities, they would need to be relocated and heavily refurbished and remodeled. Remodeling carries risks. It is more difficult to do major remodel work while maintaining access to wash facilities and drinking water. The unusual configuration and layout would increase the difficulty and cost of relocating and remodeling. It is expected that rehabilitation would have higher O&M costs and life-cycle costs while adding less value than new facilities. For these reasons, this alternative is not feasible.

Initially, the replacement of the WTP was part of the alternatives. After the initial review of the condition of the WTP and the cost to replace, it was determined that replacement was neither cost effective nor necessary. The WTP requires additional space for chemical mixing and a backwash lift station, since those are currently located in the existing washeteria. It also needs repairs or modifications to the air blower, detention tank, filters, and water storage sensors. In lieu of a full replacement, these improvements have been included in the alternatives.

The remaining alternatives are discussed in detail in this section.

b. Proposed Site Location

Any site of a proposed washeteria needs to meet the following criteria:

- Within 400 feet of the power plant to utilize waste heat
- Within 400 feet of existing WTP
- No known contaminated sites

Only two sites were identified by the village that met these criteria. Site A was selected as the only viable option.

- Site A: USS 4895, Block 7, Lot 7. This lot is an undeveloped, wooded area east of the old BIA school. It is adjacent to the aboveground utilidor and the sewage lagoon. The site has plenty of room for a new washeteria and any future WTP. The property is owned by the village.
- Site B: USS 4895, Block 6, Lots 7 and 10. This area is just east of the WTP/washeteria. The area is disturbed. It appears to have been cleared and leveled in the past with a thin layer of fill. The area is covered with grass except for trails. There is a trail that runs through the area to the village office/clinic. The village owns Lot 10. Lot 7 is owned by the Bishop of Alaska, Corporation Sole[4] and has an old missionary house. The village states they have received a letter of intent to transfer ownership to the village, but nothing has been officially recorded yet. This site is much smaller. There is room for a new washeteria but limited space for future expansion or a WTP. The biggest issue is the 15- by 16-foot depression along the east side. The depression might be a potential cultural site and it poses a risk to any foundation. It is likely a more expensive pile foundation would be required for any facility near the depression. The depression also crowds the site to limit room for a washeteria. There is an old fuel header pipe that runs through the lot. It is now abandoned. There is no known contamination, but there is a risk. Initially Site B was the preferred option, because it is closer to the WTP, but there are too many unknown risks.

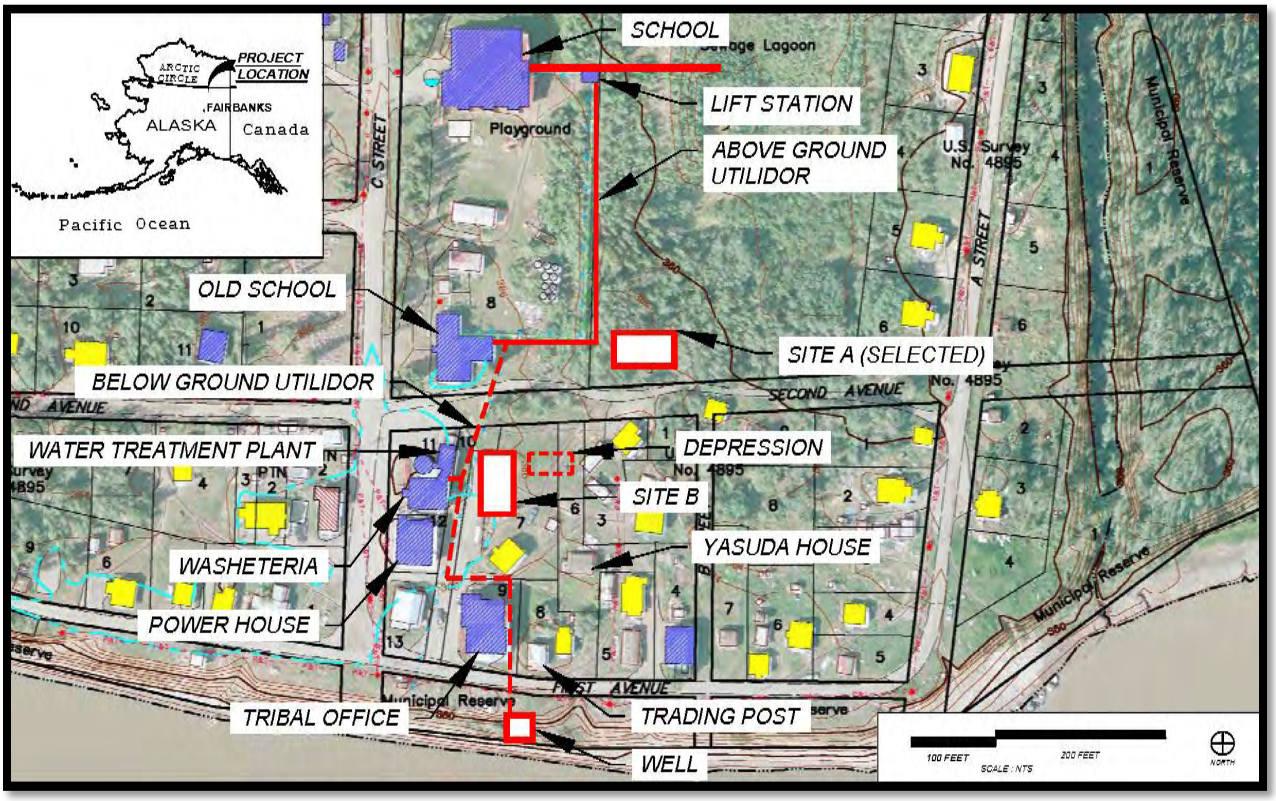


Figure 4.1: Proposed Site Locations

[4] Alaska State Recorder's Office. District Fairbanks. Deed Books, book 278, page 885. Recorded 1974.

4.1. Alternative 1: New Washeteria

a. Description

This alternative includes a new traditional stick-built washeteria. The washeteria would be located on a new insulated gravel pad east of the old BIA school. It would be approximately 400 feet closer to the sewage lagoon than current WTP/washeteria.

The alternative would construct a new two-inch HDPE insulated pipe between the water storage tank and the washeteria to deliver water. It would include a new four-inch HDPE force main from the WTP to the new washeteria and then out to the sewage lagoon to replace the existing sewer main that has freezing issues. It would also replace the two-inch HDPE raw water pipe from the well to the WTP to replace the current leaking pipe. It would also replace the aboveground utilidor which is no longer providing adequate freeze protection.

The WTP improvements include connection to waste heat, valve replacement, air blower repair, sensor replacement, and re-piping of the detention tank. A small addition would be added to contain the mixing tanks and the backwash lift station.

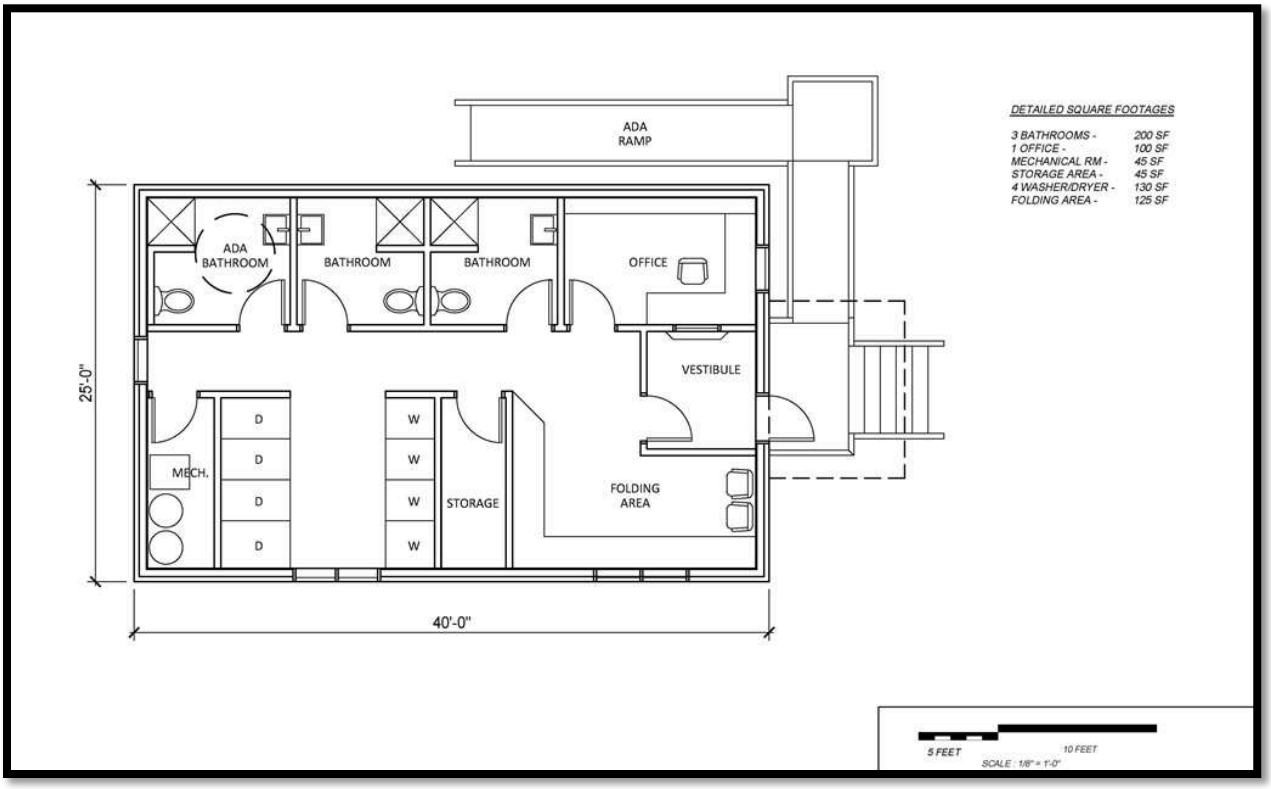


Figure 4.2: Alternative 1-New Washeteria Layout

Table 4.1: Alternative 1-Washeteria Major Components

Alternative 1-New Washeteria	
4 ft insulated gravel pad (sq ft)	4,000
Washeteria (sq ft)	1,000
WTP Addition (sq ft)	100
Replacement of raw water line (ft)	400
Replacement of sewer service lines (ft)	700
New water service lines (ft)	400
Replace aboveground utilidor (ft)	700

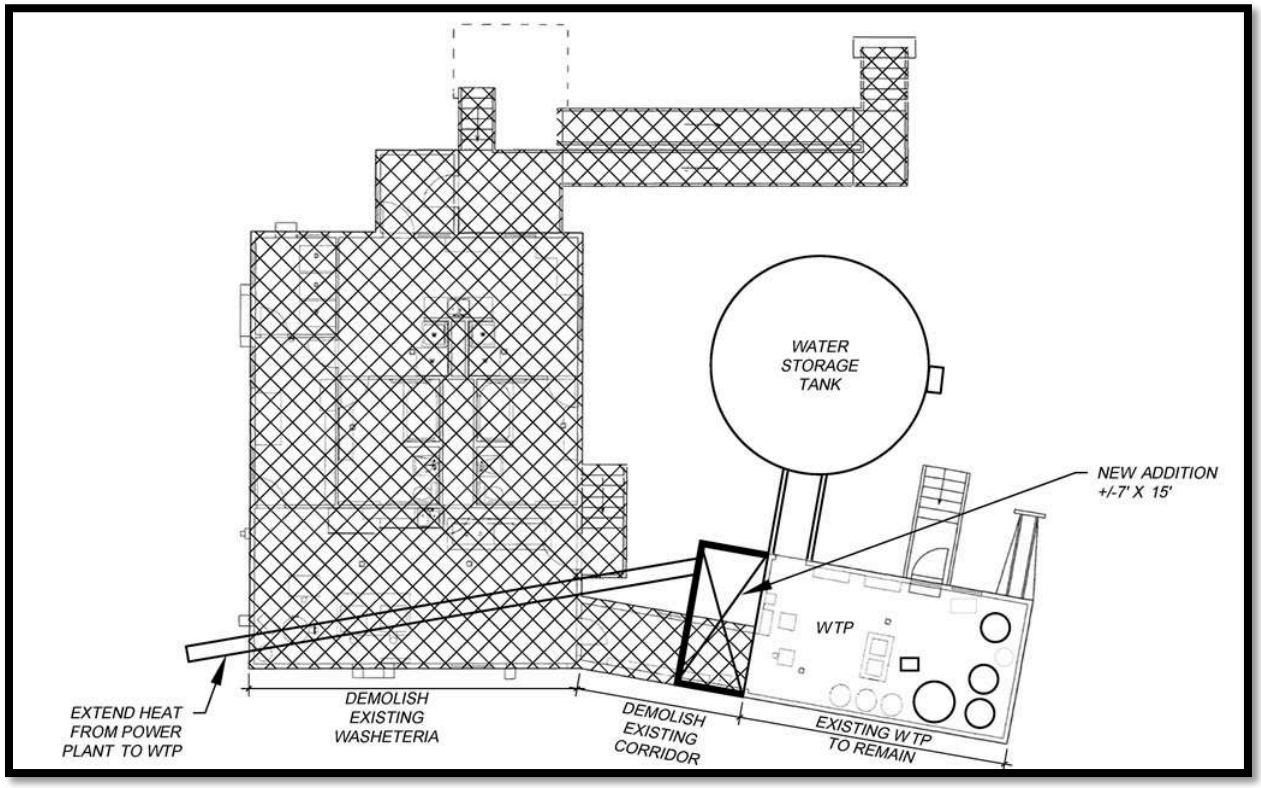


Figure 4.3: Alternative 1-WTP Improvements

b. Design Criteria

The following table contains the design criteria.

Table 4.2: Alternative 1-New Washeteria Design Criteria

Alternative 1-New Washeteria		
	Unit	
Design Population		100
Design Life	years	20
Average Daily Flow Rate	gpcd	70
Average Daily Water Usage	gpd	7,000
Maximum Hourly Flow Rate	gpm	12
Average Weekly Laundry Rate	lb/capita	20
Average Weekly Laundry Rate	lbs	2,000
Number of Bathrooms		3
Number of Showers		3
Number of ADA Bathrooms		1
Number of 4.5 ft^3 Washers	20 lbs/load	4
Number of 8.0 ft^3 Dryers		4

c. Map

Location maps are included in Appendix A.

d. Environmental Impacts

- No known contaminated sites.
- The proposed area is within a flood plain, as is the community. The finished floor would have to be above the USACE recommended finished floor elevation. The elevation is reasonable and after the construction of the gravel pad would probably meet the required elevation without having to elevate the building.
- No erosion issues.
- No archeological or cultural impacts.
- There are no mapped wetlands within the proposed work area. During preliminary engineering an environmental review would have to be completed. Any ground work would need to follow USACE regulations.
- The project would disturb less than ¼ acre.
- This alternative might require a USACE Nationwide Permit.
- A new washeteria would reduce the discharge of sewage and water to the ground that is currently happening due to building settlement and pipe damage.
- The project would require an ADEC Drinking Water and Wastewater Approvals to Construction and Approvals to Operate.
- If the gravel source next to the airport is not still available, then a new gravel source will need to be evaluated. New gravel sources will require permission from Doyon, Ltd.

- Demolition is not a major component of this alternative. The construction and demolition waste generated by this alternative will either be disposed of in the community landfill or backhauled by the contractor as decided by the Tribe. This alternative will have less construction waste than Alternative 1 because most of the construction waste is generated at the modular construction plant. The designer will work with the Tribe and ADEC to develop a demolition waste disposal plan.

The environmental impact for this alternative is minimal.

e. Land Requirements

The preferred location for a new washeteria is Site A, north of the intersection of Second Avenue and B Street. This is one of the few undeveloped lots within the community. It is located south of the sewage lagoon and east of the old BIA school on Lot 7, Block 7, US Survey 4895. The existing utilidor runs along the west property line. This lot is owned by Beaver Village.

f. Potential Construction Problems

- No site geotechnical investigation has been done. Permafrost, organic soils, and silts are known to be in the area. Currently an insulated raised gravel pad is the assumed foundation. A geotechnical investigation needs to be completed during the pre-design phase to confirm subsurface conditions.
- Wood framed buildings are at a greater risk of differential settlement damage than modular buildings. A pile foundation might be required, which would increase the construction costs by $100,000.
- Wood framed construction will require several additional months of onsite construction time compared to modular construction. This will increase the worker costs during construction. It also increases the risk that the project may get delayed due to weather, flooding, or other conditions.
- There is a limited work force within the community. It may be difficult at the time of construction for a contractor to find enough skilled local hires. This would require additional outside workers to be brought onto the site. This would increase the construction costs.
- There is a reported gravel source within the community. It appears to be adequate for this alternative. If the gravel source is not usable for structural fill, then gravel would need to be imported. This would increase construction costs and schedule. A geotechnical investigation is included in the cost estimate to confirm local gravel source. This will minimize construction risks.
- The utilidor connections are older. During construction there might be pipes within the utilidor that need to be replaced because a service connection cannot be attached.

g. Sustainability Considerations

i. Water and Energy Efficiency

This alternative would be significantly more energy efficient than the current washeteria. The design would be able to take advantage of recent improvements (e.g. LED lights and reduced-flow toilets).

ii. Green Infrastructure

Not applicable.

iii. Other

This alternative is not changing the treatment process. It is not expected to change any drinking water regulatory requirements or water operator certifications. This alternative does not increase the number of services or population served.

A newer facility would be easier to maintain. This alternative is not expected to increase O&M costs.

h. Cost Estimate

This is Alternative 1's cost estimate rounded to the nearest $1,000. A detailed cost breakdown is found in the appendix.

Table 4.3: Alternative 1-New Washeteria Cost Estimates

Item	Cost
Construction (Capital) Costs	$2,471,000
Non-Construction Costs	$780,000
Total Costs	$3,251,000
O&M Costs (Annual)	$116,000

4.2. Alternative 2: New Modular Washeteria

a. Description

This alternative includes a new modular washeteria. The modular building would be constructed and shipped to the site. This washeteria would be located at Site A on a new four-foot-thick, insulated gravel pad east of the old BIA school. It would be approximately 400 feet closer to the sewage lagoon. The modular structure would be skid mounted. The contractor would drag it from the barge to the gravel pad. The skid foundation would minimize differential settlement which is what is causing the most damage at the existing washeteria.

The alternative would construct a new two-inch HDPE insulated pipe between the water storage tank and the washeteria to deliver water. It would include a new four-inch HDPE force main from the WTP to the new washeteria and then out to the sewage lagoon to replace the existing sewer main that has freezing issues. It would also replace the two-inch HDPE raw water pipe from the well to the WTP to replace the current leaking pipe. It would also replace the aboveground utilidor which is no longer providing adequate freeze protection.

The WTP improvements include connection to waste heat, valve replacement, air blower repair, sensor replacement, and re-piping of the detention tank. A small addition would be added to contain the mixing tanks and the backwash lift station.

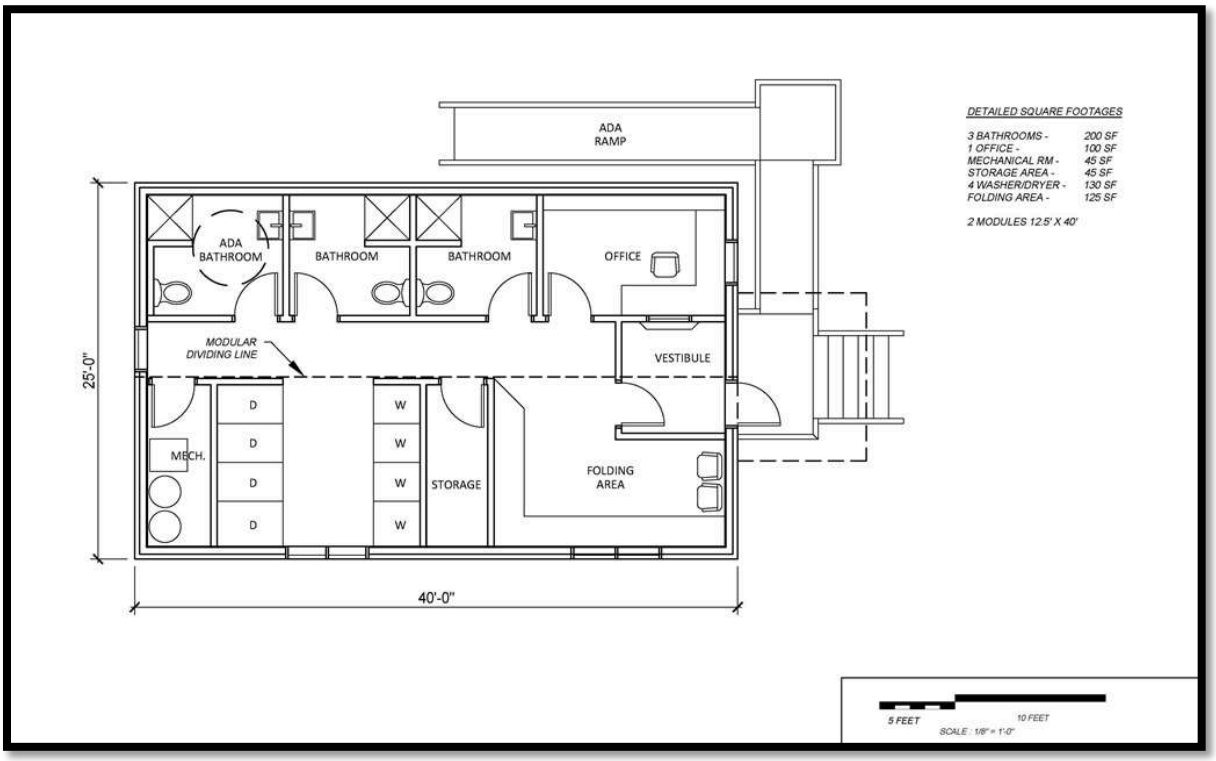


Figure 4.4: Alternative 2-New Modular Washeteria Layout

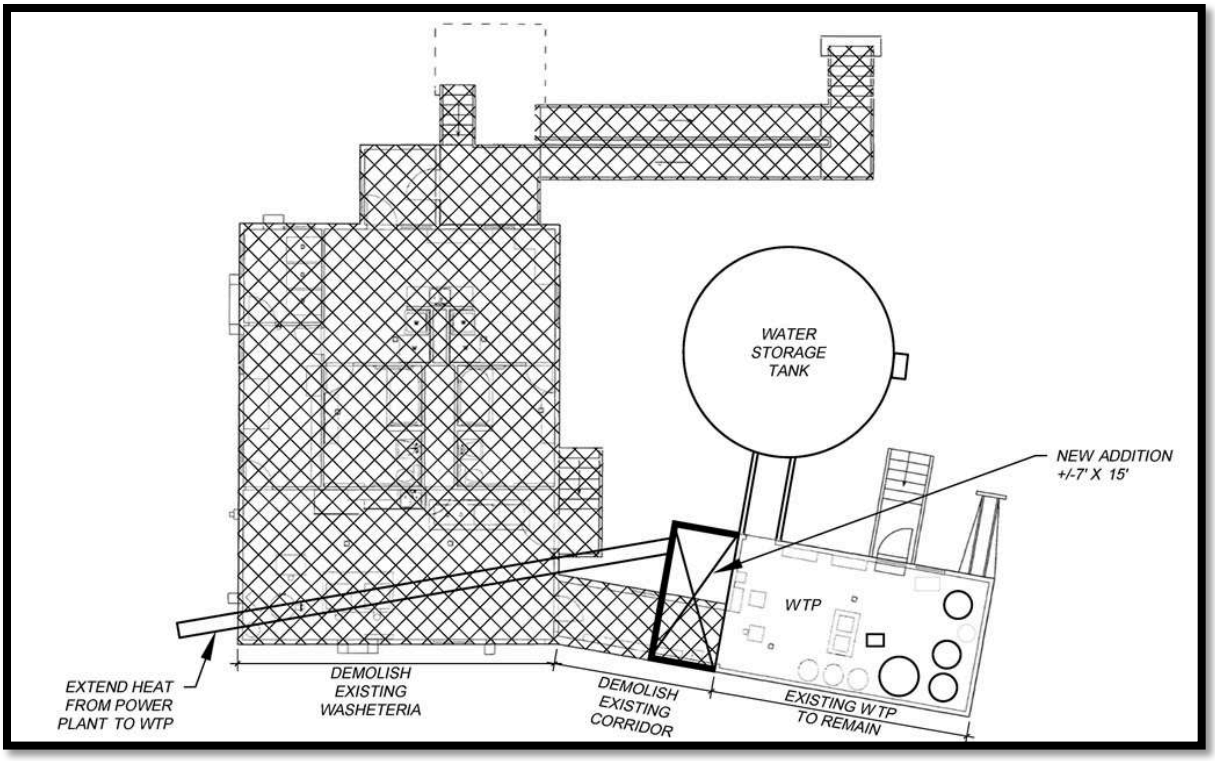


Figure 4.5: Alternative 2-WTP Improvements

Table 4.4: Alternative 2-New Modular Washeteria Major Components

Alternative 2-New Modular Washeteria	
4-ft insulated gravel pad (sq ft)	4,000
Modular Washeteria (sq ft)	1,000
Modular WTP Addition (sq ft)	100
Replacement of raw water line (ft)	400
Replacement of sewer service lines (ft)	700
New water service lines (ft)	400
Replace aboveground utilidor (ft)	700

b. Design Criteria

The following table contains the design criteria.

Table 4.5: Alternative 2-New Modular Washeteria Design Criteria

Alternative 2-New Modular Washeteria	
Design Population	100
Design Life (years)	20
Average Daily Flow Rate (gpdc)	70
Average Daily Water Usage (gpd)	7,000
Maximum Hourly Flow Rate (gpm)	12
Average Weekly Laundry Rate (lb/capita)	20
Average Weekly Laundry Rate (lbs)	2,000
Number of Bathrooms	3
Number of Showers	3
Number of ADA Bathrooms	1
Number of 4.5 ft^3 Washers (20 lbs/load)	4
Number of 8.0 ft^3 Dryers	4

c. Map

Location maps are in Appendix A.

d. Environmental Impacts

- No known contaminated sites.
- The proposed area is within a flood plain, as is the community. The finished floor would have to be above the USACE recommended finished floor elevation. The elevation is reasonable and after the construction of the gravel pad would probably meet the required elevation without having to further raise the building.
- No erosion issues.
- No archeological or cultural impacts.
- There are no mapped wetlands within the proposed work area. During preliminary engineering an environmental review would have to be completed. Any ground work would need to follow USACE regulations.
- The project would disturb less than ¼ acre.
- This alternative might require a USACE Nationwide Permit.
- A new washeteria would reduce the discharge of sewage and water to the ground that is currently happening due to building settlement and pipe damage.
- The project would require an ADEC Drinking Water and Wastewater Approvals to Construction and Approvals to Operate.
- If the gravel source next to the airport is not still available, then a new gravel source will need to be evaluated. New gravel sources will require permission from Doyon, Ltd.

- Demolition is not a major component of this alternative. The construction and demolition waste generated by this alternative will either be disposed of in the community landfill or backhauled by the contractor as decided by the Tribe. This alternative will have less construction waste than Alternative 1 because most of the construction waste is generated at the modular construction plant. The designer will work with the Tribe and ADEC to develop a demolition waste disposal plan.

The environmental impact for this project is minimal.

e. Land Requirements

The preferred location for a new washeteria is Site A, north of the intersection of Second Avenue and B Street. This is one of the few undeveloped lots within the community. It is located south of the sewage lagoon and east of the old BIA school on Lot 7, Block 7, US Survey 4895. The existing utilidor runs along the west property line. This lot is owned by Beaver Village.

f. Potential Construction Problems

- No site geotechnical investigation has been done. Permafrost, organic soils, and silts are known to be in the area. Currently an insulated raised gravel pad is the assumed foundation. A geotechnical investigation needs to be completed during the pre-design phase to confirm subsurface conditions.
- Modular buildings are at less of a risk from differential settlement damage than wood framed buildings due to the rigid skid foundation.
- Modular construction is mostly constructed at a controlled site, then shipped into the community. This reduces the onsite construction efforts and time, but it must make seasonal barges. For wood framed construction, if materials are delayed they can easily be air freighted into the community. It would be very difficult and expensive to air freight modular buildings.
- There is a limited work force within the community. Modular construction requires fewer specialized workers for the onsite work. It will be easier for a contractor to use the local work force. This will reduce construction costs.
- There is a reported gravel source within the community. It appears to be adequate for this alternative. If the gravel source is not usable for structural fill, then gravel would need to be imported. This would increase construction costs and schedule. A geotechnical investigation is included in the cost estimate to confirm local gravel source. This will minimize construction risks.
- The utilidor connections are older. During construction there might be pipes within the utilidor that need to be replaced because a service connection cannot be attached.

g. Sustainability Considerations

i. Water and Energy Efficiency

This alternative would be significantly more energy efficient than the current Washeteria. The design would be able to take advantage of recent improvements, such as LED lights and reduced flow toilets.

ii. Green Infrastructure

Not applicable.

iii. Other

This alternative is not changing the treatment process. It is not expected to change any drinking water regulatory requirements or water operator certifications. This alternative does not increase the number of services or population served.

A newer facility would be easier to maintain. This alternative is not expected to increase O&M costs.

h. Cost Estimates

This is Alternative 2's cost estimate rounded to the nearest $1,000. A detailed cost breakdown is found in the appendix.

Table 4.6: Alternative 2-New Modular Washeteria Cost Estimates

Item	Cost
Construction (Capital) Costs	$2,325,000
Non-Construction Costs	$705,000
Total Costs	$3,029,000
O&M Costs (Annual)	$116,000

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, O&M costs, and short-lived assets costs. O&M costs include the 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-New Washeteria	2-New Modular Washeteria
Construction (Capital) Costs	$2,471,000	$2,325,000
Non-Construction Costs	$780,000	$705,000
Total Project Costs	$3,251,000	$3,029,000
O&M Costs (Annual)	$116,000	$116,000
Life Cycle Costs	$3,716,000	$3,644,000

b. Non-Monetary Factors

Non-monetary factors have a significant impact on the success of a project. Table 5.3 quantifies the identified non-monetary factors. Kuna, in consultation with the owner, community, and agencies, assigns a numerical value to each factor from 1 to 5 with one 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	Alt 1-New Washeteria	Alt 2-New Modular Washeteria
Quality of Life Improvements	1	1
O&M Effort	1	1
Local Hire Potential	2	3
Archeological Risks	1	1
Permitting Effort	2	2
Construction Risks	4	2
Community Support	1	1
Totals	**12**	**11**

The non-monetary factors are defined as follows:

- **Quality of Life Improvements:** How the alternative improves the daily lives of residents related to effort spent obtaining clean water and ease of access. How the alternative improves health, safety, and hygiene within the community.
- **O&M Effort:** The relative effort and difficulty for the community to operate and maintain the alternative. How much extra effort will it take? How will it impact the current operations?
- **Local Hire Potential:** What is the potential for local hire during construction? How much will the alternative add to the local economy?
- **Archeological Risk:** What is the risk to the community's history and culture? What is the likelihood of alternative costs or delays due to archeological finds?
- **Permitting Effort:** How many permits are necessary for the alternative? What level of permitting is necessary? What is the risk of the alternative being impacted by permitting conditions?
- **Construction Risks:** The design is not completed. What is the likelihood that issues with construction would increase the costs or schedule? How difficult is the alternative to construct? Are there specialized equipment, techniques, or materials needed?
- **Community Support:** Does the community want the alternative? Which alternative is preferred? Is there an alternative that the community doesn't support?

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

Table 5.3: Alternatives Advantages & Disadvantages Summary

Alt	Description	Advantages	Disadvantages
1	New Stick Built Washeteria	Improvement in quality of life	• Higher capital costs • Higher life cycle costs Greater construction risk Greater risk of settlement • Longer construction schedule
2	New Modular Washeteria	• Lowest capital costs • lowest life cycle cost Less construction risk • Improvement in quality of life • Shorter construction schedule	Less local hire potential

6.0 PROPOSED PROJECT (RECOMMENDED ALTERNATIVE)

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

a. Preliminary Project Design

The recommended alternative is Alternative 2: New Modular Washeteria.

This proposed project includes a new modular washeteria. The modular structure would be constructed and shipped to site. This washeteria would be located on a new four-foot thick, insulated gravel pad east of the old BIA school. It would be approximately 400 feet closer to the sewage lagoon. The modular structure would be skid mounted. The contractor would drag it from the barge to the gravel pad. The skid foundation would minimize differential settlement, which is what is causing the most damage at the existing washeteria.

The proposed project would construct a new two-inch HDPE insulated pipe between the water storage tank and the washeteria to deliver water. It would also include a new four-inch HDPE force main from the washeteria to the sewage lagoon. It would add the two-inch HDPE raw water pipe from the well to the WTP. The aboveground utilidor would also be replaced.

The WTP improvements include connection to waste heat, valve replacement, air blower repair, sensor replacement, and re-piping of the detention tank. A small addition would be added to contain mixing tanks and the backwash lift station.

Table 6.1: Proposed Project-New Modular Washeteria Major Components

Proposed Project-New Modular Washeteria	
4-ft insulated gravel pad (sq ft)	4,000
Modular Washeteria (sq ft)	1,000
Modular WTP Addition (sq ft)	100
Replacement of raw water line (ft)	400
Replacement of sewer service lines (ft)	700
New water service lines (ft)	400
Replace aboveground utilidor (ft)	700

b. Project Schedule

The proposed project is outlined in a Gantt chart in the appendix. Table 6.2 summarizes the project schedule.

Table 6.2: Proposed Project-New Modular Washeteria Project Schedule

Phase	Schedule
PER & ER	February 2019
Funding	April 2019-March 2020
If Funded 2020	
Pre-Engineering	March-September 2020
Engineering	June-December 2020
Bidding	January 2021-March 2021
Construction	March-December 2021
Commissioning	January 2022

c. Permit Requirements

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

- USACE Section 404 Nationwide Permit
- Water & Wastewater ADEC Approval to Construct
- Water & Wastewater ADEC Approval to Operate

d. Sustainability Considerations

i. Water and Energy Efficiency

This alternative would be significantly more energy efficient than the current washeteria. The design would be able to take advantage of recent improvements, such as LED lights and reduced flow toilets.

ii. Green Infrastructure

Not applicable.

iii. Other

A newer facility would be easier to maintain. This alternative is not expected to increase O&M costs.

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

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

Table 6.3: Proposed Project-New Modular Washeteria Construction (capital) Costs

Construction (Capital) Costs				
Item	No.	Unit	Cost	Total
Mob & Demob	1	LS	$300,000	$300,000
Construction Survey	1	LS	$10,000	$10,000
Site Clearing	4,000	SQFT	$2	$8,000
Site Pad Work	750	CYD	$40	$30,000
Site Electrical	1	LS	$30,000	$30,000
Access Ramp	1	LS	$20,000	$20,000
Modular Washeteria	1,000	SQFT	$650	$650,000
Washeteria Equipment	1	LS	$25,000	$25,000
Washeteria-Waste Heat Connection	1	LS	$100,000	$100,000
WTP-Waste Heat Connection	1	LS	$20,000	$20,000
WTP-Piping & Other Improvements	1	LS	$120,000	$120,000
WTP-New Lift Station	1	LS	$15,000	$15,000
WTP-Addition	102	SQFT	$450	$45,900
Day Tank	1	EA	$8,000	$8,000
Replace Raw Water Line: Well-WTP	400	FT	$150	$60,000
New Sewer Piping: WTP-Lagoon	700	FT	$400	$280,000
New Water Piping: Storage Tank-Washeteria	400	FT	$150	$60,000
Replace Aboveground Utilidor	500	FT	$165	$82,500
Existing Washeteria Demolition	1	LS	$40,000	$40,000
Commissioning	1	LS	$25,000	$25,000
O&M Manual & Training	1	LS	$5,000	$5,000
O&M Equipment	1	LS	$2,500	$2,500
			Subtotal	$1,936,900
Resident Project Representative	6%	OF	$1,936,900	$116,214
Construction Administration	6%	OF	$1,936,900	$116,214
Project Administration	8%	OF	$1,936,900	$154,952
			Subtotal	$387,380
TOTAL	$2,324,280			

Major Assumptions:

- Local gravel source
- Adjustable skid foundation

Table 6.4: Proposed Project-New Modular Washeteria Non-Construction Costs

Non-Construction Costs				
Item	No.	Unit	Cost	Total
Survey	1	LS	$20,000	$20,000
Geotechnical	1	LS	$25,000	$25,000
Land Acquisition/ROW	0	LS	$0	$0
Engineering	10%	OF	$1,936,900	$193,690
Permitting	1	LS	$20,000	$20,000
Resident Project Representative	3%	OF	$1,936,900	$58,107
Project Contingency	20%	OF	$1,936,900	$387,380
Total	$704,177			

Table 6.5: Proposed Project-New Modular Washeteria Cost Summaries

Item	Cost
Construction (Capital) Costs	$2,325,000
Non-Construction Costs	$705,000
Total Costs	$3,029,000
O&M Costs (Annual)	$116,000

f. Annual Operating Budget

i. Income

The current water utility revenue sources for the water utility include: water delivery and washeteria usage. Currently there is no charge for the watering point.

The following table is the projected income for a new modular washeteria facility that includes water delivery, washeteria usage, and watering point. The estimate is for the initial years. This means that it doesn't include additional residential deliveries.

Table 6.6: Proposed Project-New Modular Washeteria Annual Income

Revenue Source	Amount	Unit	Rate	Collection Rate	Total
Washeteria[1]					
Showers[2]	3,120	Shower	$5	95%	$14,820
Small Washers[3]	2,600	Load	$2	95%	$4,940
Large Washers[3]	2,600	Load	$5	95%	$12,350
Dryers[4]	15,600	Cycle	$2	95%	$29,640
				Subtotal	**$61,750**
Water					
Residential Water Delivery[5]	1,768	Delivery	$20	65%	$22,984
School	12	Month	$1,800	100%	$21,600
Small Comerical[6]	12	Months	$100	100%	$1,200
Clinic	12	Delivery	$300	100%	$3,600
Watering Point (self-haul)[7]	100,000	Gallon	$0.05	100%	$5,000
				Subtotal	**$54,384**
				Total Revenue	**$116,134**

Notes:

1. Washeteria currently open 5 days a week, 8 hours a day.

2. Four showers per day per bathroom

3. 50 loads per week.

4. 50 loads, (3) 15 minutes cycles per load

5. Weekly delivery for 34 homes.

6. Monthly delivery for 1 commercial user.

7. 50 gallons per house, per week.

ii. Annual O&M Costs

Table 6.7: Proposed Project-New Modular Washeteria Annual O&M Budget

Operations & Maintenance Costs (Annual)				
Item	**No.**	**Unit**	**Cost**	**Total**
WTP Personnel	1,000	HR	30	$30,000
Washeteria Personnel	2,080	HR	$15	$31,200
Water Delivery Personnel	884	HR	$30	$26,520
Administrative Costs	1	LS	$2,500	$2,500
Disposable Materials	1	LS	$5,000	$5,000
Heating Costs (oil fuel)	1	LS	$10,000	$10,000
Energy Costs (Electric)	1	LS	$10,000	$10,000
Total	**$115,220**			

Notes:

1. One Level 1 operator half time

2. Washeteria staffed when open. Washeteria is open 5 days a week, 8 hours per day.

3. Average 30 minutes per delivery, 34 weekly deliveries.

4. Estimated from historic numbers.

Currently the washeteria is not staffed when open. It is likely that the utility will have to hire a full-time employee to manage the washeteria. No additional staff will be necessary for operating the WTP or making water deliveries.

The water utility will operate at a profit of less than $1,000 annually. Any profit should be saved for emergency repairs or future capital improvements.

iii. Debt Repayment

This project is expected to be funded by grants due to limited local income. Loans will not be used to finance these improvements; therefore, debt repayment is not anticipated.

iv. Reserves

This project is expected be funded by grants. A grant would do not require a General Obligation bond, loan security, or cash reserves.

7.0 CONCLUSIONS AND RECOMMENDATIONS

Village Safe Water (VSW) and Beaver Village contracted with Kuna Engineering on March 14, 2018 to develop a Preliminary Engineering Report (PER) for improving the water treatment plant (WTP), washeteria, and utilidor. The community's current washeteria has deteriorated significantly enough to endanger community access to safe sanitation. The project was funded by the US Environmental Protection Agency (EPA) and the State of Alaska. This PER was prepared using US Department of Agriculture, Rural Utilities Service (USDA-RUS) Bulletin 1780-2.

Beaver, which has a population of 84, is located along the north bank of the Yukon River, approximately 60 air miles southwest of Fort Yukon and 110 miles north of Fairbanks. Beaver is off the road system and is only accessible by air and water.

In 1976, the WTP/washeteria was constructed as two separate buildings, which have since been connected by a corridor. There is no piped water or sewer system to residents. Most of residents use the washeteria for bathing and laundry. Only the school, power plant, and village office/clinic are connected to a piped water and sewer system. The WTP gets water from a well located along the Yukon River. Sewer is discharged to a sewage lagoon east of the school. There is a combination of underground and aboveground utilidors connecting the system. Detailed description of the water and sewer systems are found in Section 3.0.

The only major upgrade to the washeteria was an ADA upgrade in 1999. The washeteria building is 43 years old, past a typical 25-year design life, and failing. Soil subsidence has damaged the building's foundation, roof, walls, and exterior significantly. The interior has extensive damage and deterioration. Much of the laundry equipment is no longer functioning. It is not logistically feasible to rehabilitate the facility. The washeteria's condition is increasing the health and safety risk of the residents because repairs and damage have limited residents' access to laundry and bathing. The WTP is in fair condition. It needs equipment and piping repairs but does not need to be replaced at this time. The aboveground utilidors, raw water piping, and force main sewer was found to be failing and needing replacement. A detailed description of the need for the project is found in Section 4.0.

In reviewing the need for the project and consulting with the community, agencies, and others, this PER determined that a new washeteria was the only feasible alternative. The PER also determined that the WTP does not need to be replaced though it does require some repairs and improvements. The PER analyzed the following two alternatives for a new washeteria:

- Alternative 1: New Washeteria (stick built)
- Alternative 2: New Modular Washeteria

After reviewing and analyzing the alternatives, Alternative 2: New Modular Washeteria is recommended as the best alternative to meet the community's needs. 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: New Modular Washeteria

This proposed project includes a new modular washeteria. The modular structure would be constructed and shipped to site. This washeteria would be located on a new four-foot thick, insulated gravel pad east of the old BIA school. It would be approximately 400 feet closer to the sewage lagoon. The modular structure would be skid mounted. The contractor would drag it from the barge to the gravel pad. The skid foundation would minimize differential settlement, which is causing the most damage at the existing washeteria.

The proposed project would construct a new two-inch HDPE insulated pipe between the water storage tank and the washeteria to deliver water. It would also include a new four-inch HDPE force main from the washeteria to the sewage lagoon. It would add the two-inch HDPE raw water pipe from the well to the WTP. The aboveground utilidor would also be replaced.

The WTP improvements include connection to waste heat, valve replacement, air blower repair, sensor replacement, and re-piping of the detention tank. A small addition would be added to contain mixing tanks and the backwash lift station.

Table 7.1: Proposed Project Cost Summary

Proposed Project Cost Summary	
Construction Costs	$2,324,280
Non-Construction Costs	$704,177
Total Project Cost	$3,028,457

Table 7.2: Annual Proposed Budget Summary

Annual Proposed Budget Summary	
Revenue	$116,134
O&M Costs	$115,220
New Annual Budget	$914

Table 7.3: Proposed Project Schedule Summary

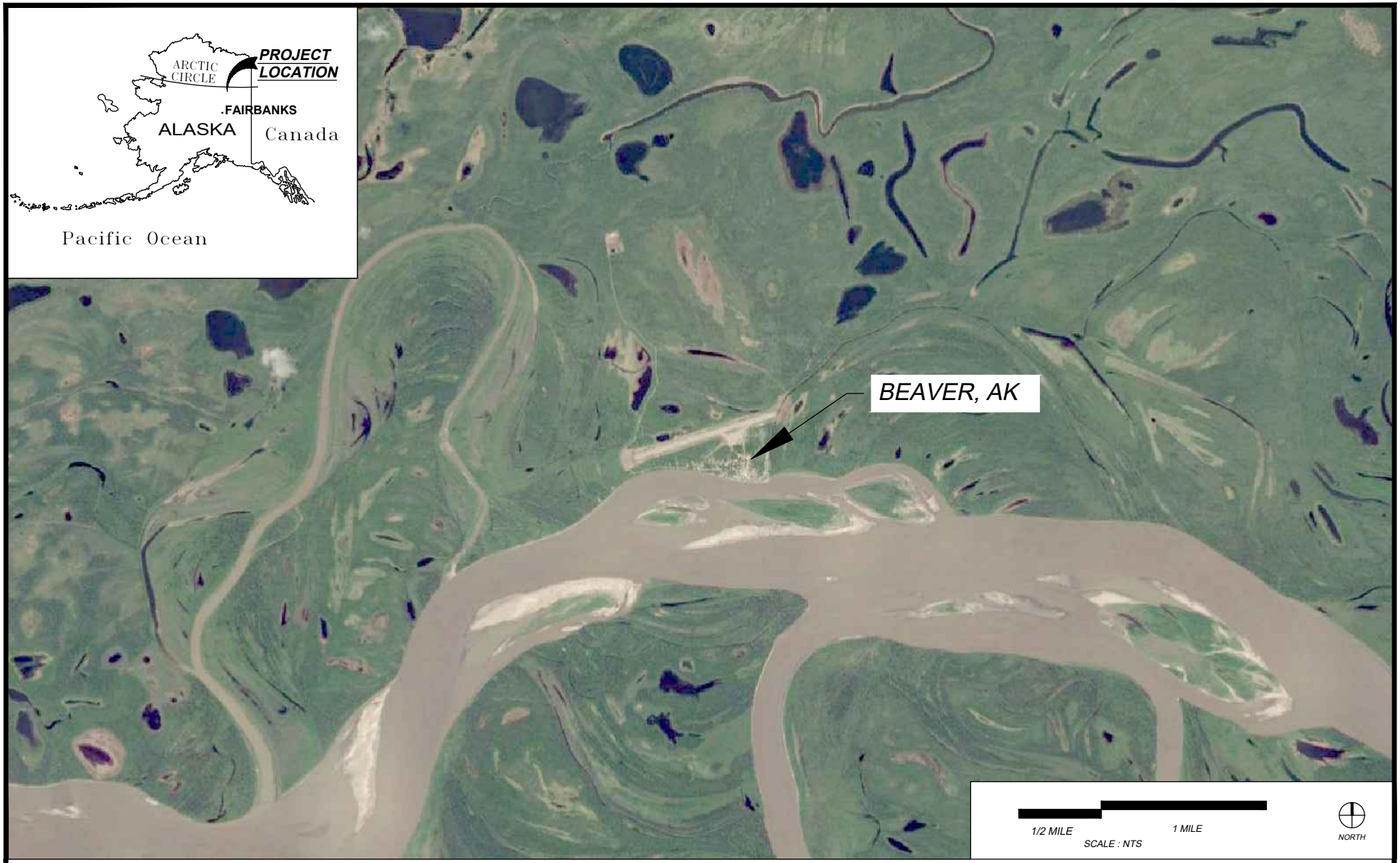
Proposed Project Schedule Summary	
Secure Funding Date	March 2020
Design Schedule (if funded)	April 2020-December 2020
Construction Schedule (if funded)	March 2021-December 2021
Project Completion Date (if funded)	January 2022

APPENDIX

Contents:

Appendix A: Vicinity, Community, and Location Maps

Contents:



BEAVER WASHETERIA IMPROVEMENTS
PRELIMINARY ENGINEERING REPORT
BEAVER, ALASKA

PROJ. NO.	P0021949W
DRAWN	TRP
CHECKED	DEN
DATE	01/03/19

KUNA ENGINEERING
3111 C Street, Ste 300 Anchorage, AK 99503
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VICINITY MAP

A.1

BEAVER WASHETERIA IMPROVEMENTS

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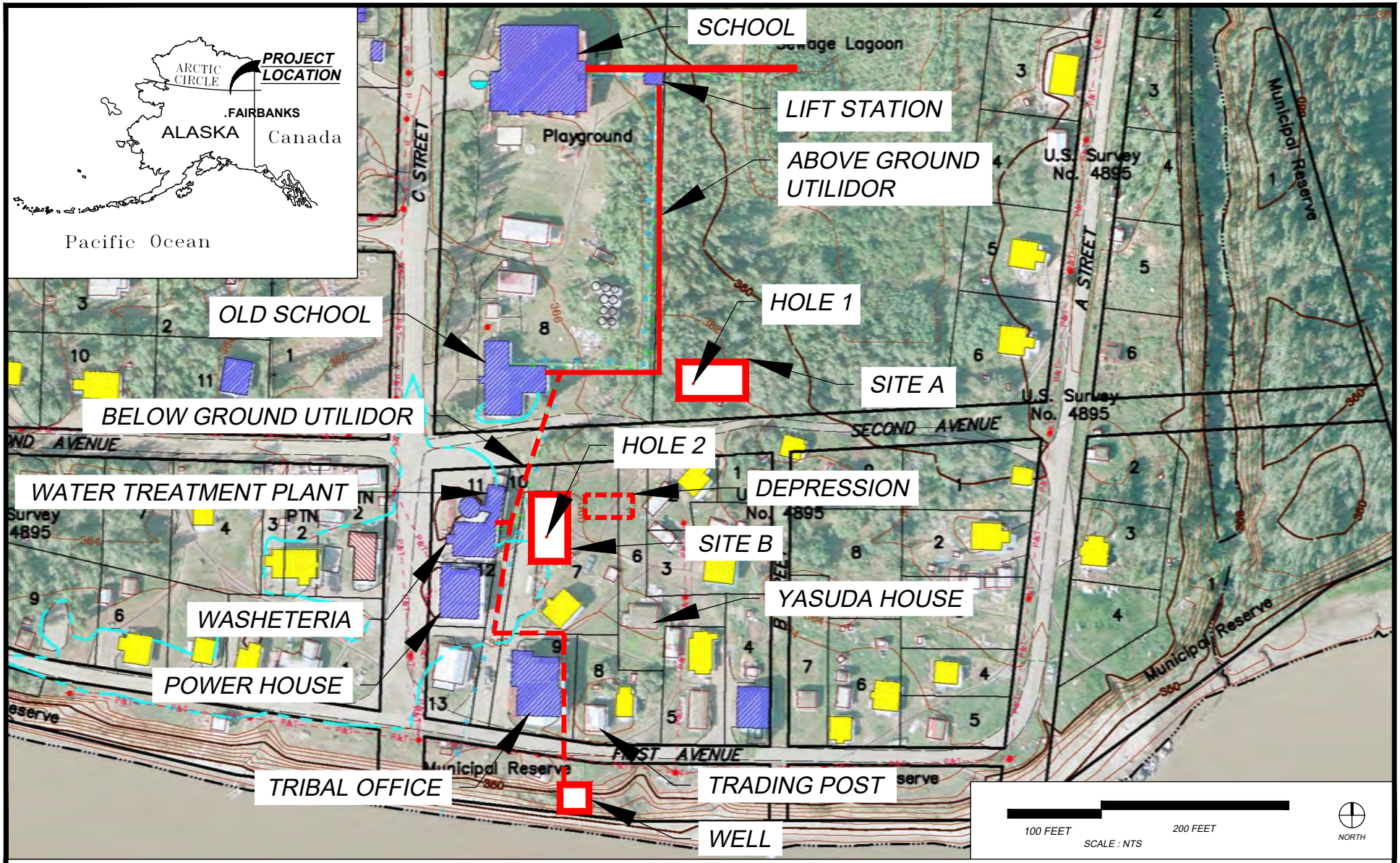
COMMUNITY PLAN

A.2



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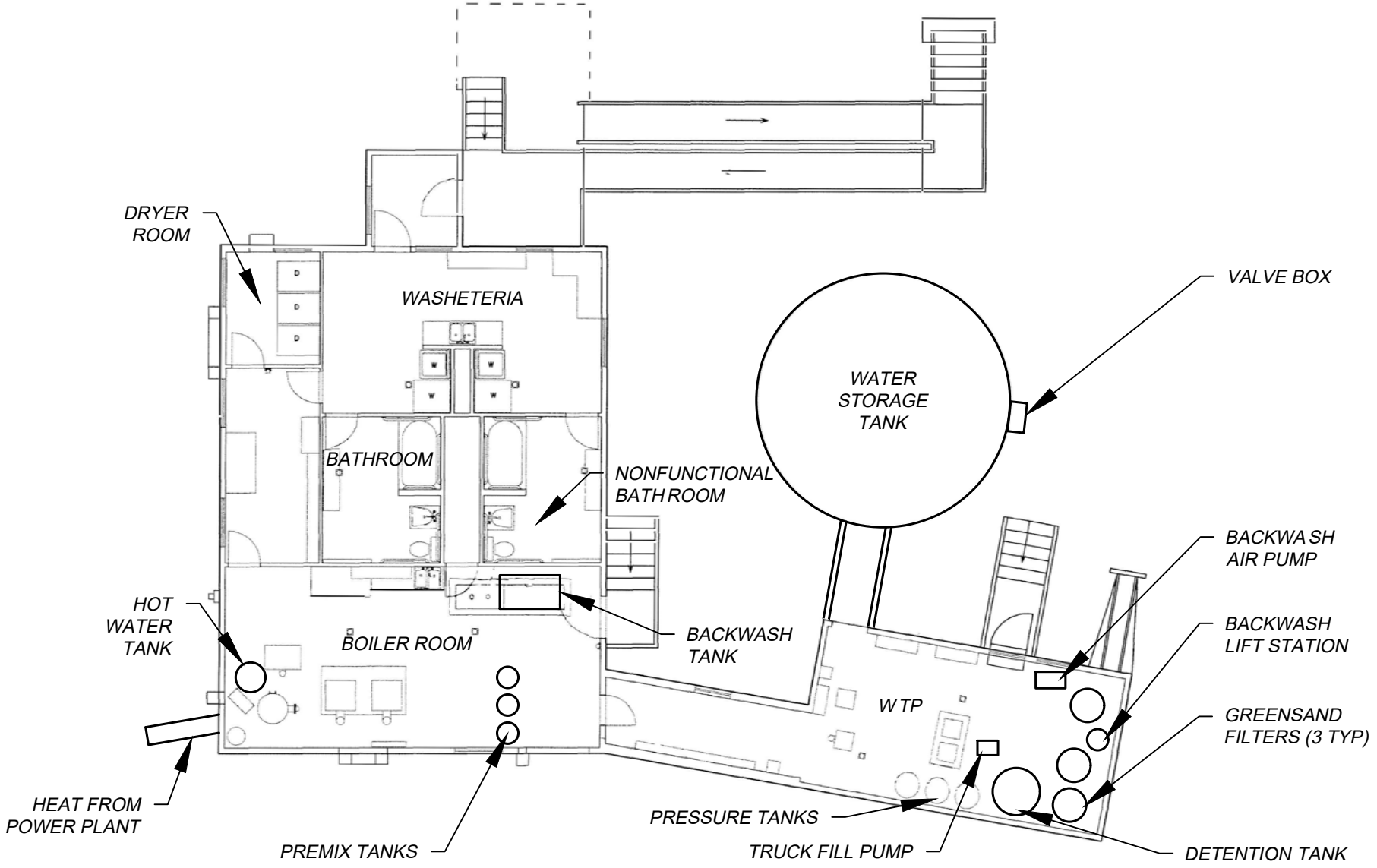
COMMUNITY SITE PLAN

A.3



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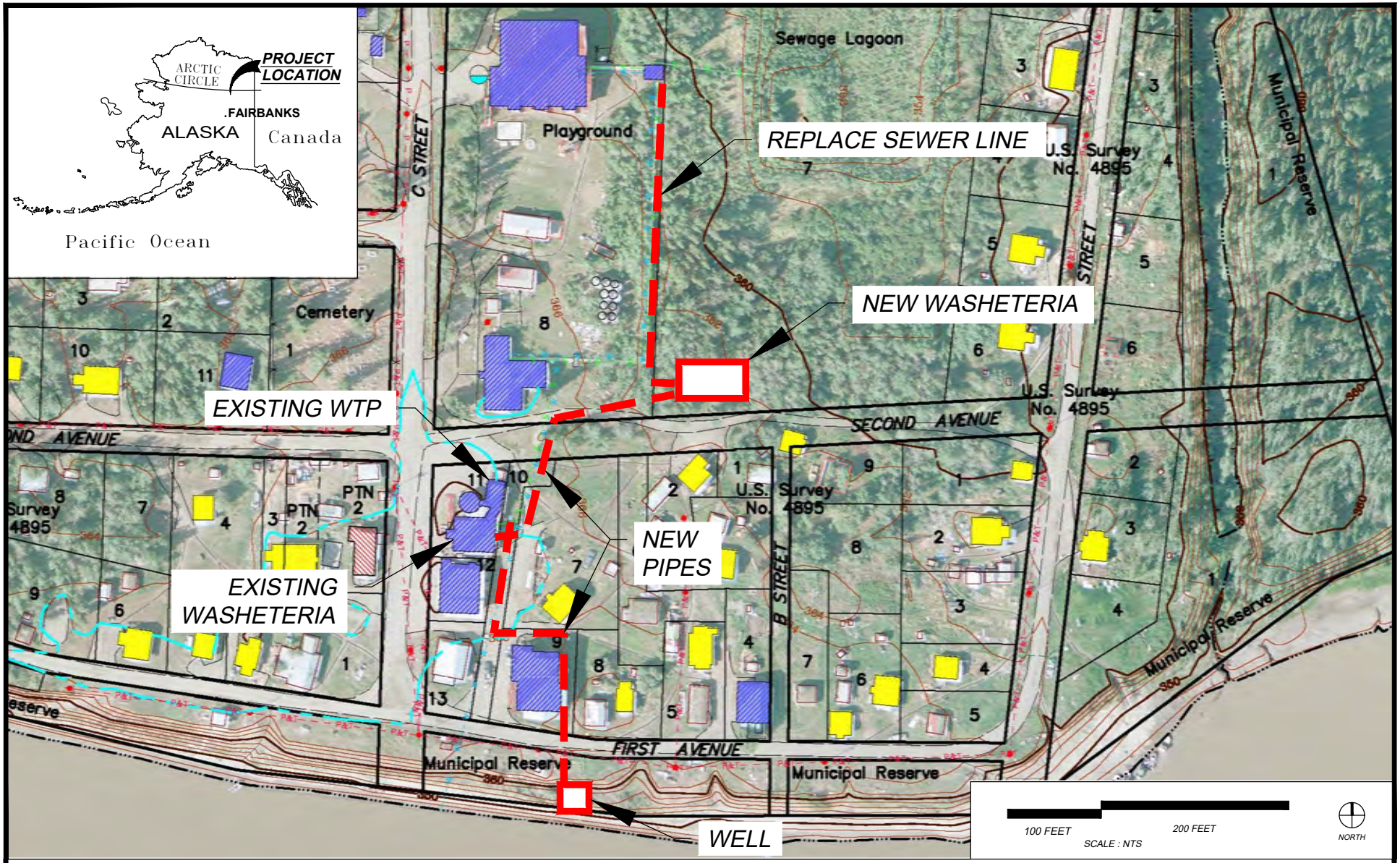
EXISTING FACILITY

A.4



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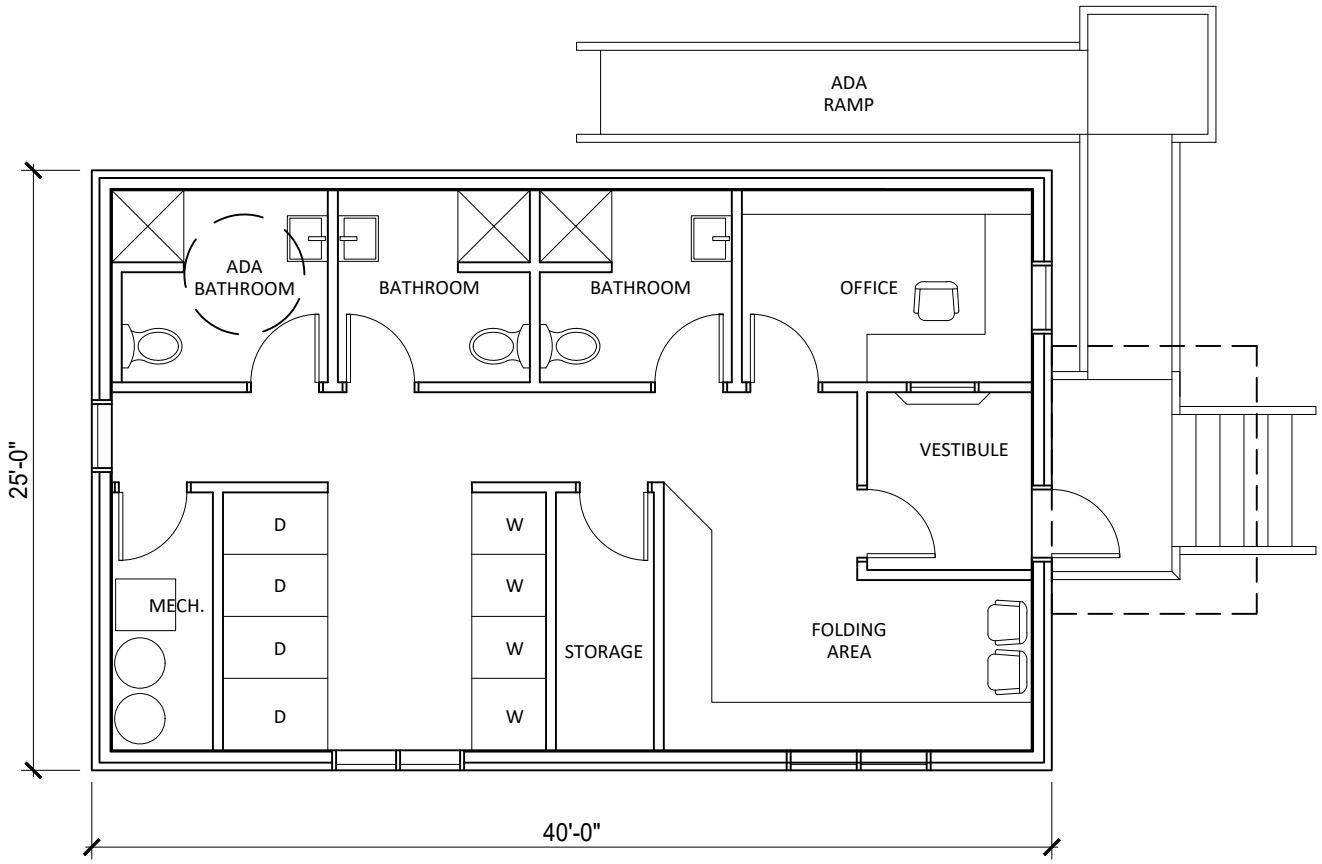
PROJECT PLAN

A.5



DETAILED SQUARE FOOTAGES

3 BATHROOMS -	*200 SF*
1 OFFICE -	*100 SF*
MECHANICAL RM -	*45 SF*
STORAGE AREA -	*45 SF*
4 WASHER/DRYER -	*130 SF*
FOLDING AREA -	*125 SF*

5 FEET *10 FEET*

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

BEAVER WASHETERIA IMPROVEMENTS

PRELIMINARY ENGINEERING REPORT
BEAVER, ALASKA

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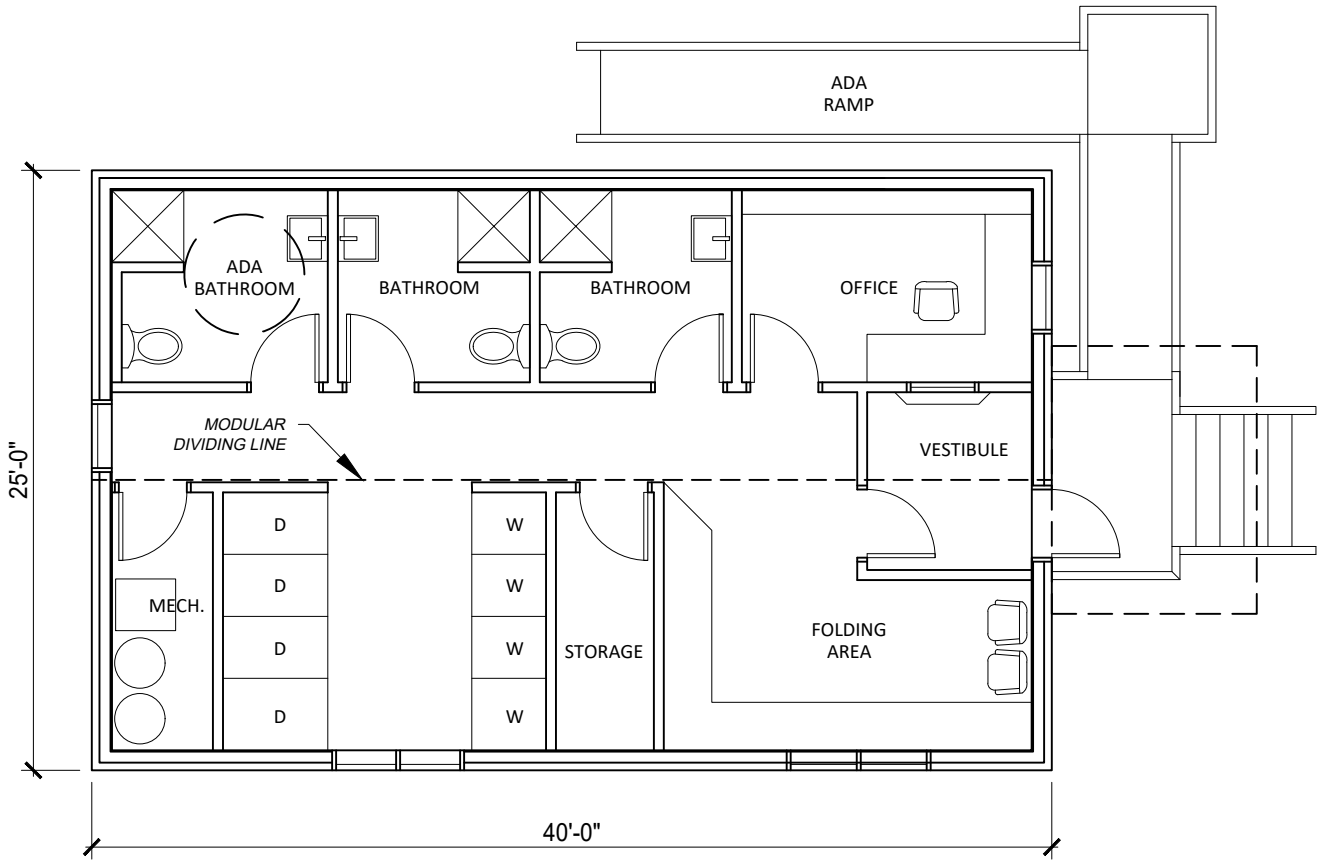
ALT 1-NEW WASHETERIA

A.6



DETAILED SQUARE FOOTAGES

3 BATHROOMS -	*200 SF*
1 OFFICE -	*100 SF*
MECHANICAL RM -	*45 SF*
STORAGE AREA -	*45 SF*
4 WASHER/DRYER -	*130 SF*
FOLDING AREA -	*125 SF*

2 MODULES 12.5' X 40'

5 FEET *10 FEET*

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

BEAVER WASHETERIA IMPROVEMENTS
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DRAWN	**TRP**
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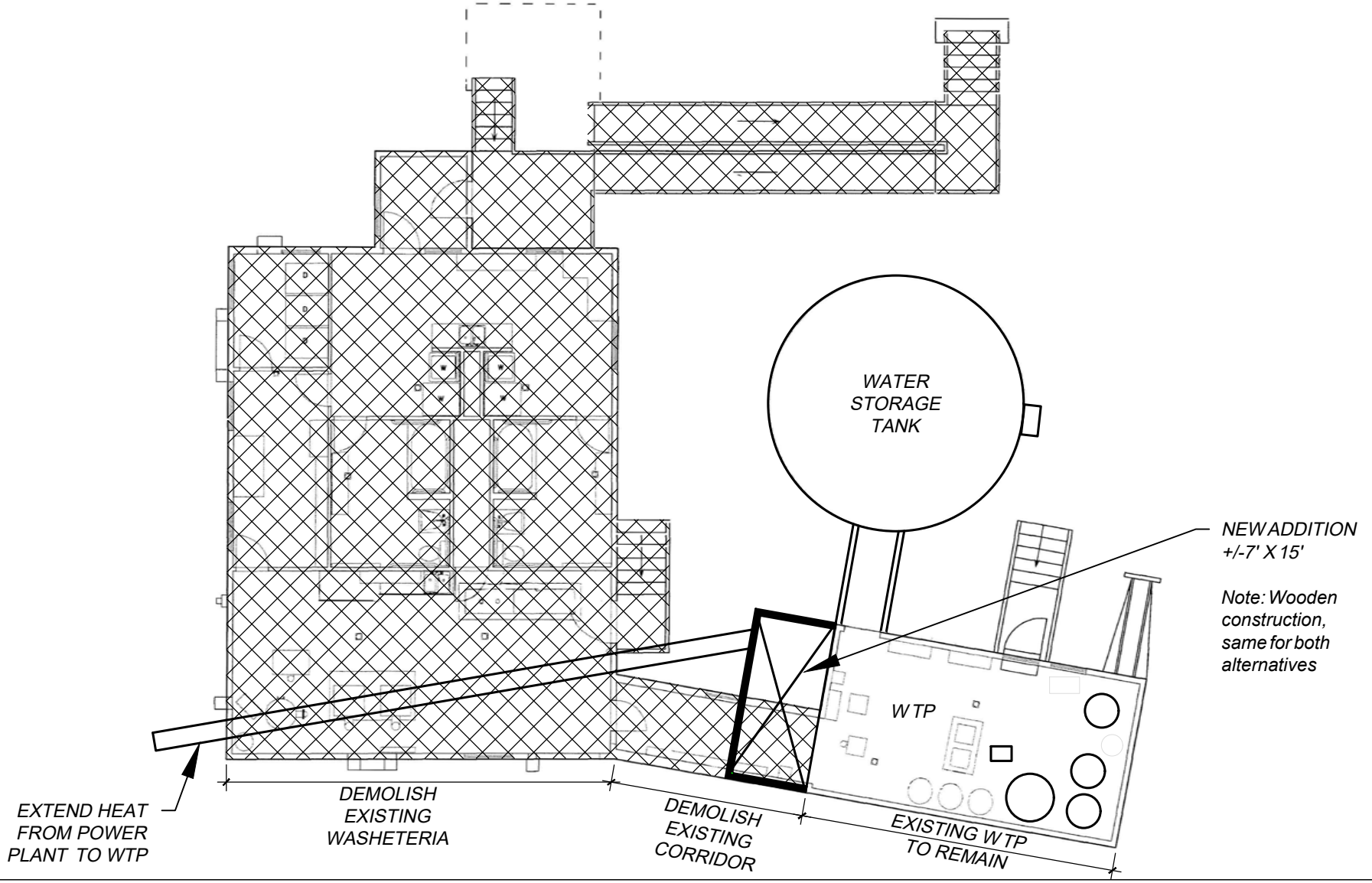
ALT 2-NEW MODULAR WASHETERIA

A.7



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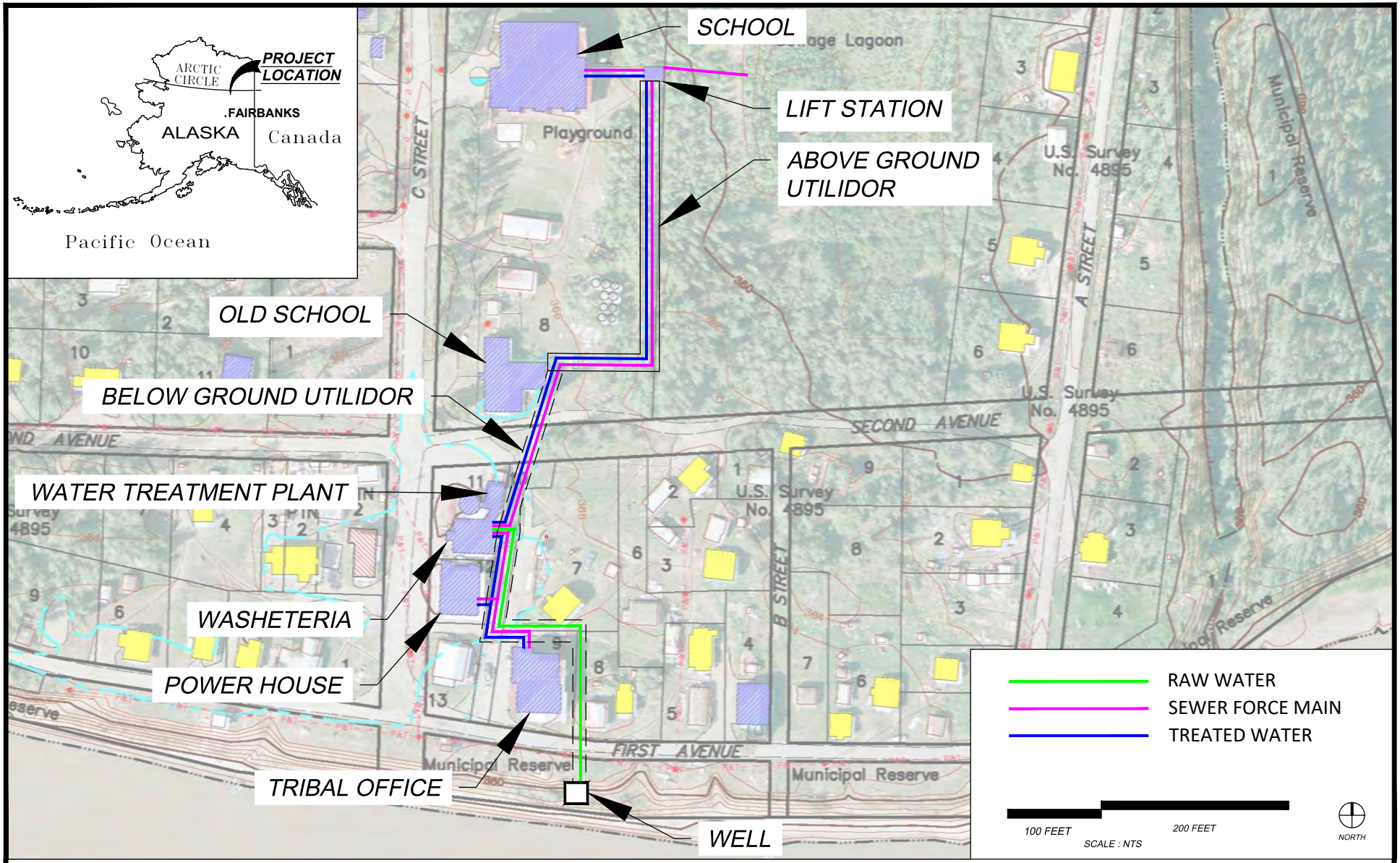
WTP ADDITION

A.8



BEAVER WASHETERIA IMPROVEMENTS

PRELIMINARY ENGINEERING REPORT
BEAVER, ALASKA

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Existing System Diagram

A.9

Appendix B: Trip Reports

Contents:

Structural Engineering Assessment

DATE: **June 20, 2014**

TO: **Mr. Carl Remley**
Energy Project Manager,
ANTHC-DEHE
3900 Ambassador Dr.
Anchorage, Alaska

RE: Beaver Water Treatment/Washeteria Structural Engineering Assessment.

Date of Site Visit:	**June 03, 2014**
Weather:	**Cool with light rain.**
Site Conditions:	**Accessible**
Site Contacts:	**Treatment Plant Operator**
Engineers on Site:	**None**

OBJECTIVES:

Mr. Danny Graham, SE, Senior Structural Engineer, LCG Lantech Inc. traveled to the Village of Beaver Alaska on the 3rd of June, 2014 with Mr. Carl Remley, Project PM, ANTHC. The projects primary engineering objective for LCG Lantech, Inc. is to evaluate the structural condition of the existing Water Treatment and Washeteria Building and the accompanying utilidors.

OBSERVATIONS:

I walked the project with Mr. Remley and have the following comments: The Water Treatment and Washeteria Building are two separate buildings connected with a wood framed bridge-way that is supported by each building at the ends. They are constructed of the same materials of approximately the same vintage. The condition of the two structures varies slightly and will be addressed individually in the report, as necessary.

Both the washeteria and the water treatment building are wood framed structures comprised of pre-engineered wood trusses and floor joists. The original wall construction was 2x6 studs at 16 inch on center filled with a Fiberglass R-19 insulation. The walls were later retrofitted with a two inch thick layer of rigid insulation covered with another layer of gypsum board under a layer of 5/8 inch thick T-111 plywood siding. All this was then covered with a FRP water resistance architectural finish. The exterior rough sawn plywood surface is original and needs maintenance and some minor repairs in some areas.

The roof trusses and sheathing on both structures appear to be in fairly good shape. I was able to access the attic space on the washeteria side and observed approximately 12 inches of fiberglass insulation that was in reasonable condition.

I was not able to gain access to the interstitial spaces of the floor framing. The concrete floor surfaces of the treatment plant appears to be in good condition, no excessive cracking or surface deterioration. The floor and interior non-bearing walls of the washeteria are not doing as well, and are exhibiting an excessive amount of settling which has manifested itself in large separations of the wall top plates from the ceiling. Some areas have as much as a one inch gap between the top of the wall and the ceiling sheetrock.

I discussed this issue at length with the plant operator and learned that one of the improvement projects included the addition of four inches of concrete placed over the original floor sheathing. Based on my observations and this information I believe that the additional dead load of the concrete is over stressing both the original floor framing and the foundations. A foundation retrofit project was undertaken in 1999 that appears to have addressed this issue but the floor is in a severe state of settlement so I can only assume that the foundations have had additional settling since the retrofit.

In addition, I observed the existing utilidors that run between the old BIA School and the sewage lagoon. They appear to be in reasonable condition. There are no excessive settlements or sagging, so we can conclude that the foundations are stable.

CONCLUSIONS:

1. The Water Treatment Building is in reasonably good condition and should have at least another 25 years of service life if maintained properly. The village should develop a complete maintenance program for entire facility.
2. The Washeteria Building roof and walls are also in reasonably good condition and should have at least another 25 years of service life if maintained properly.

   Based on our field work I have to conclude that the foundations on the washeteria have a serious issue based on the excessive settlement as discussed in the observations section. Without an in depth foundations study we cannot make any conclusions other than that the center line foundations supports have failed as exhibited in the sagging floors and wall separations. It is reasonable to assume that the foundation will continue to downgrade the service life of the structure if not addressed.

   The Village should try to secure funding for a foundation remediation project at which time the existing foundations could be examined in depth and possibly adjusted or modified to strengthen them back to the original floor level.

END OF REPORT

Sincerely,

Danny Graham PE
Vice President/Sr. Structural Engineer

Attachments: Photos:

Front Elevation.

Connecting Walkway

Walls separating from ceiling.

Adjustable Foundation Retrofit.

PRELIMINARY ENGINEERING REPORT

BEAVER – UTILIDOR UPGRADE

JULY, 2016

Prepared By:
James Crum, P.E. July 6, 2016
CCE Engineering

Reviewed By:
Michael G. Roberts, PE July 25, 2016
Director of Project Operations, ANTHC, DEHE

STATE OF ALASKA
49TH
MICHAEL G. ROBERTS
PE AELV14358
REGISTERED PROFESSIONAL ENGINEER

CONTENTS

REFERENCES

Beaver, Alaska – Sanitation Improvements – Environmental Report, CRW Engineers, December 2003.

Beaver, Alaska – Sanitation Feasibility Study, CRW Engineers, January, 2000.

Environmental Assessment, Village of Beaver, Alaska, Water and Sewer Holding Tanks and In-house Plumbing, ADEC, May, 2015.

Tanana Chiefs Conference – RMW Trip Report – Pat McAree, May 21, 2008

Village Safe Water – Observations of Construction Manager in Beaver, June, 2016.

EXECUTIVE SUMMARY

The Village of Beaver is located along the north bank of the Yukon River in north-central Alaska. This Preliminary Engineering Report (PER) discusses improvements to the village water treatment plant and adjacent utilidor serving the washeteria, multi-purpose clinic, and school.

The utilidor is made from plywood and contains water and sewer lines along with a circulating glycol heating loop with surrounding insulation. The utilidor is currently in marginal condition with a majority of the insulation being deteriorated and there are areas with the rotten wood and structural damage.

The glycol heating system to part of the utilidor is currently supplied from the school heating plant. The school heating system has periodically failed and the utilidor froze-up. This results in the sewer serving the washeteria also freezing up. These have taken several weeks to thaw out which results in the entire system being shut down due to a backed up sewer system. The sewer also handles the filter backwash water so a frozen line affects the water treatment process.

The utilidor needs upgraded to allow heating from either the washeteria or school and rotten plywood and deteriorated insulation replaced. Some pumps, valves, and piping in the water treatment plant (WTP) need to be refurbished. Some heat loop modifications and extensions will need to be installed in the WTP. Also a waste heat exchanger installed in the back-up heating system in the WTP needs to be connected. This work was partially completed in a previous project but final connections were not made. A boiler replacement with glycol heating system in the WTP which supplies the unit heaters needs to be completed with supply and return lines.

1.0 NEED FOR PROJECT

a) Project Need - The operation of the washeteria, school, water treatment plant, and clinic is dependent on the reliable operation of the heated utilidor between these facilities and the sewage lagoon. Part of this utilidor is in marginal condition and needs to be upgraded. Also some equipment in the water treatment plant needs to be rehabilitated such as valves, and fixtures that have reached the end of their service life.

b) Community Growth Projection: The population of this village is 72 people (2015 Alaska Department of Labor). Around 36 homes are occupied. The median age of the community is 32 years and the population growth is minimal or flat.

2.0 ALTERNATIVES CONSIDERED

The utilidor provides a service between several fixed structures. It is built above ground due to the need for periodic access for maintenance, marginal soil conditions, and grade to allow gravity flow to the sewer lagoon. The only alternatives that need to be considered are the types of materials used in upgrading the utilidor and alternate methods of operation that are to be incorporated into the new design.

a) Description - The existing utilidor is built from exterior grade plywood with painted surface. The plywood has been water soaked many times and has dry rot areas along its length. The insulation has been soaked many times and crumbles when touched or handled. These areas need to be replaced.

b) Design Criteria

The water source for the village is a community well that serves the washeteria, watering point, multi-purpose clinic, and school. Water is treated in the water treatment plant in the washeteria. The treatment process consists of filtration and chlorination prior to storage in the adjacent 66,000 gallon insulated tank. A watering point is provided for a community water haul and self-haul service. The capacity of this water system is adequate for the service provided.

The sewer lagoon serves the school, washeteria, water treatment plant, and village multipurpose clinic. It is adequately sized for this service. A second waste disposal lagoon is provided for the sewage haul service and is located 1-1/2 miles from the village by road. Both are adequately sized for this village.

The water supply and waste piping is adequately sized for the water treatment/washeteria facility. The utilidor circulating-heat-loop design will be checked to insure proper operation in the new operational configuration. The insulation will need to be replaced with material suitable to protect the piping when exterior conditions are at -60 degree F. This village has extreme cold periods during the winter.

c) Map, Drawings, and Photos. A map of the village, schematic plan of the utilidor, and several photos are attached at the end of the report.

d) Project Impacts - The project is to replace or upgrade parts of an existing operating facility. There are minimal impacts on the environment that are anticipated. The project will use no additional land in the village. The work will be coordinated with the operation of the school and washeteria to minimize any construction problems or needed operation of the facilities.

e) Construction Cost Estimate:

Beaver - Water Plant and Utilidor Upgrade - AK20703-5002
Beaver, Alaska
Estimate Prepared by Susan Randlett

	Description	Code	Unit	Quantity	Unit Cost	Total Cost
	Water Plant Upgrades					
1	WTP - Mechanical (Pumping) Upgrades	W-WO	SF	900	$85.00	$76,500.00
	WTP - Electrical Upgrades	W-WO	SF	900	$105.00	$42,000.00
	Shipping/Freight - Water Facilities	W-WO	LBS	17,667	$1.50	$26,500.00
	Crew Lodging/Per Diem - One Superintendent (45 days), One Electrician (40 days on site), One Plumber (60 days on site)	W-WO	Day	145	$100	$14,500.00

				Subtotal - Water		$159,500.00
				Contingency - Water	12%	$19,140.00
				PTS - Water	6%	$9,570.00
				Total Water		**$188,210.00**
	Utilidor Upgrades					
2	Sewer Utilidor	S-SO	LF	400	$165.00	$66,000.00
	Shipping/Freight - Wastewater Facilities	S-SO	LBS	17,667	$1.50	$26,500.00
	Crew Lodging/Per Diem - One Superintendent (45 days)	S-SO	Day	45	$100	$4,500.00
				Subtotal - Sewer		$97,000.00
				Contingency - Sewer	12%	$11,640.00
				PTS - Sewer	6%	$5,820.00
				Total Sewer		**$114,460.00**

Water	62%
Sewer	38%

Total Project Cost **$302,670**

Notes:
This project is replacing or upgrading in kind, with the exception of the configuration of the sewer connection to the school.
PTS of 6% reflects survey trip to ensure utilidor is on community's own land.
Contingency for delays increasing the shipping cost, and in the event of labor shortage.
Assumes local equipment available for rent; local operator available, local crew available.
Assumes that local gravel is available.
All costs include labor and material
Three Months Construction Time

f) O&M Cost Discussion - The O&M costs should be lowered by the construction of these upgrades due to improved efficiencies of operation, improved reliability of operation, and potential for lower heating costs. The village currently operates these facilities and these upgrades should make it easier for them to maintain. The waste heat system from the power plant needs to be completed (connected to the water plant). This would increase the heating capability and result in cheaper overall operating costs.

3.0 SELECTION OF AN ALTERNATIVE

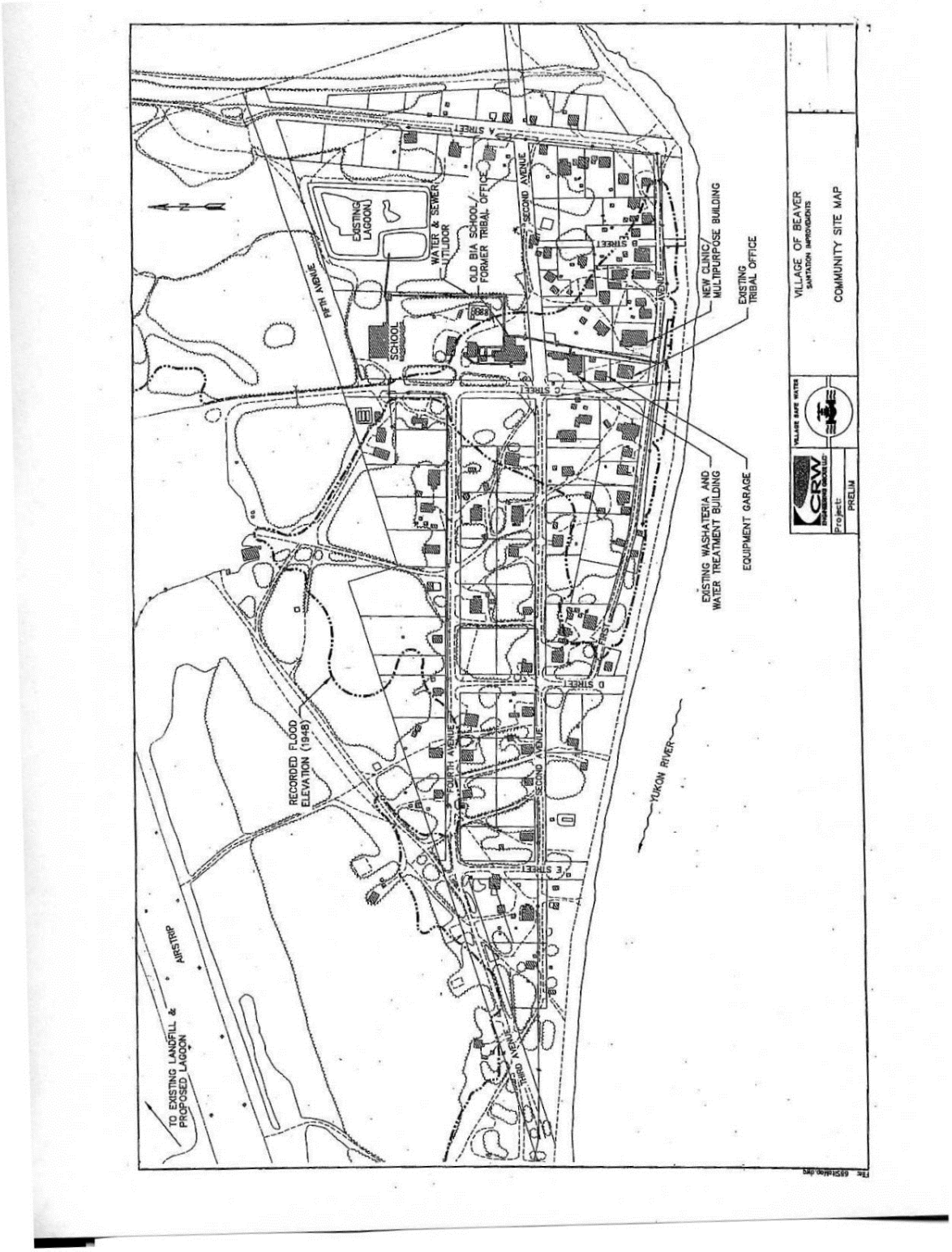
The alternatives are to do nothing or correct the deficiencies that have been identified in the water treatment equipment and utilidor. The correction of the deficiencies will make the system more reliable and efficient to provide a service to the residents of Beaver. This will improve the general quality of life for these residents.

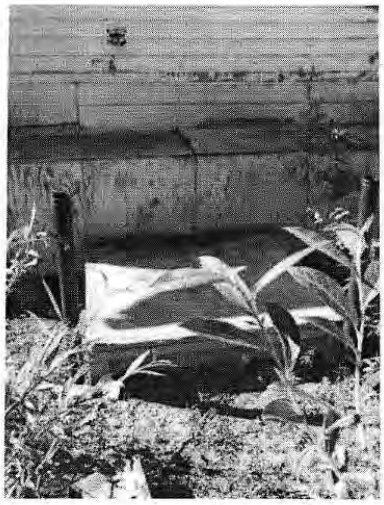
4.0 PROPOSED PROJECT (RECOMMENDED ALTERNATIVE)

The project will replace the deteriorated sections of the utilidor with pressure treated structural wood and plywood. The exterior surface (Top or lid area) will be provided with a water shielding surface to prevent water soaking and UV deterioration and other exposed surfaces will be painted. The piping materials will be analyzed during construction and if deteriorated, they will be replaced with suitable materials. The heat loop configuration will be modified to allow heat from either the school or washeteria to heat the utilidor system or be operated in a separated configuration as it is now. This will require some form of coordination agreement between the school system and village government.

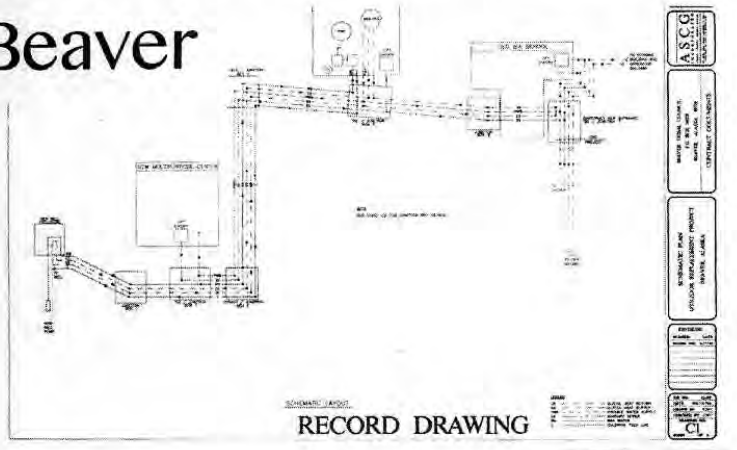
5.0 CONCLUSIONS AND RECOMMENDATIONS

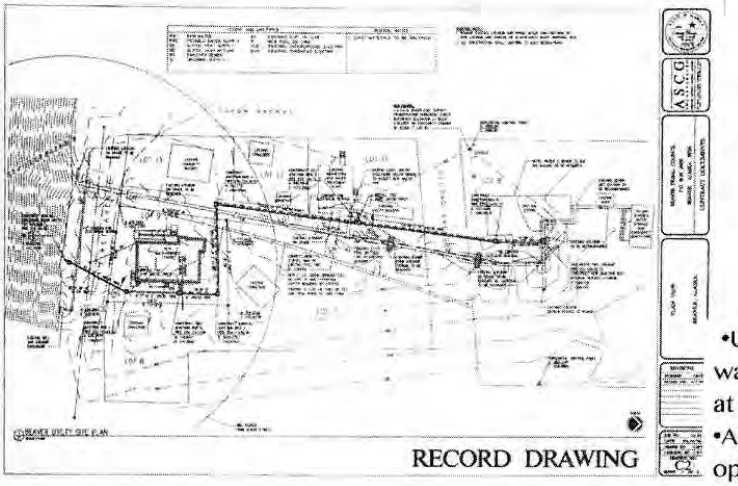
It is recommended that the project be funded as outlined in this PER report to upgrade the water treatment equipment and utilidor in Beaver, Alaska.


A STREET
B STREET
C STREET
D STREET
E STREET
FIRST AVENUE
SECOND AVENUE
THIRD AVENUE
FOURTH AVENUE
FIFTH AVENUE
EXISTING LAGOON
SCHOOL
WATER & SEWER UTILIDOR
OLD BIA SCHOOL FORMER TRIBAL OFFICE
NEW CLINIC/ MULTIPURPOSE BUILDING
EXISTING TRIBAL OFFICE
EXISTING WASHATERIA AND WATER TREATMENT BUILDING
EQUIPMENT GARAGE
RECORDED FLOOD ELEVATION (1948)
YUKON RIVER
AIRSTRIP
TO EXISTING LANDFILL & PROPOSED LAGOON
VILLAGE OF BEAVER
SANITATION IMPROVEMENTS
COMMUNITY SITE MAP
Project:
PRELIM

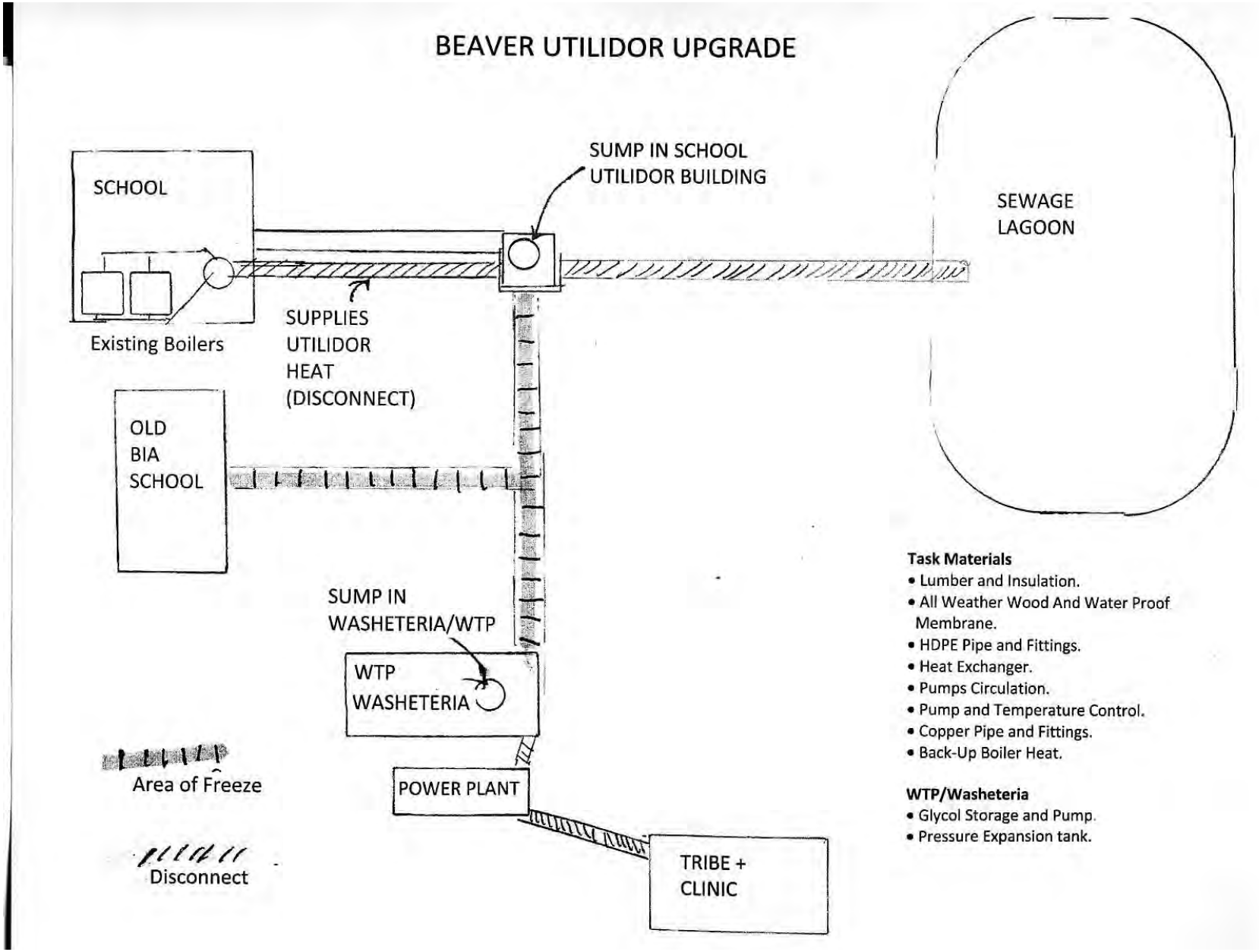


Beaver





•Utilidor freeze event stops use of water plant, washeteria, and restrooms at clinic/community center;
•Also, the system is not configured to operate without heat from the school.


BEAVER UTILIDOR UPGRADE
SCHOOL
SUMP IN SCHOOL
UTILIDOR BUILDING
SEWAGE
LAGOON
Existing Boilers
SUPPLIES
UTILIDOR
HEAT
(DISCONNECT)
OLD
BIA
SCHOOL
SUMP IN
WASHETERIA/WTP
WTP
WASHETERIA
Area of Freeze
POWER PLANT
Disconnect
TRIBE +
CLINIC
Task Materials
• Lumber and Insulation.
• All Weather Wood And Water Proof Membrane.
• HDPE Pipe and Fittings.
• Heat Exchanger.
• Pumps Circulation.
• Pump and Temperature Control.
• Copper Pipe and Fittings.
• Back-Up Boiler Heat.
WTP/Washeteria
• Glycol Storage and Pump.
• Pressure Expansion tank.

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 No. 790.07.001

CERTIFIED MAIL - RETURN RECEIPT REQUIRED: # 7016 2140 0000 1907 6752

August 23, 2017

Chief Rhonda Pitka
P.O. Box 24029
Beaver, AK 99724

Re: Beaver Public Water System Sanitary Survey Response Letter
PWSID #: 360230; Class: Community; Source: Groundwater

Dear Ms. Pitka,

This letter is the follow-up to the sanitary survey of the Beaver water system conducted by Brian Bearden with Tanana Chiefs Conference's Office of Environmental Health (TCC OEH) on July 25-26, 2017. The complete report was received by our office on August 10, 2017.

Based on the onsite inspection, it has been determined that your system has deficiencies. A list of the deficiencies with required actions and timelines for them to be resolved is outlined on the following pages. Documentation, with written verification that the listed deficiencies have been corrected (including photo documentation if applicable), is required within the timelines given. This includes corrective actions completed during Remote Maintenance Worker Wes Shales's recent site visit. Please contact our office within 30 days of receiving this letter to discuss the corrective actions required to resolve the deficiencies. If you are unable to correct any of the deficiencies within the timeframe specified, please submit a written corrective action plan and schedule (which includes a reason why the item cannot be addressed in the allotted timeframe) for Department review.

Please be advised that modifications to the drinking water system, other than routine maintenance and emergency repair, may first require approval by DEC. As the public water system owner, it is your responsibility to ensure that all replacement parts, piping, and equipment meet drinking water standards and regulations. Please contact a Drinking Water Program engineer before making any changes to the system to determine if engineered plans need to be submitted for approval.

Deficiencies

(Must be corrected or a corrective action plan with a timeline must be submitted to DEC within 120 days)

Source:

1. The well log does not indicate whether or not the well was grouted and it is located in a pit which is prohibited under drinking water regulation 18 AAC 80.015. The surveyor noted that this pit was previously filled, but fill was removed to facilitate installation of heat trace plumbing and never backfilled. The pit and surrounding well house floor must be backfilled with a low permeability material (eg: bentonite/soil mixture) and sloped to drain away from the well in all directions. The top layer of the fill may be a material that is more suitable for foot traffic.

2. The downturned electrical access point on the well that also serves as a vent was not screened (photo log page 3, photo 3). A screen must be installed to help prevent potential sources of contamination from impacting the source.

Water Treatment Plant & Storage:

3. The hose used to drain the filter vessel freeboard effluent before backwashing must have and maintain an air-gap that is at least two times the diameter of the drain hose above the backwash tank where it discharges (photo log page 14, photo 18).

4. The reagents used for testing free chlorine, total chlorine, and iron are expired. Up-to-date reagents must be obtained and kept in inventory. Mr. Bearden documented that while onsite new reagents were ordered. Photo documentation of the new reagents must be provided once they arrive.

5. The storage tank's add heat system is inoperable due to a failed heat exchanger. This leaves the water storage tank vulnerable to freezing. This issue must be addressed prior to winter to help ensure no disruption of service occurs due to freezing. If a new heat exchanger is installed it must be a double walled model.

6. It was noted that the water storage tank hatch was not locked and not water tight at the time of the inspection. Follow-up with the surveyor on August 18, 2017, clarified that the hatch will prevent entry of precipitation and other contaminants due to its design; however, photo documentation of the lockable brackets installed must be provided.

Distribution System:

7. The backflow preventer on the watering point is a dual check valve that is not certified to drinking water standards (photo log page 27, photo 37). This device must be replaced with a double check valve assembly that is certified to ANSI/NSF standard 61.

8. The unused storage tank and pressure pump system for the school is currently valved off from the distribution system. It must be physically disconnected.

9. Backflow prevention assemblies in the water system are not being routinely tested. All testable backflow prevention assemblies are required to be tested upon installation, and annually thereafter, per Plumbing Code requirements. A routine testing schedule must be developed and adhered to.

Water Haul System:

10. The truck water haul tank must be conspicuously marked "potable water only". In addition, the tank is reported to have a manufacturers serial number of BSI #08063859 noted on a manufacturer ID plate, per the design submitted to DEC during the 2006 approval process. If this plate is no longer visible, the serial number needs to be written in a location that can be visible for future inspections.

11. The truck water haul tank overflow line must be appropriately screened to help avoid potential contamination of the storage tank (photo log page 33, photo 45). Due to the extreme winter conditions in interior Alaska, the addition of a screen may cause freeze-up issues during the winter months. Therefore, a screen is only required during summer operation when freeze issues are not a concern (approximately May – September, weather dependent).

Management and Operations:

12. Drinking water regulation requires that all records including sample analysis, sanitary survey reports, and additional plans pertaining to the public water system be maintained and available for review according to the following timelines: bacteriological analysis – 5 years, chemical analysis excluding lead and copper – 10 years, lead and copper analysis/related documentation – 12 years, actions taken to correct violations – 3 years, sanitary survey reports/corrective actions – 10 years, public notices including CCR reports – 3 years, and priority measures plans – 2 years or until replaced with an updated copy. Records could not be located at the time of the survey. To request a copy of past sanitary surveys or monitoring results please contact me. An organized, easily accessible filing system must be maintained. Written documentation outlining how the system plans to maintain the appropriate records must be submitted to the Drinking Water Program.

Compliance Items

(Items listed below are not deficiencies; they are compliance related items included for your reference)

- The lead action level was exceeded in January 2016. Faucet replacement occurred and two sets of samples were collected in July 2016 and July 2017 that were below the Lead and Copper action levels. As a reminder, Lead Consumer Notification certification for the July 2017 samples is due by September 7, 2017. Notices were emailed to Ms. Selena Petruska on August 9, 2017. The Beaver water system has been placed on reduced annual monitoring for Lead and Copper. A complete set of samples must be collected during the first 6-months of 2018.

Additional Items

- The surveyor noted that regeneration of the greensand media through the use of potassium permanganate is not being performed often enough to efficiently run the plant, the air scour system is not being used, and water is not filtered to waste after the backwash cycle before returning the filter to service. Although Beaver is a groundwater system and filtration is not required, addressing these items would help ensure the proper operation of the greensand filtration system in the plant. Please contact TCC with questions on proper operation and maintenance of the filtration system.

- When the Goodyear FlexWing truck fill hose at the water treatment plant is damaged or needs replacement, it must be replaced with an NSF/ANSI 61 certified hose or pipe.

Recommendations

(Items listed below are optional; however, we encourage you to implement them if possible)

- The gasoline and lubricant tanks located approximately 150 feet from the well should be stored in a manner that would help reduce groundwater contamination from leaks, such as an enclosed shed or secondary containment.

- The chemical mix tank water make-up hoses should be disconnected when not in use (photo log page 24, photo 32).

Drinking Water Regulation 18 AAC 80.430 establishes that a community public water system must have a sanitary survey conducted at least every 3 years. **Your next sanitary survey will be due during the 2020 calendar year.**

If you have any questions about this survey or its findings, please contact me at 907-451-3038, toll free at 1-800-770-2137, or via e-mail at teslyn.visscher@alaska.gov.

Sincerely,

Teslyn Visscher

Teslyn Visscher
Environmental Program Specialist
Drinking Water Program, Fairbanks Office

Enclosures: Sanitary Survey Report

Cc w/encl: Selena Petruska, Beaver Utilities Manager – sep_99724@yahoo.com
Paul Petruska, WTP Operator – sep_99724@yahoo.com
Aaron Petruska, WTP Operator – sep_99724@yahoo.com
Brian Bearden, P.E., TCC OEH – brian.bearden@tananachiefs.org
Racheal Lee, TCC OEH – racheal.lee@tananachiefs.org
Johnny Mendez, P.E., DEC Drinking Water Program – johnny.mendez@alaska.gov

Sanitary Survey - Survey Responses

PWS Number: AK2360230 **Survey ID:** 384 **Survey Date:** 8/7/2017

Survey Name: BEAVER WATER SYSTEM - SS 2017 **User Name:** Brian Bearden

Question Number

General / SDWIS Site Visit Info

1 Reason for the visit: ☑ SNSV - Sanitary Survey

2 Date of the survey: 07/25/2017

Notes: Survey conducted 7/25 - 7/26

3 Status of the survey: ☑ C - Completed

4 Last name of inspector: Bearden

5 First name of inspector: Brian

6 Inspector organization: Tanana Chiefs Conference

7 Name of system representative participating in survey: Aaron, Paul, and Selena Petruska

Notes: Paul Petruska is primary operator; Aaron Petruska is the backup operator; Selena Petruska is the utility manager.

8 Other parties participating: Racheal Lee, TCC

General / SS Organization

Pre-Inspection:

1 **Checklist of pre-inspection tasks:**

2 Phone contact with responsible party? ☑ Yes ☐ No

Question Number		
3	Reviewed correspondence relative to the system to be inspected, including current Boil Water Notices and Public Notifications?	☑ Yes ☐ No
4	Reviewed previous sanitary survey report, including all deficiencies?	☑ Yes ☐ No
5	Reviewed previous Level 1 and Level 2 Assessments (if applicable)?	☐ Yes ☐ No ☑ NA
6	Obtained a copy of the RTCR sample siting plan from DEC to be used during the site visit for the RTCR special monitoring evaluation?	☑ Yes ☐ No
7	Reviewed compliance monitoring results and compliance records?	☑ Yes ☐ No
8	Reviewed approved plans/letters on file? (Note CT (concentration X contact time); operational requirements specified in engineering approval letters; separation distance waivers; number of storage tanks; specifications on well construction, grouting, an approved alternative to grouting, and an impervious surface; etc.)	☑ Yes ☐ No
9	Obtained a copy of the well log(s) (if applicable) to field verify that it is for the PWS's current source(s)?	☑ Yes ☐ No ☐ NA
10	Reviewed Source Water Assessment and delineated protection area, if available?	☐ Yes ☐ No ☑ Not Available
11	Reviewed the Vulnerability Assessment (VA)/Emergency Response Plan (ERP) or Priority Measures Plan (PMP) Certification form?	☑ Yes ☐ No
12	Verified both the certification level required for the water system and the certification level of the operator(s) online at the DEC Operator Certification Program? http://dec.alaska.gov/water/opcert/index.htm	☑ Yes ☐ No
13	Obtained data dump to review and provide to the water system for reference?	☑ Yes ☐ No
14	Obtained a copy of the water haul vehicle questions for each vehicle?	☑ Yes ☐ No ☐ NA
15	Obtained a copy of the chemical storage guidance?	☑ Yes ☐ No

16	Obtained full sanitary survey question set to record items on site that are not covered by this sanitary survey question set?	☑ Yes ☐ No

General / SS Organization

Post-Inspection:

1	Date official notification provided to DEC regarding potential deficiencies:	08/09/2017
Flagged for Follow-up		
2	Date inspector notified water system regarding potential deficiencies:	08/07/2017
Flagged for Follow-up		
3	If applicable, date inspector notified water system of any variance between the written evaluation and the verbal de-briefing or any draft version of the report:	
4	**Checklist of items needed for a complete survey:**	
5	Cover letter:	☑ Yes ☐ No
6	Deficiency Report:	☑ Yes ☐ No
7	Completed survey questions:	☑ Yes ☐ No
8	Photo log:	☑ Yes ☐ No
9	System site plan map (include source location and vicinity map):	☑ Yes ☐ No
10	System schematic(s) (i.e. treatment, distribution, etc.):	☑ Yes ☐ No ☐ NA
11	Lat/Long form for all new sources or if the current source is a different source than the one in the last sanitary survey:	☑ Yes ☐ No ☐ NA
12	Well log (required for all new sources and when well log is available but not in the DW Program file; not required if the inspector has verified that the well log is in the file and is the correct well log for the source. This verification must be noted here if the well log is not included.)	☑ Yes ☐ No ☐ NA

13	Please comment on any issues that are not addressed through the questions (i.e. additional deficiencies or findings).	Sinkhole near water plant/washeteria; portions of washeteria appear to have settled.
	Notes: Accordning to the operators, the depressed area behidn the plant is a sinkhole which has been growing. Cracks in the ground nearby seem to confirm this, which may be a thermokarst feature. The floor and interior walls of the washeteria appear to have sett	

General / Background Info

Name / Location:

1	Name of public water system:	BEAVER WATER SYSTEM
2	PWSID:	AK2360230
3	Physical address:	Airport Road
4	Total system design water production/treatment capacity in gallons per day (gpd):	11,200
	Notes: 11,200 gpd - design average daily demand; 29,500 gpd max based on metered plant flow rate of 20.5 gpm	
5	Average daily production (gpd):	5,000
	Notes: Operator did not have records - this figure is based on his recollection, which he stated was about 10,000 gpd of which 5,000 gpd is used for backwash.	

General / Background Info

Classification:

1	SDWIS activity status:	☑ Active
2	Primary water source:	☑ GW - Groundwater ☐ SW - Surface Water ☐ GWP - Groundwater Purchase ☐ SWP - Surface Water Purchase ☐ GWUDISW- Ground water und
3	Transient population:	
4	Residential population:	80
	Notes: Based on estimate by utility manager	
5	Non-transient population (i.e. workers, students, etc.):	

6	Number of service connections:	4
7	How many services are metered?	3
	Notes: Tribal hall/multipurpose building is not metered. School, truck fill, washeteria are metered.	
8	Is water obtained from another PWS? (If yes, list in notes the name of the water system or business and the PWSID, if applicable.)	☐ Yes ☑ No
9	Does the system sell/provide water to another water system or business? (If yes, list in notes the name of the water system or business and PWSID, if applicable.)	☐ Yes ☑ No
10	Have there been modifications to the system since the last survey? (Include all changes to the water system from the source through the distribution and additional water haul vehicles.)	☐ Yes ☑ No
11	Date(s) and description of modification(s):	
12	Have these modifications been approved by DEC? (List approvals obtained.)	☐ Yes ☐ No ☑ NA ☐ Unknown
13	Is the system only open on a seasonal basis? (If yes, list the dates of operation in notes.)	☐ Yes ☑ No
14	If seasonal system, does the entire distribution system stay pressurized throughout the year? (If no, explain in notes.)	☐ Yes ☐ No ☑ NA
15	If seasonal system, list off-season point of contact information, including: name(s), address(es), and phone number(s).	

General / Background Info

Owner:

1	Owner type:	☐ F - Federal ☐ P - Private ☐ L - Local ☐ S - State Government ☐ M - Mixed ☑ N - Native American
2	Legal owner first name/entity name:	Beaver Joint Utilities
	Notes: BJU is under the Beaver Village Council	
3	Legal owner last name (NA if entity):	NA

4	Owner's mailing street address:	P.O. BOX 24029
5	Owner's mailing address city:	BEAVER
6	Owner's mailing address state:	AK
7	Owner's mailing address zip code:	99724
8	Owner's telephone number (daytime):	907-628-6612
9	Owner's telephone number (emergency):	907-628-6288
	Notes: Selena Petruska, utility manager	
10	Owner's fax number:	
11	Owner's email address:	rpitka@beavercouncil.org
	Notes: Rhonda Pitka - Chief. Althernate: sep_99724@yahoo.com - Selena Petruska, utility manager.	

General / Background Info

Operator/Contact Info and Certification:

1	Does this PWS require a certified operator?	☑ Yes ☐ No
2	Primary operator's first name:	Paul
3	Primary operator's last name:	Petruska
4	Primary operator's street address:	P.O. Box 24029
5	Primary operator's address city:	BEAVER

Question Number		
6	Primary operator's address state:	AK
7	Primary operator's address zip code:	99724
8	Primary operator's telephone:	907-628-6288
9	Primary operator's email address:	sep_99724@yahoo.com
10	Primary operator's certification level(s): (Specify all that apply and list WT, WD, etc. and expiration date(s) in notes.) Notes: Aaron Petruska: Small Treated, exp 2017; WD Prov., exp 2018; WT Prov., exp 2018; WWC Prov., exp 2018	☐ Small - Untreated ☐ Small - Treated ☑ Provisional ☐ Level 1 ☐ Level 2 ☐ Level 3 ☐ Level 4 ☐ No Certification
11	List all secondary operators and their certification level(s): (Include WT, WD, etc. and expiration date(s) in notes.) Notes: Expires December 31, 2018.	Paul Petruska - WT 1; Alvin Winer - no certifications
12	Is at least one operator adequately certified for the system classification level? (Specify system level in notes for Water Treatment and/or Water Distribution as required by the Operator Certification Program.)	☑ Yes ☐ No
13	Does the system have an alternate method of system supervision? (i.e. maintenance contract, remote supervision, etc. If yes, describe in notes.)	☐ Yes ☑ No
14	If yes, does the system have a DEC approved Alternate Method of System Supervision (AMOSS) plan? (If yes, describe in notes.)	☐ Yes ☐ No ☑ NA
15	Emergency contacts: Day - name(s) and telephone number(s):	Aaron Petruska - 907-628-6126
16	Emergency contacts: Night - name(s) and telephone number(s):	Aaron Petruska - 907-628-6446

General / Background Info

Previous Survey Info:

1	Date of last sanitary survey:	12/8/2014
2	Last survey conducted by: (Name and Organization)	Racheal Lee, TCC

3	Have all deficiencies noted during the previous survey been corrected?	☑ Yes ☐ No ☐ NA
4	Have all defects from Level 1 and Level 2 Assessments conducted since the last sanitary survey, been corrected?	☐ Yes ☐ No ☑ NA
5	If the answer to either of the previous two questions is "no" list the remaining uncorrected deficiencies and defects: (During the site visit, the survey inspector must document the status of unresolved deficiencies/defects; use photo documentation where applicable.)	

General / Background Info

Current Survey Info:

1	Is standby or auxiliary power available?	☐ Yes ☑ No ☐ NA
2	If standby or auxiliary power is available is it in operable condition and well maintained (i.e. tested and noted in a log book)?	☐ Yes ☐ No ☑ NA
3	What parts of the system does the auxiliary power supply?	N/A
4	Does the system have a master meter? (Describe the master meter or system of meters used to comply with the master meter requirement: meters measuring treated, wasted, and distributed water. Provide photos with locational labels of these meter(s).) Notes: There are analog meters on the raw water feed, backwash, and all distribution system lines leaving the plant.	☑ Yes ☐ No ☐ NA ☐ Unknown
5	Is the master meter operable? (Explain, i.e. flow through meter, etc.)	☑ Yes ☐ No ☐ NA
6	If the system is under a current Boil Water Notice or other Public Notification requirement, is the notice posted on-site as required?	☐ Yes ☐ No ☑ NA

Management / General

1	Does the management keep separate financial records reflecting the costs of operating and maintaining this system?	☑ Yes ☐ No
2	Are the finances and budget satisfactory to cover costs of operating the water system in a safe manner (i.e. water samples, energy costs, operations, maintenance, staff training, etc.)?	☑ Yes ☐ No

3	Are routine operations and maintenance records being kept?	☐ Yes ☑ No
4	Are routine maintenance schedules established and adhered to for all components of the water system?	☑ Yes ☐ No
	Notes: Operator says he performs the work detailed in the PM plan, and this is verified by the RMW, but records of this work are created or kept.	
5	Is there a fee schedule? (If yes, describe in notes.)	☑ Yes ☐ No
	Notes: The school is charged a monthly fee, and haul customers are charged $20 per month for water service and $20 per month for sewer.	
6	Is there sufficient personnel?	☑ Yes ☐ No
7	Are supplies and maintenance parts inventories adequate?	☑ Yes ☐ No
8	Are complaints logged in and responded to? (If any major complaints have been received since the last sanitary survey, describe in notes.)	☐ Yes ☑ No
	Notes: According to the utility manager, no one complains. But there is not an established system for recording complaints if they are received.	

Emergency Preparedness/Security / General

1	Are the appropriate emergency preparedness plans available for review by the sanitary survey inspector? Vulnerability Assessment (VA) and Emergency Response Plan (ERP) for systems serving a population of 1,000 or more. Priority Measures Plan (PMP) for systems serving a population of less than 1,000.	☐ Yes ☑ No
	Notes: PMP was not available at time of survey.	
2	Is the plan accessible to all authorized personnel?	☐ Yes ☐ No ☑ NA
	Notes: PMP was not available	
3	Is training on the emergency response or priority measures plan provided? (If yes, list the date of the most recent training in notes.)	☐ Yes ☑ No ☐ NA
4	Does the plan include a call list or chain of command?	☑ Yes ☐ No ☐ NA
	Notes: The PMP does include this information, but it was not available at the time of inspection (A copy was sent to Beaver afterward)	
5	Does the system have an alternate source of water in the event that the system's primary source of water is contaminated or shut down? (If yes, list the source(s) in the notes field.)	☐ Yes ☑ No ☐ NA
	Notes: There are no other wells available and the plant cannot treat river water because it is not a surface water treatment system.	

6	Is the system secured as appropriate (i.e. locks, lighting, fences, etc.)?	☐ Yes ☑ No

Notes: The water tank ladder cage is locked, but the combination has been lost so access is provided through a vertical cage bar that is loosely bolted and is swung out of the way to allow entry. The hatch at the top of the tank is not locked. The water plant is

Regulations/Monitoring/Data Verification / General

1 Potential Deficiency	Are all components and chemicals used in contact with the water certified to ANSI/NSF standards for drinking water; include treatment chemicals, filters/housings, etc.? (List any that are not ANSI/NSF certified, in notes.)	☐ Yes ☑ No ☐ Unknown

Notes: The double check valve used on the watering point is a model that is not approved for potable water use due to not being certified lead-free. All chemicals used are NSF certified.

2	Does the system have a DEC-approved sample siting plan for total coliform (RTCR)?	☑ Yes ☐ No
3	Is a total coliform sample siting plan available for review? (If no, use the sample siting plan obtained from the DW Program to answer the following questions.)	☑ Yes ☐ No
4	Does the sample siting plan accurately represent the entire distribution system's current configuration? (Include addition or removal of distribution lines, pressure zones, system loops, or sample locations, etc. If no, explain in notes.)	☑ Yes ☐ No
5	For a seasonal system on quarterly monitoring, do the time periods listed on the sample siting plan match the actual periods of highest demand? Explain in notes.	☐ Yes ☐ No ☑ NA
6	Does the system have a supply of extra total coliform sample bottles available? (Minimum of 4 bottles for systems with a groundwater source and 3 for systems with surface water or GWUDISW sources.)	☑ Yes ☐ No
7	If applicable, does the system have a sample siting plan for Lead and Copper, DBP, LT2, etc., available for review?	☑ Yes ☐ No ☐ NA
8	**Does the water system maintain the following records? (Please review these records.)**	
9	Bacteriological/Microbiological Analysis - 5 years retention.	☐ Yes ☑ No

Notes: Records may have been available, but there is not an organized filing system for water system records so none could be found at the time of the inspection.

10	Chemical Analysis - 10 years retention. Lead and Copper (all analyses, reports, surveys, letters, evaluations, schedules, determinations, etc.) - 12 years retention.	☐ Yes ☑ No

Notes: Records may have been available, but there is not an organized filing system for water system records so none could be found at the time of the inspection.

11	Turbidity Data (monthly operator reports) - 5 years retention. Turbidity values exceeding 5 NTU - 10 years retention. Conventional or direct systems: continuous, individual (3 or more filters) or combined filter effluent readings - 3 years retention.	☐ Yes ☐ No ☑ NA

12	Disinfection Residual Data (monthly operator reports) - 5 years retention. Groundwater systems, if applicable, DEC-specified minimum disinfection residual - 10 years retention.	☐ Yes ☑ No ☐ NA
	Notes: Records may have been available, but there is not an organized filing system for water system records so none could be found at the time of the inspection.	
13	Records of actions taken to correct violations - 3 years retention.	☐ Yes ☑ No ☐ NA
	Notes: Records may have been available, but there is not an organized filing system for water system records so none could be found at the time of the inspection.	
14	Groundwater systems: documentation of corrective actions following a source water fecal positive sample result - 10 years retention.	☐ Yes ☐ No ☑ NA
15	Reports, summaries, communications, and corrective action documentation related to sanitary surveys - 10 years retention.	☐ Yes ☑ No
	Notes: Records may have been available, but there is not an organized filing system for water system records so none could be found at the time of the inspection.	
16	Reports, summaries, or communications related to Public Notifications, including CCRs as applicable - 3 years retention.	☐ Yes ☑ No ☐ NA
	Notes: Records may have been available, but there is not an organized filing system for water system records so none could be found at the time of the inspection.	
17	Variances and/or exemptions - 5 years retention after the expiration date.	☐ Yes ☑ No ☐ NA
	Notes: Records may have been available, but there is not an organized filing system for water system records so none could be found at the time of the inspection.	
18	Monitoring Plans (as applicable): Microbiological and Turbidity - 5 years retention. Chemical, IDSE, System Specific Study Plan, Stage 2 DBP, etc. - 10 years retention.	☐ Yes ☑ No ☐ NA
	Notes: Records may have been available, but there is not an organized filing system for water system records so none could be found at the time of the inspection.	
19	Disinfection Profile and Benchmark - 10 years retention.	☐ Yes ☐ No ☑ NA
20	Records of both DEC-specified requirements for membranes and failures in membrane integrity/operations - 5 years retention.	☐ Yes ☐ No ☑ NA
21	Emergency Response Plan or Priority Measure Plan - 2 years retention or until replaced by update. Certification of Compliance with Emergency Preparedness Requirements (initial and updates) - 2 years retention or until replaced by updated certification.	☐ Yes ☑ No ☐ NA
	Notes: Records may have been available, but there is not an organized filing system for water system records so none could be found at the time of the inspection.	

Sources / General

General:

1	Are there any abandoned wells in the delineated protection area? (If yes, note the location(s) on the system site plan map.)	☑ Yes ☐ No ☐ Unknown
	Notes: Two previous wells were located along the Yukon shoreline on both sides of the current well. No trace of these wells could be found, so the exact location is not known.	

2	If yes, are they properly decommissioned? Notes: No evidence visible of the previous wells	☐ Yes ☐ No ☐ NA ☑ Unknown
3	Are there any unused wells in the delineated protection area? (If yes, note the location(s) on the system site plan map.)	☐ Yes ☑ No ☐ Unknown
4	If yes, are they maintained in a safe and sanitary condition?	☐ Yes ☐ No ☑ NA ☐ Unknown
5	Does the system have a Source Water Protection Plan and is it being implemented properly to protect the source? (Explain in notes.)	☐ Yes ☑ No

Sources / Groundwater

WL BEAVER WATER SYSTEM - (Active) / General:

1	What is the name of this well? (List local and DEC name/number.)	Beaver Water System Well WL001
2	Does the system have a well log? Survey Inspector: A COPY MUST BE SUBMITTED TO DEC IF A VERIFIED COPY IS NOT ALREADY IN THE DEC PWS FILE. List the DNR WELTS log ID in notes if available. Notes: Prior sanitary survey included the incorrect well log - records review confirmed that the well in use today is the well that was drilled in 1995 by Ice Water Well, Inc., as recorded in WELTS.	☑ Yes ☐ No
3	List latitude and longitude reading in decimal degrees. (Must be in WGS 84 datum. Example +56.234230, -136.23423.) Note proximity of reading to the source, for example, "at the wellhead" or "5 feet east of the wellhead". Notes: GPS reading taken from outside the well house, approximately 5 feet south of wellhead. Accuracy indicated on GPS unit was 21 feet.	N 66.35823, W 147.39713
4	List the available Lat/Long accuracy (in meters) displayed on the device (Example, Accuracy = 13 meters).	21 feet (6.4 meters)
5	Is the well site properly drained (i.e. sloping away from the casing for 10 feet in all directions)? Note condition of the surface around the casing using a description and photo documentation that shows the well both close up and from a distance.	☑ Yes ☐ No
6	Is the well casing intact (i.e. unsealed hole or break, corrosion, visible damage, etc.)? Describe the condition in notes.	☑ Yes ☐ No
7	Is there documented 10 feet of continuous well grout within the first 20 feet below ground surface or has the department approved an alternative to grouting? (Note any documentation found regarding grout, an approved alternative to grouting, and approval to construct or operate the well. Include applicable dates for each of these documents found in the file and a copy of any obtained during the survey that are not in the file.)	☐ Yes ☑ No

8	If a visible or documented impervious surface (i.e. concrete pad, bentonite layer, or other approved seal) exists around the well casing, does it ensure drainage away from the well? (The impervious casing should be without cracks, breaks, or frost jacking, etc.) Describe the impervious surface and provide photo documentation. (Note any documentation found regarding the impervious surface design and DEC requirements.)	☐ Yes ☑ No ☐ NA
	Notes: Currently there is a pit lined with insulation foam board surrounding the well head and casing. Records indicate that this pit had previously been filled with gravel as part of a project completed in 2006. The operator stated that the gravel was removed s	
9	Is the sanitary seal or well cap properly installed to seal the casing? (The seal should create a protective cover from the elements and protect against entry of vermin or contaminants into the well. Venting should be maintained where applicable.)	☑ Yes ☐ No
10	How often is the well inspected by the operator or owner?	once per year
11	Does the system have any of the listed potential contaminant sources within the specified distance in the list below, that do not have a separation distance waiver? Wastewater Treatment/Disposal (200') Private Sewer Line (100') Community Sewer Line (200') Septic Tank (200') Leach Field (200') Bulk Fuel Storage (100') Fuel Line (100')	☐ Yes ☑ No
12	List the measured distance from the drinking water source to all contaminant sources listed in the above question and any applicable separation distance waivers.	
13	List any other contaminant sources and their distances from the drinking water source.	There is an improvised/unlined fueling station about 150 feet from the well
	Notes: This area is shown in the pictures and contained drums of gasoline and lubricating oil at the time of the inspection. One of the gasoline drums was fitted with a portable pump, hose, and fueling nozzle. This site appears to represent a high risk of spills	
14	How far away is the nearest surface water? (i.e. lake, river, slough, etc.)	50 feet
	Notes: Yukon River	
15	Does casing extend at least 12 inches above the floor or ground? (List height in notes.)	☑ Yes ☐ No
16	If vented, is well vent screened with the return bend facing downward and terminating 18 inches above ground level or above maximum flood level, whichever is higher? (If no, describe in notes.)	☐ Yes ☑ No ☐ NA
	Notes: There is an open-ended conduit extending downward from the well cap which serves as a vent. The well pump power conductors and lanyard/safety cable exit the well through this conduit, leaving a gap that is not screened.	
17	Is there a source water sample tap or other means present to sample source water? (Note location on system schematic. Describe sampling method if not from a sample tap.)	☑ Yes ☐ No
	Notes: Sample tap is located in the water plant on the raw water intake piping just ahead of the master meter.	

18	If the system has been issued a letter for RTCR reduced monitoring, stating that it has a protected groundwater source determination, is the system meeting the conditions established in the letter and associated documentation (checklist, plan approval, etc.)? (This letter will be provided by the EPS if it is applicable to this system. If you did not receive this letter as part of the sanitary survey documentation, check NA as the answer to this question.)	☐ Yes ☐ No ☑ NA

Sources / Groundwater

WL BEAVER WATER SYSTEM - (Active) / Pumps:

1	What type of pump(s) does the system have? (i.e. centrifugal, hand pump, jet, positive displacement, submersible, vertical turbine, etc.) Notes: According to the 2002 design documents and the 2009 O&M Manual, the installed pump is a 4-inch Goulds 3/4 hp 18GS07412, 230 V single phase.	Submersible pump
2	Are pumps and pump controls in good operating condition?	☑ Yes ☐ No
3	Is the electrical wiring maintained properly? (If no, describe in notes.)	☑ Yes ☐ No
4	Does the electrical wiring pose an immediate safety hazard? (If yes, describe in notes.)	☐ Yes ☑ No
5	Are there spare pumps or critical pump parts readily available? Notes: A spare well pump is not kept on-hand, but can typically be obtained from Fairbanks within 24 - 72 hours with assistance from the RMW program.	☐ Yes ☑ No

TP FOR BEAVER WATER SYSTEM - (Active) / General

Monitoring:

1	Are compliance and process monitoring sample taps in the correct location(s) (i.e. entry point to distribution, after filtration, etc.)? (List any missing sample taps and show location of all sample taps on the system schematic.)	☑ Yes ☐ No
2	List test equipment in the treatment plant. (List make, model, and use; include on-line and hand held testing equipment.) Notes: Hach Pocket Colorimeter II Cl - Catalog number 58700-00; Mn - 58700-18; Fe - 58700-22	3x Hach Pocket Colorimeter II (Cl, Fe, Mn)
3	Are testing facilities and equipment orderly and well maintained?	☑ Yes ☐ No
4	Are proper calibration standards and reagents used for analyses?	☑ Yes ☐ No ☐ NA
5	Are the reagents used in testing past the expiration date? Potential Deficiency Notes: The DPD Free Chlorine reagent expired July 2016; Total Cl exp. June 2016; Fe (FerroVer Iron Reagent) ep. Feb 2017. The Mn reagent (Ascorbic Acid) does not expire for another year or more. (I witnessed the operator place a phone order direct with Hach for	☑ Yes ☐ No ☐ NA

6	**Did the operator demonstrate competence with standard testing methods for the following: (Operator must demonstrate all control tests applicable to the system, document results in the notes section of each applicable test.)**	
7	Turbidity:	☐ Yes ☐ No ☑ NA
8	pH/Temperature:	☐ Yes ☐ No ☑ NA
9	Fluoride:	☐ Yes ☐ No ☑ NA
10	Disinfection Residual: Notes: From Lab faucet: results: 0.05 mg/L	☑ Yes ☐ No ☐ NA
12	CT (concentration X contact time) readings and calculations:	☐ Yes ☐ No ☑ NA

TP FOR BEAVER WATER SYSTEM - (Active) / General

Cross Connections:

1	Are there any unprotected cross-connections in the treatment system that pose an immediate health risk? (Describe in detail and provide well labeled photo(s).)	☐ Yes ☑ No
2	Does the system have any high hazard cross-connections with inadequate protection (i.e. check valve on the filter supply line, solo valve, etc.)? (Describe in detail and provide well labeled photo(s).)	☐ Yes ☑ No
3	Are there any other cross-connections in the system with inadequate protection (i.e. air gaps or backflow prevention not installed at all appropriate locations, such as treatment drain lines, backwash lines, instrument waste lines, etc.)? (Describe in detail and provide well labeled photo(s).)	☐ Yes ☑ No
4	If system has air gaps, are there any less than 2 times the diameter of the drain or waste line? (Describe in detail and provide well labeled photo(s).)	☐ Yes ☑ No ☐ NA
5	If backflow preventers are installed, are there any problems that may hinder operation or testing (i.e. leaking, improper installation, etc.)? (Describe in detail and provide well labeled photo(s).)	☐ Yes ☑ No ☐ NA
6	If backflow preventers are installed, are they tested? (Describe testing schedule or frequency. Include the date they were last tested and the name of the tester.)	☐ Yes ☑ No ☐ NA
7	Are any backflow prevention devices installed in a pit? (If yes, describe in detail and provide well labeled photo(s).)	☐ Yes ☑ No ☐ NA

8	Are backflow prevention device drains provided with a suitable air gap?	☑ Yes ☐ No ☐ NA
9	Has the system operator been trained to identify and control cross-connections?	☑ Yes ☐ No
10	Is there a written cross-connection control plan or program?	☐ Yes ☑ No

TP FOR BEAVER WATER SYSTEM - (Active) / General

Other Treatment Chemicals:

1	Does the system add chemicals that are not listed on the data dump?	☐ Yes ☑ No
2	What additional chemicals are added? (List manufacturer and product for each and document point of injection on the system treatment schematic.)	
3	Is chemical feed equipment maintained and in operable condition? (If no, describe in notes.) Notes: All LMI pumps were recently rehabilitated with new rebuild kits.	☑ Yes ☐ No ☐ NA
4	Are critical spare parts for chemical feed equipment readily available?	☑ Yes ☐ No ☐ NA
5	Are there adequate means of mixing the chemicals into the water downstream of chemical feed points (i.e. adequate line distance after chemical addition, static or mechanical mixers, etc.)? (Describe in notes.) Notes: Static mixers installed immediately downstream of pre-filtration oxidizer additon (Cl and KMNO4) and after disinfection injection just prior to the storage tank.	☑ Yes ☐ No ☐ NA
6	Are records maintained for quantity of each chemical used?	☐ Yes ☑ No ☐ NA
7	Are dosages for each chemical calculated on at least a daily basis? (If no, how often is this done?) Notes: Operators use charts that are posted to mix chemicals, and use measured concentrations to adjust injection rates.	☐ Yes ☑ No ☐ NA
8	Are concentrations for each chemical added monitored at appropriate locations on at least a daily basis? (Examples: chlorine residual at outlet of CT tank and/or entry point to the distribution, fluoride at the entry point to the distribution, etc.)	☑ Yes ☐ No ☐ NA
9	Are backflow prevention devices installed on water lines used for mixing chemical dilutions? Notes: Vacuum breakers, hoses kept out of chemical tanks.	☑ Yes ☐ No ☐ NA

10	Are the chemicals properly stored to prevent risk of contamination, fire or explosion? (If not, list the chemicals and potential hazard, and provide photo documentation.)	☑ Yes ☐ No ☐ NA
11	Is chemical feed equipment connected to flow switches?	☑ Yes ☐ No ☐ NA
12	Are flow switches installed in the correct location?	☑ Yes ☐ No ☐ NA
13	Are flow switches periodically checked to ensure chemical feed equipment does not operate without water flowing? (If yes, list how often in notes.)	☑ Yes ☐ No ☐ NA

Notes: Every time the filtration is used - the oeprators verify that the chemical pumps are operating.

TP FOR BEAVER WATER SYSTEM - (Active) / Chlorination

Hypochlorination:

1	What type of disinfectant is used (i.e. calcium or sodium hypochlorite)? (Also list manufacturer, product name, and NSF certification information.)	calcium hypochlorite

Notes: DryTec, NSF 60 labeled.

2	Is the disinfection equipment operated and maintained properly?	☑ Yes ☐ No

Notes: Chlorine residual was low at the time of the inspection, and operator adjusted the LMI pump to compensate. The same situation was reported during a recent RMW visit.

3	If hypochlorite is used, are the solutions being made to the proper concentration and in a safe manner? (Describe in notes.)	☑ Yes ☐ No ☐ NA

Notes: The operators prepare a 1% solution based on the wall chart provided with the plant O&M manual, which is posted in the chemical mixing area.

4	Are proper residual test kits available and are they being maintained?	☑ Yes ☐ No ☐ NA
5	Is the operator trained to use and conduct monitoring of disinfectant?	☑ Yes ☐ No ☐ NA
6	Is there adequate chlorine residual at the entry point to the distribution system? (The higher of 0.2 mg/L or level required to meet CT.)	☐ Yes ☑ No ☐ NA

Notes: There was some confusion among the operators as to what constituted the entry point. They have been taking entry point to mean the sample tap just downstream of the hypochlorite injector and static mixer, where the filter effluent enters the storage tank.

7	Are disinfectant residual measurements being made and recorded at the same time and location in the distribution system as the total coliform bacteria sample is collected?	☑ Yes ☐ No ☐ NA
8	Is there a detectable disinfectant residual being maintained throughout the distribution system?	☑ Yes ☐ No ☐ NA

9	Is there sufficient CT (concentration X contact time) between the disinfection point and the first point of use? (Attach readings for temperature, pH, free chlorine residual, peak flow rate, and tank volume or level, description of CT tank, and calculations. Also note locations of samples used to obtain the readings.)	☐ Yes ☐ No ☑ NA
10	Is there a back-up disinfection unit? (Describe in notes if it is on-line and operational. Filtration avoidance systems cannot have an NA answer; all other types of systems that do not have back-up disinfection should be NA.) Notes: There is one spare LMI pump, installed alongside the active LMI pumps. It was originally intended for polymer injection, which is nto used now.	☑ Yes ☐ No ☐ NA
11	Is there an auto switch-over for disinfection units to prevent a break in disinfection? (Filtration avoidance systems cannot have an NA answer; all other types of systems that do not have auto switch-over should be NA.)	☐ Yes ☐ No ☑ NA
12	If there is not a back-up disinfection unit, are critical spare parts for disinfection equipment readily available?	☐ Yes ☐ No ☑ NA
13	Are disinfection units hooked up to flow switches that prevent the addition of disinfectant when no water is flowing? (If yes, note how often they are checked.) Notes: They are checked every time the filtration system is operated by confirming the injection pumps are operating, and that they stop operating when the well shuts off.	☑ Yes ☐ No
14	Is disinfectant feed proportional to water flow? Notes: The flow to the plant does not vary - it is determined by system hydraulics including a flow restrictor on the raw water intake line that keeps the system operating at about 20.5 gpm as indicated by the master meter.	☐ Yes ☐ No ☑ NA
15	Is there an adequate quantity of disinfectant readily available?	☑ Yes ☐ No
16	Is the disinfectant properly stored?	☑ Yes ☐ No ☐ NA

TP FOR BEAVER WATER SYSTEM - (Active) / Filtration

General:

1	Is filtration equipment maintained and in operable condition? (List make and model of turbidimeter.)	☑ Yes ☐ No
2 Potential Deficiency	Are turbidimeters calibrated with primary standards following manufacturer's recommendations as to frequency and method? (List frequency and/or schedule in notes.) Notes: Not applicable - turbidimeters are not a part of this groundwater system.	☐ Yes ☐ No

TP FOR BEAVER WATER SYSTEM - (Active) / Filtration

Greensand:

1 What is the treatment objective?

Iron removal and disinfection

2 How many filters are there?

3

3 Are filters pressure or gravity?

- [x] Pressure
- [ ] Gravity

4 What is the filter media type?

Manganese greensand and anthracite

Notes: Filter media consists of (from top to bottom): 18" anthracite; 18" manganese greensand; gravel support

5 If there is a view port, describe condition of the media (i.e. media height, visible mud packing, etc.).

No view port

6 How often is the media inspected? (Note findings of the last inspection, if available.)

About once per year

7 What is the total surface area including all filters in ft²?

14.7

Notes: 2.5 ft OD fitlers X3

8 What is the flow rate through the filters in gpm?

25

Notes: As indicated by the master meter, observed while treating water 7/25/17

9 How is backwash frequency determined (i.e. turbidity, iron levels, time in service, etc.)?

Time - every 4 hours

Notes: The backwash frequency is based on operator experience.

10 Is backwash flow measured?

- [x] Yes
- [ ] No

11 Can backwash rate of flow be adjusted?

- [x] Yes
- [ ] No

12 What is the source of water used for backwashing?

Finished water from storage tank

13 Is there air assisted backwash capability/air scour?

- [x] Yes
- [ ] No

Notes: Operators are currently not using the air scour system - TCC will be sending an RMW in the near future to refresh training on operation of the fitlration system including the air scour.

14	Is the source of air provided by an oil-less compressor/blower or one that uses food grade lubricants? Notes: Operators state that there is no oil used for the blower.	☑ Yes ☐ No ☐ NA
15	Is there equal flow through all filters?	☑ Yes ☐ No
16	Is flow to the filter(s) controlled with a device such as a rate of flow controller?	☑ Yes ☐ No
17	Is there a surface wash?	☐ Yes ☑ No
18	Can surface wash arm rotation be verified?	☐ Yes ☐ No ☑ NA
19	How is it determined that backwash is complete and the filters can be returned to service (i.e. turbidity, grab sample, visual check, time, etc.)?	Visual check on backwash effluent
20	Does the system filter water to waste after backwash and before returning the filter to service? Notes: No, according to both primary and backup operators	☐ Yes ☐ No
21	If the system filters to waste, is a sufficient air gap or backflow prevention provided?	☐ Yes ☐ No ☐ NA
22	Is pressure drop monitored across the filter(s)?	☑ Yes ☐ No
23	Is greensand regenerated? (If yes, explain how, i.e. permanganate, chlorine, etc.) Notes: Use of KMNO4. Currently this is not being performed often enough to efficiently run the plant. TCC is sending an RMW in the near future to provide refresher training on proper greensand filtration operation.	☐ Yes ☑ No

TP FOR BEAVER WATER SYSTEM - (Active) / Other

Permanganate:

1	What is the treatment objective (i.e. oxidation of iron/manganese, regeneration of greensand media, etc.)?	Oxidation of iron and manganese, and regeneration of greensand media
2	What chemical is added? (List manufacturer and product for each, and document point of injection on the system treatment schematic.) Notes: Organic Industries Potassium Permangenate; Carus Cairox KMNO4 Free-flowing grade.	2 KMNO4 products in use

3	Is chemical feed equipment maintained and in operable condition?	☑ Yes ☐ No
4	Are critical spare parts for chemical feed equipment readily available?	☑ Yes ☐ No
5	Are there adequate means of mixing the chemicals into the water downstream of chemical feed points (i.e. adequate line distance after chemical addition, static or mechanical mixers, etc.)? Notes: Static mixer just downstream of injector	☑ Yes ☐ No
6	How is proper chemical dose determined?	Wall chart, effluent color, Fe and Mn measurements
7	How is chemical overfeed prevented (i.e. flow switch, etc.)?	Flow switch
8	Are the chemicals properly stored to prevent risk of contamination, fire or explosion? (If not, list the chemicals and potential hazards in notes and provide photo documentation.)	☑ Yes ☐ No

Storage / ST BEAVER WATER SYSTEM - (Active)

1	What is the name of this storage facility? (List local and DEC name/number.)	SF001
2	How many storage tank(s) make up this storage facility? (Describe in notes.)	1
3	List all other type(s) of structure(s)/tank(s) that are present in the system that are not listed on the data dump (i.e. bladder, elevated, ground, hydropneumatic, reservoir, underground). Notes: There is a pressure tank just ahead of the greensand filters called the Raw Water Detention Tank, used to provide contact time for the KMNO4 and Cl to oxidize the dissolved iron and manganese. There are 3 hydropneumatic pressure tanks on the distribution	Raw water detention tank; hydropneumatic tanks
4	What does this storage tank hold?	☐ Raw Water ☐ Filtered Water ☐ Disinfected Water ☑ Filtered and Disinfected Water
5	Is treated water storage covered?	☑ Yes ☐ No ☐ NA
6	Is this storage facility used to meet disinfectant contact time?	☐ Yes ☑ No

7	Is the water in the tank(s), at the time of the inspection, enough to meet applicable demand and/or disinfection contact time requirements? (Note the volume or water level in tank, if possible.)	☐ Yes ☐ No ☑ Unknown
	Notes: Water level was low. The tank high and low level sensors are not working and so the well pump/fitlration system does not operate automatically, requiring manual filling of the tank	
8	Date initially put into service?	2004
9	What is the volume of the tank(s) in gallons?	66,000
10	On what date was the tank(s) last inspected?	07/13/2017
	Notes: TCC RMW recently assisted in the cleaning of the Beaver water storage tank.	
11	On what date was the tank(s) last cleaned?	07/13/17
12	Does surface run-off drain away from the storage tank(s)?	☑ Yes ☐ No
13	Are overflow and drain lines screened or covered, and do the lines terminate a minimum of 2 times the diameter of the water outlet pipe above the ground or storage? (If no, describe in notes.)	☑ Yes ☐ No
14	Are vents screened or covered, and turned downward; and do the lines terminate a minimum of 2 times the diameter of the water outlet pipe above the ground or storage? (If no, describe in notes.)	☑ Yes ☐ No
15	Is the hatch watertight? (If no, describe in notes.)	☐ Yes ☑ No ☐ NA
	Notes: The tank hatch is a standard tank hatch with a raised bottom lip and the the cover overturned at the edges, which would prevent the entry of any precipitation. It is not fitted with a water tight gasket, however, but it fits tightly when closed and would	
16	Is the hatch locked?	☐ Yes ☑ No ☐ NA
	Notes: Hatch is not loced, but the raised ladder cage is locked. The combination to the lock has been lost, so access is provided by unfastening a bolt on one of the vertical ladder cage bars, which is then swung out of the way to allow entry from a portable lad	
17	Is the storage tank(s) clean and free from contamination? (If no, describe in notes.)	☑ Yes ☐ No ☐ Unknown
	Notes: Recently cleaned.	
18	Is the storage tank(s) structurally sound?	☑ Yes ☐ No

19	Can the storage tank(s) be isolated from the system?	☑ Yes ☐ No
20	Are leaks evident at the time of inspection?	☐ Yes ☑ No
21	Is the storage tank(s) lined or coated? (If yes, describe in notes.)	☑ Yes ☐ No ☐ Unknown
	Notes: The interior of the tank appears to be coated with the original manufacturer plate coating (the bolts are not coated).	
22	Is the storage tank(s) interior coating or liner peeling or cracking? (If yes, describe in notes.)	☐ Yes ☑ No ☐ NA ☐ Unknown
23	Is storage tank(s) safely accessible to inspector?	☑ Yes ☐ No
	Notes: Access is awkward due to the locked cage and loose cage bar, but it can be done safely with a proper portable ladder.	

DS BEAVER WATER SYSTEM - (Active) / General

1	Describe any problems that have occurred in the distribution system since the last sanitary survey.	Water supplied to clinic and multipurpose building too hot
	Notes: The water service line to the multipuprpose building/clinic is reportedly "too hot" due to the fact that it is a single non-circulating service line that must be kept heated by a glycol heat trace during winter. The village is in the process of installing	
2	Are fire hydrants connected to the distribution system? (If yes, describe in notes any problems or cross-connections related to the hydrants and if they are used for flushing.)	☐ Yes ☑ No
3	Is there any portion of the distribution system that has a pressure less than 20 psi?	☐ Yes ☑ No
4	Are there any materials used in the distribution system that should not be in contact with drinking water? (If yes, explain in notes.)	☑ Yes ☐ No ☐ Unknown
	Notes: The dual check valve on the watering point is not certified lead-free.	
5	Is there a leak detection program? (If yes, describe in notes.)	☐ Yes ☑ No
6	Was asbestos cement pipe used in the system?	☐ Yes ☑ No ☐ Unknown
7	Is there a routine main and dead-end water flushing program? (If yes, describe in notes.)	☐ Yes ☑ No ☐ NA
	Notes: No program, but also no significant dead ends. The distribution system is limited, and ordinary use keeps the water fresh.	

Question Number		
8	Are the check valves, water meters, etc., maintained and operating properly? (If no, explain in notes.)	☑ Yes ☐ No
9	Is system adequately protected from freezing? (If no, explain in notes.)	☐ Yes ☑ No
	Notes: The water storage tank add heat system is inoperable due to a failed heat exchanger. This leaves the water storage tank vulnerable to freezing. The remainder of the distribution system is protected and suffered no freeze-ups during the cold winter of 2016	
10	Are heat exchangers used in conjunction with the water system?	☑ Yes ☐ No
11	If heat exchangers are used, what type?	☐ Single Walled ☑ Double Walled ☐ NA
12	Is glycol used? (If yes, list type in notes.)	☑ Yes ☐ No
	Notes: Propylene Glycol	
13	For circulating systems, what is the temperature of the water leaving from and returning to the plant?	N/A - water distribution system is not currently a circulating system.

DS BEAVER WATER SYSTEM - (Active) / Cross Connections

1	Are there any unprotected cross-connections in the distribution system that pose an immediate health risk? (Describe in detail and provide well labeled photo(s).)	☐ Yes ☐ No ☑ Unknown
	Notes: There is an unused storage tank and pressure pump system for the school which is currently valved off from the distribution system, but remains connected. This could be a potential source of contamination, although the tank itself is sealed.	
2	Does the system have any high hazard cross-connections with inadequate protection? (Describe in detail and provide well labeled photo(s) of all high hazard connections to industry, wastewater treatment plants, clinics, etc., that are not adequately protected.)	☐ Yes ☑ No ☐ Unknown
3	Are there any other cross-connections in the system with inadequate protection? (i.e. air gaps or backflow prevention not installed at all appropriate locations, such as boiler make-up water, hose bibbs, etc. Describe in detail and provide well labeled photo(s).)	☐ Yes ☑ No
4	If system has air gaps, are any less than 2 times the diameter of the drain or waste line? (Describe in detail and provide well labeled photo(s).)	☐ Yes ☑ No ☐ NA
5	If backflow preventers are installed, are there any problems that may hinder operation or testing? (i.e. leaking, improper installation, etc. Describe in detail and provide well labeled photo(s).)	☐ Yes ☑ No ☐ NA
6 Potential Deficiency	If backflow preventers are installed, are they tested? (Describe testing schedule or frequency. Include the date they were lasted tested and the name of the tester.)	☐ Yes ☑ No ☐ NA

7	Are any backflow preventers installed in a pit? (If yes, describe in detail and provide well labeled photo(s).)	☐ Yes ☑ No ☐ NA
8	Are backflow preventer drains provided with a suitable air gap?	☑ Yes ☐ No ☐ NA
9	If the water system has a water haul fill point, do the water supply lines have appropriate backflow prevention? (List backflow prevention type in notes.) Notes: The watering point is protected only by a dual check valve assembly. The particular model of dual check is not rated for potable water and is not certified lead-free.	☐ Yes ☑ No ☐ NA
10	Has the system operator been trained in identifying and controlling cross-connections?	☑ Yes ☐ No
11	Is there a written cross-connection control program?	☐ Yes ☑ No

DS BEAVER WATER SYSTEM - (Active) / Pumps

1	Are pumps used in the distribution system? (i.e. pressure, circulation, etc. List use of each pump or group of pumps.) Notes: Pressure pumps - x2 for the distribution system, plus one additional pump for the truck fill line.	☑ Yes ☐ No
2	Are pumps and pump controls in good operating condition?	☑ Yes ☐ No ☐ NA
3	Are there spare pumps or critical spare pump parts readily available? Notes: There are spare pressure pumps in stock.	☑ Yes ☐ No ☐ NA
4	Is the electrical wiring maintained properly? (If no, describe in notes.)	☑ Yes ☐ No ☐ NA
5	Does wiring pose an immediate safety hazard? (If yes, describe in notes.)	☐ Yes ☑ No ☐ NA

DS BEAVER WATER SYSTEM - (Active) / Hydropneumatic tanks

1	Does the system have a hydropneumatic tank(s)? Notes: 3 hydropneumatic tanks	☑ Yes ☐ No
2	At the time of inspection, are all tanks water tight? (i.e. not leaking)	☑ Yes ☐ No ☐ NA

3	Are the exterior surfaces and tank supports in good condition? (If no, explain condition in notes and include photo.) Notes: There is a dent in one of the tanks, which was reported in the previous sanitary survey, but otherwise the tanks are in very good condition.	☑ Yes ☐ No ☐ NA
4	Are the hydropneumatic tanks in a condition that represents an immediate threat to health or safety, or are in danger of failure? (Describe in notes.)	☐ Yes ☑ No ☐ NA

Sanitary Survey - Survey Responses

PWS Number: AK2360230 **Vehicle ID:** No ID **Survey Date:** 07/25/2017

System Name: BEAVER WATER SYSTEM **Surveyor Name:** BEARDEN, BRIAN

Question Number

Distribution / Vehicle

1	Does the vehicle have a unique identifier number permanently affixed to the tank? (Include photo(s) and record the number in notes.)	☐ Yes ☑ No	Notes: Only one water tank, and one sewer tank. Both clearly marked "water" or "sewer". Tanks are currently used interchangeably on only one truck: tank changes are made via hydraulic hook mounted to back of truck.
2	Is the tank clearly marked "Potable Water Only"? (Describe placard position and note if it is visible to the operator while filling the tank.)	☐ Yes ☑ No	Notes: Markings on tank state: "VILLAGE OF BEAVER WATER TRUCK"
3	Are all components in contact with the water certified to ANSI/NSF Standard 61? (If no, describe materials used and note if they are DEC approved materials (i.e. stainless steel). List make and model of pump, hoses, and tank.)	☐ Yes ☑ No	Notes: Not fully certain: tank is steel, delivery hose is Goodyear labeled "potable water hose made in Canada", garage fill hose is Goodyear labeled 'White Flexwing 150 PSU WP FDA 3-A and USDA 30001 made in Canada"
4	Is the storage tank structurally sound?	☑ Yes ☐ No	Notes:
5	Is the storage tank covered or enclosed?	☑ Yes ☐ No	Notes:
6	Is the storage tank clean? (If inside the tank is available for inspection. Note when the tank was last cleaned/disinfected.)	☑ Yes ☐ No	Notes:
7	Is leaking evident at time of inspection?	☐ Yes ☑ No	Notes:
8	Are the water tank vents screened? (If vents are accesible, note any problems with them. (i.e. icing))	☐ Yes ☑ No	Notes: Tank vent/overflow lines are routed via 1.5" PVC pipe through the pump cabinet to discharge at the bottom, but are not screened. Screens in this location may freeze.

Question Number			
9	Is engine exhaust directed away from tank vents and outlets?	☑ Yes ☐ No	Notes:
10	Are the hoses provided with nozzles and anchored/locking fittings to provide a tight connection and prevent the hoses from extending down into the customer's tank? (i.e. cam-lock or equivalent)	☑ Yes ☐ No	Notes: Camlock fittings
11	Are the hoses stored in a safe, protected manner which prevents contamination when not in use? (Describe in notes and provide well labelled photo(s).)	☑ Yes ☐ No	Notes:
12	Are pumps in good operating condition? (If no, describe any problems in notes.)	☑ Yes ☐ No	Notes:
13	Are non-food grade lubricants used in the wetted components of the pumps? (If yes, list brand name and manufacturer.)	☑ Yes ☐ No	Notes: Unsure: staff was unaware of lubricants used for pump, aside from hydraulic oil for the power system.
14	Is the electrical wiring maintained properly?	☑ Yes ☐ No	Notes:
15	Are maintenance and delivery records kept? (i.e. dates, locations, and volumes)	☑ Yes ☐ No	Notes:
16	Is a standard operating procedures manual available which includes tank cleaning/disinfecting, flushing, sampling protocols, and routine maintenance and inspection schedules?	☑ Yes ☐ No	Notes:

Photo Log

Sanitary Survey

Water System Name:	Beaver Public Water System
PSWID:	**AK2360230**
Survey date:	July 25 and 26, 2017
Surveyor name:	Brian Bearden, P.E.
Surveyor Organization:	Tanana Chiefs Conference, Office of Environmental Health

Photo 1: Well WL001, with well house on the bank of the Yukon River.

Photo 2: Well WL001, showing pit left when gravel fill was removed to install glycol heat trace piping

Photo 3: Well WL001, electrical power cables and conduit

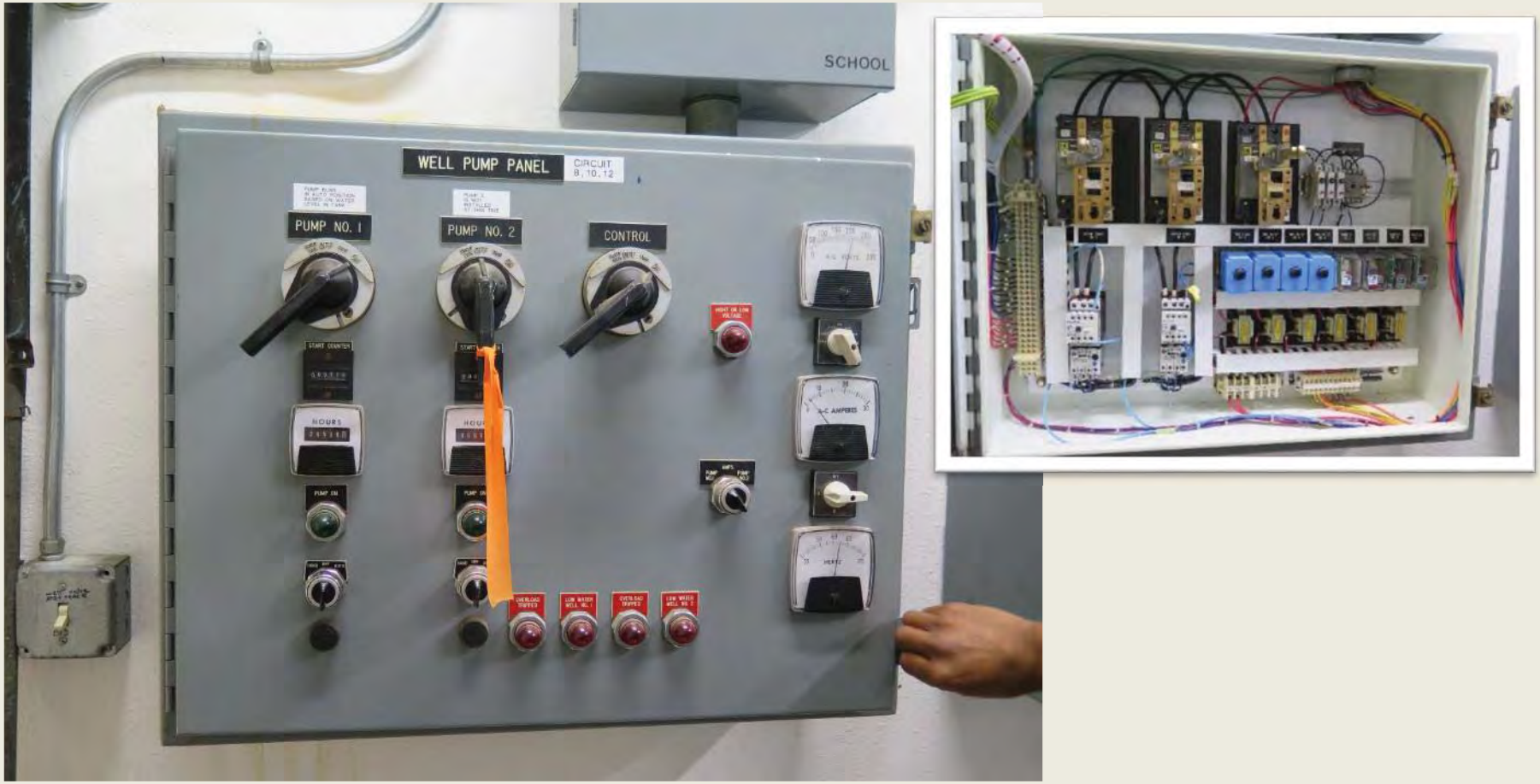


Photo 4: Well pump control panel

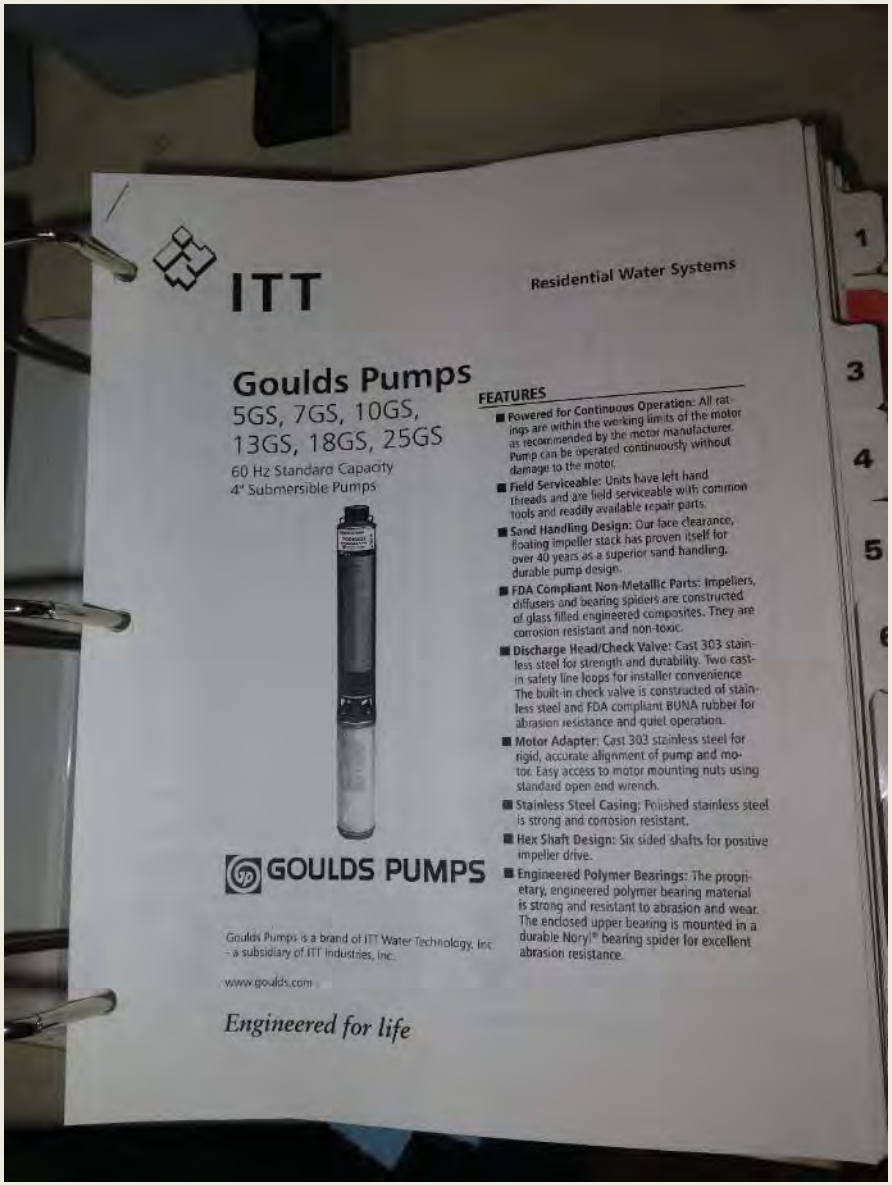


Photo 5: Well pump cut sheet included in water plant manual. Specific model is not identified.

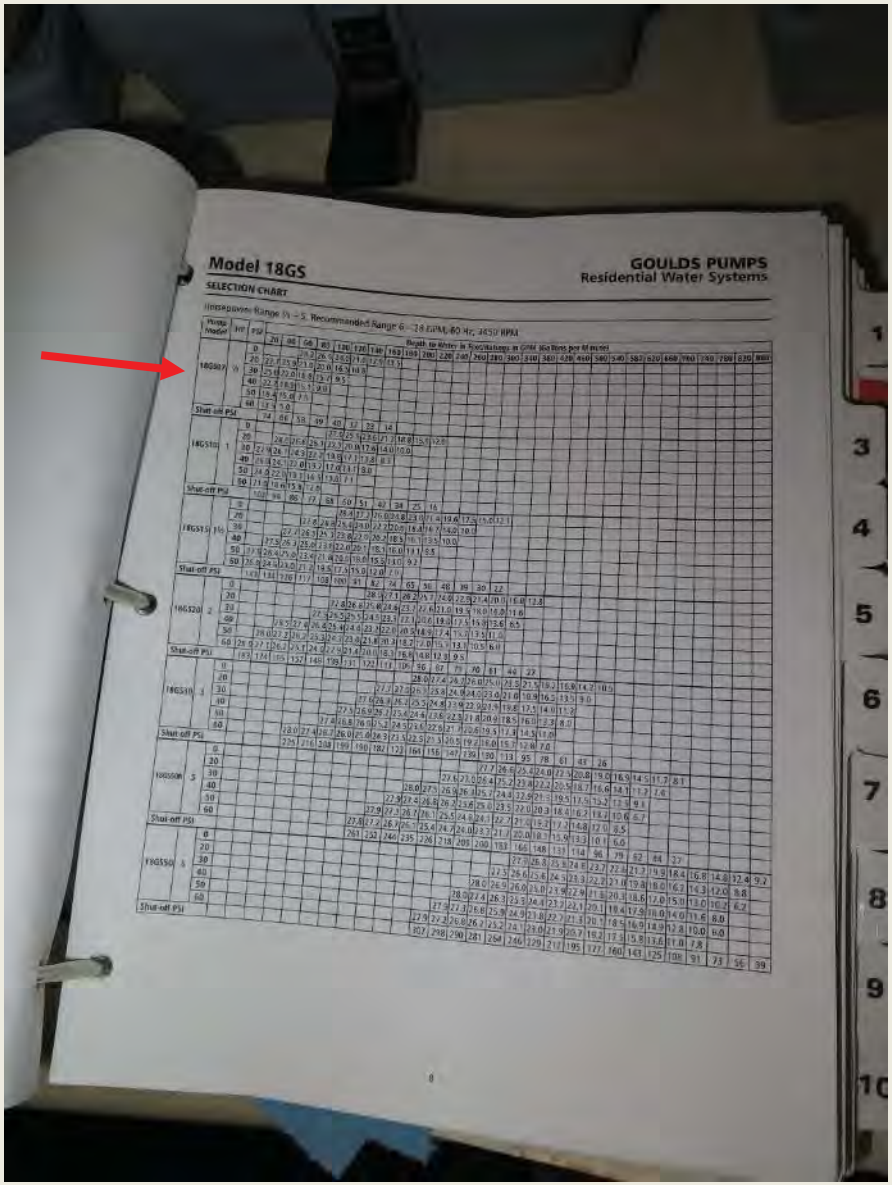


Photo 6: According to the design drawings (CRW, 2012) the well pump is a Goulds 18GS07412, ¾ hp (230V single phase), installed with the treatment plant upgrade in/around 2006. Flow rate to plant was measured at 20.5 GPM during survey.

Photo 7: Unlined gasoline and lubricant filling station and storage near Well WL001 (seen in background)

Photo 8: Raw water transmission piping (black) and glycol heat trace inside first manhole from well. Note repair couplings from previous leaks.

Photo 9: Second manhole on raw water transmission line, where it joins treated water and sewer utilidor behind multi-purpose building (first manhole in background). New PEX tubing (white) for in-progress service line project visible.

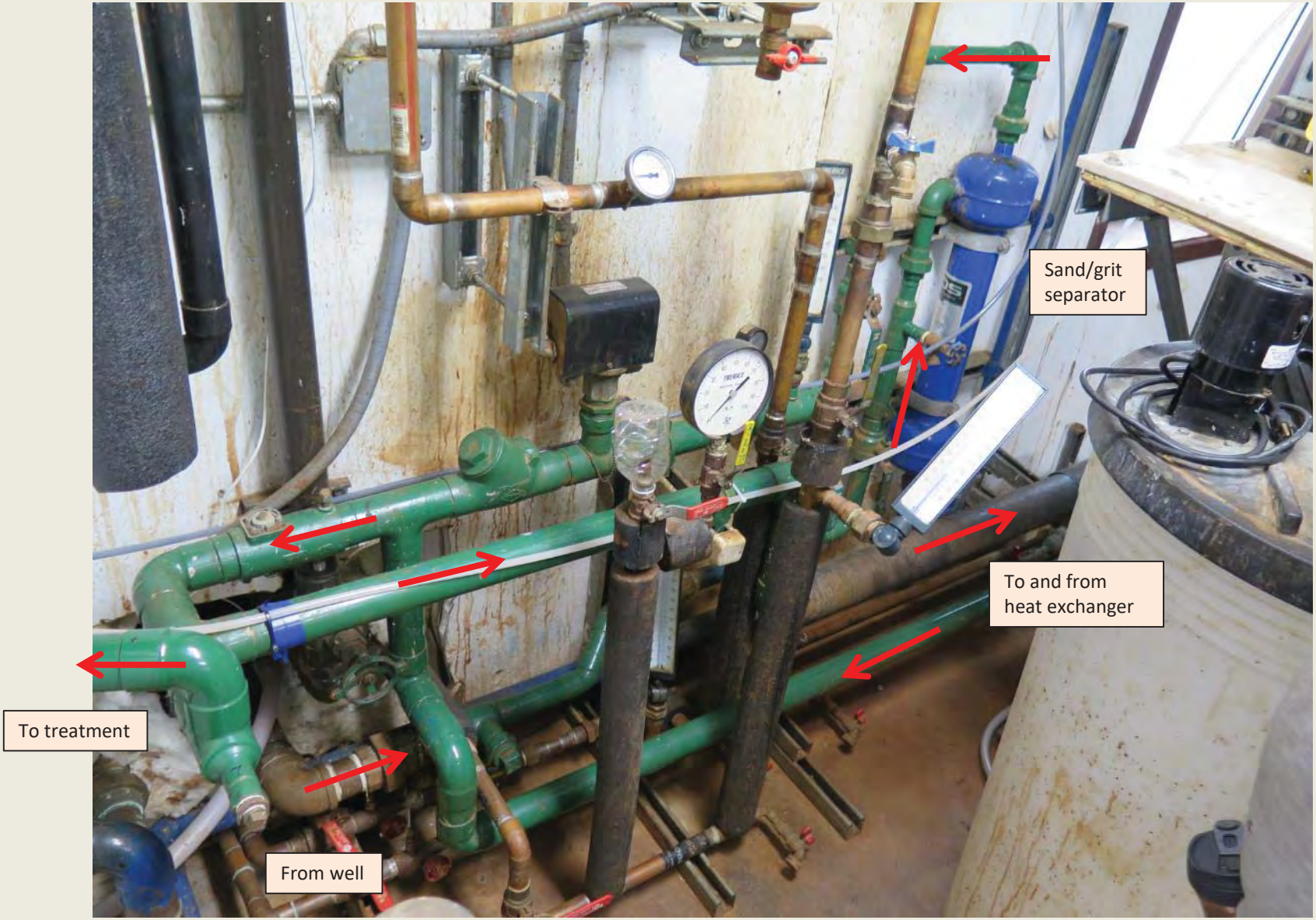


Photo 10: Raw water line intake piping inside water plant (boiler room)

Photo 11: Raw water line heat exchanger (meant to raise temperature to improve oxidizer performance). No longer functional – disconnected from glycol supply.

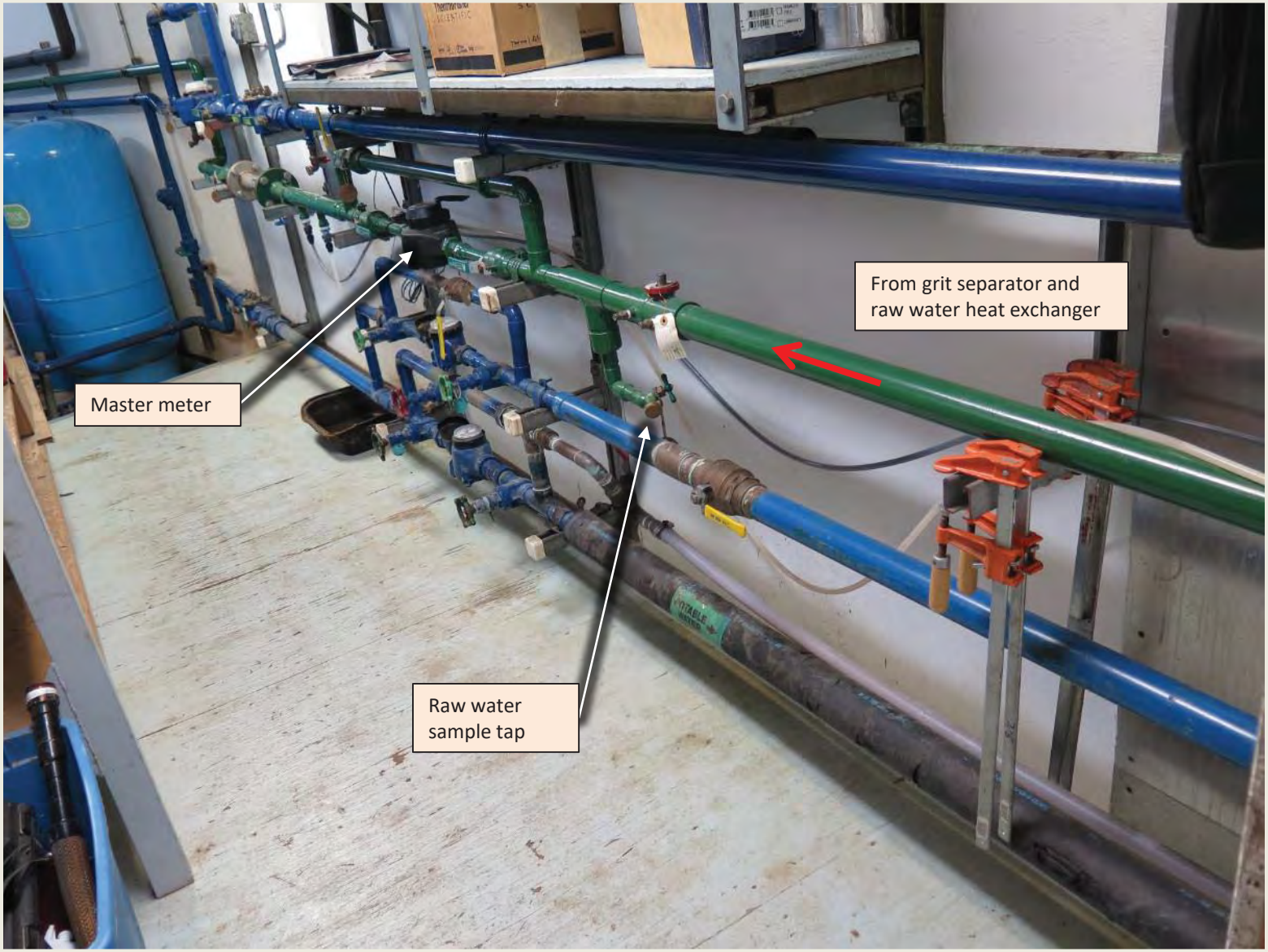


Photo 12: Raw water intake piping headed into plant, showing master meter and raw water sample tap.

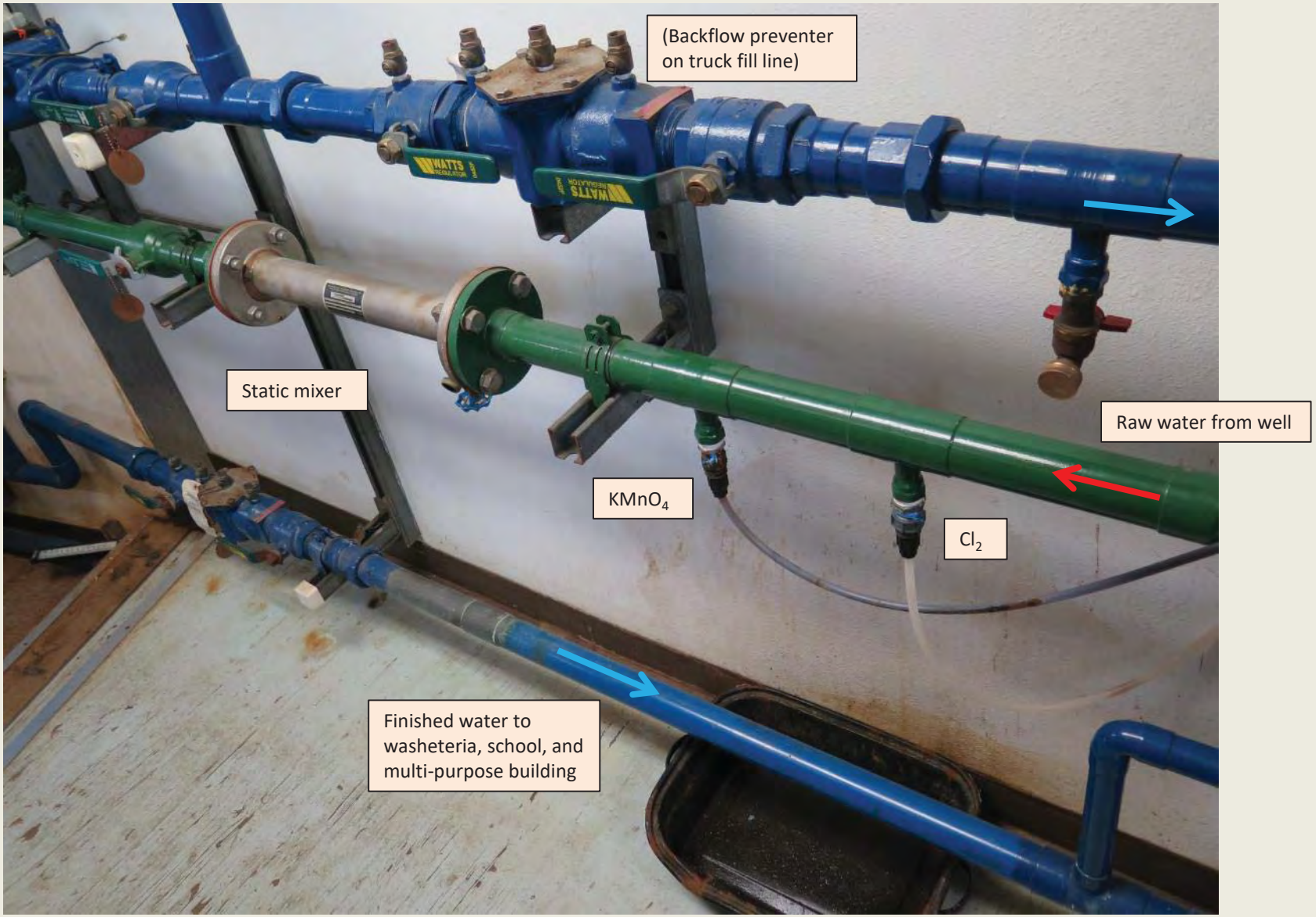


Photo 13: Injection points and static mixer for iron and manganese oxidizing agents (Potassium permanganate and calcium hypochlorate), on raw water intake line located in corridor on way into water treatment plant room.

Photo 14: Raw water detention tank, intended to provide contact/reaction time for oxidation of iron and manganese.

Photo 15: Raw water detention tank flush/wash drain pipe.

Photo 16: Greensand filters. Raw water piping in green; filter effluent in blue, backwash dark brown piping. Air scour piping in light green.

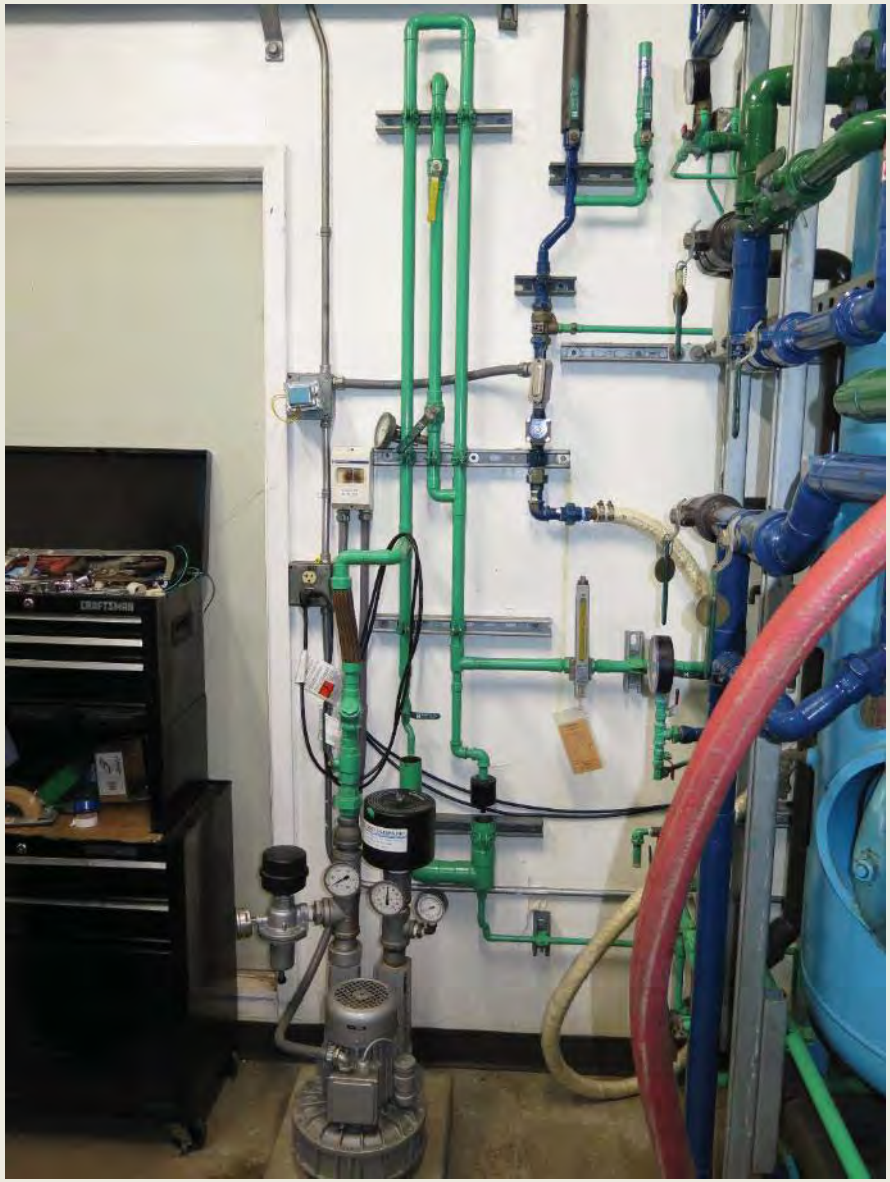


Photo 17: Greensand filter air scour compressor and piping (light green)

Photo 18: Filter vessel piping and sump tank, used to collect and pump freeboard drain effluent to backwash tank.

Photo 19: Washeteria lift station, with backwash detention tank in background..

Photo 20: Backwash detention tank, hard-piped to lift station at bottom, air gap at top.

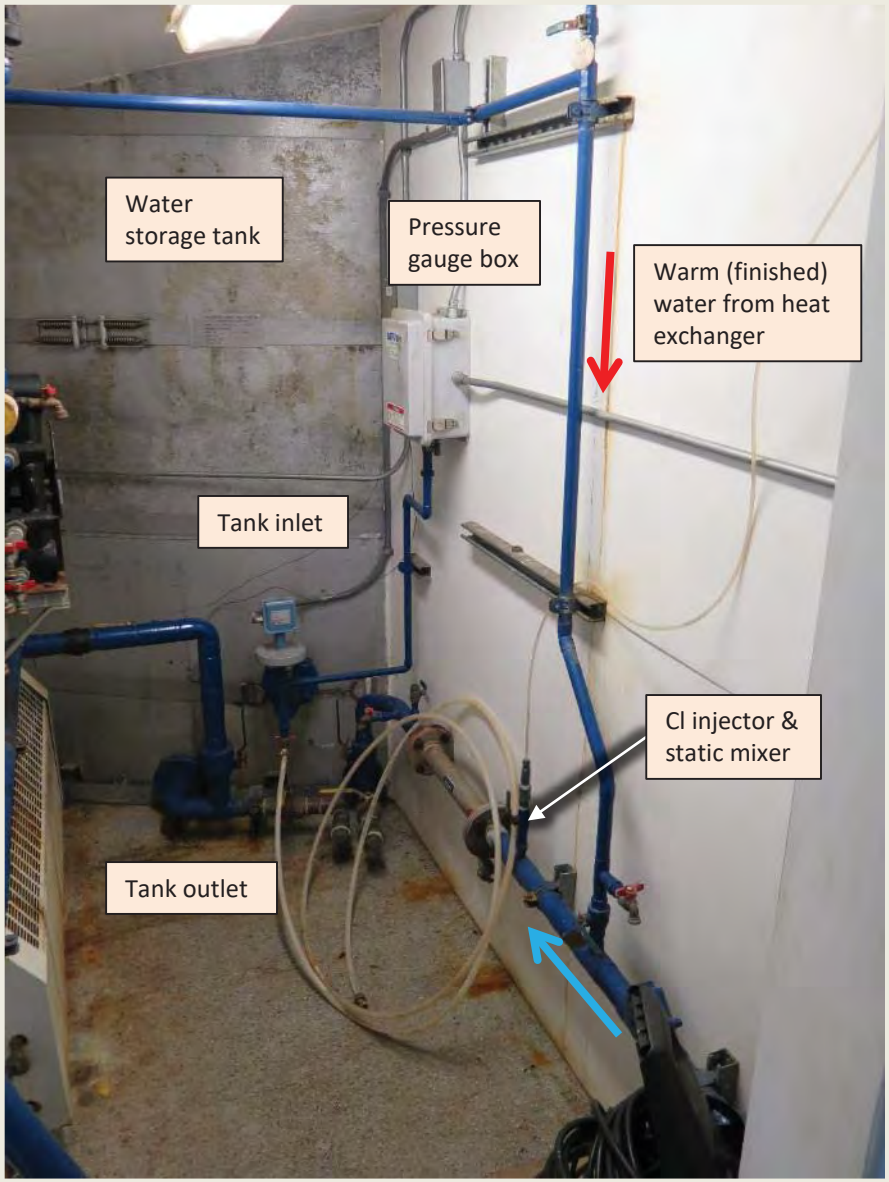


Photo 21: Filter effluent piping, disinfection system, and inlet to water storage tank.

Photo 22: Storage tank finished water outlet & tank add heat system (heat exchanger not functional)

Photo 23: Digital tank level display – not functional because the suspended electrodes used for the high and low level conditions are not working and have been removed. This failure has caused the well/filtration system to only operate in hand mode. In addition, it appears the pressure transducer is not working properly, as the depth display is inaccurate.

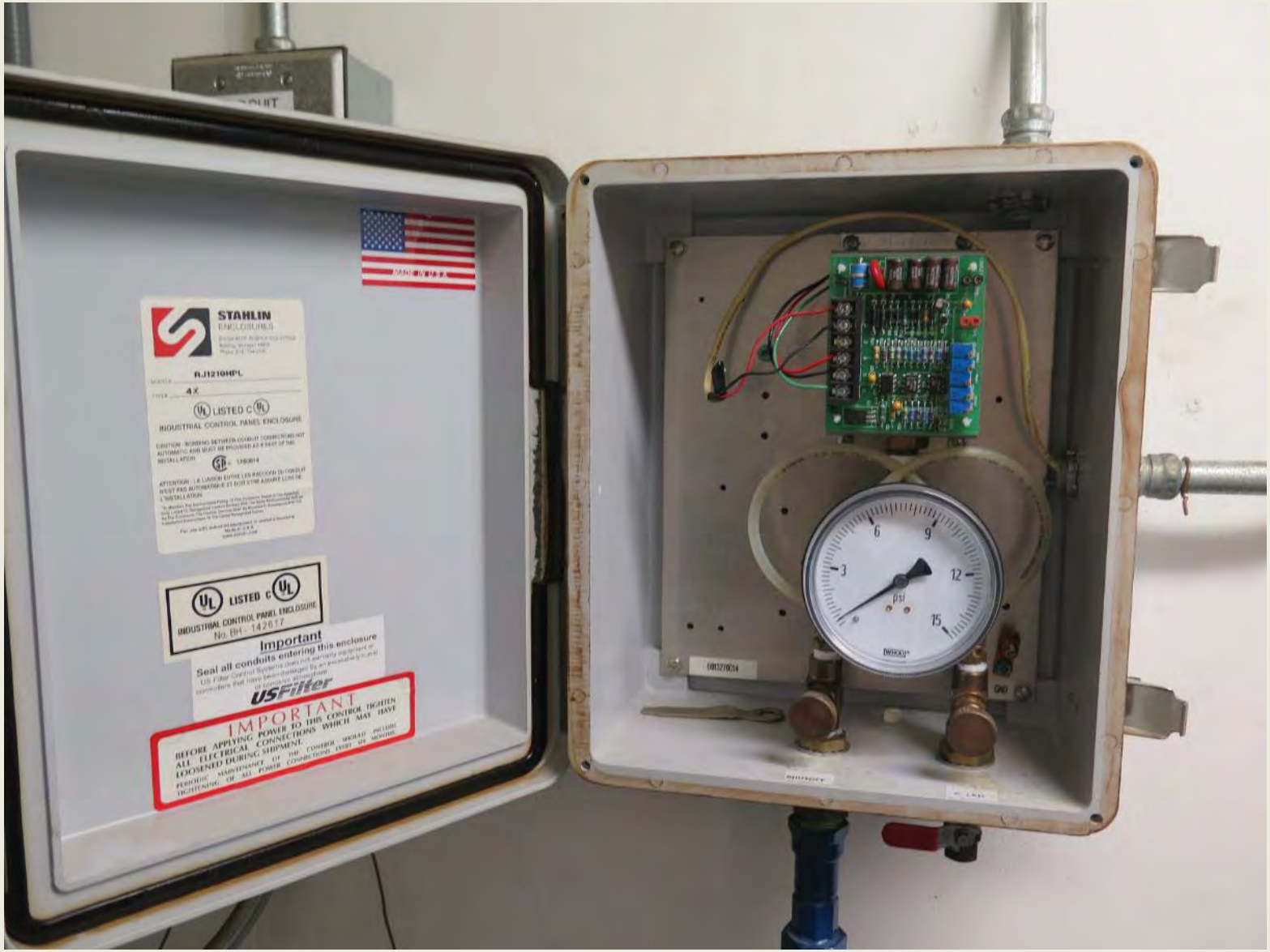


Photo 24: Analog tank pressure sensor, currently used to indicate water level.

Photo 25: Water storage tank, showing overflow pipe with perforated screen.

Photo 26: Tank access ladder.

Photo 27: Tank cover.

Photo 28: Tank vent & screened opening

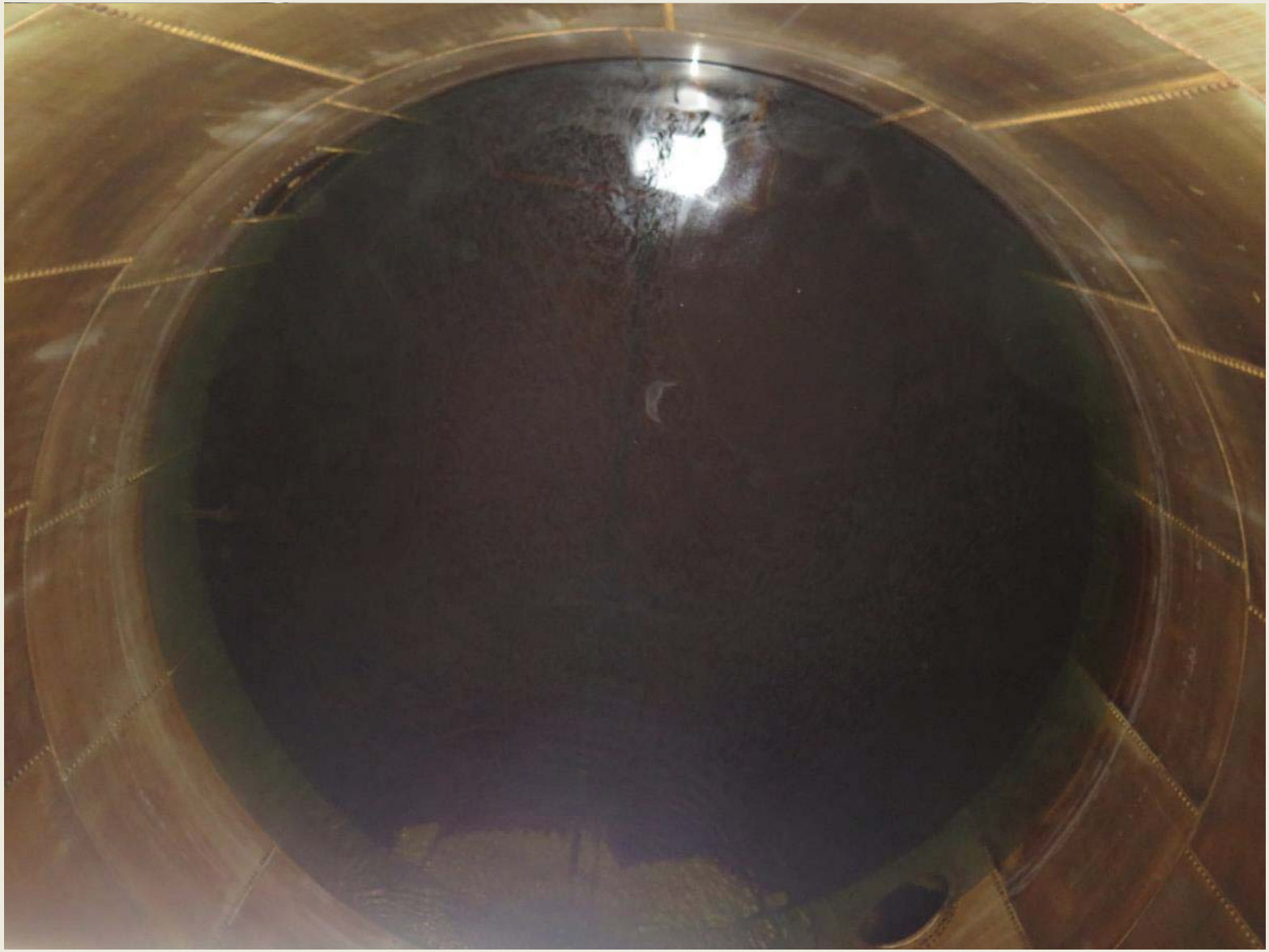


Photo 29: Tank interior. Tank had been cleaned about 2 weeks prior to inspection.

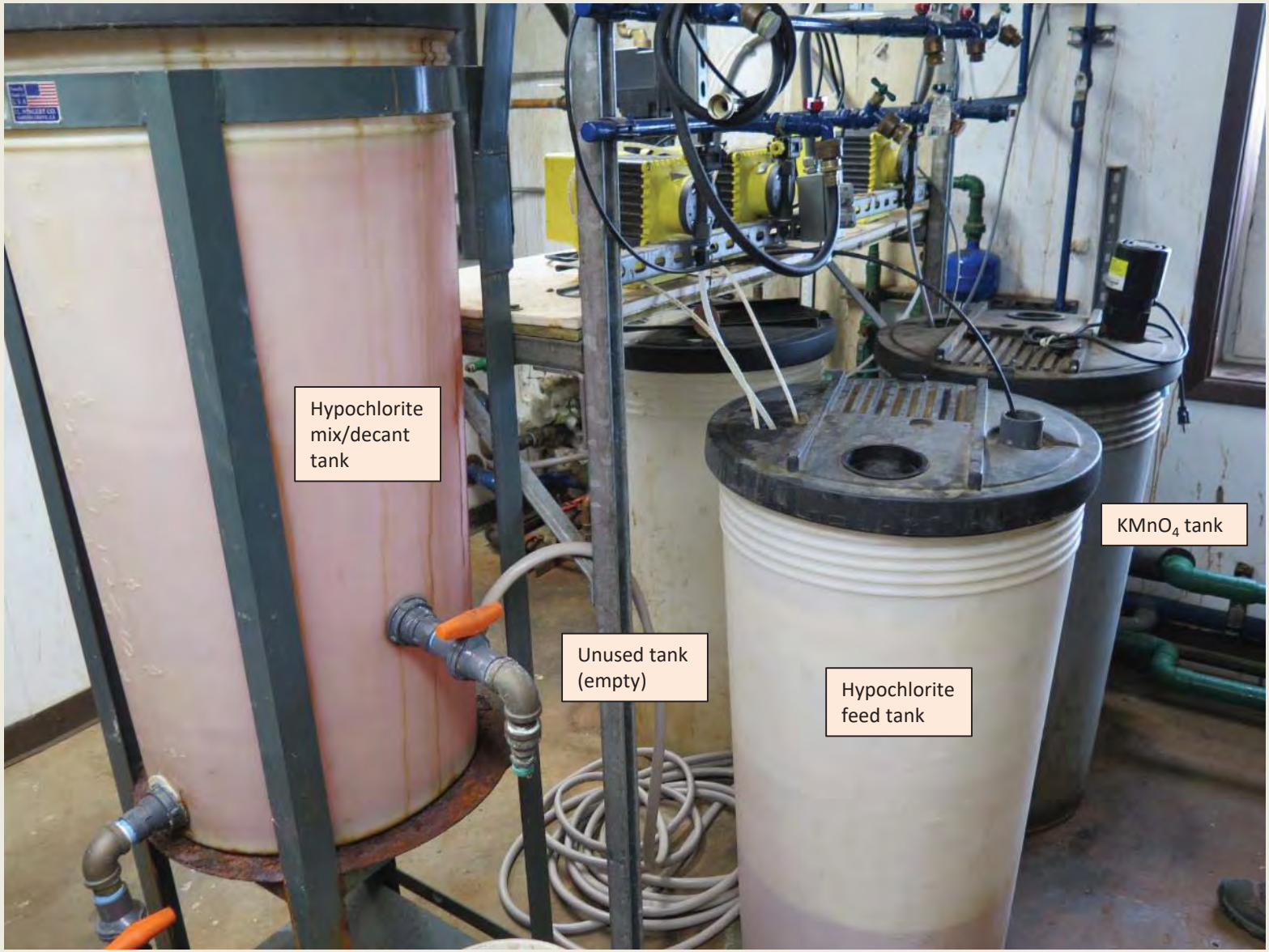
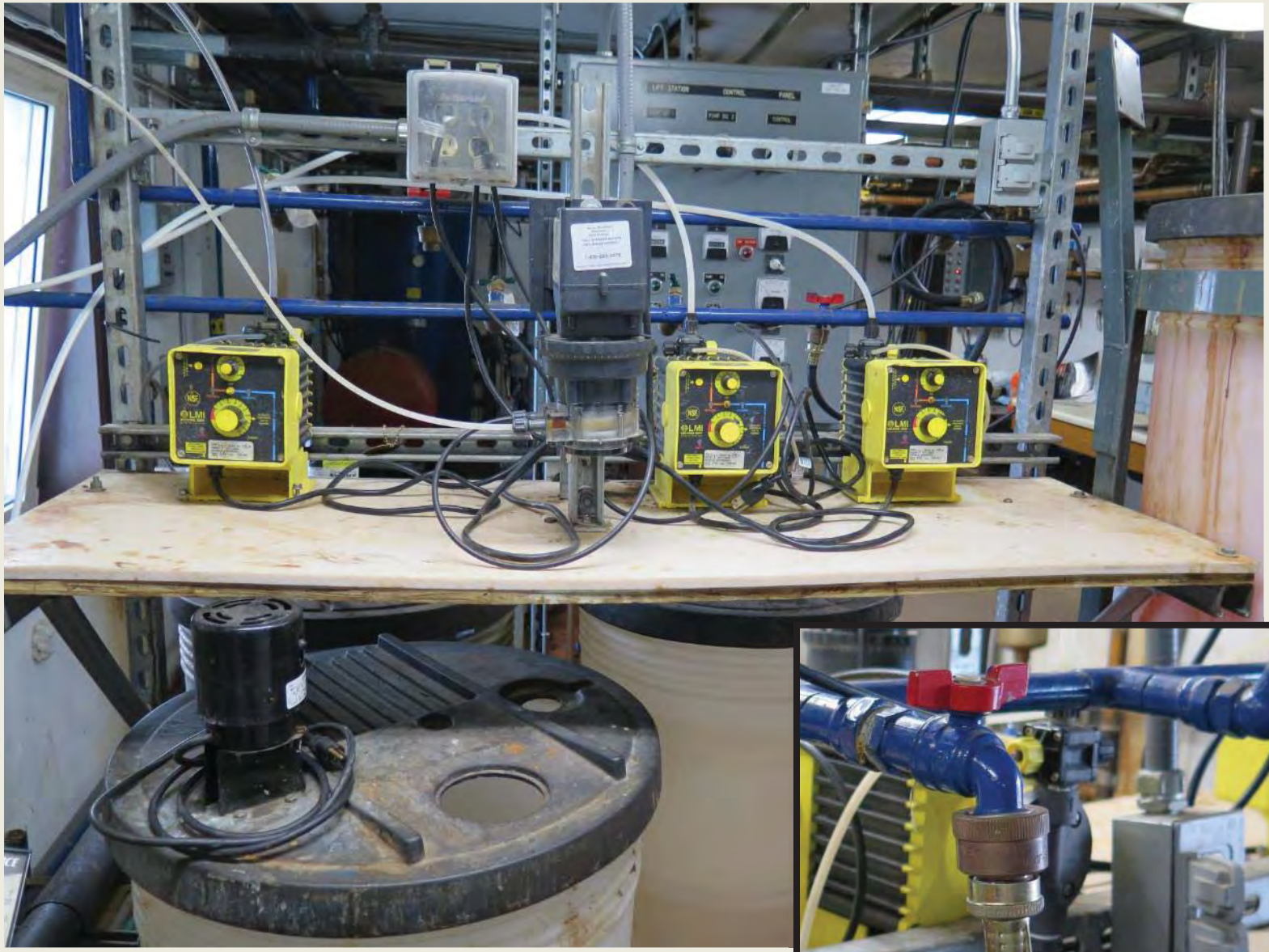


Photo 30: Chemical mixing tanks and injection pumps



Photos 31 & 32: Chemical mixing tanks and injection pumps; vacuum breakers on fill hose bibs. 1 spare (unused) LMI pump and tank shown.

Photo 33: Potassium permanganate (2 manufacturers) and calcium hypochlorite storage.

Photo 34: Distribution system pressure pumps & pressure tanks

Photo 35: Truck fill & backwash pumps

Photo 36: Watering point

Photo 37: Watering point interior plumbing showing Watts 9D-M2 dual check valve with intermediate atmospheric vent (drains to green pipe). This model check valve is not rated for potable water use, and not certified lead-free.

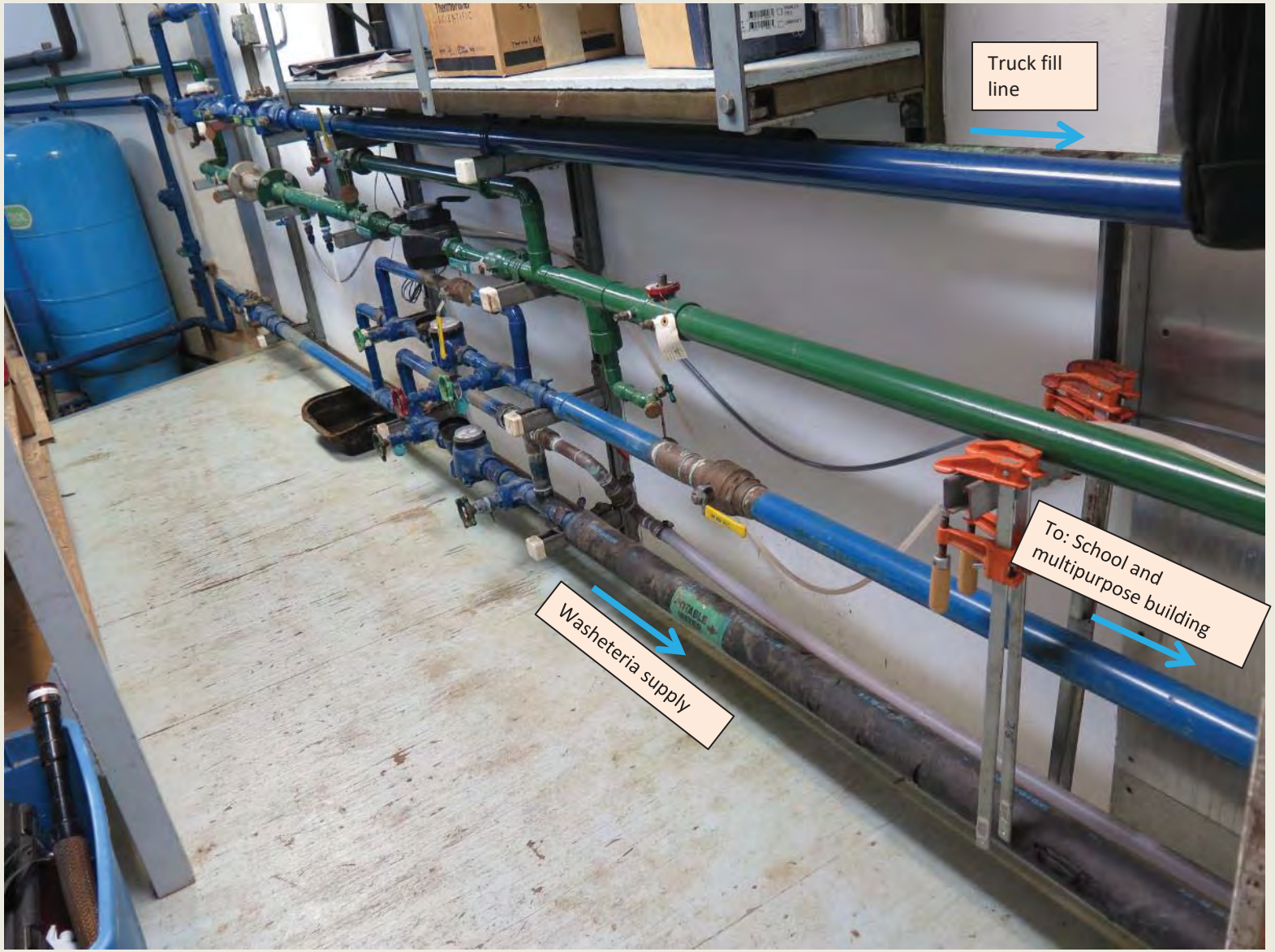


Photo 38: distribution system piping, with separate metering of individual service lines

Photo 39: distribution system piping, showing backflow preventers on all lines (truck fill line backflow preventer on top; combined washeteria/school/multipurpose building lines at bottom)

Photo 40: Backflow preventer on potable water supply to hot water generator.

Photo 41: Pressure tanks, showing dent called out in previous sanitary survey.

Photo 42: Truck fill piping (blue) and hose, in haul truck garage.

Photo 43: Truck fill hose, Goodyear brand.

Photo 44: Haul truck with sewage tank on back; water tank stored in separate garage. Water tank is separate and installed with hook/hoist when delivering water.

Photo 45: Water haul tank pump, meter, and fill hose. Tank overflow/vent piping coming from top (outlets shown in inset image)

Photos 46 & 47: Water haul tank pump and Goodyear brand fill hose.

Photo 48: Primary operator Paul Petruska and backup Aaron Petruska demonstrate use of the Hach Pocket Colorimeters for chlorine, iron, and manganese.

Photo 49: Point of connection to the old school utilitdor. Water main (left) and sewer force main in black HDPE; glycol heat trace piping shown coiled in box.

Photo 50: Point of connection to the old school utilitdor. Circulating water main in black HDPE; glycol heat trace piping shown coiled in box.

Photo 51: School's pressure pumps and pressure tanks, piped from indoor storage tank to school. This system is valved "off" but still hard-piped to the water distribution system.

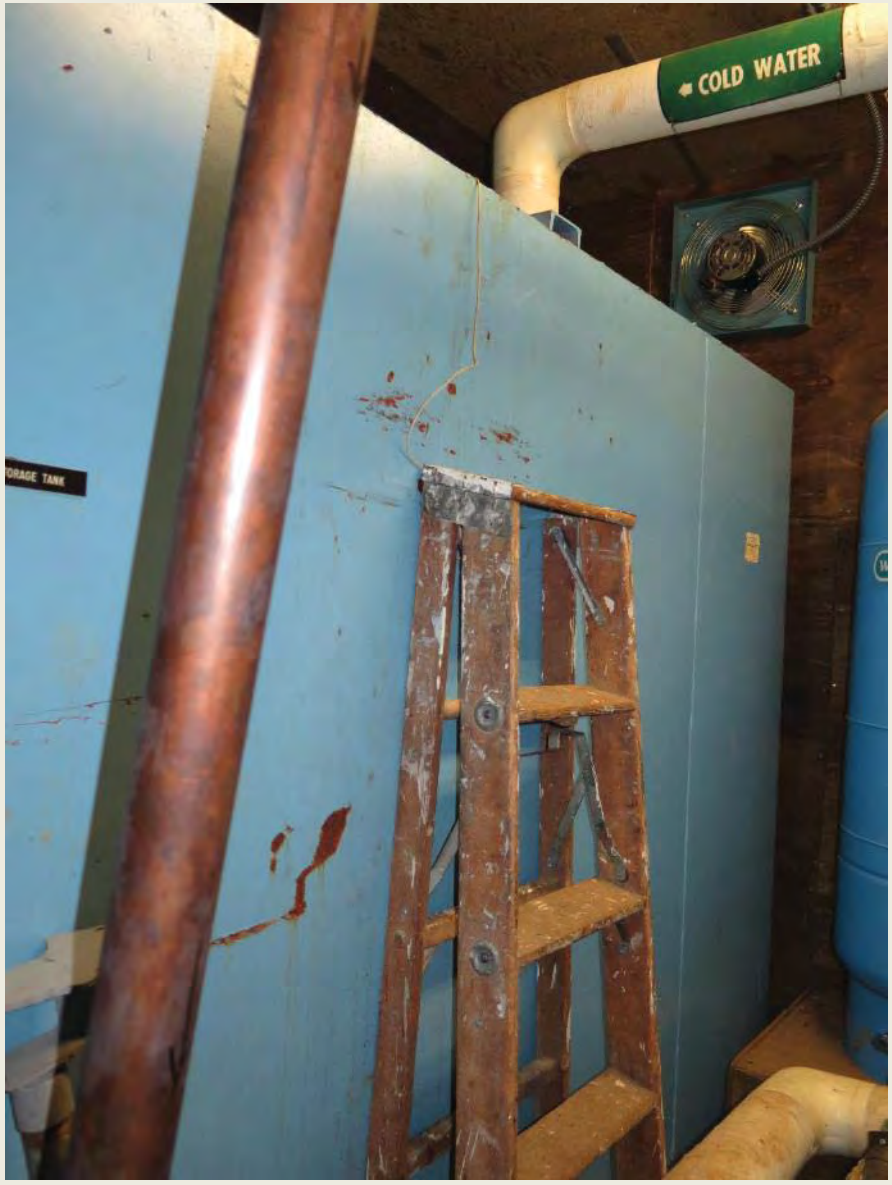


Photo 52: School storage tank. This is hard-piped from the water distribution system, but is valved "off" because the school currently uses water direct at distribution system pressure.

Photo 53: Top access hatch and water service entrance on the school's indoor storage tank, which is completely sealed. The tank is valved off from the distribution system on the inlet pipe.

Photo 54: The school lift station, located in room adjacent to school water tank and pressure distribution pump system. The sewer main is located in the same utilidor as the water lines.

Photo 55: Pressure pump control panel.

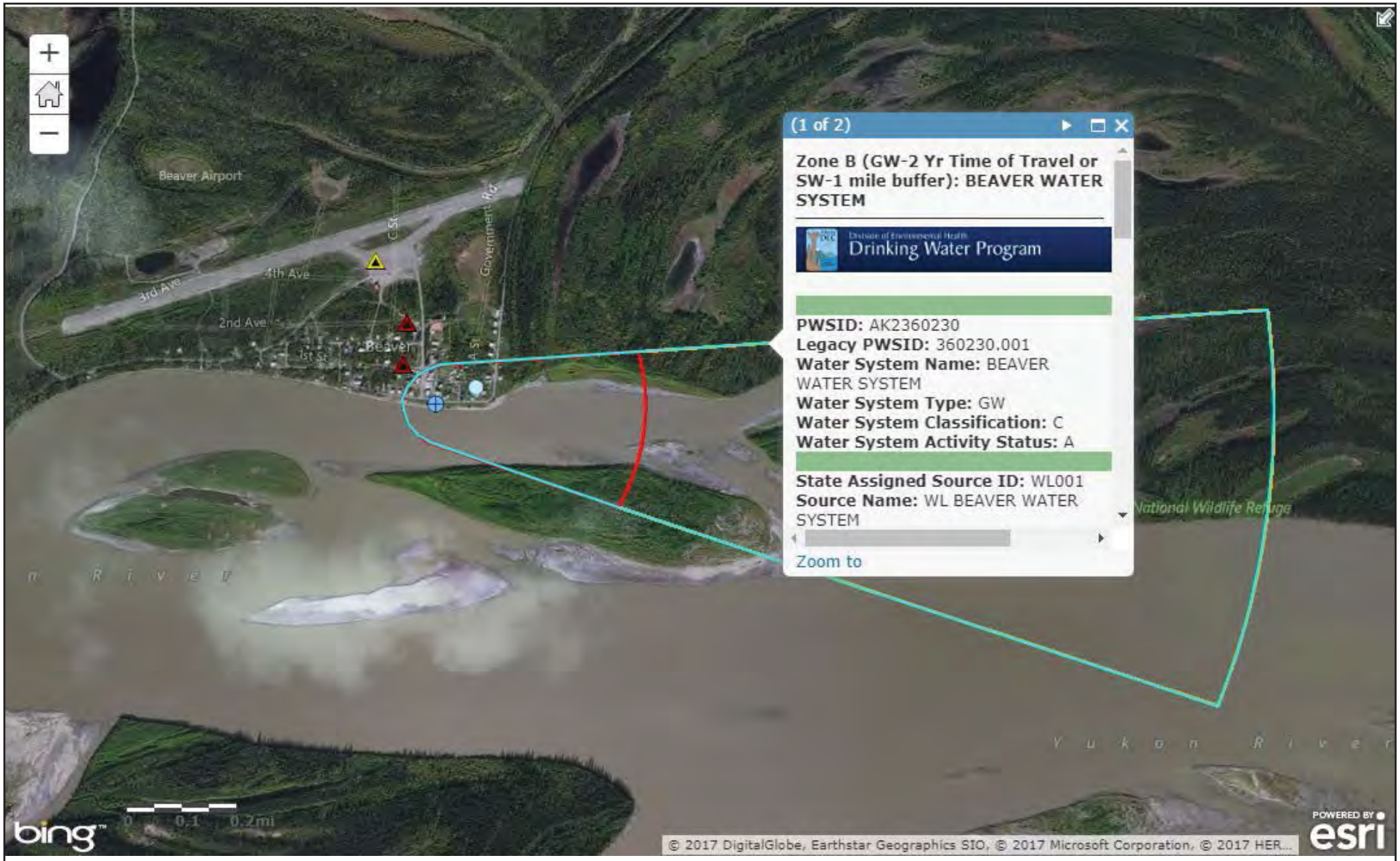
Photo 56: Backwash and Truck Fill pump control panels

Photo 57: Evidence of the building suffering differential settlement: the ceiling in the washeteria area has separated from the walls by more than one inch. This extends into the office/chemical storage room, but was not observed in the water plant area.

Photo 58: Large sinkhole(s) located less than 100 feet from water plant/washeteria building.

Photo 59: Another shot of the sinkhole(s) behind the washeteria, showing gravel-filled drum placed into center.

Photo 60: Another sinkhole which has appeared directly adjacent to the Beaver Multi-Purpose Building.



Tanana Chiefs Conference
Office of Environmental Health

SOURCE WATER PROTECTION AREA

Beaver Public Water System

PWSID AK2360230

Imagery: World Imagery (ESRI), accessed via ADEC mapping website 08/01/2017

2017 Sanitary Survey

Inspection date July 25&26, 2017

Prepared by: Brian Bearden, P.E.

Tanana Chiefs Conference

Tanana Chiefs Conference
Office of Environmental Health

SITE DIAGRAM 1

Beaver Public Water System

PWSID AK2360230

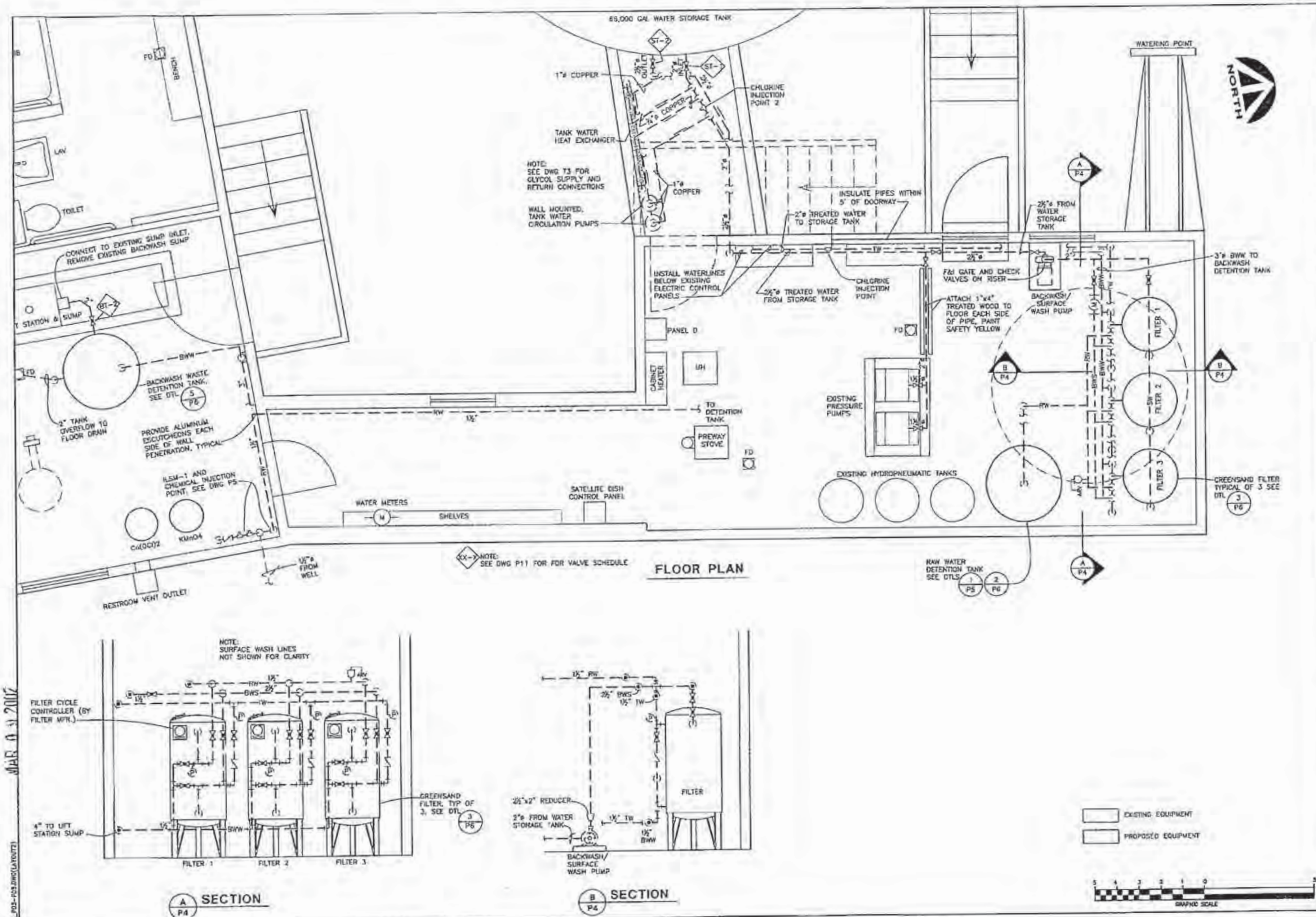
Imagery: DCRA Area Photos, 2 ft., accessed via ADEC mapping website 08/1/2017

2017 Sanitary Survey

Inspection date July 25&26, 2017

Prepared by:

Brian Bearden, P.E.



RECORD DRAWING CERTIFICATE

THESE DRAWINGS REFLECT RECORDED INFORMATION OBTAINED DURING CONSTRUCTION. INFORMATION PROVIDED HEREIN IS ACCURATE TO THE BEST OF MY KNOWLEDGE.

NAME DATE

VILLAGE SAFE WATER

VILLAGE OF BEAVER, ALASKA

WATER TREATMENT SYSTEM

WTF FLOOR PLAN AND SECTIONS

REVISION	BY	DATE

Project No. 9966
Date FEB 2002
Designed DF
Drawn AV
Approved DY

Sheet No. P4
DWG No. 9 of 21

EXISTING CONDITIONS (YEAR 2002)

- AVERAGE WATER DEMAND: 1,000 GAL/DAY
- PEAK WATER DEMAND: 45 GAL/MIN
- WELL CAPACITY: 7.7 GAL/MIN
- STORAGE VOLUME: 4,000 GAL
- INFLUENT IRON CONCENTRATION: 12.3 mg/L

WATER TREATMENT FACILITY DESIGN CONSIDERATIONS (YEAR 2022)

FLOW RATE
- DESIGN POPULATION: 138 PERSONS
- AVERAGE WATER DEMAND: 11,200 GAL/DAY=7.8 GAL/MIN
- MAXIMUM DAY WATER DEMAND: 2.5xAVERAGE=28,000 GAL/DAY=19.4 GAL/MIN
- PEAK HOUR WATER DEMAND: 5.0xAVERAGE=56,000 GAL/DAY=38.9 GAL/MIN

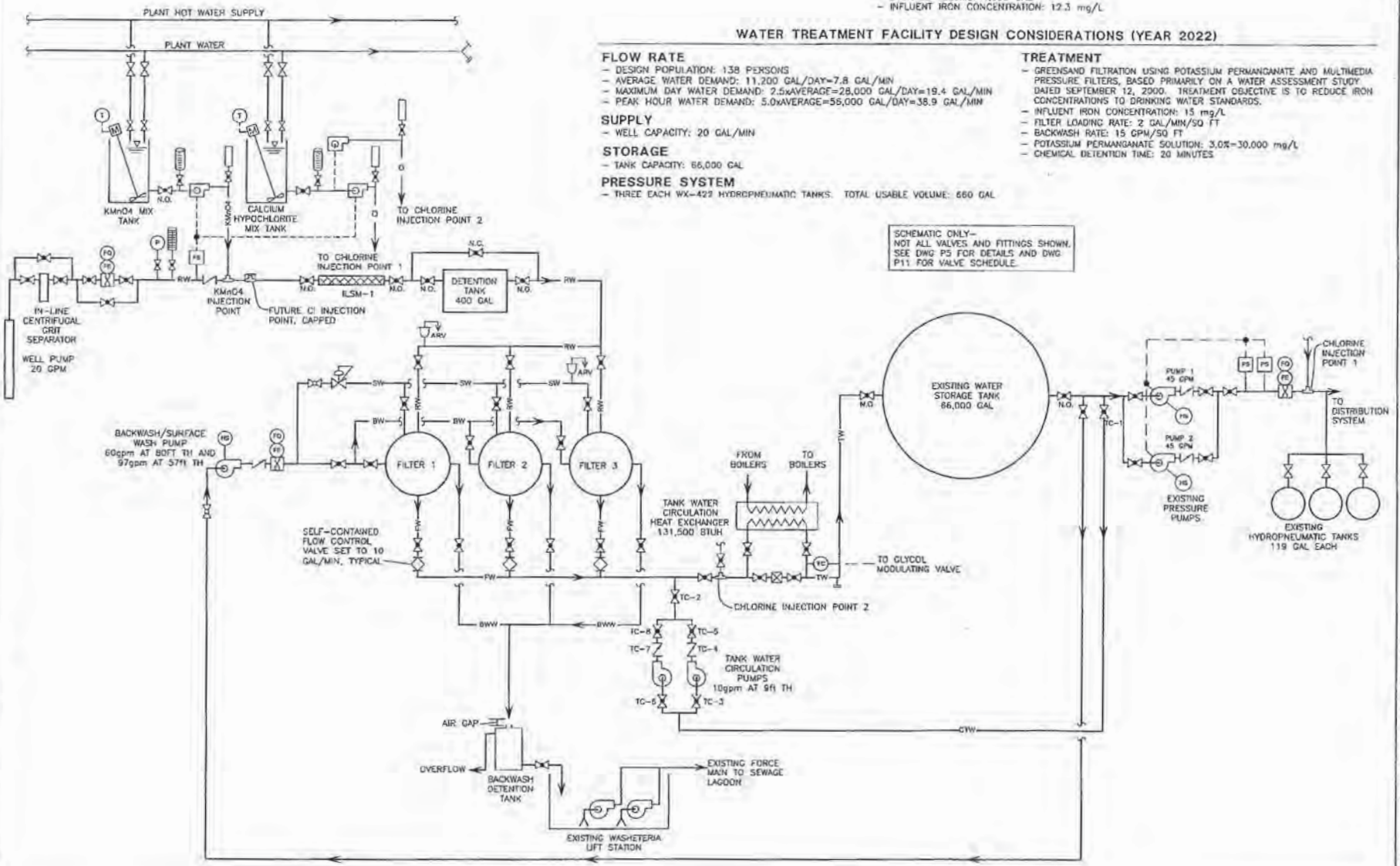
SUPPLY
- WELL CAPACITY: 20 GAL/MIN

STORAGE
- TANK CAPACITY: 66,000 GAL

PRESSURE SYSTEM
- THREE EACH WX-423 HYDROPNEUMATIC TANKS. TOTAL USABLE VOLUME: 660 GAL

TREATMENT
- GREENSAND FILTRATION USING POTASSIUM PERMANGANATE AND MULTIMEDIA PRESSURE FILTERS, BASED PRIMARILY ON A WATER ASSESSMENT STUDY DATED SEPTEMBER 12, 2000. TREATMENT OBJECTIVE IS TO REDUCE IRON CONCENTRATIONS TO DRINKING WATER STANDARDS.
- INFLUENT IRON CONCENTRATION: 15 mg/L
- FILTER LOADING RATE: 2 GAL/MIN/SQ FT
- BACKWASH RATE: 15 GPM/SQ FT
- POTASSIUM PERMANGANATE SOLUTION: 3.0%-30,000 mg/L
- CHEMICAL DETENTION TIME: 20 MINUTES

SCHEMATIC ONLY-
NOT ALL VALVES AND FITTINGS SHOWN.
SEE DWG P5 FOR DETAILS AND DWG
P11 FOR VALVE SCHEDULE.



MAR 0 9 2002

VILLAGE OF BEAVER, ALASKA
WATER TREATMENT SYSTEM
PROCESS FLOW DIAGRAM

REVISION	BY	DATE

Project 99881
Date FEB 2002
Designed DP
Drawn AV
Approved DY

Sheet No. P2
DWG No. 7 of 21

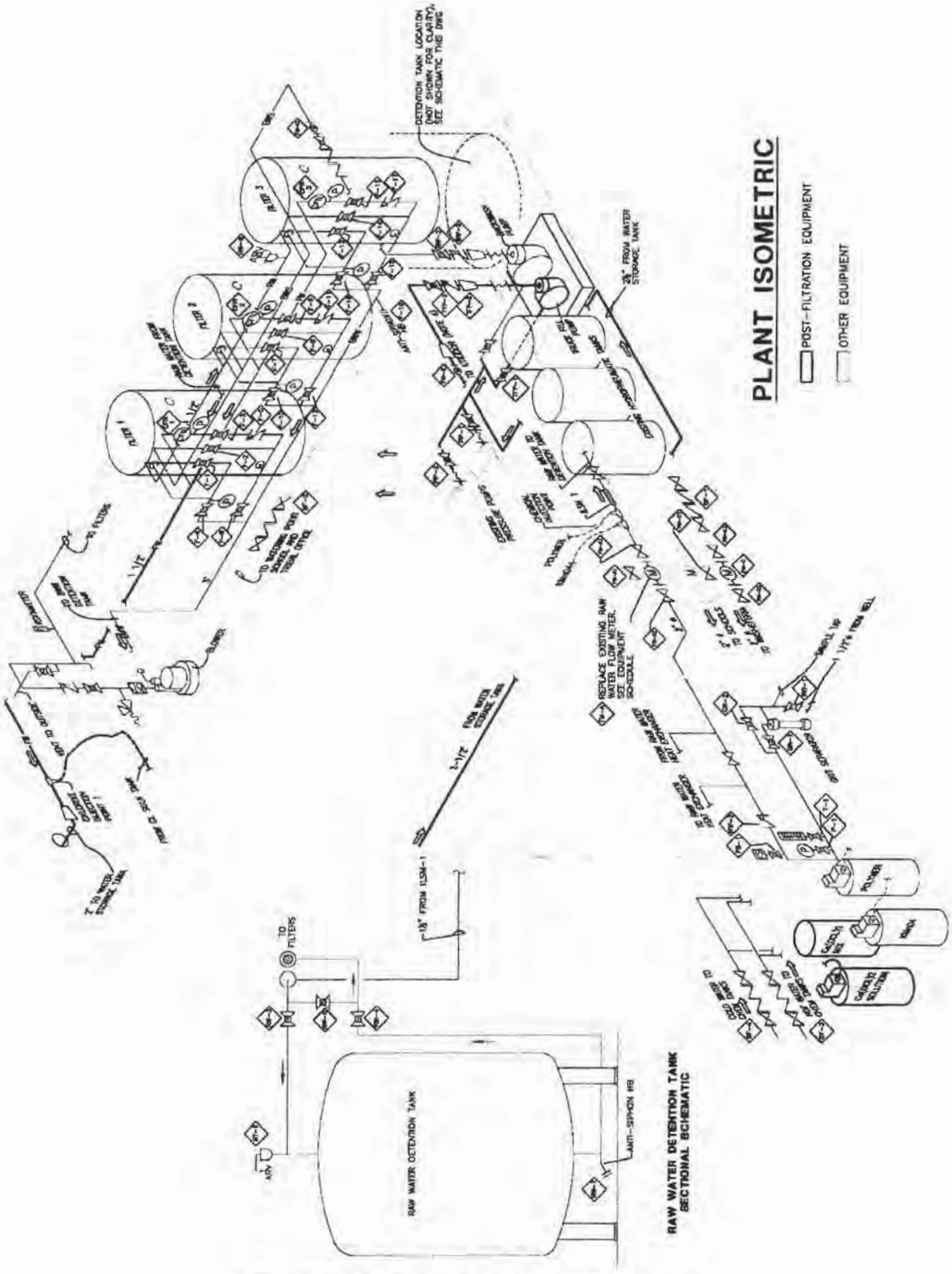
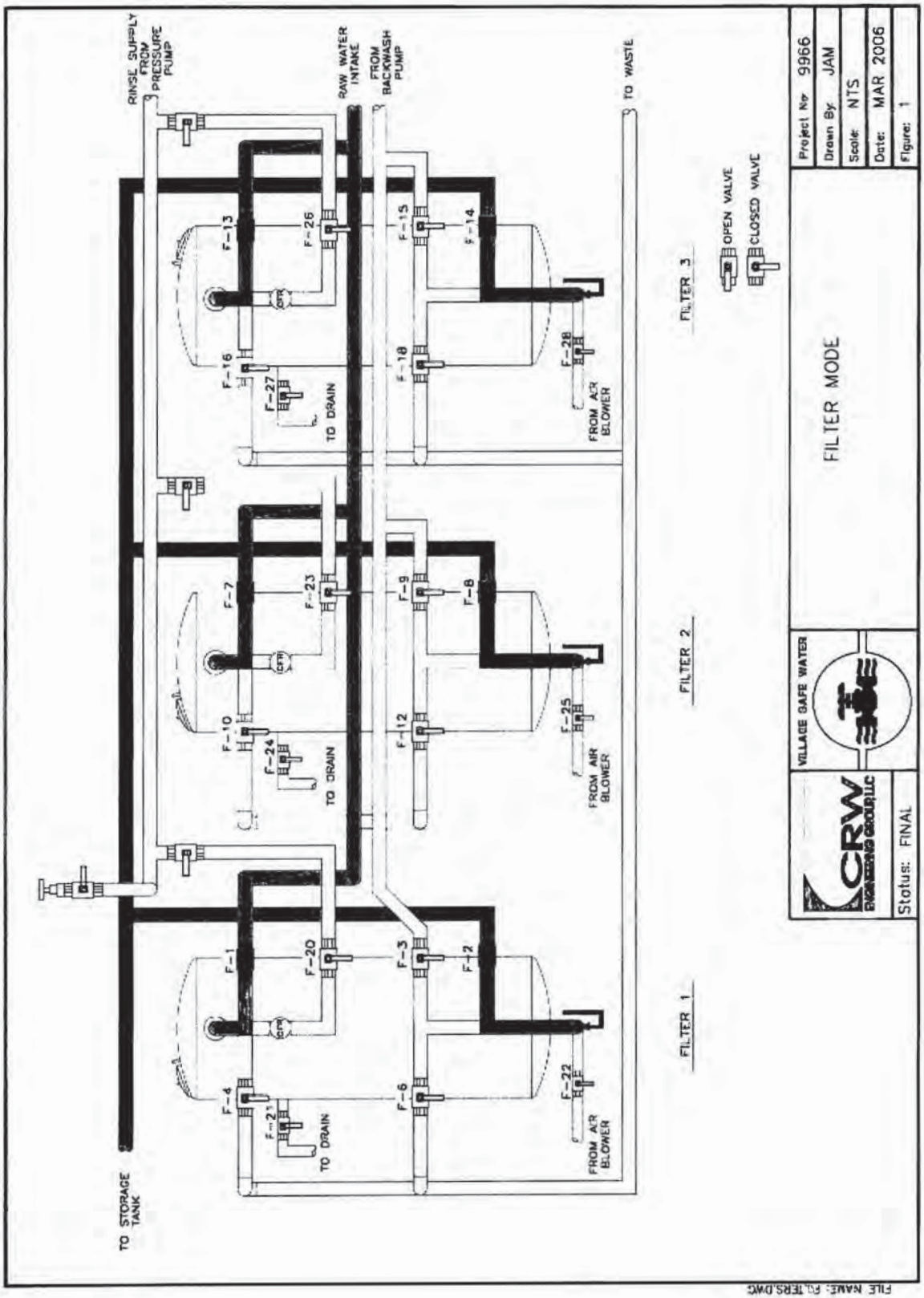
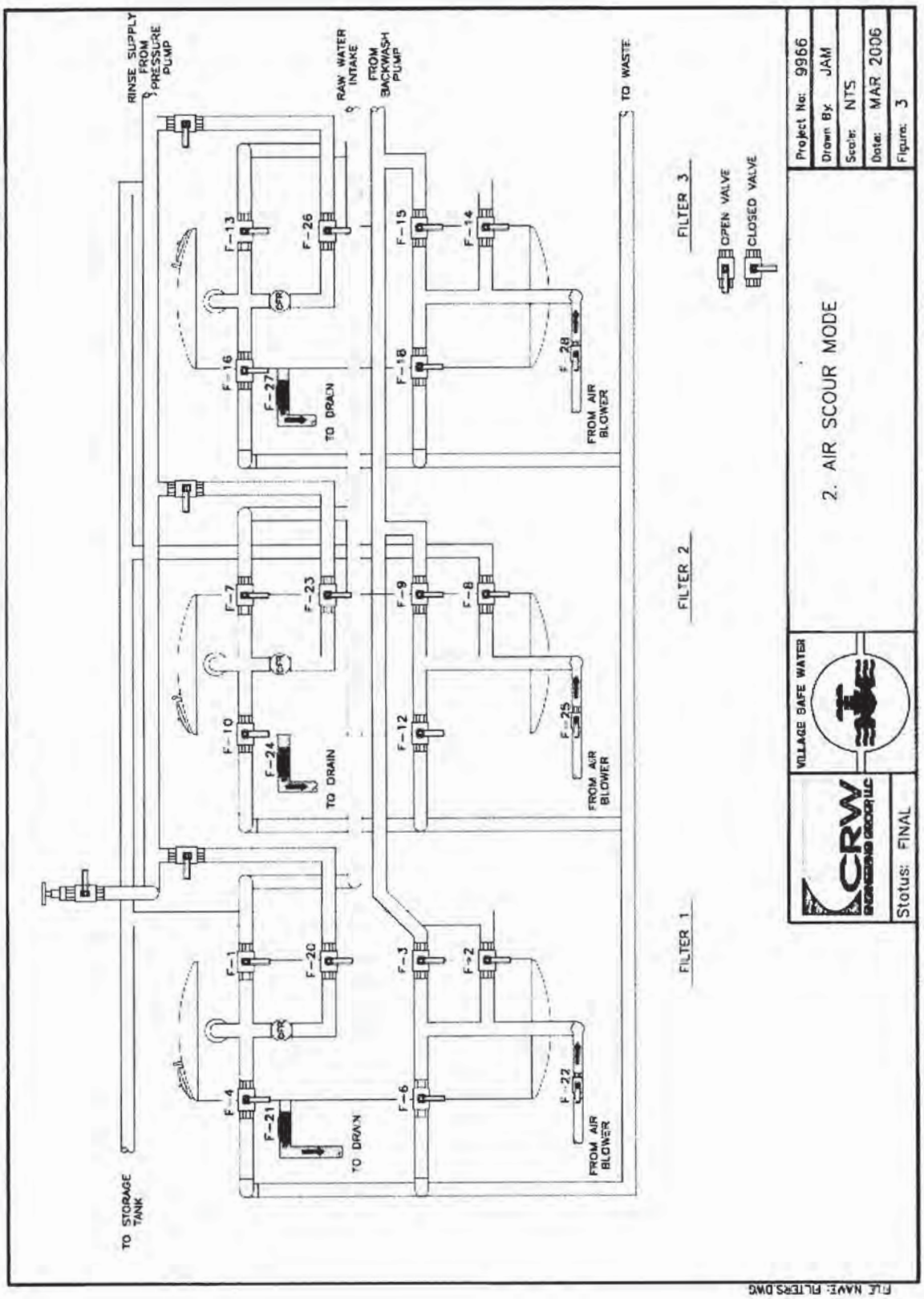
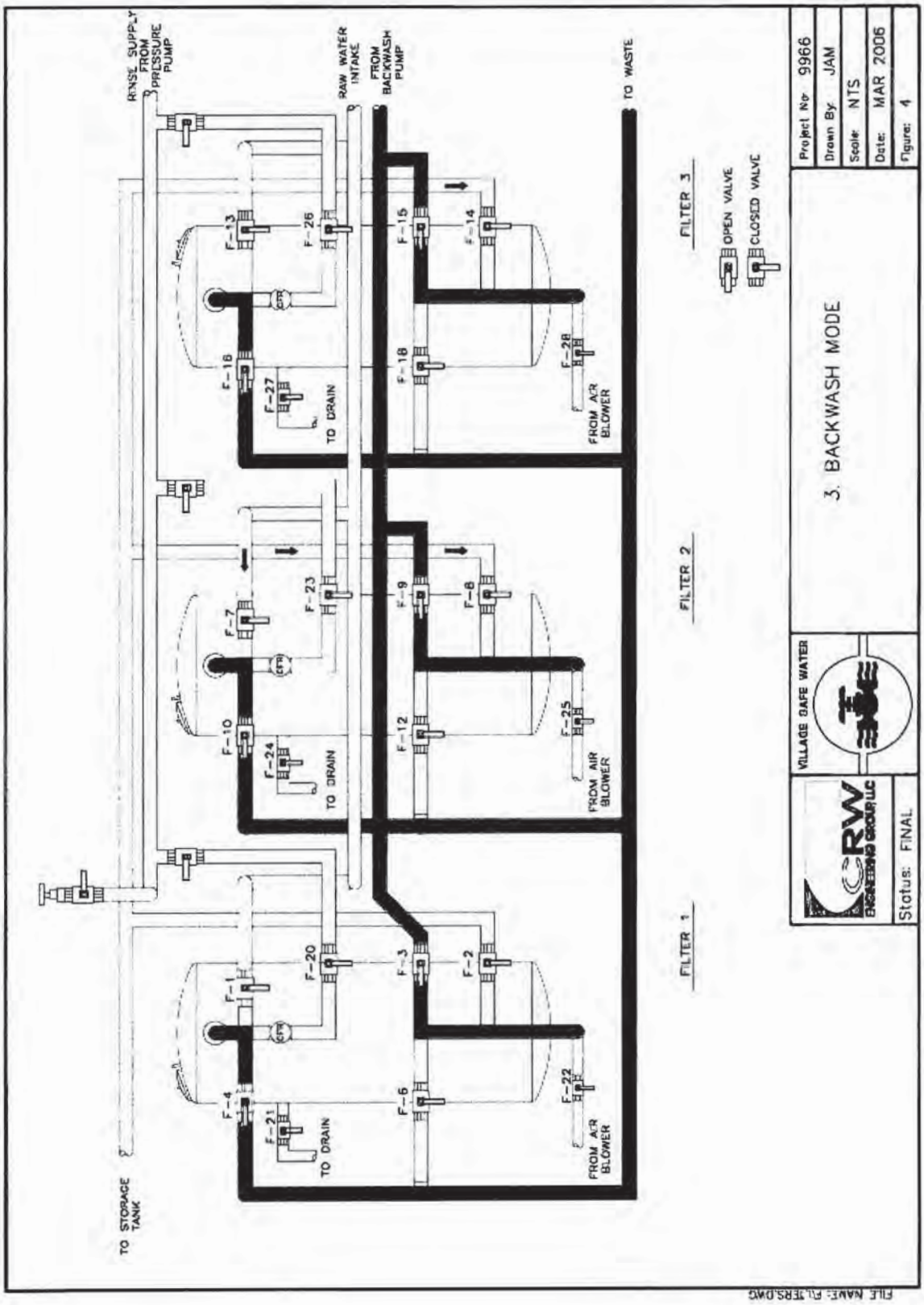


Figure 8-1 Post-Filtration Process Isometric


RINSE SUPPLY FROM PRESSURE PUMP
RAW WATER INTAKE
FROM BACKWASH PUMP
TO WASTE
TO STORAGE TANK
FILTER 1
FILTER 2
FILTER 3
TO DRAIN
FROM AIR BLOWER
OPEN VALVE
CLOSED VALVE
FILTER MODE
VILLAGE SAFE WATER
CRW ENGINEERING GROUP, LLC
Project No: 9966
Drawn By: JAM
Scale: NTS
Date: MAR 2006
Figure: 1
Status: FINAL
FILE NAME: FILTERS.DWG


RINSE SUPPLY FROM PRESSURE PUMP
RAW WATER INTAKE
FROM BACKWASH PUMP
TO WASTE
TO STORAGE TANK
TO DRAIN
FROM AIR BLOWER
FILTER 1
FILTER 2
FILTER 3
OPEN VALVE
CLOSED VALVE
2. AIR SCOUR MODE
VILLAGE SAFE WATER
CRW ENGINEERING GROUP, LLC
Status: FINAL
Project No: 9966
Drawn By: JAM
Scale: NTS
Date: MAR 2006
Figure: 3
FILE NAME: FILTERS.DWG


RINSE SUPPLY FROM PRESSURE PUMP
RAW WATER INTAKE
FROM BACKWASH PUMP
TO WASTE
TO STORAGE TANK
FILTER 1
FILTER 2
FILTER 3
OPEN VALVE
CLOSED VALVE
F-1
F-2
F-3
F-4
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F-20
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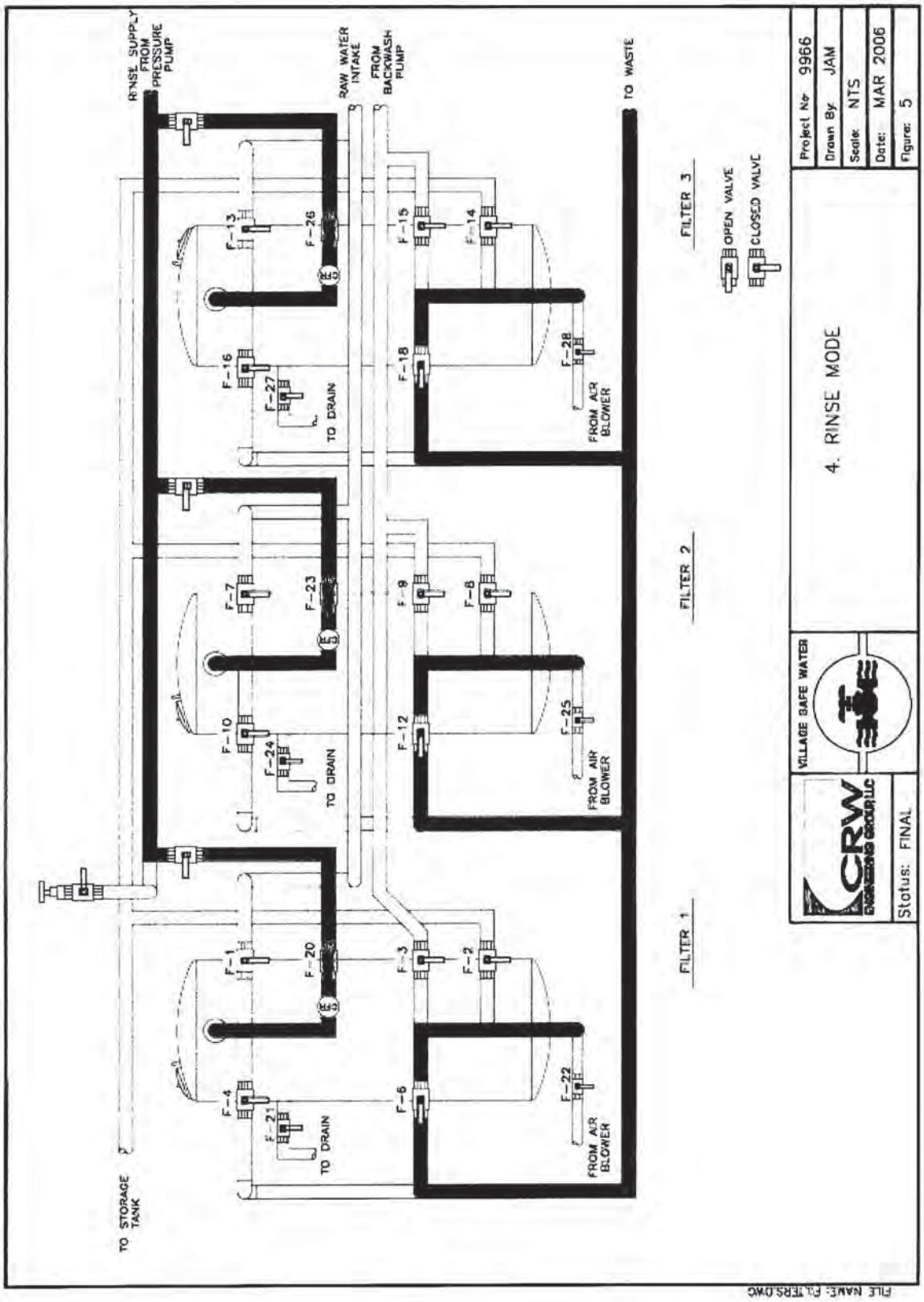
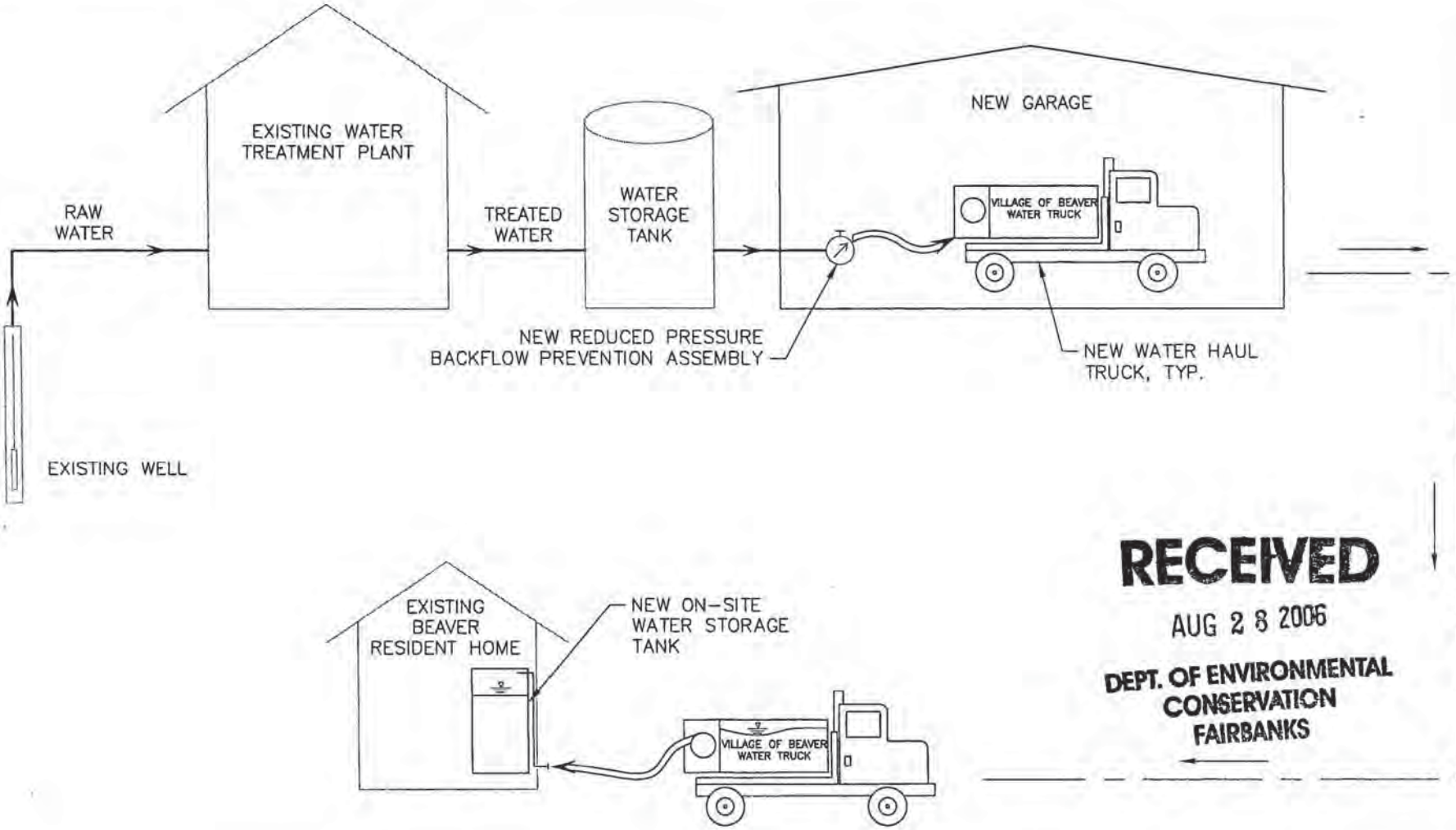
F-23
F-24
F-25
F-26
F-27
F-28
TO DRAIN
FROM AIR BLOWER
3. BACKWASH MODE
VILLAGE SAFE WATER
RW ENGINEERING GROUP, LLC
Status: FINAL
Project No: 9966
Drawn By: JAM
Scale: NTS
Date: MAR 2006
Figure: 4
FILE NAME: FILTERS.DWG


RINSE SUPPLY FROM PRESSURE PUMP
RAW WATER INTAKE
FROM BACKWASH PUMP
TO WASTE
TO STORAGE TANK
TO DRAIN
TO DRAIN
TO DRAIN
FROM AIR BLOWER
FROM AIR BLOWER
FROM AIR BLOWER
FILTER 1
FILTER 2
FILTER 3
OPEN VALVE
CLOSED VALVE
4. RINSE MODE
VILLAGE SAFE WATER
CRW
Status: FINAL
Project No 9966
Drawn By JAM
Scale NTS
Date: MAR 2006
Figure: 5
FILE NAME: F3_TERS.DWG



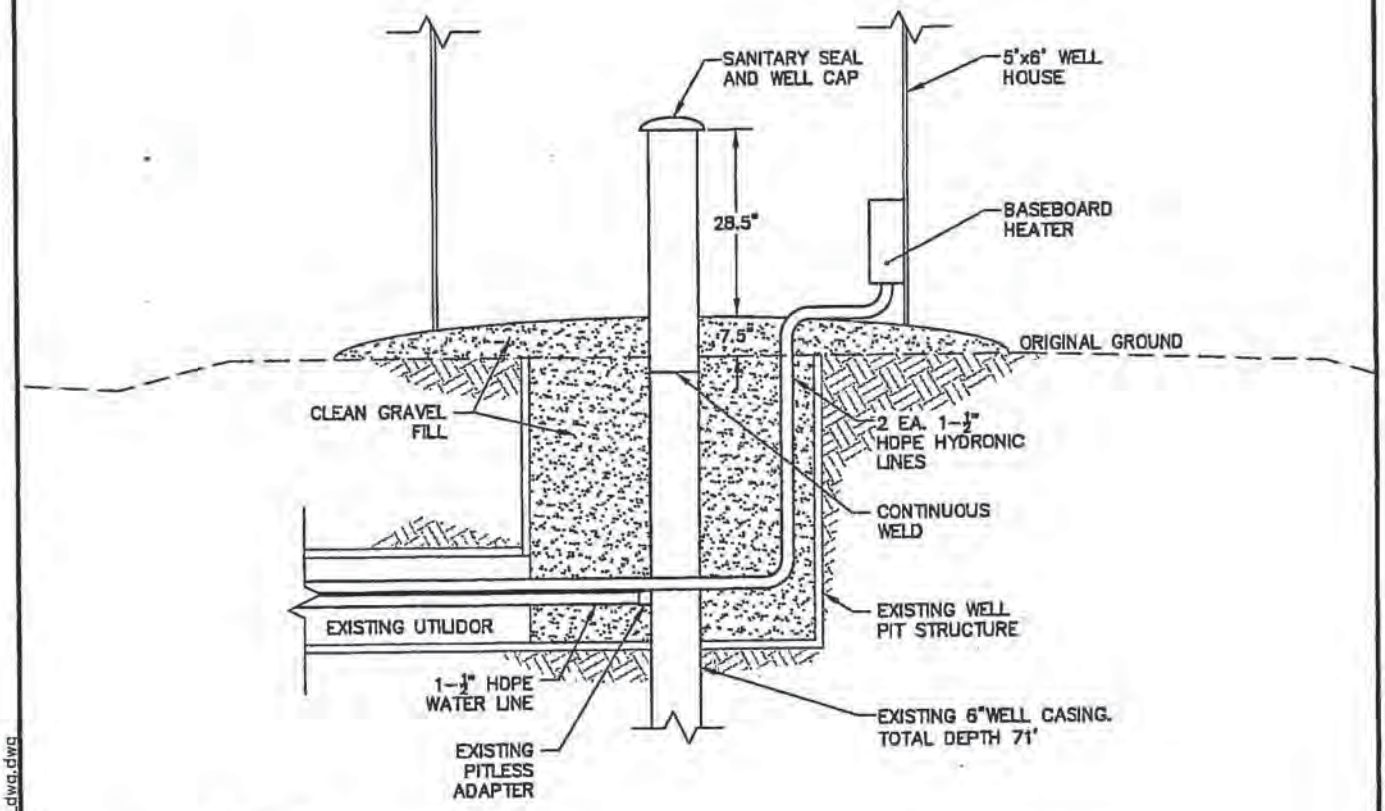
FILE NAME: 9966_WATER HAUL SCHEMATIC.DWG

CRW ENGINEERING GROUP, LLC

Project:
ADEC REVIEW

VILLAGE OF BEAVER
WATER HAUL SCHEMATIC

Project No:	9966
Drawn By:	JTK
Scale:	NTS
Date:	AUG 2006
Figure:	1



STATE OF ALASKA
49TH
David Yanoshek
David S. Yanoshek
CE-5123
8-23-06
REGISTERED PROFESSIONAL ENGINEER

NOTES:
1. SEE FIGURE 1 FOR WELL LOCATION.
2. SEE MEMO DATED 8-18-06 FOR ADDITIONAL INFORMATION.
3. SEE 11-6-95 WELL LOG FOR SUBSURFACE INFORMATION.
4. WELL IMPROVMENTS PERFORMED IN JULY, 2006.

CRW ENGINEERING GROUP, LLC

VILLAGE SAFE WATER

Project:
PRELIM

BEAVER, ALASKA

WELL IMPROVEMENTS

RECORD DRAWING

Project No:	9966
Drawn By:	TKM
Scale:	N.T.S.
Date:	8/06
Figure:	2

FILE NAME: J:\Jobsdata\9966 Beaver\CADD\Drawings\well_record_dwg.dwg

Department of Environmental Conservation
Division of Environmental Health
Drinking Water Program
555 Cordova Street
Anchorage, AK 99501
Phone: (907) 269-7540

ALASKA PUBLIC WATER SYSTEM LOCATIONAL DATA COLLECTION FORM

Public Water System Name: Beaver Water System	**PWS ID#:** AK2360230
Name of Person Determining Lat/Long: Brian Bearden	**Phone:** (907) 452-8251
Name of Person Completing Form: Brian Bearden	**Phone**
Local Facility Name: WL001	**Date Collected:** 7/25/2017 **Date Completed:** 8/2/2017

1) Facility Type. *(Check one)*

Sources: ☑ Wellhead ☐ Surface Water Intake ☐ Treatment Plant

2) The date the latitude and longitude were researched or collected. Example: 06/30/2007

0 7 / 2 5 / 2 0 1 7

3) Latitude in decimal degrees. Must be recorded in WGS 84. For Alaska, latitudes are between 51 and 80 North. Give data to available accuracy. *Example: +56.234230*

\+ 6 6 . 3 5 8 2 3

4) Longitude in decimal degrees. Must be recorded in WGS 84. For Alaska, longitudes are generally -126 to -180 West. The minus sign means "West." Use + for "East." *Example: -136.23423*

\- 1 4 7 . 3 9 7 1 3

5) Are the latitude/longitude coordinates taken at the Wellhead /Intake? ☑ **Yes** ☑ **No**
If No, describe the proximity to the wellhead/intake (*for example, 30 feet NW of the* wellhead *or intake*)

approx 5 feet south of wellhead, just outside well house

6) Type of GPS Unit used to determine latitude and longitude. (Describe unit and model number)

Garmin eTrex Vista

7.) Lat/long accuracy in meters. GPS accuracy is typically encoded in the unit's display. The datum used must be in WGS 84. *Example: 30. (meters)*

6 . Meters

8.) Site map or aerial image identifying the location of the facility must be provided to assist DEC Staff verify the lat/long location in the State geospatial database. (As-build, Google Maps, Google Earth, MSN Live Earth, Yahoo Maps are all acceptable.)

☑ Yes a map with approximate location has been provided.

46573

STATE OF ALASKA
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF MINING, LAND & WATER
Alaska Hydrologic Survey

WATER WELL LOG Revised 08/18/2016

Drilling Started: 11 / 1 / 1995 Completed: 11 / 6 / 1995 Pump Install: ___/___/_____

City/Borough	Subdivision	Block	Lot	Property Owner Name & Address
Beaver				Village Of Beaver , AK

Well location: Latitude 66.35823 **Longitude** -147.39716
Meridian F Township 018N Range 002E Section 30 , NW 1/4 of SE 1/4 of SE 1/4 of NE 1/4

BOREHOLE DATA: (from ground surface)
Suggest T.**M. Hanna's hydrogeologic classification system***
https://my.ngwa.org/NC__Product?id=a185000000BYub3AAD

	Depth From	Depth To
Silt	0.0	4.0
Gravel dry	4.0	28.0
Gravel and water	28.0	68.0
Perma Frost Gravel	68.0	69.0

Include description or sketch of well location (include road names, buildings, etc.):

North

Drilling method: ☐ Air rotary, ☐ Cable tool, ☐ Other _____
Well use: ☒ Public supply, ☐ Domestic, ☐ Reinjection, ☐ Hydrofracking
☐ Commercial, ☐ Observation/Monitoring, ☐ Test/Exploratory, ☐ Cooling,
☐ Irrigation/Agriculture, ☐ Grounding, ☐ Recharge/Aquifer Storage,
☐ Heating, ☐ Geothermal Exploration, ☐ Other _____
Fluids used: _____

Depth of hole: _____ ft Casing stickup: 2 ft
Casing type: steel Casing thickness: _____ inches
Casing diameter: 6 inches Casing depth: 60 ft
Liner type: _____ Depth: _____ ft Diameter: _____ inches
Note: _____

Well intake opening type: ☐ Open end, ☐ Open hole, ☐ Other _____
Screen type: _____, Screen mesh size: _____
Screen start: _____ ft, Screen stop: _____ ft, Perforated ☐ Yes ☒ No
Perforation description: _____ Perf from: _____ ft, Perf to: _____ ft, Perf from: _____ ft, Perf to: _____ ft
Gravel packed ☐ Yes ☒ No Gravel start: _____ ft , Gravel stop: _____ ft
Note: _____

Static water (from top of casing): 28 ft on ___/___/_____ Artesian well ☐
Pumping level & yield: _____ feet after _____ hours at _____ gpm
Method of testing: _____
Development method: _____ Duration: _____
Recovery rate: 30 gpm

Grout type: _____ Volume _____
Depth: From _____ ft, To _____ ft

Final pump intake depth: _____ ft Model: _____
Pump size: _____ hp Brand name: _____

Was well disinfected upon completion? ☐ Yes ☐ No
Method of disinfection: _____
Was water quality tested? ☐ Yes ☐ No
Water quality parameters tested: _____

Well driller name: .....
Company name: ICE WATER WELL INC. .....
Mailing address: P.O. BOX 10529 .....
City: FAIRBANKS State: AK Zip: 99710
Phone number: (907) 457 - 6444
Driller's signature: _____
Date: _____/_____/_____

AS 41.08.020(b)(4) and AAC 11 AAC 93.140(a) require that a copy of the well log be submitted to the Department of Natural Resources within **45 days of well completion**. Well logs may be submitted using the online well log reporting system available at:

https://dnr.alaska.gov/welts/

OR email electronic well logs to

dnr.water.reports@alaska.gov

Anchorage Municipal Code 15.55.060(I) and North Pole Ordinance 13.32.030(D) require that a copy of this well log be submitted to the Development Services Department/City within **30 days of well completion**.

City Permit Number: _____
Date of Issue: ___/___/_____

Parcel Identification Number: _____-_____-_____

*Guide for Using the Hydrogeologic Classification System for Logging Water Well Boreholes by Thomas M. Hanna NGWA Press

ICE WATER WELL, INC.
P.O. Box 10529
FAIRBANKS, ALASKA 99710
(907) 457-6444

WELL LOG

11-1-95 - 11-6-95

Well Owner Village of BEAVER Date Started ____ Date Finished

Well Location 1st Ave RIVER BANK Driller Les + Chuck Ice

Mailing Address BEAVER ALASKA ~~S.E. Time~~ B.E To 20-W

Size of Casing 6' STEEL Depth of Hole 70' Cased To 60'

Static Water Level 28' Drawdown 4 inches Finish of Well 10' SCREEN ASSEMBLY

Well Pump Test at 30 gpm Gallons per minute for 36 HOURS

Formations Encountered:

0	to 2	Stick up
2	to 6	Silt
6	to 30	GRAVEL "Dry"
30	to 70	GRAVEL and WATER
70	to 71	PERMA FROST GRAVEL
____	to ____	NOTE: WELL CAPPED w/ 1/4 PLATE
____	to ____	Location Between OLD
____	to ____	B.I.A well & 1976 Comm. WELL
____	to ____	SEE MAP

Pump Installation:

Date Installed 11-6-95 Type "TEST" Size 1 1/2 HP

Material Used:

6" Drive Shoe
60' STEEL CASING 6" x .250 WALL
10' SCREEN Assembly KPACKER & Bottom

RECEIVED
JUN 23 2000
DEPT. OF ENVIRONMENTAL CONSERVATION
FAIRBANKS

TANANA CHIEFS CONFERENCE
Health Services – Remote Maintenance Worker
122 1st Avenue, Suite 600
Fairbanks, AK 99701
Phone: (907) 452-8251 ext. 3265 Fax: 459-3989
Toll Free in Alaska 1-800-478-6822 ext. 3266
Email: Wesley.Shales@tananachiefs.org

Memorandum

DATE: August 14, 2017
FROM: Wesley Shales, Remote Maintenance Worker
SUBJECT: Trip Report: Beaver, August 9-11, 2017
TO: Brian Bearden, TCC RMW Program Manager
Project #: **05042** **Task #:** **07692** **Award #:** **003142**

From	To	Date	Departure	Arrival	VIA
Fairbanks	Beaver	8/9/17	2:45 p.m.	3:50 p.m.	Warbelow's
Beaver	Fairbanks	8/11/17	3:30 p.m.	4:15 p.m.	Warbelow's

OBJECTIVES:
The objective priority was to finish installation of a return water line within their distribution system utilidor and review backwash and water treatment routines. In addition, we briefly spoke about preventative maintenance plans and addressed a few recent sanitary survey findings, etc.

ACCOMPANIED BY:
N/A

CONTACTS:
Aaron Petruska, Water Plant Alternate, Waste Water Operator
Rhonda Pitka, Tribal Administrator
Paul Petruska, Water Plant Operator
Selina Petruska, Beaver Joint Utilities Manager

FINDINGS & ACCOMPLISHMENTS
Upon arriving in Beaver on the afternoon of the 9th Aaron and I were able to review and plan out our objectives for the time I would be there. He then informed me his Dad, Paul Petruska, the Primary Water Operator, was on a trip down river and wouldn't be able to meet/work with me until Friday morning. Aaron also let me know he had some personal plans for the evenings I would be there so no late night work could be performed. Other projects in the Community were occurring so furthermore no additional help was available for this trip. In addition, some work for the water and sewer routines were needed to be done by himself so we were overall looking at a reduced set of objectives on my part but I let him know I was completely understanding of that and we could plan out more work for later trips. Among other things I was hoping to set up a working welding station and perform some of the needed welding on the haul truck. I

specifically pointed out to him some of the items that needed to be addressed as listed on the recently performed sanitary survey.
Anyway, working together we penetrated thru existing openings within the flooring/sidewall of each building involved with the return line pipe and installed proper valving, a check valve, other pipe connectors and a tee where needed. All components were NSF approved including the circ pump. I ran a circuit for the circulation pump from a properly located switch at the water plant. Next we did a leak test on our work. Finally at the end of that day I properly chlorinated the isolated new work and let it sit overnight. I then drained it all the next morning and proceeded to work with mainly Paul on his backwash procedure and then his chlorine testing procedure.
Paul performed the proper freeboard drain, air scouring, backwash and then rinsing procedure on each filter. Next he showed me how he tests for chlorine residual at a tap near the pressure pumps. Finally, with Paul, I pointed out some of the deficiencies written down on the sanitary survey. We were able to install screen around the "vent" at the well casing and I showed him a good location to install a check valve on piping located near the community water draw. I pointed out the old non-nsf approved backflow preventer would have to be removed. Later on I personally climbed up the ladder to the top of the water storage tank and installed a set of brackets that held the lid down tight and prevented unauthorized access. I had a set of power tools down on the ground and ready to cut the lock off of (the combo had been lost) and then replace it but the crew axed that plan because they were comfortable with the existing set up. The ladder was essentially locked and that was good enough. Last of all Paul and I briefly spoke about pm plans and reporting them.
While installing the final run of return line pipe to the water plant outside I noticed a hideous looking hole in the ground--under the building that from normal standing level or distance from the back of the building would be obscured. It looked like a vortex of tornado like design. Instantly I recognized it to be some sort of giant alien sink hole in the ground! This situation would most assuredly be responsible for the majority of structural problems existing within the plant/washeteria. I inquired with Aaron as to any local knowledge of the hole and he stated he didn't realize it existed. I also alerted Rhonda to the situation eventually. I cautioned her about the obvious dangers involved including further structural but also advised her to consider possible other dangers like animals or people near it. She definitely became concerned. The building isn't skirted. See attached pictures.

RECOMMENDATIONS/CONCLUSION

I advised Paul and Aaron I would assist them with obtaining material to address the remaining sanitary survey conditions at the plant. Paul said he plans on putting fill in around the open area at the well casing. Aaron said he would insulate and cover up with boarding all the areas we opened up to access piping or the utilidor itself. He would also wrap the piping with insulation in needed areas.

Distribution list electronic:
Bill Justice, Director, TCC-OEH
Brian Bearden, TCC RMW Supervisor
sdkell@anthc.org

Notice the “fractures/fissures/cracks forming on the surface of the ground.

Notice how rocks/dirt that received spray from prior spray painting of the outside of the building are migrating towards the sink hole!

I dare not crawl any closer, right?

The sink hole is on the left hand side of the picture and is located under the building just below the opened window. The 60,000 plus gallon water storage tank is on the other side of the building in the background.

TECHNICAL MEMORANDUM

Beaver PER Trip Report

Date:	November 15, 2018	Project Number:	165.0021949
To:	Susan Randlett, Village Safe Water		
From:	Daniel Nichols, P.E., CCCA		

INTRODUCTION

Kuna Engineering (Kuna) was hired by Village Safe Water (VSW) for the Beaver Washeteria Improvements Preliminary Engineering Report (PER). Daniel Nichols, project manager, made a site visit to Beaver, Alaska on October 1, 2018 through October 3, 2018.

Site Contacts:

- Rhonda Pitka, Tribal Chief
- Paul Williams, Sr., Elder, Past Tribal Chief
- Aaron Petruska, Assistant Water Treatment Operator
- Paul Williams, Jr., Cultural Specialist/Teacher
- Selina Petruska, Utility Clerk

SCHEDULE

Monday, October 1, 2018

I left Anchorage at 1:40 pm and flew to Fairbanks. I arrived in Beaver around 5:30 pm on Warbelow Air's regular flight. I stayed at the school.

Tuesday, October 2, 2018

I arrived at the tribal office around 8:10 am. 10:45 am, met with Rhonda and discussed project and collected information. 1:40 pm, Aaron and I went to the washeteria and water treatment plant (WTP). 3:00 pm, I went back to the office and met with Rhonda again. 4:00 pm, I walked over to the WTP and washeteria to document and investigate sinkhole under building. 5:00 pm, I used hand auger to check soils at site east of WTP. 7:00 pm, dinner break. 7:30 pm, I drilled hole with hand auger at site adjacent to utilidor corner. 8:30 pm, quit for the night.

Wednesday, October 3, 2018

8:00 am, went to the office. Worked on trip report, reviewed information, and collected drawings of 1990 washeteria remodel. 10:40 am, Aaron and I went to the WTP. I observed Aaron through treating a batch of water and documented the condition of the WTP. 1:00 pm, I toured the washeteria and documented the conditions. 2:00 pm, I returned to the office and reviewed notes and worked on reports. 3:00 pm, I went out and photographed wellhead, utilidor, existing buildings, WTP attic, and other items I had not yet documented. 3:00 pm, I returned to the office to work.

OBSERVATION AND DISCUSSIONS

The following information was collected through direct observations or discussions.

Washeteria

- Washeteria is open 24 hours per day, 7 days a week.
- Most people shower at the washeteria. It is reported that "people shower regularly throughout a week."
- Rhonda reports that residents' health and hygiene have really improved with in-house systems, but she is worried it will deteriorate because of the poor condition of the washeteria.
- Only one bathroom works.
- It costs $5 for a shower.
- General Building
    - Electricity went out 2-3 times last year. When it goes out the washeteria must shut down.
    - Washeteria and WTP are hooked up to the school's emergency power. There is only enough power to keep lights on.
    - Solar panel power comes into washeteria electrical panel. It appears that they took over breakers originally labeled for alarm fuses. It is unclear if the fire and other alarms still work.
    - Outside lights don't work.
    - There is rotting of baseboard and window frame wood around the arctic entry.
    - Building needs new exterior paint.
    - Much of the interior piping needs to be replaced. It is reported to be very corroded and water often comes out brown when water sits in the pipes. Maintenance staff replaces copper piping with PEX piping if possible when making repairs.
- Laundry
    - The windows are all now non-operable. Several are cracked due to building settling.
    - There are 4 washers, but three are out of service. One washer is being repaired. Washers regularly go down, limiting the amount of laundry that can be washed.
    - There are 3 dryers, but two are out of service.
    - Louvers throughout the building don't work anymore.
    - Electric heater doesn't work.
    - 2 overhead lights are broken and need to be replaced.
    - All doors need to be replaced. There are holes and broken locks in each.

  - Emergency exit signs work but are due for replacement. Emergency lights do not work. Smoke detectors are broken. Fire extinguishers are empty.
  - The flooring, baseboards, and counter surfaces are in poor condition.
  - The sink/water fountain do not work.
- Functioning Bathroom
  - Door, bath tub, and step up should be replaced.
  - Showers are stained and mold is growing around the top of the walls.
  - Bathtub needs new caulk.
  - Light switch has exposed wires and is a safety hazard.
  - Bench ripping out of the wall.
  - Vanity and mirror are severely damaged and need to be replaced.
  - There are holes in the walls and multiple patches.
  - Ventilation fan doesn't work and needs replacing.
  - Rot and mold along the baseboards and shower wall. Exposed plywood is separating.
  - Electric outlets are corroded and need replacing.
  - Floor needs replacing down to subfloor.
  - There is 1- to 2-inch gap between the wall and the ceiling caused by the building sinking along the east side.
  - The toilet and sink piping have been repaired and patched because of pipe failures due to building settling.
- Dryer Room
  - Ventilation louver doesn't work
  - Old dryers and heater that aren't in operation should be removed.
  - Electric heater doesn't work.
  - Walls have burn marks and heat stains, probably due to excess heat buildup in the room.
  - Floor is buckling.
  - There is extensive water damage to the floor.
  - The electrical chase has exposed wires.
  - The walls are beginning to separate from the ceiling due to settling.
- Boiler Room
  - Floor drains open directly to ground outside. The drainage piping has been removed.
  - Abandoned hot water heater should be removed.
  - Rot and water damage exists along the entire baseboards. It is especially severe by the lift station and the chemical mixing tanks.
  - Backwash tank is not secured and is a tipping hazard.
  - The pre-mix tank is leaking on the floor.
  - There is a lot of abandoned piping and exposed wiring that should be removed.
  - Backup electric heater doesn't work.
  - Low tank alarm is always on.
  - There are many cracks in the walls. Wall separation covered by electrical chase running along entire wall crown.
  - Outside door should be replaced.
  - The electrical panels for both the washeteria and WTP are in this room. They are labeled; Panel A-Washeteria & WTP, Panel B-Dryers, Washers, and Utility Circulation Pumps, Panel C-Emergency Power.

  - Lift station girder is failing due to corrosion and wear and should be replaced.
- Washer Access Room
  - There are holes in walls and patched hoses because of building settling.
  - Light doesn't work
  - Rot is occurring along baseboards and floor.
- Washeteria Foundation
  - The building rests on a wooden pile foundation. Depth and original construction are unknown. There are 11 piles along building perimeter.
  - In 1999, five wooden piles on post and pad were added along the interior center line of the building. This is along grid lines C.4/ 1.1 to 3.5.
  - A 10-foot-diameter depression has formed under the building. It is centered on grid line C.5/3.5. The depression is at least two feet deep.
  - There is evidence of water flowing into the depression and ponding, though it was dry during the site visit.
  - There are shear failures around the depression and it appears the depression is getting bigger.
  - The depression has undercut several of the nearest piles and caused the piles to fail.
  - The greatest settling in the building occurs where those piles have failed.
  - The depression is directly below an open floor drain. It appears water drains into the depression.
  - It is reported that when the WTP was connected to the power plant's waste heat, the boilers were drained of glycol. It is suggested that the glycol was drained through the floor drain onto the ground. This has not been confirmed, but the depression began to appear after the waste heat project. The glycol should have been non-toxic.
  - Ponding or flowing water would cause the underlying permafrost to melt causing the soil to settle. As the depression grew and more water collected the melting would accelerate. If glycol was dumped, this would also accelerate the settling.
  - The washeteria has settled so much that last year the sewer service connection into the building had to be cut and reconnected to the building. The washeteria was down for 1-2 days for the repair.

Water Treatment Plant

- Water treatment operators are scheduled to work for 3 hours per day at $20/hour.
- There is significant iron staining in washeteria sinks and showers. Water has strong rusty taste. Most people use a Britta-style filter system at home for drinking water.
- 4-5 years ago, the WTP and washeteria converted from gas boilers to heat recovery from the power plant located next door. The contractor reported that the WTP went from using 12,000 gallons of heating oil each year to 400 gallons. The village is going to expand the heat recovery to the village office building.
- General Building
  - There is no emergency power generator.
  - There is no ventilation in WTP. Operators prop doors open when mixing chemicals.
  - Emergency exit signs work but are due for replacement. Emergency lights do not work. Several of the fire extinguishers are empty.
  - All floor drains dump directly onto the ground. There is no drainage piping.

  - Outside lights don't work.
  - There are miscellaneous light and electrical issues that need repairing.
- Watering Point
  - The outside watering point hose spills and overflows frequently. Water continues to flow after button is released and dribbles water on to the ground. It is reported that the area glaciates throughout the winter. The ice become thick and slick. Operators want a retractable hose that doesn't dribble and freeze.
  - There is no charge for self-haul. Most people haul 30-50 gallons at a time.
  - No backflow preventer valve on hose. It is currently not code compliant and there is a danger of water backflowing into WTP.
- Water Storage
  - They only fill the water storage tank to about 3 psi (approximately 7 feet deep). If the pressure gets much higher than 3 psi, several valves begin to leak between the filters and the tanks.
  - Water level sensor is broken on water storage tank. In addition, the low water level light on the control panel is always on.
  - WTP went down when the water storage tank froze last year. It was down for several days. The heat exchanger was replaced 2 months ago, in hope that the tank won't freeze again this year.
  - Replace heat trace for storage tank. The outside valves froze last winter because it doesn't work.
  - Outside insulated valve box is rotting and should be replaced.
- Treatment Process
  - Operators treat water in 3-hour batches. After 3 hours, the water starts to turn yellow as it comes out of the filter. They then backwash, check chemicals, and start filtering again. They usually do two batches a day.
  - Operators pretreat with 2.0% $KMnO_4$ and 1% Cl. Polymer and flocculant agents are no longer used.
  - The pre-mix tank for $KMnO_4$ leaks.
  - Last year, the flow meter for backwash was replaced.
  - The backwash tank often overflows because inflow is greater than pump capacity.
  - Fix air blower. The blower doesn't work, so currently operators are not air scouring during backwash. This makes the backwash less effective.
  - Settling tank is plumbed incorrectly. The influent is supposed to enter from the bottom not the top.

Water and Sewage Distribution

- Houses have buried septic tanks and water cisterns in the houses. The Village hauls water and pumps sewage.
- Rhonda stated that the cisterns only hold 100 gallons, which is too small. A couple of showers and they run out of water. The result is most people shower that the washeteria.
- There are problems with freezing pipes at homes. It is reported that many residents haul ice and snow for water during the winter.
- Monthly rate for school is $1,800. Residential rate is $20 per month.

- There are three water services; school, power plant, and clinic/village office building. The community center also had water service, but the building burned down.
- The water distribution truck fill line is in the power plant. The power plant line isn't a circulating water line. A circulating line would increase freeze protection and keep the line fresh.

WTP to Lagoon Utilidor

- The utilidor froze 3 times last year and water and sewer were down 1-2 days for each incident. Washeteria would be shut down also because of it. They could still haul water and sewage for individual homes but not for the school.
- WTP heats utilidor to junction box at the old school, approximately 190 feet.
- School heats utilidor from junction box to lift station then to lagoon, approximately 500 feet.
- The utilidor is a simple wooden box with insulation board. The utilidor was originally part of the old school and is in poor shape. It was constructed pre-1970s.
- The utilidor appears to rest directly on the ground.

Potential Site Investigation

- Discussed with Rhonda two potential sites. The two sites are shown on the attached figures.
- Site A: USS 4895, Block 7, Lot 7.
    - The village is listed as the owner.
    - The lot is wooded and undeveloped.
    - A single hole was hand augured approximately 45 feet east of the utilidor corner.
    - The hole went to 5 feet deep before the gravel size was too big for the auger.
    - The soil profile included organics to 1-foot depth. From 1 to 5-foot depth was a uniform brown silt with sand. At 5-foot depth the augur pulled up clean river gravel with rocks over 2 inches.
    - No water or ice was found in the hole.
- Site B: USS 4895, Block 6, Lot 7.
    - The Alaska Recorder's Office online database lists the owner as the church. The old missionary house is located on the property. Rhonda stated that the property was transferred to the Beaver Village Council approximately 2 years ago. She is going to try and find the letter for me.
    - The site is a disturbed area adjacent to the WTP. It appears to have been cleared and some fill placed to level it out. There are grassy areas where there are no trails.
    - A single hole was hand augured approximately 45 feet southeast from the northeast corner of the WTP.
    - The hole went to 6 feet deep before the gravel size was too big for the auger.
    - The soil profile included organics to 1-foot depth. From 1 to 2-foot depth, brown silt mixed with gravel, potential fill material. From 2 to 3-foot, light brown silty sand. From 4 to 5-foot depth, clean sand. From 5 feet to bottom of hole, sand and gravel with rocks over 2 inches.
    - No water or ice was found in the hole.
    - Rhonda prefers this site because it is closer to the WTP.

- There is a 15-foot by 30-foot hole, sloping down to a depth of approximately 2 feet. It is located about 30 feet east of the WTP's northeast corner. The shape suggests a building foot print.
- There are two deeper holes within that hole. One is approximately 3 feet deeper and the top of a 55-gallon steel drum is visible at the bottom. The other hole opens into an underground chamber. The chamber appears to be approximately 5-feet deep. Exposed insulation board and chicken wire were visible within the chamber. It appears to be manmade, such as a cellar that is collapsing.
- No one reported remembering a building in that exact area or knew what its use may have been.

General Community Information

- It has been a wet year but there has been no flooding. The last flood was in 1992.
- Prevailing winds are from east to west.
- Paul Williams Sr. reports that he drinks untreated Yukon River water and uses a honey bucket. There are only two people still using honey buckets. He doesn't like treated water, he says, it has too much harmful stuff and he thinks the washeteria water is harmful.
- A 455 Caterpillar dozer is operable. They anticipate a track loader to be running soon. Dump truck works. The Village has a grader, but it doesn't work. Their backhoe needs over $18,000 in repairs.
- Fuel price is $6.00 per gallon.
- There are several old buildings. Two might qualify as culturally significant historical buildings. One is the trading post and the other is Yasuda House. Both are log buildings constructed around 1912. Neither building should be impacted by the project.
- It is reported that when digging gravels, permafrost is found at approximately a 6-foot depth.

ATTACHMENTS

- Trip Photos
- Site Selection Figure A.3
- Washeteria & WTP Layout Redlines
- Washeteria Foundation Redlines

Figure 1: WTP, Storage Tank, Washeteria-North West Side

Figure 2: Storage Tank, Washeteria-West Side (above)

Figure 3: Power Plant (below)

Figure 4: Watering Point

Figure 5: Power Plant Heating Pipe

Figure 6: Historic Trading Post

Figure 7: Historic Yasuda House

Figure 8: Blue Box Where the WTP Underground Utilidor Connects to the School's Utilidor

Figure 9: Lift Station at School

Figure 10: Outfall from Lift Station to Lagoon

Figure 11: Site A-Looking North from Road

Figure 12: Sandy Silt from Hole A.

Figure 13: Site B-West of WTP, Looking North to Old School & Site A

Figure 14: Site B-West of WTP, Looking South Towards Missionary Housing & Village Office

Figure 15: Depression-West of Site B, Looking East

Figure 16: Depression, East Hole, Insulation Board Exposed

Figure 17: Gravel with Sand from Hole B.

Figure 18: Hole B

Figure 19: Depression Under Washeteria

Figure 20: Soil Subsidence Under Cutting Foundation

Figure 21: Washeteria Foundation Pile Failing

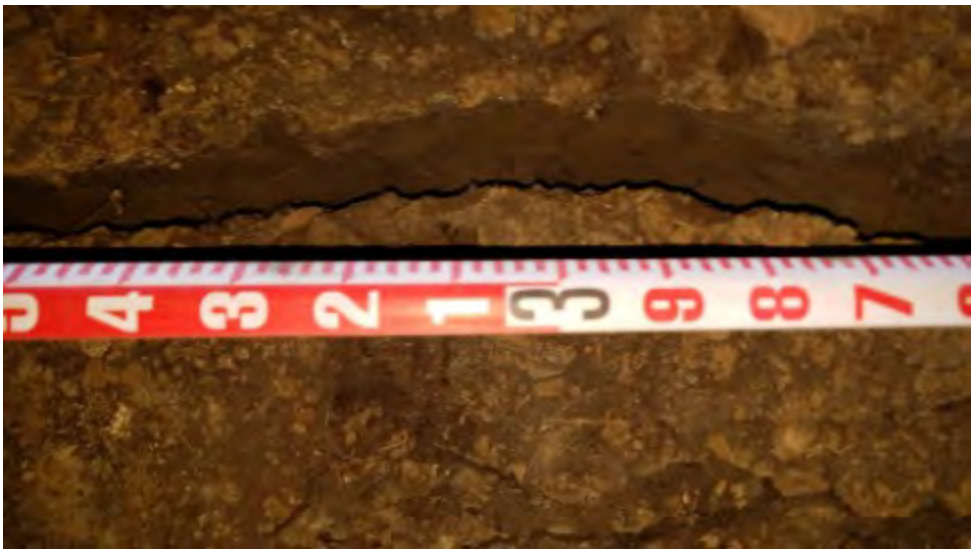


Figure 22: Shear Failure Around Depression

Figure 23: Typical Perimeter Pile, Beginning to Fail, Leans Towards Depression

Figure 24: Water Storage Tank-Exterior Valve Box

Figure 25: WTP Filters, Settling Tank, and Pressure Tanks

Figure 26: WTP-Settling Tank

Figure 27: WTP-Water Storage Tank Valve Room

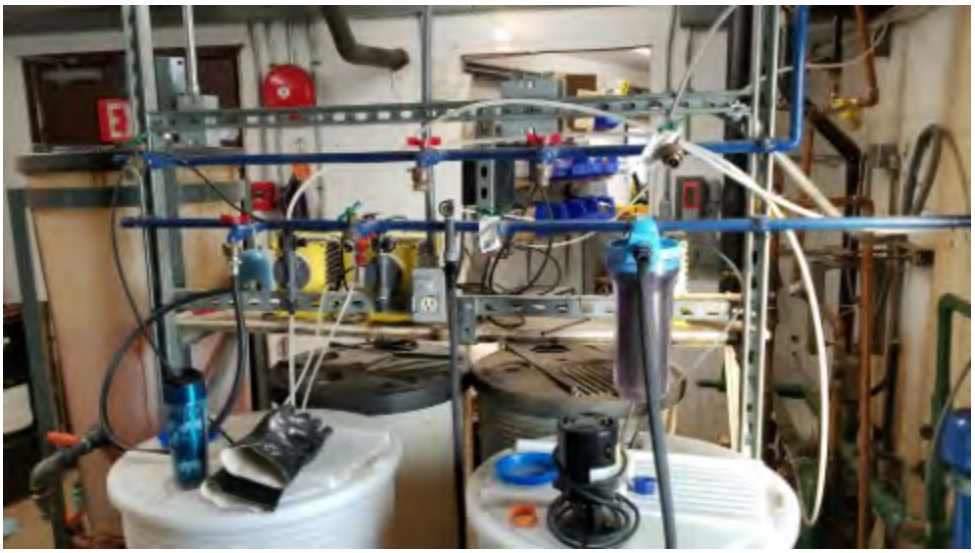


Figure 28: Boiler Room-Chemical Mixing Tanks

Figure 29: Boiler Room-Lift Station and Backwash Tank (Brown Tank)

Figure 30: Washer Access Room

Figure 31: Laundry Room-East Side

Figure 32: Laundry Room-South Side

Figure 33: Laundry Room-West Side

Figure 34: Bathroom-Bathtub

Figure 35: Bathroom-Wall and Ceiling Separation

Figure 36: Bathroom-Toilet Repair Due to Settling

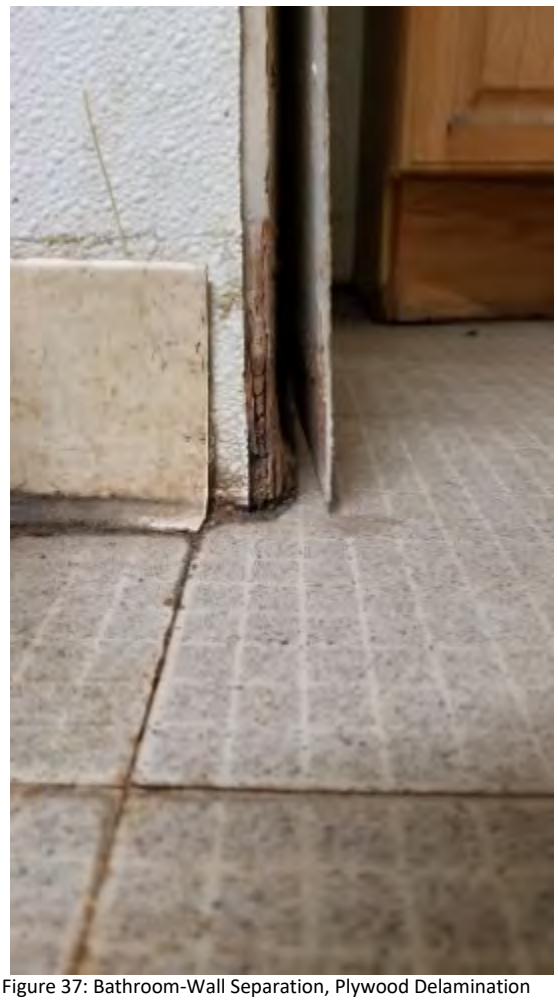
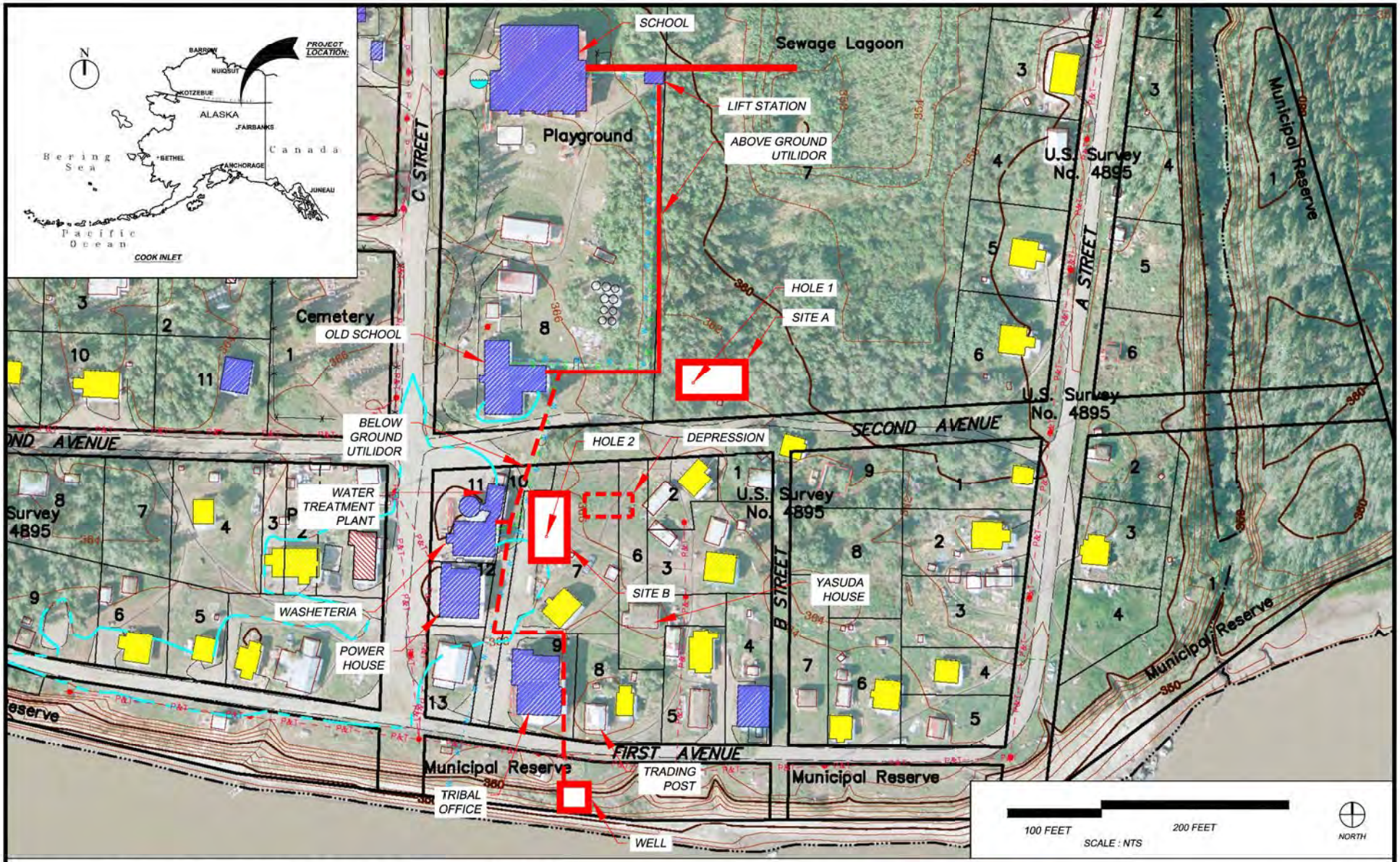


Figure 37: Bathroom-Wall Separation, Plywood Delamination

Figure 38: Laundry-Nonfunctioning Smoke Alarm



BEAVER WASHETERIA IMPROVEMENTS

PRELIMINARY ENGINEERING REPORT

BEAVER, ALASKA

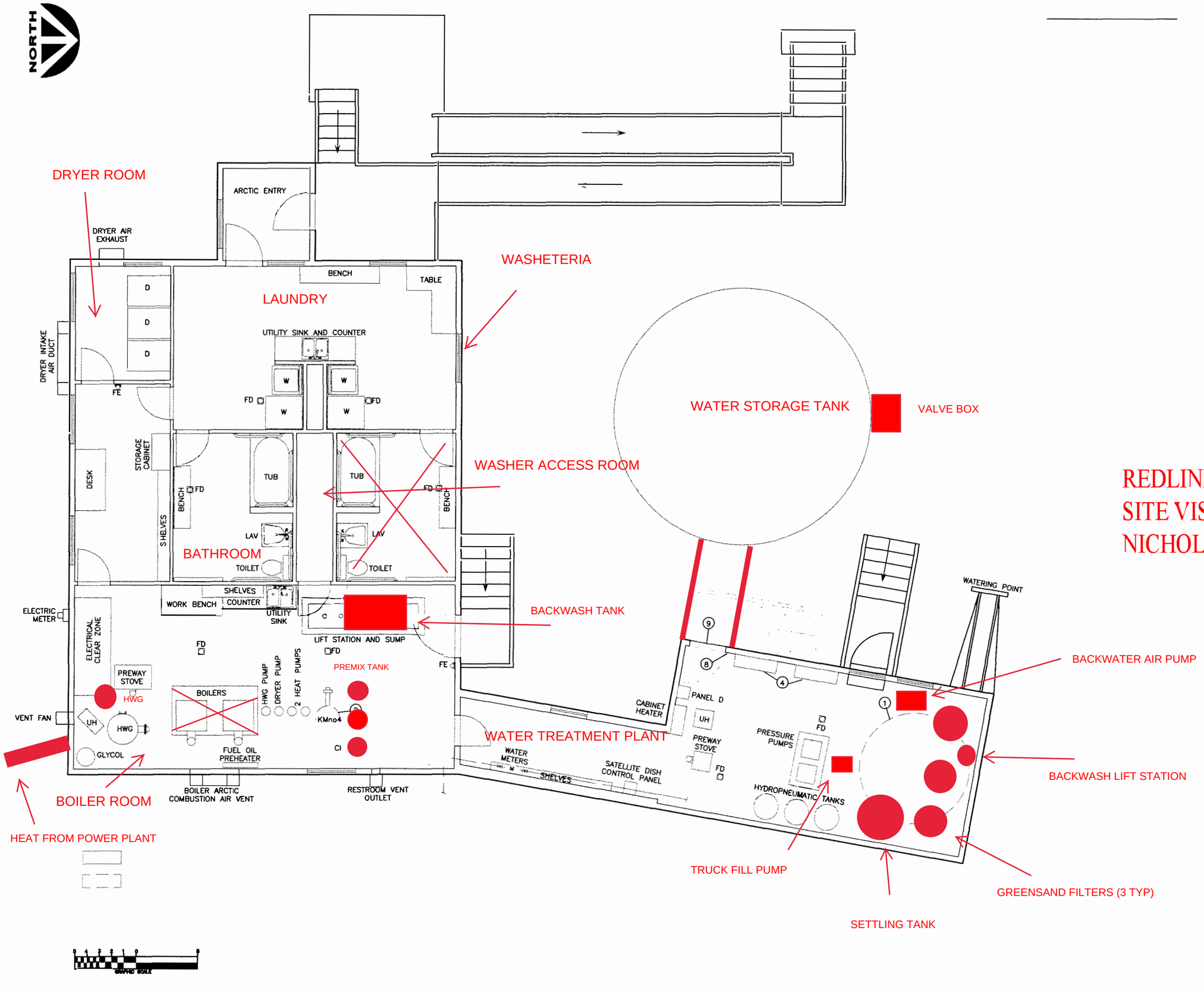
PROJ. NO.	P0021949W
DRAWN	TRP
CHECKED	DEN
DATE	11/15/18

KUNA ENGINEERING

3111 C Street, Ste 300 Anchorage, AK 99503
907-339-6500 Fax 907-339-5327
www.whpacific.com License #:AECC1163

SITE SELECTION

A.3



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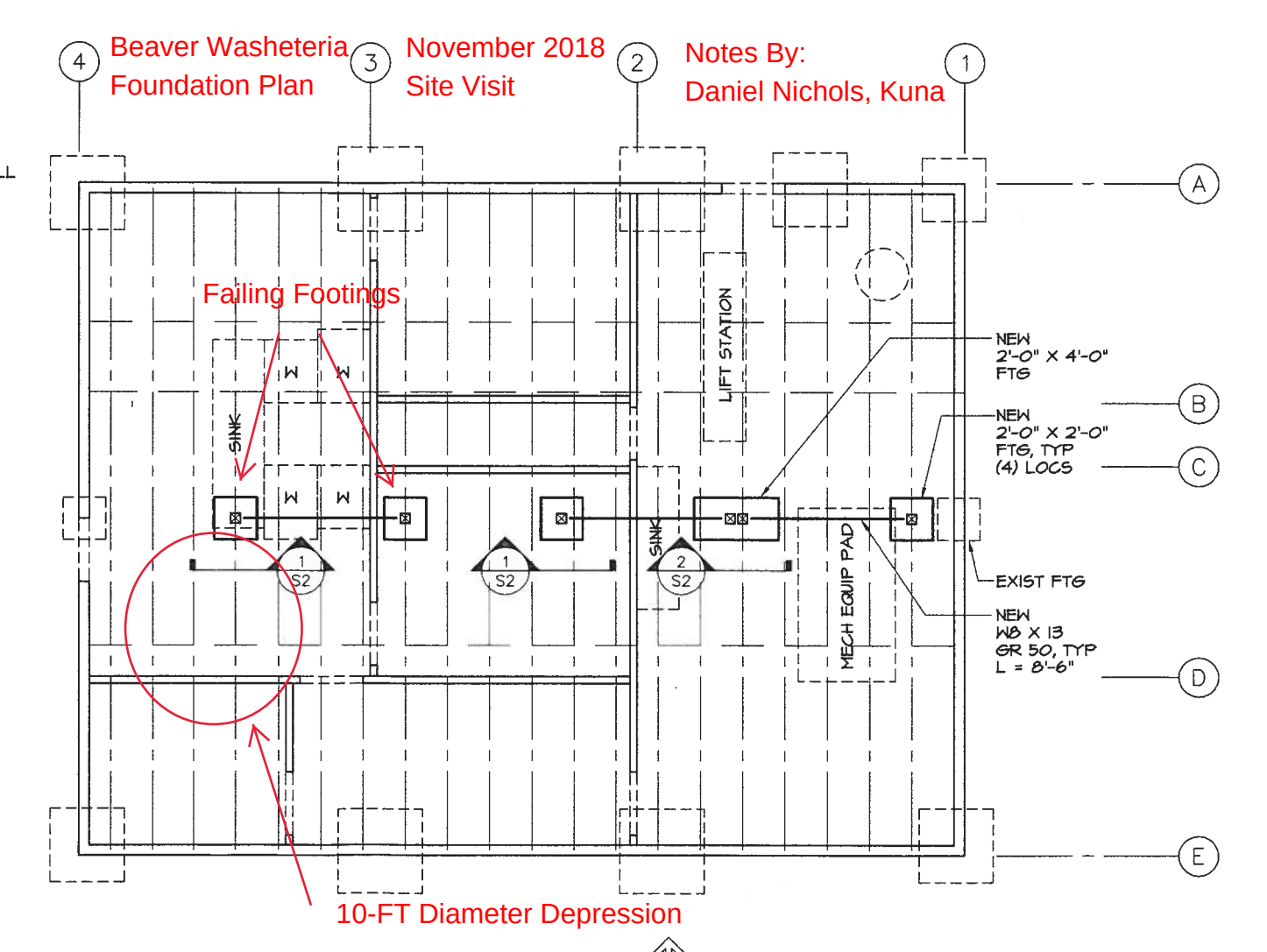

Beaver Washeteria
Foundation Plan
November 2018
Site Visit
Notes By:
Daniel Nichols, Kuna
Failing Footings
LIFT STATION
SINK
SINK
MECH EQUIP PAD
NEW
2'-0" X 4'-0"
FTG
NEW
2'-0" X 2'-0"
FTG, TYP
(4) LOCS
EXIST FTG
NEW
W8 X 13
GR 50, TYP
L = 8'-6"
10-FT Diameter Depression

Category		Best Practice	Points	
Technical	*Operator Certification*	Utility has more than one operator certified to the level of the water system	10	
		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	
		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	
		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	
		Total Technical Points	**45**	
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	
	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	
		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	
		Total Managerial Points	**10**	
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	
		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	
		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 workers' compensation policy for all employees for the past two years and has a current policy in place	5	
		Utility has a current workers' compensation policy in place for all employees	2	
		Utility has no workers' compensation policy	0	
	Payroll Liability Compliance	Utility has no past due tax liabilities and is current with all tax obligations	5	
		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	
		Total Financial Points	**45**	
		Total Points Possible	**100**	

Best Practices Score
Beaver
FALL 2018

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	10	System Classification: Water Treatment 1 Primary Operator: *Paul Petruska* Certification Level: *WT 1* Backup Operator: *Aaron Petruska* Certification Level: *WT 1* Both Aaron Petruska and Paul Petruska hold certifications at the correct level.	Aaron Petruska needs 0.7 CEUs by 12/31/18 to renew his certificate. Paul Petruska needs 3.0 CEUs by 12/31/18 to renew his certificate. 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	15	The utility is not performing the required maintenance or isn't keeping records of maintenance.	To receive the full points in this category, the operator must have a Preventative Maintenance plan that they follow and the completed plan must be submitted to your assigned RMW each quarter.	George Yatlin TCC RMW 452-8251 ext. 3267
		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	5	The utility had 2 Drinking Water Monitoring and Reporting violations in 2017.	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.	Teslyn Visscher ADEC Drinking Water Program 451-3038
		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	Elsie Wade attended clerks 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.	Brendan Smyth DCRA RUBA Program 451-2744
	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	0	Meeting minutes have not been provided to the RUBA program.	The governing body needs to meet according to local ordinance and submit minutes to RUBA. The meeting minutes should document that a report was made by the operator to the governing board.	
		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	0	An adopted, realistic budget has not been submitted to RUBA.	Provide RUBA with an adopted, realistic budget. Provide RUBA with monthly financial reports and meeting minutes that demonstrate the council is reviewing the monthly financial reports.	
		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	0	No fee schedule nor collection policy has been provided to RUBA.	Provide RUBA with the utility's fee schedule and collection policy. RUBA can assist in developing these if none exist.	
		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	0	The Utility does not have a current worker's compensation policy.	The utility must obtain worker's compensation insurance to receive additional 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	0	The RUBA program did not receive authorization to access tax information for the community.	Provide RUBA with a completed authorization form so they may confirm compliance with tax liabilities.	
		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	0	SDS O&M Score	6	TOTAL SCORE	35		

2018 Best Practices Score
Beaver
March 1, 2018

Category		O&M Scoring Criteria	Possible	Score
Technical	**Operator Certification**	Utility has more than one operator certified to the level of the water system	10	7
		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	
	System Classification: Water Treatment 1 Primary Operator: *Paul Petruska* Certification Level: *WT 1* Backup Operator: *Aaron Petruska* Certification Level: *WT P*			
	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	15
		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	5
		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	
	2 Monitoring and Reporting Violations in 2017			
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
	Attendee: *Elsie Wade* Course: *Utility Clerks* Date: *12/4/2017*			
	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	0
		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	0
		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	0
		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	0
		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
		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	0	SDS O&M Score	6	TOTAL SCORE	37

2017 Best Practices Score
Beaver
August 22, 2017

Category		O&M Scoring Criteria	Possible	Score
Technical	**Operator Certification**	Utility has more than one operator certified to the level of the water system	10	7
		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	
	System Classification: Water Treatment 1 Primary Operator: *Paul Petruska* Certification Level: *WT 1* Backup Operator: *Aaron Petruska* Certification Level: *WT P*			
	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	15
		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	5
		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	
	1 Monitoring and Reporting Violations in 2016			
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
	Attendee: *Vivian Juneby* Course: *Clerks* Date: *2/10/2015*			
	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	0
		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	0
		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	15
		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	0
		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	0
		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	0	SDS O&M Score	8	TOTAL SCORE	47

Appendix C: Cost Estimates

Contents:

Construction (Capital) Costs				
Item	No.	Unit	Cost	Total
Mob & Demob	1	LS	$600,000	$600,000
Construction Survey	1	LS	$15,000	$15,000
Site Clearing	4,000	SQFT	$2	$8,000
Site Pad Work	750	CYD	$40	$30,000
Site Electrical	1	LS	$30,000	$30,000
Access Ramp	1	LS	$20,000	$20,000
Stick-Built Washeteria	1,000	SQFT	$450	$450,000
Washeteria Equipment	1	LS	$25,000	$25,000
Washeteria-Waste Heat Connection	1	LS	$100,000	$100,000
WTP-Waste Heat Connection	1	LS	$20,000	$20,000
WTP-Piping & Other Improvements	1	LS	$120,000	$120,000
WTP-New Lift Station	1	LS	$15,000	$15,000
WTP-Addition	102	SQFT	$450	$45,900
Day Tank	1	EA	$8,000	$8,000
Replace Raw Water Line: Well-WTP	400	FT	$150	$60,000
New Sewer Piping: WTP-Lagoon	700	FT	$400	$280,000
New Water Piping: Storage Tank-Washeteria	400	FT	$150	$60,000
Replace Aboveground Utilidor	500	FT	$165	$82,500
Existing Washeteria Demolition	1	LS	$40,000	$40,000
Commissioning	1	LS	$25,000	$25,000
O&M Manual & Training	1	LS	$5,000	$5,000
O&M Equipment	1	LS	$2,500	$2,500
			Subtotal	$2,041,900
Resident Project Representative	7%	OF	$2,041,900	$142,933
Construction Administration	6%	OF	$2,041,900	$122,514
Project Administration	8%	OF	$2,041,900	$163,352
			Subtotal	$428,799
TOTAL	$2,470,699			

Non-Construction Costs				
Item	No.	Unit	Cost	Total
Survey	1	LS	$20,000	$20,000
Geotechnical	1	LS	$25,000	$25,000
Land Acquisition/ROW	0	LS	$0	$0
Engineering	12%	OF	$2,041,900	$245,028
Permitting	1	LS	$20,000	$20,000
Resident Project Representative	3%	OF	$2,041,900	$61,257
Project Contingency	20%	OF	$2,041,900	$408,380
Total	$779,665			

Operations & Maintenance Costs (Annual)				
Item	No.	Unit	Cost	Total
WTP Personnel	1,000	HR	30	$30,000
Washeteria Personnel	2,080	HR	$15	$31,200
Water Delivery Personnel	884	HR	$30	$26,520
Administrative Costs	1	LS	$2,500	$2,500
Disposable Materials	1	LS	$5,000	$5,000
Heating Costs (oil fuel)	1	LS	$10,000	$10,000
Energy Costs (Electric)	1	LS	$10,000	$10,000
Total	$115,220			

Item	Cost
Construction (Capital) Costs	$2,470,699
Non-Construction Costs	$779,665
Total Costs	$3,250,364
O&M Costs (Annual)	$115,220

Construction (Capital) Costs				
Item	No.	Unit	Cost	Total
Mob & Demob	1	LS	$300,000	$300,000
Construction Survey	1	LS	$10,000	$10,000
Site Clearing	4,000	SQFT	$2	$8,000
Site Pad Work	750	CYD	$40	$30,000
Site Electrical	1	LS	$30,000	$30,000
Access Ramp	1	LS	$20,000	$20,000
Modular Washeteria	1,000	SQFT	$650	$650,000
Washeteria Equipment	1	LS	$25,000	$25,000
Washeteria-Waste Heat Connection	1	LS	$100,000	$100,000
WTP-Waste Heat Connection	1	LS	$20,000	$20,000
WTP-Piping & Other Improvements	1	LS	$120,000	$120,000
WTP-New Lift Station	1	LS	$15,000	$15,000
WTP-Addition	102	SQFT	$450	$45,900
Day Tank	1	EA	$8,000	$8,000
Replace Raw Water Line: Well-WTP	400	FT	$150	$60,000
New Sewer Piping: WTP-Lagoon	700	FT	$400	$280,000
New Water Piping: Storage Tank-Washeteria	400	FT	$150	$60,000
Replace Aboveground Utilidor	500	FT	$165	$82,500
Existing Washeteria Demolition	1	LS	$40,000	$40,000
Commissioning	1	LS	$25,000	$25,000
O&M Manual & Training	1	LS	$5,000	$5,000
O&M Equipment	1	LS	$2,500	$2,500
			Subtotal	$1,936,900
Resident Project Representative	6%	OF	$1,936,900	$116,214
Construction Administration	6%	OF	$1,936,900	$116,214
Project Administration	8%	OF	$1,936,900	$154,952
			Subtotal	$387,380
TOTAL	$2,324,280			

Non-Construction Costs				
Item	No.	Unit	Cost	Total
Survey	1	LS	$20,000	$20,000
Geotechnical	1	LS	$25,000	$25,000
Land Acquisition/ROW	0	LS	$0	$0
Engineering	10%	OF	$1,936,900	$193,690
Permitting	1	LS	$20,000	$20,000
Resident Project Representative	3%	OF	$1,936,900	$58,107
Project Contingency	20%	OF	$1,936,900	$387,380
Total	$704,177			

Operations & Maintenance Costs (Annual)				
Item	No.	Unit	Cost	Total
WTP Personnel	1,000	HR	30	$30,000
Washeteria Personnel	2,080	HR	$15	$31,200
Water Delivery Personnel	884	HR	$30	$26,520
Administrative Costs	1	LS	$2,500	$2,500
Disposable Materials	1	LS	$5,000	$5,000
Heating Costs (oil fuel)	1	LS	$10,000	$10,000
Energy Costs (Electric)	1	LS	$10,000	$10,000
Total	$115,220			

Item	Cost
Construction (Capital) Costs	$2,324,280
Non-Construction Costs	$704,177
Total Costs	$3,028,457
O&M Costs (Annual)	$115,220

Life Cycle Costs & Short Term Assets List
Alternative 1: New Washeteria 3/30/2019

Year of Repair Replacement	Item/Event[1]	2018 Federal Discount Rate Conversion Factor[3]	Cost of Event in Todays Dollars	Present Value
1	Annual O&M Costs[4]	19.5861	$115,220	$2,256,709
1		0.9980		$0
2		0.9960		$0
3		0.9940		$0
4		0.9920		$0
5	Sealants	0.9901	$500	$495
6		0.9881		$0
7		0.9861		$0
8	Washers/Dryers	0.9841	$12,000	$11,810
9		0.9822		$0
10	Sealants, Exhaust Fans, Painting, Showers, Flooring	0.9802	$23,700	$23,231
11		0.9783		$0
12		0.9763		$0
13		0.9744		$0
14		0.9724		$0
15	Sealants	0.9705	$500	$485
16	Washers/Dryers	0.9685	$12,000	$11,622
17		0.9666		$0
18		0.9647		$0
19		0.9627		$0
20	Sealants, Exhaust Fans, Painting, Showers, Flooring	0.9608	$23,700	$22,772
20	Project Salvage Value[5]	-0.9608	$680,633	-$653,971
			Total Present Value	**$1,673,153**

Total Construction Cost[7] **$2,041,900** Useful Life 30 yr
Annual O&M Costs **$115,220** Remaining Life 10 yr

Federal Discount Interest Rate[2] 0.2%

Project Present Worth (Lift Cycle Cost)[6] **$3,715,053**

Notes:
1. See Short Term Assets list for items.
2. The Federal real discount interest rate from OMB Circular A94 for 2018. https://www.whitehouse.gov/wp-content/uploads/2017/11/Appendix-C-revised.pdf (retrieved 4/3/2018)
3. Short Lived Assest'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
7. For Life Cycle Cost, total construction cost doesn't Resident Project Representative, CA Service, or Project Administration.

SHORT LIVED ASSETS LISTING & REPLACEMENT COST

Item/Event	Frequency (yr)	Amount	Unit	Cost	Total
Sealants and Caulking	5	1	LS	$500	$500
Washing Machines and Dryers	8	1	LS	$12,000	$12,000
Exhaust Fans	10	6	LS	$200	$1,200
Exterior and Interior Painting	10	1	LS	$8,000	$8,000
Showers	10	3	EA	$3,000	$9,000
Flooring	10	1000	SQFT	$5	$5,000

Life Cycle Costs & Short Term Assets List
Alternative 2: New Modular Washeteria 3/30/2019

Year of Repair Replacement	Item/Event[1]	2018 Federal Discount Rate Conversion Factor[3]	Cost of Event in Todays Dollars	Present Value
1	Annual O&M Costs[4]	19.5861	$115,220	$2,256,709
1		0.9980		$0
2		0.9960		$0
3		0.9940		$0
4		0.9920		$0
5	Sealants	0.9901	$500	$495
6		0.9881		$0
7		0.9861		$0
8	Washers/Dryers	0.9841	$12,000	$11,810
9		0.9822		$0
10	Sealants, Exhaust Fans, Painting, Showers, Flooring	0.9802	$23,700	$23,231
11		0.9783		$0
12		0.9763		$0
13		0.9744		$0
14		0.9724		$0
15	Sealants	0.9705	$500	$485
16	Washers/Dryers	0.9685	$12,000	$11,622
17		0.9666		$0
18		0.9647		$0
19		0.9627		$0
20	Sealants, Exhaust Fans, Painting, Showers, Flooring	0.9608	$23,700	$22,772
20	Project Salvage Value[5]	-0.9608	$645,633	-$620,342
			Total Present Value	**$1,706,782**

Total Construction Cost[7]	**$1,936,900**	Useful Life	30	yr
Annual O&M Costs	**$115,220**	Remaining Life	10	yr
Federal Discount Interest Rate[2]	0.2%			

Project Present Worth (Lift Cycle Cost)[6] $3,643,682

Notes:

1. See Short Term Assets list for items.
2. The Federal real discount interest rate from OMB Circular A94 for 2018. https://www.whitehouse.gov/wp-content/uploads/2017/11/Appendix-C-revised.pdf (retrieved 4/3/2018)
3. Short Lived Assest'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
7. For Life Cycle Cost, total construction cost doesn't Resident Project Representative, CA Service, or Project Administration.

SHORT LIVED ASSETS LISTING & REPLACEMENT COST

Item/Event	Frequency (yr)	Amount	Unit	Cost	Total
Sealants and Caulking	5	1	LS	$500	$500
Washing Machines and Dryers	8	1	LS	$12,000	$12,000
Exhaust Fans	10	6	LS	$200	$1,200
Exterior and Interior Painting	10	1	LS	$8,000	$8,000
Showers	10	3	EA	$3,000	$9,000
Flooring	10	1000	SQFT	$5	$5,000

Beaver Washeteria Improvements PER
Cost Summary

3/30/2019

Costs	Alternatives	
	1-New Washeteria	2-New Modular Washeteria
Construction (Capital) Costs	$2,471,000	$2,325,000
Non-Construction Costs	$780,000	$705,000
Total Project Costs	$3,251,000	$3,029,000
O&M Costs (Annual)	$116,000	$116,000
Life Cycle Costs	$3,716,000	$3,644,000

Washeteria Replacement
Beaver, Alaska
SDS Cost Estimate

Prepared by Daniel Nichols, Kuna (03/30/2019)

	Description	Code	Unit	Quantity	Unit Cost	Total Cost
Water System-WTP Upgrades/Washeteria						
1	Geotechnical Investigation-Site Foundation	C-WA	Ea	0.5	$25,000	$12,500
2	Site Survey	C-WA	Ea	0.5	$20,000	$10,000
3	Land Acquisition/RoW	C-WA	Ea	0.5	$0	$0
4	Mob & Demo	C-WA	Ea	0.5	$300,000	$150,000
5	Construction Survey	C-WA	Ea	0.5	$10,000	$5,000
6	Site Clearing	C-WA	Sf	2,000	$2	$4,000
7	Site Electrical	C-WA	Ea	0.5	$30,000	$15,000
8	Access Ramp	C-WA	Ea	0.5	$20,000	$10,000
9	Modular Washeteria	C-WA	Sf	500	$650	$325,000
10	Washeteria Equipment	C-WA	Ea	0.5	$25,000	$12,500
11	Washeteria-Waste Heat Connection	C-WA	Ea	0.5	$100,000	$50,000
	WTP-Waste Heat Connection	W-WP	Ea	1	$20,000	$20,000
12	WTP-Piping & Other Improvements	W-WP	Ea	1	$120,000	$120,000
13	WTP- New Lift Station	W-WP	Ea	1	$15,000	$15,000
14	WTP-Addition	W-WP	Sf	102	$450	$45,900
15	Day Tank	W-WP	Ea	0.5	$8,000	$4,000
16	Replace Raw Water Line: WTP-Well	W-BD	ft	400	$150	$60,000
17	New Water Piping: Storage Tank-Washeteria	C-WA	ft	350	$150	$52,500
18	Existing Washeteria Demolition	C-WA	Ea	0.5	$40,000	$20,000
24	Permitting	M-DS	Ea	0.5	$20,000	$10,000
25	Commissioning	C-WA	Ea	0.5	$25,000	$12,500
26	O&M Manual & Training	C-WA	Ea	0.5	$5,000	$2,500
	O&M Equipment	C-WA	Ea	0.5	$2,500	$1,250

Construction Cost		$957,650
Contingencies	20%	$191,530
Total Construction Cost		$1,149,180
Project Technical Support	8%	$91,934
Specialty Engineering (Specify[1])		$210,147
Subtotal Costs: Water System-WTP/Washeteria		**$1,451,261**

	Description	Code	Unit	Quantity	Unit Cost	Total Cost
Sewer Systems-Washeteria/Sewer Piping/Utilidor						
1	Geotechnical Investigation-Site Foundation	C-WA	Ea	0.5	$25,000	$12,500
2	Site Survey	C-WA	Ea	0.5	$20,000	$10,000
3	Land Acquisition/RoW	C-WA	Ea	0.5	$0	$0
4	Mob & Demo	C-WA	Ea	0.5	$300,000	$150,000
5	Construction Survey	C-WA	Ea	0.5	$10,000	$5,000
6	Site Clearing	C-WA	Sf	2,000	$2	$4,000
7	Site Electrical	C-WA	Ea	0.5	$30,000	$15,000
8	Access Ramp	C-WA	Ea	0.5	$20,000	$10,000
9	Modular Washeteria	C-WA	Sf	500	$650	$325,000
10	Washeteria Equipment	C-WA	Ea	0.5	$25,000	$12,500
11	Washeteria-Waste Heat Connection	C-WA	Ea	0.5	$100,000	$50,000
6	New Sewer Piping: WTP-Lagoon	S-SF	ft	700	$400	$280,000
7	Replace Aboveground Utilidor	M-IU	ft	500	$165	$82,500
10	New Water Piping: Storage Tank-Washeteria	C-WA	ft	350	$150	$52,500
11	Existing Washeteria Demolition	C-WA	Ea	0.5	$40,000	$20,000
16	Permitting	M-DS	Ea	0.5	$20,000	$10,000
17	Commissioning	C-WA	Ea	0.5	$25,000	$12,500
18	O&M Manual & Training	C-WA	Ea	0.5	$5,000	$2,500
19	O&M Equipment	C-WA	Ea	0.5	$2,500	$1,250

Construction Cost		$1,055,250
Contingencies	20%	$211,050
Total Construction Cost		$1,266,300
Project Technical Support	8%	$101,304
Specialty Engineering (Specify[1])		$210,147
Subtotal Costs: Sewer System-Washeteria		**$1,577,751**

Project Summary	
Water System-WTP Upgrades/Washeteria	$ 1,451,261
Sewer Systems-Washeteria/Sewer Piping/Utilidor	$ 1,577,751
Total =	**$ 3,029,012**

1. Specialty Engineering justification: Architectural, structural, civil, electrical, mechanical and system integration design service will be required to complete the design and construction of the project.

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

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

Table 6.1: Proposed Project-New Modular Washeteria Construction (capital) Costs-SDS Format

Water System-WTP Upgrades/Washeteria		
Description	Code	Total Cost
Washeteria-Water System Total	C-WA	$682,750
Water Treatment Upgrades Total	W-WP	$204,900
Replace Raw Water Line: WTP-Washeteria	W-DB	$60,000
Permitting	M-DS	$10,000
Subtotal Cost	$957,650	
Contingencies (20%)	$191,530	
Total Construction Cost	$1,149,180	
Project Technical Support (8%)	$91,934	
Specialty Engineering	$210,147	
Total Costs: Water System-WTP/Washeteria	$1,451,261	

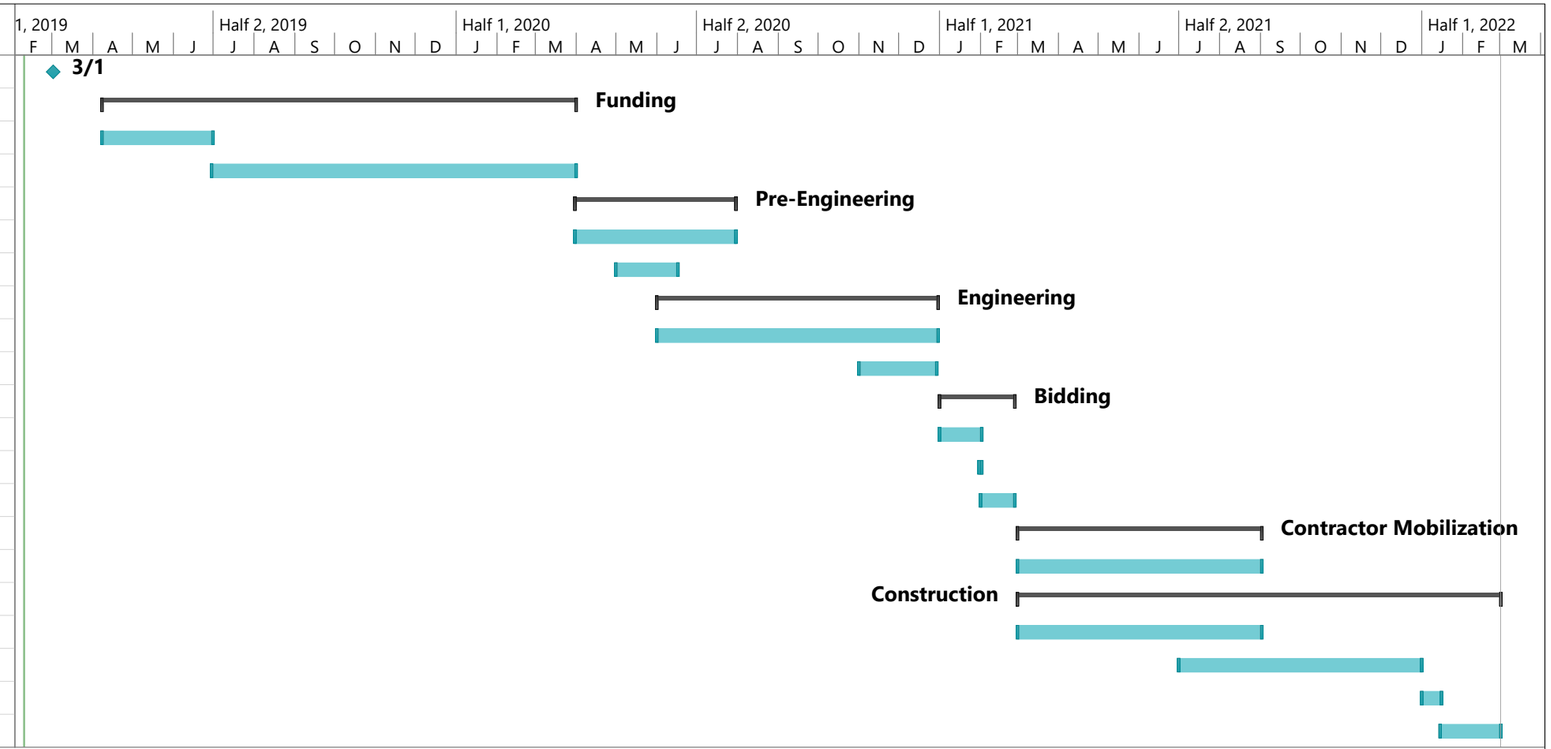
Sewer Systems-Washeteria/Sewer Piping/Utilidor		
Description	Code	Total Cost
Washeteria-Sewer System Total	C-WA	$682,750
New Sewer Piping: WTP-Lagoon	M-BW	$280,000
Replace Aboveground Utilidor	M-IU	$82,500
Permitting	M-DS	$10,000
Subtotal Cost	$1,055,250	
Contingencies (20%)	$211,050	
Total Construction Cost	$1,266,300	
Project Technical Support (8%)	$101,304	
Specialty Engineering	$210,147	
Total Costs: Sewer System-Washeteria	$1,577,751	
Project Summary Costs	$3,029,012	

Major Assumptions:

- Local gravel source
- Adjustable skid foundation

Appendix D: Proposed Project Schedule

ID	Task Mode	Task Name	Duration	Start	Finish
1		PER & ER	1 day	Fri 3/1/19	Fri 3/1/19
2		**Funding**	**257 days**	**Mon 4/8/19**	**Tue 3/31/20**
3		Request Funding	61 days	Mon 4/8/19	Sun 6/30/19
4		Secure Funding	198 days	Sun 6/30/19	Tue 3/31/20
5		**Pre-Engineering**	**88 days**	**Tue 3/31/20**	**Thu 7/30/20**
6		Geotechnical Investigation	88 days	Tue 3/31/20	Thu 7/30/20
7		Survey	33 days	Fri 5/1/20	Tue 6/16/20
8		**Engineering**	**153 days**	**Mon 6/1/20**	**Wed 12/30/20**
9		Construction Documents	153 days	Mon 6/1/20	Wed 12/30/20
10		Permitting	43 days	Sun 11/1/20	Tue 12/29/20
11		**Bidding**	**41 days**	**Fri 1/1/21**	**Fri 2/26/21**
12		Bid Advertising	22 days	Fri 1/1/21	Mon 2/1/21
13		Contractor Selection	2 days	Sun 1/31/21	Mon 2/1/21
14		Contracting	20 days	Mon 2/1/21	Fri 2/26/21
15		**Contractor Mobilization**	**133 days**	**Mon 3/1/21**	**Wed 9/1/21**
16		Mobilization	133 days	Mon 3/1/21	Wed 9/1/21
17		**Construction**	**262 days**	**Mon 3/1/21**	**Tue 3/1/22**
18		Construct Modules	133 days	Mon 3/1/21	Wed 9/1/21
19		Construction	132 days	Thu 7/1/21	Fri 12/31/21
20		Commissioning	12 days	Sat 1/1/22	Sat 1/15/22
21		Contract Closeout	33 days	Sat 1/15/22	Tue 3/1/22



Project: Beaver
Water Improvements
Date: Fri 2/8/19

Task	Project Summary	Manual Task	Start-only	Deadline
Split	Inactive Task	Duration-only	Finish-only	Progress
Milestone	Inactive Milestone	Manual Summary Rollup	External Tasks	Manual Progress
Summary	Inactive Summary	Manual Summary	External Milestone

Appendix E: Energy Audit & Business Plan

Contents:

- 2014 Comprehensive Energy Audit, Beaver Water Plant and Washeteria
- 2005 Village of Beaver, Alaska, Water and Wastewater Utilities Business Plan

Comprehensive Energy Audit
Beaver Water Plant and Washeteria

Prepared For

Beaver Tribal Council
And Village Safe Water

June 30, 2014

Prepared By:

ANTHC-DEHE
3900 Ambassador Drive, Suite 301
Anchorage, AK 99508

Table of Contents

PREFACE

The Energy Projects Group at the Alaska Native Tribal Health Consortium (ANTHC) prepared this document for The Beaver Tribal Council, Beaver, Alaska and Village Safe Water (VSW). The authors of this report are Carl Remley, Certified Energy Auditor (CEA) and Certified Energy Manager (CEM) and Gavin Dixon. Danny Graham, Structural Engineer for Larsen Consulting Group, Inc. contributed to the on–site portion of this audit.

The purpose of this report is to provide a comprehensive document of the findings and analysis that resulted from an energy audit conducted in June of 2014 by the Energy Projects Group 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.

This energy audit was conducted using funds provided by the State of Alaska Village Safe Water (VSW) program. In the near future, a representative of VSW will be contacting the Beaver Tribal Council and the water treatment plant operator to follow up on the recommendations made in this audit report.

In general, the facility is in fair condition. A separate structural evaluation has been prepared to discuss a few concerns. The washeteria equipment including the showers, washers and dryers are near end of life and need to be replaced.

As part of conducting this audit, a meeting was held with the two contractors the Beaver Tribal Council has chosen to upgrade the water treatment plant/washeteria. Those companies are Lars Construction and Alaska BTU. Representing those companies at the meeting was Rex Goolsby and Mike Hirt respectively.

ACKNOWLEDGMENTS

The ANTHC Energy Projects Group gratefully acknowledges the assistance of Chief Rhonda Pitka, Tribal Admin Wilma Pitka, Utility Manager Selena Petruska, and Water Plant Operator Paul Petruska all of the Beaver Tribal Council as well as Susan Randlett of VSW.

Information on the existing PV solar system was graciously provided by Dave Pelunis-Messier of Tanana Chiefs Conference.

1. EXECUTIVE SUMMARY

This report was prepared for the Beaver Tribal Council and VSW. The scope of the audit focused on the Beaver water treatment plant/washeteria. The scope of this report is a comprehensive energy study, which included an analysis of building shell, interior and exterior lighting systems, heating and ventilation systems, water processing loads, and plug loads.

Based on electricity and fuel oil prices in effect at the time of the audit, the annual predicted energy costs for the water plant/washeteria analyzed are $22,081 for electricity and $15,772 for # 1 fuel oil. The Beaver Tribal Council does not charge the water plant/washeteria for the recovered heat supplied by the power plant. The total energy cost as modeled is $37,871 per year. This compares very favorably with the $38,906 actual energy cost.

It should be noted that this facility did not receive the power cost equalization (PCE) subsidy from the state of Alaska. As a non-state or federal owned facility, the facility should be eligible. The Tribal Council could save as much as $12,000 a year in electricity costs with PCE. Receiving PCE would reduce the electricity cost savings listed in this report.

Table 1.1 below summarizes the energy efficiency measures analyzed for the Beaver water plant/washeteria. Listed below are the estimates of the annual savings, installed costs, and two different financial measures of investment return.

Table 1.1
PRIORITY LIST – ENERGY EFFICIENCY MEASURES

Rank	Category	Improvement Description	Annual Energy Savings	Installed Cost	Savings to Investment Ratio, SIR[1]	Simple Payback (Years)[2]
1	Other Electrical – Repair Dryer Pump Controls	Repair relay controls such that dryer pump only runs when dryers do	$7,853	$2,500	36.90	0.3

Table 1.1 PRIORITY LIST – ENERGY EFFICIENCY MEASURES						
Rank	**Category**	**Improvement Description**	**Annual Energy Savings**	**Installed Cost**	**Savings to Investment Ratio, SIR[1]**	**Simple Payback (Years)[2]**
2	Lighting – Convert Exterior Lighting to LED	Replace exterior lighting with LED 20 watt wall packs controlled by a photocell	$605 Plus $40 Maintenance Savings	$2,000	4.72	3.1
3	Lighting – Replace washeteria fluorescent lighting with LED's	Replace existing fluorescent lamps by removing the ballast and installing direct wired 18 watt LED lamps	$136 Plus $10 Maintenance Savings	$800	2.64	5.5
4	Lighting - Replace WTP 4 lamp fluorescent Lighting with LED's	Replace existing fluorescent lamps by removing the ballast and installing direct wired 18 watt LED lamps	$84 Plus $40 Maintenance Savings	$800	2.25	6.5
5	Lighting - Replace WTP2 lamp fluorescent lighting with LED's	Replace existing fluorescent lamps by removing the ballast and installing direct wired 18 watt LED lamps	$341 Plus $80 Maintenance Savings	$3,200	1.91	7.6
6	Building Shell: Replace existing metal exterior door.	Remove existing metal door in the WTP and install standard pre-hung better insulated door.	$100	$1,380	1.70	13.8
7	Building Shell: Replace the Broken Window in Washeteria	Replace existing broken window in the washeteria with double paned glass window.	$75	$849	1.54	11.3
8	Building Shell: Replace existing wood exterior door	Remove existing wood door in the washeteria and install standard pre-hung better insulated door.	$64	$1,030	1.47	16.0
9	Heating and Ventilation: Improve recovered heat system and replace boilers.	Re-commission power plant side of heat recovery system including repairing or replacing variable frequency drives on radiator fans, resizing the pumps as necessary to maximize the heat output, do what is necessary to reduce the temperature difference between the hot and cold side of the power plant heat exchanger, and set up the system such that the first priority for the heat is the water plant/washeteria. In the water plant/washeteria, replace the boilers with more appropriately sized and efficient oil fired boilers.	$1,234 Plus $200 Maintenance Savings	$25,000	1.00	17.4

Table 1.1 PRIORITY LIST – ENERGY EFFICIENCY MEASURES						
Rank	**Category**	**Improvement Description**	**Annual Energy Savings**	**Installed Cost**	**Savings to Investment Ratio, SIR[1]**	**Simple Payback (Years)[2]**
	TOTAL, all measures		**$10,493 Plus $370 Maintenance Savings**	**$37,559**	**3.78**	**3.5**

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 $10,493 per year, or 27.7% of the buildings' total energy costs. These measures are estimated to cost $37,559, for an overall simple payback period of 3.5 years.

Table 1.2 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 1.2

Annual Energy Cost Estimate											
Description	**Space Heating**	**Water Heating**	**Ventilation Fans**	**Clothes Drying**	**Lighting**	**Other Electrical**	**Raw Water Heat Add**	**Tank Heat**	**Other**	**Service Fees**	**Total Cost**
Existing Building	$5,042	$2,052	$0	$10,855	$3,205	$9,310	$1,334	$2,700	$3,372	$0	**$37,871**
With Proposed Retrofits	$4,074	$999	$0	$3,365	$1,992	$9,310	$1,376	$2,785	$3,477	$0	**$27,377**
Savings	$969	$1,053	$0	$7,490	$1,213	$0	-$41	-$85	-$105	$0	**$10,493**

2. AUDIT AND ANALYSIS BACKGROUND

2.1 Program Description

This audit included services to identify, develop, and evaluate energy efficiency measures at the Beaver water plant/washeteria. The scope of this project included evaluating building shell, lighting and other electrical systems, water process loads, heating and ventilating 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 and ventilation equipment
- Lighting systems and controls
- Building-specific equipment
- Water consumption, treatment, distribution & 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 Beaver water plant/washeteria 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.

The Beaver water plant/washeteria is classified as being made up of the following activity areas:

1) Washeteria: 750 square feet
2) Water Treatment Plant: 930 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; water treatment process loads; heating and ventilation; 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>=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. Beaver Water Plant/Washeteria

3.1. Building Description

The 1,680 square foot Beaver Water Plant/Washeteria was constructed in 1977 and the last major remodel was in 2008. It has a normal occupancy of approximately two people. One of those people is the water plant operator and the other is a washeteria customer. The building is occupied approximately 13 hours per day, seven days per week.

Raw water is supplied by a nearby well, filtered, chlorinated and pumped to the water storage tank. The underground raw water well line is heated with a temperature controlled glycol trace during the winter months. The 66,000 gallon water storage tank is also heated. Both heat-adds are through heat exchangers off the boiler/recovered heat glycol loop. Pressure pumps are used to maintain distribution pressure for the potable water although the water distribution is limited to the washeteria, community building, and school.

The sewer system is a force main piped through a mostly above ground utilador made of plywood. The utilador is insulated and heated from the same glycol boiler/recovered heat loop as the water supply lines. With some maintenance, the utilador system should have a remaining life of up to ten years. The school heats the utilador from the school to the lagoon. This could become an issue if the school closes due to decreasing enrollment.

The washeteria is used primarily for showers and washing and drying clothes. There are an average of about 3.5 showers taken in the facility per day, and about six loads of clothes per day washed. During the audit, there was one operable shower, one operable washing machine, and two operable dryers. Hot water for the washers and showers is provided from a hot water storage tank heated off the boiler/heat recovery system. Heat for the dryers is provided off the same system but through a separate pump. The pump should only run when a dryer is calling for heat but at present, these controls are not functioning properly and the pump is always on.

The water plant/washeteria has a heat recovery system that recovers heat from the Tribally operated power plant generators and transfers that heat to the water plant to reduce the amount of fuel oil required by the water plant. Although functional, the heat recovery system is not optimized. The amount of heat available as well as the temperature can be increased by re-commissioning the heat recovery system, especially on the power plant side.

A PV solar system was installed in 2007 to help reduce electricity costs at the water plant. A total of 14 panels with a capacity of approximately 180 watts each generate electricity for use at the water plant. This would be a maximum output of 2,520 watts. Over the past seven years, the solar array has generated 13,941 KWHs of electricity. This is an average of approximately 2,000 KWHs per year. Based on this information, the PV solar has been offsetting approximately eight percent of the water plant/washeteria usage. Obviously most of that offset has been in the summer. The system appears to be operating as designed and installed.

Description of Building Shell

The exterior walls are a 2x6 frame with five and a half inches of R-19 fiberglass insulation. There is an additional 1.5 inches of polyurethane insulation with plywood sheathing and siding that has been added to the exterior of the building. The building has a cold roof with 12 inches of loose fill insulation. The building has a piling foundation and a floor with 2x6 framing and approximately 5.5 inches of polyurethane insulation. Typical windows throughout the building are double pane with vinyl frames. The frame on one of the windows in the washeteria is broken and does not close. This window needs to be replaced. The remaining windows should be good for the life of the building.

One exterior door is a metal door with a polyurethane core with low insulation value. The other door is a wooden door with a solid core with low insulation value. Both of these doors should be replaced.

Description of Heating Plants

The heating systems used in the building are:

Burnham Commercial Boiler

Fuel Type:	#1 Oil
Input Rating:	646,000 BTU/hr
Steady State Efficiency:	80 %
Idle Loss:	1.5 %
Heat Distribution Type:	Glycol
Boiler Operation:	All Year

Burnham Commercial Boiler

Fuel Type:	#1 Oil
Input Rating:	646,000 BTU/hr
Steady State Efficiency:	80 %
Idle Loss:	1.5 %
Heat Distribution Type:	Glycol
Boiler Operation:	All Year

Recovered Heat

Fuel Type:	Recovered Heat (from power plant)
Input Rating:	50,000 BTU/hr
Steady State Efficiency:	98 %
Idle Loss:	0 %
Heat Distribution Type:	Glycol
Operation:	All Year

The two boilers are oversized for the load. Significant savings could be realized by installing new high efficiency appropriately sized boilers to supplement the heat recovery system as needed.

Space Heating Distribution Systems

Space heating in the facility is provided by unit heaters in the dryer make up air area, water plant, and washeteria. There is additionally a small amount of baseboard heating in the water plant.

Domestic Hot Water System

A 90 gallon hot water tank heated by the boilers and recovered heat system provides hot water to the facility. An average of 130 gallons of hot water is used per day, which is used for hot water to the showers and for clothes washing.

Recovered Heat System

The Beaver Tribal Council owns both the power plant and the water plant/washeteria. The generators used to produce electricity also produce heat as a byproduct. In most power plants, this heat is exhausted to the air through radiators. In an attempt to reduce the heating load in the water plant/washeteria, a heat recovery system was installed to recover the heat from the generators and transfer it to the water plant through a series of heat exchangers and an in-ground glycol loop. Although functional, this system needs to be re-commissioned.

Lighting

Lighting in the facility is made up primarily of T8 fluorescent lighting each with a electronic ballast. The fixtures have either two or four lamps each. Four of the fixtures in the washeteria have been retrofitted with LED lamps. Exterior lighting is provided by four high pressure sodium fixtures with 50 watt lamps.

Major Equipment

A 2 horsepower glycol circulation pump is the largest single electrical load in the facility. It is a Grundfos pump with three speeds, currently operating at the highest speed (3). There is one operational washing machine which runs a few hours per day at 150 watts/hour. The pressure pump runs intermittently 24 hours a day. The pump is three horsepower. The well pump is ½ horsepower and operates about 10% of the time year round. The backwash pump is a 2 horsepower pump that runs periodically to backwash the filters when treating water. The lift station (located in the water plant) operates a single pump off a level float, and runs about 4% of the time year round. The pump is 2 horsepower.

3.2 Predicted Energy Use

3.2.1 Energy Usage / Tariffs

The electric usage profile chart (below) represents the predicted electrical usage for the building. The model used to predict usage was calibrated to approximately match actual usage. The electric utility measures consumption in kilowatt-hours (KWH). One KWH usage is equivalent to 1,000 watts running for one hour.

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 following is a list of the utility companies providing energy to the building and the class of service provided:

Electricity: Beaver Village Electric Utility - Commercial - Small

The average cost for each type of fuel used in this building is shown below in Table 3.1. This figure includes all surcharges, subsidies, and utility customer charges:

Table 3.1 – Average Energy Cost

Description	Average Energy Cost
Electricity	$ 1.00/kWh
#1 Oil	$ 4.93/gallon
Recovered Heat	$ No Charge

It should be noted that the water plant/washeteria does not presently receive power cost equalization (PCE) from the state program. This issue should be investigated since it could reduce the cost of electricity by approximately one half.

3.2.1.1 Total Energy Use and Cost Breakdown

At current rates, Beaver Tribal Council pays approximately $37,871 annually for electricity and fuel oil for the Beaver water plant/washeteria. The Tribal Council does not charge for the power plant supplied recovered heat.

Figure 3.1 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. This table does not include potential savings from the PCE program.

Figure 3.1
Annual Energy Costs by End Use

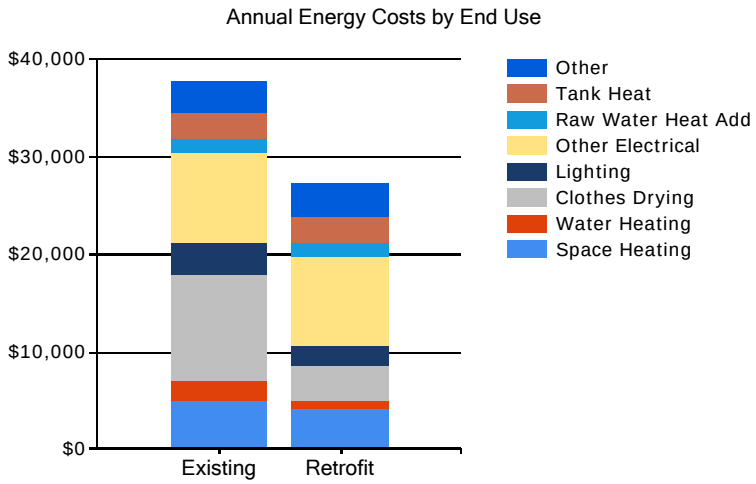


Figure 3.2 below shows how the annual energy cost of the building splits between the different fuels used by the facility. The "Existing" bar shows the breakdown for the building as it is now; the "Retrofit" bar shows the predicted costs if all of the energy efficiency measures in this report are implemented. As mentioned earlier, the Beaver Tribal Council does not charge the water plant/washeteria for the recovered heat.

Figure 3.2
Annual Energy Costs by Fuel Type

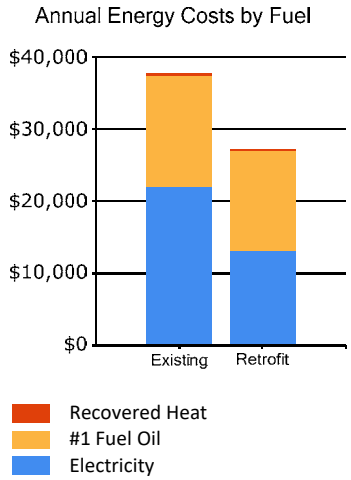
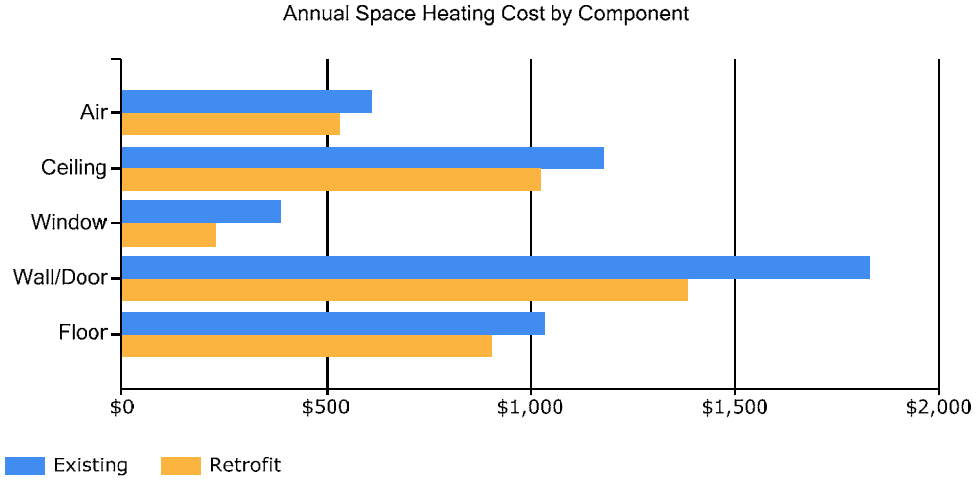


Figure 3.3 below addresses only space heating costs. The figure shows how each heat loss component contributes to those costs; for example, the figure shows how much annual space heating cost is caused by the heat loss through the walls/doors. For each component, the space heating cost for the existing building is shown (blue bar) and the space heating cost assuming all retrofits are implemented (yellow bar) are shown.

Figure 3.3
Annual Space Heating Cost by Component



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.

Electrical Consumption (kWh)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Space_Heating	25	21	19	12	8	8	8	9	10	14	20	24
DHW	15	13	15	14	18	17	18	18	17	15	14	15
Clothes_Drying	753	686	753	729	756	732	756	756	732	753	729	753
Lighting	312	284	312	301	206	200	206	206	254	312	301	312
Other_Electrical	1113	1014	1113	1077	614	141	146	146	641	1113	1077	1113
Raw_Water_Heat_Add	8	7	8	8	0	0	0	0	0	8	8	8
Tank_Heat	21	18	16	10	0	0	0	0	0	10	17	21
Other	20	19	21	21	0	0	0	0	0	21	20	20

Fuel Oil #1 Consumption (Gallons)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Space_Heating	132	111	102	62	55	53	55	55	53	72	108	130
DHW	22	20	23	23	45	44	45	45	44	24	22	22
Clothes_Drying	23	21	24	24	48	46	48	48	46	25	23	23
Raw_Water_Heat_Add	37	34	38	38	0	0	0	0	0	39	36	37
Tank_Heat	97	81	76	47	0	0	0	0	0	49	78	95
Other	93	85	95	97	0	0	0	0	0	100	92	93

Recovered Heat Consumption (Million Btu)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Space_Heating	2	2	2	1	0	0	0	0	0	1	2	2
DHW	1	1	1	1	1	1	1	1	1	1	1	1
Clothes_Drying	1	1	1	1	1	1	1	1	1	1	1	1
Raw_Water_Heat_Add	1	1	1	1	0	0	0	0	0	1	1	1
Tank_Heat	3	2	2	1	0	0	0	0	0	1	2	3
Other	3	3	3	3	0	0	0	0	0	3	3	3

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 3.4 for details):

$$\textit{Building Site EUI} = \frac{(\textit{Electric Usage in kBtu + Fuel Oil Usage in kBtu})}{\textit{Building Square Footage}}$$

$$\textit{Building Source EUI} = \frac{(\textit{Electric Usage in kBtu X SS Ratio + Fuel Oil Usage in kBtu X SS Ratio})}{\textit{Building Square Footage}}$$

where "SS Ratio" is the Source Energy to Site Energy ratio for the particular fuel.

Table 3.4
Beaver Washeteria 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	22,081 kWh	75,363	3.340	251,712
#1 Oil	3,199 gallons	422,282	1.010	426,505
Recovered Heat	89.11 million Btu	89,115	1.280	114,067
Total		**586,759**		**792,283**
BUILDING AREA		1,680	Square Feet	
BUILDING SITE EUI		349	kBTU/Ft²/Yr	
BUILDING SOURCE EUI		472	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.				

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 heating and ventilation 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 Beaver water plant/washeteria was modeled using AkWarm© energy use software to establish a baseline space heating and cooling energy usage. Climate data from Beaver 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 Beaver. 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 and cooling 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 cooling/heating loads across different parts of the building.
• The model does not model HVAC systems that simultaneously provide both heating and cooling to the same building space (typically done as a means of providing temperature control in the space).

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.

Table 4.1
Water Plant/Washeteria, Beaver, Alaska
PRIORITY LIST – ENERGY EFFICIENCY MEASURES

Rank	Feature	Improvement Description	Annual Energy Savings	Installed Cost	Savings to Investment Ratio, SIR	Simple Payback (Years)
1	Other Electrical – Repair Dryer Pump Controls	Repair relay controls such that dryer pump only runs when dryers do	$7,853	$2,500	36.90	0.3
2	Lighting – Convert Exterior Lighting to LED	Replace exterior lighting with LED 20 watt wall packs controlled by a photocell	$605 Plus $40 Maintenance Savings	$2,000	4.72	3.1
3	Lighting – Replace washeteria fluorescent lighting with LED's	Replace existing fluorescent lamps by removing the ballast and installing direct wired 18 watt LED lamps	$136 Plus $10 Maintenance Savings	$800	2.64	5.5
4	Lighting - Replace WTP 4 lamp fluorescent Lighting with LED's	Replace existing fluorescent lamps by removing the ballast and installing direct wired 18 watt LED lamps	$84 Plus $40 Maintenance Savings	$800	2.25	6.5
5	Lighting - Replace WTP2 lamp fluorescent lighting with LED's	Replace existing fluorescent lamps by removing the ballast and installing direct wired 18 watt LED lamps	$341 Plus $80 Maintenance Savings	$3,200	1.91	7.6

Table 4.1 Water Plant/Washeteria, Beaver, Alaska PRIORITY LIST – ENERGY EFFICIENCY MEASURES						
Rank	**Feature**	**Improvement Description**	**Annual Energy Savings**	**Installed Cost**	**Savings to Investment Ratio, SIR**	**Simple Payback (Years)**
6	Building Shell: Replace existing metal exterior door.	Remove existing metal door in the WTP and install standard pre-hung better insulated door.	$100	$1,380	1.70	13.8
7	Building Shell: Replace the Broken Window in Washeteria	Replace existing broken window in the washeteria with double paned glass window.	$75	$849	1.54	11.3
8	Building Shell: Replace existing wood exterior door	Remove existing wood door in the washeteria and install standard pre-hung better insulated door.	$64	$1,030	1.47	16.0
9	Heating and Ventilation: Improve recovered heat system and replace boilers.	Re-commission power plant side of heat recovery system including repairing or replacing variable frequency drives on radiator fans, resizing the pumps as necessary to maximize the heat output, do what is necessary to reduce the temperature difference between the hot and cold side of the power plant heat exchanger, and set up the system such that the first priority for the heat is the water plant/washeteria. In the water plant/washeteria, replace the boilers with more appropriately sized and efficient oil fired boilers.	$1,234 Plus $200 Maintenance Savings	$25,000	1.00	17.4
	TOTAL, all measures		**$10,493 Plus $370 Maintenance Savings**	**$37,559**	**3.78**	**3.5**

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, process loads and occupants generate heat within the building. When the building is in cooling mode, these items contribute to the overall cooling demands of the building; therefore, lighting efficiency improvements will reduce cooling requirements in air-conditioned buildings. Conversely, lighting-efficiency improvements are anticipated to slightly increase heating requirements. Heating penalties and cooling benefits were included in the lighting project analysis.

4.3 Building Shell Measures

4.3.1 Window Measures

Rank	Location	Size/Type, Condition	Recommendation
7	Washeteria Window: This window is in the open area of the washeteria.	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	This window does not close properly and thereby is essentially a hole between the heated washeteria and the outside ambient temperature. In Beaver, this results in a significant heat loss. The existing window should either be repaired or replaced with double paned glass window with vinyl frame.

Installation Cost	$849	**Estimated Life of Measure (yrs)**	20	**Energy Savings (/yr)**	$75
Breakeven Cost	$1,306	**Savings-to-Investment Ratio**	1.5	**Simple Payback yrs**	11

Auditors Notes: This broken window is allowing for significant heat loss to the outside ambient. Replacing it with a better insulated double paned window will produce substantial savings and significantly improve the comfort level.

4.3.2 Door Measures

Rank	Location	Size/Type, Condition	Recommendation
6	Exterior Door: Water Plant	Door Type: Entrance, Metal, polyurethane core, metal edge Modeled R-Value: 2.5	Remove existing door and install standard pre-hung better insulated door. Proper weather stripping should be part of the installation.

Installation Cost	$1,380	**Estimated Life of Measure (yrs)**	30	**Energy Savings per year**	$100
Breakeven Cost	$2,347	**Savings-to-Investment Ratio**	1.7	**Simple Payback in years**	14

Auditors Notes: Current door doesn't fit properly and is poorly insulated.

Rank	Location	Size/Type, Condition	Recommendation
8	Exterior Door: Washeteria	Door Type: Entrance, Wood, solid core flush, 2-1/4" Modeled R-Value: 3.7	Remove existing door and install standard pre-hung better insulated door. Proper weather stripping should be part of the installation.

Installation Cost	$1,030	**Estimated Life of Measure (yrs)**	30	**Energy Savings per year**	$64
Breakeven Cost	$1,516	**Savings-to-Investment Ratio**	1.5	**Simple Payback in years**	16

Auditors Notes: Current door doesn't fit properly and is poorly insulated.

4.4 Mechanical Equipment Measures

4.4.1 Heating/Domestic Hot Water Measure

Rank	Recommendation				
9	Re-commission power plant side of heat recovery system including repairing or replacing variable frequency drives on radiator fans, resizing the pumps as necessary to maximize the heat output, do what is necessary to reduce the temperature difference between the hot and cold side of the power plant heat exchanger, and set up the system such that the first priority for the recovered heat is the water plant/washeteria. In the water plant/washeteria, replace the boilers with more appropriately sized and efficient oil fired boilers.				
Installation Cost	$25,000	**Estimated Life of Measure (yrs)**	20	**Energy Savings per year**	$1,234
				Maintenance Savings per year	$200
Breakeven Cost	$25,000	**Savings-to-Investment Ratio**	1.0	**Simple Payback in years**	17
Auditors Notes: The system as installed is not optimized. Some of the generator heat is being exhausted to the atmosphere through the power plant radiators. This is mainly due to non-functioning variable frequency drives on the radiator fans. There is also an issue with the pumps or heat exchanger that is resulting in a large temperature differential between the hot and cold sides of the power plant heat exchanger. The re-commissioning should also set up the water plant/washeteria as the first priority for the recovered heat.					

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 lamps 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 lamps give off less heat.

4.5.1a Lighting Measures – Replace Existing Fixtures/Lamps

Rank	Location	Existing Condition		Recommendation	
2	Exterior Lighting	Four HPS 50 Watt Magnetic with Photocell Switching		Replace by installing four 20 W LED wall packs with photocell controls to ensure lights only come on when it is dark.	
Installation Cost	$2,000	**Estimated Life of Measure (yrs)**	20	**Energy Savings per year**	$605
				Maintenance Savings per year	$40
Breakeven Cost	$9,434	**Savings-to-Investment Ratio**	4.7	**Simple Payback in years**	3
Auditors Notes: Replacing exterior fixtures with LED wall packs will reduce energy use, improve functionality in the cold, and require less bulb maintenance. Installing photocell controls will reduce run time so that the fixtures only operate when it is dark.					

Rank	Location	Existing Condition		Recommendation	
3	Washeteria; 2 Lamp Fluorescent	4 Fluorescent 2 lamp T8 4' F32T8 32W lamps electronic ballasts with manual switching and occupancy sensor		Replace existing fluorescent lamps by removing the ballast and installing direct wired 18 watt LED lamps.	
Installation Cost	$800	**Estimated Life of Measure (yrs)**	20	**Energy Savings per year**	$136
				Maintenance Savings per year	$10
Breakeven Cost	$2,112	**Savings-to-Investment Ratio**	2.6	**Simple Payback in years**	5
Auditors Notes: Four of the eight fixtures are already LED in the washeteris area. LED replacement lamps use less energy last longer, and contain no poisonous mercury. They can be direct wired without using a ballast.					

Rank	Location	Existing Condition	Recommendation
4	WTP; 4 Lamp Fluorescent	2 fluorescent 4 lamp T8 4' F32T8 32W lamps with electronic ballasts with manual switching	Replace existing fluorescent fixtures by removing the ballast and installing direct wired 18 watt LED lamps.

Installation Cost	$800	**Estimated Life of Measure (yrs)**	20	**Energy Savings per year**	$84
				Maintenance Savings per year	$40
Breakeven Cost	$1,798	**Savings-to-Investment Ratio**	2.2	**Simple Payback in years**	6

Auditors Notes: LED replacement lamps use less energy last longer, and contain no poisonous mercury. They can be direct wired without using a ballast.

Rank	Location	Existing Condition	Recommendation
5	WTP 2 Lamp Fluorescent	16 fluorescent 2 lamp T8 4' F32T8 32W lamps with electronic ballasts with manual Switching	Replace existing fluorescent fixtures by removing the ballast and installing direct wired 18 watt LED bulbs.

Installation Cost	$3,200	**Estimated Life of Measure (yrs)**	20	**Energy Savings per year**	$341
				Maintenance Savings per year	$80
Breakeven Cost	$6,100	**Savings-to-Investment Ratio**	1.9	**Simple Payback in years**	8

Auditors Notes: LED replacement lamps use less energy last longer, and contain no poisonous mercury. They can be direct wired without using a ballast.

4.5.2 Other Measures

Rank	Location	Description of Existing	Efficiency Recommendation
1	Washeteria: Clothes Dryers	Clothes Drying Load	Repair relay controls such that dryer pump only runs when dryers do.

Installation Cost	$2,500	**Estimated Life of Measure (yrs)**	15	**Energy Savings per year**	$7,853
Breakeven Cost	$92,244	**Savings-to-Investment Ratio**	36.9	**Simple Payback in years**	0

Auditors Notes: When the dryers were installed, a small relay panel was installed that only turned on the pump that provides heat to the dryer coils when one of the dryers is operating (approximately 5% of the time). These relay controls are not functioning at the present time. As a result, the dryer glycol pump is running continuously. This is resulting in both excessive fuel oil use and excessive electricity use. A controls electrician can fairly easily correct this problem.

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.

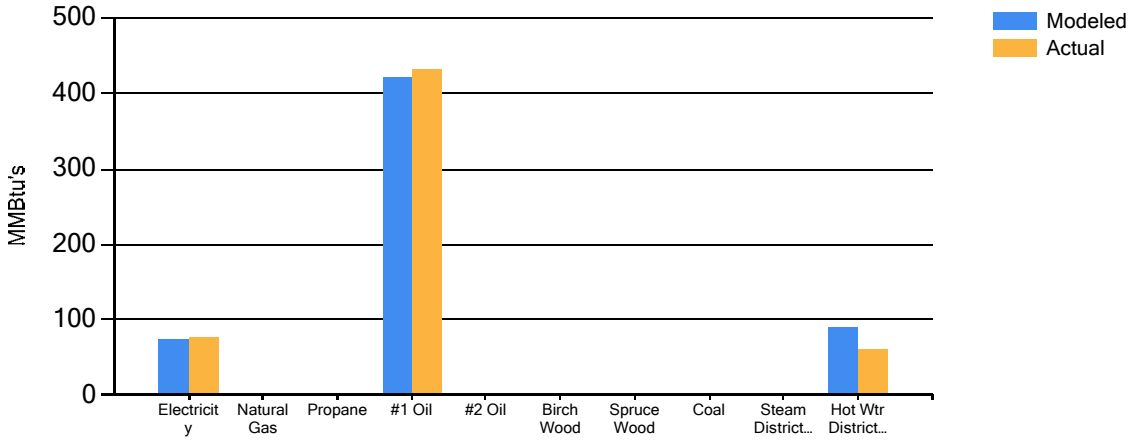
Several types of EEMs can be implemented immediately by building staff, and others will require various amounts of lead time for engineering and equipment acquisition. In some cases, there are logical advantages to implementing EEMs concurrently. For example, if the same electrical contractor is used to install both lighting equipment and repair the dryer controls, implementation of these measures should be scheduled to occur simultaneously.

This energy audit was conducted using funds provided by the State of Alaska Village Safe Water (VSW) program. In the near future, a representative of VSW will be contacting the Beaver Tribal Council and the water treatment plant operator to follow up on the recommendations made in this audit report.

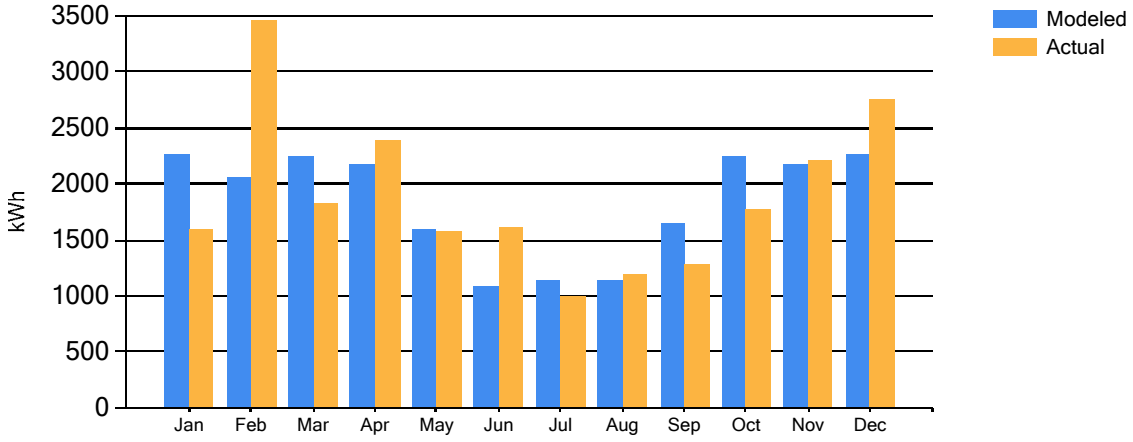
Appendix A – Actual Fuel Use versus Modeled Fuel Use

The Orange bars show Actual fuel use, and the Blue bars are AkWarm's prediction of fuel use.

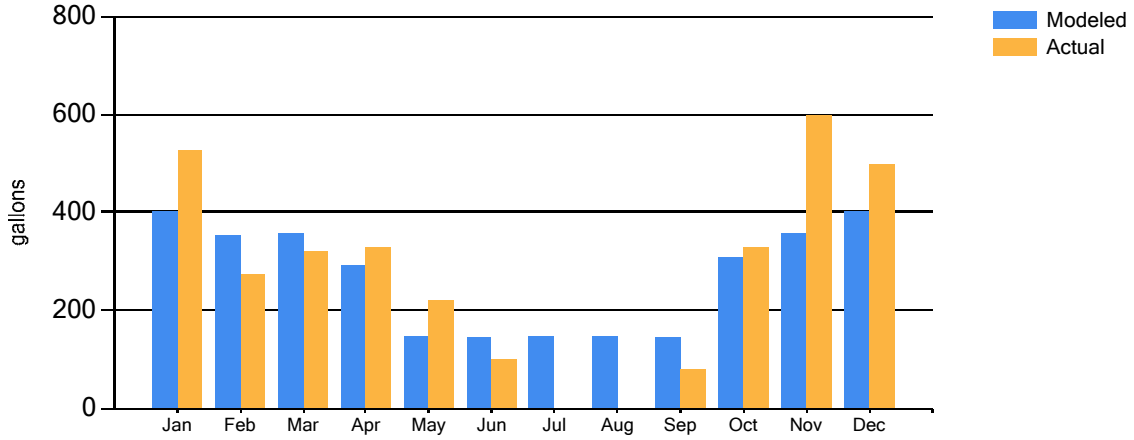
Annual Fuel Use



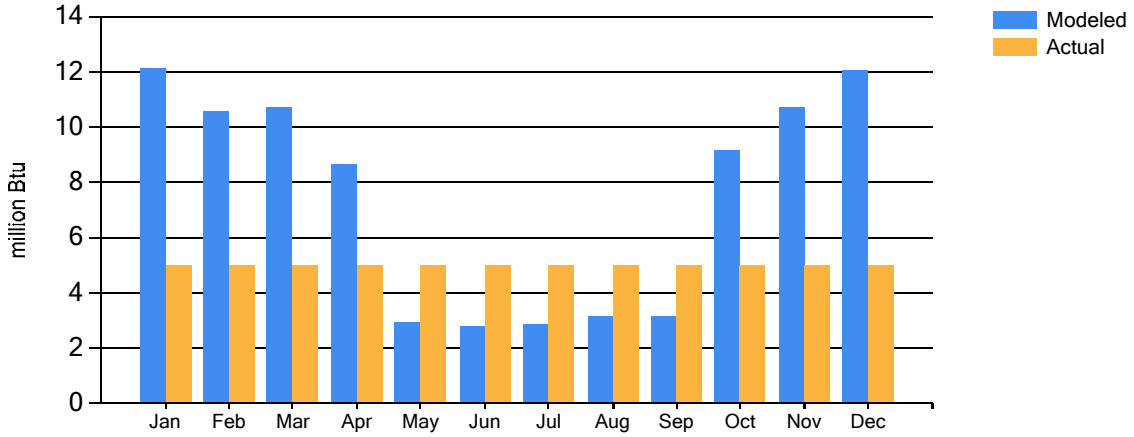
Electricity Fuel Use



#1 Fuel Oil Fuel Use



Recovered Heat



Appendix B - Electrical Demands

Estimated Peak Electrical Demand (kW)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Current	4.2	4.2	4.2	4.2	3.5	2.9	2.9	2.9	3.6	4.2	4.2	4.2
As Proposed	3.9	3.9	3.9	3.9	3.2	2.6	2.6	2.6	3.3	3.9	3.9	3.9

Estimated Demand Charges (at $0.00/kW)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Current	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
As Proposed	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0

AkWarmCalc Ver 2.3.2.1, Energy Lib 4/11/2014

MEMORANDUM

State of Alaska
Department of Environmental Conservation
Division of Water

TO:	File	DATE:	May 26, 2005
		FILE NO:	
THRU:		PHONE NO:	465-5139
FROM:	Lori Telfer, Planner III	SUBJECT:	Village of Beaver Water and Wastewater Utilities Business Plan

The Beaver Water and Wastewater Utilities Business Plan was resubmitted to DEC by Roger Burleigh, VSW on May 18, 2005. The revised business plan addressed all comments outlined in the April 13, 2005 VSW review memo and was approved as complete for the purposes of VSW review items.

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Village of Beaver, Alaska
Water and Wastewater Utilities Business Plan

The Beaver Village Council (BVC) owns the current water and wastewater utilities (WWU) in the village. The BVC also manages the electrical utility and fuel oil distribution in Beaver. The Beaver Village Council had completed a Feasibility Study in 2000, in which both piped and haul systems were evaluated. The Village has recently constructed a new 66,000-gallon water storage tank and designed water treatment plant upgrades. The BVC, after considerable post-Feasibility Study debate, issued a resolution with the signing of a VSW Grant Offer, stating that they decided to design and construct a Haul Water and Wastewater system. The BVC will utilize their current administration to operate, maintain, and construct the proposed WWU.

This Business Plan will formalize the WWU management structure and provide a fiscal outline for guiding the implementation of ordinances, rules and regulations, and the annual budgeting process.

Project Overview

Beaver Village is located on the north bank of the Yukon River approximately 60 miles southwest of Ft. Yukon and approximately 110 miles north of Fairbanks, Alaska. Fuel and most other cargo arrives by air to a well-maintained gravel airstrip. The local economy is based upon local and regional government, education, Fish and Wildlife, seasonal fire-fighting, local construction, and tourism employment. Traditional crafts, hunting, trapping, fishing, and gathering also contribute to the subsistence of local residents. The electrical utility uses the Power Cost Equalization (PCE) program to supplement electrical costs and individual residents may supplement heating costs (wood or fuel) through a means-tested program administered by the Village Council and the Tanana Chief Conference (TCC), a regional Health and Human services organization.

The proposed Beaver Water and Wastewater project will design and construct: (1) a new sewage lagoon, (2) water treatment plant upgrades, (3) haul equipment maintenance and operations facility, (4) residential service fixtures and tanks, (5) purchase haul equipment.

Current Utility Management

Currently the BVC is responsible for the management of the well, water treatment and storage, sewage lagoon, and distribution piping (utilidor) to the school and the Village-owned washeteria. The BVC also owns and operates the village power plant and fuel storage and dispensing business. The school is currently the only customer supplied by piped water and sewer. The BVC charges the

school district $1,000 per month for water and sewer service. A new community building nearing completion will house the new clinic, and a myriad of other social services offices. The utilidor extends to the new community building and should provide the BVC-WWU with another commercial account. Residents currently use the bathing and toilet facility at the washeteria at no direct cost, however, clothes washing requires the purchase of tokens. Treated potable water is self-hauled at no cost from an outdoor watering point at the washeteria. Most households currently have outhouses for wastewater disposal.

The BVC owns a new landfill (1997) located about two miles by road north of the village. The landfill is a zero-fee self-haul operation that is routinely maintained by the BVC.

The annual cost of operating and maintaining the current sanitation facilities in Beaver is approximately $27,000. The cash-revenues are about $20,000 annually. The BVC subsidizes the remaining $7,000 through other revenue sources such as annual IHS 638 Compact Funds and Tribal Self Governance grant funds. Currently the residents and public facilities pay for some provided services based upon the following:

- School Water and Sewer - $1,000/month
- Self-haul water (unlimited) - $0
- Sewage disposal - $0
- Solid waste disposal - $0
- Laundry: Washers - $2/load [small washer], $4/load [large washer]
  Dryers - $2 per 15-minute cycle
  Shower/bath - $2

The current public administration consists of the Village Council composed of the 1st Chief, 2nd Chief, and 5 council members. A Tribal Administrator, bookkeeper, 1 administrative staff person, and two water treatment plant operators (WPO) round out the public administrative staff.

Fiscal Controls and Accounting Practices

The two officers of the Council, 1st Chief and the 2nd Chief, and 2 appointed Council members have check writing authority for the Council. Both of the officers and the Secretary have the authority to sign documents such as resolutions on behalf of the Council. A Bookkeeper maintains the financial records for the Council with support from a contracted CPA firm.

The BVC currently utilizes QuickBooks Pro accounting software to track customer transactions and system revenue and expenditures. Budgets are established each fiscal year beginning January 1 and ending December 31st.

A Profit and Loss statement for the period January 1, 2000 through November 6, 2003 was recently reviewed. A summary of this statement and the raw data are presented in Appendix A. According to this data the BVC has accumulated a loss of $192,645 from all of their operations. A significant portion of this accumulated loss results from construction-related operations and mismanagement of the Beaver Joint Utilities (BJU - former power and fuel operators). The BJU is now managed by the BVC.

Appendix A also includes the 2 most recent years of revenue generated by the washeteria - this shows an average annual revenue of $20,000 a year .

Operation of the New Water and Wastewater Utility

The BVC will assign the Tribal Administrator to oversee the operations and maintenance of the proposed water and wastewater utility. The Tribal Administrator has attended recent training in Utility Management. The powers and duties of the Administrator shall include (but not limited to):

- Appoint, train, hire, promote, layoff, suspend, demote, or remove all employees for the water and wastewater utility

- Administer the water and wastewater utility budgets and capital improvement programs as enacted by the Beaver Village Council.

- Prepare and submit to the Beaver Village Council, annual budgets, capital improvement requests, and make recommendations thereon for the efficient and economical operation of the utility.

- Prepare and submit to the Beaver Village Council at the end of each fiscal year a report on the finances and administrative activities of the water and sewer systems; and prepare and make available for public distribution an annual report on the water and wastewater utility finances.

- Formulate and enforce the general rules and policies pertaining to water and wastewater utility operation practices within the Village and generally have full and complete surveillance of all the systems and their operations and fiscal affairs, including the maintenance, operation, expansion, extension, and improvement of the public utility.

- Study and make recommendations generally on public utility matters such as, but not limited to, rates, fiscal matters, personnel staffing, labor relations, expansion or extension of services, and public relations.

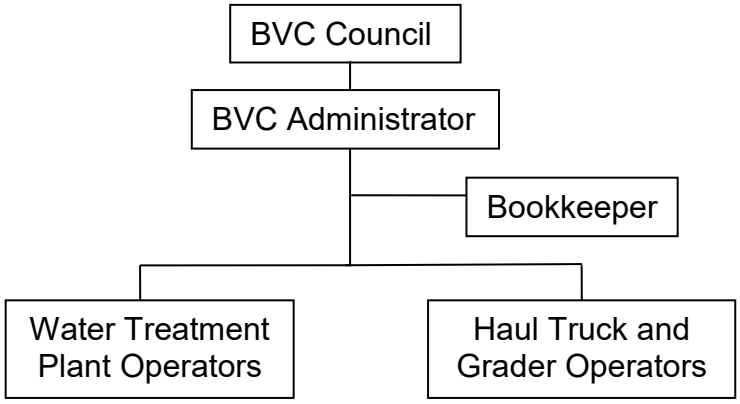
A resolution establishing the new powers and duties of the Tribal Administrator pertaining to the water and wastewater utility is included as Appendix B to this Business Plan. A draft Homeowner's Agreement detailing the responsibility's of the Homeowner and the Water and Wastewater Utility is also included as Appendix C to this Business Plan.

Staffing and Training

The Tribal Administrator (TA) will conduct the day-to-day management of the Beaver Water and Wastewater Utility. Daily operation of the utility will be conducted by the Water Treatment Plant operator(s) (WPO) or Haul-truck Laborers (HTL). The HTL's will also be responsible for road maintenance associated with the haul-truck operations. During construction the TA will receive additional training in Utility Management. The WPO's and the HTL's will receive training in utility operations during construction. The TA will be responsible for promoting additional training for the administrative and operations staff. Advice regarding appropriate training will be sought through the Department of Community and Economic Development, Rural Utility Business Advisor Program (RUBA) and the Tanana Chiefs Conference (TCC) Office of Environmental Health.

The following organizational chart illustrates the staff relationships of the proposed Water and Wastewater Utility;

Village of Beaver
Water and Wastewater Utility



The WTO and HTL positions shown on the chart are dedicated solely to the operations of the Water and Wastewater utility. The Tribal Administrator and the clerical staff also manage the electrical utility and other health and human services provided by the BVC. The duties of each position relating to the Water and Wastewater utility are described as follows:

Beaver Village Council - Responsible for contract relations, policy resolutions, dispute resolutions, and government-to-government affairs.

Tribal Administrator - Responsible for directing financial planning and accounting practices, over-seeing budgeting and audits, payroll, tax accounting, and activities of the accounts receivable and accounts payable clerk.

Bookkeeper - Maintenance and reporting of accounts receivable and accounts payable.

Water Treatment Plant Operator (WTO) - Responsible for inspecting the Water and Wastewater utility, minor maintenance and repairs, coordinating major maintenance and repairs. Water treatment process monitoring, sampling, and compliance data reporting.

Haul Truck and Grader Operator (HTL) - Delivery of fresh water and extraction and disposal of wastewater. Maintenance of vehicle garage and haul trucks. Snow removal and grading of local roads.

Financial Estimates

The following financial estimates are based upon an analysis provided in appendix C using 2002 dollars. In the analysis several assumptions were used that are expected to vary considerably in the actual implementation of the water and wastewater service. For instance,

- The $1.96/gallon fuel rate is based upon a $0.20/gallon surcharge recommended by the Alaska Energy Authority for replacement cost of a proposed new tank farm. Whether the Village of Beaver implements the surcharge or not will depend upon the community's financial abilities. The surcharge will cost the utility approximately $1,025 annually, not counting the cost to individuals.

- The non-PCE rate for electricity (currently $0.43/kWh) may actually drop if the utility comes into program compliance. The PCE will save the utility approximately $6,200 annually.

- The 2000 Feasibility Study showed 43 habitable homes in Beaver. However, the actual year-around occupancy rate is more like 34 homes (2003). Monthly residential costs in this Business Plan are calculated by dividing the residential category of revenue by 34, not 43.

- The determination of the *Household* Haul System annual O&M cost estimate is described in detailed in Appendix D. The annual estimate is $55,080. The

Monthly Haul System Household Cost does not take into account revenues from the school or other sources, nor does it include the benefits of non-surcharged fuel costs or the application of the PCE. It also does not include the cost of running the washeteria. It does include the cost for Insurance.

- Haul systems are prone to a variable degree of homeowner participation: that is, some folks may find it advantageous to haul their own water, but not sewage.

It is the expectation that the gravity of financial abilities, learned conservation practices, the diligence of management, and the participation of homeowners will interact over time to mold and further refine the financial landscape of the utility. The Business Plan will adjust accordingly.

Key Financial Assumptions

A detailed System Cost Study report and a separate fiscal analysis of revenues and expense projections is included in Appendix D to this Business Plan.

Estimated Annual Revenues

Revenues required to support the proposed Water and Wastewater Utility will be met by using a variety of sources including 1 commercial, 34 residential, school and clinic user fees, and local capital contributions appropriated for use in managing local governmental functions. Local capital sources include Tribal Self-Governance and Indian Health Serve (IHS) 638 Compact grant funds. The revenue required is based upon the projected annual costs for a Large-Truck Haul Water and Wastewater system plus a small amount of profit for use on unexpected repairs. Based upon these projections, and including the washeteria O&M costs, the annual revenue requirement for the entire utility is itemized in the following table. Revenue for the school contract has not increased in years and is expected to go from $1,000 to $1,200 per month. The rate of collection for residential users is estimated to be 90%.

Revenue Source	**Annual Estimate**
Residential User Fees (34 connections x $99/month x 0.9)	$36,353
Small Commercial User Fees (12 x $99)	$1,188
School Account (12 x $1,200)	$14,400
Clinic Building (12 x $300)	$3,600
User Fees from Washeteria (laundry & bathing)	$20,000
Local Capital Contribution (IHS Compact Funds)	$5,376
Total	$80,917

Estimated Annual Expenses

A detailed and tabulated estimate of operation and maintenance (O&M) expenses is provided in Appendix C and summarized in the following table. Other expenses that may be incurred by the utility are for major repair and replacement (R&R) of items exceeding $5,000 ***or*** items that are not normally replaced on an annual basis. These items are to be distinguished from major capital expenses such as buildings and lagoons. The potentially relevant items in the Beaver utility may include the 2 haul-system tanker trucks and the road grader, the well pump, or a washer or dryer.

Assuming that each of the 3 pieces of rolling stock cost $100,000, and a capital recovery factor of 4% over a 10-year period is applied, then a total of $28,410 must be collected and set aside each year to replace these items. This is an unrealistic expectation for the Village of Beaver unless grant funds were obtained from sources other than through governmental agencies typically involved in improving rural sanitation. A well pump replacement would cost approximately $2,000, parts & labor, but these are likely to last 10 years or so. A washing machine has a 2-5 year life in a washeteria and can cost $2,000 to $5,000 depending upon the model. The business plan will include a $3,000/year provision for R&R to cover these projected costs.

Expense Category	**Annual Estimate**
Administration/clerical	$2,500
Labor	$27,909
Electricity	$12,791
Fuel	$11,607
Water Treatment & Equipment Maintenance	$3,600
Sewage Treatment & Equipment Maintenance	$1,500
Insurance	$15,110
Road Maintenance	$1,000
Total	$76,017

Annual Profit

An annual profit based upon a rate of return of 2.5% of O&M costs (equals $1,900) for the combined washeteria and haul systems has been included. This annual profit will allow the utility to build up a reserve account that will be available for working capital to cover unexpected expenses or system improvements.

Cash-flow and Profit/Loss Statements

An estimated annual cash-flow and profit/loss statement for Beaver's water and wastewater utility are included below.

Annual Estimated Operating Cash-flow

The Annual Estimated Operating Cash-flow depicts the annual flow of money in and out of the business over the course of an operating year; regardless of whether or not the expenditure is fully tax deductible, such as capital expenditures (annual R&R) or loan principal payments.

Annual Estimated Operating Cash-flow	
Cash Sources	**Annual**
Small Commercial User Fees (12 x $99 /year)	$1,188
Residential User Fees (34 connections/$99/month x 0.9)	$36,353
School User Fees ($1,200/month)	$14,400
Clinic User Fees (12 x $300/month)	$3,600
Washeteria User Fees ($2,500 annually)	$20,000
Local Capital Contributions	$5,376
Cash Uses	
Annual Operations and Maintenance (O&M) Costs	$76,017
Annual Repair and Replacement (R&R) Costs	$3,000
Excess (Shortage) of Cash Over Expenditures	$1,900

Based upon the preliminary estimates for the Beaver Water and Wastewater Utility, annual excess of Cash Over Expenditures will be approximately $1,900. These excess funds should be accumulated by the Utility in a reserve account and made available for unexpected expenses or system improvements.

Annual Estimated Operating Income Statement

The Annual Estimated Operating Income Statement depicts the taxable Net Income, based upon generally accepted utility accounting principles. Expenses on the Income Statement will not include long-term capital expenditures such as

the R&R costs, but would normally include the associated depreciation expense over a multi-year period. High cost items expecting to need replacement such as the haul trucks are not included in R&R expenses, however, washing machines and pumps are included in the R&R estimate. It is further assumed that the original system costs are not expensed by the Utility given that these costs are offset by contributed capital or are grant-funded.

Annual Estimated Operating Income Statement	
Revenue	
Small Commercial User Fees ($99/month)	$1,188
Residential User Fees (34 connections/$99/month)	$36,353
School User Fees ($1,200/month)	$14,400
Washeteria User Fees (per year)	$20,000
Clinic User Fees ($300/month)	$3,600
Total Revenue	$75,541
Expenses	
Annual Operations and Maintenance (O&M) Costs	$76,017
Depreciation (R&R expenses)	$3,000
Total Expenses	$79,017
Net Operating Income	$(3,476)
Net Operating Income	$(3,476)
Plus: Local Capital Contribution	$5,376
Annual Estimated Cash-flow	$1,900

Based upon the preliminary estimates for the Beaver Water and Wastewater Utility, the annual Net Operating Income will be approximately ($3,476). The Net Operating Income does not include the extraordinary expenses such as the future cost of total system replacement. The following discusses future capital replacement.

Future Capital Replacement Costs

Eventually, the major components of the Beaver Water and Wastewater Utility will require major capital replacement. The design life of major system components varies. For instance, the haul trucks and grader will likely have a useful life of 10 years, whereas the equipment garage, lagoon, and water treatment facility would have a design life of 30 years. To replace these system components, funds would have to be accumulated over the components design-life. If each component replacement cost was expressed as an annual deposit,

at a given interest rate, then the combined component costs would be the equivalent annual cost cycle (EACC) for the system. For this calculation the design life of the system is set at 10 years for the minor components and 30 years for the major components. The design life factor (DLF), using an interest rate of 4% is .0947 for 10 years and .0578 for 30 years. Therefore, based on an estimated capital cost (CC) for the system [$300,000 for rolling stock and $2,939,000 for major components], and not including residential home service equipment ($1,232,000), the equivalent annual capital cost would be:

$$EACC = CC \times DLF$$

$$= (\$300{,}000 \times 0.0947) + (\$2{,}939{,}000 \times 0.0578)$$

$$= \$198{,}284 \text{ (per year)}$$

Summary of Total Revenue and Expenses / Rate of Return

Based on the previous discussion of revenues and expenses, and a review of the resulting cash-flow and operating income statements, the impact of the future capital replacement costs are significant. The following table is a summary of operating revenue and expenses including an estimate of the total annual amount necessary to replace the Beaver Water and Wastewater Utility in 30 years.

Summary of Total Revenue and Expenses / Rate of Return

Revenue		
Small Commercial User Fees ($99/month)	$	1,188
Residential User Fees (34 connections x $99/month x 0.9)		36,353
School User Fees ($1,200/month)		14,400
Washeteria User Fees (per year)		20,000
Clinic User Fees ($300/month)		3,600
Local Capital Contribution		15,376
Annualized Non-local Capital Replacement Subsidy		198,284
	$	279,201
Expenses		
Annualized Operations and Maintenance Costs	$	6,017
Repair and Replacement Fund		3,000
Equivalent Annual Replacement Costs		198,284
Rate of Return		1,900
	$	279,201

APPENDIX D

Table of Contents

Parts

Large-Scale Haul Water & Sewer

Fuel ($1.96/gallon)	
Washeteria	$8,820
Water Plant/ Storage	$386
Haul Equipment Garage	$1,390
Haul Equipment	$1,011
	$11,607

Electricity *non-PCE rate of $.43/kWh	
Washeteria	$7,381
Water Plant	$3,690
Haul Equipment Garage	$1,720
	$12,791

Labor	
Road Maintenance	$900
Washeteria	$1,500
Water Plant	$11,700
Water Haul (34 homes)	$6,983
Sewage Haul (34 homes)	$6,826
Clerical	$2,500
	$30,409

Operations Equipment Maintenance	
Road Maintenance Equipment	$1,000
Washeteria	$1,200
Water Plant	$900
Water Distribution	$1,500
Sewer Distribution	$1,500
	$6,100

Insurance	
Washeteria	$3,191
Water & Sewer Haul system	$11,919
	$15,110

Haul System Cost Estimate:	**$54,925**
Washeteria Cost Estimate:	**$21,092**
Total	**$76,017**
Monthly Haul System Household Cost (based on 34 homes):	**$135**
Monthly hot water heating cost (based on fuel oil heater):	**$10**
Added Monthly Electric Cost:	**$30**

Appendix D

Beaver Large Scale Haul Water and Sewer O&M Cost Estimate

General Description

The Large-Scale Water and Sewer (LSWS) alternative will utilize water supplied by the planned upgrade to the water treatment plant and a new sewage lagoon to be built north of the airport. A Large-scale haul system can be defined in several configurations. If water is stored in the home then the system can be defined as storage of 100-300 gallons of water and 500 gallons of sewage (LSWS-1). If water is stored in a heated tank barn outside of the home then water storage can be increased to 400 gallons with a 500-gallon sewage storage tank (LSWS-2). Residents will learn to conserve water and use less water in a haul system compared to the piped alternative due to the high cost of delivery and disposal.

A pre-engineered garage building on slab will house haul trucks and equipment in warm storage. If feasible, waste heat from the power plant could be utilized to offset the heating cost for the garage facility. A cost-effective well-maintained garage facility is critical to the successful maintenance and operation of the haul system infrastructure. Depending upon the site location of the garage it is also feasible to pipe water to the garage as a water-loading base. A critical evaluation of the lands peripheral to the water plant should be undertaken, including the possibility of tearing down the existing BIA school and utilizing the existing water and sewer utilidor to serve the garage.

There will be additional homeowner costs for electricity (heat tape) and fuel (hot water) in the Haul system alternative. These costs have been estimated to be $30 and $10 respectively. For the most part the increase in electric costs will be for freeze protection of the sewage tank with a minor part for water and fuel pumps. The basis for the electrical cost estimate is the experience of Northway, AK homeowners for a similar system (section D)

The following cost estimation for the alternative of Haul water and sewer system is calculated using a fuel-cost basis of $1.96 per gallon and electric base rate of $0.43/kWh. The high cost of fuel reflects a $0.20/gallon surcharge that will have to be charged as a consequence of a proposed new tank farm and fuel dispensing system. The electric rate does not reflect cost reductions from the Power Cost Equalization (PCE) program and thus all electric costs should be considered maximum costs. The most recent PCE rate is $0.2576/KWh for the first 500 kilowatts (60% of the base rate). All labor costs were estimated using a flat rate of $15 per hour.

In the ensuing paragraphs and calculations it is important to realize that costs attributable to the washeteria are itemized so that the actual water and sewer delivery system cost estimates can be can calculated separately. Although the washeteria in Beaver forms an integral building with the water plant, the business of the washeteria has a different function and customer base than the delivery of water and removal of sewage. Bringing Haul water and sewage to homes will likely ***not*** displace business away from the washeteria.

Washeteria operations would cost an additional $21,092. The school district provides income to the utility of $12,000 per year. The school revenue can be used to offset either the residential rates or subsidize the re-occurring operating deficit of the washeteria.

Assuming the school revenue is used to offset ***only*** the washeteria costs, and that the 34 residential services are billed monthly, then the cost per service connection is estimated to be $135 per month. If PCE is maintained at a rate of $0.2576/ KWh, the savings are significant and can reduce the estimated monthly water and sewer rate to $130, not counting the residential electrical costs.

There are additional costs to the homeowner above that billed by the water and sewer utility. The homeowner can expect their electric and fuel costs to increase as a consequence of freeze protection (heat trace and circulation pump) and the making of hot water. These costs are estimated at $30 and $10 respectively for a total of $40 per month.

Road Maintenance Equipment: Maintenance Cost

Road maintenance is critical for the effective operation of the haul system - it is the pipeline. While the standard for road maintenance is not the same as for the airport, annual airport equipment-hour-data is indicative of the weather conditions prevailing in the Beaver area. The standard for the airport is for snow removal if there is a snowfall of 2" or more. For the purposes of estimating the cost road maintenance it is assumed that 50% of the airport hours is a realistic target cost.

Haul Equipment Maintenance Cost

Maintenance costs for the haul equipment include the maintenance cost for a Ford F550 truck times a location factor of 1.3 and the associated pumping equipment. There are no published maintenance cost estimates for trucks of this type. Typically a new truck will have a 100,000 mile or 5 year warranty on the engine and drive train. The mileage estimated in the Haul Equipment Fuel Cost is about 1,100 and 2,100 miles per year for water and sewer respectively. Therefore the 5 year warranty is effective and the only maintenance costs the first 5 years should be for changing lubricants twice a year, or, about $250 annually. The next 10-year period should see a small increase in maintenance cost to $300/ year as the annual mileage is not expected to increase, just wear and tear on equipment.

The pumping, hose, and tank equipment on each haul vehicle will likely require a fair amount of care on an annual basis. Lubricants will have to be replaced and hoses are subjected to significant wear and tear - especially in the severe cold temperatures experienced in Beaver each winter. One should expect to replace hoses each year at a cost of $400 per haul vehicle, and lubricants and miscellaneous fittings may cost an additional $50 per year per vehicle.

In total, for two haul system rigs, the annual maintenance cost is estimated to be $1,400 per year for the first 10 years.

Road Maintenance Labor Cost^

10 snowfalls/ year x 42 hrs/ snowfall x $15/hr = $600/ year

5 road-gradings/ year x 4 hrs/ grading x $15/hr = $300/year

^ There is an estimated 3.5 miles of road to be maintained inclusive of village and landfill roads.

Fuel (basis $1.76/gallon, FY01)

Washeteria	($.20[#]+$1.76/gal) x 4,500 gal	=	$8,820
Water Plant/ Storage	($.20[#]+$1.76/gal) x 197 gal	=	$386
Haul Equipment Garage^^	($.20[#]+$1.76/gal) x 709 gal	=	$1,390
Haul Equipment Fuel	($.20[#]+$1.76/gal) x 516 gal	=	$1,011
		Estimate total	= $11,607

[#] This represents a projected $0.20/gallon surcharge for replacement cost of the new fuel system: held in escrow.
**Assumption that more than enough heat is available to heat the water in the haul equipment garage facility. This does not include the cost of delivering waste heat.

Electricity

Washeteria^^ : $0.43/KWh[#] x (2/3) x 25,747kWh	=	$7,381
Water Plant**: $0.43/KWh x (1/3) x 25,747kWh	=	$3,690
Haul equipment garage: $0.43/KWh x 4,000 kWh	=	$1,720
	Estimate total =	$12,791

^^Based upon 2001 usage in the Beaver washeteria/water plant (25,747 KWh in 2001) and that 2/3 of the power was used by the washeteria.
[#] See *Basis for Electric Cost* described below.

Labor

Road Maintenance[#]	60 hr x $15/hr	=	$900
Washeteria	100 hr x $15/hr	=	$1,500
Water Plant*	780 hr x $15/hr	=	$11,700
Water Distribution[#]	466 hr x $15/hr	=	$6,983
Sewer Distribution[#]	455 hr x $15/hr	=	$6,826
Clerical	4 hr x 52 weeks x $12/hr	=	$2,500
		Estimate total =	$27,909

[#] Based upon annual hours estimated in Part B
* Based upon 3 hrs/day x 5 days a week, year round

Operations Equipment Maintenance

Road Maintenance	=	$1,000
Washeteria	=	$200
Water Plant	=	$500
Water Distribution	=	$1,500
Sewer Distribution	=	$1,500
W & S Haul Equipment	=	$1,400
Estimate total	=	$6,600

Insurance

Washeteria	=	$3,191
Water & Sewer Haul operations	=	$11,919
Estimate Total		$15,110

Haul Equipment Fuel Costs

Criteria

1. Trucks get 6 miles per gallon
2. 2 water and 1 sewage haul per month
3. each water haul has a cost equivalent of 1 mile
4. each sewage haul has a cost equivalent of 4 miles
5. 34 services per year

Water Haul

($1.96/gal) x (1 gal/6 miles) x (2 x 34 x 12 serv/year) x (1 mile/serv) = $266.56/year
or -- 136 gal/year

Sewer Haul

($1.96/gal) x (1 gal/6 miles) x (34 x 12 serv/year) x (4 mile/serv) = $533.12/year
or -- 272 gal/year

PART A

BEAVER VILLAGE: Insurance Estimate for the Water & Sewer Utility

Item		Estimated Value	Rate	Estimated Premium
Buildings^^				
	Washeteria*	$ 310,000	0.00805	$ 2,496
	Maintenance Garage	$ 400,000	0.00805	$ 3,220
Building Contents^^				
	Washeteria*	$ 210,000	0.01122	$ 2,356
	Maintenance Garage	$ 20,000	0.01122	$ 224
Equipment^^				
	Grader	$ 30,000	0.00591	$ 177
	Water Truck	$ 110,000	0.00591	$ 650
	Sewer Truck	$ 110,000	0.00591	$ 650
General Liability^^				
	Office			$ 164
	Garage			$ 84
	Auto Liability			$ 400
	Washeteria#			$ 765
	Water Plant			$ 579
Workmans Compensation**				
6319	Water / Sewer delivery	$ 13,809	0.1261	$ 1,741
6319	Water Plant Operator*	$ 11,700	0.1261	$ 1,475
5509	Street Maintenance	$ 900	0.1189	$ 107
9910	Administration/ Clerical	$ 2,500	0.0083	$ 21
			Annual Estimate	$ 15,110

^^Basis of all rates are the 2003 premium rates applied to the Tuntutuliak Community Services Association Water & Sewer Utility

**Quote from Ribelin & Lowell for 2004 rates

* 50% attributed to washeteria operations

100% attributed to washeteria operations

Part B

Water & Sewer Haul Labor

Criteria:

100 people
34 homes
3 residents per home
5 gallons/day/capita water
5.5 gallons/day/capita sewage
200 gallon water storage tank
500 gallon sewage holding tank (450 gallon effective volume)
30 minute fill cycle for water
60 minute sewage pump-out cycle

Water Labor:

200 gal/fill x 1 home/(15 gal/day) = 13.33 day/fill per home

(365 days/ year) x (1 fill/ 13.33 days) x (0.5 hrs/fill) x ($15/hr) = $205/ year per home

($205/home) x 34 homes = $6,981 per year

Sewer Labor

450 gal/haul x 1 home/(16.5 gal/day) = 27.7 day/haul per home

(365 days/ year) x (1 haul/ 27.7 days) x (1 hr/haul) x ($15/hr) = $201/year per home

($201/home) x 34 homes = $6,732 per year

Part C

BASIS FOR ELECTRIC COST

The anticipated construction of a new fuel system by the Alaska Energy Authority / Denali Commission will require a $0.78/gallon surcharge on diesel and gasoline fuels. The average price for fuel in FY01 is $1.76/gallon. The surcharge will have to be passed on to the consumer through their electric bills as well as fuel purchases. This surcharge will affect the cost of fuel but should not affect the non-fuel cost for the electric utility. The Beaver Electric Utility generated 335,520 kWh in FY01.

$1.76/gal + $0.20/gal = $1.96/gal
-- and --
1.96/1.76 = 1.11 is the ratio of increased fuel cost.

From the Power Cost Equalization calculation sheet for Beaver - FY01 the

Cost of Fuel:	$48,992 x 1.11	=	$54,381
Non-Fuel Cost:		=	$71,885
	Total Utility Cost	=	$126,266

Therefore the cost per kWh is: $\frac{\$126,266}{335,520 \text{ kWh}}$ = $0.376/kWh

However, recent (2003) inquiries to the Alaska Energy Authority show the current non-PCE rate is approximately $043/kWh.

Part D

HOME HOT WATER HEATING
COST ADJUSTMENTS

Regardless of the water delivery system in the village, if the homeowners choose to have a hot water heater, there will be additional costs associated with heating this water. This section provides a basis for the homeowner and the aggregate community to make informed choices. There are basically three energy-source types of hot water heaters applicable to homeowners in Beaver - propane, fuel oil, and electric. Both the propane and the electric-powered hot water heaters are available as either on-demand and storage-heater configurations. On-demand systems only make hot water when the tap is turned on. On-demand systems generally provide lower flow and deliver lower temperature hot water than storage-style systems. On-demand heaters can save energy consumption 20% to 30% due to the fact that there is no standby heat loss that is characteristic with storage heaters. On-demand heaters also take up much less interior space. Anticipated water usage from on-demand heaters should be limited to a single water fixture at a time because of the low flow characteristic. Low-flow water fixtures, such as at the showerhead, will provide increased efficiency with on-demand systems. Storage-style heaters can supply hot water to several fixtures at a time. Storage-heater systems come in a wide variety of storage capacities that allow for customization to the lifestyle and space needs of the homeowner. Low-flow water fixtures will increase efficiency with storage-style systems.

Storage-Heater Systems

A recent comparative study of storage-style hot water heaters was completed by Village Safe Water with respect to application in the Village of Nulato, Alaska (Part E). The study applied the same performance criteria when comparing fuel-oil, electric, and propane systems. It is important to note that the energy costs applied in the Nulato study are $2.25/gallon, $0.1854/kWh, and $90/100 lb bottle respectively. A direct ratio calculation using Beaver energy costs is applied to the table below to recalculate the annual cost estimate for Beaver. A summary of advantages and disadvantages of these three energy systems is attached to this report (attachment 6 in Part E). The pros and cons of each system focus upon maintenance capabilities and should bear equal weight to the annual operating cost in the decision making process. Both the operating cost and responsibility for maintenance is born by the homeowner. It is also very important to consider the ease with which the water heater can be drained if the homeowner anticipates the home will routinely be left to freeze.

General assumptions:

- Average persons per house = 4 persons
- Household hot water demand for a family of 4 = 72.5 gal/day
- 1 BTU raises 1 lb water 1°F
- Water input to hot water heater = 40°F
- Water output from hot water heater = 120°F

Heating costs per year for each of the options:

- Fuel oil = $265 (Nulato) : $299 (Beaver)*
- Electric = $1059 (Nulato) : $2,399 (Beaver)^
- Propane = $1059 (Nulato) : $1,000 (Beaver)#

Operating costs for inspections, maintenance, and replacement parts are not included. In addition, standby heat loss is also not included and can generally be assumed attributable to correlate to storage insulation which is assumed equal between the three system types.

*Includes a $0.78/gal surcharge in addition to $1.76/gal fuel rate.
^A non-PCE cost basis of $0.43/kWh for Beaver is applied.
#A 100 lb bottle of propane cost $85 in Beaver.

Capital cost estimate including shipping:

- Fuel oil = $1,318
- Electric = $ 477
- Propane = $ 905

On-Demand Heater Systems

The two on-demand hot water systems, electric and propane, provide a lower flow of hot water and are best when used in conjunction with low flow fixtures. A similar comparative analysis can be applied to these systems that reflect energy costs in Beaver. It is expected that less hot water will be used in homes with the on-demand style heaters, therefore, the demand criteria used in the operating cost is36 gal/day and the output water temperature is a minimum of 100°F. Calculations of annual costs were completed using this demand criteria in the methodology described in section A. It is important to consider the life-cycle cost (Capital + Operation) when making a selection of on-demand heaters. For a 20-year period the life-cycle cost of the propane heater will be $7,280, whereas the electric unit will cost $19,760. Power Cost Equalization (PCE) was not factored into the electric cost estimation presented below. The savings with PCE could be substantial - as much as 40%.

General assumptions:

- Average persons per house = 4 persons
- Household hot water demand for a family of 4 = 36 gal/day
- 1 BTU raises 1 lb water 1°F
- Water input to hot water heater = 40°F
- Water output form hot water heater = 100°F
- Electric system: Acutemp 100 with temperature modulation
  - Assume average power consumption of 7.5 kWh
- Propane system: Paloma PH12MD with Variable Input Burner

Water heating costs per year for each of the options:

- Electric = $ 953^
- Propane = $ 329#

Operating costs for inspections, maintenance, and replacement parts are not included.

^A non-PCE cost basis of $0.43/kWh for Beaver is applied.
#A 100 lb bottle of propane cost $85 in Beaver.

Capital cost estimate for on-demand systems including shipping:

- Electric = $ 700
- Propane = $ 700

Part E

WATER HEATING OPTIONS FOR NULATO

This report compares the energy and capital cost of hot water heaters. The focus is on three types of energy: fuel oil, electric and propane.

General Assumptions

- Average persons per house = 4 persons *DCRA Community Profile Database– Nulato*
- Household hot water demand for a family of 4 = 72.5 gal/day *See Attachment 1*
- 1 Btu raises 1 lb water 1°F
- Water input to hot water heater = 40°F
- Water output from hot water heater = 120°F

Heating costs per year for each one of the options:

- Fuel oil = $264.63 *See Attachment 2*
- Electric = $1058.50 *See Attachment 3*
- Propane = $1058.50 *See Attachment 4*

Other operating costs include inspections and replacement of parts. These costs are beyond the scope of this report.

Capital cost including shipping *See Attachment 5*

- Fuel oil = $1317.80
- Electric = $477.00
- Propane = $905.40

Advantages and Disadvantages *See Attachment 6*

Appendix D

Attachment 1

DAILY HOT WATER DEMAND

Based on average gallons of water used per activity from Table 5.1 *Consumer Guide to Home Energy Savings*

Assumptions:

- Average persons per house = 4 persons *DCRA Community Profile Database– Nulato*
- Everyone showers daily
- Two persons shaving daily
- Everyone washes their face & hands daily
- Everyone shampoos their hair daily
- Dishes are hand washed twice daily
- Food preparation with water occurs once daily
- Hot water demand is ½ of water usage

Activity	**Daily Activity**	**Gallons per Activity**	**Daily demand (gallons)**
Showering	4	20	80
Shaving	2	2	4
Washing Face & Hands	8	4	32
Shampoo Hair	4	4	16
Hand Dishwashing	2	4	8
Preparing Food	1	5	5
		Total	**145 gallons / day**

Daily hot water demand $= \frac{145 gal Water / day}{2}$ **= 72.5 gallons of water per day**

Hot water usage of 75.2 gallons of hot water per day is a reasonable assumption because the *Consumer Guide to Home Energy Savings* uses a similar amount (64 gal/day).

Appendix D

Attachment 2

FUEL OIL

Assumptions

- Efficiency 82% *Gas Appliance Manufacturing Association Consumers' Directory of Certified Efficiency Ratings*
- 1 Btu raises 1 lb water 1°F
- Water input to hot water heater = 40°F
- Water output from hot water heater = 120°F
- Household hot water demand = 72.5 gal/day *See Attachment 1*
- #2 Fuel Oil (similar to #2 Diesel used in Nulato) *Oil Heat Technicians Manual, Petroleum Marketers Association of America*
- 1 gal #2 Fuel Oil @ 60°F = 140,000 Btu *Oil Heat Technicians Manual, Petroleum Marketers Association of America*
- Cost / gal #2 Fuel Oil = $2.25 *according to a Nulato resident*

Energy to heat 1 gallon of water from 40°F to 120°F

$$(\Delta T)\left(\frac{1Btu}{1lbWater}\right)\left(\frac{8.34lbWater}{1galWater}\right) = Btu/galWater$$

$$=\left(\frac{80°F}{1°F}\right)\left(\frac{1Btu}{1lb}\right)\left(\frac{8.34lb}{1galWater}\right) = 667.2\ Btu/galWater$$

Cost to heat 1 gallon of water from 40°F to 120°F

$$\left(\frac{Btu}{galWater}\right)\left(\frac{1}{FuelHeatingValue}\right)\left(\frac{1}{Efficiency}\right)\left(\frac{fuel\ cost}{gallonFuel}\right) = Cost/galWater$$

$$=\left(\frac{667.2Btu}{1galWater}\right)\left(\frac{1}{140{,}000\ Btu/galFuel}\right)\left(\frac{1}{0.82}\right)\left(\frac{\$2.25}{galFuel}\right) = \$0.01/galWater$$

Annual heating cost based on 72.5 gallons hot water per day (fuel cost)

$$\left(\frac{Cost}{galWater}\right)\left(\frac{galWater}{day}\right)\left(\frac{day}{year}\right) = Cost/year$$

$$=\left(\$0.01/galWater\right)\left(72.5galWater/day\right)\left(365day/year\right) = \$264.63/year$$

Appendix D

Attachment 3

ELECTRIC

Assumptions

- Efficiency = 87% *Consumer Guide to Home Energy Savings*
- 1 Btu raises 1 lb water 1°F
- Water input to hot water heater = 40°F
- Water output from hot water heater = 120°F
- Household hot water demand = 72.5 gal/day *See Attachment 1*
- 1 kWh = 3412 Btu *David Brennan, AVEC*
- Cost / kWh = $0.1854 *AVEC website www.alaska.net/~avec/rates.htm*

Energy to heat 1 gallon of water from 40°F to 120°F

$$(\Delta T)\left(\frac{1Btu}{1lbWater}\right)\left(\frac{8.34lbWater}{1galWater}\right) = Btu/galWater$$

$$=\left(\frac{80°F}{1°F}\right)\left(\frac{1Btu}{1lb}\right)\left(\frac{8.34lb}{1galWater}\right) = 667.2\ Btu/galWater$$

Cost to heat 1 gallon of water from 40°F to 120°F

$$\left(\frac{Btu}{galWater}\right)\left(\frac{1}{FuelHeatingValue}\right)\left(\frac{1}{Efficiency}\right)\left(\frac{fuel\cos t}{gallonFuel}\right) = Cost/galWater$$

$$=\left(\frac{667.2Btu}{1galWater}\right)\left(\frac{1}{3412\ Btu/kWh}\right)\left(\frac{1}{0.87}\right)\left(\frac{\$0.1854}{kWh}\right) = \$0.04/galWater$$

Annual heating cost based on 72.5 gallons hot water per day (fuel cost)

$$\left(\frac{Cost}{galWater}\right)\left(\frac{galWater}{day}\right)\left(\frac{day}{year}\right) = Cost/year$$

$$=\left(\$0.04/galWater\right)\left(72.5galWater/day\right)\left(365day/year\right) = \$1058.50/year$$

Appendix D

Attachment 4

PROPANE

Assumptions

- Efficiency = 76% *Gas Appliance Manufacturing Association Consumers' Directory of Certified Efficiency Ratings*
- 1 Btu raises 1 lb water 1°F
- Water input to hot water heater = 40°F
- Water output from hot water heater = 120°F
- Household hot water demand = 72.5 gal/day *See Attachment 1*
- One 100 lb bottle of propane bought in Nulato = $ 90.00 *According to a Nulato Resident*
- 4.24 lb propane = 1 gallon *Suburban Propane Representative*
- One 100 lb bottle propane $= \dfrac{100 lb\ \mathrm{Pr}opane}{4.24 lb\ \mathrm{Pr}opane / gal} = 23.6 gal\ \mathrm{Pr}opane$
- Cost / gal propane $= \dfrac{\$90.00}{23.6 gal\ \mathrm{Pr}opane} = \$3.81 / gal\ \mathrm{Pr}opane$
- One gallon of propane = 92,500 Btu / gal propane *Suburban Propane Representative*

Energy to heat 1 gallon of water from 40°F to 120°F

$$(\Delta T)\left(\frac{1Btu}{1lbWater}\right)\left(\frac{8.34lbWater}{1galWater}\right) = Btu / galWater$$

$$= \left(\frac{80°F}{1°F}\right)\left(\frac{1Btu}{1lb}\right)\left(\frac{8.34lb}{1galWater}\right) = 667.2\ Btu / galWater$$

Cost to heat 1 gallon of water from 40°F to 120°F

$$\left(\frac{Btu}{galWater}\right)\left(\frac{1}{FuelHeatingValue}\right)\left(\frac{1}{Efficiency}\right)\left(\frac{fuel\ cost}{gallonFuel}\right) = Cost / galWater$$

$$= \left(\frac{667.2Btu}{1galWater}\right)\left(\frac{1}{92{,}500\ Btu / gal\ \mathrm{Pr}opane}\right)\left(\frac{1}{0.78}\right)\left(\frac{\$3.81}{1gal\ \mathrm{Pr}opane}\right) = \$0.04 / galWater$$

Annual heating cost based on 72.5 gallons hot water per day (fuel cost)

$$\left(\frac{Cost}{galWater}\right)\left(\frac{galWater}{day}\right)\left(\frac{day}{year}\right) = Cost / year$$

$$= \left(\$0.04 / galWater\right)\left(72.5 galWater / day\right)\left(365 day / year\right) = \$1058.5 / year$$

Attachment 5

CAPITAL COST

Fuel Oil:

- Bock 32E Oil Fired Storage Water Heater (not including vents)= $1232.60 *Quote from Central Plumbing & Heating*
- Weight = 294 lb
- Shipping via Carlile Enterprises, Inc. from Anchorage to Nenana = $45.00 *Carlilie Enterprises, Inc. Representative*
- Shipping via Yutana Barge Lines from Nenana to Nulato = $13.80 / 100 lb with a minimum of $40.00 = $40.00 *Yutana Barge Lines Representative*
- Bock 32E + shipping = $1231.60 + $85.00 = $1316.60

Electric:

- Kenmore Power Miser, 66 gallon, 9 year warranty = $399 *Sears Representative*
- Weight = 135 lb
- Shipping via Carlile Enterprises, Inc. from Anchorage to Nenana = $38.00 *Carlilie Enterprises, Inc. Representative*
- Shipping via Yutana Barge Lines from Nenana to Nulato = $13.80 / 100 lb with a minimum of $40.00 = $40.00 *Yutana Barge Lines Representative*
- Kenmore Power Miser + shipping = $399.00 + $78.00 = $477.00

Propane:

- Bradford White 40 gallon MIMS40T6LX direct vent propane storage water heater + Roof Jack = $725.40 + $105.00 = $830.40 *Suburban Propane Representative*
- Weight = 126 lb
- Shipping via Carlile Enterprises, Inc. from Anchorage to Nenana = $35.00 *Carlilie Enterprises, Inc. Representative*
- Shipping via Yutana Barge Lines from Nenana to Nulato = $13.80 / 100 lb with a minimum of $40.00 = $40.00 *Yutana Barge Lines Representative*
- MIMS40T6LX + shipping = $830.40 + $75.00 = $905.40

Appendix D

Attachment 6

ADVANTAGES AND DISADVANTAGES

Fuel Oil

Advantages
- Nulato has people qualified to work on oil-fired systems
- Fuel oil is easy to store and transfer *Steven Glatt Central Plumbing and Heating*
- Fuel oil storage water heaters are easier to get parts for and maintain than other systems *Steven Glatt Central Plumbing and Heating*
- Additives can be added to fuel oil to increase flow in low temperatures *Steven Glatt Central Plumbing and Heating*

Disadvantages
- Possibility of unpleasant smell while burning
- Installation and venting can be expensive

Electric

Advantages
- High efficiency *Consumer Guide to Home Energy Savings*
- Nulato has people qualified to work on electrical systems

Disadvantages
- AVEC plant most likely unable to handle increased load from 70 new electric water heaters without extensive plant upgrades *David Brennan, AVEC*

Propane

Advantages
- Propane gas burns cleaner than fuel oil *Suburban Propane website: www.suburbanpropane.com*

Disadvantages
- At low temperatures propane liquefies, resulting in an inconsistent mixture in the combustion chamber. This inconsistent mixture reduces efficiency and increases the possibility of explosion. *John Bock and Joe Brown, Bock Water Heaters*
- Propane does not react efficiently in cold temperatures *Steven Glatt Central Plumbing and Heating*
- Nulato does not have anyone qualified to work on propane systems
- Lack of propane water heater manufacturers, parts and technical assistance *Suburban Propane Representative*
- Propane systems have high incidence of maintenance problems *Steven Glatt Central Plumbing and Heating*

Part F

Northway Haul System

System Parameters

Water Storage: 200 or 300 gallon interior storage tanks depending upon space availability. Some homes have 500 gallon tanks in their basements.

Sewage Storage: 500 gallon exterior storage in fiberglass insulated tanks. Top fill, top evacuation; Thermostatically controlled heat trace adds $30/month to the electric bill; High-level controls in the tank shut the system down. Sewage is evacuated from the holding tanks by low pressure blower forcing air into the holding tank pushing wastewater out.

Home hot water generation: oil-fired Toyotomi on-demand hot water heaters have 2-gallon storage. Residents are reportedly rather pleased with the operation and hot water supply.

Equipment Garage fuel costs

Equipment Fuel use cost

Water and Sewer Rates

The current flat rate is $125 per month which reportedly provides water and sewer service on demand. Project superintendent, Joe Spickler, reported that this rate is covering the cost of operations and with more and more systems coming on line they are considering a rate reduction. The service area for the system is 20 miles long.

Napaskiak Water and Sewer Haul System

System Parameters

Almost all residential water and sewer systems used in Napaskiak are CoWater, Inc. designed systems. These systems flush wastewater using the INAX toilet into a specially designed transfer tank. When full, the transfer tank is evacuated into an exterior, insulated, stainless steel holding tank. Sewage is evacuated into a 120 gallon trailer-mounted haul tank with a low-pressure evacuation blower system. Air is forced into the holding tank which pushes wastewater into the haul tank-trailer. The trailer is pulled by a 4-wheel ATV unit.

Water is hauled to the home in 100 gallon tank trailer and pulled by a 4 wheel ATV unit. Water is dispensed through a pipe through the wall of the home into 110 gallon interior water tanks. An electric low-pressure blower pressurizes the haul tank forcing water into the home.

Freeze protection of the sewage holding tank is accomplished with an 8-foot-long 3-watt per foot heat trace on the transfer pipe and 8 ft of 3 watt heat trace in the sewage tank which combined requires 1.15 kWh per day. A manual switch operates the heat trace.

Water and Sewer Rates

The utility has billed residential units with the CoWater system an average of $75 per month for the existing 6 demonstration units. The CoWater uses a pint-per-flush toilet.

Residential units with modified CoWater systems have conventional 1.6 gallon-per-flush toilets and cost an average $150 per month. These units use much more water due to the toilet selection.

Appendix F: Approvals

Contents:

THE STATE of ALASKA
GOVERNOR MIKE DUNLEAVY

Department of Environmental Conservation

DIVISION OF WATER
Village Safe Water

555 Cordova Street
Anchorage, Alaska 99501
Main: 907.269.7502
Fax: 907.269.7509
dec.alaska.gov

DATE: March 4, 2019

FROM: Doug Poage, P.E., Village Safe Water Program (VSW)

TO: Marty Brewer, Program Manager VSW

COPY: Susan Randlett PE, VSW Engineer

SUBJECT: Lead Engineer's **Review of Beaver Preliminary Engineering Report**

The 95% draft Preliminary Engineering Report (PER) named "Washeteria Replacement Preliminary Engineering Report" dated February 11, 2019 was submitted by Susan Randlett to the VSW Lead Engineer for review.

This **PER** is approved for submission to the Full Committee that reviews PERs at the 95% level of completion.

Sincerely,

Doug Poage, P.E.
Lead Engineer
ADEC Division of Water – Facilities Program

[INSERT BEAVER RESOLUTION]

The community has approved this PER but have not yet finalized the resolution. Once VSW receives the resolution, this page will be removed and the resolution inserted in its place.